GEOTECHNICAL INVESTIGATION
SAN JACINTO MDP LINE C, STAGE 2, LINE C-4,
STAGE 1, LINE C-5, AND LINE B STORM DRAIN
[PROJECT NO. 4-0-00124]
SAN JACINTO, CALIFORNIA

PREPARED FOR:

Attention: Kyle Gallup, P.E., Senior Civil Engineer
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
1995 Market Street
Riverside, California 92501

PREPARED BY:

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August 31, 2012
Project No. R206-014

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Attention: Kyle Gallup, P.E., Senior Civil Engineer
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
1995 Market Street
Riverside, California 92501

Re: Geotechnical Investigation
San Jacinto MDP Line C, Stage 2, Line C-4, Stage 1, Line C-5, and Line B Storm Drain [Project No. 4-0-00124]

Dear Mr. Gallup:

We are pleased to submit the results of our geotechnical investigation for the referenced project. This investigation was conducted in general accordance with our proposal dated March 14, 2012.

The results of our investigation indicate that the proposed storm drain project is feasible from a Geotechnical Engineering standpoint. Our report includes design recommendations along with the field and laboratory data.

We appreciate the opportunity of being of service to the District on this project. If there are any questions, please contact our office.

Respectfully,
INLAND FOUNDATION ENGINEERING, INC.

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I. SCOPE OF SERVICES

This geotechnical investigation was conducted to determine engineering characteristics of the subsoil conditions and to develop recommendations for the design of the San Jacinto MDP Line C, Stage 2, Line C-4, Stage 1, Line C-5, and Line B Storm Drain [Project No. 4-0-00124]. Our investigation included field exploration, laboratory testing, engineering analysis and the preparation of this report. Our investigation was performed in accordance with our proposal dated March 14, 2012. Preliminary alignment and profile plans entitled "San Jacinto MDP Line C, (STG 2), C-4 (STG 1), C-5 (STG 1) & B (STG 1)", prepared by Riverside County Flood Control and Water Conservation District were provided as a reference during this study.

Limitations: Our investigation was conducted for Riverside County Flood Control and Water Conservation District for their use in the design of the proposed storm drain. This report may only be used by Riverside County Flood Control and Water Conservation District for this purpose. The use of this report by parties other than Riverside County Flood Control and Water Conservation District or for other purposes is not authorized without written permission by Inland Foundation Engineering, Inc. Inland Foundation Engineering, Inc. will not be liable for any projects connected with the unauthorized use of this report.

Scope of Services: The purpose of the geotechnical investigation was to provide geotechnical parameters for design and construction of the proposed project. The scope of the geotechnical investigation included:

- A review of the general geologic conditions and specific subsurface conditions of the project site.
- An evaluation of the engineering and geologic data collected for the project.
- Preparation of a formal report providing geotechnical conclusions and recommendations for design and construction.

The tasks performed in order to achieve these objectives included:

  - The collection and review of data in order to develop an exploration program.
  - Subsurface exploration to determine the nature and stratigraphy of the subsurface soils and to obtain representative samples for laboratory testing.

- A visual reconnaissance of the site and surrounding area to ascertain the existence of any unstable or adverse geologic conditions.

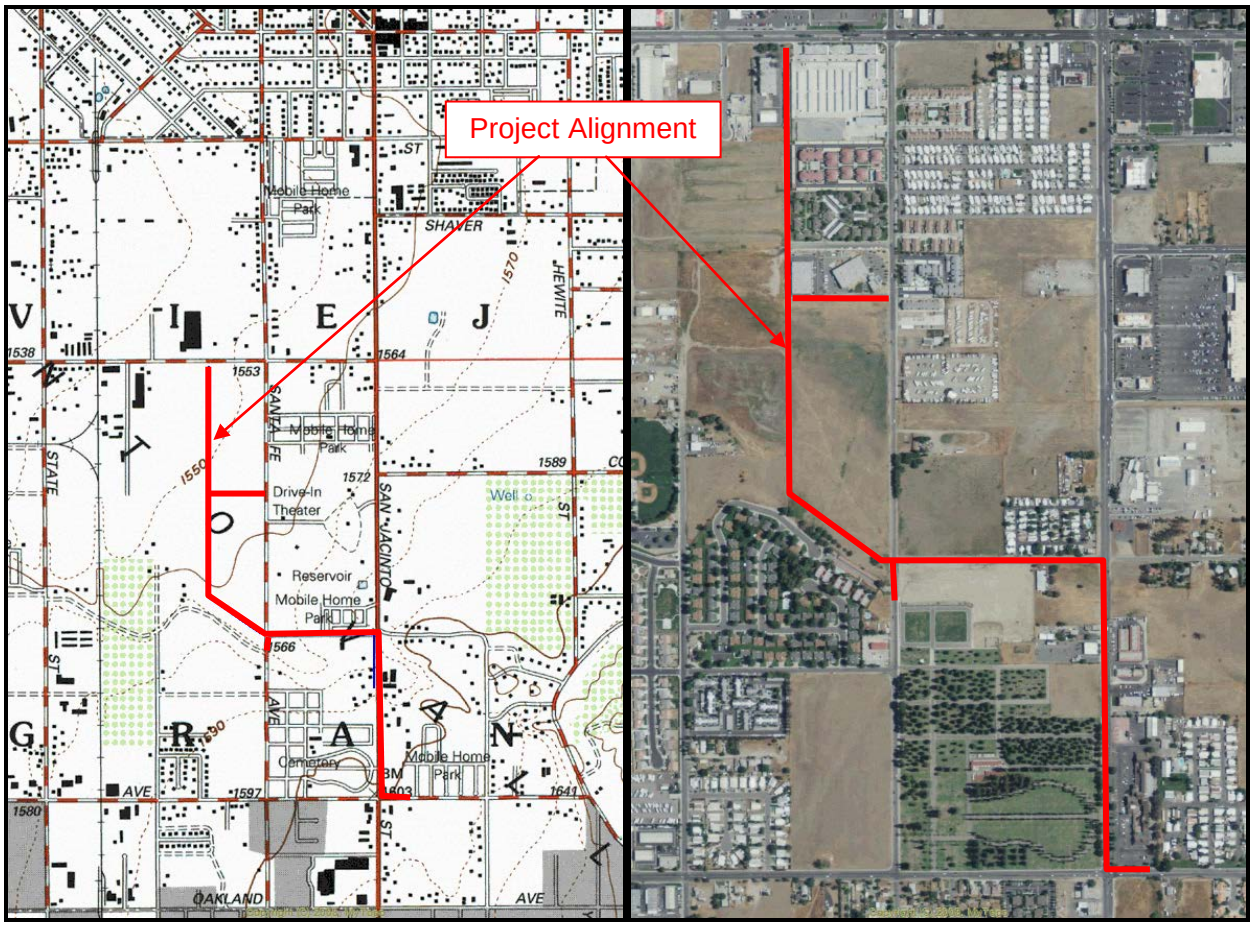
- Laboratory testing of representative samples in order to establish the classification and engineering properties of the soils.

- Analysis of the data collected and the preparation of this report presenting our geotechnical conclusions and recommendations.

The information in this report represents professional opinions that have been developed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, either expressed or implied, is made as to the professional advice included in this report.

II. PROJECT DESCRIPTION

The proposed project will consist of the construction of approximately 8,440 linear feet of reinforced concrete box and reinforced concrete pipe storm drain. The project lies within the easterly portion of Section 3, and the southwesterly portion of Section 2, Township 5 South, Range 1 West, S.B.B. & M. Approximately 4,890 feet of the project will be constructed within public right-of-way while the remaining 3,550 feet will be constructed in an undeveloped field.



U.S.G.S. Topographic Map, San Jacinto 7.5' Quadrangle and Aerial Photograph (2009)

Proposed Improvements: The project under consideration consists of the construction of approximately 7,165 linear feet of reinforced concrete box with dimensions varying from 5 to 8 feet high and 8 to 14 feet wide. In addition, there is approximately 1,270 lineal feet of reinforced concrete pipe with diameters ranging from 42 to 60 inches. The proposed excavation depth of the storm drain ranges from 9 to 23 feet.

The proposed storm drain has four designated line segments as described as Line C, Line C-5, Line C-4, and Line B. These segments are described below:

Line C (STG 2) – This segment consists of a reinforced concrete box (RCB) and reinforced concrete pipe (RCP), which begins at a point (Sta. 0+99.71) adjacent to Esplanade Avenue, southerly along an unpaved easement, then southeasterly and easterly along Midway Street to a point at the intersection of Midway Street and San Jacinto Street (Sta. 51+00). The line transitions from 14'x6' and 14'x7' RCB to a 96" RCP beginning at Sta. 43+30. Midway Street is a paved two-lane roadway. The existing asphalt concrete on Midway Street is severely cracked and alligatored. Debris including asphalt, concrete, and other materials are present along a portion of this segment between approximate Station Nos. 21+00 through 26+75. Adjacent properties along this segment include existing commercial and multi-family residential buildings, vacant parcels, a cemetery, and a mobile home park.

The topography along this segment may be described as relatively planar and gently sloping. Minor undulations in surface elevations are present. Existing ground elevations across segment range from an approximate high elevation of 1581' above mean seal level (msl) at the end of the Line C segment (Sta. 51+00) to a low elevation of approximately 1549' above msl at the beginning of the segment (±Sta. 0+99.71).

Line C-5 (STG 1) - This segment consists of a 48" RCP beginning at Sta. 1+00 and ending at Sta. 7+69.40. This line is located between the unpaved easement from the planned Line C and extending easterly along an open field south of existing commercial buildings to Santa Fe Street. Adjacent properties along this segment include existing commercial buildings and vacant land.

Existing ground elevations across this segment range from an approximate high elevation of 1566' above mean seal level (msl) at the beginning of the Line C-5 segment (Sta. 1+00) to a low elevation of approximately 1561' above msl near the end of the segment (±Sta. 7+69.40).

Line C-4 (STG 1) - This segment consists of a 54" RCP lateral beginning at Sta. 1+00 and ending at Sta. 3+54.44. This planned lateral is located within Santa Fe Street, beginning just south of the intersection of Midway Street. The existing asphalt concrete within this portion of Santa Fe Street may be described as poor to fair with alligatoring. Adjacent properties along this segment include a

residential development to the west and a cemetery property to the east. Existing ground elevations across this segment range from an approximate high elevation of 1575' above mean seal level (msl) at the end of the Line C-4 segment (Sta. 3+54.44) to a low elevation of approximately 1569' above msl at the beginning of the segment (Sta. 1+00).

Line B (STG 1) - This segment consists of 78", 90", and 84" RCP beginning at Sta. 51+00 and ending at 72+85.33. This line is located within San Jacinto Street beginning just south of Midway Street and ends along Menlo Avenue, approximately 300 feet east of the intersection of San Jacinto Street. An inlet structure is planned near the terminus of Line B. The existing asphalt pavement within San Jacinto Street and Menlo Avenue is in fair to good condition. Some cracking and alligatoring of the asphalt was observed along Menlo Avenue. Adjacent properties along this segment include vacant parcels and commercial properties.

Existing ground elevations across this segment range from an approximate high elevation of 1605' above mean seal level (msl) at the end of the Line B segment (Sta. 72+85.33) to a low elevation of approximately 1581' above msl at the beginning of the segment (Sta. 51+00).

Project plans indicate numerous existing underground utilities are in close proximity to the proposed storm drain at various locations. These include, but may not be limited to, water, sewer, irrigation, electric, gas, and telephone utilities.

III. GEOLOGIC SETTING

Regional Geology: The subject site is situated within a natural geomorphic province in southwestern California known as the Peninsular Ranges, which is characterized by steep, elongated ranges and valleys that trend northwesterly. This geomorphic province encompasses an area that extends 125 miles, from the Transverse Ranges and the Los Angeles Basin, south to the Mexican border, and beyond another 795 miles to the tip of Baja California (Norris & Webb, 1990; Harden, 1998). This province is believed to have begun as a thick accumulation of predominantly marine sedimentary and volcanic rocks during the late Paleozoic and early Mesozoic. Following this accumulation, in mid-Cretaceous time, the province underwent a pronounced episode of mountain building. The accumulated rocks were then complexly metamorphosed and intruded by igneous rocks, known locally as the Southern California Batholith. A period of erosion followed the mountain building, and during the late Cretaceous and Cenozoic time, sedimentary and subordinate volcanic rocks were deposited upon the eroded surfaces of the batholithic and pre-batholithic rocks.

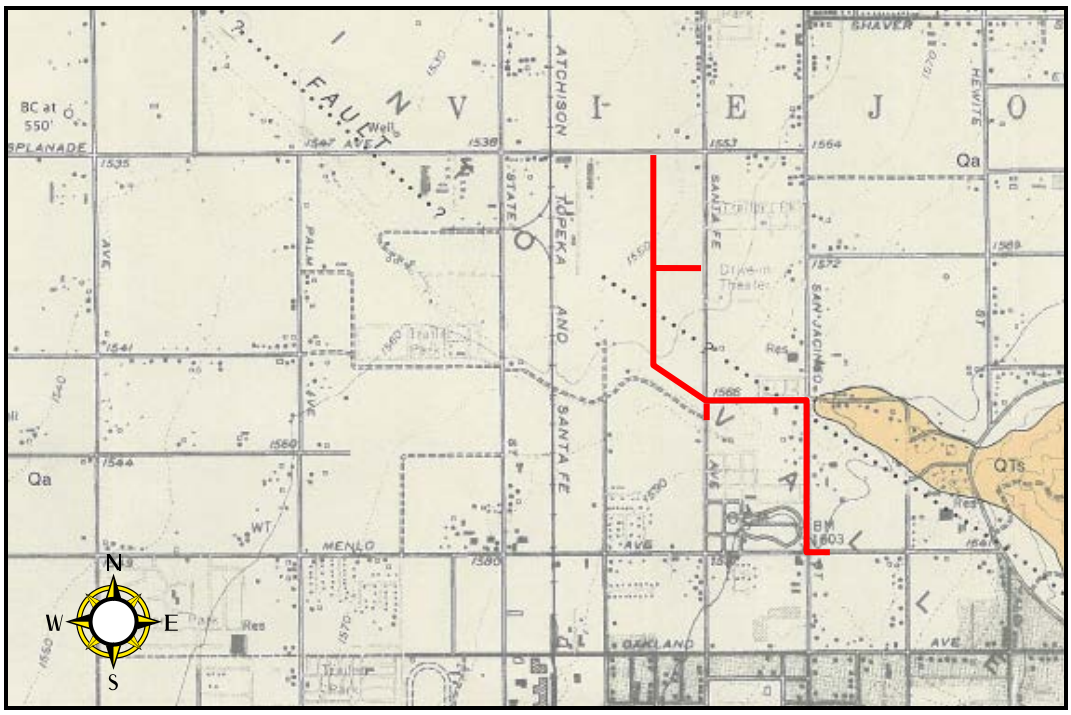
Base Map: C.D.M.G., 1966, Geologic Map of California, Santa Ana Sheet, Scale 1:250,000.

More specifically, the site is situated along the northeastern portion of the Perris Block, an eroded mass of Cretaceous and older crystalline rock. Thin sedimentary and volcanic units mantle the bedrock in a few places with alluvial deposits filling in the lower valley areas. The Perris Block is a structurally stable, internally unfaulted mass of crustal rocks bounded on the west by the Elsinore-Chino fault zones, on the east by

the San Jacinto fault zone, and on the north by the Cucamonga fault zone (Woodford, et al., 1971). On the south, the Perris Block is bounded by a series of sedimentary basins that lie between Temecula and Anza (Morton and Matti, 1989).

Local Geology: Locally the study area is included within a substructural unit of the Perris Block known as the San Jacinto Valley. This valley is essentially a deep alluvial filled graben formed by the structural movements of the San Jacinto Fault Zone locally. The site is underlain by Quaternary alluvial deposits comprised predominantly of unconsolidated gravel, sand, and silt. The alluvial deposits have principally originated as outwash from the San Jacinto River and other lesser tributaries.

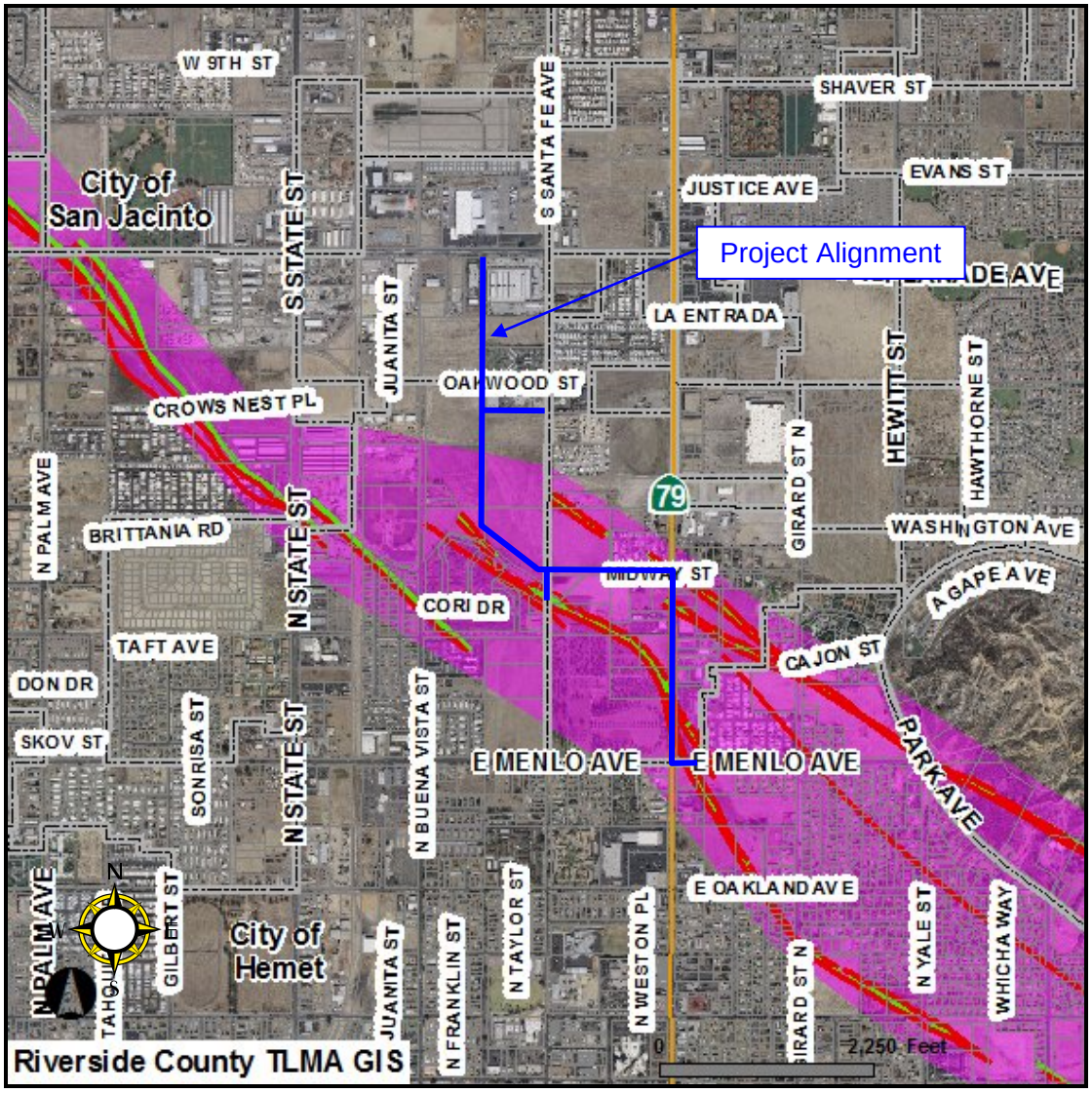
According to Dibblee (2003), the subject site is shown to be underlain by Quaternary alluvial deposits (Qa) comprised predominantly of unconsolidated alluvial sand and clay of valley areas. Following is a copy of a portion of the Geologic Map of the San Jacinto Quadrangle (Dibblee, 2003) depicting the mapped geologic units in the vicinity of the proposed alignment:



Qa - Alluvial sand and clay of valley areas, covered by gray soil, unconsolidated, undissected (Holocene).

QTs - Bautista Beds, Sandstone, arkosic; includes some cobble-pebble conglomerate and thin lenses of gray claystone (Plio-Pleistocene).

Faulting: There are at least 41 major late Quaternary active/potentially active faults that are within a 100-kilometer radius of the site as tabulated within Appendix C. A portion of the proposed alignment is located within a County of Riverside and State of California Alquist-Priolo Earthquake Fault Zone (Casa Loma segment of the San Jacinto Fault Zone). For informational purposes, below is a County of Riverside TMLA GIS map (2102) indicating the mapped Earthquake Fault Zone and approximate locations of some of the faults. It is important to note that the mapped faults are not precisely plotted and are presented on large-scale geologic maps. The locations presented should be considered as estimations only. The preliminary findings as presented in this report are based solely on a review and interpretation of existing published geologic data. No subsurface exploration or photogeologic analysis was performed for this evaluation.



The Casa Loma Fault is locally considered to be the southern splay of the San Jacinto Valley segment of the San Jacinto Fault Zone. The San Jacinto Fault is considered to be one of the major splays of the San Andreas Fault system and is considered to be the most seismically active fault in southern California (Sharp, 1967). The tectonics and structure of the San Jacinto Fault Zone is very complex and is composed of numerous faults that are discontinuous and/or "en-echelon" in nature. The San Jacinto Fault (San Jacinto Valley Segment) is a right-lateral, strike-slip fault, being approximately 42 kilometers in length, with an estimated maximum moment magnitude (M_w) earthquake of M_w6.9 and an associated slip-rate of 12.0 ±6.0 mm/year.

According to maps compiled by the California Department of Conservation, Division of Mines and Geology (CDMG) the major faults influencing the site, distances and maximum earthquake magnitudes are as follows:

Fault Zone	Approximate Distance (km)	Earthquake Magnitude (M_w)	Slip Rate (mm/yr)
San Jacinto-San Jacinto Valley	0.0	6.9	12.00
San Jacinto-Anza	2.4	7.2	12.00
San Andreas - Southern	28.2	7.4	24.00
Elsinore-Temecula	34.3	6.8	5.00
San Jacinto-San Bernardino	37.8	6.7	12.00

Seismicity: On the bases of the subsurface conditions and local fault characteristics, the 2010 California Building Code provides the following seismic design parameters as indicated in the following table:

CBC-Chap.16 Ref. No.	Seismic Parameter	Recommended Value
Table 1613.5.2	Site Class	D
Fig. 1613.5.1	Mapped Spectral Acceleration - S_s	1.964g
Fig. 1613.5.1	Mapped Spectral Acceleration - S_1	0.751g
1613.5.3 (1)	Site Coefficient - F_a	1.0
1613.5.3 (2)	Site Coefficient - F_V	1.5
Eq. 16-36	MCE Spectral Acceleration - S_{MS}	1.964g
Eq. 16-37	MCE Spectral Acceleration - S_{M1}	1.127g
Eq. 16-38	Design Spectral Acceleration - S_{DS}	1.297g
Eq. 16-39	Design Spectral Acceleration - S_{D1}	0.751g

It is the responsibility of both the property owner and project structural engineer to determine the risk factors with respect to using CBC minimum design values for the subject project. The previously-outlined CBC seismic classifications and data have been provided for use by the project structural engineer, to aid in evaluating design criteria, if needed. This information should be used to help select the appropriate seismic parameters, as outlined in the California Building Code (CBC, 2010).

The primary geologic hazard affecting the project is that of ground shaking. Other secondary effects and geologic hazards include slope failure, lurching, seismic settlement, seiches, and tsunamis. These are not considered to be of significance to the project. The potential for surface fault rupture for the portion of the storm drain within the mapped Earthquake Fault Zone is considered high and is discussed in later sections of this report.

Groundwater: The alignment is located near the border of the San Jacinto and Hemet groundwater subbasins in southwestern Riverside County, California. This basin is generally bordered to the northeast by the San Jacinto Fault and to the southwest by the Casa Loma Fault (Southern Branch of the San Jacinto Fault Zone).

Groundwater was not encountered within our exploratory borings, which extended to a maximum depth of 35.5 feet. Based upon data prepared by the Western Municipal Water District Cooperative Well Monitoring Program (2010), several wells in the vicinity of the project have been monitored recently. State Well No. 05S01W03001S, located approximately 3,450 feet west-northwest of the project alignment was monitored on May 20, 2010. At that time, the depth to groundwater was 282 feet. State Well No. 05S01W10B001S, located approximately 4,000 feet west-southwest of the proposed alignment was monitored on February 25, 2010. At that time, the depth to groundwater was 267.2 feet.

According to a map entitled “Map of San Jacinto and Temecula Basins California” (Waring, 1919), groundwater elevation contours in November 1915 indicated a depth to groundwater of approximately 50 feet in the vicinity of the subject site. Significant declines in groundwater in the San Jacinto Valley have occurred since that time. Based on historical groundwater data reviewed for this project and data indicating the regional decline in groundwater levels, it is our opinion that groundwater is not likely to reach the historical high level of approximately 50 feet in the future. We have conservatively estimated a high groundwater level of 200 feet at the site.

Liquefaction: Liquefaction is a phenomenon where soil temporarily loses strength due to cyclic stresses such as those caused by an earthquake. The primary effects of liquefaction are loss of support of the foundation, sand boils, lateral spreading and seismically induced settlement. Liquefaction is generally considered a hazard in relatively loose sandy soils with the groundwater table within fifty feet of the surface.

Groundwater was not encountered within our exploratory borings, which extended to a maximum depth of 35.5 feet. We have conservatively estimated a high groundwater level of 200 feet at the site. Based on the depth to groundwater beneath the alignment, it is our opinion that the potential for liquefaction beneath the site is nil.

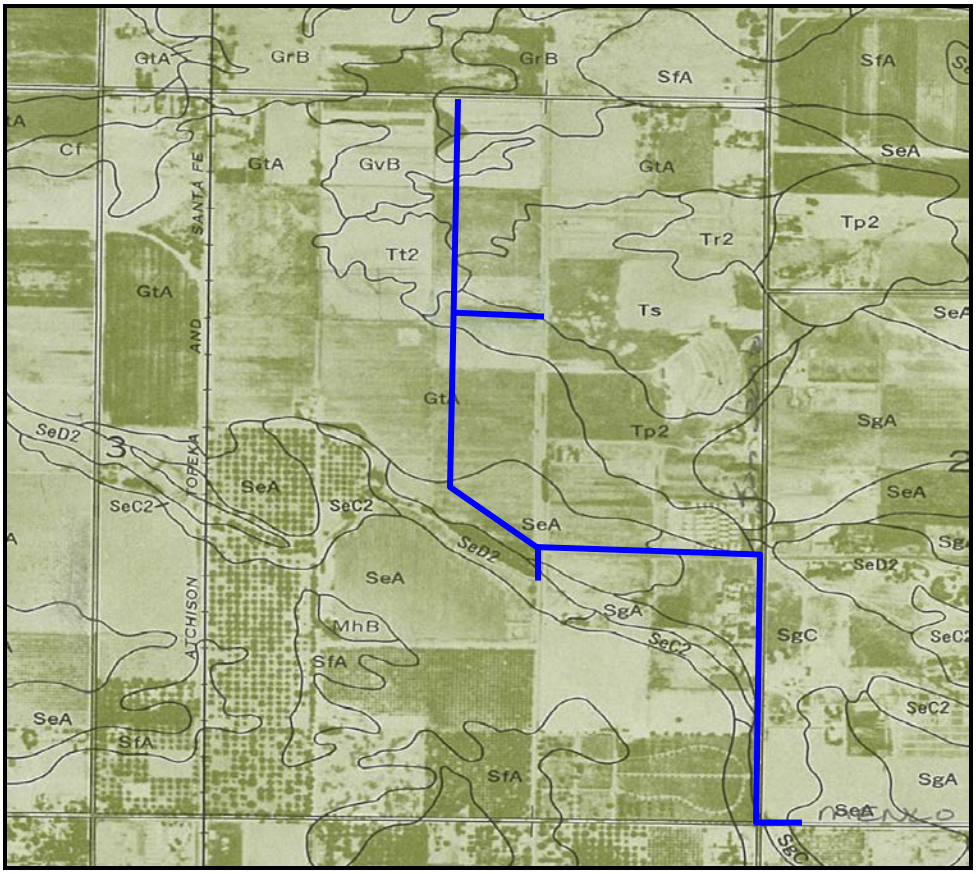
IV. SUBSURFACE CONDITIONS

Our field exploration consisted of drilling 12 exploratory borings ranging in depth from approximately 22.5 to 35.5 feet. The borings were excavated by means of a truck mounted rotary auger drill rig at the approximate locations shown on Figure A-15. A description of our drilling and sampling procedures and the Boring Logs are presented in Appendix A. Laboratory testing was performed on selected samples of the subsurface soils. Results of these tests are presented in Appendix B including Sand Equivalent Values.

In addition to subsurface exploration, a review of the Soil Survey of Western Riverside Area, California was made. This review reveals that there are three predominate agricultural soil types (Series) present along the project alignment. These include (from north to south) Grangeville Fine Sandy Loam (GrB, GtA), Traver fine Sandy loam (Tt2), and San Emigdio Loam (SgA, SgC). Soil type classifications are useful tools in identifying particular site conditions that may be present along the alignment. The predominate soil series along the alignment are described as:

> Grangeville Fine Sandy Loam (GrB, GtA) – These are moderately well-drained to poorly drained soils on alluvial fans and flood plains. These soils developed in alluvium made up of granitic materials. In a typical profile, the surface layer is grayish-brown loamy fine sand about 17 inches thick. The underlying layers are stratified and range from grayish brown to light brownish gray in color and from loamy fine sand to very fine sandy loam in texture. These soils typically have fines (passing No. 200 Sieve) less than 15 percent and less than 25 percent gravel. These soils typically have low shrink-swell potential, slight to high compressibility, poor to good stability and poor to good resistance to piping.
>
> Traver fine Sandy loam (Tt2, Tp2) - This soil series consists of moderately well-drained soils that occur on valley plains and in basins. These slightly to strongly saline-alkali soils developed in alluvium predominantly from granitic materials. In a typical profile, the surface layer is light brownish gray to grayish-brown loam fine sand about 13 inches thick. The subsoil is grayish brown to light brownish gray fine sandy loam to a depth of about 38 inches. Below this, to a depth of about 53 inches, the subsoil is light brownish gray loam. It is underlain by light brownish gray loam. These soils typically contain more than 40 percent fines (passing No. 200 Sieve), and less than 25 percent gravel. These soils typically have low shrink-swell potential, fair to poor stability, slight compressibility and have poor resistance to piping.

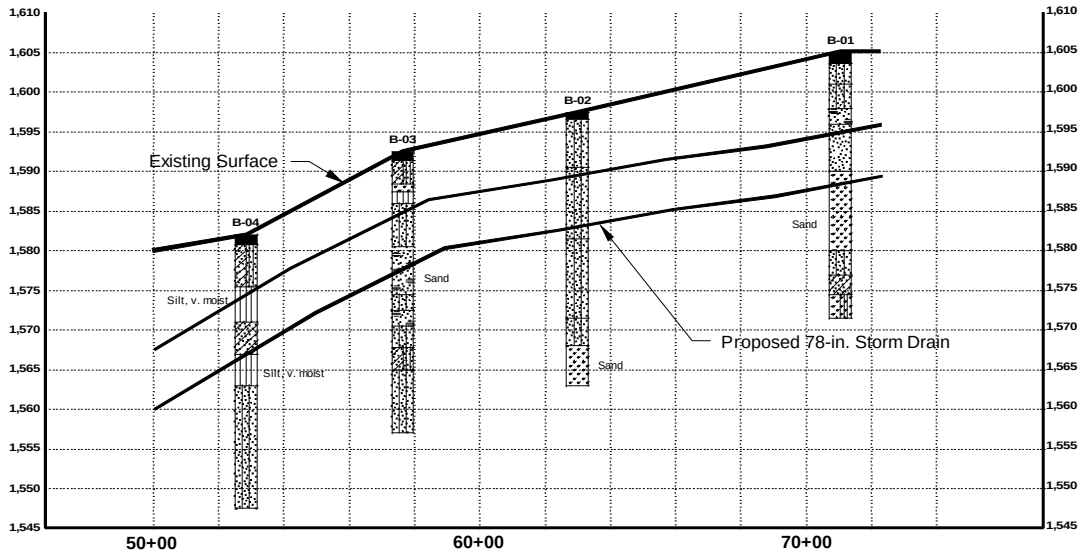
San Emigdio Loam (SgA, SgC) – These are well-drained soils on alluvial fans. These soils developed in alluvium that was derived mainly from weakly consolidated sedimentary formations. In a typical profile, the surface layer is light brownish gray fine loam about 8 inches thick. The next layer, of similar color and texture, is about 14 inches thick. Underlying this and extending to a depth of more than 60 inches is light gray fine sandy loam. These soils typically have a low shrink-swell potential, contain more than 50 percent fines (passing No. 200 Sieve), have slight to medium compressibility, poor to fair stability and poor to good resistance to piping.



The results of our subsurface exploration revealed conditions that appear to be fairly consistent with those indicated by the Soil Survey for the surficial materials.

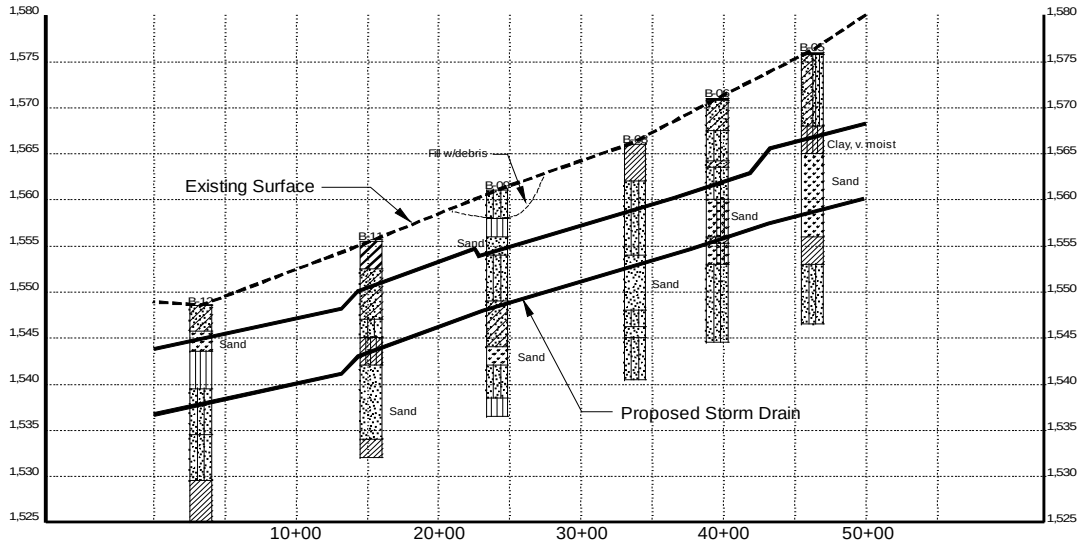
In general, our field exploration indicates that the project alignment is underlain by mapped younger (Holocene) alluvial fan deposits. Subsurface materials encountered within our exploratory borings consisted of predominately interbedded fine- to medium-grained silty sands, sandy silts, sands, clayey sands, and sandy silty clays in a loose to medium dense condition.

Typical profiles of the conditions revealed by our exploration along the project alignment are presented in the following cross-sections:



LINE B

Of particular significance along Line B were clean sands encountered within the excavation depths in Borings B-01 and B-03. In addition, silt layers encountered in Boring B-04 were in a very moist condition with moisture contents as high as 34 percent.

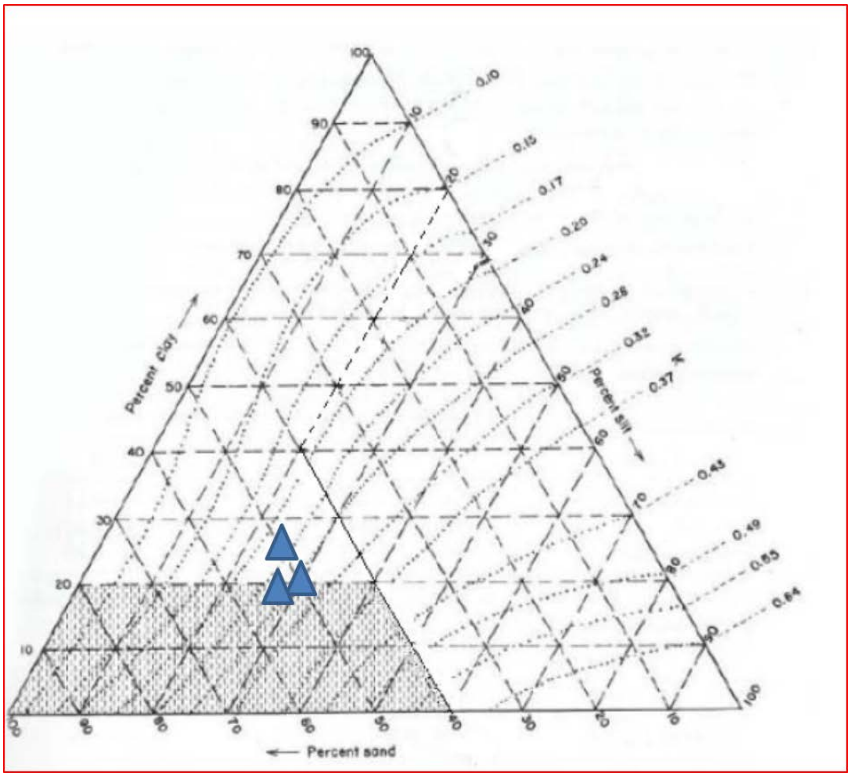


LINE C

Approximately 3 feet of artificial fill was encountered within our exploratory Boring B-09, located at Sta. 24+12. These materials consisted of silty sand with gravel, debris asphalt, concrete, and other materials. Surficial debris in this vicinity is located in the vicinity between approximate Station Nos. 21+00 through 26+75. Clean sands were encountered within the excavation depths in Borings B-05 through B-08. Very moist clay was encountered in the upper portions of Boring B-05.

Although not encountered in our exploratory borings, artificial fill and/or backfill material associated with adjacent underground utilities will likely be encountered during construction. The compaction of this fill/backfill is not known. The potential for caving associated with the existing utility fill/backfill should be considered during excavation and construction of the storm drain.

Soil Erodibility Factor (K): The K factor can be determined by using the nomograph method, which requires that a particle size analysis (ASTM D-422) be done to determine the percentages of sand, very fine sand, silt and clay. The soil may be classified as a sandy loam to a sandy clay loam. On the basis of classification testing, the value for K is estimated to be between 0.24 and 0.28 as indicated on the following chart.



Erickson triangular nomograph used to estimate soil erodibility (K) factor. USDA nomograph from Erickson 1977 as referenced by Goldman et al., 1986.

The moisture content of the soil at the time of our investigation ranged from approximately 2 to 34 percent within the planned excavation depths. Portions of the soil profile indicate moisture contents exceeding the optimum moisture content. A detailed description of the subsurface soil conditions encountered is presented on the attached Boring Logs, Figures A-3 through A-14.

Existing asphalt concrete was encountered within our borings B-01 through B-07. The thickness of asphalt pavement underlying base material, where encountered, is presented on the boring logs.

Groundwater was not encountered within our exploratory borings, which extended to a maximum depth of 35.5 feet. We have conservatively estimated a high groundwater level of 200 feet at the site. Thin and discontinuous zones of perched groundwater may be present above that depth, however no perched water was encountered during our investigation.

Sand Equivalent values ranged from 2 to 34.

Analytical testing was conducted in our laboratory as-well-as in the laboratory of HDR│Schiff. The results of the testing by HDR│Schiff are included in their report which is appended. The combined test data indicates concentrations of water-soluble sulfates of up to 2,166 parts per million (0.22%). Chloride concentrations of up to 661 parts per million were revealed. The pH values ranged from 7.7 to 8.6. Saturated Resistivities ranged from 300 to 13,200 ohm-cm.

The soils within the planned excavation depths were observed to be plastic. Overall Plasticity Index testing revealed Plasticity Indices (PI's) ranging from 0 to 15. Liquid Limits (LL's) ranged from 16 to 32.

The soil is typically in a loose to medium dense condition with Relative Compactions ranging from approximately 70 to over 90 percent. The low Relative Compactions were typically observed within the upper 10 feet and above the pipe zone for the proposed storm drain.

Direct shear testing indicates an angle of internal friction (phi) of 25 to 34 degrees. We have assumed a value of 34 degrees in our analyses.

R-value testing indicated R-values of 25. Expansion pressures of up to 208 pounds per square foot were indicated by R-Value test data. An Expansion Index of 67 was revealed during our testing.

A portion of the project alignment is within an Earthquake Fault Hazard Zone associated with the Casa Loma segment of the San Jacinto Fault. Several mapped fault splays (Riverside County TLMA, 2012) cross the proposed pipeline alignment within the fault zone. The locations of the fault splays are tentative and do not reflect all of the potential faults present. It is likely that other unmapped faults within the mapped fault zone could intersect the proposed storm drain.

The designers should consider this in the design of the storm drain for this reach. We anticipate that both vertical and horizontal offsets could occur. Potential damage to the pipeline could occur from a single-event offset or creep, which has also been associated with this fault zone.

