WESTSIDE SUBWAY EXTENSION PROJECT

Addendum to the Geotechnical and Hazardous Materials Technical Report

Metro

August 2011

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SUMMARY

On October 28, 2010, the Metro Board selected the Westwood/VA Hospital Extension (Alternative 2 in the Draft EIS/EIR) as the Locally Preferred Alternative (LPA) and authorized the preparation of the *Westside Subway Extension Final EIS/EIR* (the Final EIS/EIR) to analyze the LPA. This alternative would extend HRT, in subway, approximately nine-miles from the existing Metro Purple Line Wilshire/Western Station to a Westwood/VA Hospital Station. A detailed description of the LPA is provided in Chapter 2 of the Final EIS/EIR.

This addendum supplements materials in the *Westside Subway Extension Project Geotechnical and Hazardous Materials Technical Report* (the Report) dated August 2010 and supports the Final EIS/EIR. The LPA is referred to as Alternative 2 in this addendum and the Report. Modifications to the Report incorporated into this addendum reflect responses to comments on the Draft EIS/EIR and refinements to Alternative 2 as described in Chapter 2 of the Final EIS/EIR. The Metro Board directed that further geotechnical investigations be conducted during the preparation of the Final EIS/EIR to address concerns regarding the safety of tunneling beneath homes and schools. This addendum includes the results and evaluations from these recent geotechnical studies along the project alignment. Two additional studies were conducted to respond to the Board direction: the Century City Area Tunneling Safety Report, and the Century City Area Fault Study Report.

Unless stated otherwise in this addendum, all descriptions in the report also apply to this addendum. In any case where this addendum differs from the Report (or any previous addenda to the Report), the information in this addendum supersedes that of the Report (and any previous addenda to the Report).

1.0 INTRODUCTION

Change The following is a modification of and replaces the first paragraph in Section 1.1.

1.1 Purpose

The purpose of this report is to address geotechnical, subsurface, seismic, and hazardous materials issues and their potential impacts on the proposed project alternatives. It also covers the topics of surface fault rupture, seismic ground shaking, differential seismic settlement, liquefaction, subsidence, hazardous subsurface gases, and hazardous materials. Strands of the active Santa Monica fault and the West Beverly Hills Lineaments cross Study Area.

2.0 PROJECT DESCRIPTION

No change.

3.0 AFFECTED ENVIRONMENT

Change The following is a modification of and replaces the second paragraph in Section 3.1.

3.1 Topography

The topography in the area of the alignment alternatives that runs westerly along Wilshire Boulevard from the intersection with Western Avenue slopes gently to the west at about a 0.5 percent gradient from an elevation of 200 feet msl to an elevation of 170 feet msl at the intersection with Fairfax Avenue. From that intersection, the terrain rises to the west and northwest at a gradient of about 1.5 to 2 percent to an elevation of about 260 feet msl at the Santa Monica Boulevard intersection. Southwesterly from that intersection and westerly through Westwood, much of the terrain gently undulates multi-directionally at elevations ranging from about 240 feet to 340 feet msl until the intersection with the 405 Freeway which lies at an elevation of 340 feet msl. From that point southwesterly through West Los Angeles and Santa Monica the terrain slopes to the south and southwest at gradients ranging from about 2 to 4 percent to the westerly terminus of the study area in Santa Monica which lies at an elevation of 85 feet msl.

Change The following is a modification of and replaces the Local Groundwater Conditions section in Section 3.2.3.

3.2 Geology

3.2.3 Groundwater Conditions

Local Groundwater Conditions

The following discussion of groundwater conditions along the alternative alignments based on groundwater elevation data from Mactec's (2010) geotechnical borings drilled and monitoring wells installed in 2009 and 2011 (Task 10.02) and previous borings and monitoring wells from other consultants as shown on Mactec's geologic profiles (Plates 1.1 to 1.21), which are included as Appendix A to this report.

Most of the West Hollywood portion of Alternatives 4 and 5 are located in an area of West Hollywood that historically has been an area of high groundwater, with substantial marshland and artesian wells. Groundwater data shown by Mendenhall (1905) indicate that artesian groundwater conditions existed in 1905 along Santa Monica Boulevard from near La Cienega east to about Doheny on the west and extending south of Wilshire Blvd. Following cessation of groundwater pumping for urban use in the West Hollywood area in the late 1970s, groundwater levels have generally risen in the West Hollywood area. A groundwater contour map prepared for the city's Draft General Plan/Final EIR (West Hollywood Draft General Plan/Final EIR (1988) indicated that in the 1980s groundwater depths were as shallow as 0 to 10 feet bgs in portions of the city. As shown on Figure 3-2, the California Geological Survey mapped historic high groundwater depths along the West Hollywood portion of Alternatives 4 and 5 as ranging from approximately 10 to 110 feet bgs.

Groundwater data obtained from Mactec's borings drilled and wells installed in 2009 and 2011 were used in their analysis of recent groundwater conditions. Groundwater data obtained from previous borings, existing reports and well records and from previous construction observation records were also utilized. A brief summary of their findings and conclusions is presented in the following paragraph.

Along the alignment from Hollywood/Highland to the intersection with Fairfax Avenue and Santa Monica Boulevard, groundwater levels ranged from 20 to 87 feet bgs (Plates 1.26 to 1.29). From Fairfax/Santa Monica to Wilshire Boulevard, groundwater elevations ranged from 1.3 to 20.3 feet bgs (Plates 1.29 to 1.36). Mactec (2010) stated that data from three of the wells from Fairfax to La Cienega (Plates 1.29 to 1.31, wells G-34, G36, and G-37) suggest a southerly hydraulic gradient in this area and they attribute some of the widely varying groundwater levels between relatively closely spaced monitoring wells to be due to perched water conditions (wells G-39 and G-40 on Plate 1.34). Artesian conditions were encountered during construction of well G-39 (Plate 1.34) near the intersection of La Cienega and Beverly Boulevards which is located within the artesian groundwater zone delineated by Mendenhall (1905).

The following is a discussion of recent groundwater conditions based on Mactec's analysis (2010 and 2011) along the portions of Alternatives 1 through 5 and MOS 1 and 2 that extend westerly from the Wilshire/Western Station and as far as the Wilshire/4th Street Station in Santa Monica.

In the segment along Wilshire Boulevard between Western and Fairfax Avenues, exploratory borings drilled by Woodward-Clyde Consultants (WCC, 1977) and Converse Ward Davis Dixon/Earth Science Associates/Geo-Resource Consultants (CWDD/ESA/GSC, 1981) encountered shallow groundwater (probably perched) between approximately 10 to 35 feet below the ground surface (bgs) (Plates 1.1 to 1.7). As shown on Plates 1.2 to 1.6, groundwater levels measured in monitoring wells along Wilshire between Crenshaw and Burnside Avenues in September 2007 by TRC ranged between 12 to 40 feet bgs (TRC, 2007). Differing water levels for each of the shallow and deep screened intervals suggests either perched or possibly semi-confined groundwater. Groundwater as shallow as 5 to 10 feet bgs was reported (LeRoy Crandall and Associates, 1983) in borings drilled along Wilshire Boulevard between Curson and Orange Grove Avenues, just east of Fairfax (Plates 1.5 and 1.6). Groundwater elevation data from Mactec's borings drilled and monitoring wells installed in 2009 and 2011 indicate that depth to groundwater along Wilshire Boulevard between Crenshaw Boulevard and Fairfax Avenue ranges from approximately 10 to 48 feet bgs (Plates 1.2 to 1.7).

Along Wilshire Boulevard between Fairfax Avenue and Santa Monica Boulevard, groundwater elevation data from Mactec's borings drilled and monitoring wells installed in 2009 and 2011 indicate that depth to groundwater generally ranges from 21 to 59 feet bgs (Plates 1.7 to 1.12).

In the alignment segment from the intersection of Wilshire and Santa Monica Boulevards westward through Westwood and Century City to the intersection of

Wilshire and the 405 Freeway, Mactec's (2010 and 2011) borings and wells drilled in 2009 and 2011 indicate groundwater elevations ranging from approximately 16 to 69 feet bgs (Plates 1.12 to 1.18).

Borings drilled by Woodward-Clyde Consultants just south of Wilshire at Westwood Boulevard (WCC, 1970) encountered water at depths of 65 and 70 feet bgs.

Caltrans drilled four borings in the immediate vicinity of the intersection of Wilshire Boulevard and the 405 Freeway in 2007 and encountered groundwater at depths ranging from 63 to 73 feet bgs (Caltrans, 2007). One of Mactec's groundwater monitoring wells (G-24) installed in 2009 in the same area indicated depth to groundwater of 69 feet bgs (Plate 1.18). Recently (2011) installed by Mactec groundwater monitoring well at the VA Hospital site indicate depths to groundwater of 68 feet bgs.

Based on their interpretation of data from current monitoring wells and prior borings Mactec (2010 and 2011) suggested that groundwater is likely perched within different zones and depths along the portion of the Westside Subway Extension from its easterly terminus to approximately the 405 Freeway. The stratigraphic layers encountered along the alignment appear to be laterally discontinuous within the older alluvium. The fine grained units within the older and possibly younger alluvium (in paleo-drainages) may act as aquitards at variable depths along the Santa Monica Extension alignment. This appears to be reflected in the variable ground water levels measures in the current monitoring wells and the prior borings.