V. CONCLUSIONS AND RECOMMENDATIONS

On the basis of our field and laboratory exploration and testing, it is our opinion that the proposed construction will be feasible from a soil mechanics standpoint. The following sections present more detailed recommendations and conclusions that may be applied to this project. These considerations include:

- Overall feasibility
- Soil types expected to be encountered/geologic logs
- Geologic setting/seismicity
- Excavation characteristics
- Rippability and recommendations for trenching, temporary excavations and soil parameters soil parameters for the design of shoring
- Recommendation of shoring that may not be suitable for construction based on soil conditions
- Suitability of on-site materials as related to applicability/feasibility of jetting and backfill
- Description of groundwater, site and subsurface conditions
- Recommendations for unusual soil conditions or groundwater conditions during construction, if encountered
- Soil compressibility, preliminary soil strength
- Soluble sulfate and chloride content analysis
- Trenching and shoring considerations and recommendations
- Existing pavement thickness at each boring location

Specific design parameters that will be determined for the pipe and reinforced concrete box installation include, but are not limited to:

- Allowable bearing pressure
- Design lateral earth pressures
- Shoring/trench safety
- Subgrade R-Values along alignment
- Coefficient of friction
- Sand Equivalent values and soil density
- Site Preparation including compaction requirements and compaction characteristics of native soils
- Shrinkage and subsidence
- Corrosion evaluation and recommendations for cement type and corrosion protection of steel
- General site grading/backfilling recommendations

- RCP design variables for Marston-Spangler method of pipe design, including soil unit weight in the compacted backfill prism (γ_w), and the dimensionless product of the Rankine ratio and sidewall friction coefficient (K_μ').
- Values to determine the Soil Erodibility Factor (K) using the Erickson triangular nomograph, including the percentages of sand, very fine sand, silt and clay (hydrometer test)

Overall Feasibility: Based on our investigation, the project appears to be feasible from a geotechnical and geologic standpoint, provided our conclusions and recommendations for this project are considered. Both fine-grained and granular soils were encountered and in a loose to medium dense condition. Some relatively clean sands and gravels were encountered and may be susceptible to caving. Our borings indicate that these occur in the younger fan deposits on the easterly portion of the project. They may also be present near the center of the project between approximate Station Nos. 20+00 through 52+00. The most problematic exposures were encountered in Borings B-05 through B-08.

Some of the fine-grained soil encountered during our exploration are in a very moist condition and may not be suitable for compacted backfill unless they are processed with dryer soils or allowed to dry back.

Analytical testing reveals that the project will be affected by very severely corrosive soils and high sulfate concentrations. A separate report concerning soil corrosion has been prepared by HDR│Schiff and is appended. General recommendations for mitigation are included.

Expansion testing indicated an Expansion Index of 67. Other sites investigated in this vicinity have also revealed expansive soils. Some of these soils may not be appropriate for structural backfill.

Groundwater was not encountered within the planned excavation limits. Historical groundwater levels are well below the planned excavation limits.

Expected Soil Types To Be Encountered: The surface and subsurface materials that will be encountered during the construction of this project will include predominately younger alluvial deposits. The actual soil types will vary considerable, ranging from clean sands to elastic silts and clays.

Artificial fill was encountered in Boring B-09. Scattered debris was observed across the surface between approximate Stations 21+00 and 26+75.

Sand Equivalent Values and Soil Density: The density of the in-place materials was determined using the relatively undisturbed samples retrieved during the field exploration. Unit weights were observed to be highly variable and ranged from approximately 95 to 145 pounds per cubic foot. We've assumed a unit weight of 136 pounds per cubic foot in our analyses.

Sand Equivalent values ranged from 2 to 34. The following table presents the Sand Equivalent values on representative samples along the alignment:

Boring No.	Depth (ft.)	SE
B-01	1.33-4.0	17
B-02	0.92-7.0	12
B-02	7.0-16.0	11
B-03	1.07-4.0	9
B-04	1.25-6.5	9
B-05	0.25-8.0	11
B-06	11.0-15.0	34
B-08	4.0-12.0	15
B-10	0.0-2.25	4
B-10	5.0-9.0	2
B-11	0.0-3.0	4
B-12	0.0-2.75	12

Excavation Characteristics/Rippability Concerns: Our investigation did not reveal materials expected to cause excavation difficulties for conventional equipment. The younger alluvial deposits are not expected to present difficulties during excavation with the exception of caving which should be anticipated.

Unusual Soil Conditions or Groundwater Conditions: Artificial fill was encountered within our exploratory boring B-09, which was located in an area where surficial debris is present, between approximate Stations 21+00 and 26+75. Groundwater was not encountered. Some of the fine-grained deposits were observed to be very moist and may require processing to enable compaction.

The soil has been classified as being severely corrosive to ferrous metals, severe for sulfate attack on concrete and aggressive with respect to exposure to reinforcing steel.

Expansive soils were encountered. R-Value testing indicates expansion pressures in excess of 100 pounds per square foot. Testing indicates an Expansion Index of 67 and

Plasticity Indices (PI) of up to 15. Expansive soil pressures should be considered in the design of manhole and RCB bases. Soils exhibiting Expansion Indices in excess of 20 should not be used for structural backfill.

Soil Compressibility, Preliminary Soil Strength: Shear testing was conducted upon both undisturbed specimens and samples remolded to the in-place densities. The angles of internal friction ranged from 25 to 34 degrees. Cohesive strengths were minimal.

Water Soluble Sulfates: Testing indicates that some of the soils have very high concentrations of water-soluble sulfates. This is addressed in the report of the Soil Corrosivity Evaluation which is appended.

Trenching and Shoring Recommendations: All trenches shall be configured and shored in accordance with the requirements of Cal/OSHA. We would classify the soils as Type C. Some cohesionless soils may be encountered at depths that may be subject to caving when exposed in unshored vertical excavation sidewalls. If a trench shield is used, careful monitoring will be required.

The contractor should have a “competent person” on-site for the purpose of assuring safety within and about all construction excavations. Unshored excavations shall have a maximum slope of 1.5:1 (H:V) and shall not exceed twenty feet in height. Shoring, shields, or other protective systems shall be used in accordance with all specifications, recommendations, and limitations provided by the manufacturer. Shoring should be designed using an at-rest earth pressure of 79 pounds per cubic foot. We have assumed a unit weight of compacted backfill to be 136.5 pounds per cubic foot for this determination. This is based upon compacted soil at near optimum moisture content. A Registered Professional Engineer shall design shoring or benching for excavations greater than twenty feet deep.

Protection of Existing Facilities: Where existing utilities cross or are exposed by the planned excavation, we recommend that these lines be assessed for sensitivity to post-construction settlements. Typically, this is a concern for rigid pipelines such as water and sewer lines. In these cases, we recommend that the placement of compacted backfill be terminated no closer than 12 inches from the line. At that point, the backfill should consist of a sand-cement slurry (one-sack) or Controlled Density Fill (CDF) placed to at-least the springline of the pipe. This will assure adequate post-construction support and will minimize the effects of the overlying backfill.

Allowable Bearing Pressure: A conservative design value for any proposed foundations would be 1000 pounds per square foot assuming foundation supported

upon undisturbed soil having an in-place Relative Compaction of at least 85 percent or soil that is recompacted to at least 90 percent Relative Compaction.

Earth Pressures: Lateral earth pressure will act on buried walls of the proposed inlet/outlet structures, headwalls and other appurtenances. Cantilever walls supporting compacted fill soils should be designed using an equivalent active earth pressure of 50 pounds per cubic foot (pcf) for level backfill. Braced walls should be designed for at-rest earth pressure of 79 pcf, with the resultant applied at mid-height. This is based upon backfill exhibiting an Expansion Index of less than 20.

Any applicable construction and seismic surcharges should be added to the above pressures. The effects of seismic forces may be characterized as an Equivalent Fluid Pressure of 15 pounds per cubic foot.

Design lateral loads may be resisted by passive earth pressure on foundations on compacted fill or dense native soils. This resistance may be determined from a design passive pressure based on an equivalent fluid pressure of 180 pcf. This value includes a factor safety of 1.5 on the ultimate passive pressure.

Appropriate drainage should be provided behind any retaining walls to prevent the build-up of hydrostatic pressures. All subdrain systems must be protected against piping by means of graded filters or filter fabrics.

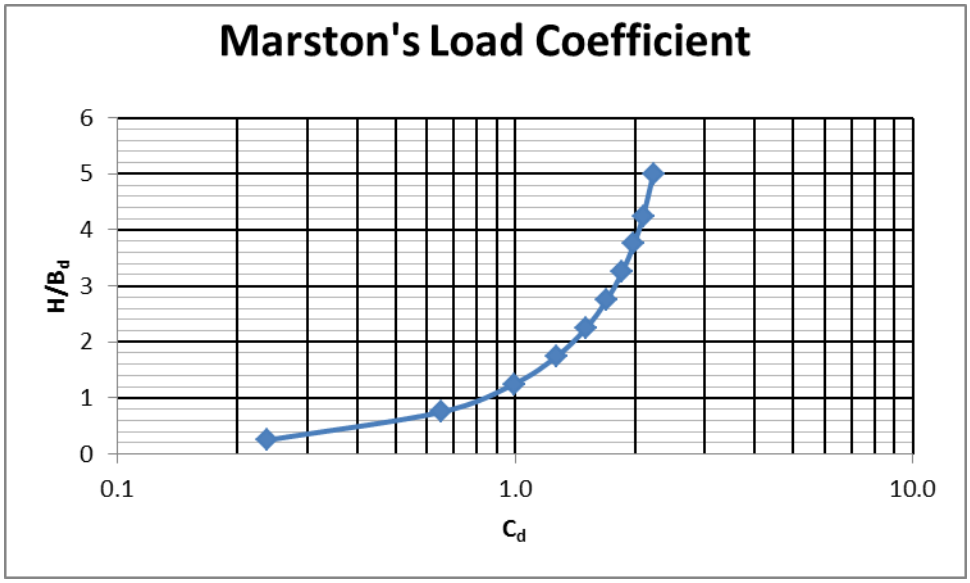
Coefficient of Friction: A coefficient of friction of 0.3 between soil and concrete may be used with dead load forces only.

Unit Weight: Our recommendations are based upon a total unit weight of 136 pounds per cubic foot for compacted backfill. Our testing indicates the product of the Rankine ratio and sidewall friction coefficient ($K\mu'$) to be approximately 0.19. Loads under trench conditions are to be estimated using Marston's Formula:

$$W_c = C_d w B_d^2$$

Where: W_c = Load on Pipe
w = Unit Weight of Backfill (135 pcf)
B_d = Trench Width (ft.)

H = Height of Fill above Pipe (H<20ft.)
C_d = Marston's Load Coefficient as shown in the following chart:



Pipe Design E': Values of the Lateral Modulus of Subgrade Reaction (E') may vary across the alignment. Based upon the material types anticipated, we recommend a Lateral Modulus of Subgrade Reaction not exceeding 400 pounds per cubic inch.

Settlement: Settlements under foundations for the proposed structures are expected to be minor. Considering a continuous load of 2 kips per linear foot at a depth of 8 feet and a bearing pressure not exceeding 1 kip per square foot, maximum settlements are expected to be on the order of one inch.

Shrinkage and Subsidence: Volumetric shrinkage of surficial soils that are excavated and replaced as controlled compacted backfill will be minimal. We estimate that this shrinkage will be less than ten percent. Subsidence of soil surfaces that are scarified and compacted will be on the order of 0.2 feet per foot of recompaction. The effects of the recompaction of the soil "in-place" may extend up to two feet beneath the surface that is compacted. Therefore, subsidence due to such recompaction may be up to 0.4 feet. Subsidence due to compaction will vary depending upon the type of equipment used and the moisture content of the soil at the time of grading.

Corrosivity: A corrosivity evaluation for this project was conducted by HDR│Schiff Associates. The report indicates that the soils are severely corrosive to ferrous metals, aggressive to copper, severe for sulfate attack on concrete and aggressive with respect to exposure to reinforcing steel due to high chloride concentrations. The report provides specific recommendations and generalized alternatives for mitigation of these items for concrete, reinforced concrete and concrete structures. The entire report is appended and includes test data.

Applicability/Feasibility of Jetting On-Site Materials: On-site soils are not compatible to compaction by jetting. The use of sand/cement slurry or Controlled Density Fill (CDF) may be an acceptable alternative.

Earthwork/Backfilling: The on-site materials are suitable for use as compacted backfill. Soils should be brought to near optimum moisture content, and compacted in 6 to 8 inch thick lifts to a minimum of 90 percent of the maximum dry density as determined by Caltrans test method 216 or ASTM Standard D1557-09, whichever is indicated in the project specifications. Soils should be mechanically compacted. Compaction by jetting is not recommended and should be avoided. All work shall be in accordance with District requirements. The following specifications have been developed on the basis of our field and laboratory testing:

Trench Backfill: Trench backfill material should be native or approved granular materials which are free of organic and deleterious materials, rocks or lumps greater than 3 inches in greatest dimension and other unsuitable materials. We recommend that all backfill be either non-expansive or have an Expansion Index of less than 20. Trench backfill may be compacted at near optimum moisture content by mechanical means as necessary for the achievement of satisfactory compaction. Controlled Density Fill (CDF) or Sand-Cement Slurry may be used in lieu of mechanically compacted native soils as backfill material. Unless otherwise specified by the drawings, specifications or encroachment permits, the minimum acceptable degree of compaction shall be 90 percent of the maximum dry density. This is with the exception of the upper 12 inches within roadway areas which shall be compacted to a minimum of 95 percent Relative Compaction.

Foundations/Structures: The surfaces to receive concrete for foundations should be recompacted to at least 90 percent Relative Compaction for a depth of at least 12 inches below the footing base. Where the existing soil is soft due to excessive moisture, they should be removed as necessary to establish a stable platform for compaction and replaced with suitable soil. The placement of a 12 inch thick layer of aggregate base compacted to at least 95 percent Relative Compaction is recommended below the bases of the reinforced box culverts in order to establish uniform support for these structures. The soil below the base course should be compacted to at least 90 percent Relative compaction.

Import Materials: All proposed import soils should be reviewed by the soils engineering consultant prior to use. It is anticipated that only on-site soils will be used for this project. Expansive soils should not be imported for this project. At

least two working days notice should be allowed for the soil engineer to review and approve any proposed imported soils. If laboratory testing is necessary to obtain approval of import soils, an additional one to two days should be allowed. To provide protection from particle migration, imported pipe embedment material should be in accordance with the following criteria:

Imported Embedment Material Criteria
D_{15} <1.0 mm, and D_{50} <2.5 mm

where D_{15} and D_{50} represent bedding material particle sizes corresponding to 15 and 50 percent passing by weight, respectively.

Observations and Compaction Testing: During backfilling, observations and compaction testing shall be conducted in order to verify satisfactory compaction. The Maximum Dry Density-Optimum Moisture Content relationship shall be determined by means of either ASTM Standard D1557-09, test method or California Test Method No. 216, whichever is indicated in the project specifications. The field density shall be determined by either the ASTM Standard D1556-07 (Sand Cone) or ASTM 6938-10 (Nuclear) test method. The compaction shall be verified at maximum intervals of 250 feet for each 2-foot vertical lift or as otherwise determined to be necessary by the inspector in the field during backfilling. Some backfill and compaction methodologies will dictate much shorter test intervals.

Retests: Should testing reveal insufficient compaction, additional testing may be necessary in order to define the area requiring recompaction. Without further testing, it should be assumed that the area between a failing test and a passing test is not properly compacted. As a guideline for evaluation, one test may be taken at a distance from the failing test equal to 20 percent of the distance to the next passing test. If the test reveals satisfactory compaction, the area between the failing test and the passing test shall be recompacted. If the test reveals inadequate compaction, the process should be repeated in order to delineate the unsatisfactory area. After recompaction of “failing” areas, retesting should be conducted in order to confirm satisfactory compaction. At least one retest is required for each failing test, even if failing tests are for the purpose of delineating the area requiring additional work.

GENERAL

The findings and recommendations presented in this report are based upon an interpolation of the soil conditions between boring locations. Due to the type of exploration and the limited soil exposures resulting from exploratory borings, the boring logs may not present a thorough characterization of the actual subsurface conditions. Conditions should be anticipated to vary between boring locations. Significant changes may require revisions in the recommendations presented herein. Should conditions be encountered during construction that appears to be different than those indicated by this report, this office should be notified. We recommend that a pre-job conference be held on the site prior to the initiation of construction. The purpose of this meeting will be to assure a complete understanding of the recommendations presented in this report as they apply to the actual work to be performed.

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APPENDIX A

FIELD AND LABORATORY EXPLORATION AND TESTING

For our field exploration, twelve exploratory borings were excavated by means of a truck mounted rotary auger rig at the approximate locations shown on Figures A-15. Continuous logs of the materials encountered were made on the site by a Staff Geologist. These are presented on Figures A-3 through A-14.

Representative undisturbed samples were obtained within our borings by driving a thin-walled steel penetration sampler with successive 30-inch drops of a 140-pound hammer. The number of blows required to achieve each six inches of penetration were recorded on our boring logs and used for estimating the relative consistencies of the subsoils. Two different samplers were used. The first sampler used was a Standard Penetration Sampler for which published correlations relating the number of hammer blows to the strength of the soil are available. The second sampler type was larger in diameter, carrying brass sample rings having inner diameters of 2.41 inches. Undisturbed samples were removed from the sampler and placed in moisture sealed containers in order to preserve the natural soil moisture content. Representative bulk soil samples were obtained from the auger cuttings. All samples were then transported to our laboratory for further observations and testing.

Representative bulk samples were obtained and returned to our laboratory for further testing and observations. The results of this testing are discussed and presented in Appendix B.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487-06)

PRIMARY DIVISIONS			GROUP SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIALS IS LARGER THAN #200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN #4 SIEVE	CLEAN GRAVELS (LESS THAN) 5% FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVEL WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN #4 SIEVE	CLEAN SANDS (LESS THAN) 5% FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN HALF OF MATERIALS IS SMALLER THAN #200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
	HIGHLY ORGANIC SOILS		PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS
TYPICAL FORMATIONAL MATERIALS	SANDSTONES		SS	
	SILTSTONES		SH	
	CLAYSTONES		CS	
	LIMESTONES		LS	
	SHALE		SL	

CONSISTENCY CRITERIA BASES ON FIELD TESTS

RELATIVE DENSITY – COARSE – GRAIN SOIL

RELATIVE DENSITY	SPT * (# BLOWS/FT)	RELATIVE DENSITY (%)
VERY LOOSE	<4	0-15
LOOSE	4-10	15-35
MEDIUM DENSE	10-30	35-65
DENSE	30-50	65-85
VERY DENSE	>50	85-100

CONSISTENCY – FINE-GRAIN SOIL

CONSISTENCY	SPT* (# BLOWS/FT)	TORVANE UNDRAINED SHEAR STRENGTH (tsf)	POCKET ** PENETROMETER UNCONFINED COMPRESSIVE STRENGTH (tsf)
Very Soft	<2	<0.13	<0.25
Soft	2-4	0.13-0.25	0.25-0.5
Medium Stiff	4-8	0.25-0.5	0.5-1.0
Stiff	8-15	0.5-1.0	1.0-2.0
Very Stiff	15-30	1.0-2.0	2.0-4.0
Hard	>30	>2.0	>4.0

* NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1 3/8 INCH I.D.) SPLIT BARREL SAMPLER (ASTM -1586 STANDARD PENETRATION TEST)

** UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ.FT. READ FROM POCKET PENETROMETER

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
DRY	Absence of moisture, dusty, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbled or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

EXPLANATION OF LOGS

Figure A-2

LOG OF BORING B-01

Elevation:	1605.0	Date(s) Drilled:	5/30/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	USCS	Description	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
		ASPHALT CONCRETE over DECOMPOSED GRANITE, (4 inches over 12 inches)							
	SM	**SILTY SAND,** fine to medium grained with trace clay, olive brown, moist, medium dense.		BULK					
			X		SS	7 8	8	123	
5	SM	**SILTY SAND,** fine to medium grained, olive, moist, loose to medium dense.		BULK					
	SP SM	**SAND with SILT,** fine to medium grained, olive, slightly moist, loose.	X		SS	4 6	4	108	
10	SP	**SAND,** fine to medium grained, olive, moist, loose, interbedded with silt.		BULK					
			X		SS	5 5	12	88	
15	SW	**SAND,** fine to coarse grained, olive brown, slightly moist, medium dense.							
			X		SS	9 11	2	103	
20									
			X		SS	10 15	3	113	
25	SM	**SILTY SAND,** fine to medium grained with trace clay, olive, moist, medium dense.							
			X		SS	4 7	9	105	
	SC	**CLAYEY SAND**, very fine to fine grained, olive brown, moist, medium dense.							
30	SW SM	**SAND with SILT,** fine to coarse grained, olive, slightly moist, medium dense.							
			X		SS	16 17	2	116	
		End of boring at 33.5 feet. No groundwater or mottling encountered.							

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Figure No. A-3

LOG OF BORING B-02

Elevation:	1597.5	Date(s) Drilled:	5/30/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	GRAPHIC	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
			ASPHALT CONCRETE, (11 inches)							
		SM	**SILTY SAND,** fine to medium grained with trace clay, olive, moist, loose, with thin interbeds of silt or clay.			BULK				
5				X		SS	2 3	7	97	
		SM	**SILTY SAND,** very fine to fine grained, olive, moist, loose, with thin interbeds of silt or clay.			BULK				
10				X		SS	3 4	11	94	
15				X		SS	3 5	7	92	
		SM	**SILTY SAND,** fine to coarse grained, olive, moist, loose, with sporadic very thin layers of clay.			BULK				
20				X		SS	3 5	5	89	
25				X		SS	5 7	8	110	
		SM	**SILTY SAND,** fine to medium grained, olive, moist, medium dense, with thin interbeds of sand.	X		SS	6 14	5	105	
30		SW	**SAND,** fine to coarse grained, olive, slightly moist, medium dense.	X		SS	13 16	2	112	
			End of boring at 34.5 feet. No groundwater or mottling encountered.							

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San Jacinto, CA
Project No. R206-014

Figure No. **A-4**

LOG OF BORING B-03

Elevation:	1592.5	Date(s) Drilled:	5/30/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	GRAPHIC	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
			ASPHALT CONCRETE, (13 inches)							
		SC SM	**SILTY, CLAYEY SAND**, very fine to fine grained, olive, moist, loose.		■	BULK				
		SW	**SAND,** fine to coarse grained, olive, slightly moist, loose.		■	BULK				
5		ML	**SANDY SILT,** very fine to fine grained, olive, moist, soft.	☒		SS	4 3	2	109	
		SM	**SILTY SAND,** fine to medium grained, olive, moist, loose.		■	BULK				
10				☒	■	SS	2 4	8	107	
		SP SM	**SAND with SILT,** fine to medium grained, olive, moist, medium dense, with thin interbeds of silty sand.		■	BULK				
15				☒	■	SS	7 6	4	104	
		SM	**SILTY SAND,** fine to medium grained, olive, moist, loose to medium dense.							
20		SP SM	**SAND with SILT,** fine to medium grained, light olive, slightly moist, loose.	☒		SS	5 6	9	103	
		SM	**SILTY SAND,** fine to medium grained, olive, moist, loose.							
25		SC SM	**SILTY, CLAYEY SAND**, fine to medium grained, olive, moist, medium dense.	☒	■	SS BULK	4 5	11	96	
		SM	**SILTY SAND,** fine to coarse grained, olive, moist, medium dense.							
30				☒		SS	8 12	5	100	
35				☒		SS	6 12	9	106	
			End of boring at 35.5 feet. No groundwater or mottling encountered.							

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Figure No. A-5

LOG OF BORING B-04

Elevation:	1582.0	Date(s) Drilled:	5/30/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	GRAPHIC	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
			ASPHALT CONCRETE, (15 inches)							
		SC SM	**SILTY, CLAYEY SAND,** very fine to fine grained, dark olive, moist, loose.			BULK				
5				X		SS	2 3	13	100	
		ML	**SANDY SILT,** very fine to fine grained, dark olive, very moist, soft, with thin interbeds of silt or clay.			BULK				
10				X		SS	2 4	36	87	
		SC	**CLAYEY SAND**, very fine to fine grained, olive, very moist, loose, with thin interbeds of silt or clay.			BULK				
15				X		SS	4 5	17	101	
		ML	**SANDY SILT,** very fine to fine grained, olive, very moist, stiff.			BULK				
20		SM	**SILTY SAND,** fine to medium grained, olive, moist, medium dense, with sporadic interbeds of sand or silt.	X		SS	6	16	105	
						BULK	8			
25				X		SS	7 7	7	104	
30				X		SS	8 11	7	114	
				X		SS	13 18	10	122	
			End of boring at 34.5 feet. No groundwater or mottling encountered.							

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Figure No. A-6

LOG OF BORING B-05

Elevation:	1576.0	Date(s) Drilled:	5/30/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	GRAPHIC	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
			ASPHALT CONCRETE, (3 inches)							
		SC SM	**SILTY, CLAYEY SAND**, very fine to fine grained, olive, moist, loose, with thin interbeds of silty sand.			BULK				
5				X		SS	3 4	8	96	
		CL ML	**SANDY SILTY CLAY**, very fine grained, olive, moist, soft.			BULK				
10				X		SS	2 2	16	91	
		SW	**SAND,** very fine to fine grained, dark olive, moist, loose, interbedded with sandy silty clay.			BULK				
15				X		SS	2 3	18	95	
				X		SS	4 5	21	94	
20		CL	**SANDY CLAY**, fine grained, dark olive, very moist, soft to stiff, interbedded with silty sand.			BULK				
		SM	**SILTY SAND,** fine to medium grained with trace clay, olive, moist, medium dense.	X		SS	4 8	12	107	
25				X		SS	7 7			
			End of boring at 29.5 feet. No groundwater or mottling encountered.							

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Figure No. A-7

LOG OF BORING B-06

Elevation:	1571.0	Date(s) Drilled:	5/30/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
	SC	**ASPHALT CONCRETE**, (3 inches)							
		CLAYEY SAND, very fine to fine grained, dark olive, moist, medium dense.		■	BULK				
	SM	**SILTY SAND,** fine to medium grained, olive brown, moist, loose.							
5			X		SS	2 3	11	112	
	SC	**CLAYEY SAND**, very fine to fine grained, olive, moist, loose.							
	SM	**SILTY SAND,** fine to medium grained, olive, moist, loose to medium dense.		■	BULK				
10			X		SS	5	3	114	
	SW SM	**SAND with SILT,** fine to coarse grained, olive, moist, medium dense.		■	BULK	11			
15	SC	**CLAYEY SAND**, very fine to fine grained, olive, moist, medium dense.	X		SS	7 12	14	104	
	SW SM	**SAND with SILT,** fine to coarse grained, olive, moist, medium dense.							
	SM	**SILTY SAND,** fine to medium grained, olive, moist, medium dense, sporadic very thin layers of clay.		■	BULK				
20			X	■	SS	5 6	8	107	
25			X	■	SS	7 9	4	100	
		End of boring at 26.5 feet. No groundwater or mottling encountered.							

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Figure No. **A-8**

LOG OF BORING B-07

Elevation:	1571.0	Date(s) Drilled:	5/30/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	GRAPHIC	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
			ASPHALT CONCRETE over DECOMPOSED GRANITE, (5.5 inches over 3.5 inches)							
		SM	**SILTY SAND,** fine to medium grained with trace clay, olive brown, moist, very loose to loose.			BULK				
		SM	**SILTY SAND,** fine to medium grained, olive, moist, loose, interbedded with sandy clay.			BULK				
				X		SS	2 2	10	101	
5										
		SM	**SILTY SAND,** fine to medium grained with trace clay, olive, moist, loose, interbedded with sandy clay.			BULK				
				X		SS	2 2	12	106	
10										
		SM	**SILTY SAND,** fine to medium grained, olive, slightly moist, medium dense, with thin interbeds of sandy silt.			BULK				
				X		SS	6 8	5	110	
15										
		SW	**SAND,** fine to coarse grained, olive, slightly moist, medium dense.							
				X		SS	13 15	3	109	
20										
		SM	**SILTY SAND,** fine to medium grained, olive, moist, medium dense, with very thin interbeds of silt.			BULK				
				X		SS	5 7	13	104	
25										
				X		SS	6 7	14	93	
			End of boring at 29.5 feet. No groundwater or mottling encountered.							

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Figure No. A-9

LOG OF BORING B-08

Elevation:	1566.0	Date(s) Drilled:	5/31/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	GRAPHIC	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
		CL	**SANDY CLAY**, very fine to fine grained, dark olive, moist, soft to stiff.			BULK				
5		SM	**SILTY SAND,** fine to medium grained, olive brown, moist, loose to medium dense.	X		BULK SS	6 8	5	92	
10				X		SS	4 5	6	101	
		SP	**SAND,** fine to medium grained, light olive, slightly moist, medium dense.			BULK				
15				X		SS	7 11	2	109	
		SM	**SILTY SAND,** fine to medium grained with trace clay, olive, moist, medium dense.							
20		SP	**SAND,** fine to medium grained, light olive, moist, medium dense.	X		SS	7 11	10	102	
		SM	**SILTY SAND,** fine to medium grained, olive, moist, medium dense.							
25				X		SPT	4 5	7		
			End of boring at 25.5 feet. No groundwater or mottling encountered.							

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Figure No. A-10

LOG OF BORING B-09

Elevation:	1561.0	Date(s) Drilled:	5/31/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
	SM	**ARTIFICIAL FILL,** SILTY SAND, fine to very coarse grained, olive, slightly moist, very loose to loose, with asphalt and concrete debis.	BULK				
	ML	**SILT with SAND**, very fine grained, olive, moist, soft.	SS	3 2	12	99	
5	SP	**SAND,** fine to medium grained, olive, slightly moist, loose.	BULK				
	SM	**SILTY SAND,** very fine to fine grained with trace clay, dark olive, moist, loose, with thin interbeds of clay.	BULK				
			SS	3 4	7	110	
10							
	SC	**CLAYEY SAND**, very fine to fine grained, dark olive, moist, loose.	BULK				
			SS	3 4	12	101	
15							
	SW	**SAND,** fine to coarse grained, olive, slightly moist, medium dense.	SS	7 6	3	107	
	SM	**SILTY SAND,** fine to medium grained, olive, moist, medium dense.	BULK				
20							
	ML	**SILT with SAND,** very fine to fine grained, dark olive, very moist, stiff, interbedded with silty sand.	SPT	4 5	25		
		End of boring at 24.5 feet. No groundwater or mottling encountered.					

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Figure No. A-11

LOG OF BORING B-10

Elevation:	1559.5	Date(s) Drilled:	5/31/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
	CH	**SANDY CLAY**, very fine grained, dark olive, slightly moist to moist, stiff, rootlets.		■	BULK				
			X	■	SS	4 7	16	99	
	SC	**CLAYEY SAND**, very fine to fine grained, olive, slightly moist to moist, medium dense.							
	SM	**SILTY SAND,** fine to medium grained, olive brown, moist, medium dense.		■	BULK				
5	CH	**SANDY CLAY**, very fine grained, olive, moist, stiff.		■	BULK		20	109	
			X	■	SS	9 15	8	110	
10	SC	**CLAYEY SAND**, very fine to fine grained, olive, slightly moist, medium dense.		■	BULK				
			X	■	SS	13 17	4	107	
	SP	**SAND,** fine to medium grained, light olive, slightly moist, medium dense.							
15	SC SM	**SILTY, CLAYEY SAND**, very fine to fine grained, olive, moist, medium dense.		■	BULK				
	ML	**SILT with SAND,** very fine grained, olive, moist, hard.							
			X		SS	11 15	11	103	
	SW	**SAND,** fine to coarse grained, light olive, slightly moist, medium dense.							
20									
			X		SPT	5 7	12		
		End of boring at 22.5 feet. No groundwater or mottling encountered.							

INLAND FOUNDATION ENGINEERING, INC.

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Figure No. A-12

LOG OF BORING B-11

Elevation:	1555.5	Date(s) Drilled:	5/31/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

DEPTH (ft)	GRAPHIC	USCS	SUMMARY OF SUBSURFACE CONDITIONS This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
		CH	**SANDY CLAY**, very fine grained, dark olive, dry to slightly moist, stiff to hard, strongly cemented.			BULK				
				X		SS	17 19	5	109	
		SC	**CLAYEY SAND**, very fine to fine grained, olive, slightly moist, medium dense, strongly cemented.			BULK				
5				X		SS	17 24	8	113	
		SM	**SILTY SAND,** very fine to fine grained, olive, slightly moist, medium dense to dense, with thin interbeds of sand.			BULK				
10		CL ML	**SANDY ,SILTY CLAY**, very fine to fine grained, olive, slightly moist, very hard.			BULK				
				X		SS	14 19	9	107	
		SP	**SAND,** fine to medium grained, olive, slightly moist, dense.			BULK				
15										
				X		SS	13 17	2	105	
20										
		CL	**SANDY CLAY**, very fine grained, dark olive, moist, stiff, interbedded with clayey sand.	X		SPT	3 6	26		
			End of boring at 23.5 feet. No groundwater or mottling encountered.							

INLAND FOUNDATION ENGINEERING, INC.

San Jacinto MDP
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Figure No.
A-13

LOG OF BORING B-12

Elevation:	1548.5	Date(s) Drilled:	5/31/12	Logged by:	FWC
Drilling Method:	Rotary Auger			Hammer Type:	Auto-Trip
Drilling Rig:	Mobile B-61			Hammer Weight:	140 lb.
Boring Diameter:	8-inches			Hammer Drop:	30-inches

SUMMARY OF SUBSURFACE CONDITIONS

This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered and is representative of interpretations made during drilling. Contrasting data derived from laboratory analysis may not be reflected in these representations.

DEPTH (ft)	GRAPHIC	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES: DRIVE SAMPLE	SAMPLES: BULK SAMPLE	SAMPLES: SAMPLE TYPE	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	RELATIVE COMPACTION (%)
		SC	**CLAYEY SAND**, very fine grained, dark olive, slightly moist, dense.		■	BULK				
		SW	**SAND,** fine to coarse grained, olive, slightly moist, dense.	X	■	SS	25	6	118	
					■	BULK	35			
5		ML	**SANDY SILT,** very fine to fine grained, dark olive, slightly moist, hard, interbedded with sand or silty sand.		■	BULK				
				X	■	SS	9 16	2	104	
10		SM	**SILTY SAND,** very fine to fine grained, olive, moist, medium dense, with thin interbeds of sand.		■	BULK				
				X	■	SS	15 20	4	106	
15		SM	**SILTY SAND,** fine to medium grained, dark olive, moist, dense.							
				X		SS	16 20	4	112	
20		CL	**SANDY CLAY**, very fine to fine grained, dark olive, moist, stiff, interbedded with silty sand.							
				X		SPT	4 6	24		
			End of boring at 23.5 feet. No groundwater or mottling encountered.							

INLAND FOUNDATION ENGINEERING, INC.

San Jacinto MDP
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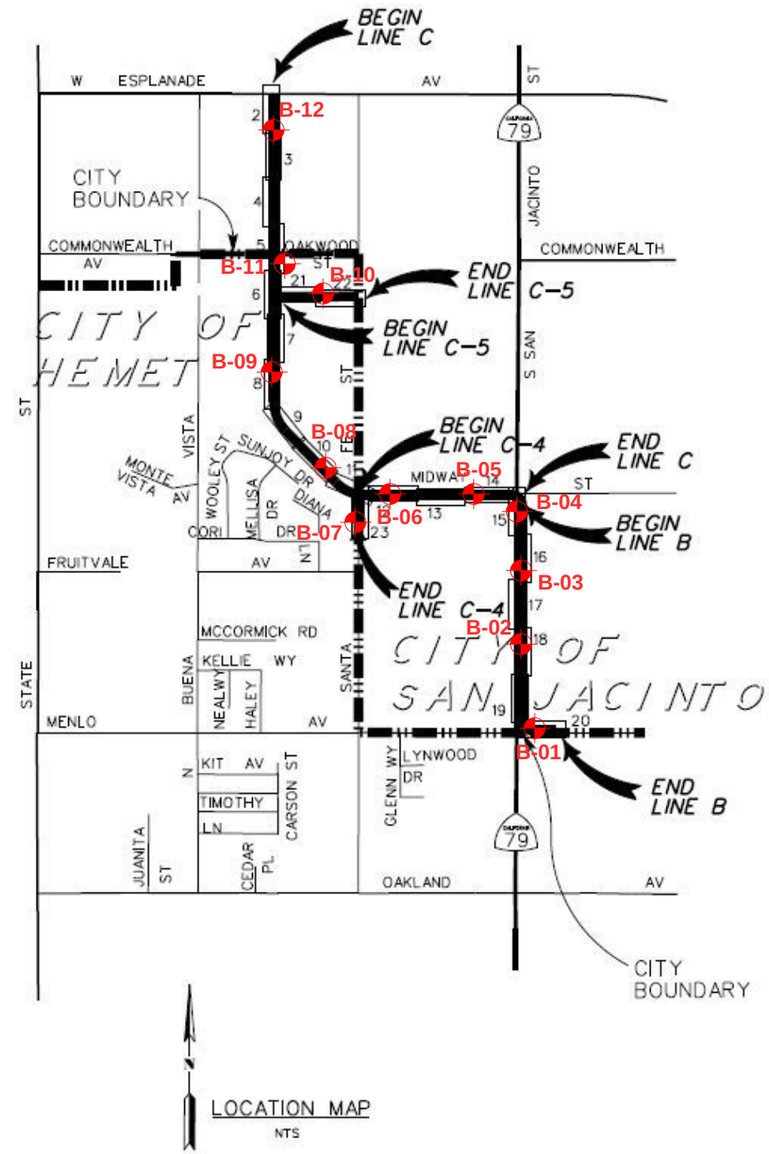
Figure No. A-14



Indicates Approximate Boring Location

INLAND FOUNDATION ENGINEERING, INC.
1310 South Santa Fe Avenue
San Jacinto, California
(951) 654-1555 FAX (951) 654-0551

A-15

DRAWN BY: LES	JOB NO.: R206-014
SCALE: NTS	DATE: July 2012

APPENDIX B

LABORATORY DATA

Representative bulk soil samples were obtained in the field and returned to our laboratory for additional observations and testing. Laboratory testing was generally performed in two phases. The first phase consisted of testing in order to determine the compaction of the existing natural soil and the general engineering classifications of the soils across the site. This testing was performed in order to estimate the engineering characteristics of the soil and to serve as a basis for selecting samples for the second phase of testing. The second phase consisted of soil mechanics and analytical testing. This testing included direct shear testing, consolidation testing, and testing to estimate the corrosion potential of the soils to concrete. These tests were performed in order to provide a means of developing specific design recommendations based on the strength and chemical characteristics of the soil.

CLASSIFICATION AND COMPACTION TESTING

Unit Weight and Moisture Content Determinations: Each undisturbed sample was weighed and measured in order to determine its unit weight. A small portion of each sample was then subjected to testing in order to determine its moisture content. This testing was performed in accordance with the ASTM Standards D2937-10 and D2216-10. This was used in order to determine the dry density of the soil in its natural condition. The results of this testing are shown on the Boring Logs (Figure Nos. A-3 through A-14).

Maximum Density-Optimum Moisture Determinations: Representative soil types were selected for maximum density determinations. This testing was performed in accordance with ASTM D1557-09. The maximum densities are compared to the field densities of the soil in order to determine the existing Relative Compaction. This data is useful in estimating the strength and compressibility of the soil. The results of this testing are shown on Figure Nos. B-4 and B-5.

Classification Testing: Twelve soil samples were selected for classification testing. This testing consists of mechanical grain size analyses, sand equivalent testing, and Atterberg Limits determinations. This testing was performed in accordance with the ASTM Standards D422-63(2007), D4318-10 and D2419-09. These tests provide information for developing classifications for the soil in accordance with the Unified Classification System. This classification system categorizes the soil into groups having similar engineering characteristics. The results of this testing are very useful in detecting variations in the soils and in selecting samples for further testing. The results of this testing are presented on Figure Nos. B-6 through B-8.

SOIL MECHANIC'S TESTING

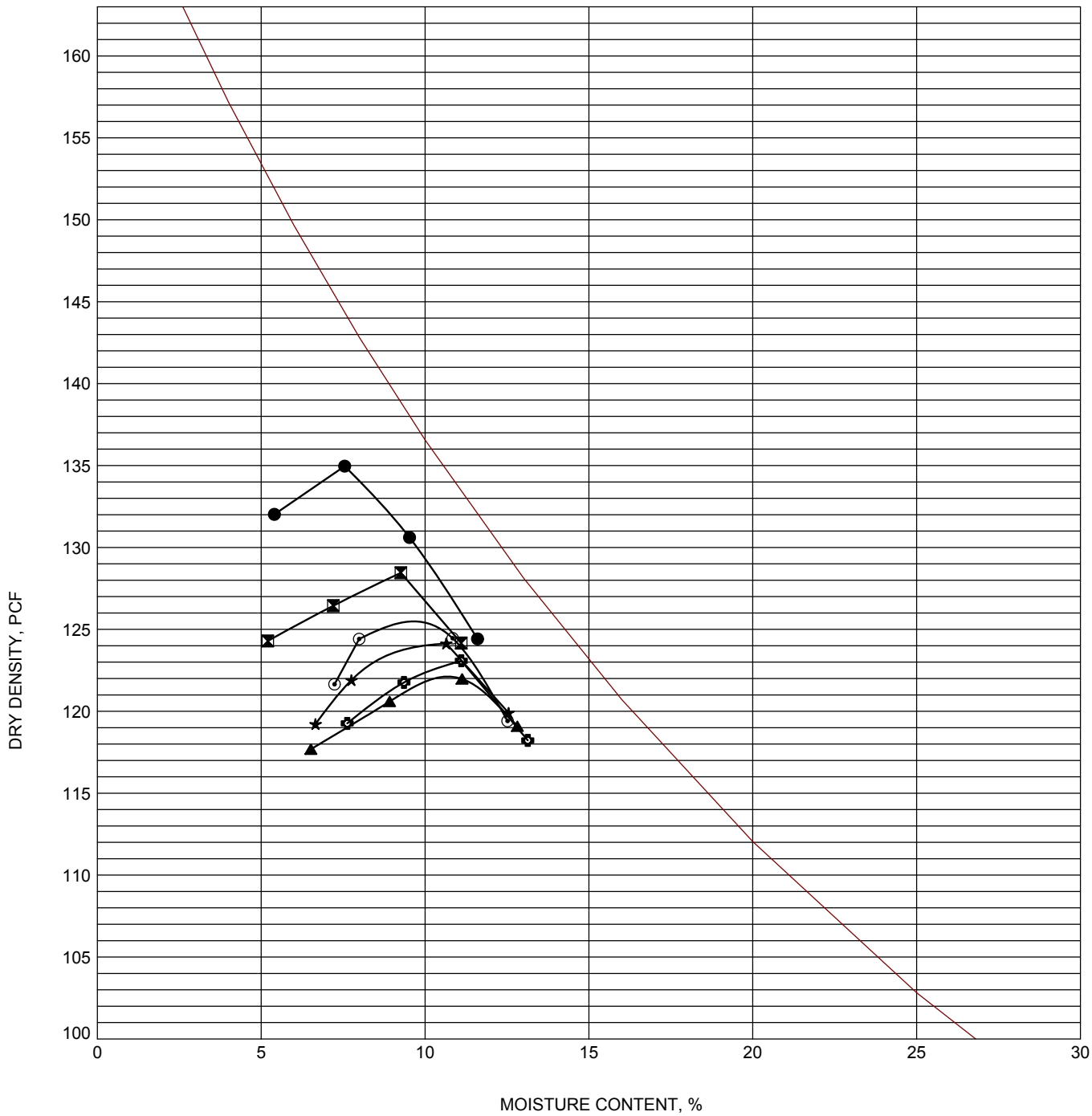
Direct Shear Testing: Four samples were selected for Direct Shear Testing. This testing was performed in accordance with the ASTM Standard D3080/3080M-11. This testing measures the shear strength of the soil under various normal pressures and is used in developing parameters for foundation design and lateral design. Testing was per-formed using recompacted test specimens which were saturated prior to testing. Testing was performed using a strain controlled test apparatus with normal pressures ranging from 934 to 2230 pounds per square foot. The results of this testing are shown on Figure No. B-9.

R-Value Determination: Three samples were selected for R-Value testing. This test measures the ability of soil to resist lateral deformation under applied vertical loads, and is used in developing parameters for pavement structural sections. Testing was performed in accordance with ASTM D2844-07. The result of this testing is shown on Figure Nos. B-10 through B-12.

Expansion Testing: One sample was selected for Expansion testing. Expansion testing was performed in accordance with the UBC Standard 18-2. This testing consists of remolding 4-inch diameter by 1-inch thick test specimens to a moisture content and dry density corresponding to approximately 50 percent saturation. The samples are subjected to a surcharge of 144 pounds per square foot and allowed to reach equilibrium. At that point the specimens are inundated with distilled water. The linear expansion is then measured until complete. The results of this testing are shown on Figure No. B-13.

GENERAL

All laboratory testing has been conducted in conformance with the applicable ASTM test methods by personnel trained and supervised in conformance with our QA/QC policy. Our test data only relates to the specific soils tested. Soil conditions typically vary and any significant variations should be reported to our laboratory for review and possible testing. The data presented in this report are for the use of Riverside County Flood Control and Water Conservation District only and may not be reproduced or used by others without written approval of Inland Foundation Engineering, Inc.



Specimen Identification			Classification	Max.Density	MC%
●	**B-01**	**1.3**	**SILTY SAND SM**	**135.5**	**8.0**
⊠	**B-02**	**0.9**	**CLAYEY SAND SC**	**128.5**	**9.0**
▲	**B-02**	**7.0**	**SILTY, CLAYEY SAND SC-SM**	**122.5**	**10.5**
★	**B-03**	**1.1**	**CLAYEY SAND SC**	**125.0**	**9.5**
⊙	**B-04**	**1.3**	**SILTY, CLAYEY SAND SC-SM**	**126.5**	**9.5**
✿	**B-05**	**0.3**	**SILTY, CLAYEY SAND SC-SM**	**123.5**	**11.0**

PROJECT San Jacinto MDP
Lines B and C

PROJECT NO. R206-014
DATE July 27, 2012

MAXIMUM DENSITY-OPTIMUM MOISTURE CURVES

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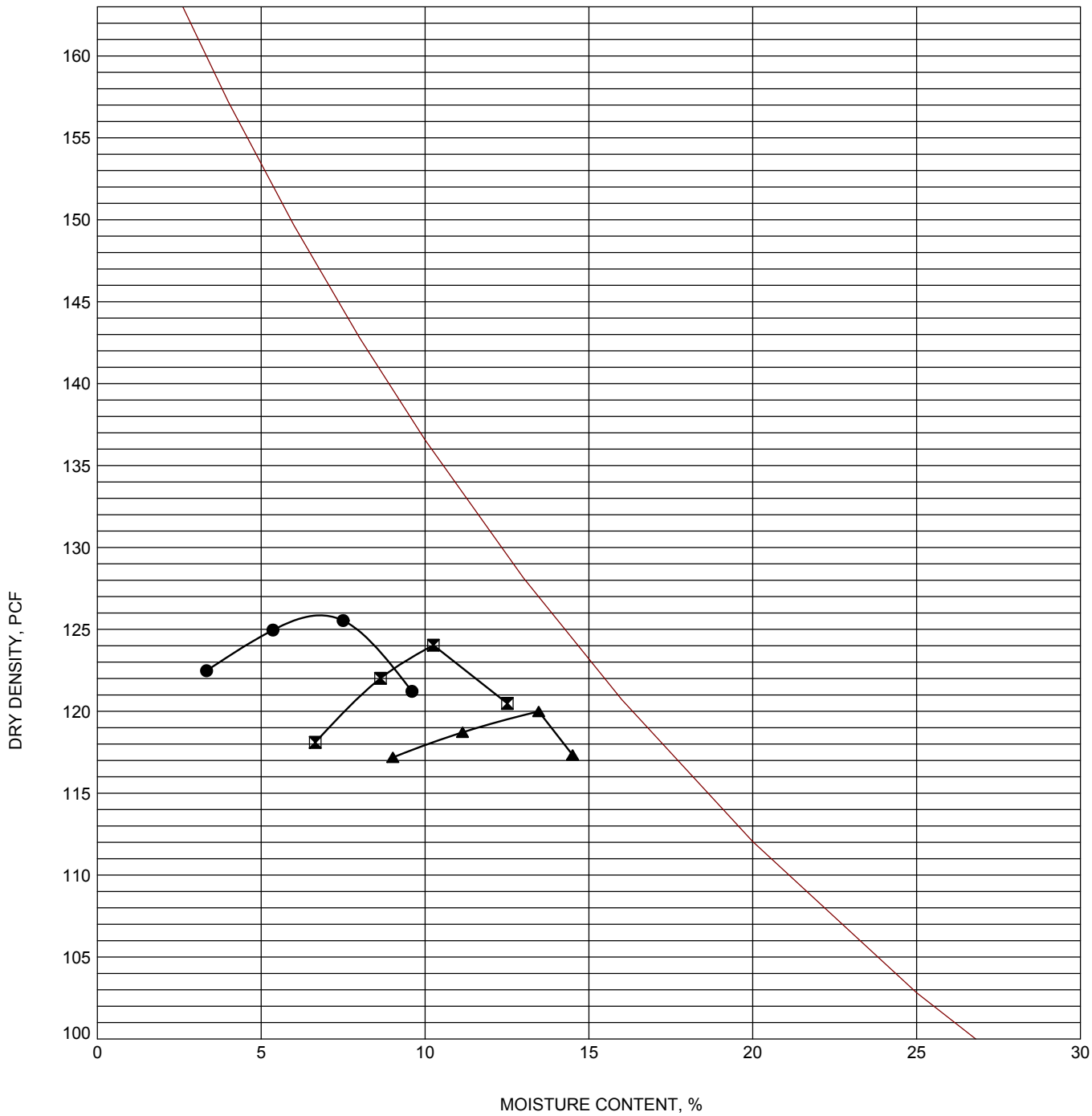
FIGURE NO. B-4



Specimen Identification			Classification	Max.Density	MC%
●	**B-06**	**11.0**	**WELL-GRADED SAND with SILT SW-SM**	**126.0**	**7.0**
⊠	**B-08**	**4.0**	**SILTY SAND SM**	**124.5**	**10.0**
▲	**B-10**	**5.0**	**CLAYEY SAND SC**	**120.0**	**13.5**

PROJECT San Jacinto MDP
Lines B and C

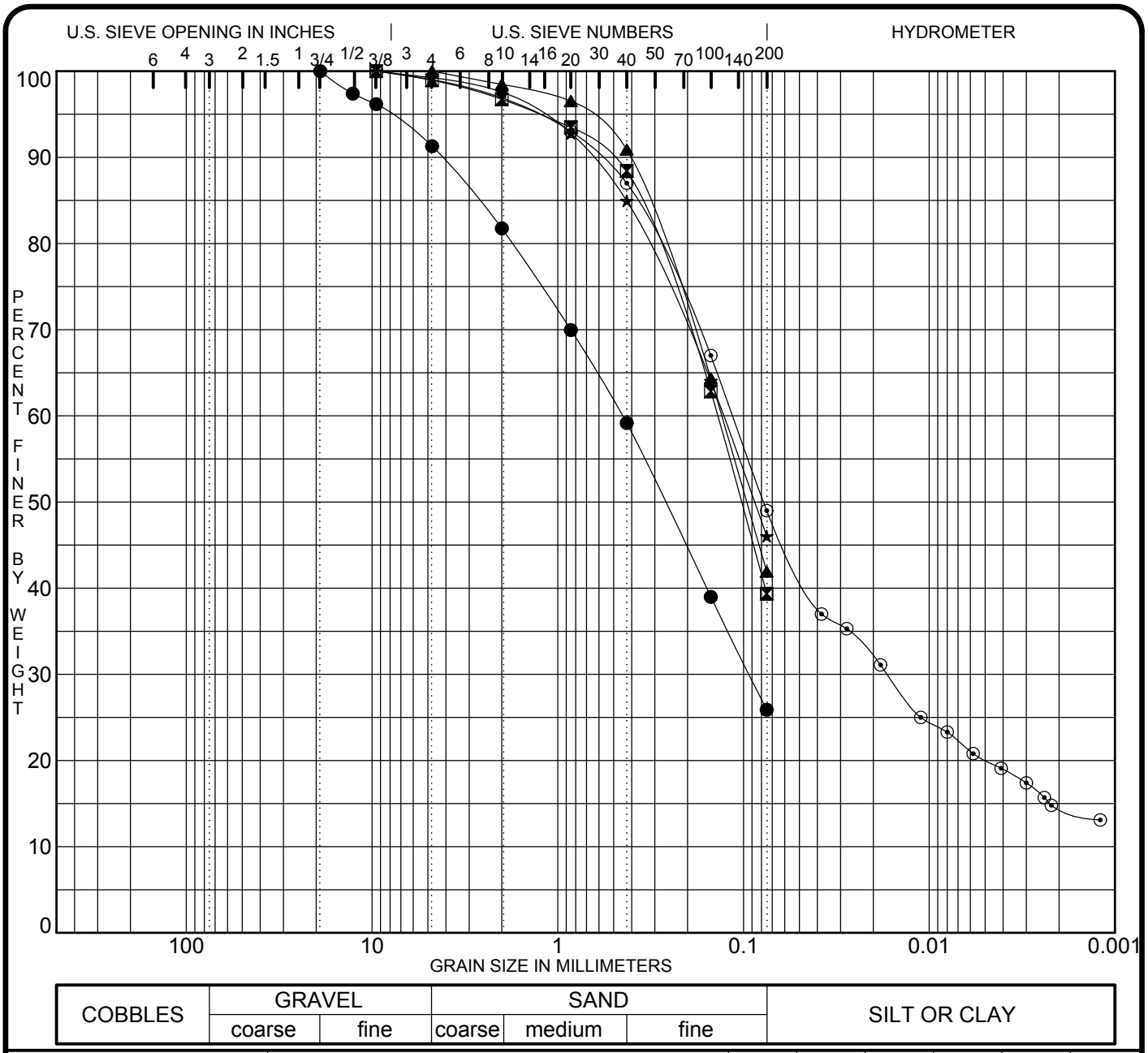
PROJECT NO. R206-014
DATE July 27, 2012

MAXIMUM DENSITY-OPTIMUM MOISTURE CURVES

Inland Foundation Engineering, Inc.

San Jacinto, CA

FIGURE NO. B-5



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	S.E.	LL	PL	PI	Cc	Cu
●	**B-01**	**1.3**	**SILTY SAND SM**	**17**	**19**	**18**	**1**		
⧗	**B-02**	**0.9**	**CLAYEY SAND SC**	**12**	**23**	**14**	**9**		
▲	**B-02**	**7.0**	**SILTY, CLAYEY SAND SC-SM**	**11**	**21**	**17**	**4**		
★	**B-03**	**1.1**	**CLAYEY SAND SC**	**9**	**25**	**17**	**8**		
⊙	**B-04**	**1.3**	**SILTY, CLAYEY SAND SC-SM**	**9**	**22**	**16**	**6**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-01**	**1.3**	**19.00**	**0.45**	**0.093**		**8.7**	**65.4**	**25.9**	
⧗	**B-02**	**0.9**	**9.50**	**0.14**			**1.1**	**59.6**	**39.3**	
▲	**B-02**	**7.0**	**4.75**	**0.13**			**0.0**	**58.1**	**41.9**	
★	**B-03**	**1.1**	**9.50**	**0.13**			**0.8**	**53.2**	**46.0**	
⊙	**B-04**	**1.3**	**9.50**	**0.11**	**0.017**		**2.0**	**49.0**	**28.9**	**20.1**

PROJECT San Jacinto MDP
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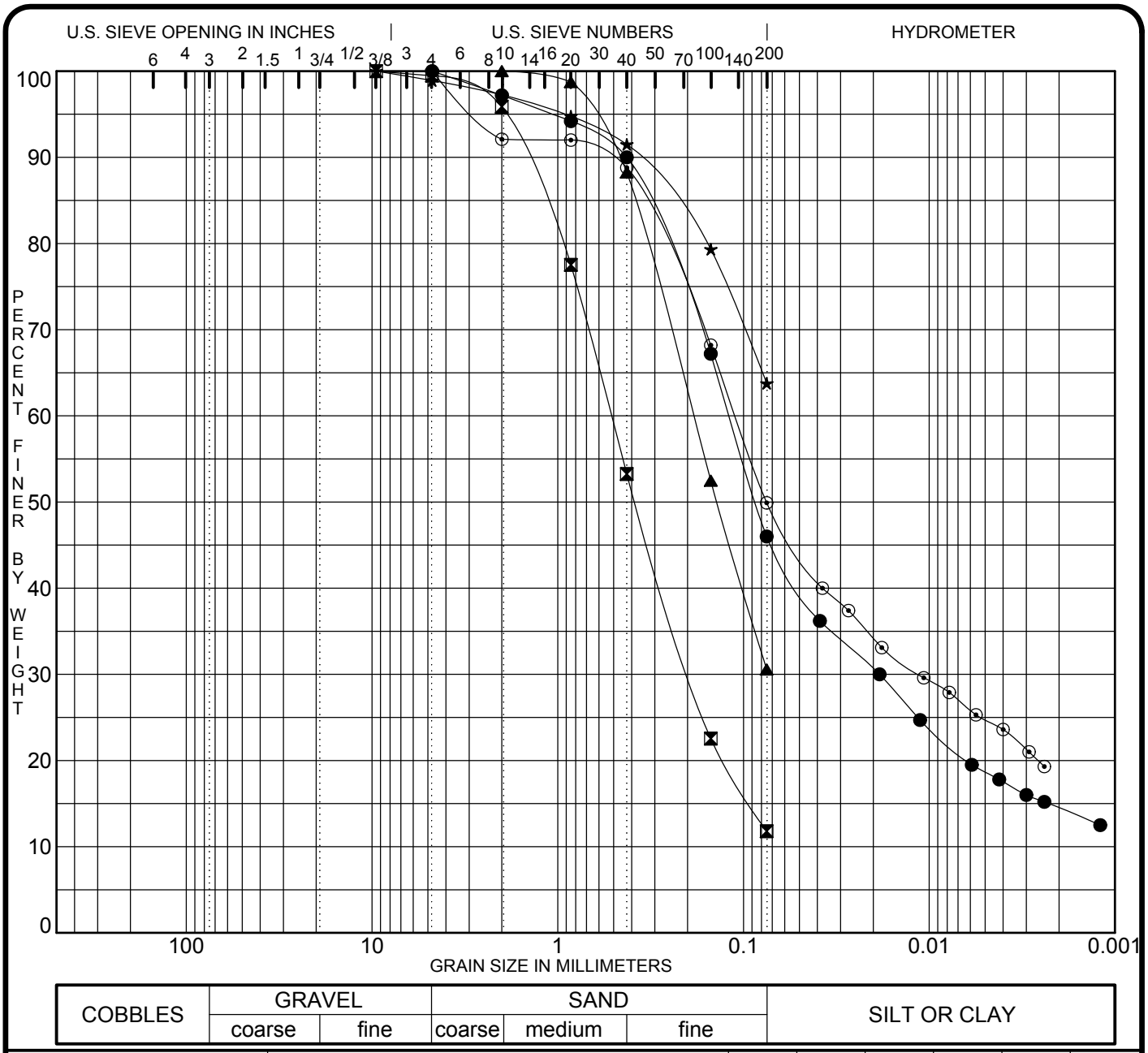
GRADATION CURVES

Inland Foundation Engineering, Inc.

San Jacinto, CA

FIGURE NO. B-6



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	S.E.	LL	PL	PI	Cc	Cu
●	**B-05**	**0.3**	**SILTY, CLAYEY SAND SC-SM**	**11**	**22**	**17**	**5**		
⊠	**B-06**	**11.0**	**WELL-GRADED SAND with SILT SW-SM**	**34**	**16**	**14**	**2**	**1.08**	**7.7**
▲	**B-08**	**4.0**	**SILTY SAND SM**	**15**	**18**	**16**	**2**		
★	**B-10**	**0.0**	**SANDY LEAN CLAY CL**	**4**	**32**	**19**	**13**		
⊙	**B-10**	**5.0**	**CLAYEY SAND SC**	**2**	**31**	**16**	**15**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-05**	**0.3**	**4.75**	**0.12**	**0.019**		**0.0**	**54.0**	**27.3**	**18.7**
⊠	**B-06**	**11.0**	**9.50**	**0.52**	**0.193**		**0.5**	**87.7**	**11.8**	
▲	**B-08**	**4.0**	**2.00**	**0.19**			**0.0**	**69.4**	**30.6**	
★	**B-10**	**0.0**	**9.50**				**1.1**	**35.1**	**63.8**	
⊙	**B-10**	**5.0**	**4.75**	**0.11**	**0.011**		**0.0**	**50.1**	**25.2**	**24.7**

PROJECT San Jacinto MDP
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GRADATION CURVES

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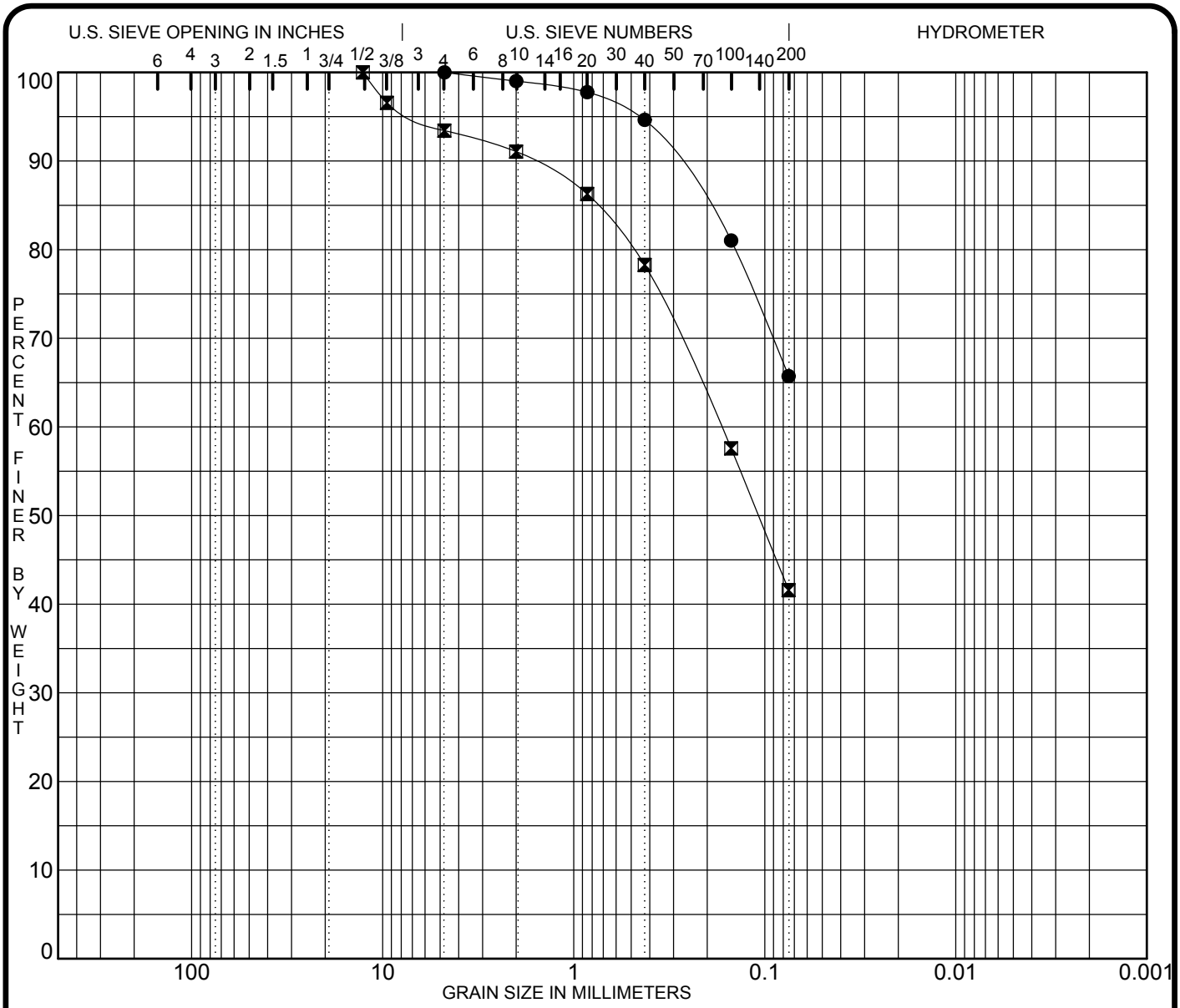
FIGURE NO. B-7



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	S.E.	LL	PL	PI	Cc	Cu
●	**B-11**	**0.0**	**SANDY LEAN CLAY CL**	**4**	**31**	**18**	**13**		
⊠	**B-12**	**0.0**	**CLAYEY SAND SC**	**12**	**27**	**16**	**11**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-11**	**0.0**	**4.75**				**0.0**	**34.3**	**65.7**	
⊠	**B-12**	**0.0**	**12.70**	**0.17**			**6.6**	**51.8**	**41.6**	

PROJECT San Jacinto MDP
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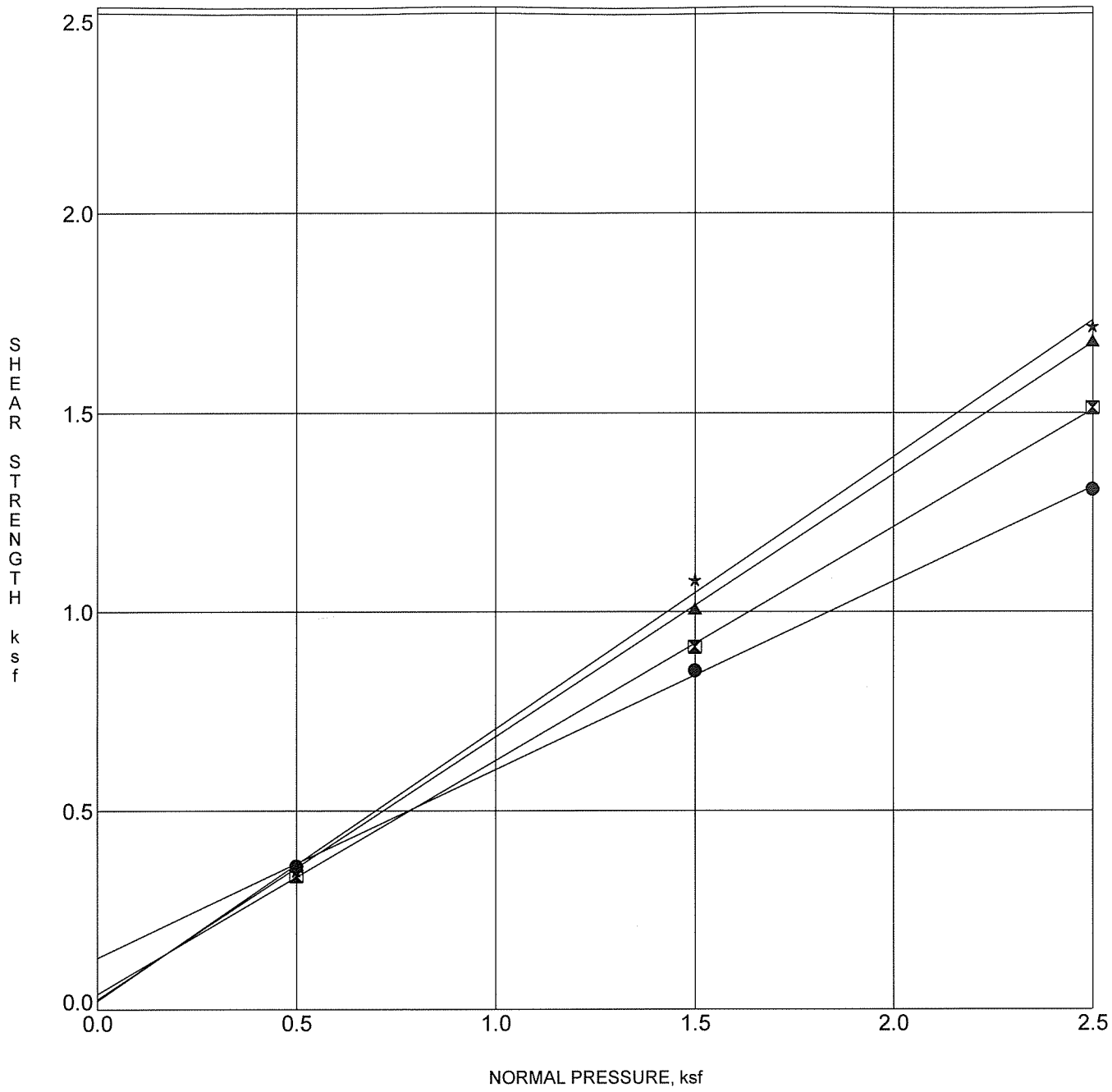
GRADATION CURVES

Inland Foundation Engineering, Inc.

San Jacinto, CA

FIGURE NO. B-8



Specimen Identification			Classification	Phi	Cohesion	DD	MC%
●	B-04	8.5	SANDY SILT ML	25	0.129	87	31
⊠	B-05	8.5	SANDY SILTY CLAY CL-ML	30	0.038	92	28
▲	B-10	5.0	SANDY CLAY CL	33	0.026	109	20
★	B-12	7.5	SANDY SILT ML	34	0.022	105	22

PROJECT San Jacinto MDP
Lines B & C

PROJECT NO. R206-014
DATE

SHEAR TEST DIAGRAM

Inland Foundation Engineering, Inc

FIGURE NO. B-9

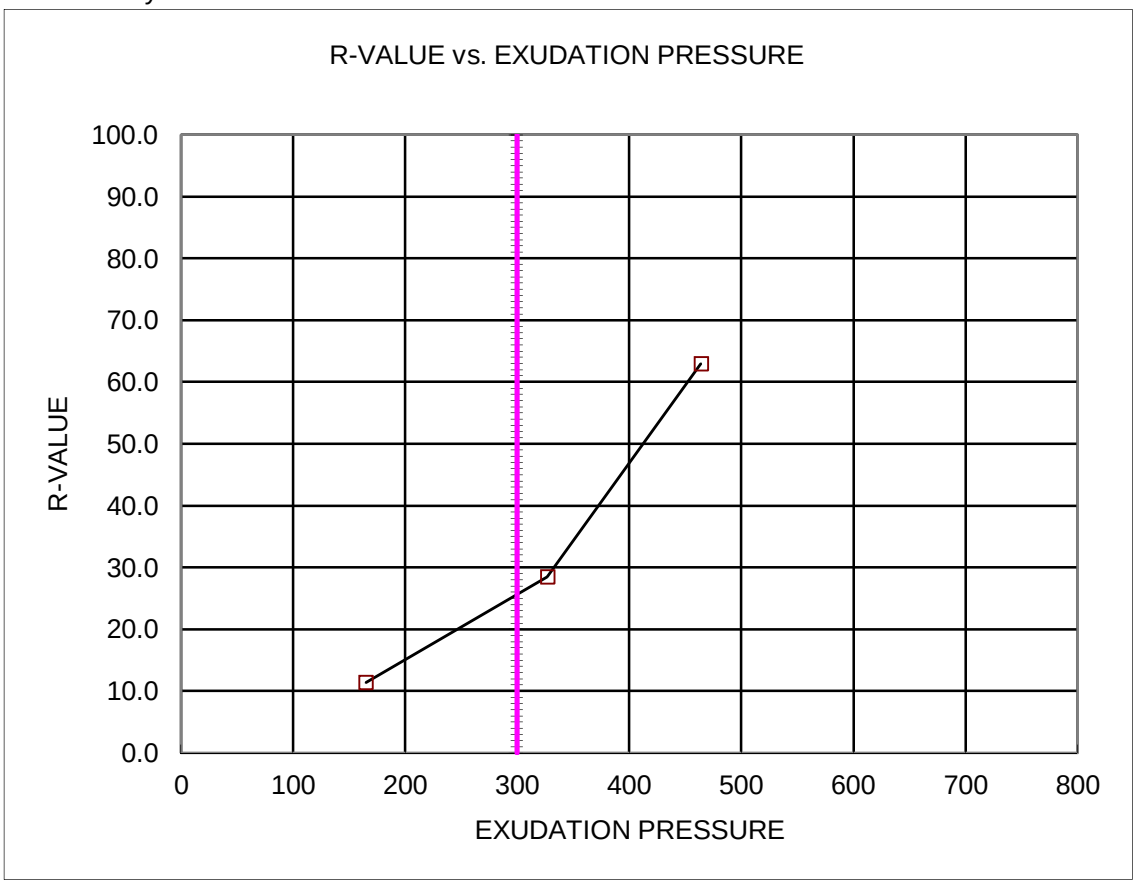
R-VALUE DETERMINATION

Project: San Jacinto MDP
Project No: R206-014 Date: 7/24/2012

Sample No.:
Sample Location: B-04
Sample Depth: 1.25 - 6.5 ft.

Test Specimen	A	B	C	D
Sample Weight(gm)	1060	1060	1060	
Initial Moisture	8.1	8.1	8.1	
Moisture Added(ml)	20	30	40	
Compaction Moist.%	10.1	11.2	12.2	
Wet Wght. (grms)	1080	1090	1100	
Height (in)	2.38	2.45	2.46	
Correction	2.4	1	1	
Density (pcf)	2.4	121.3	120.8	
Stabilometer@2000	38	92	128	
Displacement	4.18	4.64	4.84	
R-Value	63.0	28.5	11.4	
Exudation Press.	464	327	165	
Exp. Initial	632	692	622	
Exp. Final	680	716	632	
Exp. Pressure	207.84	103.92	43.3	
Exp. Thickness	1.60	0.80	0.33	

R-VALUE by Exudation: 25



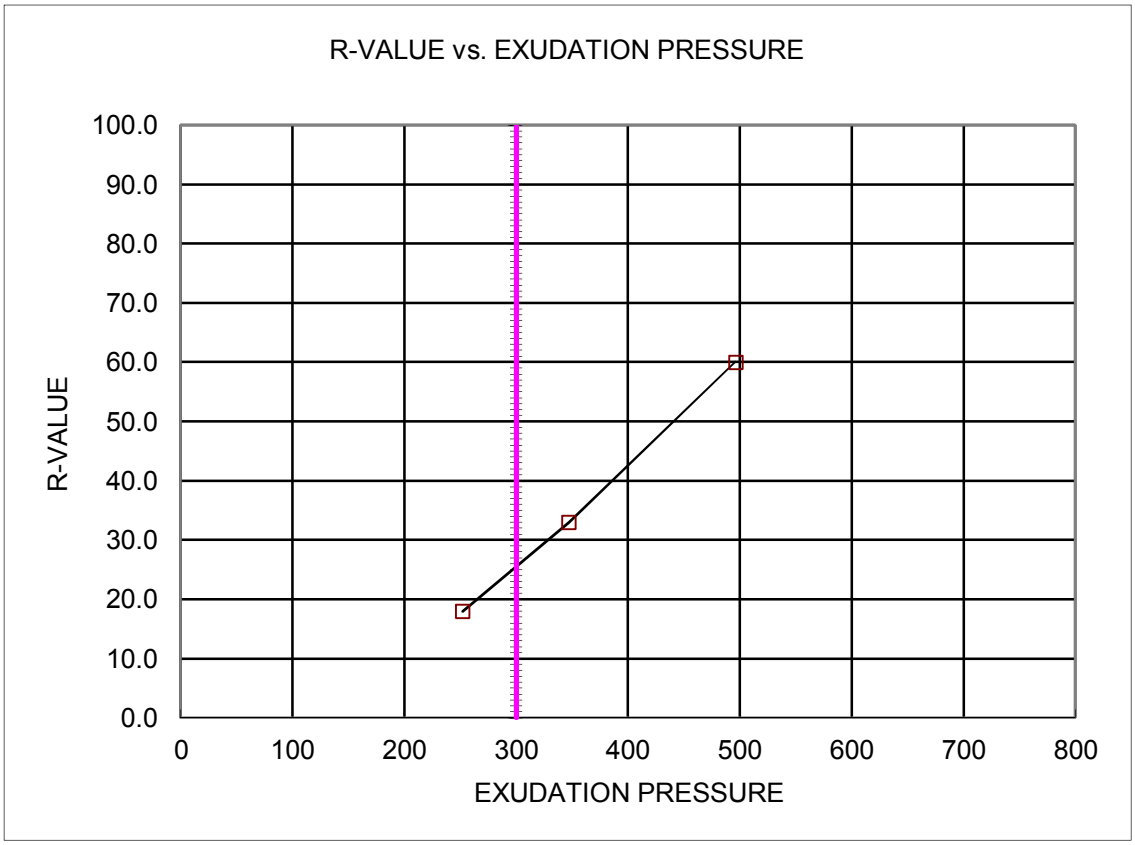
R-VALUE DETERMINATION

Project: San Jacinto MDP Line C
Project No: R206-014 Date: 7/24/2012

Sample No.:
Sample Location: B-05
Sample Depth: 0.3-8.0

Test Specimen	A	B	C	D
Sample Weight(gm)	1080	1080	1080	
Initial Moisture	6.7	6.7	6.7	
Moisture Added(ml)	60	50	40	
Compaction Moist.%	12.6	11.6	10.7	
Wet Wght. (grms)	1140	1130	1120	
Height (in)	2.64	2.63	2.59	
Correction	1	1	1	
Density (pcf)	116.2	116.6	118.4	
Stabilometer@2000	109	80	46	
Displacement	5.74	5.67	4.57	
R-Value	18.0	33.0	60.0	
Exudation Press.	252	347	496	
Exp. Initial	694	623	633	
Exp. Final	702	636	657	
Exp. Pressure	34.64	56.29	103.92	
Exp. Thickness	0.27	0.43	0.80	

R-VALUE by Exudation: 25



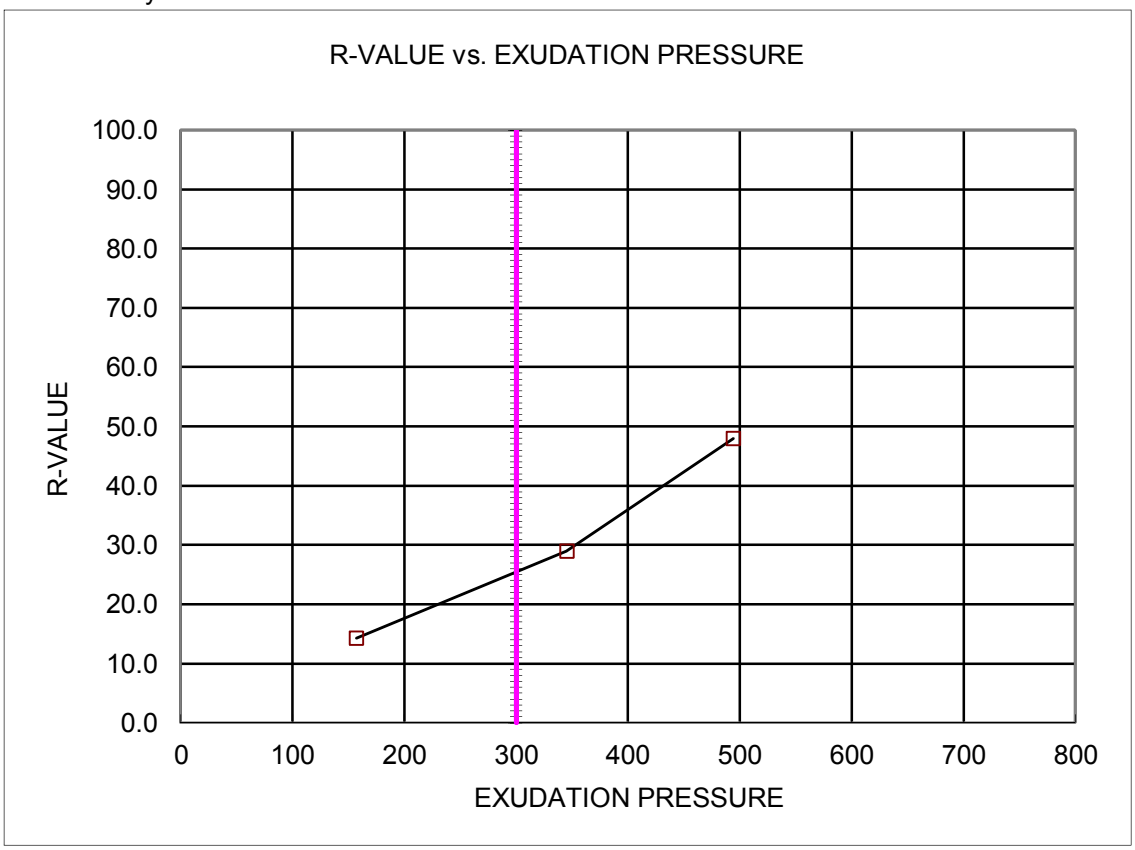
R-VALUE DETERMINATION

Project: San Jacinto MDP Line C
Project No: R206-014 Date: 7/24/2012

Sample No.:
Sample Location: B-12
Sample Depth: 0.3-8.0

Test Specimen	A	B	C	D
Sample Weight(gm)	1060	1060	1060	
Initial Moisture	8	8	8	
Moisture Added(ml)	30	40	50	
Compaction Moist.%	11.1	12.1	13.1	
Wet Wght. (grms)	1090	1100	1110	
Height (in)	2.42	2.44	2.5	
Correction	1	1	1	
Density (pcf)	122.9	121.9	119.0	
Stabilometer@2000	55	86	120	
Displacement	4.73	5	5	
R-Value	48.0	29.0	14.3	
Exudation Press.	494	345	157	
Exp. Initial	631	692	623	
Exp. Final	657	709	631	
Exp. Pressure	112.58	73.61	34.64	
Exp. Thickness	0.87	0.57	0.27	

R-VALUE by Exudation: 25



EXPANSION TEST SUMMARY

Sample Location	Sample Depth, ft.	Initial Dry Density, pcf	Initial Moisture Content, %	Expansion Index
B-11	0.0-3.0	105.6	10.8	67

APPENDIX C

CLOSEST DISTANCES BETWEEN SITE AND FAULT RUPTURES

NO.	FAULT NAME	CD_1DRP	CD_2DRP	CDIST	CLODIS	CD_EPI	CD_HYPO
1	SAN JACINTO-SAN JACINTO VALLEY	0.1(0.0)	0.1	0.1	0.1	0.1	1.1 km
2	SAN JACINTO-ANZA	5.1(2.4)	5.1	5.1	5.1	6.2	6.3 km
3	SAN ANDREAS - Whole M-1a	29.8	29.8	29.8	29.8	29.8	29.8 km
4	SAN ANDREAS - SB-Coach. M-1b-2	29.8	29.8	29.8	29.8	29.8	29.8 km
5	SAN ANDREAS - San Bernardino M-1	29.8	29.8	29.8	29.8	29.8	29.8 km
6	SAN ANDREAS - SB-Coach. M-2b	29.8	29.8	29.8	29.8	29.8	29.8 km
7	ELSINORE (TEMECULA)	34.3	34.3	34.3	34.3	34.3	34.3 km
8	SAN JACINTO-SAN BERNARDINO	37.8	37.8	37.8	37.8	38.9	38.9 km
9	ELSINORE (GLEN IVY)	38.0	38.0	38.0	38.0	38.5	38.5 km
10	PINTO MOUNTAIN	39.4	39.4	39.4	39.4	40.3	40.3 km
11	ELSINORE (JULIAN)	43.3	43.3	43.3	43.3	43.9	43.9 km
12	SAN ANDREAS - Coachella M-1c-5	48.9	48.9	48.9	48.9	49.6	49.6 km
13	SAN JACINTO-COYOTE CREEK	54.2	54.2	54.2	54.2	55.3	55.3 km
14	BURNT MTN.	56.3	56.3	56.3	56.3	56.6	56.6 km
15	CHINO-CENTRAL AVE. (Elsinore)	56.3	56.3	56.3	56.3	57.4	57.4 km
16	EUREKA PEAK	61.5	61.5	61.5	61.5	61.9	61.9 km
17	CLEGHORN	61.8	61.8	61.8	61.8	62.0	62.0 km
18	WHITTIER	63.0	62.2	62.9	62.9	63.3	64.0 km
19	CUCAMONGA	64.0	64.0	64.0	64.0	65.0	65.1 km
20	NORTH FRONTAL FAULT ZONE (East)	65.5	52.7	54.2	54.2	53.6	55.0 km
21	LANDERS	66.5	66.5	66.5	66.5	67.0	67.0 km
22	NORTH FRONTAL FAULT ZONE (West)	66.9	53.6	55.2	55.2	54.4	55.8 km
23	HELENDALE - S. LOCKHARDT	68.0	68.0	68.0	68.0	68.7	68.7 km
24	SAN JOAQUIN HILLS	68.2	68.2	68.3	68.3	69.6	69.7 km
25	LENWOOD-LOCKHART-OLD WOMAN SPRGS	72.3	72.3	72.3	72.3	72.9	72.9 km
26	EARTHQUAKE VALLEY	73.8	73.8	73.8	73.8	74.8	74.8 km
27	SAN ANDREAS - 1857 Rupture M-2a	76.5	76.5	76.5	76.5	77.5	77.5 km
28	SAN ANDREAS - Mojave M-1c-3	76.5	76.5	76.5	76.5	77.5	77.5 km
29	SAN ANDREAS - Cho-Moj M-1b-1	76.5	76.5	76.5	76.5	77.5	77.5 km
30	JOHNSON VALLEY (Northern)	76.9	76.9	76.9	76.9	77.3	77.3 km
31	SAN JOSE	77.6	77.6	77.6	77.6	78.2	78.2 km
32	NEWPORT-INGLEWOOD (Offshore)	77.6	77.6	77.6	77.6	77.6	77.6 km
33	SIERRA MADRE	82.1	82.1	82.1	82.1	83.3	83.3 km
34	EMERSON So. - COPPER MTN.	83.1	83.1	83.1	83.1	83.1	83.1 km
35	ROSE CANYON	83.0	83.0	83.0	83.0	83.5	83.5 km
36	PUENTE HILLS BLIND THRUST	85.4	85.4	85.6	85.6	86.7	86.9 km
37	NEWPORT-INGLEWOOD (L.A.Basin)	90.5	90.5	90.5	90.5	91.1	91.1 km
38	CALICO - HIDALGO	92.5	92.5	92.5	92.5	92.8	92.8 km
39	SAN JACINTO - BORREGO	94.9	94.9	94.9	94.9	96.0	96.0 km
40	PISGAH-BULLION MTN.-MESQUITE LK	96.7	96.7	96.7	96.7	96.7	96.7 km
41	CLAMSHELL-SAWPIT	97.2	97.2	97.2	97.2	98.4	98.4 km

EXPLANATION

CD_1DRP = Closest distance to projection of rupture area along fault trace.
CD_2DRP = Closest distance to surface projection of the rupture area.
CDIST = Closest distance to seismogenic rupture.
CLODIS = Closest distance to subsurface rupture.
CD_EPI = Closest epicentral distance.
CD_HYPO = Closest hypocentral distance.