For the portion of the alignment west of the 405 Freeway to its westerly terminus at Wilshire Boulevard and Ocean Avenue in Santa Monica, groundwater level data is sparse. A well located near the intersection of Wilshire Boulevard and Bundy Drive in the Sawtelle area of Los Angeles had water levels recorded for the years 2005 thru 2008 that ranged from about 25 to 31 feet bgs (Los Angeles County Department of Public Works, 2008). Mactec installed a monitoring well (G-26) in June 2009 on Wilshire Boulevard about 200 feet east of Bundy drive and recorded the depth to groundwater as 21.6 bgs in August 2009 (Plate 1.20). Mactec noted that groundwater depths are at least 20 feet shallower than prior groundwater level measurements taken in wells from this vicinity in the 1970s and attributed this change to a decrease in groundwater pumping in the vicinity. Mactec (2010) suggests that groundwater levels along Wilshire Boulevard in the city of Santa Monica are generally deeper than 50 feet bgs. The California Division of Mines and Geology (1998a) interpreted the highest historical groundwater level to range from approximately 10 to 40 feet bgs for the area of the alignment west of the 405 Freeway (Figure 3-2).

Change The following is a modification of and replaces the third paragraph in Section 3.2.5.

3.2.5 Gassy Ground Conditions

Hazardous gas monitoring performed as part of studies for various proposed and completed tunneling projects in the Los Angeles area has been occurring for many years. As part of this study, Metro installed permanent gas monitoring wells at 25 locations (2009), and at 23 locations (2011) along the proposed alternative alignments to further evaluate the presence of hazardous gases and their possible impact upon construction of the proposed subway extension. The well locations were typically chosen in areas within known methane areas as defined by Los Angeles City, Department of Public Works, Bureau of Engineering (Figure 3-5, Methane Zones Map) or within or near active or abandoned oil fields in Beverly Hills and West Hollywood.

Change The following is a modification of and replaces the third paragraph in the Liquefaction and Lateral Spreading Section in Section 3.2.6.

3.2.6 Geological and Seismic Hazards

Liquefaction and Lateral Spreading

The CGS has designated certain areas within California as liquefaction hazard zones. The areas within these zones have had historic occurrences of liquefaction or include geological and groundwater conditions that are conducive to ground displacement to such a point that mitigation would be required to make the areas suitable for structural development. Based on the CGS seismic hazard mapping, portions of the alternative alignments are located within liquefaction hazard zones (CDMG, 1997, 1999). As shown on Figure 3-6, Liquefaction Hazard Zones, the alignment alternatives cross liquefaction hazard zones in the vicinity of San Vicente Boulevard and in the vicinity of Interstate 405. However, based on the relatively thin cover of Holocene sediments in these areas, it appears that at tunnel excavation elevations, the tunnels will be driven below the potentially liquefiable Holocene section and into the underlying older Pleistocene alluvium and Pleistocene Lakewood and San Pedro Formation sediments as well sedimentary bedrock of the Pliocene-age bedrock of the Fernando Formation and Miocene-age Puente Formation (Task 10.02). Therefore, liquefaction is not considered a potential seismic hazard to the tunnel components of the project. However, based on their review of recent and past geotechnical subsurface data, CGS maps and reports, Mactec (2010 and 2011) concluded that due to the presence of shallow groundwater and young alluvial deposits there may be potential for liquefaction in soils adjacent to the upper portions of some station walls. However, settlement beneath these stations due to liquefaction is considered remote due to the dense character of the older alluvium at preliminary station depths. Since the terrain in the study area is generally flat-lying, lateral spreading of liquefiable soils is not considered a significant hazard to the project.

Change The following is a modification of adds an oil well to Table 3-3, Identified Oil Wells

3.3.2 Oil Wells

Table 3-3: Identified Oil Wells

Well Name/API No.	Location	Plan Sheet (Appendix A)	Approximate Station	Well Status
Kansas Crude Co 2/API 03700992	30 feet east of Ensley Street and 90 feet north of alignment	C-214A	345+50-346+00	Buried idle

4.0 ENVIRONMENTAL IMPACT/ENVIRONMENTAL CONSEQUENCES

No change.

5.0 MITIGATION MEASURES

Change The following is a modification of and replaces Section 5.1.1 and 5.1.2

5.1.1 Mitigation for Operational Impacts

Seismic Ground Shaking

Metro design criteria require probabilistic seismic hazard analyses (PSHA) to estimate earthquake loads on structures. These analyses take into account the combined effects of all nearby faults to estimate ground shaking. A site-specific PSHA will be used as the basis for evaluating the ground motion levels along the Build Alternatives. The structural elements of the Build Alternatives will be designed and constructed to resist or accommodate appropriate site-specific estimates of ground loads and distortions imposed by the design earthquakes and conform to Metro's Design Standards for the operating and maximum design earthquakes. The concrete structures are designed according to the Building Code Requirements for Structural Concrete by the American Concrete Institute (ACI 318).

Fault Rupture

Design will allow for the tunnels to cross the faults nearly perpendicular to limit the area of potential damage and will use Metro's two level approach to asses fault offsets and the associated structural design required to accommodate the offset. Fault crossings will be designed for the ground conditions and incorporate the methods used to excavate and support the tunnel. Design criteria will require:

- Tunnel safety by preventing collapse of the tunnel
- Maintaining structural continuity of tunnel ring
- Preventing inflow of water and soil
- Establishing the tunnel size to maintain tunnel clearances and provide a guideway for derailed trains to decelerate without impact

Several preliminary design approaches or combinations have been considered and will be further developed in final design:

- Steel tunnel rings with compressible material between the ring and soil to accommodate movement of the fault
- Flexible steel linings
- Articulated joints between tunnel segments for added flexibility
- Oversized tunnel to allow additional movement and to some extent, more rapid repair after a seismic event.

Another possible alternative to tunneling through a fault crossing is to construct widened cut-and-cover box structures at those locations and incorporate the resilient and repairable support system for the trackwork as discussed above.

Operational Procedures during Earthquake

In addition to design measures, as Metro has implemented on the existing Red line, it will implement Standard Operating Procedures in seismic areas to detect earthquakes and will provide uninterruptible, power, lighting, and ventilation systems to increase safety during tunnel or station evacuations in the event of loss of power due to an earthquake. For example, seismographs are located in 11 of the existing Metro Red/Purple Line stations to detect ground motions and trigger Standard Operating Procedures (SOP #8 – Earthquake) by the train operators and controllers. Operating procedures are dependent on the level of earthquake and include stopping or holding trains, gas monitoring, informing passengers, communications with Metro's Central Control, and inspecting for damage.

Liquefaction and Seismic Settlement

At liquefaction or seismic settlement prone areas, evaluations by geotechnical engineers will be performed to provide estimates of the magnitude of the anticipated liquefaction or settlement. Based on the magnitude of evaluated liquefaction, a suitable mitigation will be selected, either structural design, or ground improvement (such as deep soil mixing) or deep foundations to non liquefiable soil (such as drilled piles). Site specific design will be selected based upon the State of California Guidelines design criteria set forth in the Metro Seismic Design Criteria.

Hazardous Subsurface Gas Operations

As with the existing Red and Purple Lines and the Metro Gold Line Eastside Extension, Metro will install gas monitoring and detection systems with alarms, as well as ventilation equipment to dissipate gas to safe levels according to Metro's current Design Criteria and Cal/OSHA standards for a safe work environment. Measures will include the following for both tunnel and station operation:

- High volume ventilation systems with back-up power sources
- Gas detection systems with alarms
- Emergency ventilation triggered by the gas detection systems
- Automatic equipment shut-off
- Maintenance and operations personnel training

Gas detection instrumentation is set to send alarms to activate ventilation systems and evacuate the structures as follows: Methane gas—Minor alarm at 10 percent of LEL (activate ventilation) and major alarms at 25 percent of LEL (evacuation of area) and Hydrogen sulfide—Minor alarm at 8 ppm and major alarm at 10 ppm.

Hazardous Subsurface Gas Structural Design

Tunnels and stations will be designed to provide a redundant protection system against gas intrusion hazard. The primary protection from hazardous gases during operations is provided by the physical barriers (tunnel and station liner membranes) that keep gas out of tunnels and stations. As with the existing Metro Red and Purple Lines and the Metro Gold Line Eastside Extension, tunnels and stations will be designed to exclude gas to below alarm levels and include gas monitoring and detection systems with alarms, as well as ventilation equipment to dissipate gas.

- At stations in elevated gassy ground (e.g., Wilshire/Fairfax, construction will be accomplished using slurry walls—or similar methods such as continuous drilled piles—to provide a reduction of gas inflow both during and after construction than would occur with conventional soldier piles and lagging.
- Other station design concepts to reduce gas and water leakage will use additional barriers, compartmentalized barriers to facilitate leak sealing, and use of flexible sealants, such as poly-rubber gels, along with the high-density polyethylene-type materials that are used on Metro's underground stations.
- Consideration of secondary station walls to provide additional barriers or an active system (low or high pressure barrier) will also be studied further to determine if they will be incorporated into the Build Alternatives. The evaluations will include laboratory testing programs such as those conducted for the Metro Gold Line Eastside Extension during development of the double gasket system and material testing for long term exposure to the ground conditions for materials such as rubber gaskets used for tunnel segment linings.
- Testing programs will examine:
  - Segment leakage—gasket seal under pressure before, during, and after seismic movements. This will include various gasket materials and profiles (height and width).
  - Gasket material properties—effective life and resistance to deterioration when subjected to man-made and natural contaminants, including methane, asphaltic materials, and hydrogen sulfide.
  - Alternative products to High Density Polyethylene products such as poly-rubber gels, now in use in ground containing methane in other cities.
  - Methods for field testing high-density polyethylene joints. These are now being used for landfill liners and water tunnels under internal water pressure.
  - Ground modification methods—ground treatment to reduce/neutralize, extraction or venting to remove, grouting to capture contaminants such as man-made contaminants, natural contaminants, methane, H2S, and the like.