APPENDIX D

SOIL CORROSIVITY EVALUATION – HDR | SCHIFF

SOIL CORROSIVITY EVALUATION

for the

SAN JACINTO MDP STORM DRAIN

in

SAN JACINTO, CALIFORNIA

prepared for

INLAND FOUNDATION ENGINEERING, INC.
1310 South Santa Fe Avenue
San Jacinto, CA 92583

Project No.: R206-014

PROJECT MANAGER: MR. DAN LIND, P.G., C.E.G.

prepared by

HDR|SCHIFF
Consulting Corrosion Engineers
431 West Baseline Road
Claremont, California 91711

HDR #188604

July 25, 2012

EXECUTIVE SUMMARY

The proposed storm drain construction consists of approximately 8,440 linear feet of a combination of 14- by 6-foot and 14- by 7-foot reinforced concrete box (RCB) and 48-, 54-, 78-, 84-, 90-, and 96-inch reinforced concrete pipe (RCP).

A soil corrosivity analysis along the proposed storm drain alignment was requested. Laboratory tests on ten soil samples selected by HDR Engineering, Inc. (HDR|Schiff) from boring logs provided for the San Jacinto Storm Drain project have been completed. The purpose of these tests was to determine soil corrosivity regarding the proposed storm drain and concrete structures.

No groundwater was encountered during exploratory borings.

The legs of the proposed storm drain alignment are bound between West Esplanade Avenue and Menlo Avenue to the north and south and North Buena Vista and South San Jacinto Street to the west and east. The storm drain alignment is located in San Jacinto, California.

This soil is classified as severely corrosive to ferrous metals, aggressive to copper, severe for sulfate attack on concrete, and aggressive with respect to exposure of reinforcing steel to the migration of chloride.

Based on this investigation, reinforced construction materials are satisfactory for this alignment. Use type V cement, a maximum water/cement ratio of 0.45, and minimum strength of 4,500 psi. In addition, protect steel and iron embedded in concrete structures and pipe from chloride attack using a protective concrete mix design, waterproof concrete, coating embedded steel, or cathodic protection.

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ALL PIPE 4

CONCRETE STRUCTURES 3

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APPENDIX

Table 1 - Laboratory Tests on Soil Samples A1

INTRODUCTION

A soil corrosivity analysis along the proposed storm drain alignment was requested. Laboratory tests on ten soil samples selected by HDR|Schiff from boring logs provided for the San Jacinto Storm Drain project have been completed under laboratory number 12-0572SCS. The purpose of these tests was to determine soil corrosivity regarding the proposed storm drain and concrete structures.

The proposed construction consists of approximately 8,440 linear feet of underground storm drain. Materials being considered are RCP and concrete structures. The storm drain design will consist of a combination of 14- by 7-foot and 14- by 6-foot pre-cast reinforced concrete box and 48-, 54-, 78-, 84-, 90-, and 96-inch reinforced concrete pipe, or a combination of both. Depth of cover ranged from 2.5–14.5 feet.

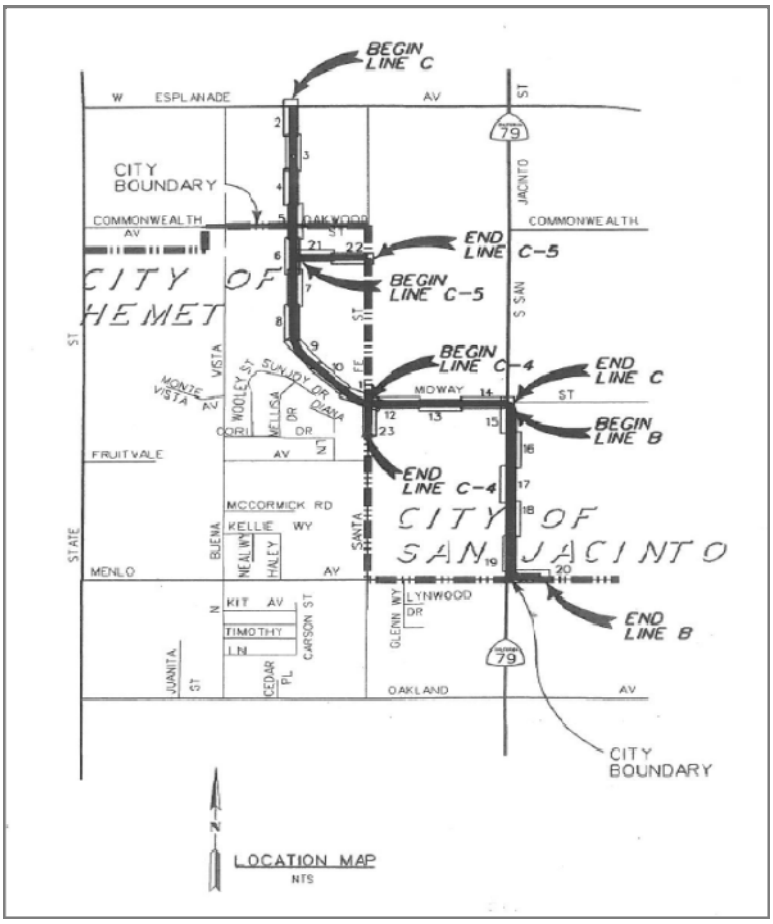


Figure 1 - Project Location Map

The legs of the proposed storm drain alignment are bound between West Esplanade Avenue and Menlo Avenue to the north and south and North Buena Vista and South San Jacinto Street to the west and east. The storm drain alignment is located in San Jacinto, California. Line C (STG 2) runs south from Esplanade Avenue between Buena Vista and Santa Fe Street, turns east at Midway Street, and ends at San Jacinto Street. Line C-4 (STG 1) runs south from Midway Street along Santa Fe Street and ends approximately 250 feet south of Midway Street. Line C-5 (STG 1) is a 670 foot segment located just south of Oakwood Street running west from Santa Fe Street. Line B (STG 1) runs south along San Jacinto Street from Midway Street, turns east at Menlo Avenue and terminates approximately 350 feet east of San Jacinto Street. The project location can be seen in Figure 1. No groundwater was encountered during exploration boring.

The scope of this study is limited to a determination of soil corrosivity and general corrosion control recommendations for materials planned for construction.

TEST PROCEDURES

Laboratory Tests on Soil Samples

The electrical resistivity of each of the ten samples was measured in a soil box per ASTM G187 in its as-received condition and again after saturation with distilled water. Resistivities are at about their lowest value when the soil is saturated. The pH of the saturated samples was measured per CTS 643. A 5:1 water:soil extract from each sample was chemically analyzed for the major soluble salts commonly found in soil per ASTM D4327 and D6919. Test results are shown in Table 1 in the Appendix.

DISCUSSION

A major factor in determining soil corrosivity is electrical resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil resistivity. Lower electrical resistivities result from higher moisture and soluble salt contents and indicate corrosive soil.

A correlation between electrical resistivity and corrosivity toward ferrous metals is (Romanoff, 1989):

Soil Resistivity in ohm-centimeters	Corrosivity Category
Greater than 10,000	Mildly Corrosive
2,001 to 10,000	Moderately Corrosive
1,001 to 2,000	Corrosive
0 to 1,000	Severely Corrosive

Other soil characteristics that may influence corrosivity towards metals are pH, soluble salt content, soil types, aeration, anaerobic conditions, and site drainage.

Electrical resistivities were in the mildly to moderately corrosive categories with as-received moisture. When saturated, the resistivities were in the mildly to severely corrosive categories. The resistivities dropped considerably with added moisture because the samples were dry as-received.

Soil pH values varied from 7.7 to 8.6. This range is mildly to strongly alkaline.[1] Soil with a pH greater than 8.5 may be aggressive to aluminum.

[1] *Romanoff, Melvin. Underground Corrosion, NBS Circular 579. Reprinted by NACE. Houston, TX, 1989, p. 8.*

The soluble salt content of the samples ranged from low to very high.

The soluble salt content was very high in the sample from boring B-10 @ 6.5' to 7.5'and less in the others. Chloride and sulfate salts were the predominant constituents. Chloride is particularly corrosive to ferrous metals, and in the higher concentrations measured in the soil sample, chloride can overcome the corrosion inhibiting effect of concrete on reinforcing steel. High concentrations of sulfate, as was measured in the soil sample, can react with components in concrete to cause degradation and reduced strength in a mechanism known as sulfate attack.

The nitrate concentration was high enough to be aggressive to copper.

Tests were not made for sulfide and negative oxidation-reduction (redox) potential because these samples did not exhibit characteristics typically associated with anaerobic conditions.

The variation in soil types can create differential-aeration corrosion cells that would affect all metals.

Variation in soil resistivity of an order of magnitude or more can create differential-aeration corrosion cells that would affect all metals.

This soil is classified as severely corrosive to ferrous metals, aggressive to copper, severe for sulfate attack on concrete, and aggressive with respect to exposure of reinforcing steel to the migration of chloride.

CONCLUSIONS

This soil is classified as severely corrosive to ferrous metals, aggressive to copper, severe for sulfate attack on concrete, and aggressive with respect to exposure of reinforcing steel to the migration of chloride.

Based on this investigation, reinforced construction materials are satisfactory for this alignment. Use type V cement, a maximum water/cement ratio of 0.45, and minimum strength of 4,500 psi. In addition, protect steel and iron embedded in concrete structures and pipe from chloride attack using a protective concrete mix design, waterproof concrete, coating embedded steel, or cathodic protection.

RECOMMENDATIONS

Concrete Structures and Reinforced Concrete Pipe

1. Protect concrete structures and pipe from sulfate attack in soil with a severe sulfate concentration, 0.2 to 2.0 percent. Use Type V cement, a maximum water/cement ratio of 0.45, and minimum strength of 4,500 psi per applicable code.

2. Chloride levels were measured at levels where additional protective measures are required for concrete. Protect steel and iron embedded in concrete structures and pipe from chloride attack. This applies to such items as reinforcing steel. The protection could be one or a combination of the following:

    a. Protective Concrete - A concrete mix designed to protect embedded steel and iron that should be based on the following parameters: 1) a chloride content of 660 ppm in the soil; 2) the desired service life; and 3) concrete cover. A protective concrete mix may include a corrosion inhibitor admixture and/or silica fume admixture.

    b. Waterproof Concrete - Waterproofing for concrete structures could be a gravel capillary break under the concrete, a waterproof membrane, and/or a liquid applied waterproof barrier coating such as CETCO Liquid Boot® or Grace's Preprufe® Waterproofing System. Visqueen or similar rolled barriers are not a viable waterproofing system.

    c. Coat Embedded Metal - A coating for embedded steel and iron could be an epoxy coating applied to the metal. Purple fusion bonded epoxy (FBE) (ASTM International, A934-07) intended for prefabricated reinforcing steel reinforcing steel is suitable. The green flexible FBE (ASTM International, A775-07b) is not recommended.

    d. Cathodic Protection - Cathodic protection is most practical for pipelines and must be designed for each application. The amount of cathodic protection current needed can be minimized by coating the steel or iron.

All Pipe

1. On all pipes, appurtenances, and fittings not protected by cathodic protection or encased in concrete, coat pipe specials such as valves, bolts, flange joints, joint harnesses, and flexible couplings with wax tape per AWWA C217 after assembly.

2. Where metallic pipelines penetrate concrete structures such as building floors, vault walls, and thrust blocks use plastic sleeves, rubber seals, or other dielectric material to prevent pipe contact with the concrete and reinforcing steel.

CLOSURE

Our services have been performed with the usual thoroughness and competence of the engineering profession. No other warranty or representation, either expressed or implied, is included or intended.

Please call if you have any questions.

Respectfully Submitted,
HDR ENGINEERING, INC.

for

Ian Budner

Brien L. Clark, P.E.

LICENSED PROFESSIONAL ENGINEER
BRIEN L. CLARK
No. CH 6291
Exp. 12-31-13
CHEMICAL
STATE OF CALIFORNIA

7-25-12

188604_Pipeline_Rpt_IB-rev00_LS

WORKS CITED

ASTM International. (A934-07). "Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars". West Conshohocken, PA: www.astm.org.

ASTM International. (A775-07b). "Standard Specification for Epoxy-Coated Steel Renforcing Bars". West Conshohocken, PA: www.astm.org.

Romanoff, M. (1989). Underground Corrosion, National Bureau of Standards (NBS) Circular 579. Houston, TX, United States of America: Reprinted by NACE.

APPENDIX

Table 1 - Laboratory Tests on Soil Samples

Inland Foundation Engineering, Inc.
San Jacinto MDP Storm Drain
HDR|Schiff #12-0572SCS
5-Jul-12

Sample ID			B-01 @ 7.5'-8.5'	B-03 @ 9.5'-10.5'	B-04 @ 13.5'-14.5'	B-05 @ 13.5'-14.5'	B-06 @ 5.5'-6.5'
Resistivity		**Units**					
as-received		ohm-cm	24,400	26,800	6,800	8,000	120,000
saturated		ohm-cm	5,200	8,000	4,000	5,200	13,200
pH			7.7	8.1	8.1	8.2	8.4
Electrical Conductivity		mS/cm	0.07	0.06	0.09	0.09	0.04
Chemical Analyses							
Cations							
calcium	Ca^{2+}	mg/kg	78	69	90	82	52
magnesium	Mg^{2+}	mg/kg	6.4	7.8	12	10	5.5
sodium	Na^{1+}	mg/kg	18	26	30	33	8.7
potassium	K^{1+}	mg/kg	12	12	14	18	9.3
Anions							
carbonate	CO_3^{2-}	mg/kg	6.0	24	6.0	9.0	12
bicarbonate	HCO_3^{1-}	mg/kg	140	121	194	197	92
fluoride	F^{1-}	mg/kg	1.6	3.8	6.3	8.8	1.7
chloride	Cl^{1-}	mg/kg	2.6	1.6	6.2	2.1	ND
sulfate	SO_4^{2-}	mg/kg	27	15	20	11	1.8
phosphate	PO_4^{3-}	mg/kg	1.3	ND	1.1	1.1	0.8
Other Tests							
ammonium	NH_4^{1+}	mg/kg	ND	ND	ND	ND	ND
nitrate	NO_3^{1-}	mg/kg	28	5.9	4.5	ND	1.3
sulfide	S^{2-}	qual	na	na	na	na	na
Redox		mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

Inland Foundation Engineering, Inc.
San Jacinto MDP Storm Drain
HDR|Schiff #12-0572SCS
5-Jul-12

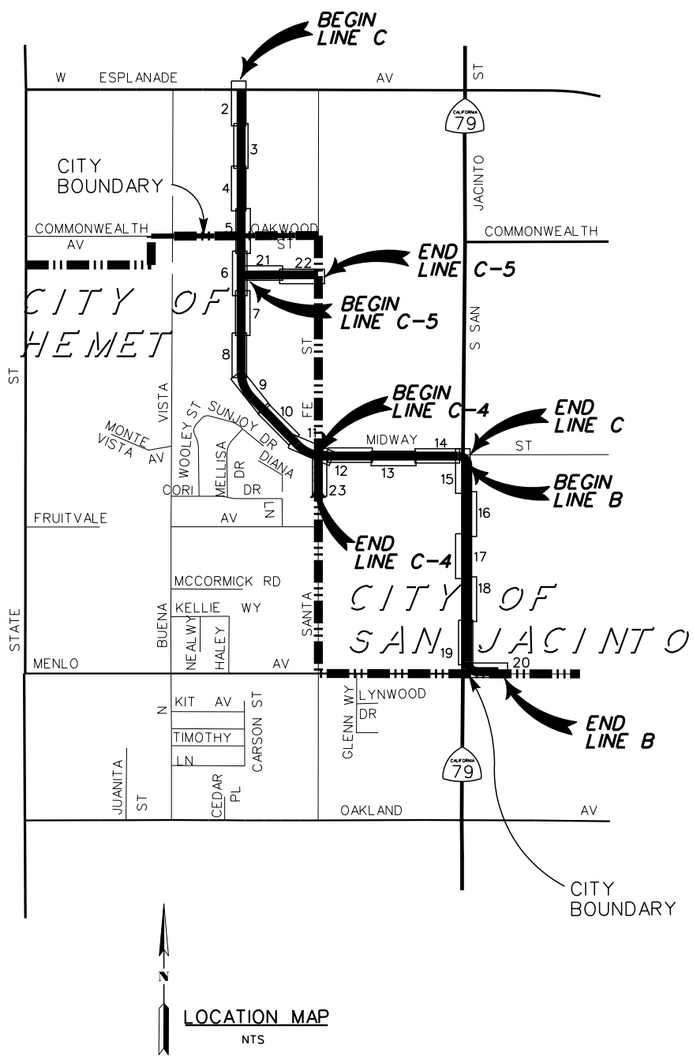
Sample ID			B-08 @ 9.5'-10.5'	B-09 @ 13.5'-14.5'	B-10 @ 6.5'-7.5'	B-11 @ 2.5'-3.5'	B-12 @ 2.5'-3.5'
Resistivity		**Units**					
as-received		ohm-cm	12,000	5,600	2,680	22,000	224,000
saturated		ohm-cm	4,400	2,280	300	1,760	7,600
pH			8.2	8.1	8.6	8.5	8.6
Electrical Conductivity		mS/cm	0.10	0.14	1.84	0.27	0.07
Chemical Analyses							
Cations							
calcium	Ca^{2+}	mg/kg	69	206	25	132	49
magnesium	Mg^{2+}	mg/kg	8.7	12	11	9.1	7.6
sodium	Na^{1+}	mg/kg	59	95	2,151	295	37
potassium	K^{1+}	mg/kg	16	12	15	6.9	12
Anions							
carbonate	CO_3^{2-}	mg/kg	12	33	168	159	21
bicarbonate	HCO_3^{1-}	mg/kg	192	462	181	364	124
fluoride	F^{1-}	mg/kg	6.5	16	48	11	2.9
chloride	Cl^{1-}	mg/kg	11	7.5	661	52	1.0
sulfate	SO_4^{2-}	mg/kg	16	40	2,166	121	13
phosphate	PO_4^{3-}	mg/kg	2.4	0.9	ND	ND	1.1
Other Tests							
ammonium	NH_4^{1+}	mg/kg	ND	ND	ND	ND	ND
nitrate	NO_3^{1-}	mg/kg	2.4	33	108	1.8	1.7
sulfide	S^{2-}	qual	na	na	na	na	na
Redox		mV	na	na	na	na	na

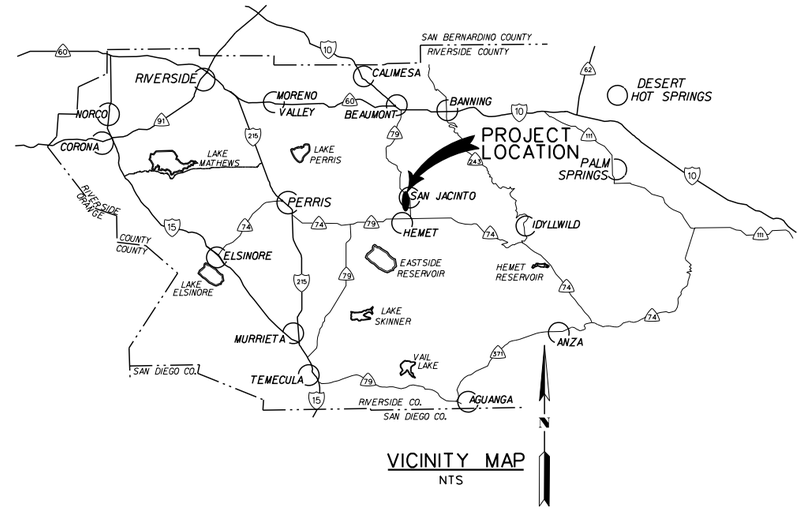
Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

APPENDIX E

PRELIMINARY PROJECT PLANS WITH APPROXIMATE BORING LOCATIONS

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT





1. BEDDING AND PAYLINES ARE SHOWN ON RCFC STANDARD DRAWING M815 UNLESS SHOWN OTHERWISE ON THESE PLANS.
2. ALL STATIONING REFERS TO CENTERLINE OF CONSTRUCTION.
3. ALL CHANNEL/STORM DRAIN REFERENCES AND CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM.
4. TOPOGRAPHY BY DIGITAL PHOTOGRAMMETRIC METHODS. AERIAL PHOTOGRAPHS TAKEN AT AN ALTITUDE NOT TO EXCEED A FLYING HEIGHT TO CONTOUR INTERVAL RATIO OF 1800. PHOTOGRAPHY DATED 8-6-2009.
5. THE VERTICAL DATUM IS DERIVED FROM NAVD 88. THE HORIZONTAL DATUM IS DERIVED FROM NAD 83.
6. STANDARD DRAWINGS CALLED FOR ON THE PLAN & PROFILE SHALL CONFORM TO RCFC & WCD STD DRAWINGS, OR CALTRANS/CITY/COUNTY STANDARD PLANS.
7. ELEVATIONS AND LOCATIONS OF UTILITIES WERE OBTAINED FROM AVAILABLE INFORMATION AND ARE SHOWN APPROXIMATELY ON THESE PLANS. 48 HOURS BEFORE EXCAVATION CALL UNDERGROUND SERVICE ALERT AT 1-800-227-2600. ALL UTILITIES SHALL BE PROTECTED IN PLACE EXCEPT AS NOTED ON PLANS AND SPECIFICATIONS.
8. THE CONTRACTOR IS REQUIRED TO CONTACT ALL UTILITY AGENCIES REGARDING TEMPORARY SUPPORT AND SHORING REQUIREMENTS FOR THE VARIOUS UTILITY LINES SHOWN ON THESE PLANS.
9. ALL OPENINGS RESULTING FROM CUTTING OR PARTIAL REMOVAL OF EXIST. CULVERTS, PIPES, OR SIMILAR STRUCTURES TO BE ABANDONED, SHALL BE SEALED AT BOTH ENDS WITH 6" MIN CLASS "B" CONCRETE.
10. UNLESS OTHERWISE SPECIFIED, MINIMUM STREET RECONSTRUCTION SHALL BE 0.25' TYPE "B" ASPHALT CONCRETE OVER 6" CLASS 2 AGGREGATE BASE OR AS SPECIFIED BY THE ENGINEER.
11. ALL RECONSTRUCTION, RESURFACING AND PAVEMENT DELINEATION, CURBS, SIDEWALKS AND OTHER IMPROVEMENTS ARE TO BE RECONSTRUCTED IN KIND AT THE SAME LOCATIONS AND ELEVATIONS AS THE EXISTING IMPROVEMENTS, UNLESS OTHERWISE NOTED.
12. ⊕ INDICATES APPROX. SOIL BORING LOCATION PER SOILS REPORT BY xxxx DATED xx/xx/xxxx.
13. FOR COMPLETE RIGHT-OF-WAY AND TEMPORARY EASEMENT REFER TO DRAWING NO. x-xxx, SHT x TO x.

INDEX

	SHEET NO.:
TITLE SHEET	1
PLAN & PROFILE	2-23
CONNECTOR PIPE PROFILES	
MISCELLANEOUS DETAILS	
TRAFFIC CONTROL PLAN	

R.C.F.C. & W.C.D. STANDARD DRAWINGS

CB100	CATCH BASIN NO. 1
CB110	CONCRETE DROP INLET
JS226	JUNCTION STRUCTURE NO. 1
JS227	JUNCTION STRUCTURE NO. 2
JS228	JUNCTION STRUCTURE NO. 3
JS229	JUNCTION STRUCTURE NO. 4
MH252	MANHOLE NO. 2
MH253	MANHOLE NO. 3
MH257	MANHOLE SHAFT FOR CAST PIPE
MH259	STANDARD DROP STEPS
MH260	MANHOLE FRAME AND COVER
M803	CONCRETE COLLAR FOR PIPE 12" THROUGH 66"
M814	ABBREVIATIONS AND SYMBOLS
M815	BEDDING AND PAY LINES
M816	CONCRETE BULKHEAD
M819	MAXIMUM CHORD LENGTHS FOR CURVED SECTIONS
TS302	TRANSITION STRUCTURE NO. 2
TS303	TRANSITION STRUCTURE NO. 3
TS304	TRANSITION STRUCTURE NO. 4

CALTRANS STANDARD DRAWINGS

B11-47	CABLE RAILING
B11-52	CHAIN LINK RAILING TYPE 7
D80	CAST-IN-PLACE REINFORCED CONCRETE SINGLE BOX CULVERT

COUNTY OF RIVERSIDE TRANSPORTATION

401	SIDEWALK AND CURB
200	TYPE A-6 CURB

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER WARREN D. WILLIAMS No. 32336 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485
ELEVATION= 1555.79 NAVD 88

REF.	DESCRIPTION	APPR.	DATE
	REVISIONS		

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

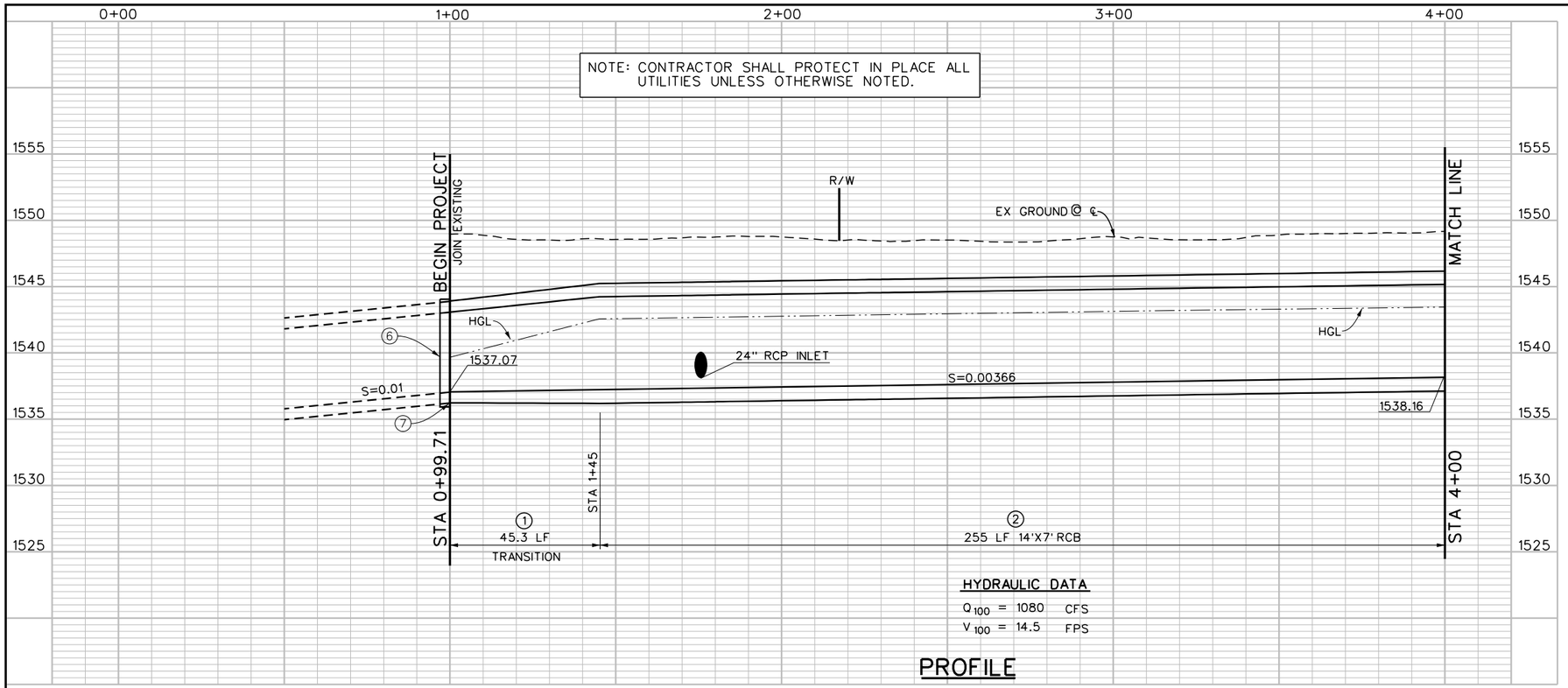
DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY:
CHIEF, DESIGN & CONSTRUCTION
DATE: R.E. No. 44684

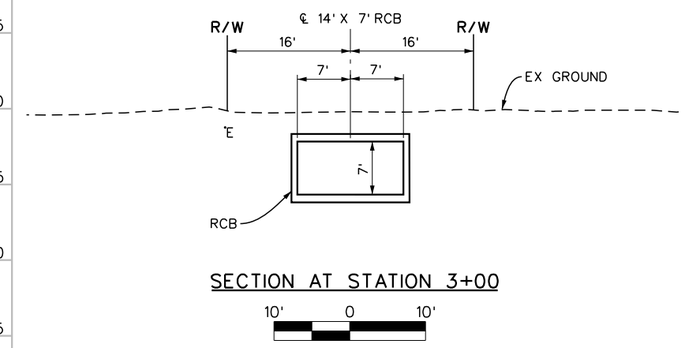
APPROVED BY:
CHIEF ENGINEER
DATE: R.E. NO. 32336

SAN JACINTO MDP
LINE C (STG 2), C-4 (STG 1), C-5 (STG 1), & B (STG 1).
TITLE SHEET

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 01 OF XX



PROFILE



SECTION AT STATION 3+00

Ⓐ ℄ STORM DRAIN CURVE DATA

Δ = 09° 51' 55"
R = 90.00'
L = 15.50'
T = 7.77'
BC = STA 1+68.83
EC = STA 1+84.33
PI = N 2225505.29
E 6344286.69

Ⓑ ℄ STORM DRAIN CURVE DATA

Δ = 09° 51' 55"
R = 90.00'
L = 15.50'
T = 7.77'
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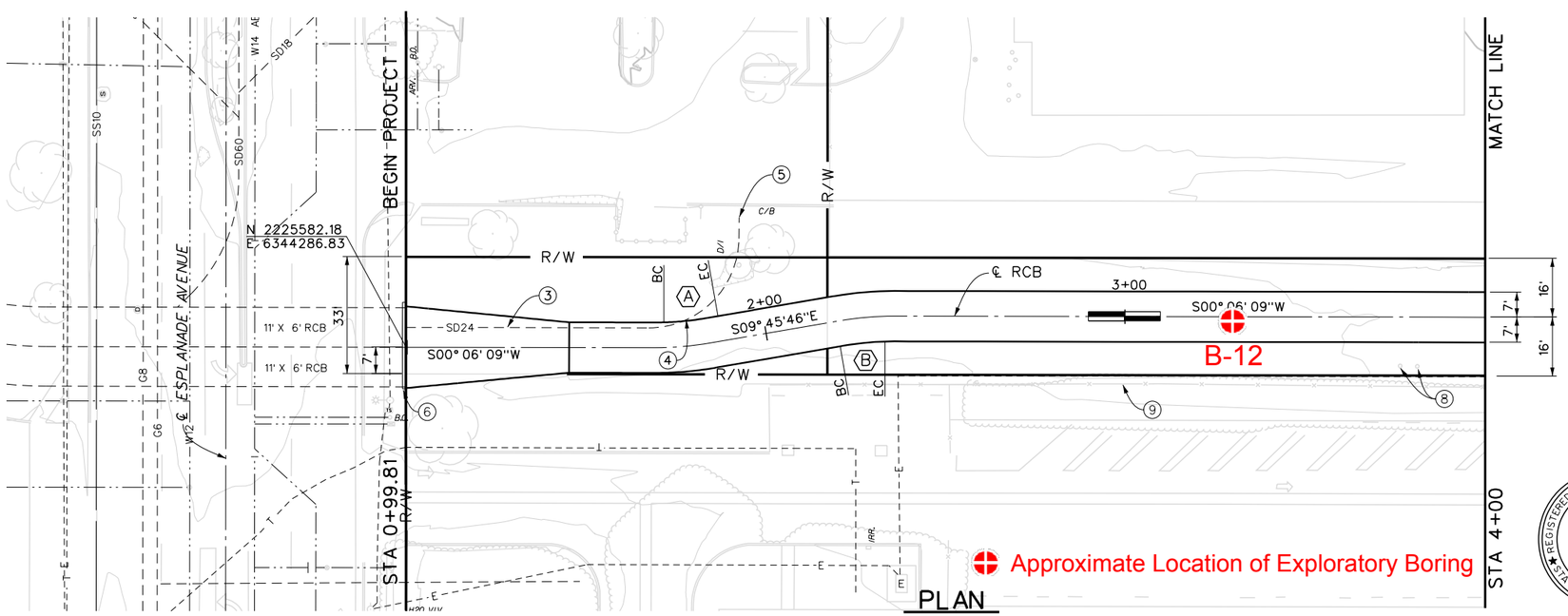
EC = STA 2+36.02
PI = N 2225454.32
E 6344295.46



PLAN

NOTES

1. CONSTRUCT TRANSITION STRUCTURE NO. 4 PER STD TS304 AND DETAILS SHEET XX.
2. CONSTRUCT 14'X7' REINFORCED CONCRETE BOX PER CALTRANS STD D80, PLAN, PROFILE AND DETAIL.
3. CUT AND REMOVE INTERFERING PORTIONS OF EXISTING 24" SD.
4. CONSTRUCT JS NO. 3 PER STD PLAN JS228 A= , B= , C= , EL. R= , EL. S= .
5. PROTECT IN PLACE.
6. REMOVE AND DISPOSE EXISTING BULKHEAD.
7. JOIN EXISTING DBL 11'X6' RCB PER SAN JACINTO MDP LINE C (STG. 1), PROJ. NO. 4-0-124, DWG NO. 4-549, SHEET 3 OF 22.
8. PROTECT IN PLACE EDISON UTILITY.
9. PROTECT IN PLACE EXISTING FENCE.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★
SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485
ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

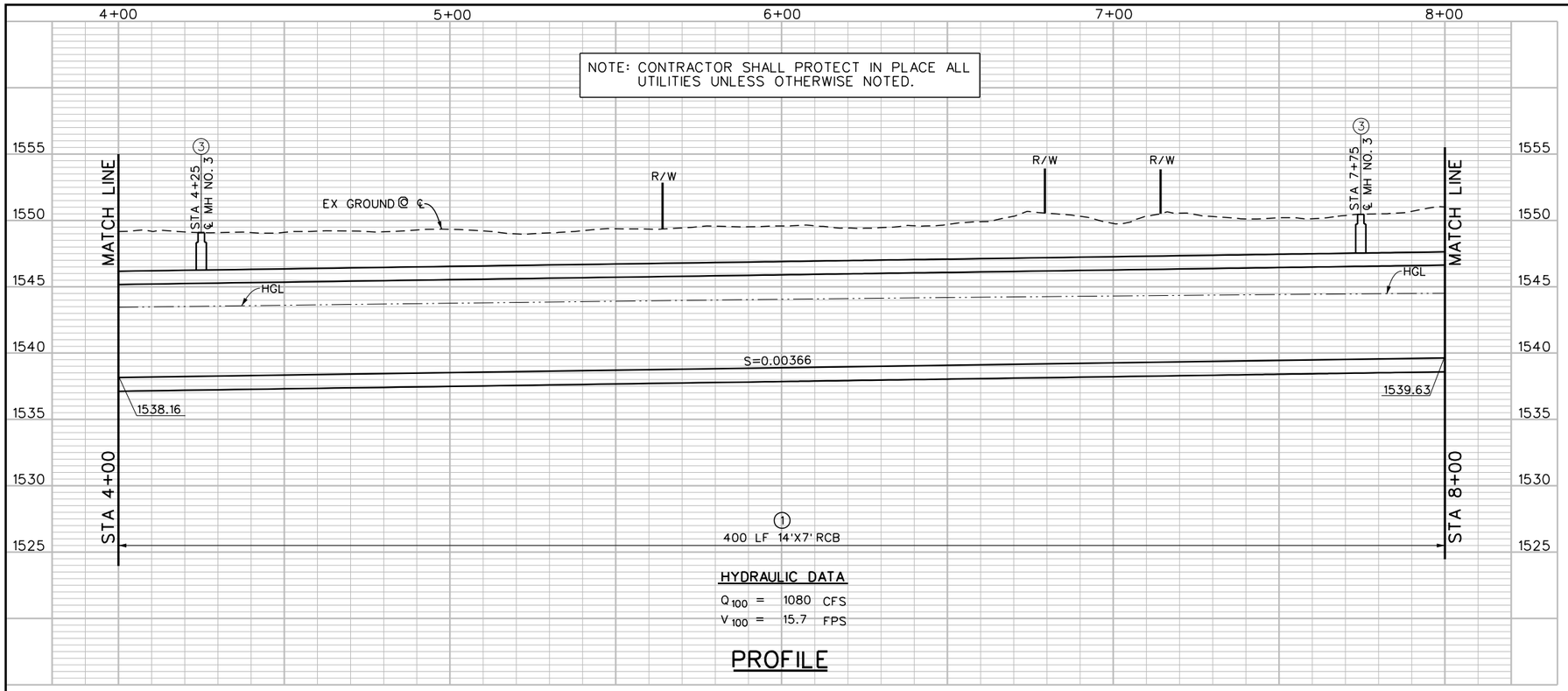
RECOMMENDED FOR APPROVAL BY: DATE:
APPROVED BY: DATE:

SAN JACINTO MDP
LINE C (STG 2)
STA. 1+00 TO STA. 4+00

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 02 OF XX

San Jacinto MDP.DGN 5/7/2012 3:23:14 PM

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES UNLESS OTHERWISE NOTED.

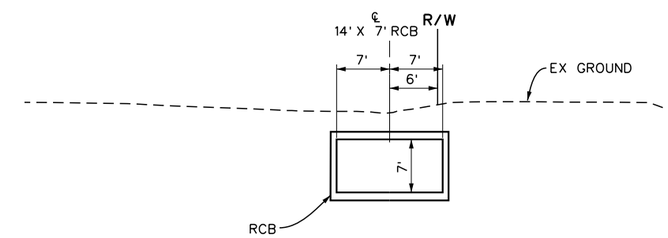


HYDRAULIC DATA

Q_{100} = 1080 CFS

V_{100} = 15.7 FPS

PROFILE



SECTION AT STATION 7+00

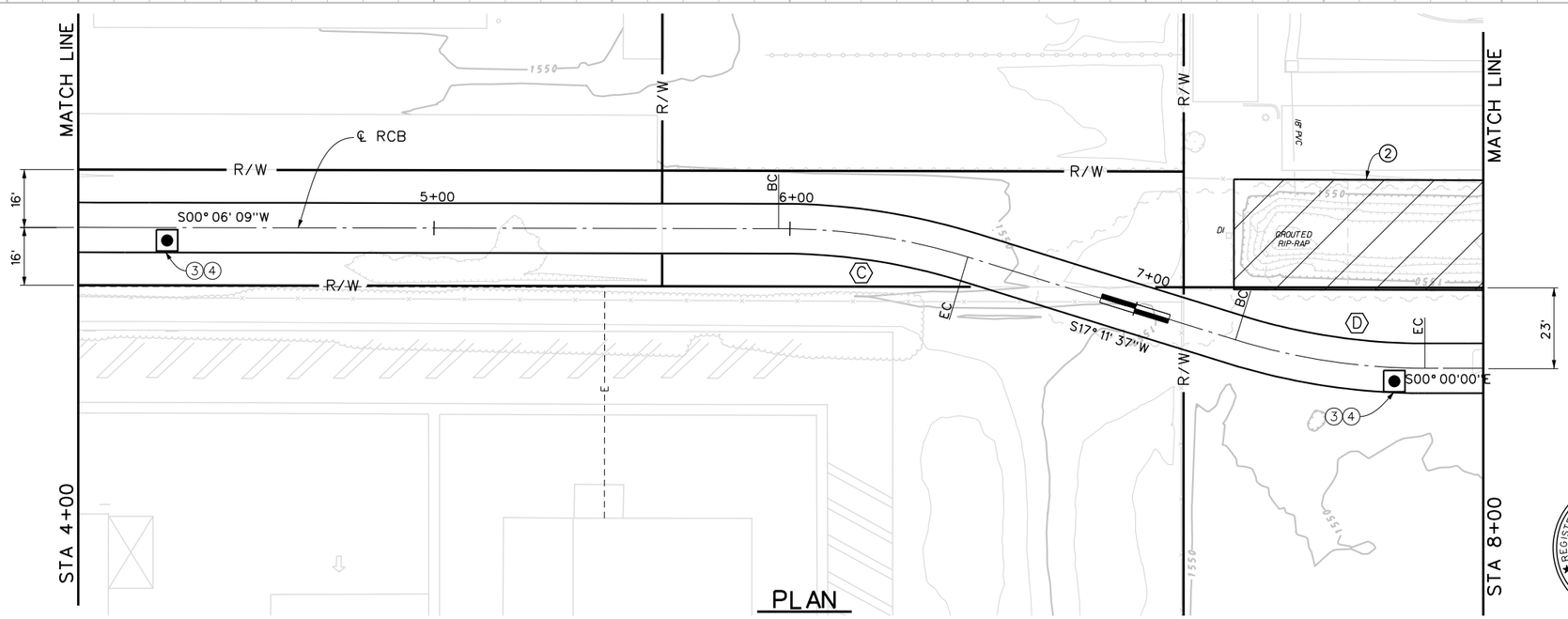
10' 0 10'

(C) ℄ STORM DRAIN CURVE DATA

Δ = 17° 05' 28"
R = 180.00'
L = 53.69'
T = 27.05'
BC = STA 5+97.47
EC = STA 6+51.16
PI = N 2225058.05
E 6344294.75

(D) ℄ STORM DRAIN CURVE DATA

Δ = 17° 11' 37"
R = 180'
L = 54.02'
T = 27.21'
BC = STA 7+29.56
EC = STA 7+83.58
PI = N 2224931.32
E 6344255.54



PLAN

NOTES

1. CONSTRUCT 14'X7' REINFORCED CONCRETE BOX PER CALTRANS STD. D80, PLAN, PROFILE AND DETAIL.
2. ANY GRADING OR OTHER DISTURBANCES WITHIN THE EXISTING RETENTION BASIN IS NOT AUTHORIZED BY RCFC&WCD.
3. CONSTRUCT MANHOLE NO. 3 PER STD MH253.
4. CONSTRUCT 6'X6'X6" CONCRETE PAD PER DETAIL ON SHEET XX.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: DATE:

APPROVED BY: DATE:

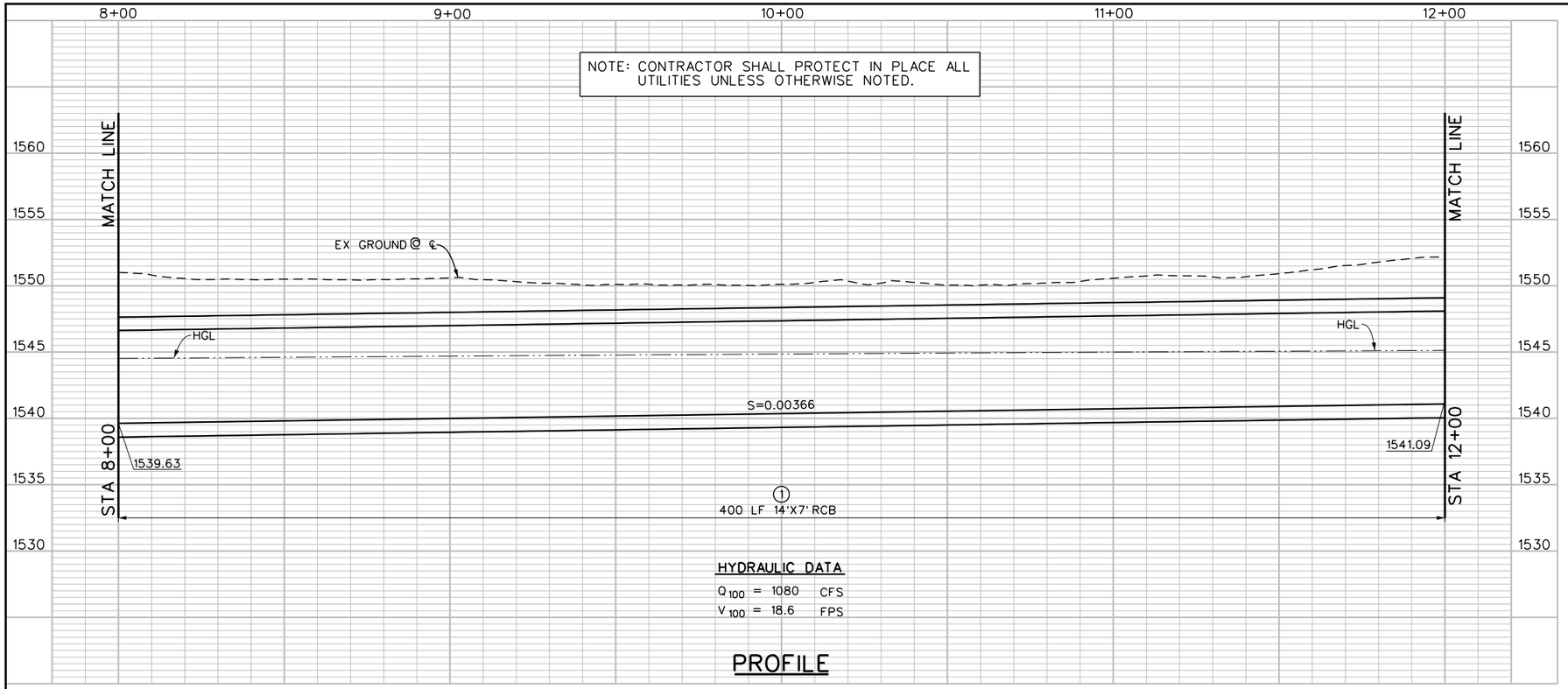
SAN JACINTO MDP

LINE C (STG 2)

STA. 4+00 TO STA. 8+00

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 03 OF XX

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES UNLESS OTHERWISE NOTED.

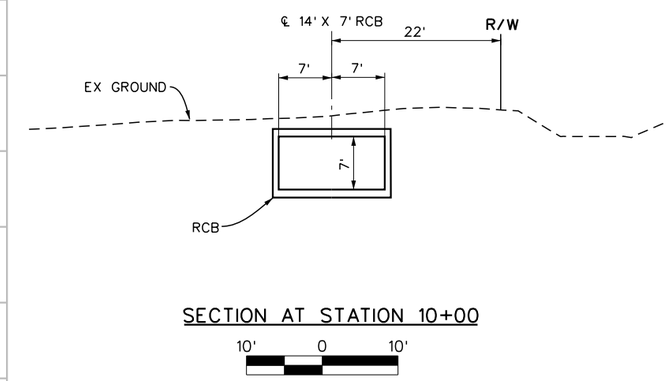


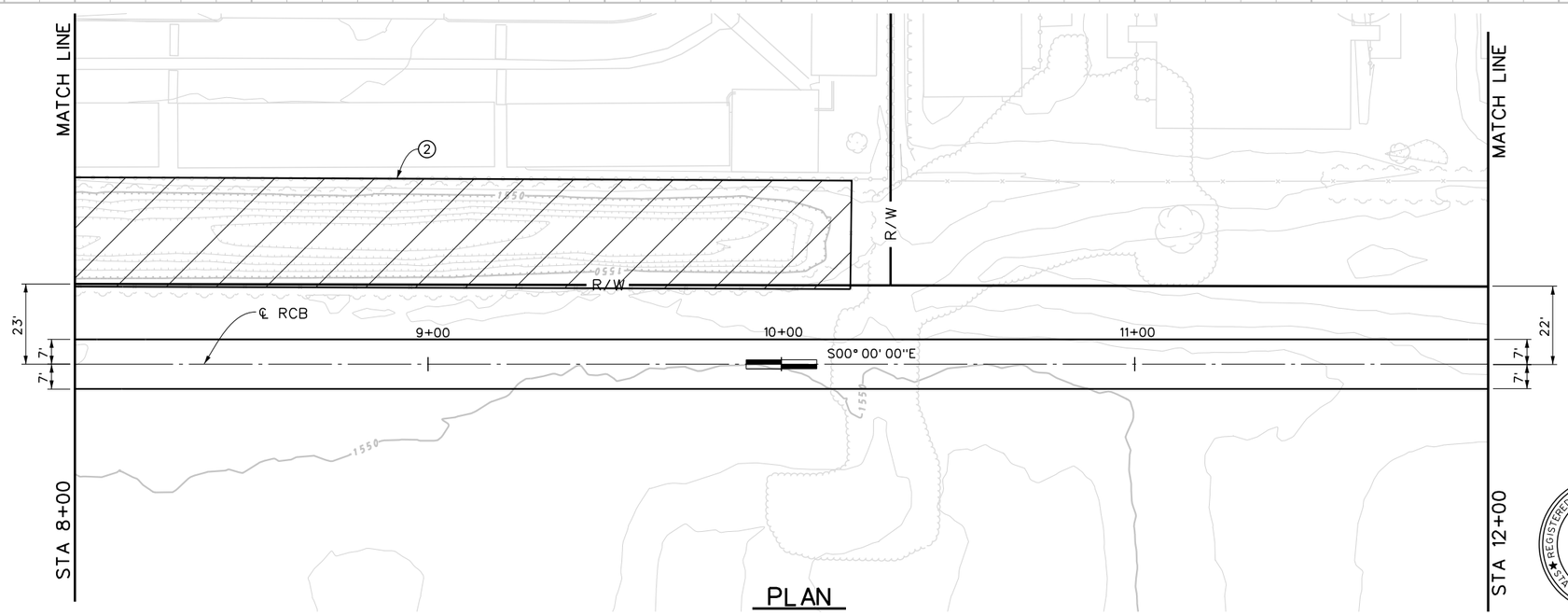
HYDRAULIC DATA

Q_{100} = 1080 CFS

V_{100} = 18.6 FPS

PROFILE





PLAN

NOTES

1. CONSTRUCT 14'X7' REINFORCED CONCRETE BOX PER CALTRANS STD. D80, PLAN, PROFILE AND DETAIL.
2. ANY GRADING OR OTHER DISTURBANCES WITHIN THE EXISTING RETENTION BASIN IS NOT AUTHORIZED BY RCFC&WCD.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

SAN JACINTO MDP

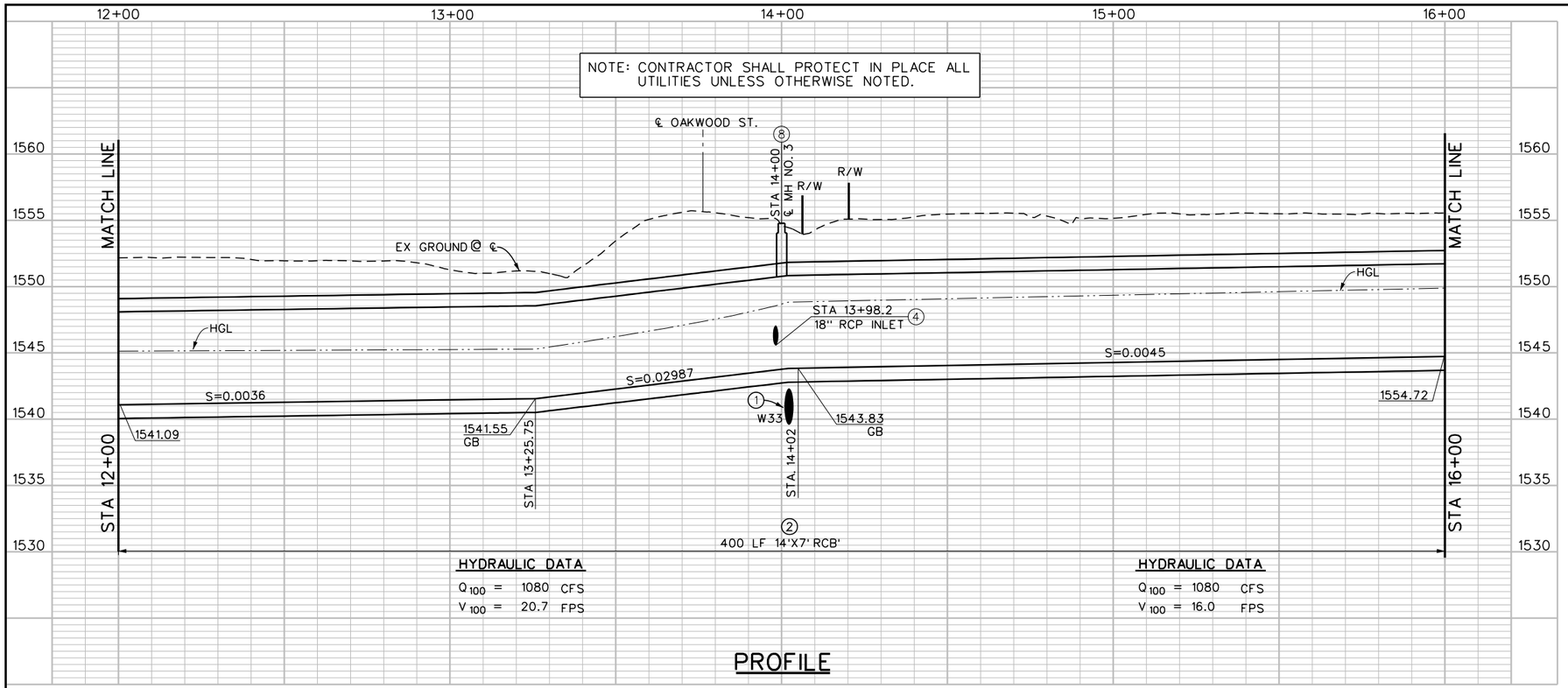
LINE C (STG 2)

STA. 8+00 TO STA. 12+00

PROJECT NO. 4-0-0124

DRAWING NO. 4-713

SHEET NO. 04 OF XX



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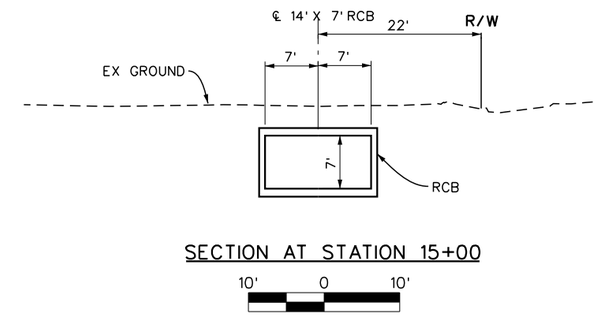

Ⓔ ℄ STORM DRAIN CURVE DATA

Δ = 09° 27' 42"
R = 180.00'
L = 29.72'
T = 14.90'
BC = STA 13+11.85
EC = STA 13+41.57
PI = N 2224360.94
E 6344255.54

Ⓕ ℄ STORM DRAIN CURVE DATA

Δ = 09° 27' 42"
R = 180'
L = 29.72'
T = 14.90'
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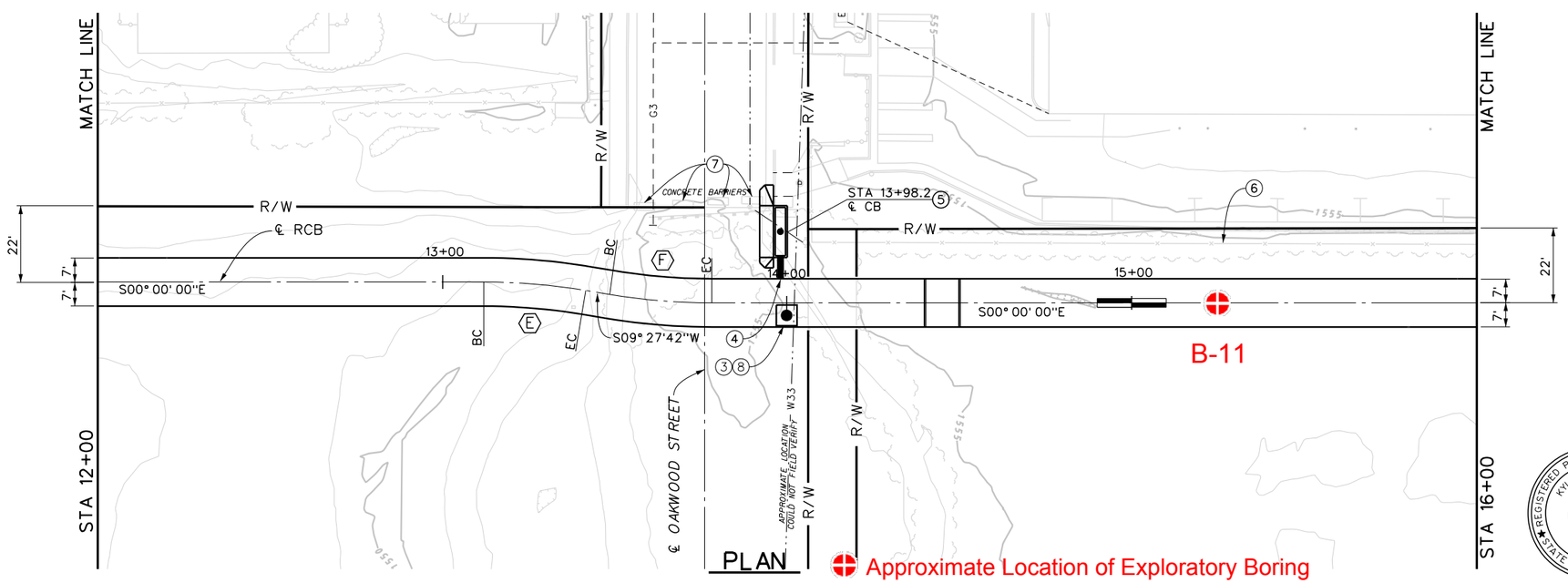
E 6344249.49



NOTES

1. PLACE SLURRY CEMENT BETWEEN 33" WATERLINE AND BOTTOM OF BOX.
2. CONSTRUCT 14'X7' REINFORCED CONCRETE BOX PER CALTRANS STD. D80 PLAN, PROFILE AND DETAIL.
3. CONSTRUCT 6'X6'X6" CONCRETE PAD PER DETAIL ON SHEET XX.
4. CONSTRUCT JS NO. 3 PER STD. JS228. SEE PROFILE ON SHEET XX.
5. CONSTRUCT CATCH BASIN NO. 1 PER STD CB100. V=3.50' & W=14'. SEE PROFILE ON SHEET XX.
6. PROTECT IN-PLACE EXISTING FENCE.
7. REMOVE AND REPLACE INTERFERRING CONCRETE BARRIERS.
8. CONSTRUCT MANHOLE NO. 3 PER STD MH253.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★
SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485
ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

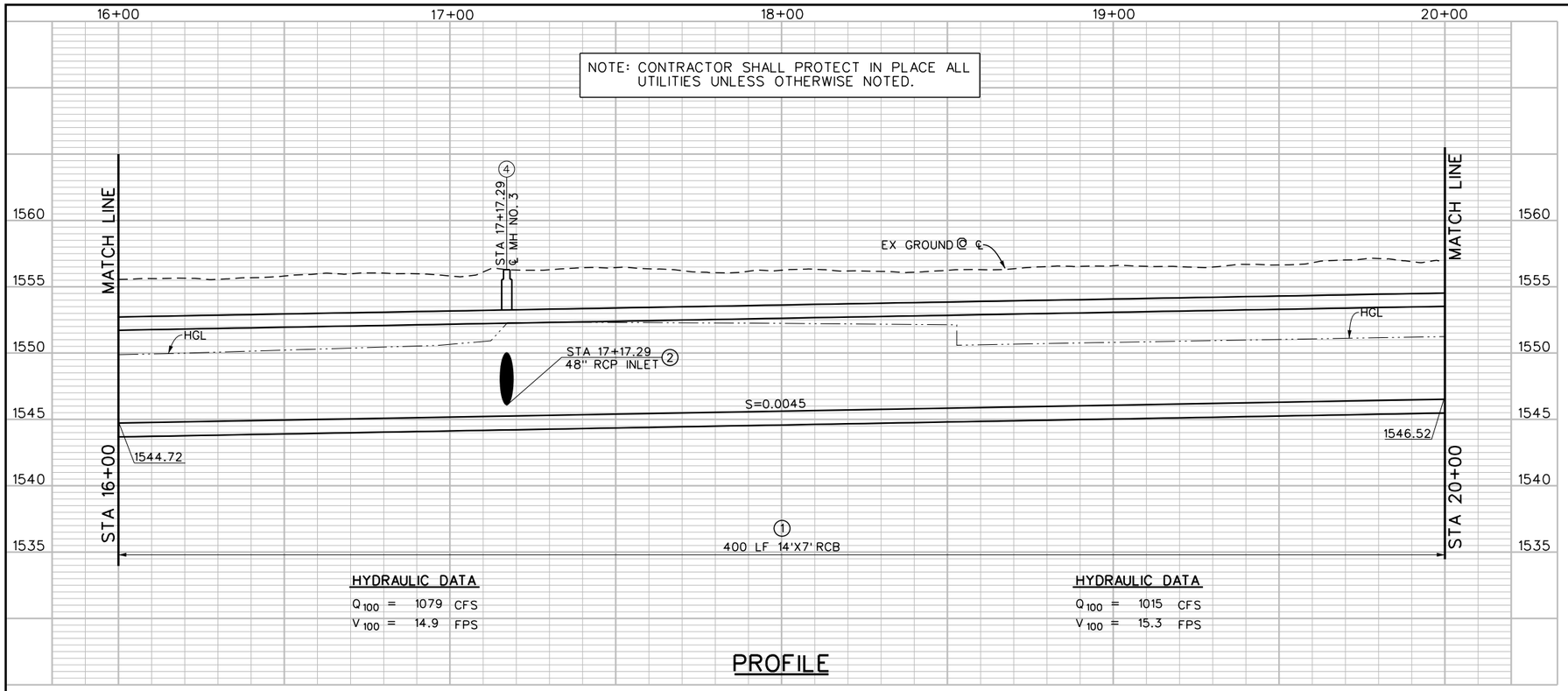
DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: DATE:
APPROVED BY: DATE:

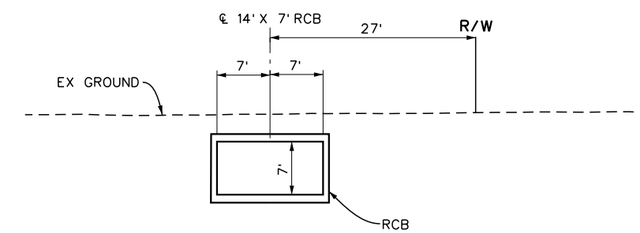
SAN JACINTO MDP
LINE C (STG 2)
STA. 12+00 TO STA. 16+00

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 05 OF XX

San Jacinto MDP.DGN 5/7/2012 3:23:14 PM

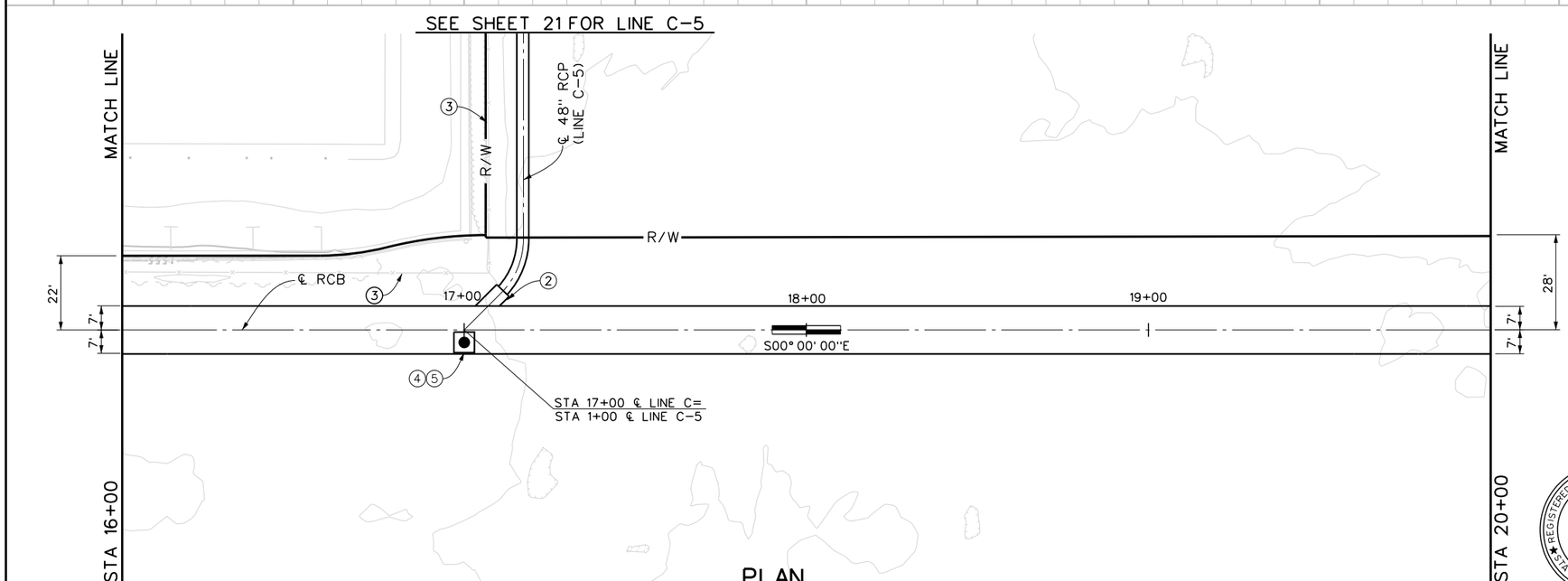


PROFILE



SECTION AT STATION 18+00

10' 0 10'



PLAN

NOTES

1. CONSTRUCT 14'X7' REINFORCED CONCRETE BOX PER CALTRANS STD. D80 PLAN, PROFILE AND DETAIL.
2. CONSTRUCT JS NO. 1 PER STD. JS 226. A=90°, B=48", C=8.8', EL. R=1546.631, EL. S=1546.623.
3. PROTECT IN-PLACE EXISTING FENCE.
4. CONSTRUCT MANHOLE NO. 3 PER STD MH253.
5. CONSTRUCT 6'X6'X6" CONCRETE PAD PER DETAIL ON SHEET XX.
6. LINE C-5 DETAILS ON SHEET 21.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REF.	DESCRIPTION	APPR.	DATE
	REVISIONS		

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

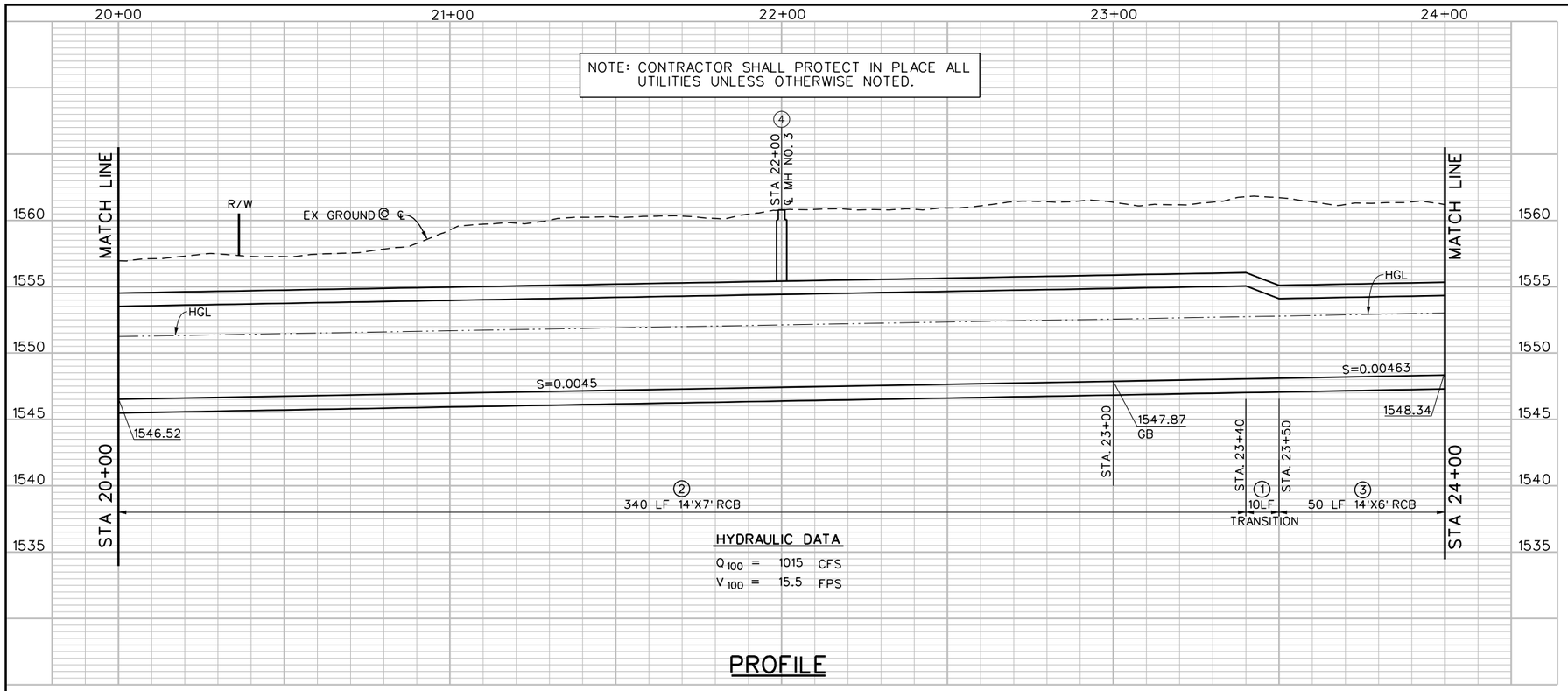
APPROVED BY: _____ DATE: _____

SAN JACINTO MDP

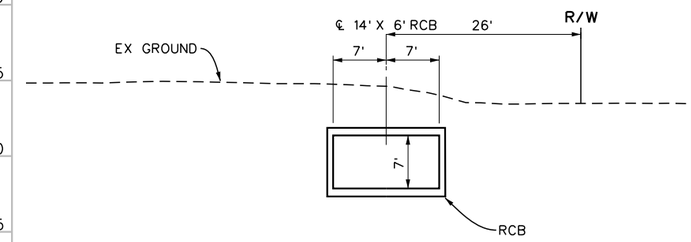
LINE C (STG 2)

STA. 16+00 TO STA. 20+00

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 06 OF XX

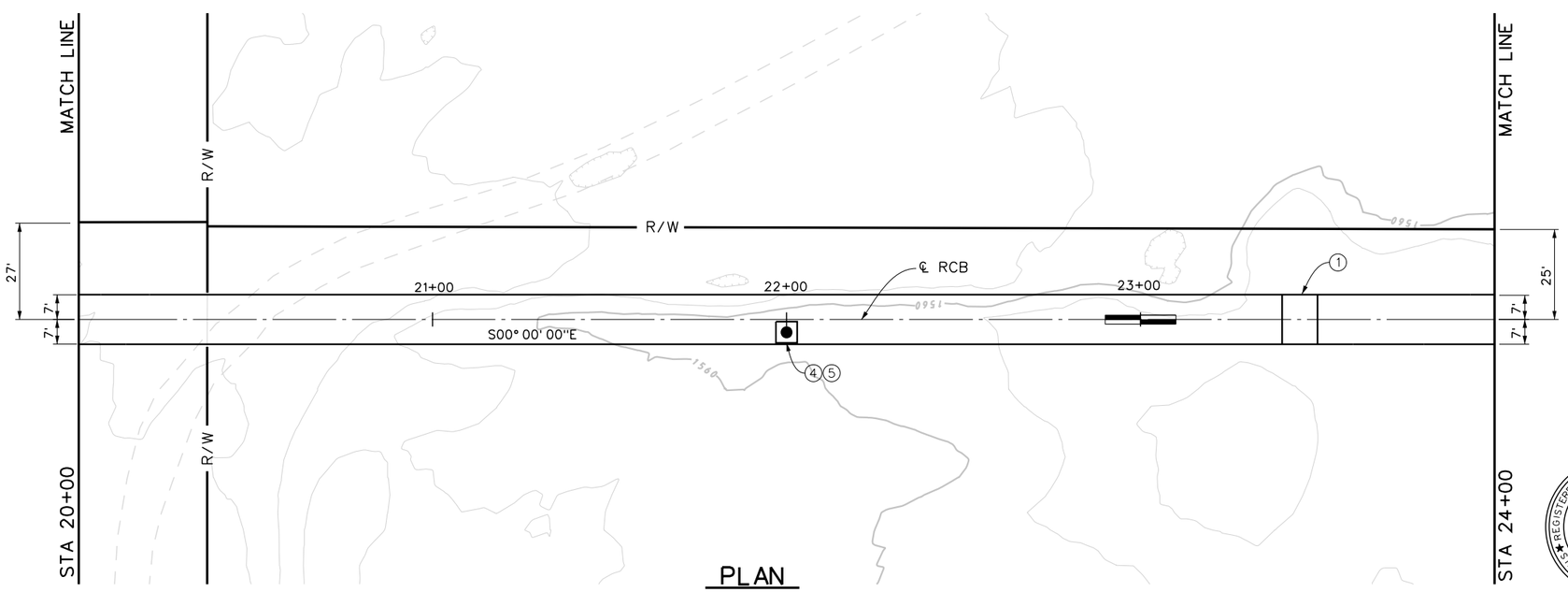


PROFILE



SECTION AT STATION 23+00

10' 0 10'



PLAN

NOTES

1. CONSTRUCT TRANSITION STRUCTURE NO.2 PER STD TS302 AND DETAILS SHEET XXX.
2. CONSTRUCT 14'X7' REINFORCED CONCRETE BOX PER CALTRANS STD D80, PLAN, PROFILE, AND DETAIL.
3. CONSTRUCT 14'X6' REINFORCED CONCRETE BOX PER CALTRANS STD D80, PLAN, PROFILE, AND DETAIL.
4. CONSTRUCT MANHOLE NO. 3 PER STD MH253.
5. CONSTRUCT 6'X6'X6" CONCRETE PAD PER DETAIL ON SHEET XX.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REF.	DESCRIPTION	APPR.	DATE
	REVISIONS		

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

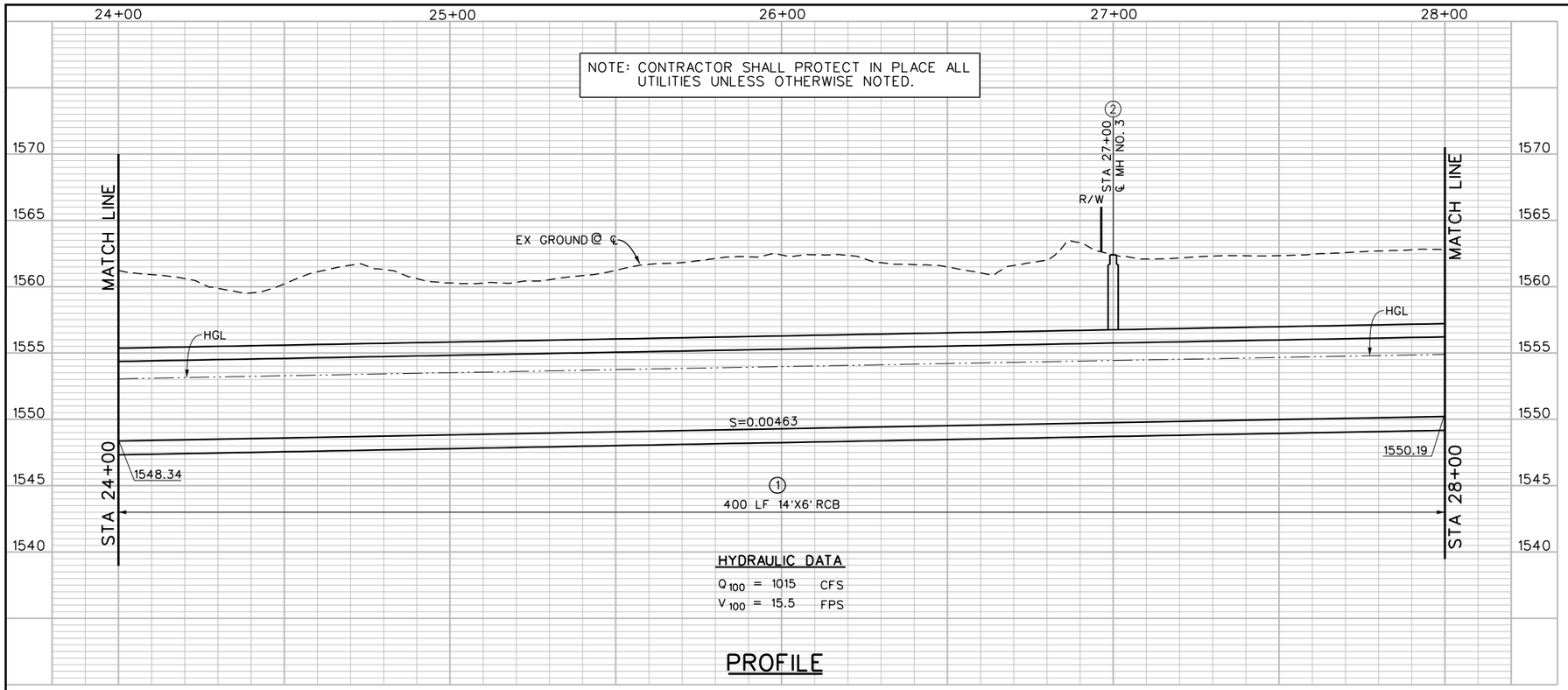
APPROVED BY: _____ DATE: _____

SAN JACINTO MDP

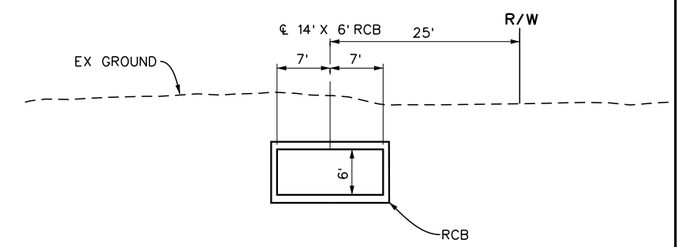
LINE C (STG 2)

STA. 20+00 TO STA. 24+00

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 07 OF XX

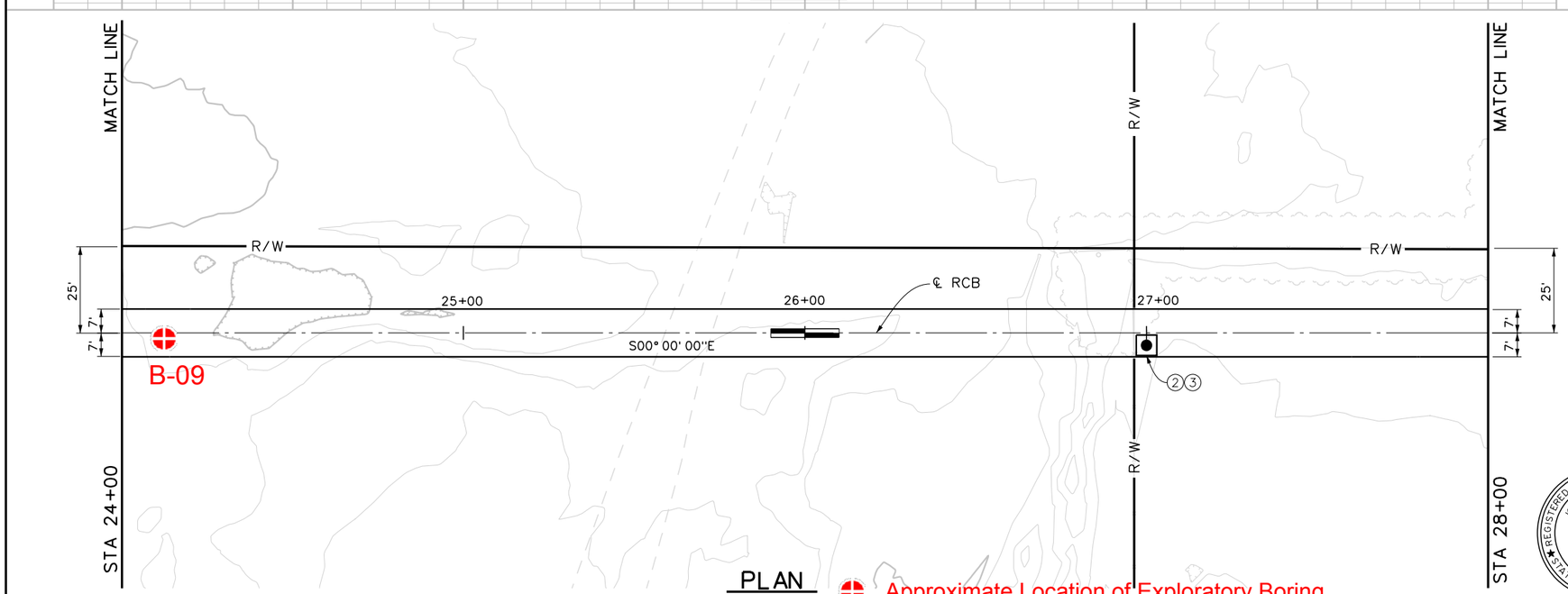


PROFILE



SECTION AT STATION 26+00

10' 0 10'



PLAN

Approximate Location of Exploratory Boring

NOTES

1. CONSTRUCT 14'X6' REINFORCED CONCRETE BOX PER CALTRANS STD. D80, PLAN, PROFILE AND DETAIL.
2. CONSTRUCT MANHOLE NO. 3 PER STD MH253.
3. CONSTRUCT 6'X6'X6" CONCRETE PAD PER DETAILS ON SHEET XX.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

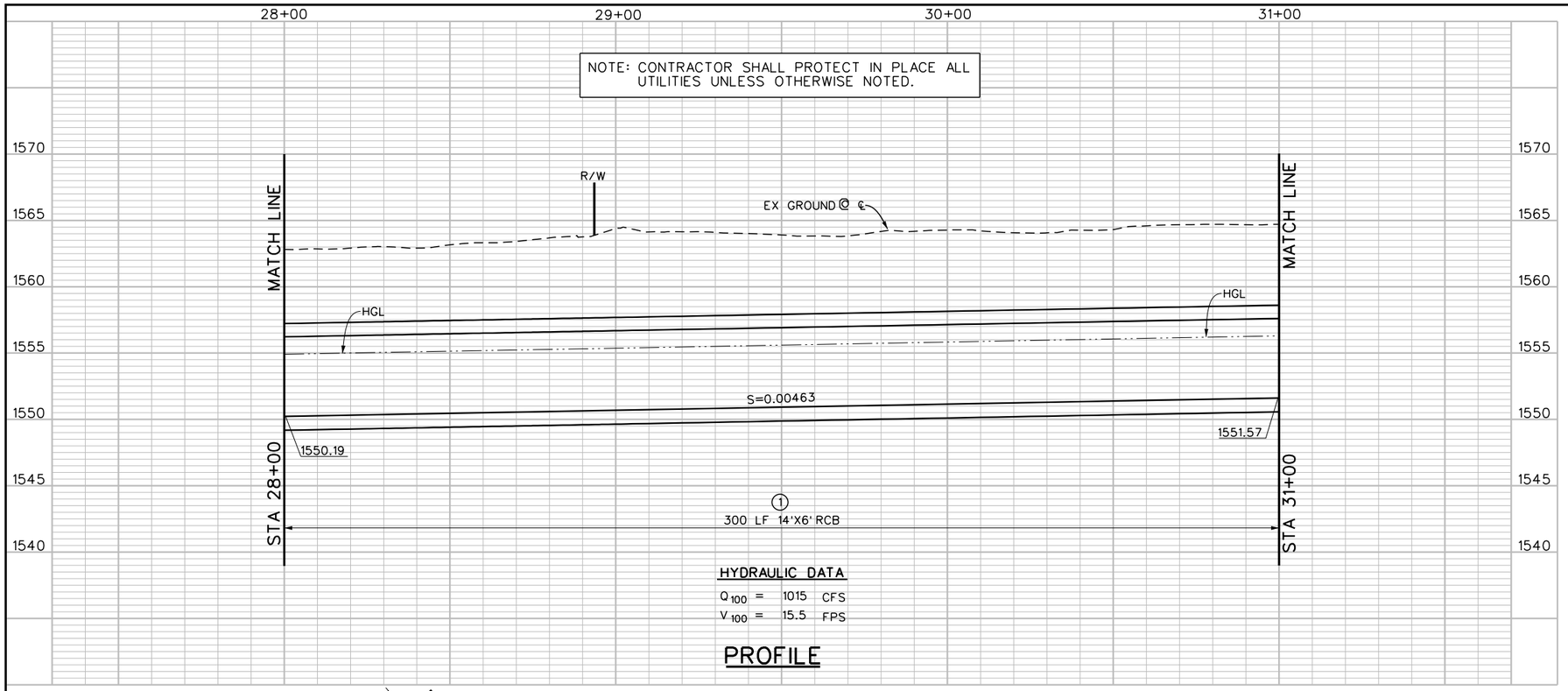
SAN JACINTO MDP

LINE C (STG 2)

STA. 24+00 TO STA. 28+00

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 08 OF XX

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES UNLESS OTHERWISE NOTED.