Tar Sand Disposal

Tar sands from the Project excavations will be safely disposed of. Disposal options for Tar Sands include transporting the material under an appropriate waste manifest to a local landfill that accepts petroleum-impacted soils as daily cover or transporting the waste to a soil recycling facility where it is thermally treated (incinerated to burn off the petroleum constituents) and then reused as fill material for various construction projects. High volumes of tar sand soils would likely need to be sent to a facility such as Waste Management in McKittrick, California that accepts soils with hydrocarbons. Alternatively, if feasible, Metro will conduct additional investigations for disposal of tar sands. Based on results, tar sands may also be transported to a facility where they can be re-cycled and incorporated into the asphalt pavement manufacturing process.

Hazardous Materials

Disposal of groundwater from underground structures will comply with the City of Los Angeles Industrial Wastewater Permit if there is any contaminated groundwater leakage into final structure.

In the unlikely event of a major hazardous materials release close to or Metro will develop emergency response procedures in conformance with Federal, State, and local regulations.

5.1.2 Mitigation for Construction Impacts

Mitigation measures are listed below where appropriate to mitigate impacts of project construction due to surface fault rupture, seismic ground shaking, differential seismic settlement, liquefaction, subsidence, hazardous subsurface gases, and hazardous materials.

Surface Fault Rupture

Considering the infrequency of surface fault rupture occurring on the faults that cross the project alignment and the relatively short construction time for the project, the probability of surface fault rupture occurring during construction is considered extremely remote. Therefore, surface fault rupture is not considered a significant construction hazard that would require mitigation.

Seismic Ground Shaking

To mitigate potential impact from seismic ground shaking, the structural elements of the alternative alignments would be designed and constructed to resist or accommodate appropriate site-specific ground motions and conform to MTA Design Criteria as well as all applicable federal, state and local building codes. As mentioned previously, Metro is currently developing ground motion response spectra suitable for design of the project facilities.

Liquefaction

As discussed previously, the only subway structures that are likely to be potentially affected by liquefaction of the surrounding soils are the upper portions of some station walls. However, considering the infrequency of earthquakes of magnitudes great enough to cause liquefaction and the relatively short construction time for the project, the probability of liquefaction occurring during construction is considered remote. Metro Design Criteria includes national standards and codes to protect the workers and work under construction considering seismic conditions. Designs to minimize risk of liquefaction related damage to the excavation support system include increasing the depth of solider piles to reach non-liquefiable zones, or ground improvement to densify the soil may be provided prior to the installation of the excavation support system therefore liquefaction is not a significant impact during construction.

Settlement

To optimize control of the ground overlying and surrounding the tunnels and limit ground settlement to acceptable levels, pressurized-face TBMs will be used for tunnel construction, which will allow the tunnel lining to be installed and grout to be injected into the annulus between the lining and the ground immediately behind the TBM concurrently and without having to lower groundwater levels by dewatering.

Preconstruction Survey, Instrumentation, and Monitoring: As added protection to detect tunneling-induced settlement and settlement induced by other excavation activities, pre-construction surveys will be performed to document the existing conditions of buildings along the alignment before tunneling begins, and instrumentation will be installed to monitor structures. During construction, instrumentation (e.g., ground surface and building monitoring programs) will be in place to measure movements and provide information to the resident engineer and contractor on tunneling performance, as well as to document that the settlement specifications are met. If measurements indicate settlement limits could be exceeded, the contractor will be required to change or add methods and/or procedures to comply with those limits. Construction work will be reassessed if settlements exceed action (warning) levels.

During the design phases, additional geotechnical exploration and analysis will be undertaken to confirm areas where dewatering will be required and if it will cause significant additional subsidence. If these conditions are found, methods to prevent lowering of the groundwater outside of the excavation will be employed. These methods could include use of slurry walls, secant pile walls, or other methods for the construction of the station walls to reduce the settlement impacts due to groundwater lowering.

Where conditions warrant (for example, more shallow tunnels directly below sensitive structures or utilities), additional methods to reduce settlement will be specified. Such methods could include the following:

- Permeation grouting to improve the ground prior to tunneling
- Compaction grouting to consolidate the ground above the tunnel
- Compensation grouting as the tunnel is excavated
- Underpinning the structure's foundation

Hazardous Subsurface Gases

A fully enclosed tunnel mining system, such as a slurry-face TBM (a type of pressurized-face TBM) is expected to be used for tunneling in known gassy or potentially gassy areas. This technology is considered a considerable improvement over the methods used during construction of Metro's initial operating segments. Slurry-face TBMs minimize exposure of workers to elevated gas concentrations underground, since the excavated soil is removed in a fully enclosed slurry pipeline to an above-ground, enclosed treatment plant.

In areas where hydrogen sulfide is encountered, several techniques could be used to lower the risk of exposure. The primary measures to prevent exposure to hydrogen sulfide gas are separation of materials from the tunnel environment through use of enclosed tunneling systems such as pressurized face - TBMs and increased ventilation capacity to dilute gases to safe levels as defined by Cal/OSHA. Secondary measures could include pre-treatment of groundwater containing hydrogen sulfide by displacing and oxidation of the hydrogen sulfide by injecting water (possibly containing dilute hydrogen peroxide) into the ground and groundwater in advance of the tunnel excavation. This "in-situ oxidation" method reduces hydrogen sulfide levels even before the ground is excavated. This pre-treatment method is unlikely to be necessary where a slurry-face TBM is used, but may be implemented at tunnel-to-station connections or at cross-passage excavation areas and where open excavation and limited dewatering may be conducted such as emergency exit shafts and low-point sump excavations.

When needed to reduce hydrogen sulfide to safe levels for slurry treatment; additives could be mixed with the bentonite (clay) slurry during the tunneling and/or prior to discharge into the slurry separation plant. For example, zinc oxide could be added to the slurry as a "scavenger" to precipitate dissolved hydrogen sulfide when slurry hydrogen sulfide levels get too high. Gas levels will be maintained in accordance with Cal/OSHA requirements for a safe working environment.

For the stations in elevated gas zones, the use of relatively impermeable lagging, use of diaphragm or slurry walls or equivalent will be implemented to reduce of gas inflows both during and after construction. The slurry wall provides a thick (typically 3 to 4 feet) concrete barrier against water and gas intrusion, and significantly reduces the need for dewatering the station during construction. Grout tubes can be pre-placed within slurry wall panels to be used in the event leakage occurs. Slurry walls present a challenge in accommodating existing utilities, and typically more utility relocation is required for slurry wall systems. Additional ventilation, continuous monitoring, and worker training for exposure to hazardous gases will also be required during station construction. In extreme cases, some work may require use of personal protective equipment, such as fitted breathing apparatus.

Prior to construction, more detailed research on oil well locations will be conducted. Detection of oil wells will include use of magnetic devices to sense oil well casings within the tunnel alignment. Where the tunnel alignment cannot be adjusted to avoid well casings, the California Department of Conservation (Department of Oil, Gas and Geothermal Resources) will be contacted to determine the appropriate method to re-abandon the well. Oil Well abandonment must proceed in accordance with California Laws for Conservation of Petroleum and Gas (1997), Division 3. Oil and gas, Chapter 1. Oil and Gas Conservation, Article 4, Sections 3228, 3229, 3230, and 3232. The requirements include written notification of the State Department of Oil, Gas and Geothermal Resources (DOGGR), protection of adjacent property, and before commencing any work to abandon any well, obtaining approval by the DOGGR. Abandonment work including sealing off oil/gas bearing units, pressure grouting etc, must be performed by a state-licensed contractor under the regulatory oversight and approval of DOGGR. Similarly, during construction if an unknown well is encountered, the contractor will notify Metro, Cal/OSHA, and the Gas and Geothermal Resources for well abandonment, and proceed in accordance with state requirements.

Although not specifically required for gassy tunnels, workers will be supplied with oxygen-supply-type self-rescuers (breathing apparatus required for safety during evacuation during fires).

Hazardous Materials

Site Assessments

As detailed design-level plans are prepared, and precise Build Alternatives excavation limits defined, a more detailed Environmental Site Assessment (Phase II) will be conducted prior to construction in areas of impacted soil. A base line soil sampling protocol will be established with special attention to those areas of environmental concern. The soil will be assessed for constituents likely to be present in the subsurface including, but not limited to, total petroleum hydrocarbons, volatile and semi-volatile organic compounds, polychlorinated biphenyls, polynuclear aromatic hydrocarbons, pesticides, lead arsenates, and Title 22 metals. The depth of the sampling will be based on the depth of excavation or type of construction activities. In addition, in areas where groundwater will be encountered, samples will also be analyzed for suspected contaminants prior to dewatering to ensure that National Pollutant Discharge Elimination System discharge requirements are satisfied.

Soil Reuse

As detailed design-level plans are prepared, and precise Build Alternatives excavation dimensions defined, a soil mitigation plan will be prepared showing the extent of soil excavation during construction. The soil mitigation plan will use Metro's Standard Specifications for soil reuse criteria, which include a sampling plan for stockpiled materials, and the disposition of materials that do not satisfy the reuse criteria. It will specify guidelines for imported materials. The plan will include provisions for soil screening for contamination during grading or excavation activities.

Sampling During Construction

Metro will sample soil suspected of contamination and analyze the excavated soil for the purpose of classifying material and determining disposal requirements. If excavated soil is suspected or known to be contaminated, the contractor to perform the following operations:

- Segregate and stockpile the material in a way that will facilitate measurement of the stockpile volume
- Spray the stockpile with water or an SCAQMD-approved vapor suppressant and cover the stockpile with a heavy-duty plastic (e.g., Visqueen) to prevent soil volatilization to the atmosphere or exposure to nearby workers.