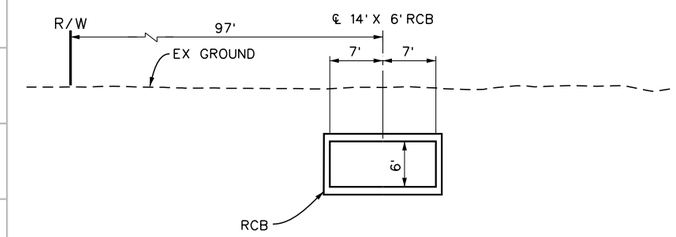


HYDRAULIC DATA

Q_{100} = 1015 CFS

V_{100} = 15.5 FPS

PROFILE

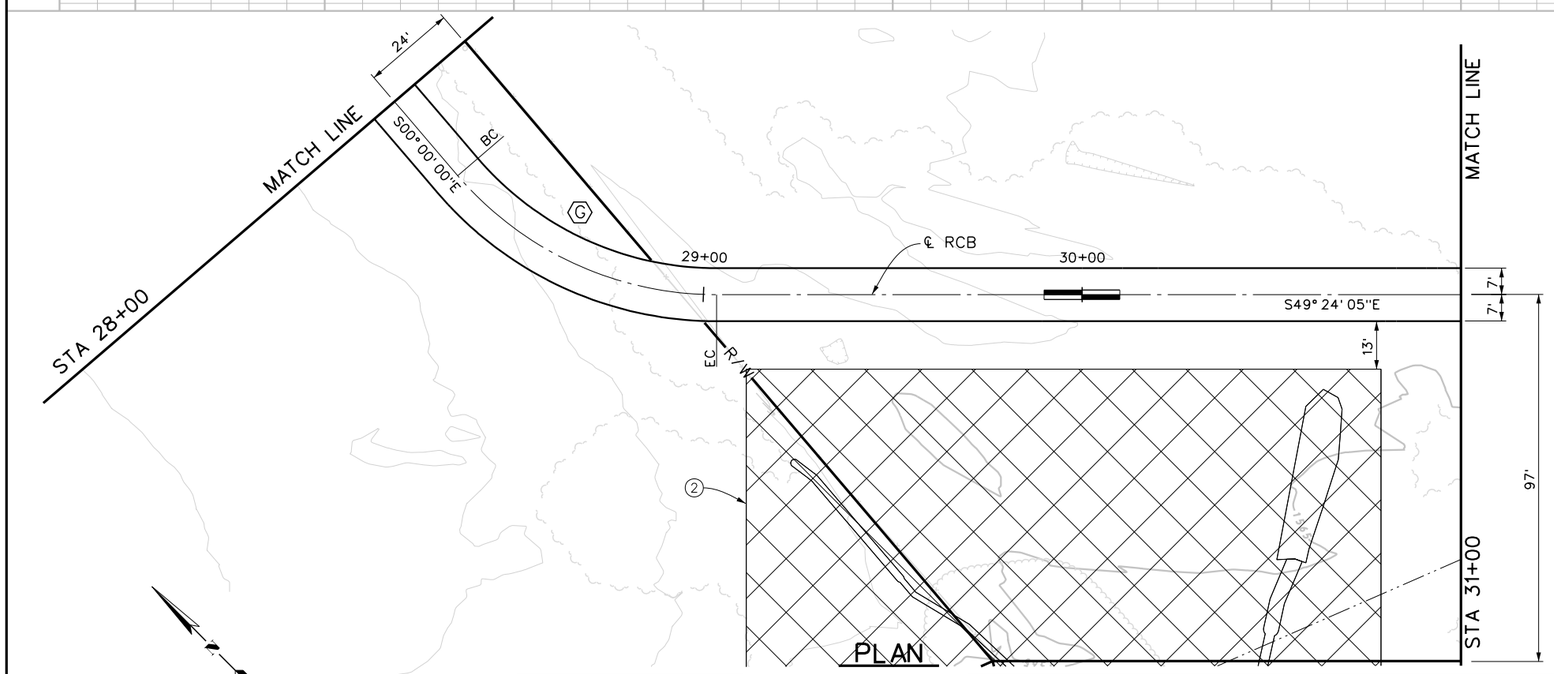


SECTION AT STATION 30+00

10' 0 10'

ENVIRONMENTALLY SENSITIVE AREA

WARNING: THE CONTRACTOR SHALL NOT ENTER OR DAMAGE ANY VEGETATION OUTSIDE OF THE CONSTRUCTION / EXCAVATION LIMITS.



20' 0 20'

G ℄ CHANNEL CURVE DATA

Δ = 49°24'05"
R = 90.00'
L = 77.60'
T = 41.40'
BC = STA 28+25.90
EC = STA 29+03.50
PI = N 2222820.75
E 6344249.49

NOTES

1. CONSTRUCT 14'X6' REINFORCED CONCRETE BOX PER CALTRANS STD. D80, PLAN, PROFILE, AND DETAIL.
2. ANY GRADING OR OTHER DISTURBANCES WITHIN THE ENVIROMENTALLY SENSITIVE AREA IS NOT AUTHORIZED BY RCFC&WCD.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

SAN JACINTO MDP

LINE C (STG 2)

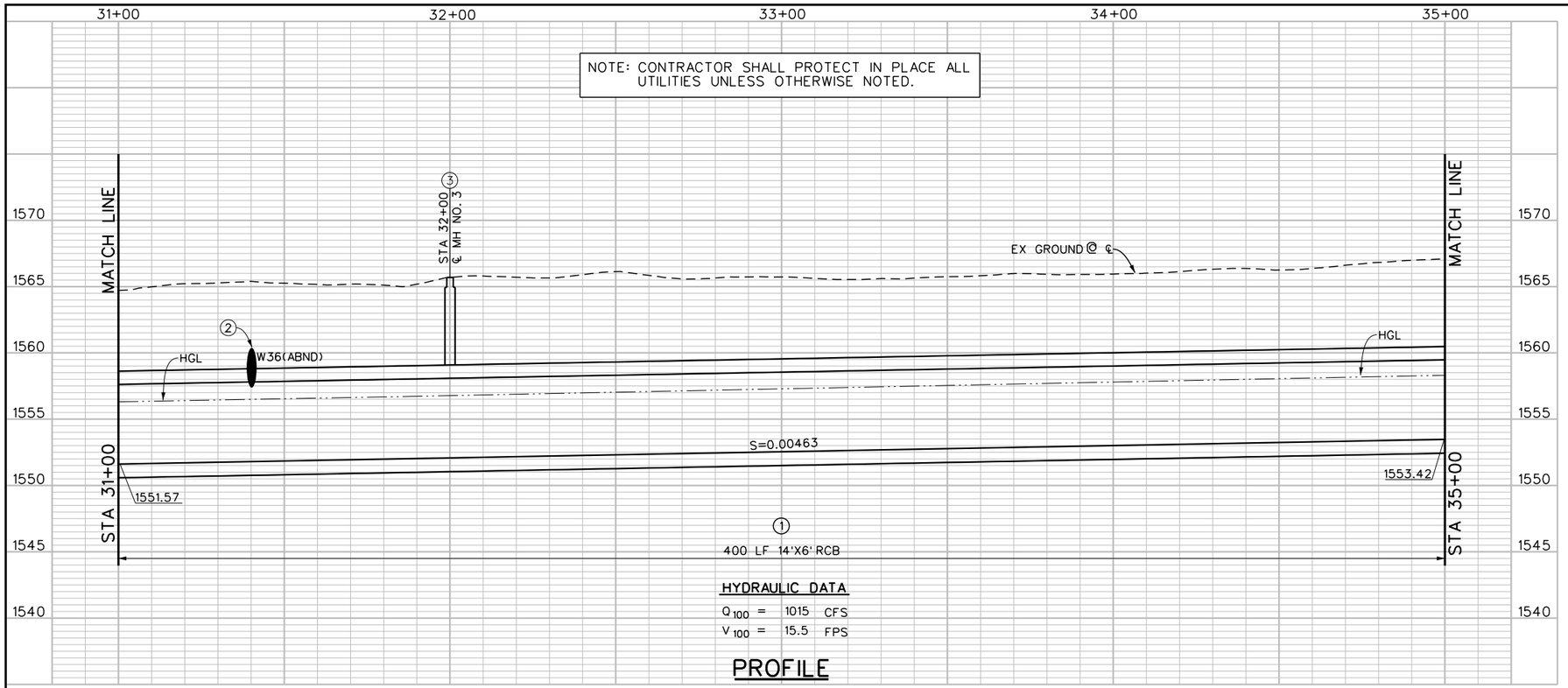
STA. 27+50 TO STA. 31+00

PROJECT NO. 4-0-0124

DRAWING NO. 4-713

SHEET NO. 09 OF XX

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES UNLESS OTHERWISE NOTED.

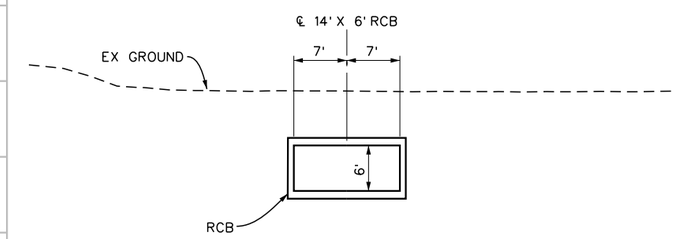


HYDRAULIC DATA

Q_{100} = 1015 CFS

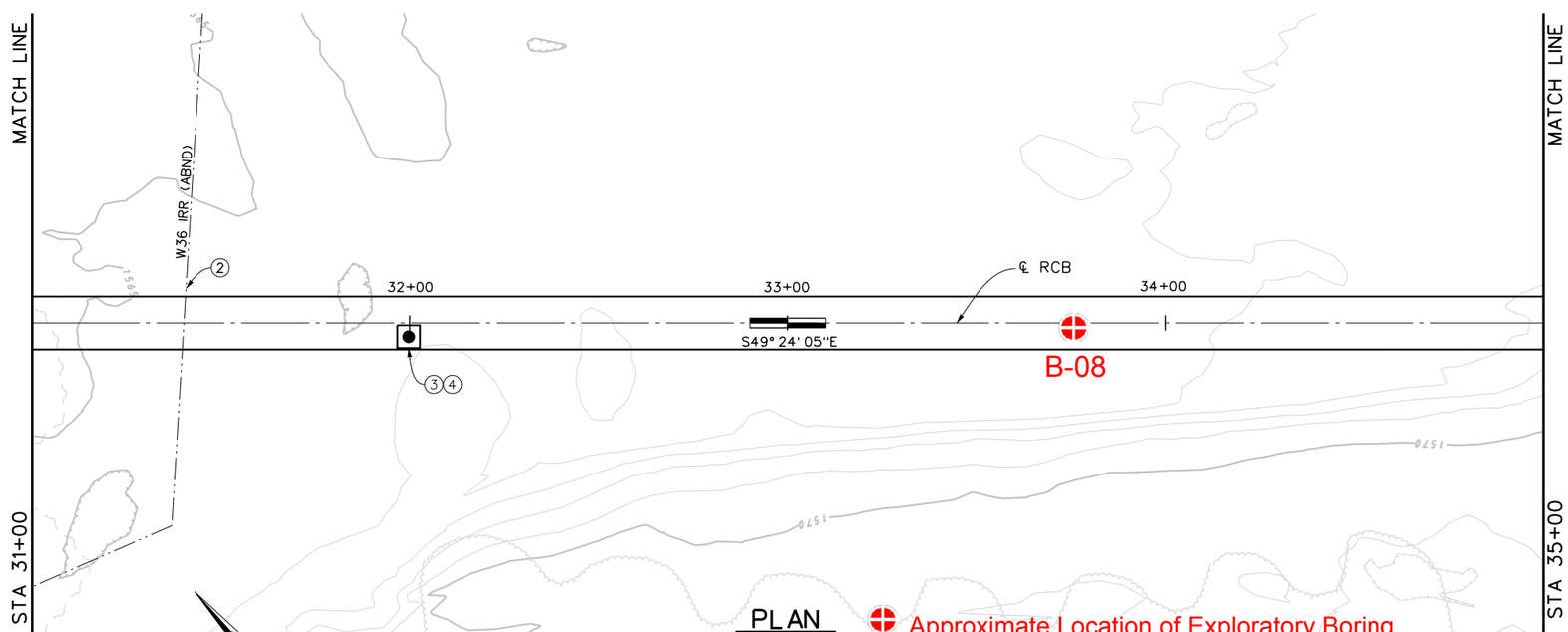
V_{100} = 15.5 FPS

PROFILE



SECTION AT STATION 33+00

10' 0 10'



PLAN

Approximate Location of Exploratory Boring

20' 0 20'

NOTES

1. CONSTRUCT 14'X6' REINFORCED CONCRETE BOX PER CALTRANS STD. D80, PLAN, PROFILE, AND DETAIL.
2. CUT AND PLUG INTERFERING PORTION OF EXISTING ABANDONED 36" WATER LINE.
3. CONSTRUCT MANHOLE NO. 3 PER STD MH253.
4. CONSTRUCT 6'X6'X6" CONCRETE PAD PER DETAILS ON SHEET XX.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: DATE:

APPROVED BY: DATE:

SAN JACINTO MDP

LINE C (STG 2)

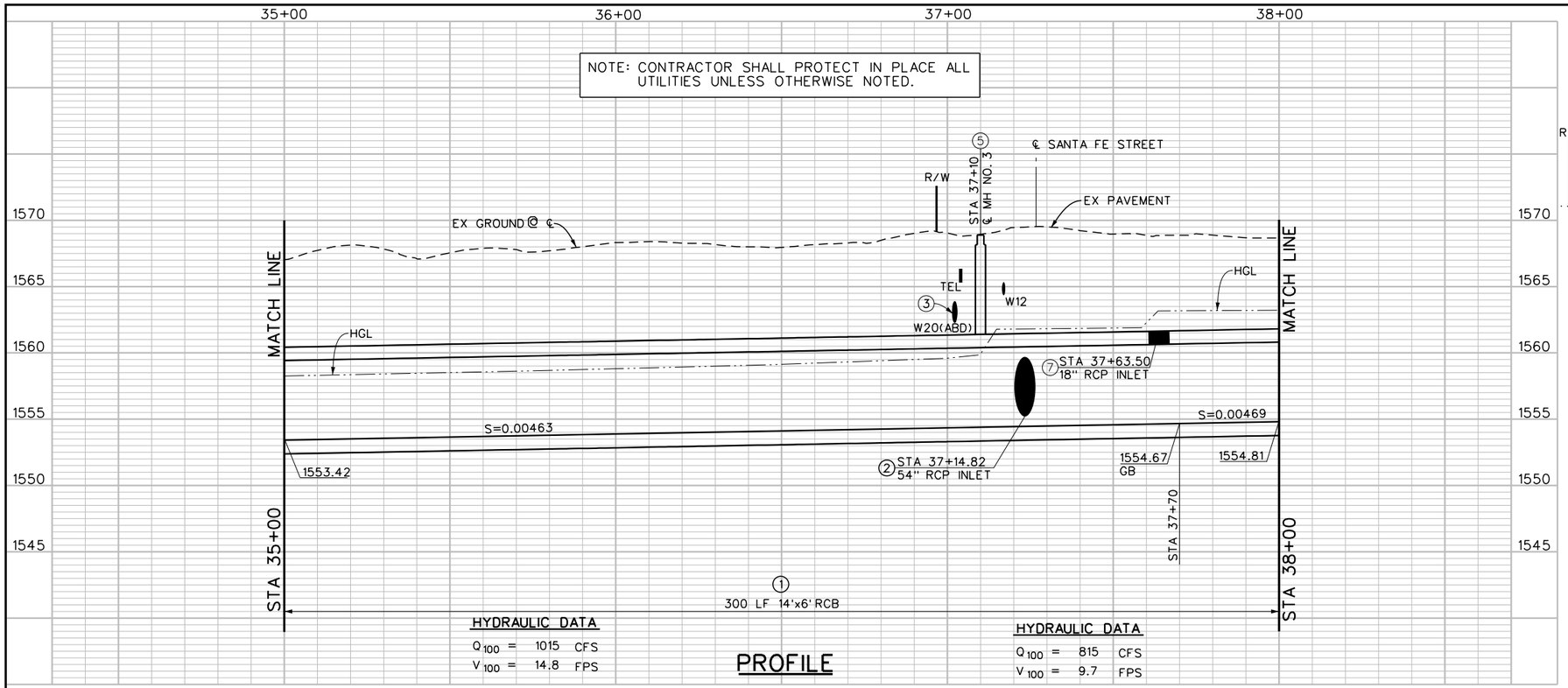
STA. 31+00 TO STA. 35+00

PROJECT NO. 4-0-0124

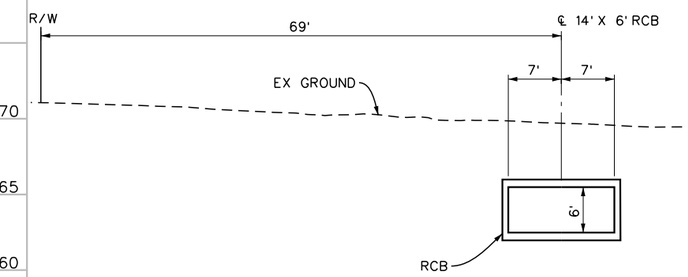
DRAWING NO. 4-713

SHEET NO. 10 OF XX

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES UNLESS OTHERWISE NOTED.



PROFILE

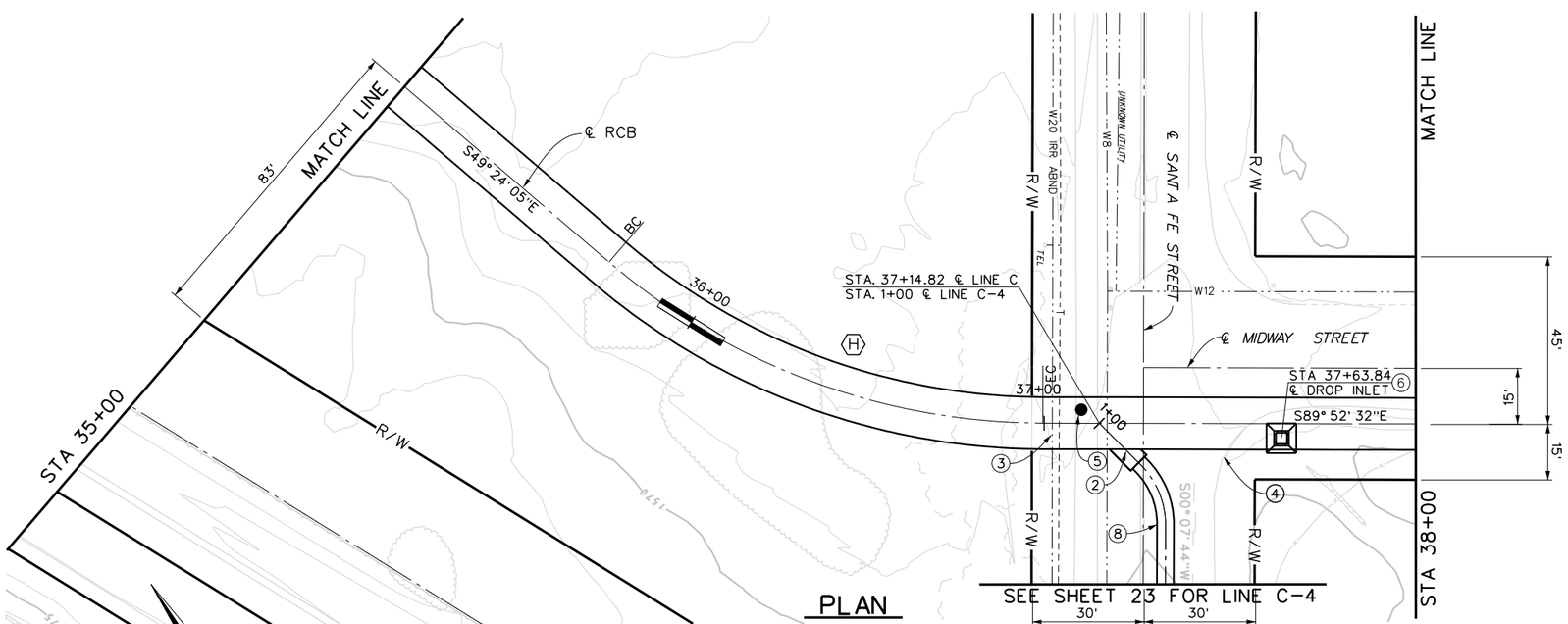


SECTION AT STATION 36+00

10' 0 10'

Ⓗ ℄ STORM DRAIN CURVE DATA

Δ = 40° 28' 27"
R = 180.00'
L = 127.15'
T = 66.36'
BC = STA 35+72.53
EC = STA 36+99.69
PI = N 2222315.25
E 6344839.29



PLAN

NOTES

1. CONSTRUCT 14'X6' REINFORCED CONCRETE BOX PER CALTRANS STD D80, PLAN, PROFILE, AND DETAIL.
2. CONSTRUCT JS NO.1 PER STD JS226. A=45°, B=54", C=15', EL. R=1555.080, EL. S=1554.953.
3. REMOVE AND PLUG INTERFERING PORTION OF EXISTING ABANDONED 20" WATER LINE.
4. REMOVE AND REPLACE HMA BERM.
5. CONSTRUCT MANHOLE NO. 3 PER STD MH253.
6. CONSTRUCT DROP INLET PER STD CB110. V=4', & W=XX'. SEE PROFILE ON SHEET XX.
7. CONSTRUCT JS NO. 3 CASE 3 PER STD JS228. A=90°, D=18". SEE PROFILE ON SHEET XX.
8. LINE C-4 DETAILS ON SHEET 23.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: DATE:

APPROVED BY: DATE:

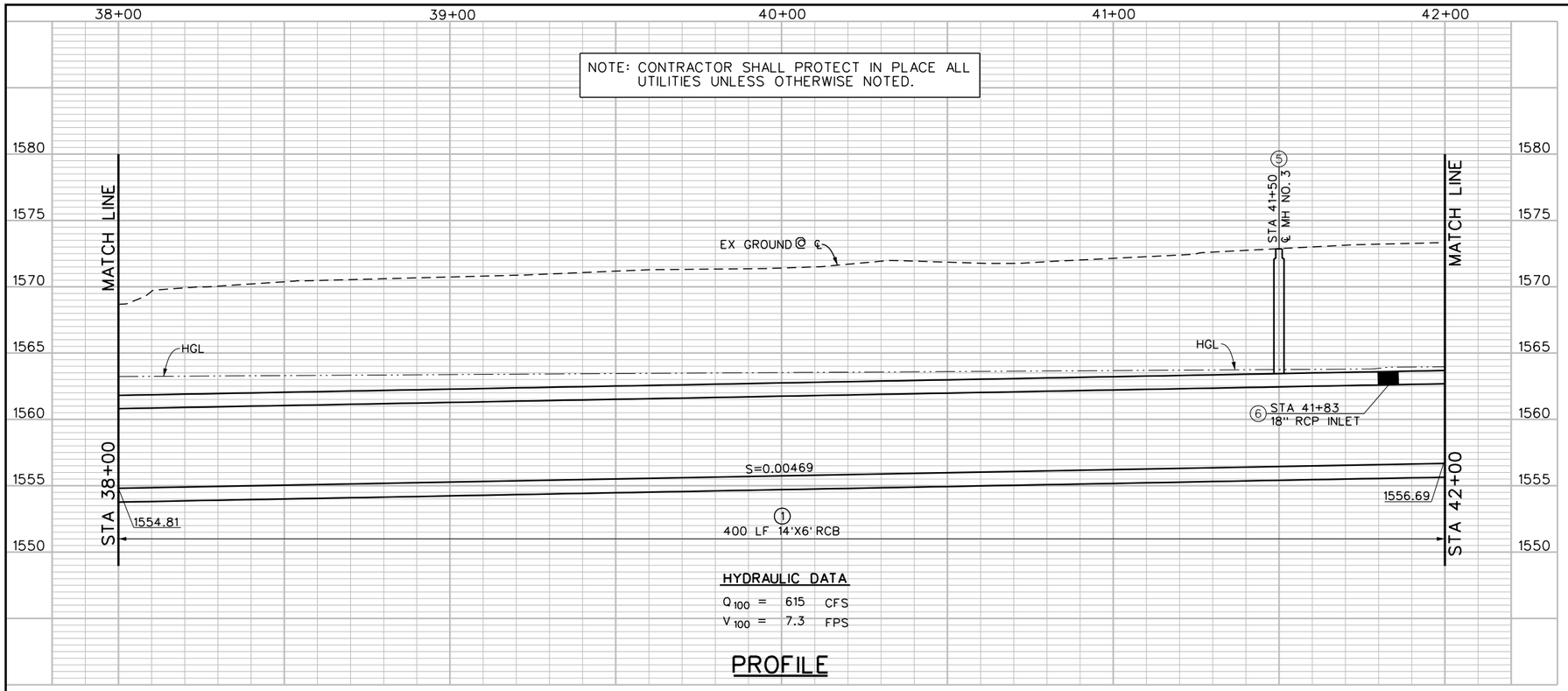
SAN JACINTO MDP

LINE C (STG 2)

STA. 35+00 TO STA. 38+00

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 11 OF XX

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES UNLESS OTHERWISE NOTED.

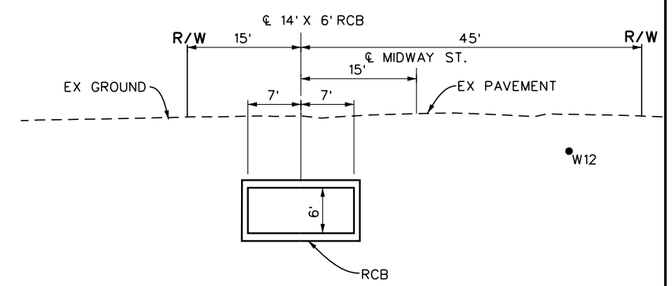


HYDRAULIC DATA

Q_{100} = 615 CFS

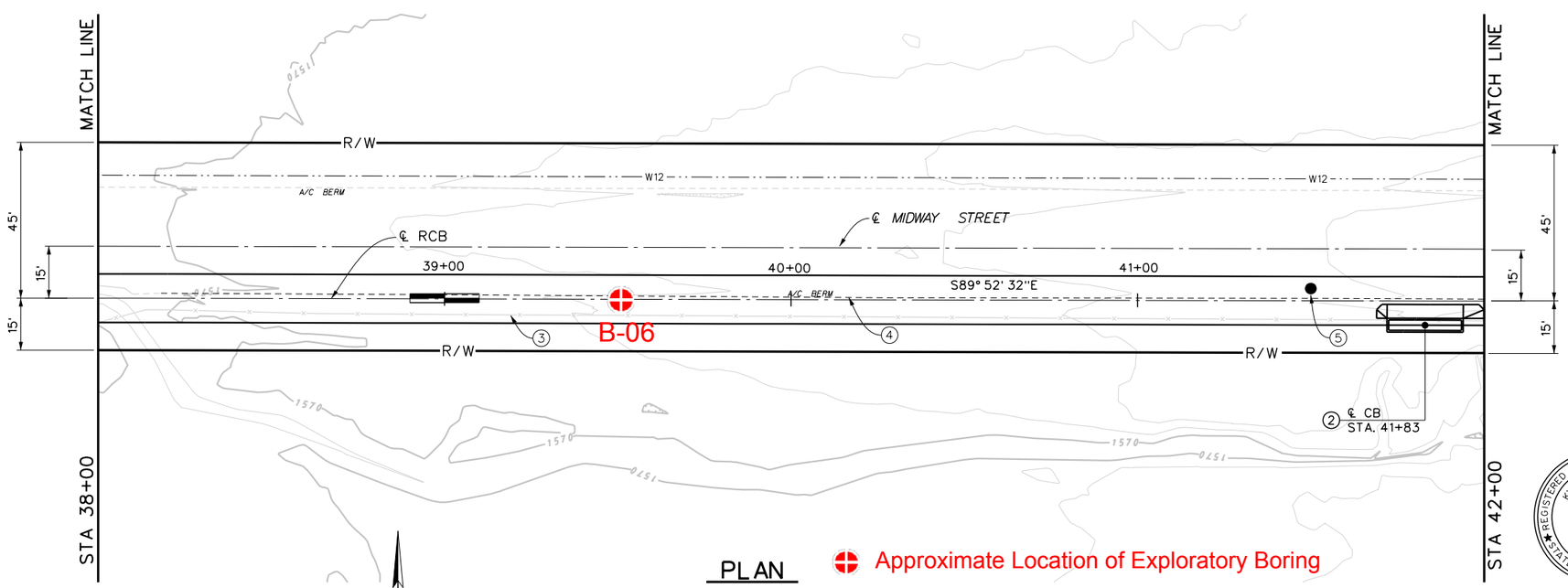
V_{100} = 7.3 FPS

PROFILE



SECTION AT STATION 39+00

10' 0 10'



PLAN

Approximate Location of Exploratory Boring

20' 0 20'

NOTES

1. CONSTRUCT 14'X6' REINFORCED CONCRETE BOX PER CALTRANS STD D80 PLAN, PROFILE, AND DETAIL.
2. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 3' & W = 21', SEE PROFILE ON SHEET XXX.
3. REMOVE AND DISPOSE EXISTING FENCE/DELINEATORS.
4. REMOVE AND REPLACE HMA BERM.
5. CONSTRUCT MANHOLE NO. 3 PER STD MH253.
6. CONSTRUCT JS NO. 3 CASE 3 PER STD JS228. A=XX°, D=18". SEE PROFILE ON SHEET XX.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

SAN JACINTO MDP

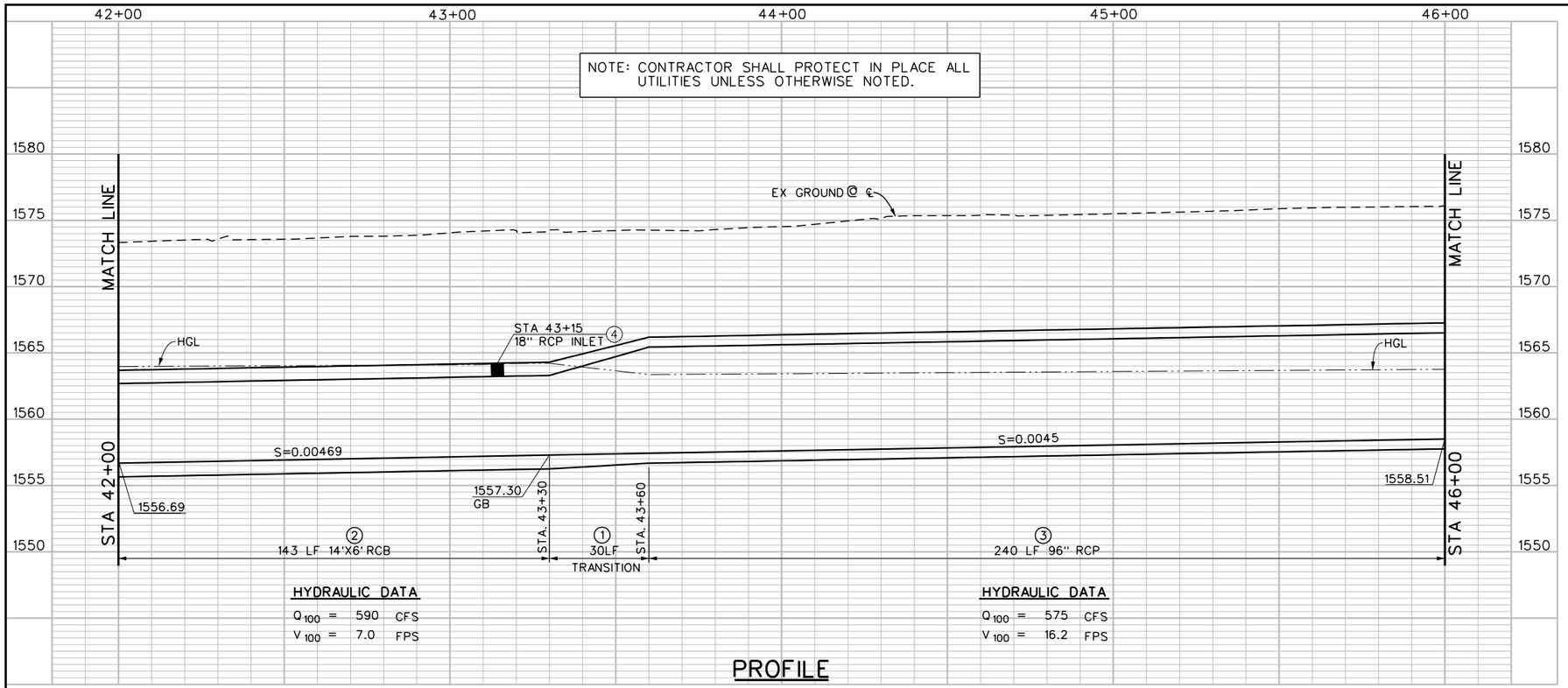
LINE C (STG 2)

STA. 38+00 TO STA. 42+00

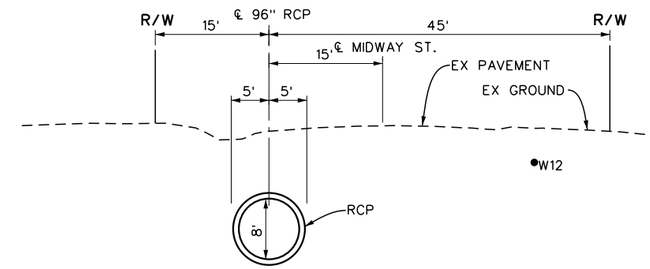
PROJECT NO. 4-0-0124

DRAWING NO. 4-713

SHEET NO. 12 OF XX

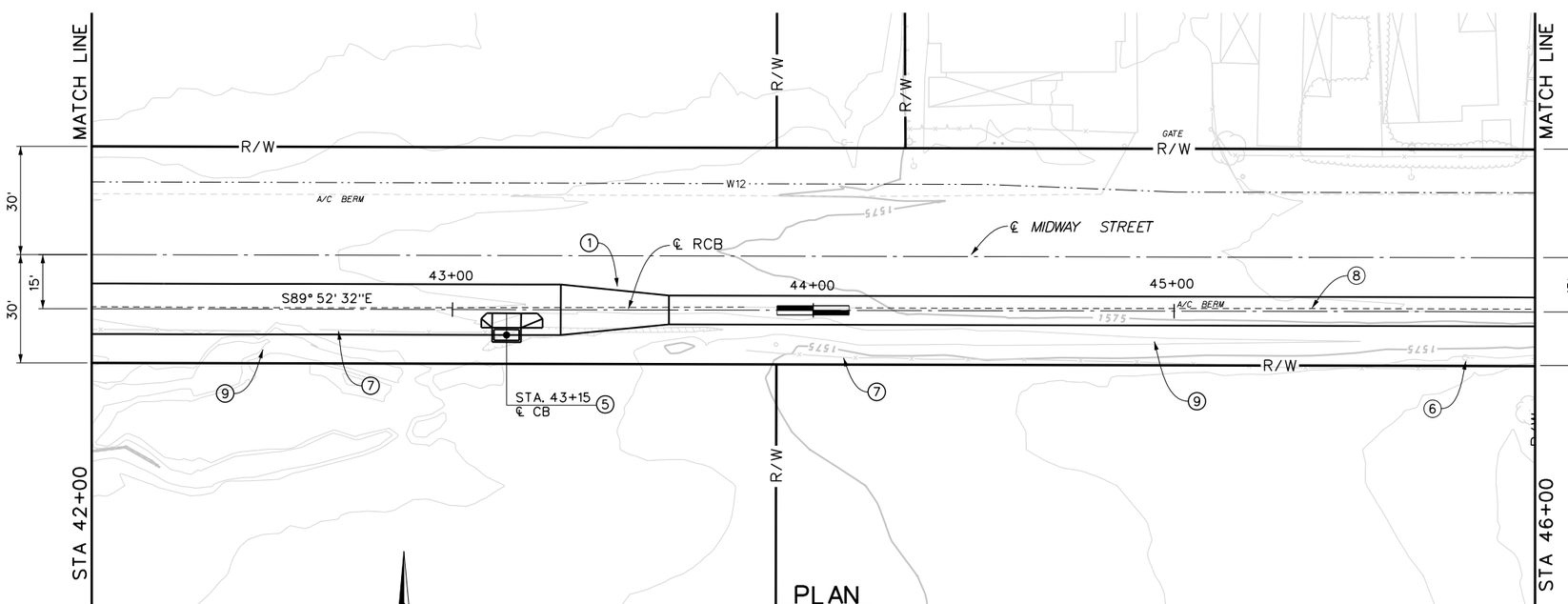


PROFILE



SECTION AT STATION 44+00

10' 0 10'



PLAN

20' 0 20'

NOTES

1. CONSTRUCT TRANSITION STRUCTURE NO.1 PER STD TS301 AND DETAILS SHEET XXXX.
2. CONSTRUCT 14'X6' REINFORCED CONCRETE BOX PER CALTRANS STD D80 PLAN, PROFILE, AND DETAIL.
3. CONSTRUCT CONCRETE REINFORCED PIPE WITH D=96".
4. CONSTRUCT JS NO.3 CASE 3 PER STD JS228. AXX°, D=18". SEE PROFILE ON SHEET ZZZ.
5. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 3' & W = 7', SEE PROFILE ON SHEET XXX.
6. PROTECT IN-PLACE EXISTING GUY-WIRE.
7. REMOVE AND DISPOSE EXISTING FENCE/DELINEATORS.
8. REMOVE AND REPLACE HMA BERM.
9. BACKFILL TO MATCH SURROUNDING SITE.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

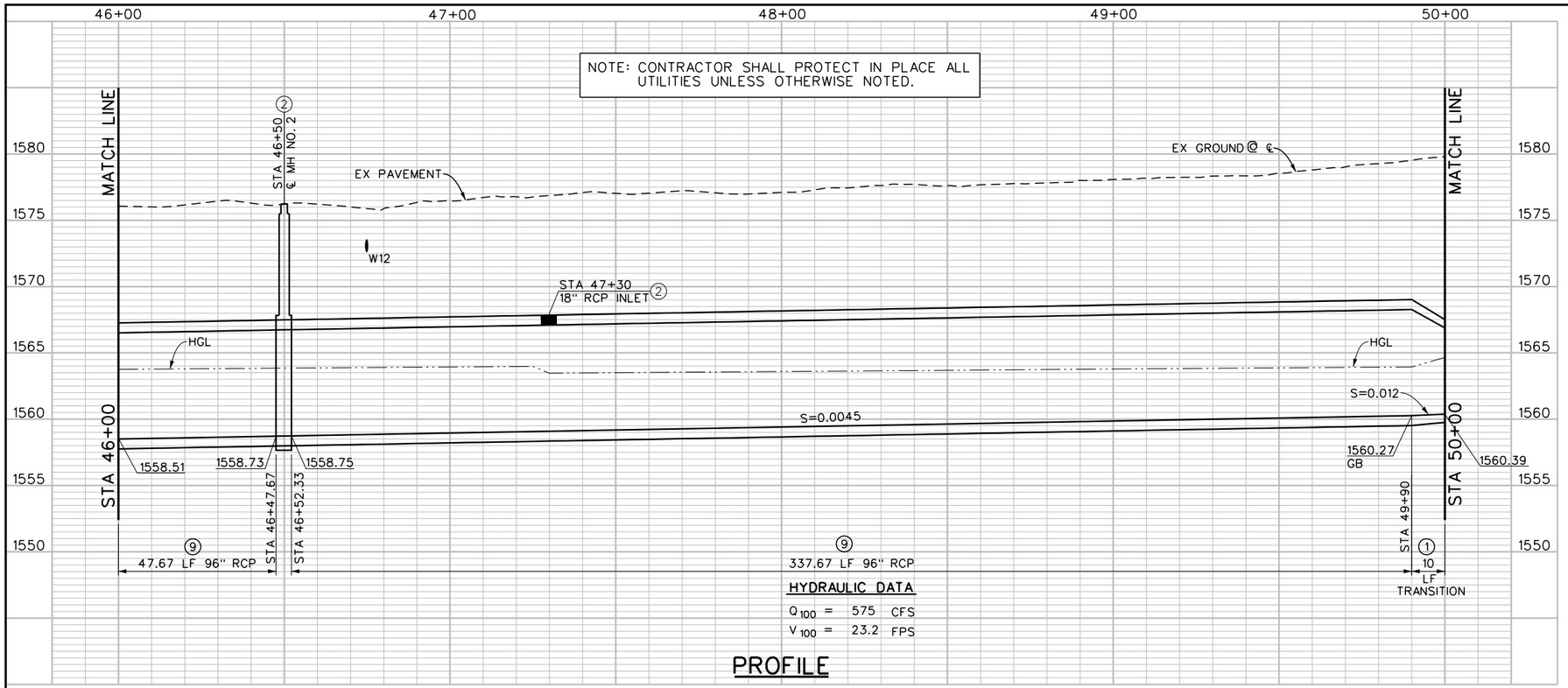
APPROVED BY: _____ DATE: _____

SAN JACINTO MDP

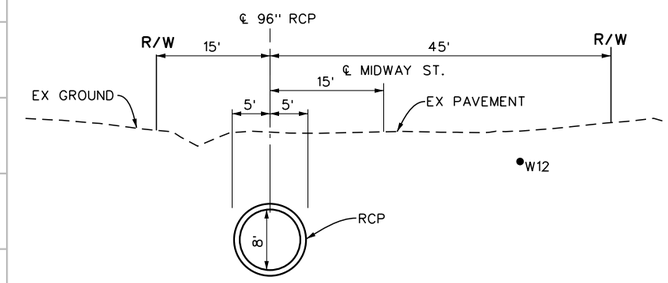
LINE C (STG 2)

STA. 42+00 TO STA. 46+00

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 13 OF XX

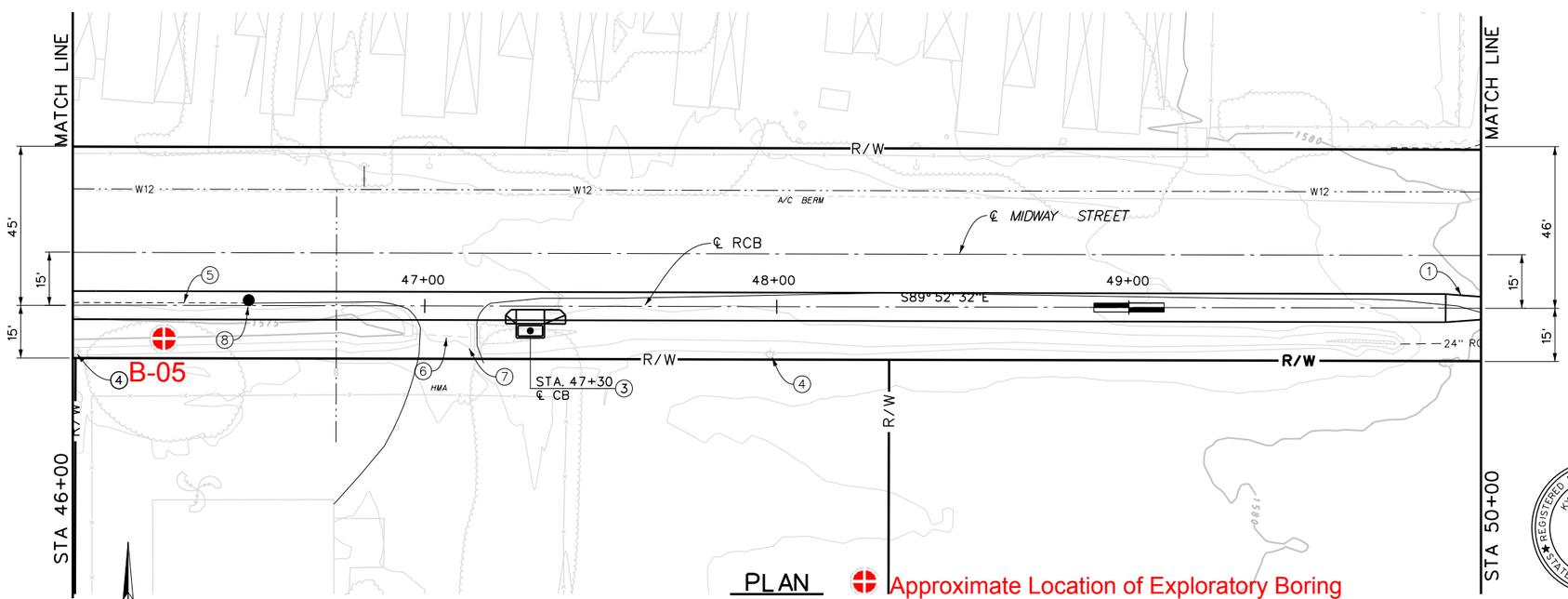


PROFILE



SECTION AT STATION 49+00

10' 0 10'



PLAN

Approximate Location of Exploratory Boring

20' 0 20'

NOTES

1. CONSTRUCT TRANSITION STRUCTURE NO. 3 PER STD TS303 AND DETAILS SHEET XX.
2. CONSTRUCT JS NO.3 CASE 3 PER STD JS228. A=XX°, D=18". SEE PROFILE ON SHEET XX.
3. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 3' & W = 7', SEE PROFILE ON SHEET XXX.
4. PROTECT IN-PLACE EXISTING POWER POLE.
5. REMOVE AND REPLACE HMA BERM.
6. REMOVE AND DISPOSE EXISTING CULVERT.
7. REMOVE AND REPLACE EXISTING DRIVEWAY HMA THICKNESS WITHIN RCB PAYLINE.
8. CONSTRUCT MANHOLE NO. 2 PER STD MH252.
9. CONSTRUCT REINFORCED CONCRETE PIPE WITH D=96".