Soil Testing

Soil samples that are suspected of contamination will be analyzed for suspected chemicals by a California certified laboratory. If contaminated soil is found, it will be removed, transported to an approved disposal location and remediated or disposed according to State and federal laws. Where contaminated levels can be diluted to acceptable levels soils may be re-used on-site.

Personal Protection

The contractor will provide qualified and trained personnel and personal protective equipment (PPE) to perform operations that require the disturbance of contaminated substances including excavation of stations, slurry/tunnel material processing, segregation, stockpiling, loading and hauling.

Contaminated Groundwater

Groundwater contamination encountered during subsurface construction activities may be treated on-site to acceptable local and state criteria and then discharged into the sanitary sewer. If on-site treatment is not feasible due to the type and severity of the contamination identified, the contaminated ground water may need to be disposed of by recycling in a permitted facility. If unanticipated contaminated groundwater (not included in the health and safety plan) is encountered during construction, the contractor will stop work in the vicinity, cordon off the area, and contact Metro and the appropriate hazardous waste coordinator and maintenance hazardous spill coordinator at Metro and will immediately notify the Certified Unified Program Agencies (City of Los Angeles Fire Department, County of Los Angeles Fire Department, and Los Angeles Regional Water Quality Control Board [LARWQCB]) responsible for hazardous materials and wastes. In coordination with the LARWQCB, an investigation and remediation plan will be developed in order to protect public health and the environment. Any hazardous or toxic materials will be disposed according to local, state, and federal regulations.

Health and Safety Plan

A health and safety plan will be required by Build Alternatives specifications. The plan will include response to exposure of personnel to constituents of concern identified in the Phase II Environmental Site Assessment.

Storage of Contaminated Materials

Hazardous or contaminated materials will be properly stored to prevent contact with precipitation and runoff.

Monitoring the Environment

An effective monitoring and cleanup program will be developed and implemented for spills and leaks of hazardous materials

Equipment to be repaired or maintained will be placed in covered areas on a pad of absorbent material to contain leaks, spills, or small discharges

Any significant chemical residue on the construction sites will be removed

APPENDIX A

Change The following is a modification of and replaces Plates for Alternatives 1 and 2.

EXPLANATION

Proposed Geotechnical / Soil-Gas Investigation for PE Phase:

G-206	Geotechnical Rotary-Wash Boring
M-124	Gas Monitoring Well
G-199/M-122	Dual Geotechnical Boring / Gas Monitoring Well
CB-105	CPT [Geotechnical + Gas - BAT]
C-127	CPT [Geotechnical]
S-115	Geotechnical Sonic Core
P-103	Pump Test

Prior ACE Phase Investigations:

M-15	MACTEC Environmental Exploration
G-3	MACTEC Geotechnical Exploration
SB-2	Prior Fault Investigation Boring

Prior Investigations (depth >70') : ● = Geotechnical ● = Gas Well or CPT w/ Gas Reading

M 4953-05-1851	MACTEC Geotechnical Exploration
CPT9G	MACTEC CPT Exploration (1994)
P-43	MACTEC Environmental Exploration (1992)
MW2C	MACTEC Geotechnical Exploration (1990)
CWDD 18-2	CWDD Converse Ward Davis Dixon (1981)
CWDD 18	CWDD Dual Geotechnical / Environmental Exploration (1981)
MC-2	Converse Consultants West (1992)
RC-17, GW-1	EnviroRail 1994 (1996)
WWC 4	Woodward Clyde Consultants (1977)

Symbol Labels:

(MW)	Ground water monitoring (observation) well
(NV)	Boring with noise and vibration testing
(P)	Boring with pressure meter testing

CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

Symbols Legend:

- Site view of station. Alignment based on data provided by PB (7/15/2011)
- Profile view of station (red) with tunnel outline (black) and track (blue)
- Site view showing center of tracks (blue), tunnel outlines (magenta dash) with perpendicular of cross passage.
- Cross passage (profile view).
- NV-185 — Noise and Vibration Point of Interest.
- (12-24-08) — Ground-water depth measured during 2009 to 2011 in an observation well, drilled by MACTEC and date of measurement.
- Overnight Ground-water depth measured in a 2011 boring, drilled by MACTEC.
- Ground-water depth measured during drilling of a boring in 2011, by MACTEC.
- Geologic contact line.
- Top of tar impregnated soil.
- Geotechnical boring completed as a part of PE phase investigation.
- Geotechnical boring to be completed as a part of PE phase investigation.

Geologic Units:

af	ARTIFICIAL FILL (undocumented)
Qal	YOUNGER ALLUVIUM (Holocene) - predominantly sand, silt and clay
Qalo	OLDER ALLUVIUM - varying layers of Silty Sand, Clayey/Silty Clay, and Silt with occasional gravel
Qlw	LAKEWOOD FORMATION (late Pleistocene) - interbedded Silty sands, Silts, and Clays with clayey Sand Layers
Qsp	SAN PEDRO FORMATION (mid Pleistocene) - predominately greenish gray and bluish gray fine-grained Sands, medium to coarse Sands and some Silt Layers.
Tf	FERNANDO FORMATION (Pliocene) - predominately massive Siltstone with some Claystone interbeds

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

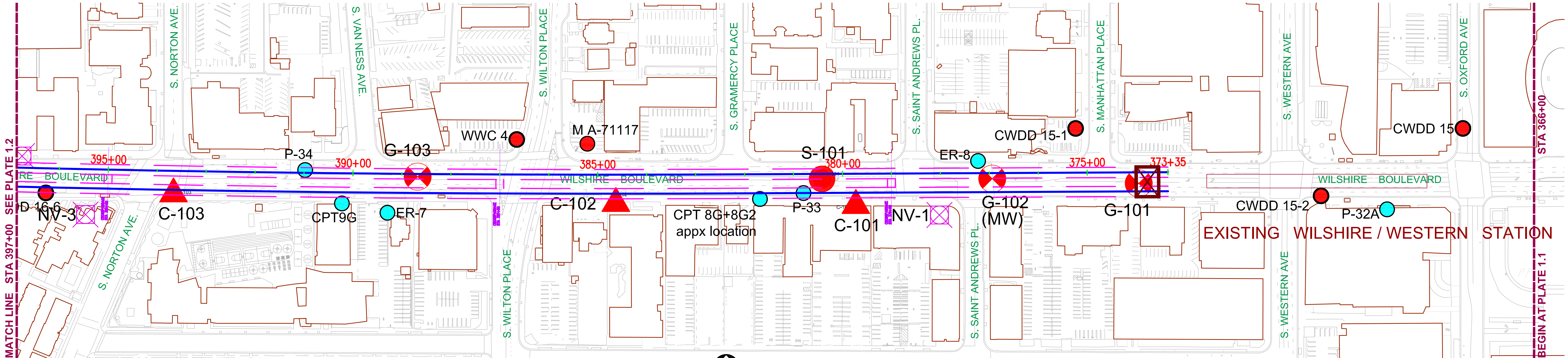
REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
DRAWN BY L. MORLEY
CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

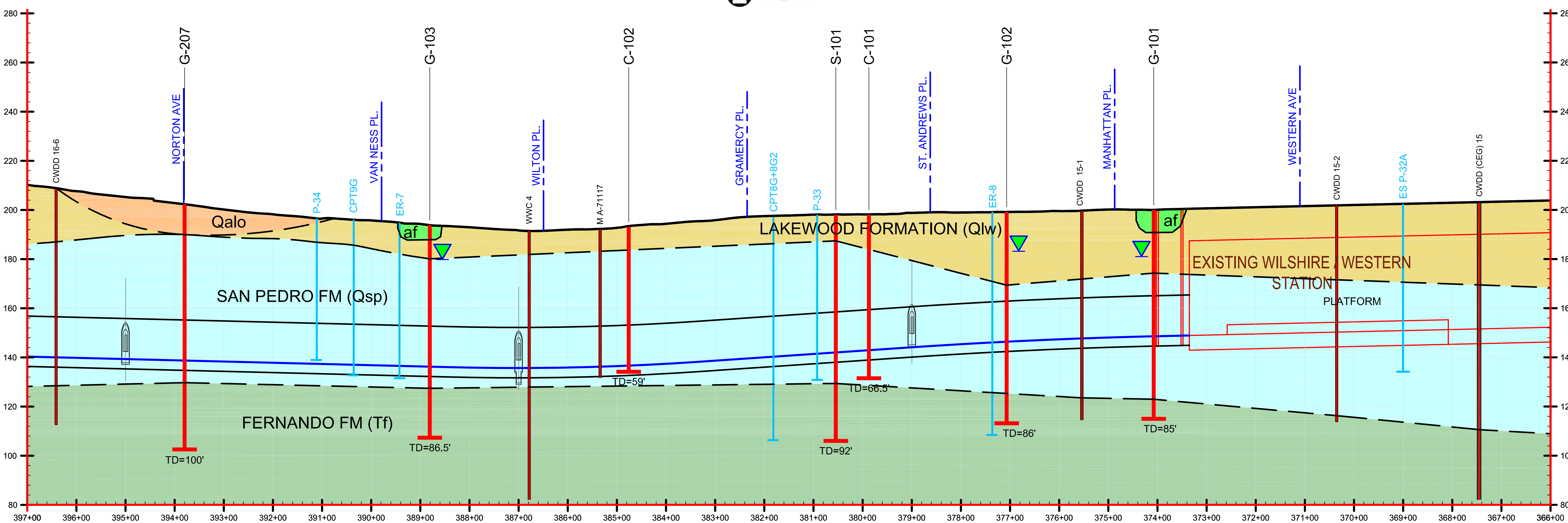
Metro
LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY
PB
PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE
LEGEND SHEET
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.0 REV
SCALE N/A
SHEET NO



PLAN



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
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DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

STATION 366+00 to 397+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.1
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO

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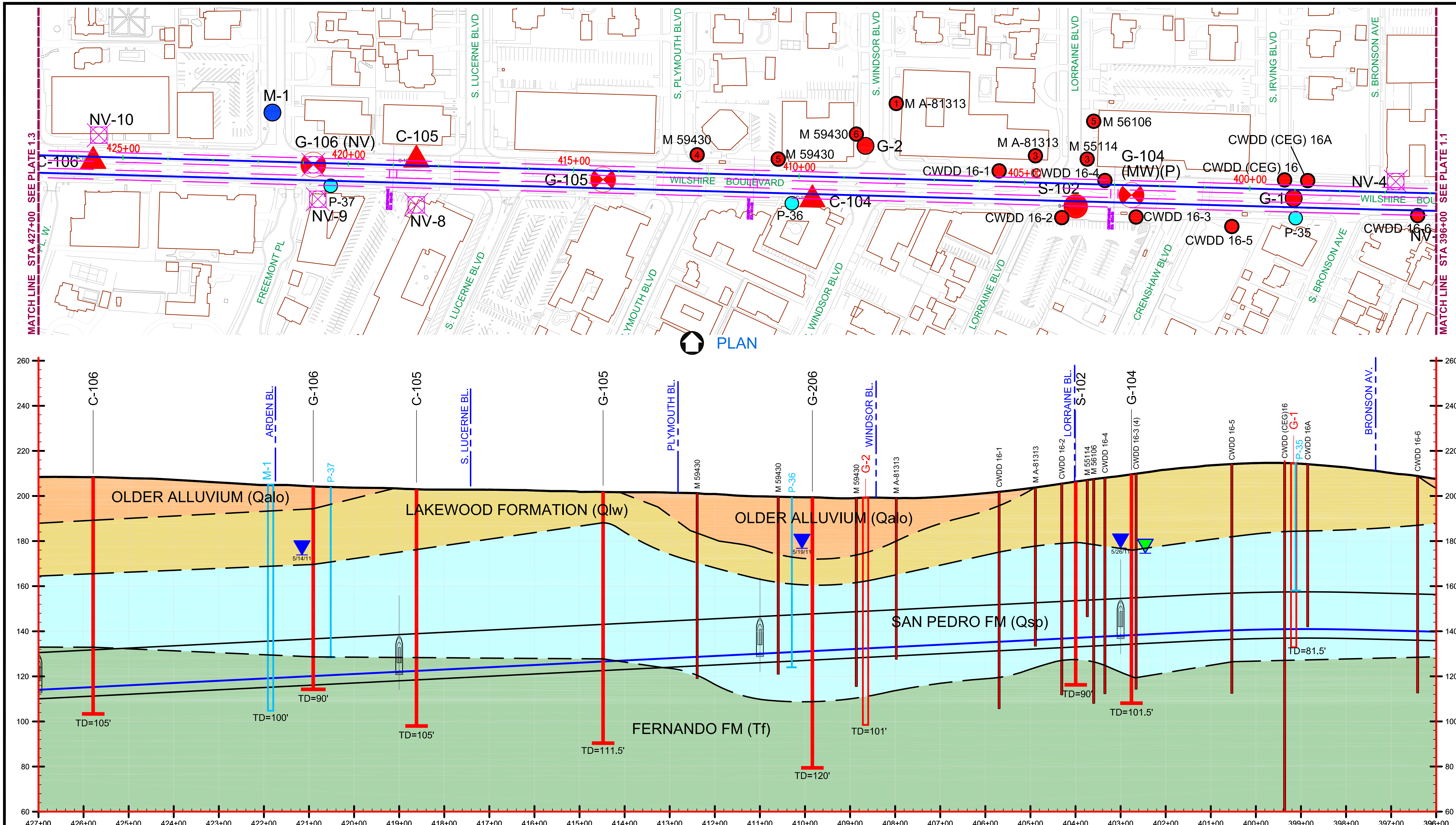

CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
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CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

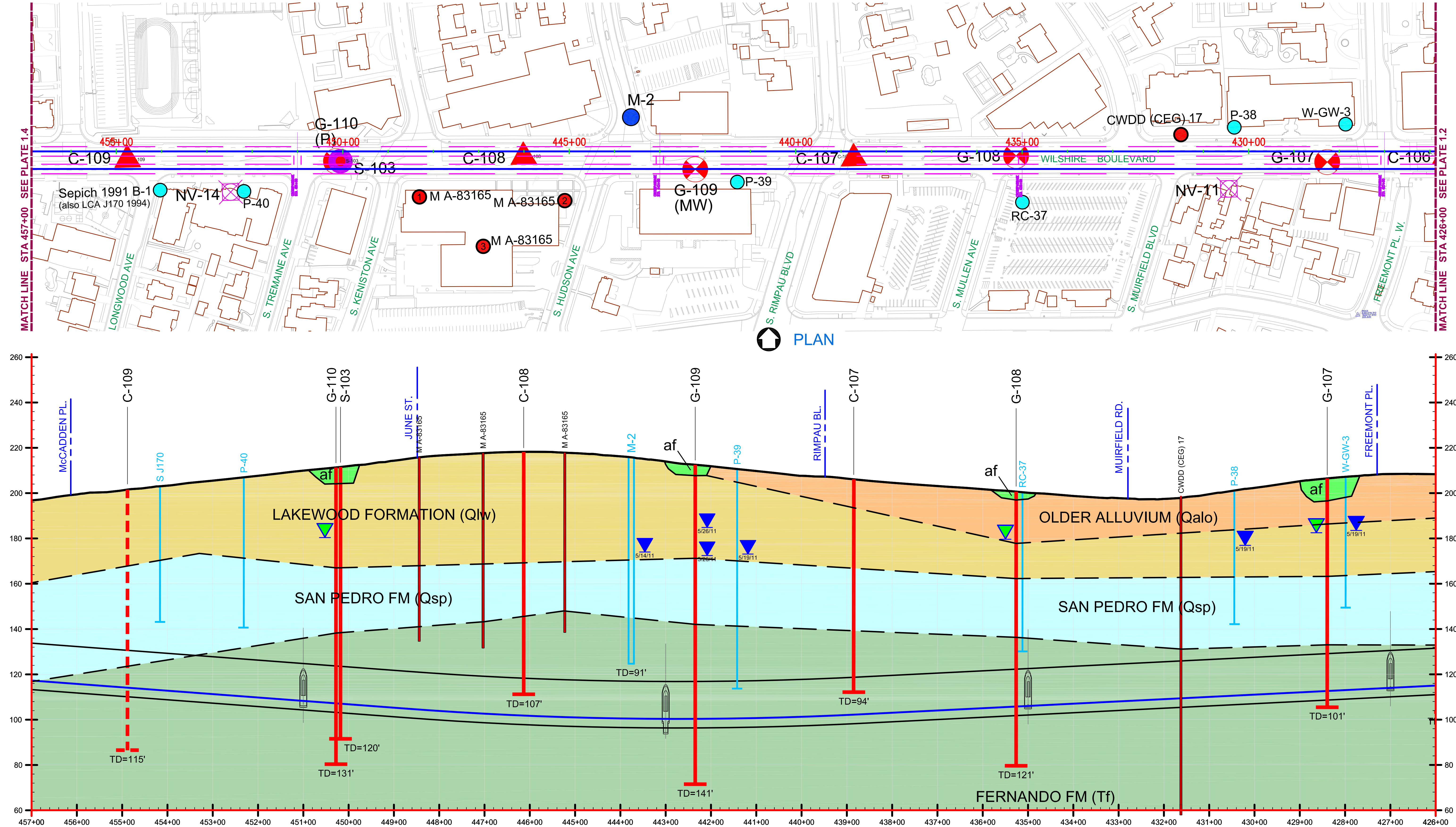
LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION AUTHORITY

PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE
STATION 386+00 to 427+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.2
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
DRAWN BY L. MORLEY
CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