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★
SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485
ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

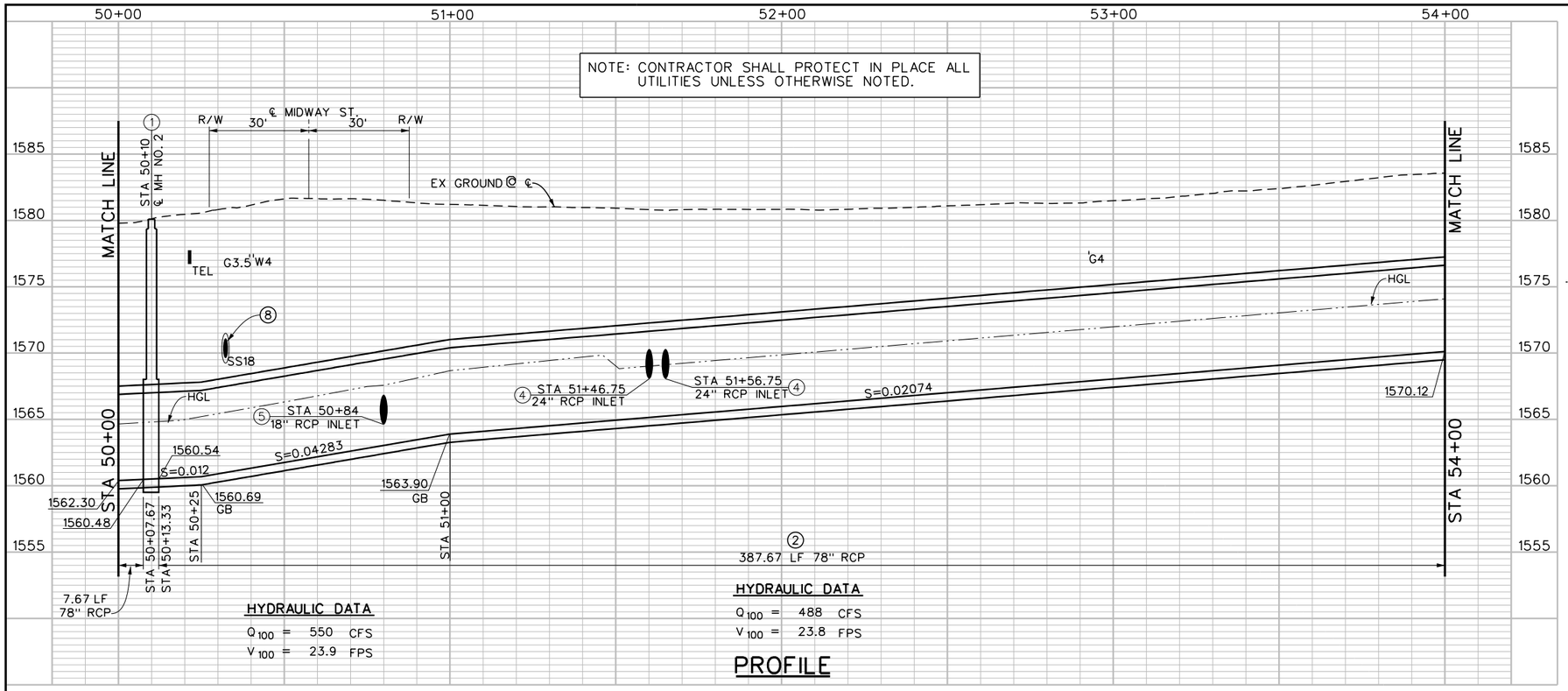
RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

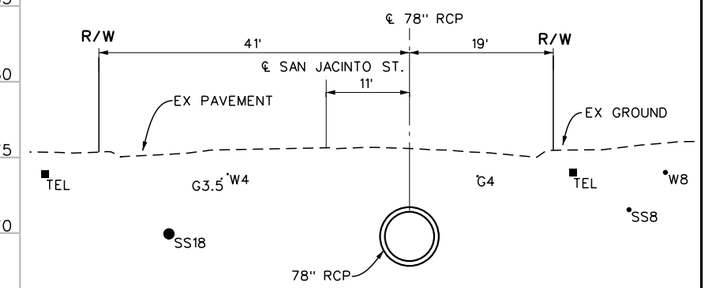
SAN JACINTO MDP
LINE C (STG 2)
STA. 46+00 TO STA. 50+00

PROJECT NO. 4-0-0124
DRAWING NO. 4-713
SHEET NO. 14 OF XX

NOTE: CONTRACTOR SHALL PROTECT IN PLACE ALL UTILITIES UNLESS OTHERWISE NOTED.



PROFILE

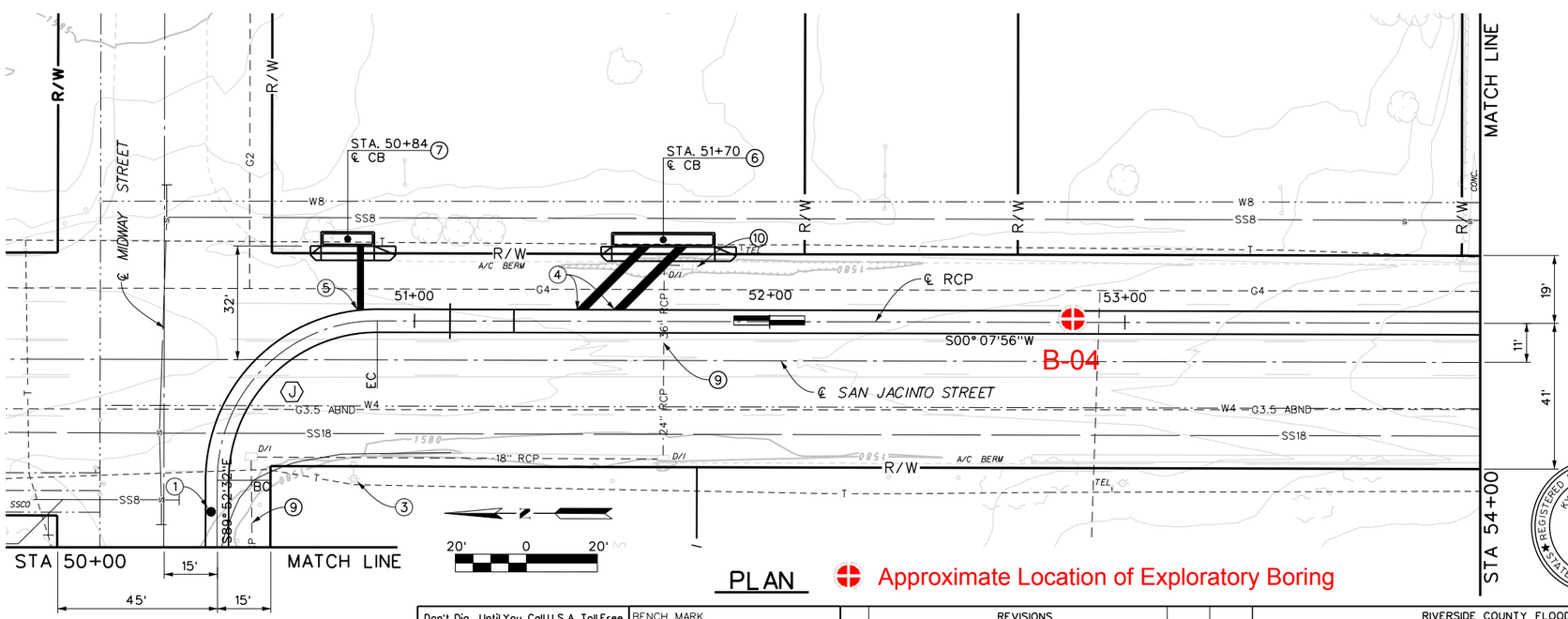


SECTION AT STATION 52+00

10' 0 10'

(J) ℄ STORM DRAIN CURVE DATA

Δ = 90° 00' 28"
R = 45.00'
L = 70.69'
T = 45.01'
BC = STA 50+18.85
EC = STA 50+89.55
PI = N 2222312.14
E 6346269.82



PLAN

Approximate Location of Exploratory Boring

NOTES

1. CONSTRUCT MANHOLE NO. 2 PER STD 252.
2. CONSTRUCT REINFORCED CONCRETE PIPE WITH D=78".
3. PROTECT IN-PLACE EXISTING POWER POLE.
4. CONSTRUCT JS NO. 3 PER STD JS228. SEE PROFILE ON SHEET XXX. A= , B= , C= , EL. R= , EL. S= ,
5. CONSTRUCT JS NO.3 PER STD JS228. SEE PROFILE ON SHEET XXX.
6. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 7.0' & W = 28'. SEE PROFILE ON SHEET XXX.
7. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 4.0' & W = 14'. SEE PROFILE ON SHEET XXX.
8. PLACE SLURRY CEMENT BETWEEN BOTTOM OF EXISTING 18" SEWER AND TOP OF BOX.
9. CUT AND PLUG INTERFERING PORTIONS OF EXISTING RCP.
10. REMOVE AND DISPOSE EXISTING CATCH BASIN.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

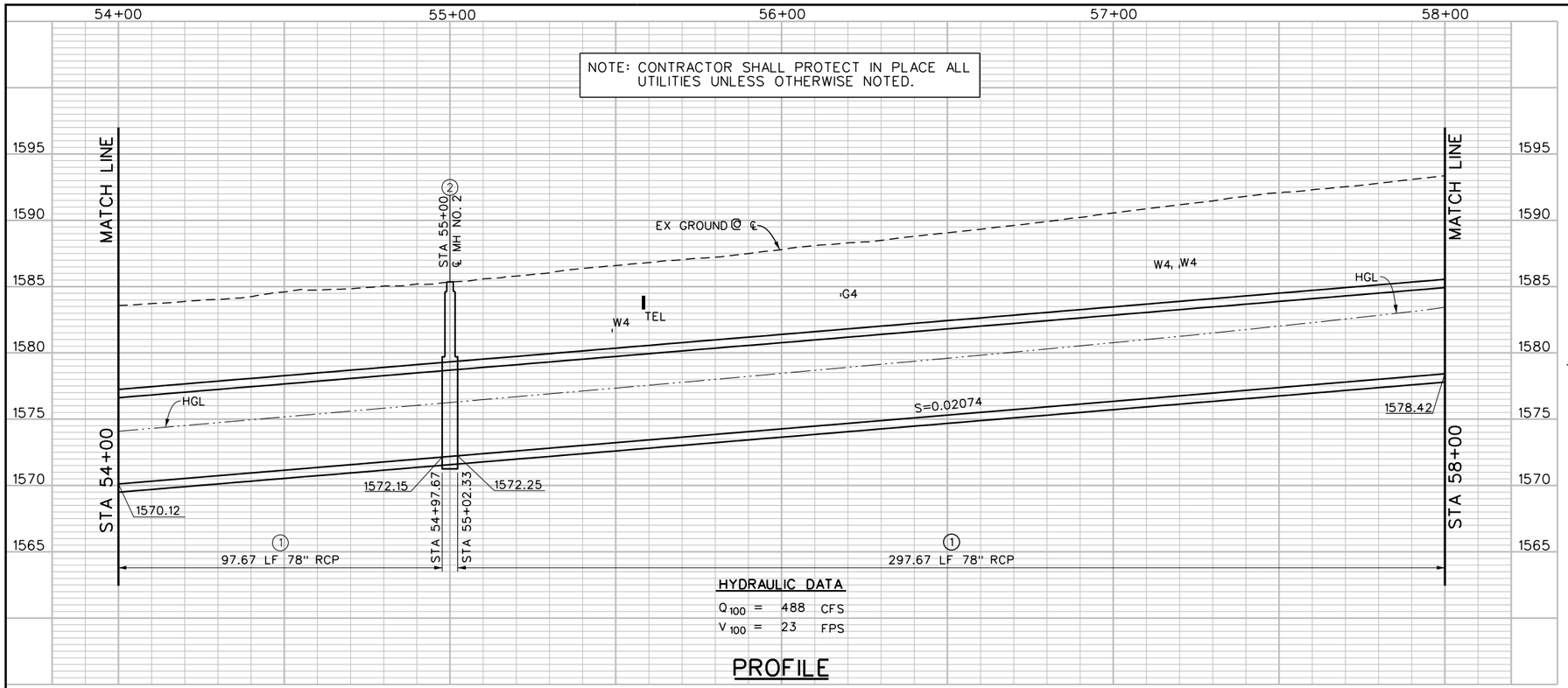
DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

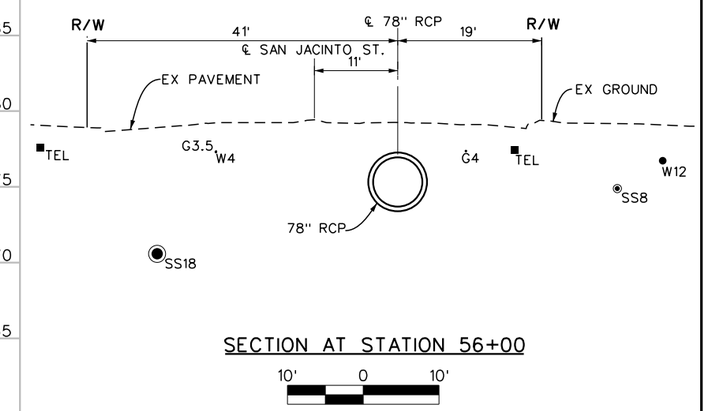
RECOMMENDED FOR APPROVAL BY: DATE:

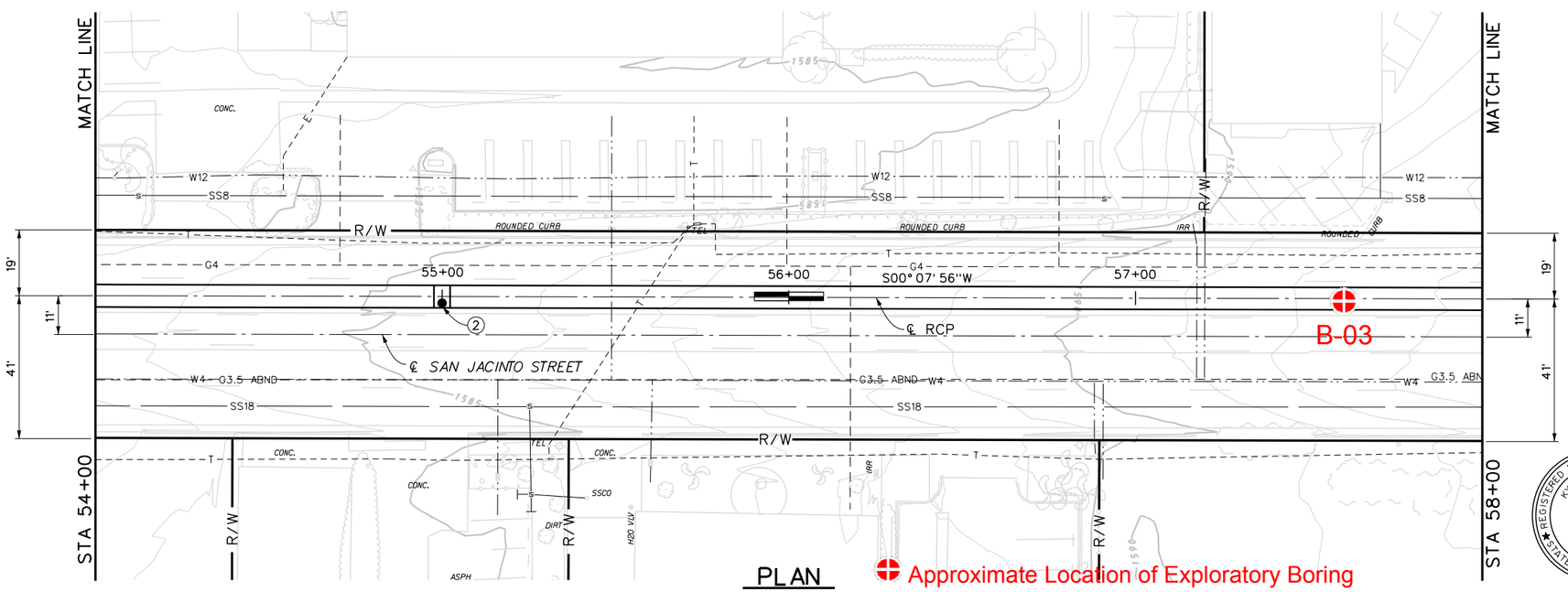
APPROVED BY: DATE:

SAN JACINTO MDP
LINE C (STG 2)
STA. 50+00 TO STA. 51+00
LINE B (STG 1)
STA. 51+00 TO STA. 54+00

PROJECT NO. 4-0-0042
DRAWING NO. 4-713
SHEET NO. 15 OF XX







PLAN

Approximate Location of Exploratory Boring

NOTES

① CONSTRUCT REINFORCED CONCRETE PIPE WITH D=78".

② CONSTRUCT MANHOLE NO. 2 PER STD MH252.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: DATE:

APPROVED BY: DATE:

SAN JACINTO MDP

LINE B (STG 1)

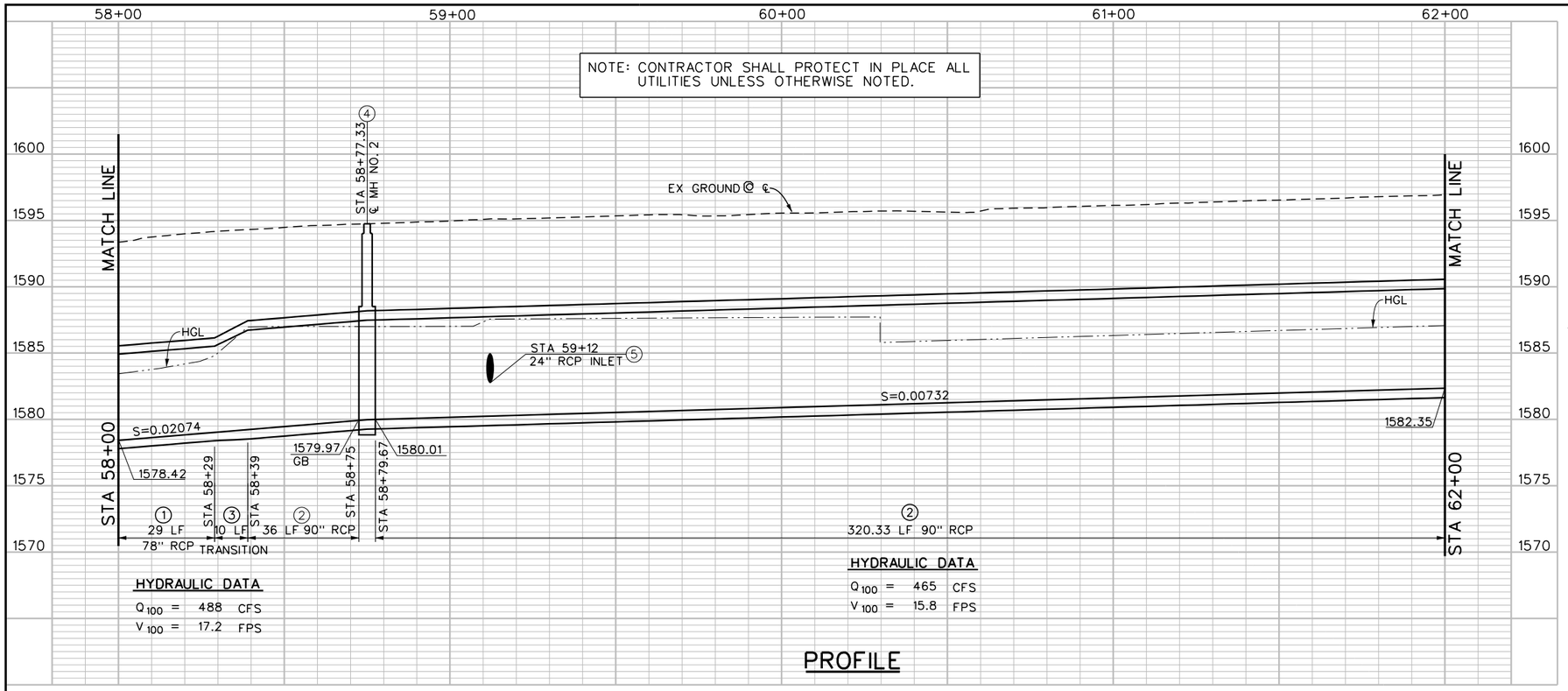
STA. 54+00 TO STA. 58+00

PROJECT NO. 4-0-0042

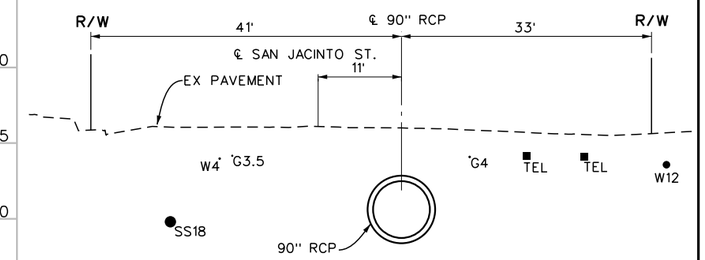
DRAWING NO. 4-713

SHEET NO. 16 OF XX

San Jacinto MDP.DGN 5/7/2012 3:23:17 PM

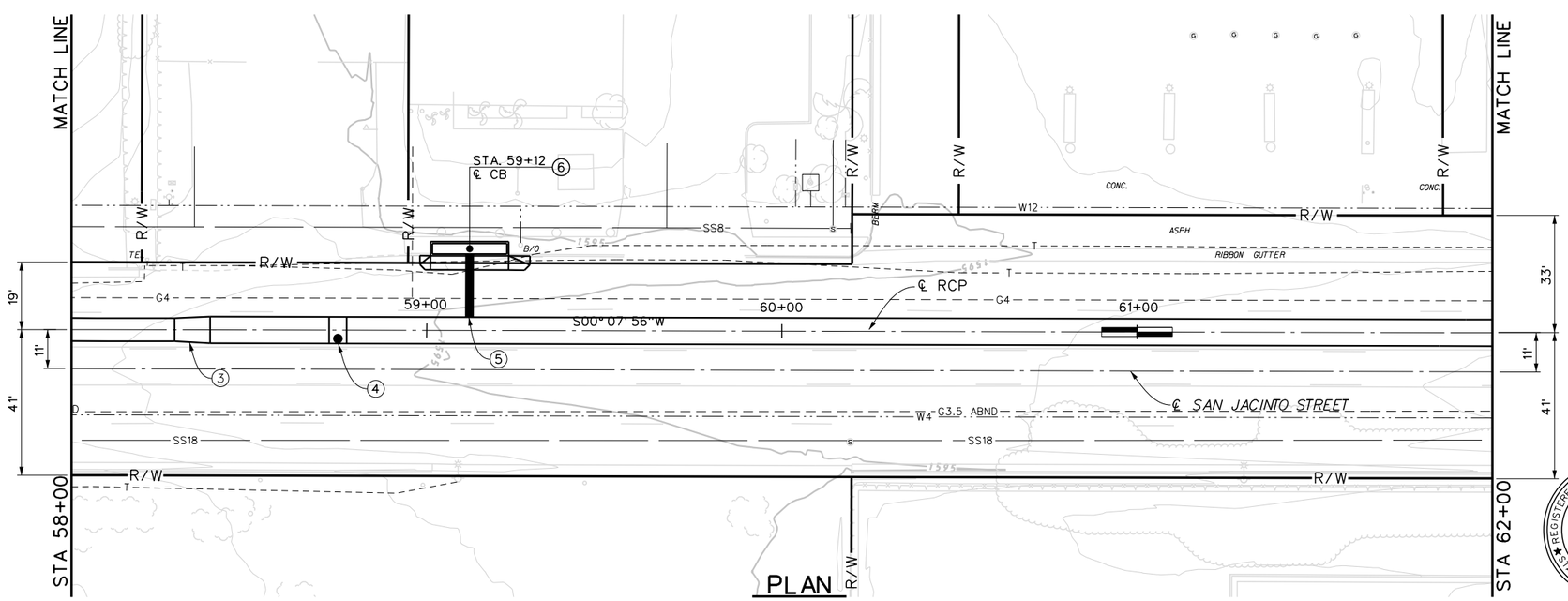


PROFILE



SECTION AT STATION 61+00

10' 0 10'



PLAN

NOTES

1. CONSTRUCT REINFORCED CONCRETE PIPE WITH D=78".
2. CONSTRUCT REINFORCED CONCRETE PIPE WITH D=90".
3. CONSTRUCT TRANSITION STRUCTURE NO. 3 PER STD TS303 AND DETAILS ON SHEET XX.
4. CONSTRUCT MANHOLE NO. 2 PER STD MH252.
5. CONSTRUCT JS NO.4 PER STD JS229. SEE PROFILE ON SHEET XX.
6. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 7.0' & W = 21'. SEE PROFILE ON SHEET XX.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

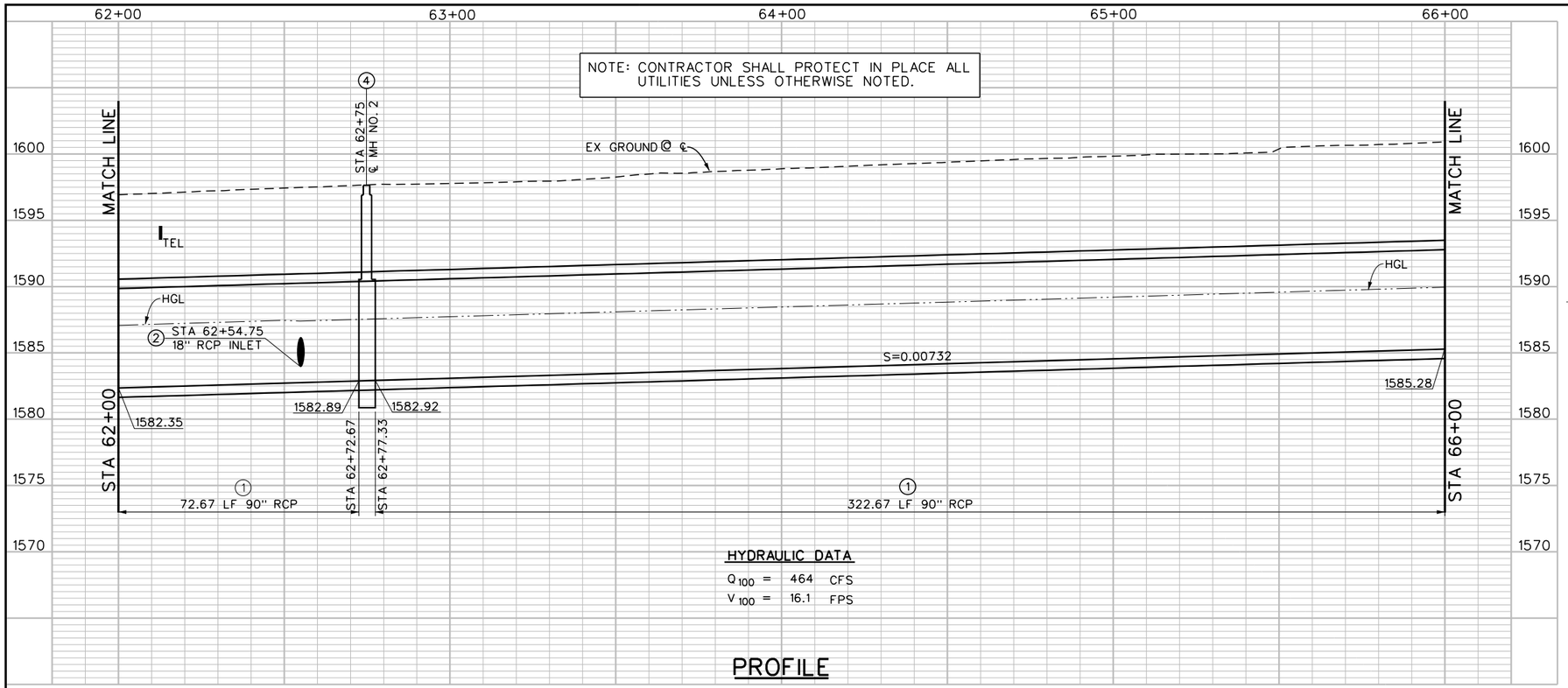
APPROVED BY: _____ DATE: _____

SAN JACINTO MDP

LINE B (STG 1)

STA. 58+00 TO STA. 62+00

PROJECT NO. 4-0-0042
DRAWING NO. 4-713
SHEET NO. 17 OF XX

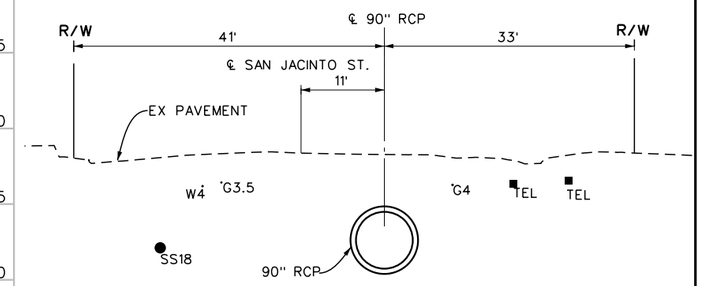


HYDRAULIC DATA

Q_{100} = 464 CFS

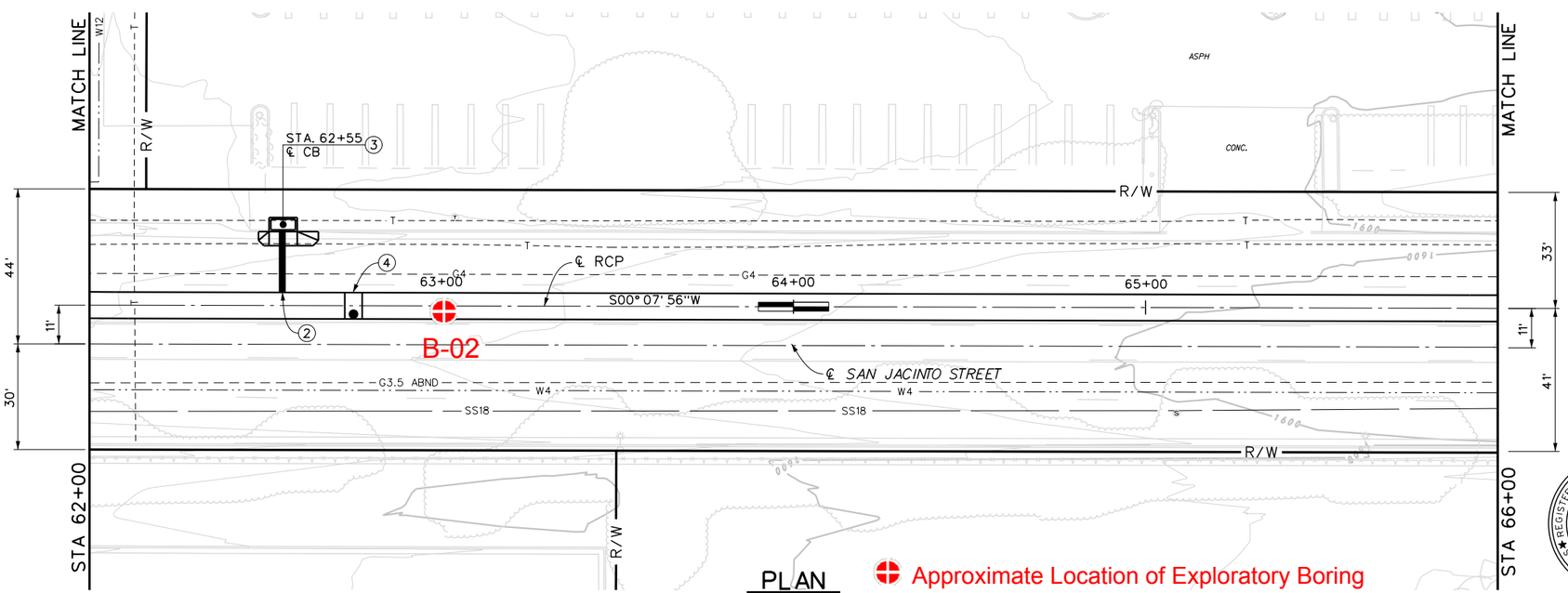
V_{100} = 16.1 FPS

PROFILE



SECTION AT STATION 64+00

10' 0 10'



PLAN

⊕ Approximate Location of Exploratory Boring

NOTES

1. CONSTRUCT REINFORCED CONCRETE PIPE WITH D=90".
2. CONSTRUCT JS NO.4 PER STD JS229. SEE PROFILE ON SHEET XXX.
3. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V=4.5' & W=7', SEE PROFILE ON SHEET XX.
4. CONSTRUCT MANHOLE NO. 2 PER STD MH252.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

SAN JACINTO MDP

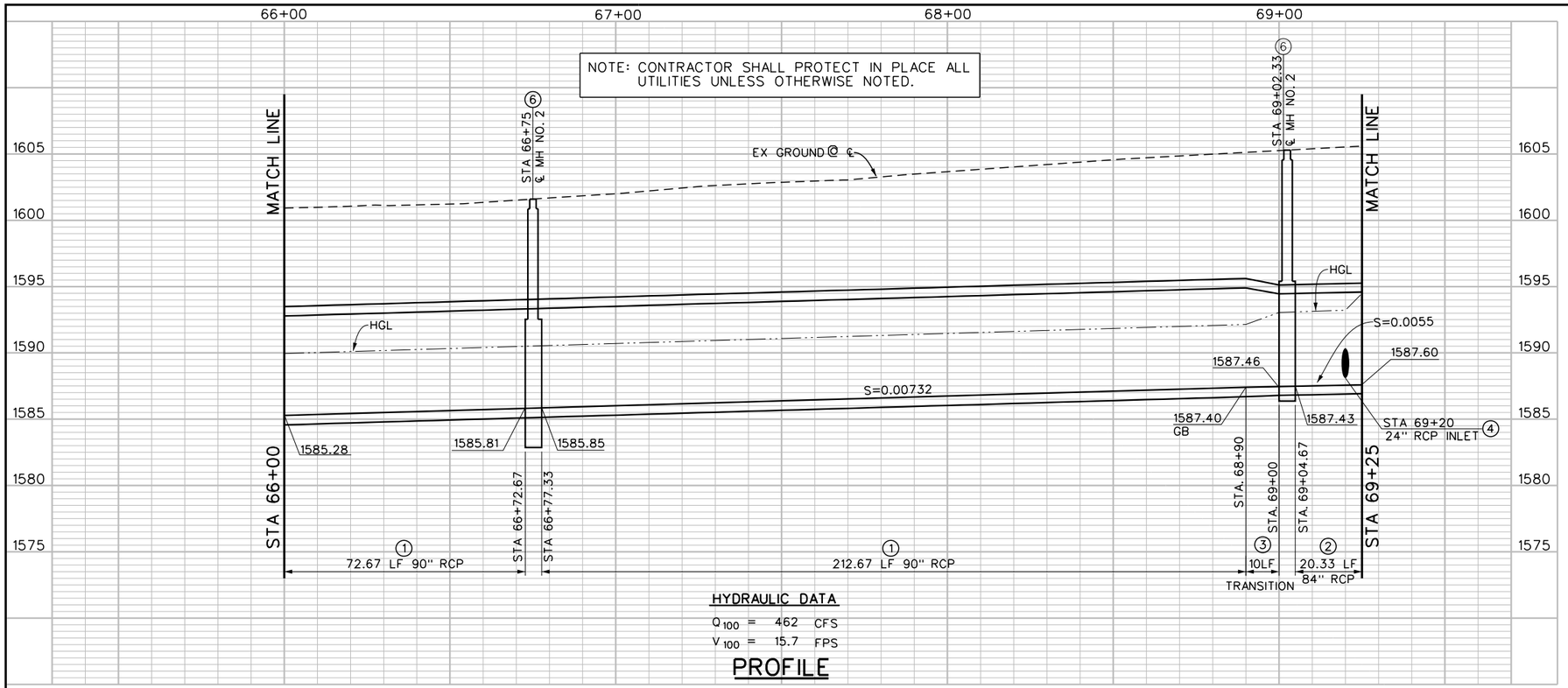
LINE B (STG 1)

STA. 62+00 TO STA. 66+00

PROJECT NO. 4-0-0042

DRAWING NO. 4-713

SHEET NO. 18 OF XX

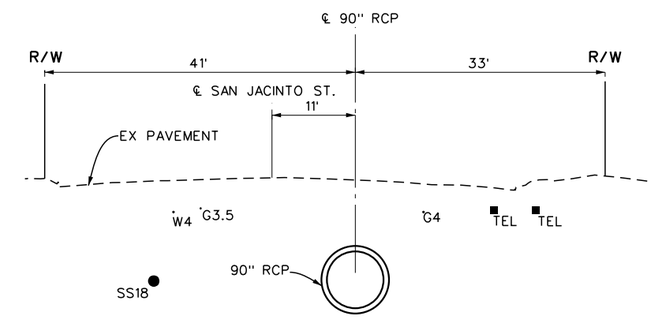


HYDRAULIC DATA

Q_{100} = 462 CFS

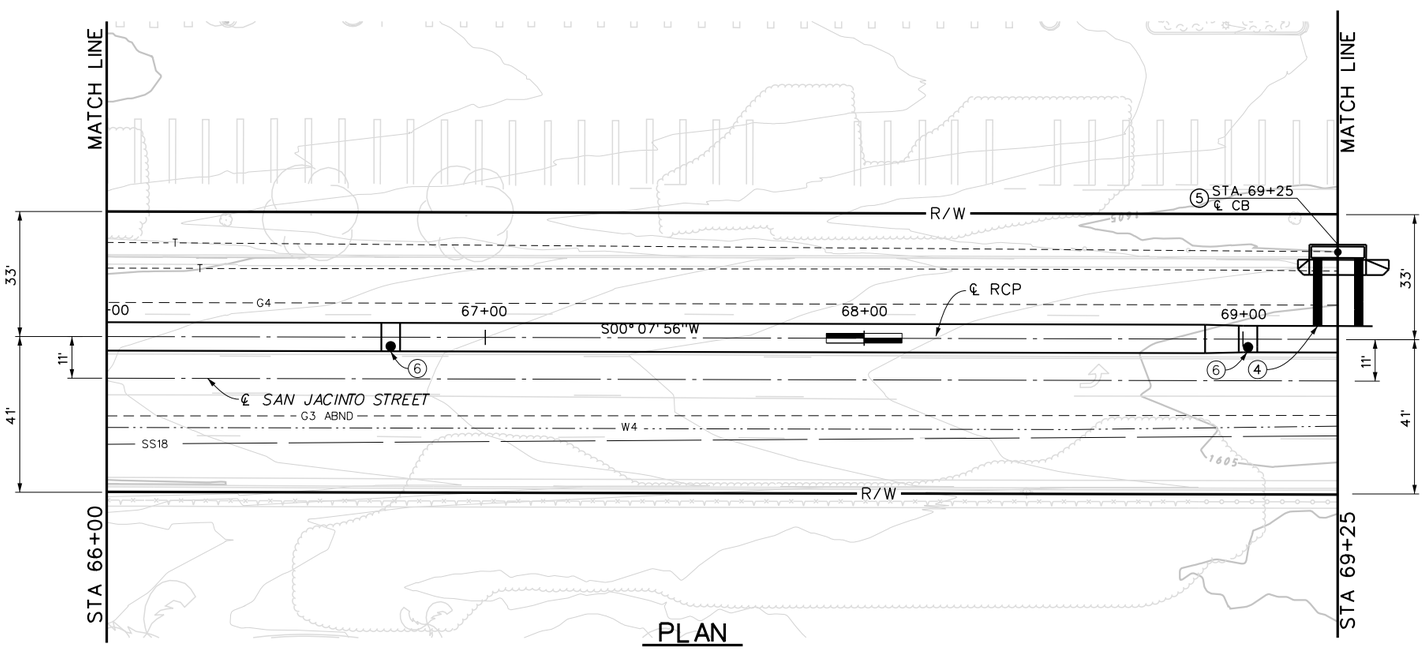
V_{100} = 15.7 FPS

PROFILE



SECTION AT STATION 68+00

10' 0 10'



PLAN

NOTES

① CONSTRUCT REINFORCED CONCRETE PIPE WITH D=90".