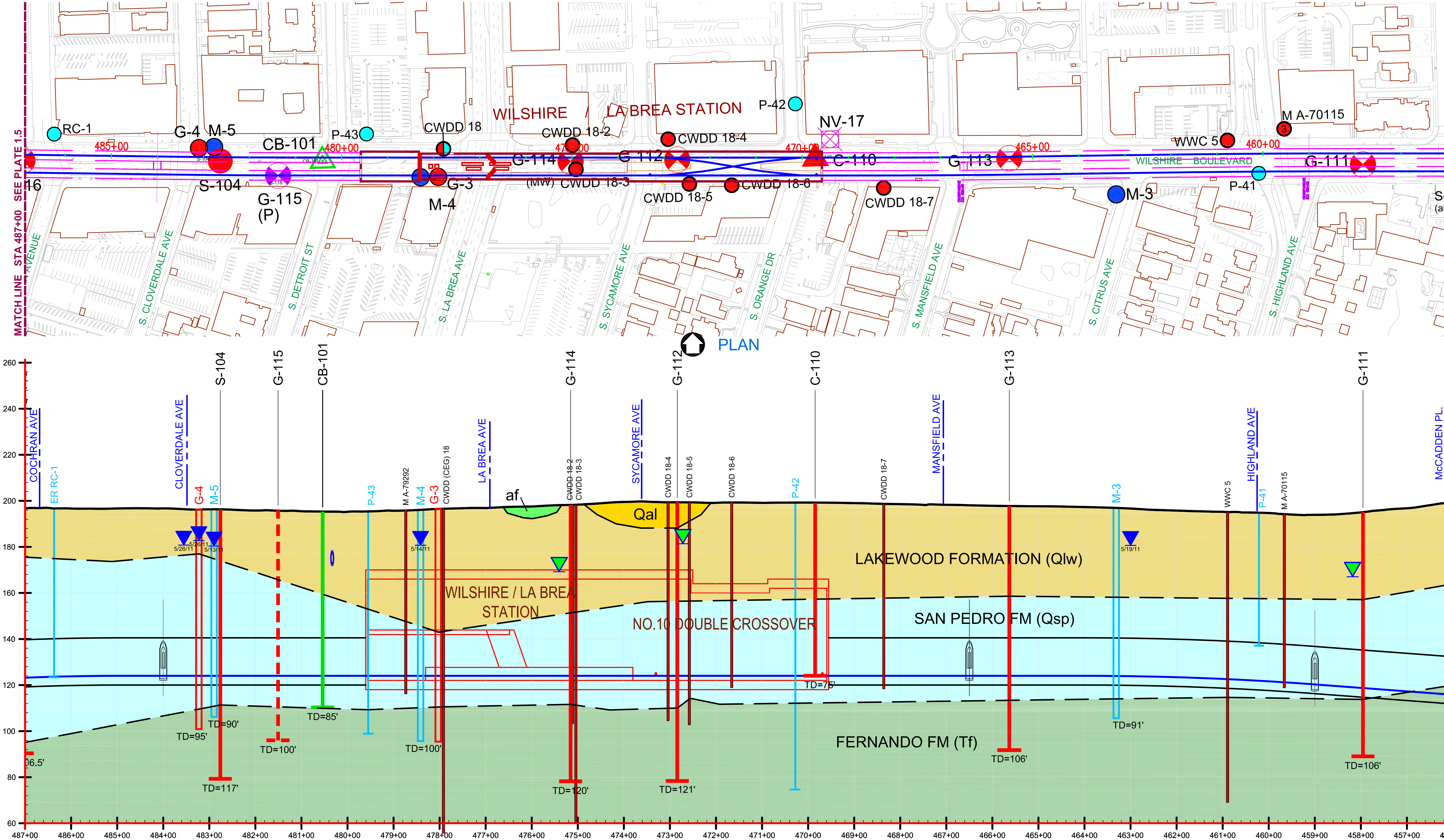
PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

STATION 426+00 to 457+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.3
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
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CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

STATION 456+00 to 487+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.4
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO

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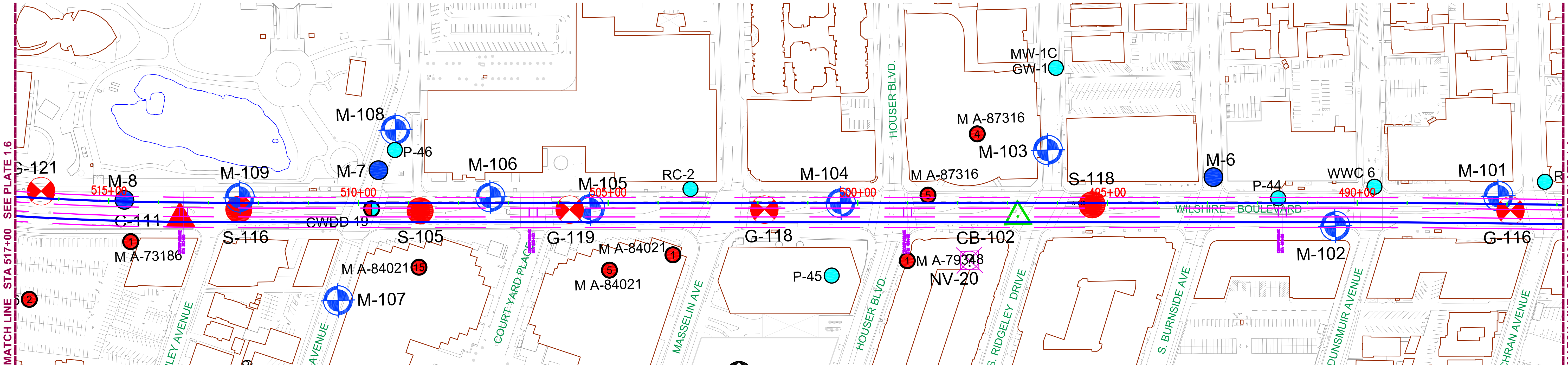
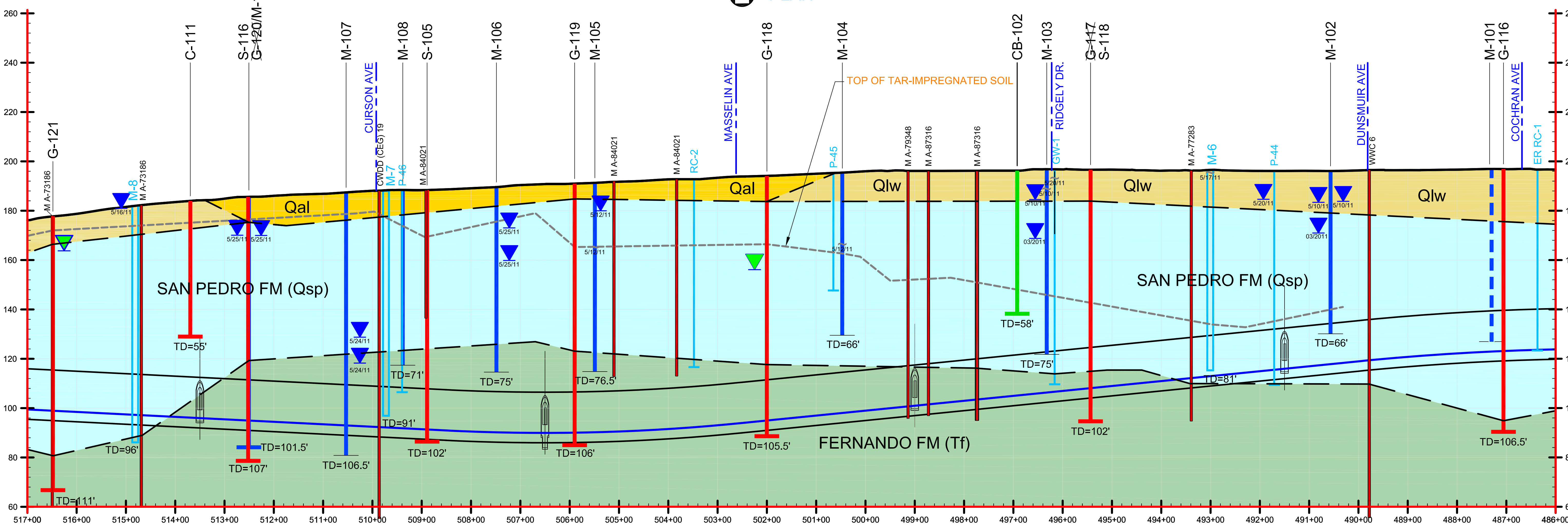


PLAN



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
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IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

STATION 486+00 to 517+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.5
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO

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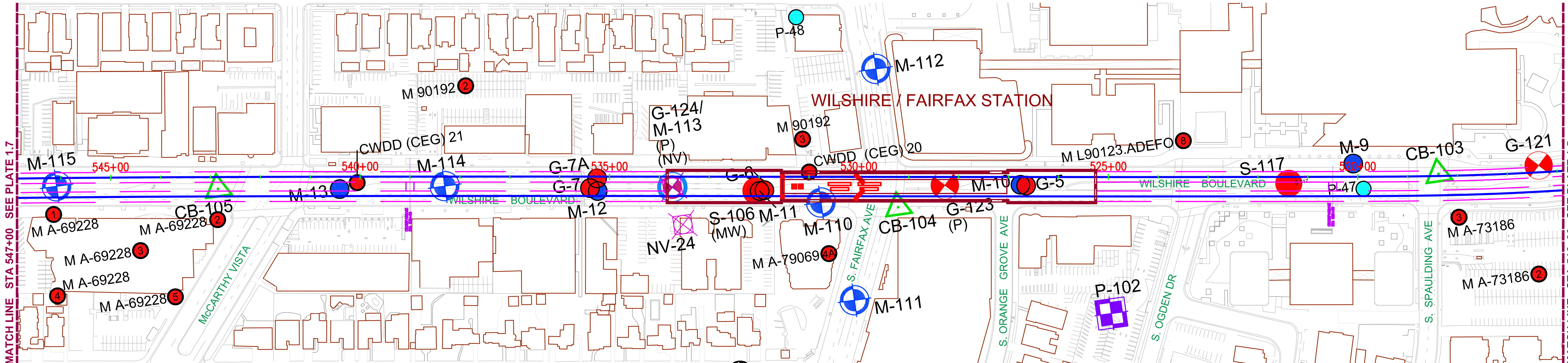
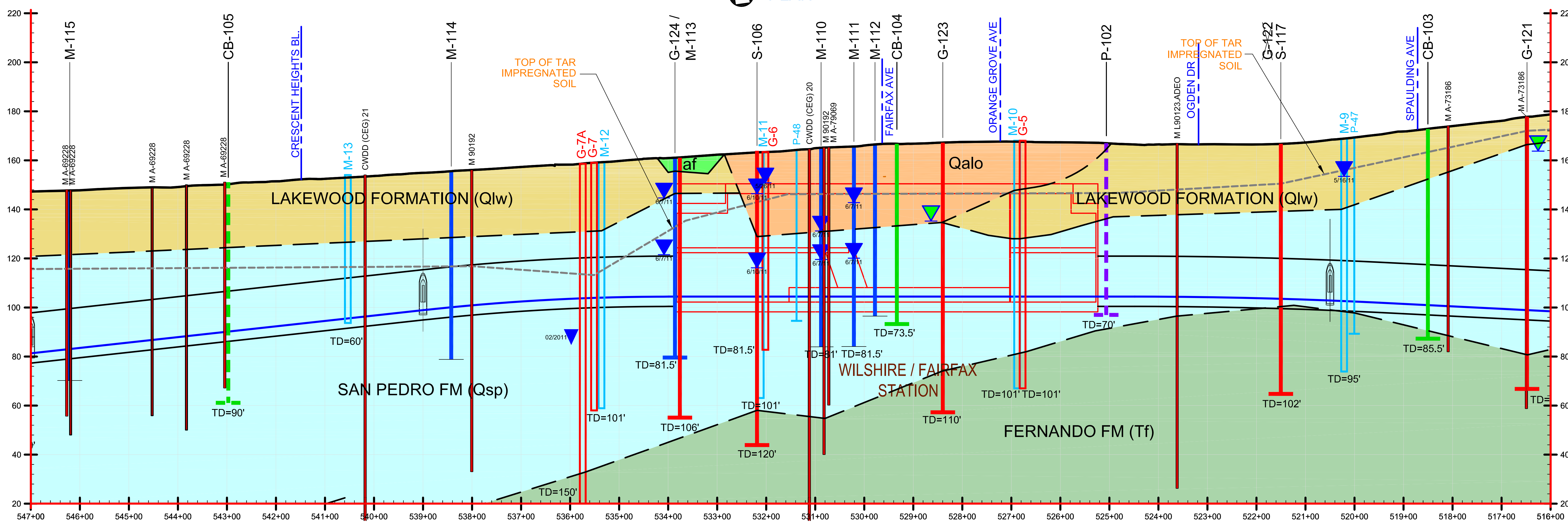