② CONSTRUCT REINFORCED CONCRETE PIPE WITH D=84".

③ CONSTRUCT TRANSITION STRUCTURE NO. 3 PER STD TS303 AND DETAILS ON SHEET XX.

④ CONSTRUCT JS NO.4 PER STD JS229. SEE PROFILE ON SHEET XX.

⑤ CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 3.75' & W = 14', SEE PROFILE ON SHEET XX.

⑥ CONSTRUCT MANHOLE NO. 2 PER STD MH252.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services.

TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

SAN JACINTO MDP

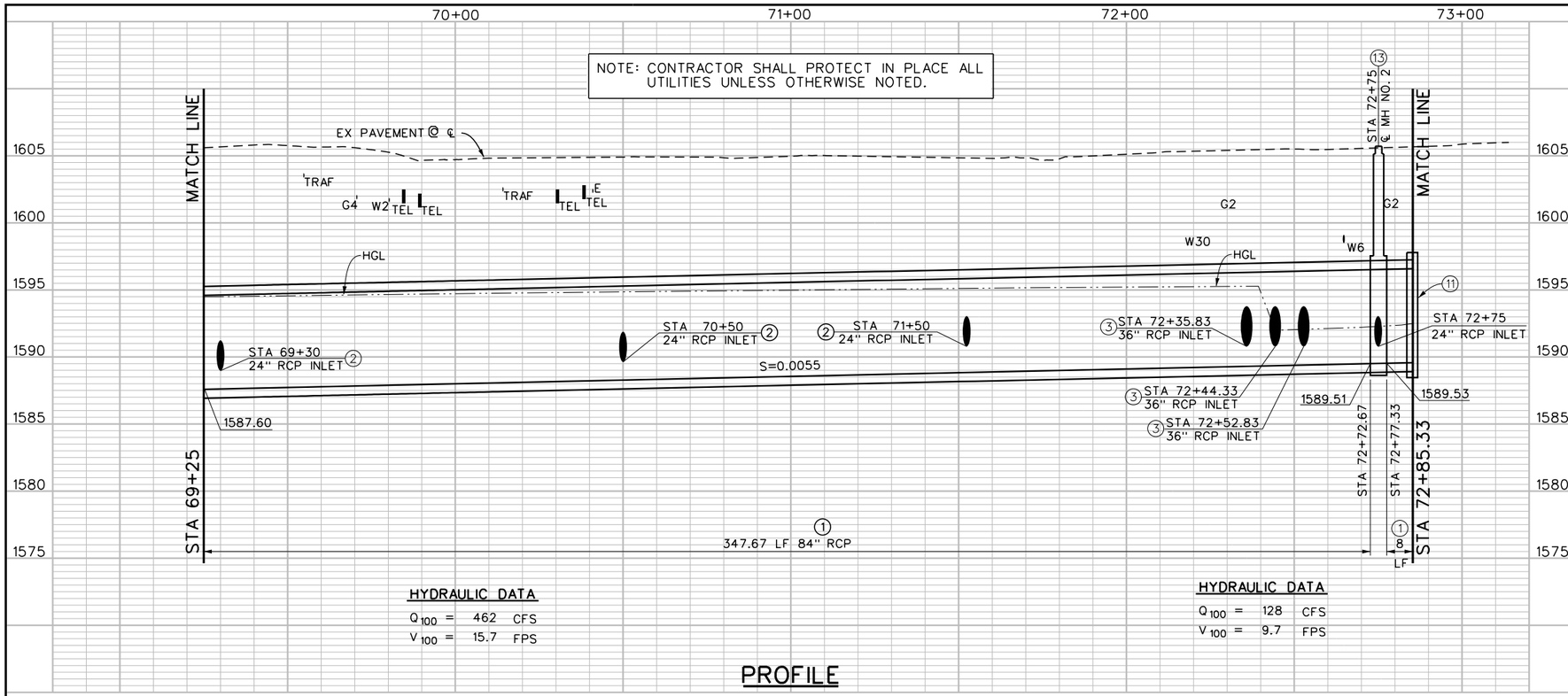
LINE B (STG 1)

STA. 66+00 TO STA. 69+25

PROJECT NO. 4-0-0042

DRAWING NO. 4-713

SHEET NO. 19 OF XX



HYDRAULIC DATA

Q_{100} = 462 CFS

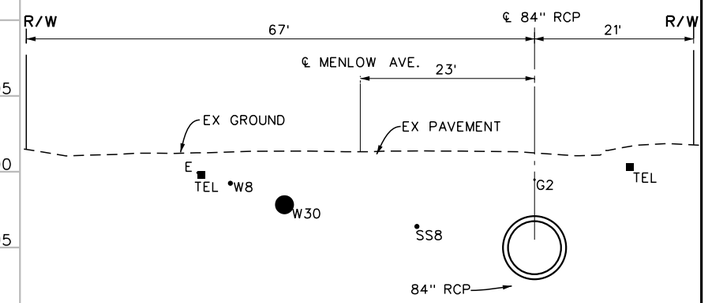
V_{100} = 15.7 FPS

HYDRAULIC DATA

Q_{100} = 128 CFS

V_{100} = 9.7 FPS

PROFILE



SECTION AT STATION 72+00

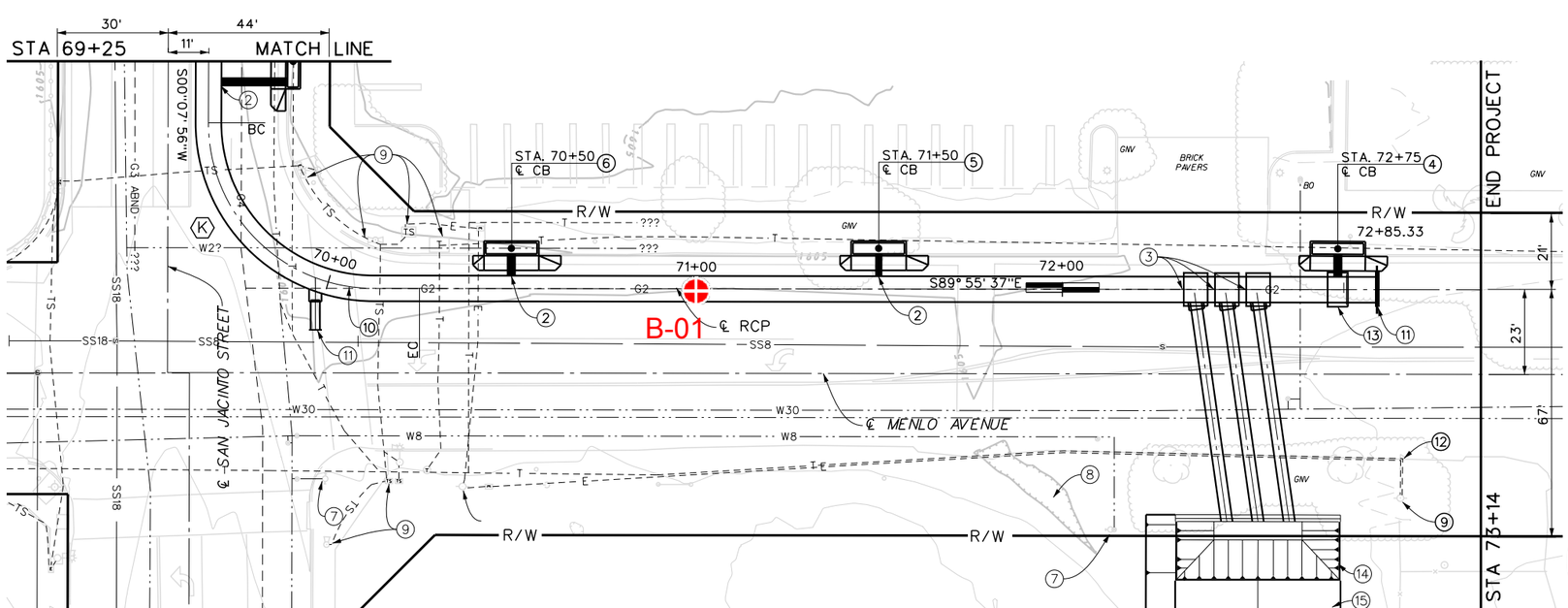
10' 0 10'

(K) ℄ STORM DRAIN CURVE DATA

Δ = 90° 03' 33"
R = 45.00'
L = 70.73'
T = 45.05'
BC = STA 69+41.73
EC = STA 70+12.46
PI = N 2220369.91
E 6346265.34

NOTES

1. CONSTRUCT REINFORCED CONCRETE PIPE WITH D=84".
2. CONSTRUCT JS NO. 4 PER STD JS229. SEE PROFILE ON SHEET XX.
3. CONSTRUCT JS NO.2 PER STD JS227. SEE PROFILE ON SHEET XX.
4. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 4.75' & W = 14', SEE PROFILE ON SHEET XX.
5. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 4' & W = 14', SEE PROFILE ON SHEET XX.
6. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 4' & W = 14', SEE PROFILE ON SHEET XX.
7. PROTECT IN-PLACE EXISTING FIRE HYDRANT.
8. FILL AND GRADE TO DRAIN.
9. PROTECT IN-PLACE EXISTING UTILITIES.
10. EXISTING 2" GAS LINE TO BE RELOCATED BY OTHERS AND ABANDONED IN PLACE.
11. CONSTRUCT CONCRETE BULKHEAD PER STD. 816.
12. RELOCATE MAILBOX.
13. CONSTRUCT MANHOLE NO. 2 PER STD 252.
14. CONSTRUCT CUSTOM INLET STRUCTURE PER DETAILS ON SHEET XX.
15. GRADE APPROACH CHANNEL PER DETAILS ON SHEET XX.



PLAN

Approximate Location of Exploratory Boring

20' 0 20'

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★

SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK

REF.	DESCRIPTION	APPR.	DATE
	REVISIONS		

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: DATE:

APPROVED BY: DATE:

SAN JACINTO MDP

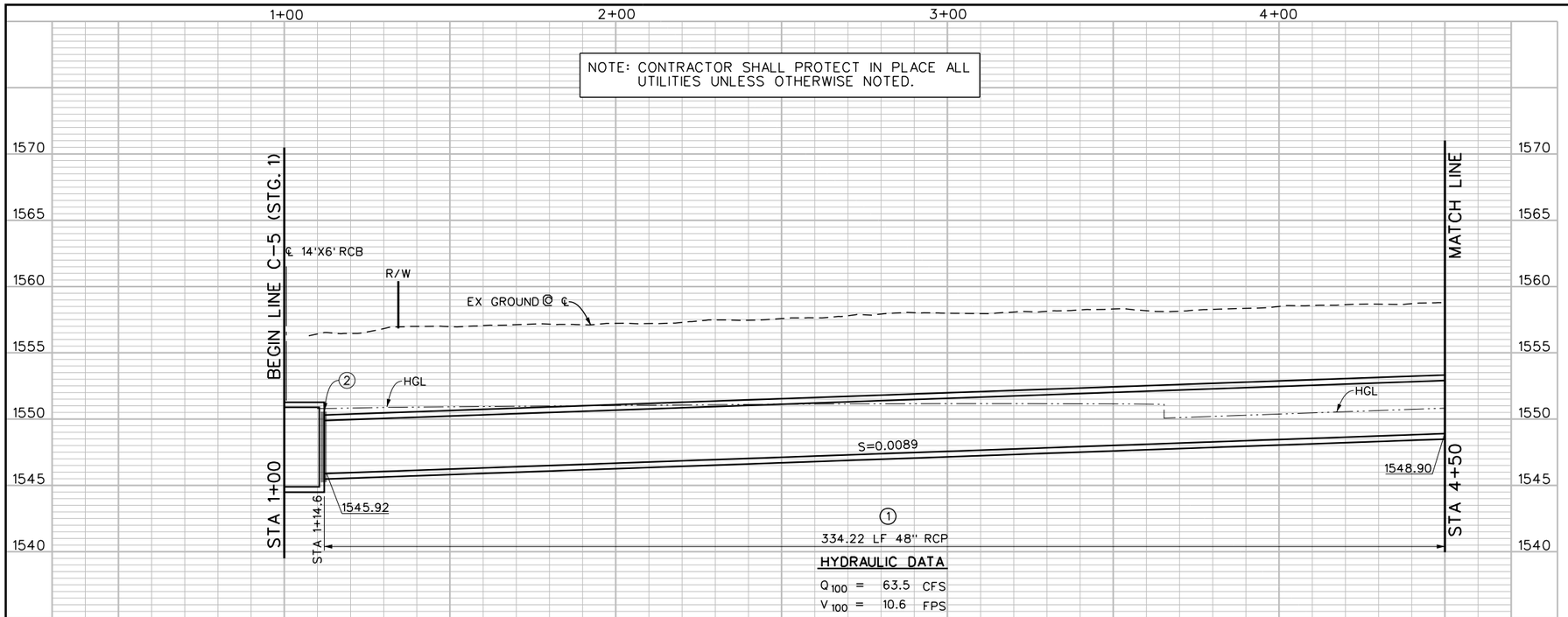
LINE B (STG 1)

STA. 70+00 TO STA. 73+14

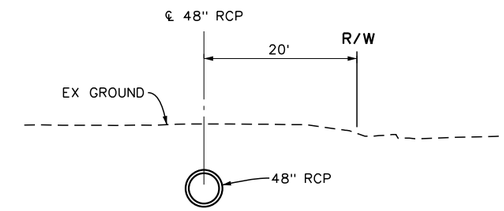
PROJECT NO. 4-0-0042

DRAWING NO. 4-713

SHEET NO. 20 OF XX



PROFILE

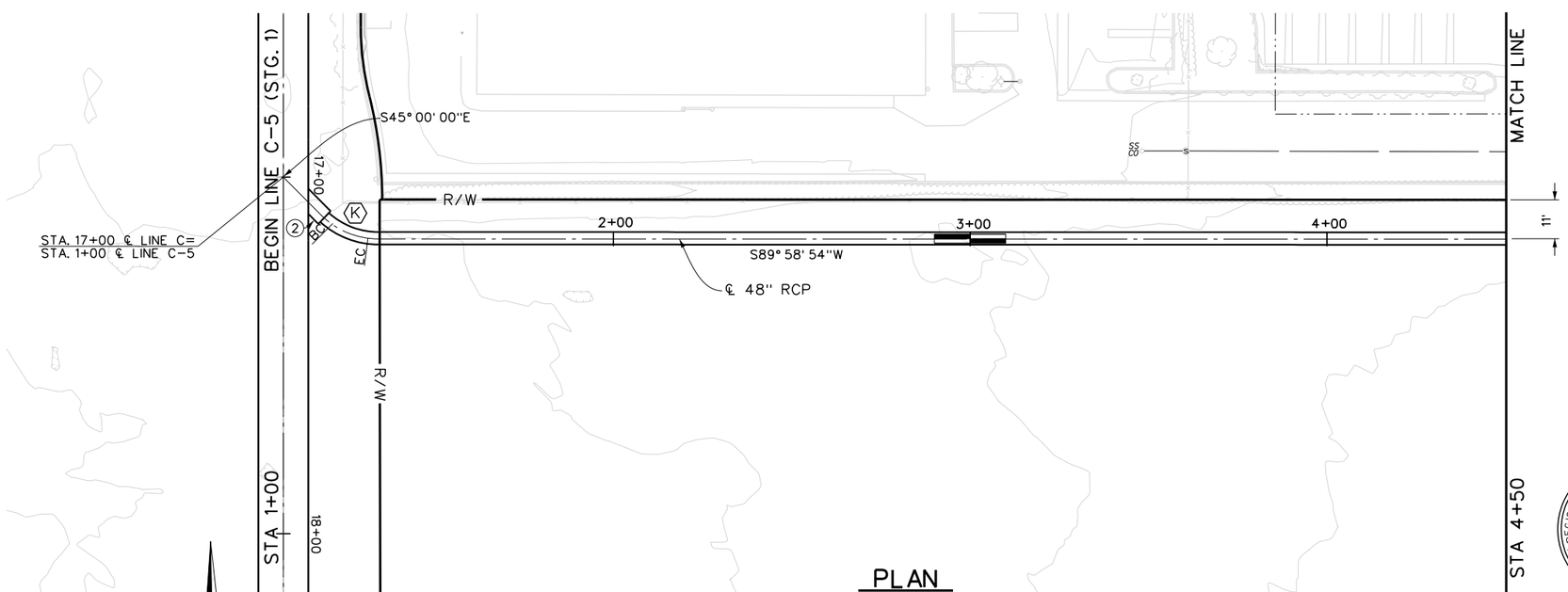


SECTION AT STATION 3+00

10' 0 10'

(K) ℄ STORM DRAIN CURVE DATA

Δ = 44° 59' 09"
R = 22.50'
L = 17.67'
T = 9.32'
BC = STA 1+15.14
EC = STA 1+32.81
PI = N 2223970.75
E 6344266.78



PLAN

NOTES

1. CONSTRUCT REINFORCED CONCRETE PIPE WITH D = 48".
2. CONSTRUCT JS NO.1 PER STD JS226. SEE PROFILE ON SHEET XX. A=90°, B=48", C=8.8', EL. R=1546.631, EL. S=1546.623.

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

★ PRELIMINARY ★
SUBJECT TO REVISION

N

20' 0 20'

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485
ELEVATION= 1555.79 NAVD 88

REF.	DESCRIPTION	APPR.	DATE
	REVISIONS		

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

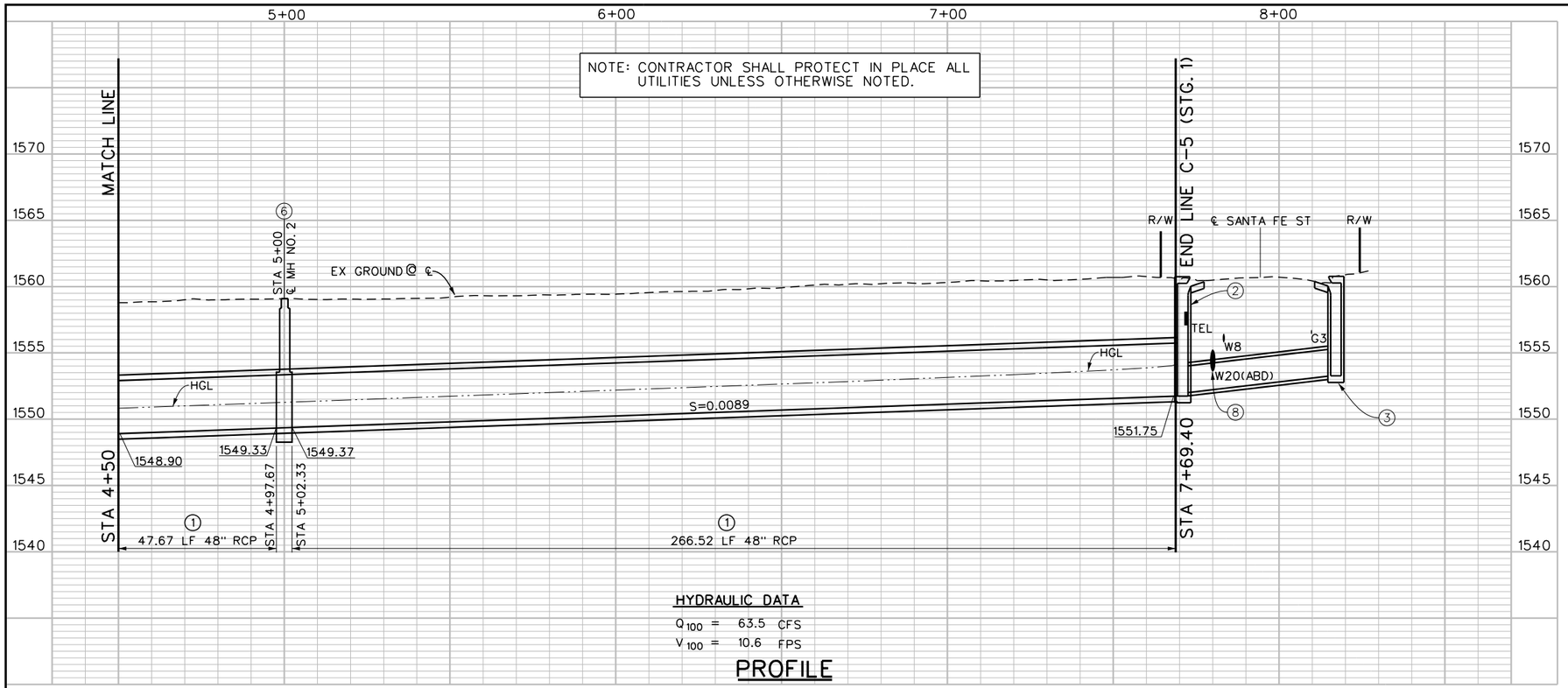
RECOMMENDED FOR APPROVAL BY: DATE:
APPROVED BY: DATE:

SAN JACINTO MDP

LINE C-5 (STG 1)

STA. 1+00 TO STA. 4+00

PROJECT NO. 4-0-0040
DRAWING NO. 4-713
SHEET NO. 21 OF XX

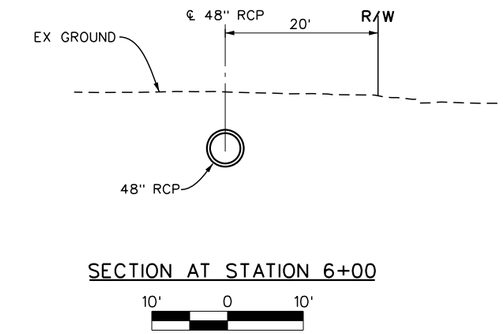


HYDRAULIC DATA

Q_{100} = 63.5 CFS

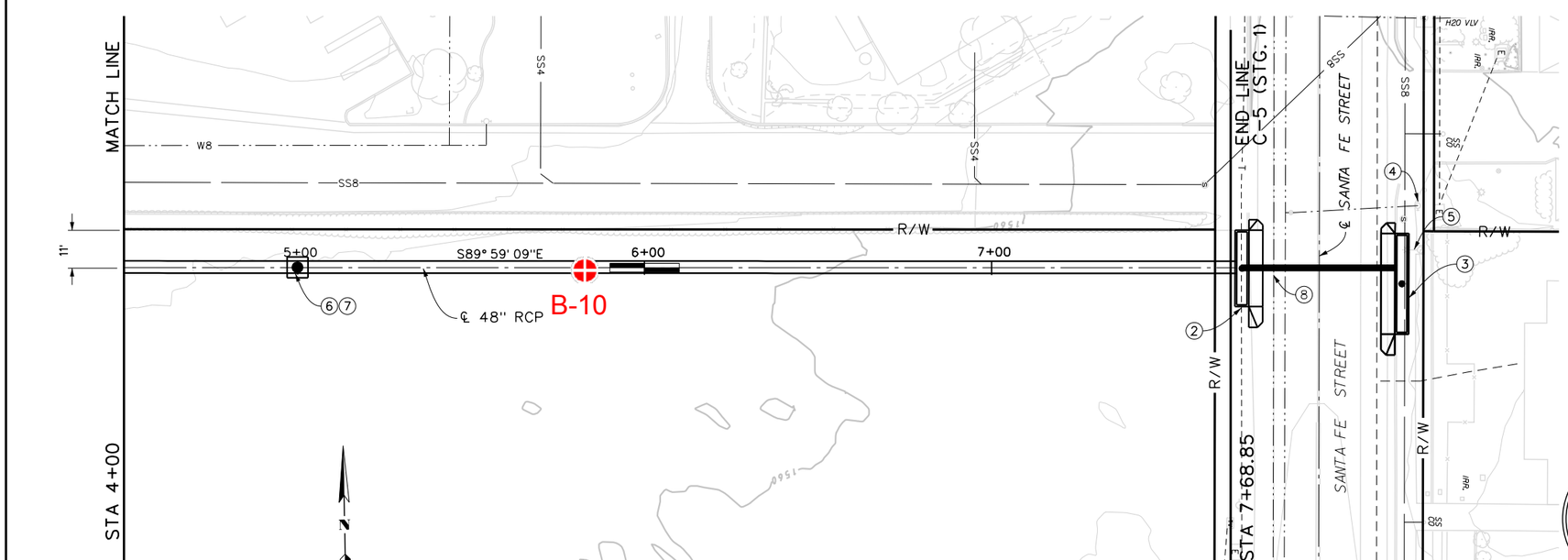
V_{100} = 10.6 FPS

PROFILE



SECTION AT STATION 6+00

10' 0 10'



PLAN

Approximate Location of Exploratory Boring

20' 0 20'

NOTES

1. CONSTRUCT REINFORCED CONCRETE PIPE WITH D = 48".
2. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 9' & W = 21', SEE PROFILE ON SHEET XX.
3. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 7.5' & W = 28', SEE PROFILE ON SHEET XX.
4. PROTECT IN-PLACE FIRE HYDRANT.
5. PROTECT IN-PLACE EXISTING POWER POLE.
6. CONSTRUCT MANHOLE NO. 2 PER MH252.
7. CONSTRUCT 6'X6'X6" CONCRETE PAD PER DETAIL ON SHEET XX.
8. REMOVE AND PLUG INTERFERING PORTIONS OF EXISTING ABANDONED 20" WATER LINE.

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SUBJECT TO REVISION

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BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: _____ DATE: _____

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SAN JACINTO MDP

LINE C-5 (STG 1)

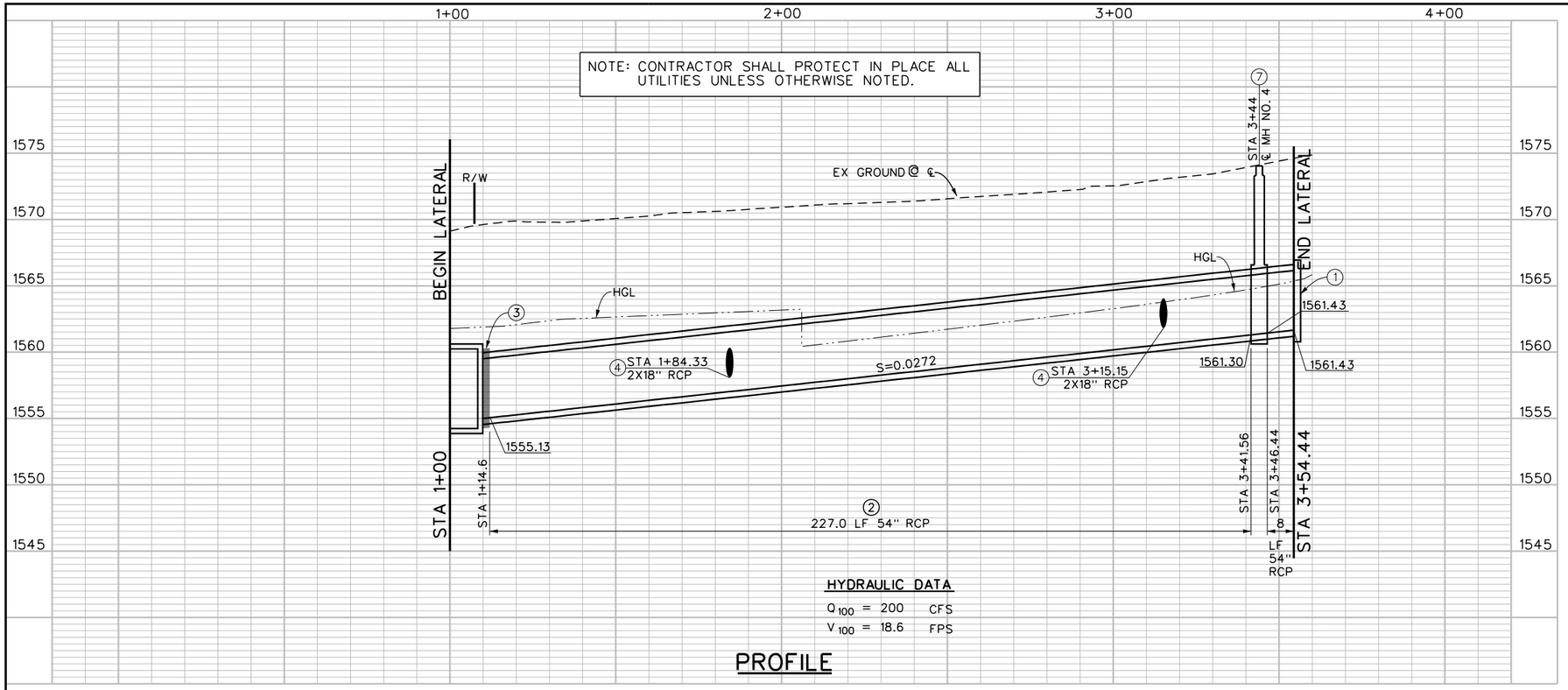
STA. 4+00 TO STA. 7+88

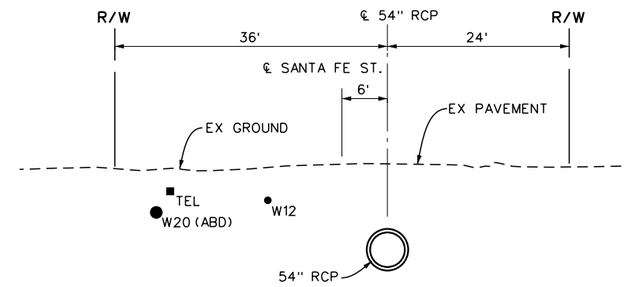
PROJECT NO. 4-0-0040

DRAWING NO. 4-713

SHEET NO. 22 OF XX

San Jacinto MDP.DGN 5/7/2012 3:23:18 PM





SECTION AT STATION 2+00

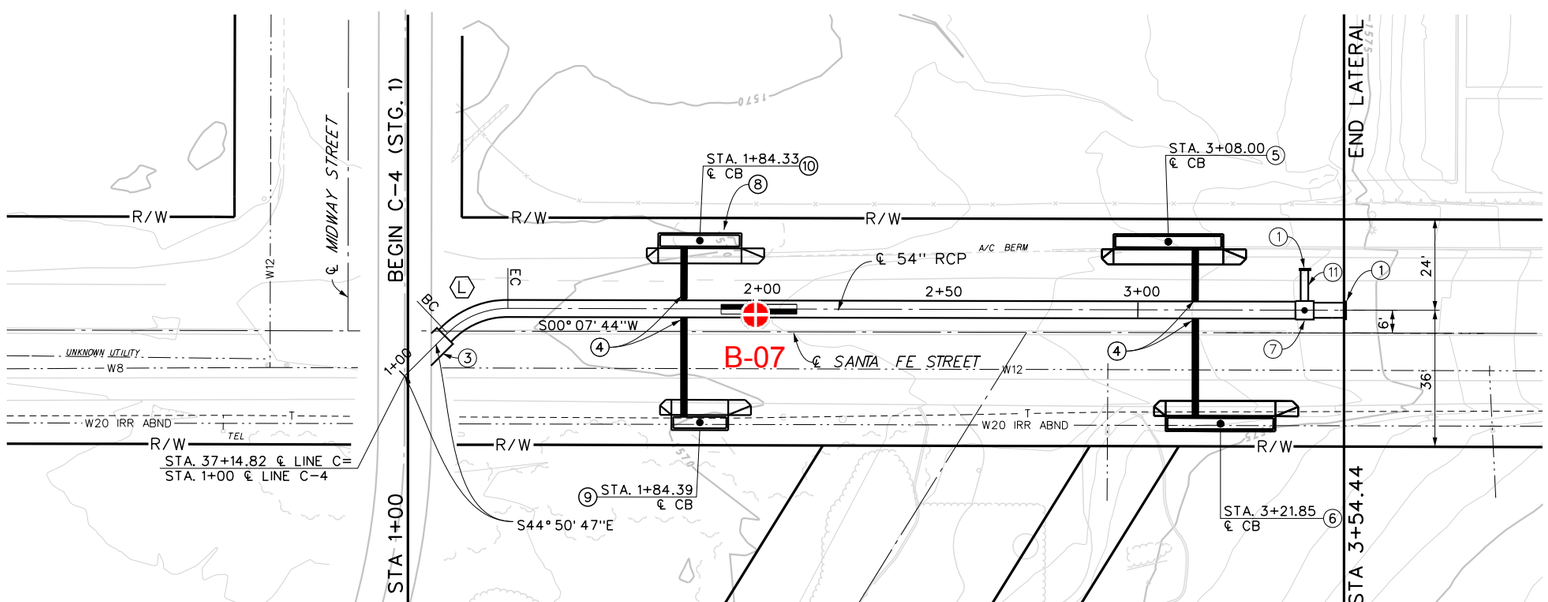
10' 0 10'

℄ STORM DRAIN CURVE DATA

Δ = 44° 58' 31"
R = 22.50'
L = 17.66'
T = 9.31'
BC = STA 1+06.51
EC = STA 1+24.17
PI = N 2222303.84
E 6344938.65

NOTES

1. CONSTRUCT CONCRETE BULK HEAD PER STD. M816.
2. CONSTRUCT REINFORCED CONCRETE PIPE WITH D = 54".
3. CONSTRUCT JS NO.1 PER STD JS226. SEE PROFILE ON SHEET XX. A=45°, B=54", C=15', EL. R=1555.080, EL.S=1554.953.
4. CONSTRUCT JS NO. 4 PER STD JS229. SEE PROFILE ON SHEET XX.
5. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 4' & W = 28', SEE PROFILE ON SHEET XX.
6. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 6', & W = 28', SEE PROFILE ON SHEET XX.
7. CONSTRUCT MH NO. 4 PER STD MH254.
8. REMOVE AND DISPOSE EXISTING ROCK.
9. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 5.5' & W = 14', SEE PROFILE ON SHEET XX.
10. CONSTRUCT CATCH BASIN NO.1 PER STD CB100. V = 4.5' & W = 21', SEE PROFILE ON SHEET XX.
11. CONSTRUCT 8' STUBOUT WITH 24" RCP.



PLAN

Approximate Location of Exploratory Boring

20' 0 20'

REGISTERED PROFESSIONAL ENGINEER KYLE W. GALLUP No. 74610 CIVIL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER ROBERT J. CULLEN No. 44684 CIVIL STATE OF CALIFORNIA

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SUBJECT TO REVISION

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BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485
ELEVATION= 1555.79 NAVD 88

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

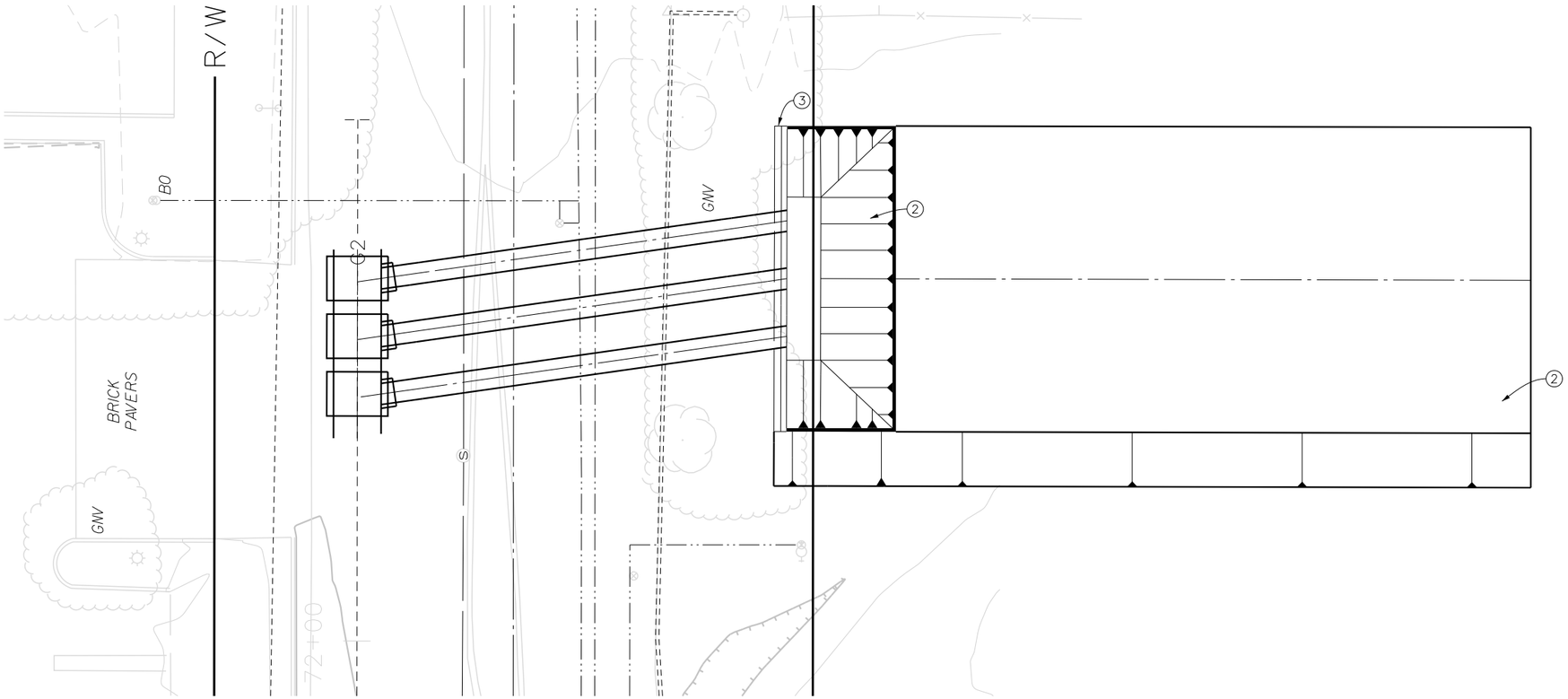
DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

RECOMMENDED FOR APPROVAL BY: DATE:
APPROVED BY: DATE:

SAN JACINTO MDP
LINE C-4 (STG 1)
STA. 1+00 TO STA. 3+60

PROJECT NO. 4-0-0039
DRAWING NO. 4-713
SHEET NO. 23 OF XX

San Jacinto MDP.DGN 5/7/2012 3:23:19 PM



NOTES

1. CONSTRUCT CUSTOM INLET STRUCTURE PER XXXXXXXX.
2. GRADE APPROACH CHANNEL WITH BASE= XX, AND SIDE SLOPES= XX(WEST).
3. CONSTRUCT 8' HEADWALL.

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SUBJECT TO REVISION

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. BURIED CABLE. TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
B.M. NO. Z 11286
NAIL & TAG RCFC
SET FLUSH
N 2224310
E 6344485

ELEVATION= 1555.79 NAVD 88

REF.	DESCRIPTION	APPR.	DATE
	REVISIONS		

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S. TSE
DRAWN BY: M. HOWARD
DATE DRAWN: JAN 2013

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SAN JACINTO MDP

LINE B (STG 1)

PROJECT NO. 4-0-0039
DRAWING NO. 4-713
SHEET NO. 24 OF XX