PLAN



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
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CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

STATION 516+00 to 547+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.6
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO

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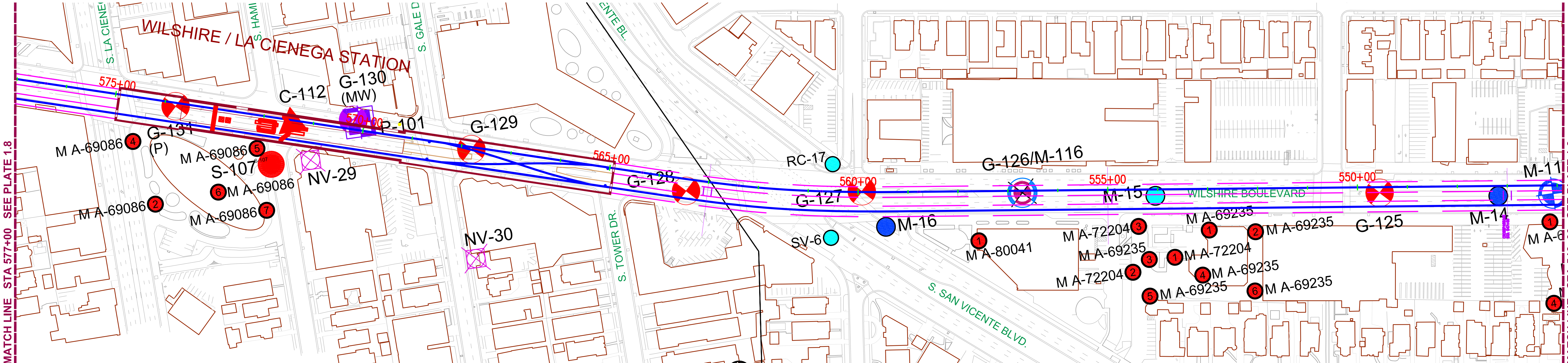

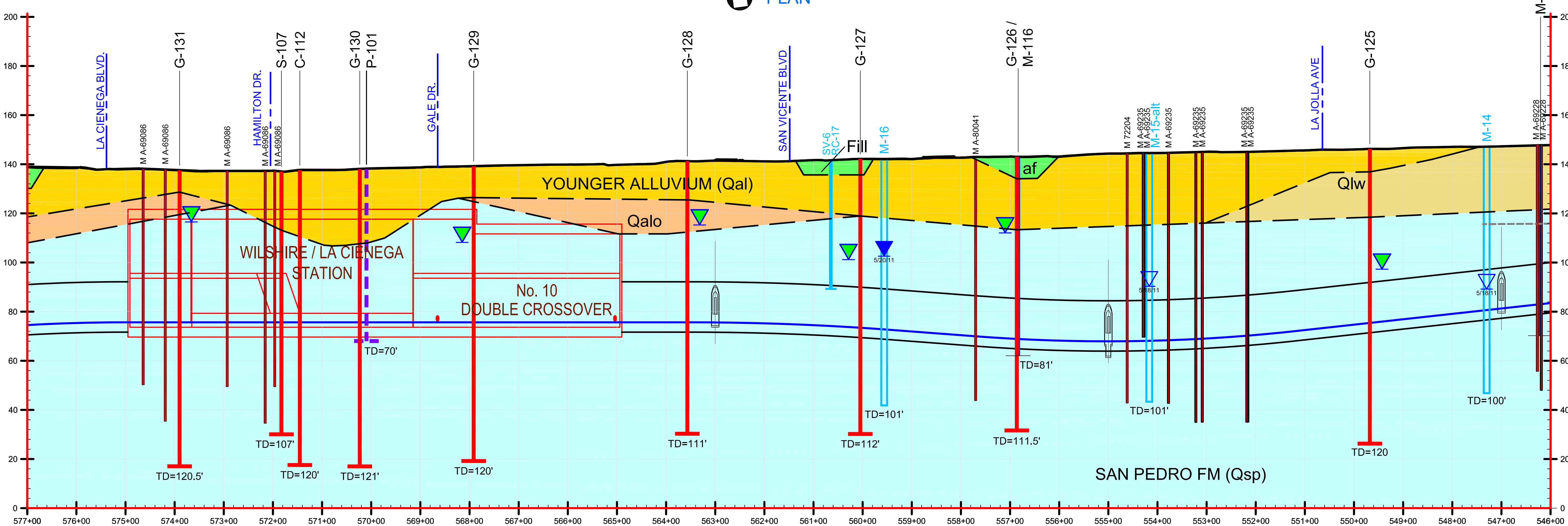

CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

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IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

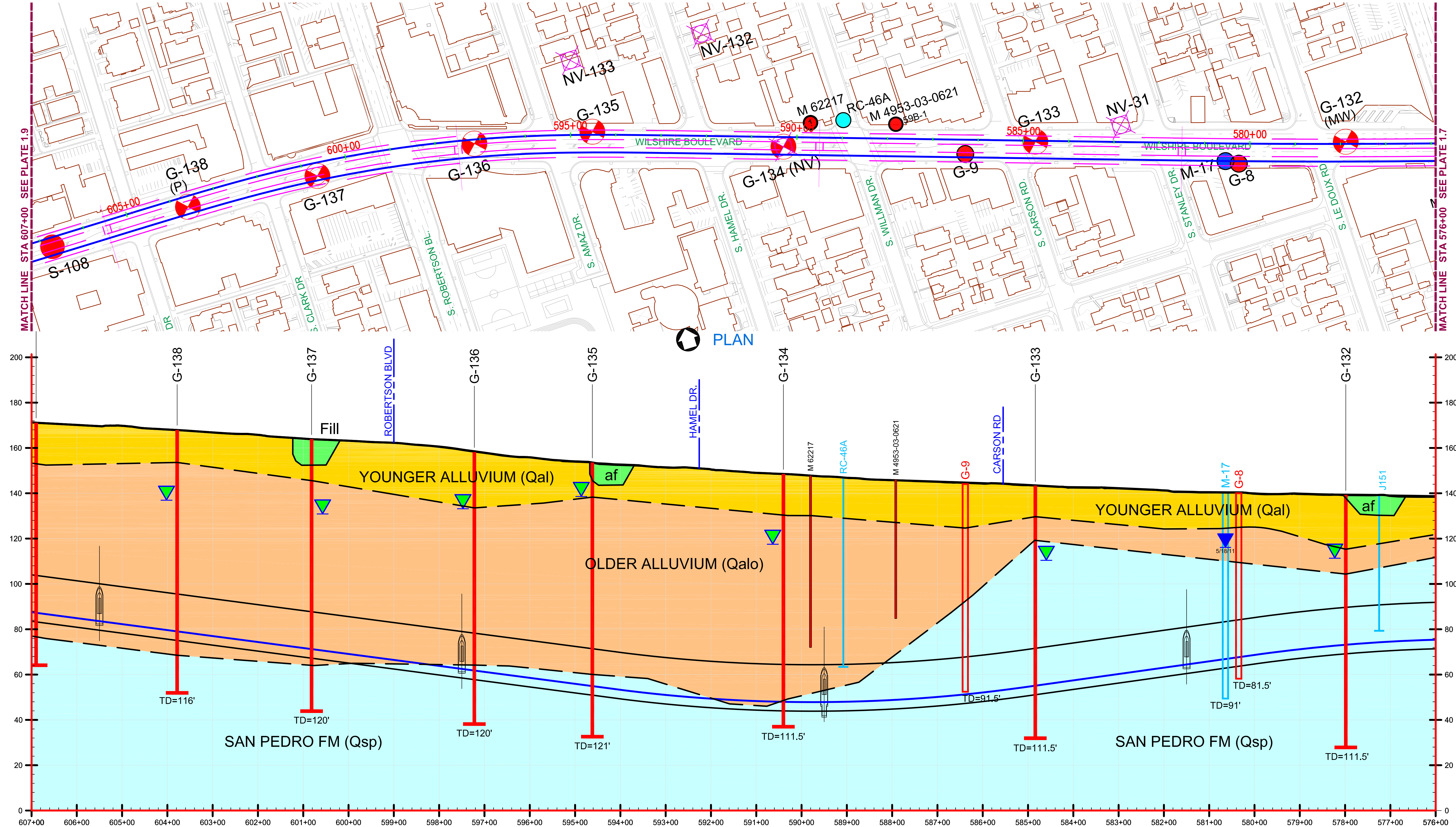
LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

STATION 546+00 to 577+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.7
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
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IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

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LOS ANGELES COUNTY
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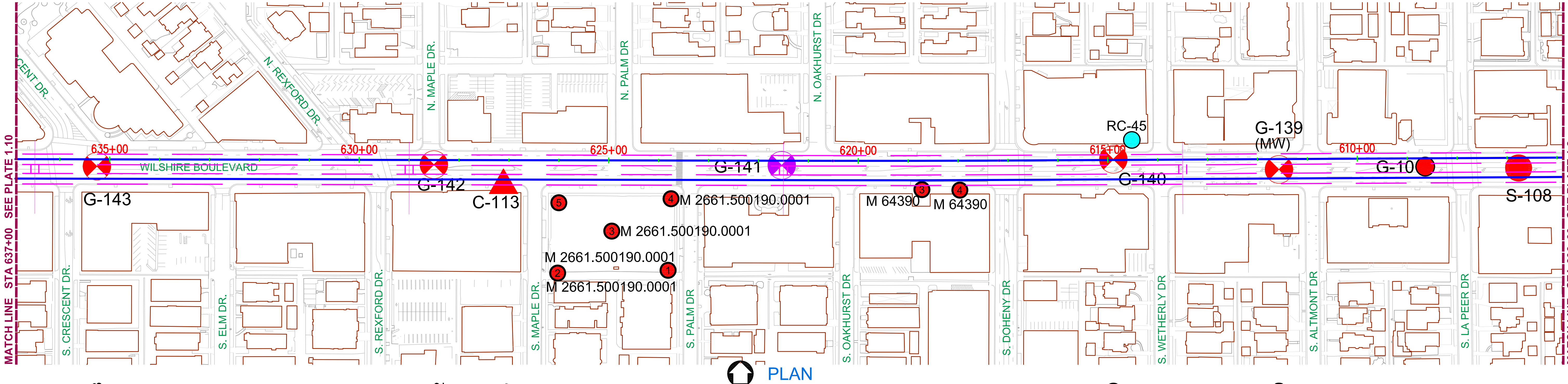
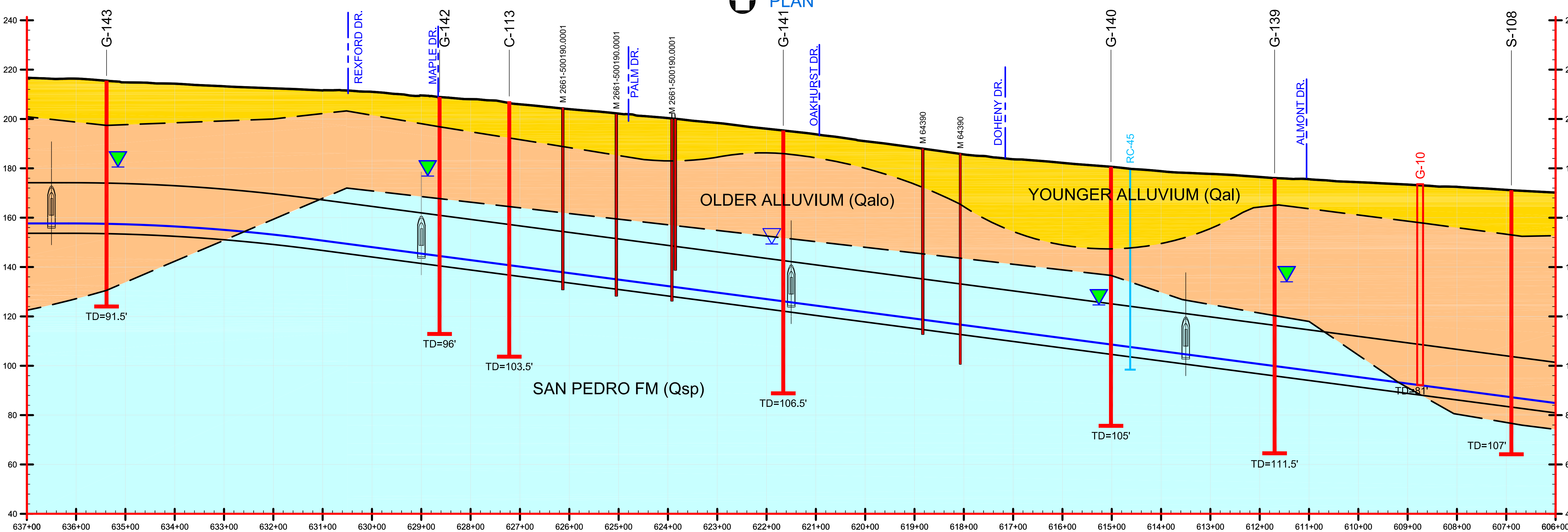
PB
PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE
STATION 576+00 to 607+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.8
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO





CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
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IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING

BORING PLAN AND GEOLOGIC PROFILE

STATION 606+00 to 637+00
LOCALLY PREFERRED ALIGNMENT (LPA)

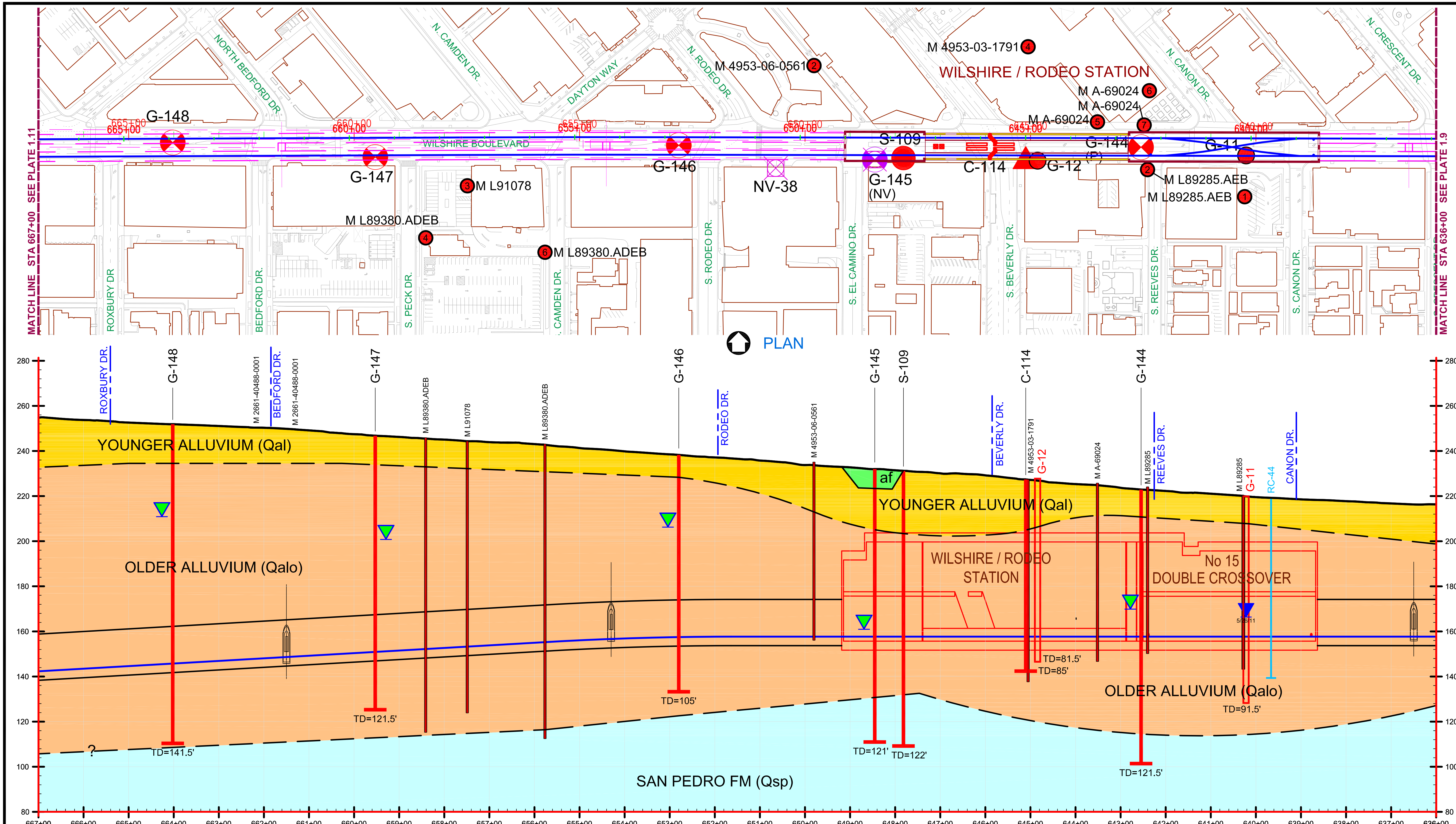
CONTRACT NO

DRAWING NO PLATE 1.9

REV

SCALE 1" = 200' (11x17" Sht.)

SHEET NO



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
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CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

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LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE
STATION 636+00 to 667+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.10
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO

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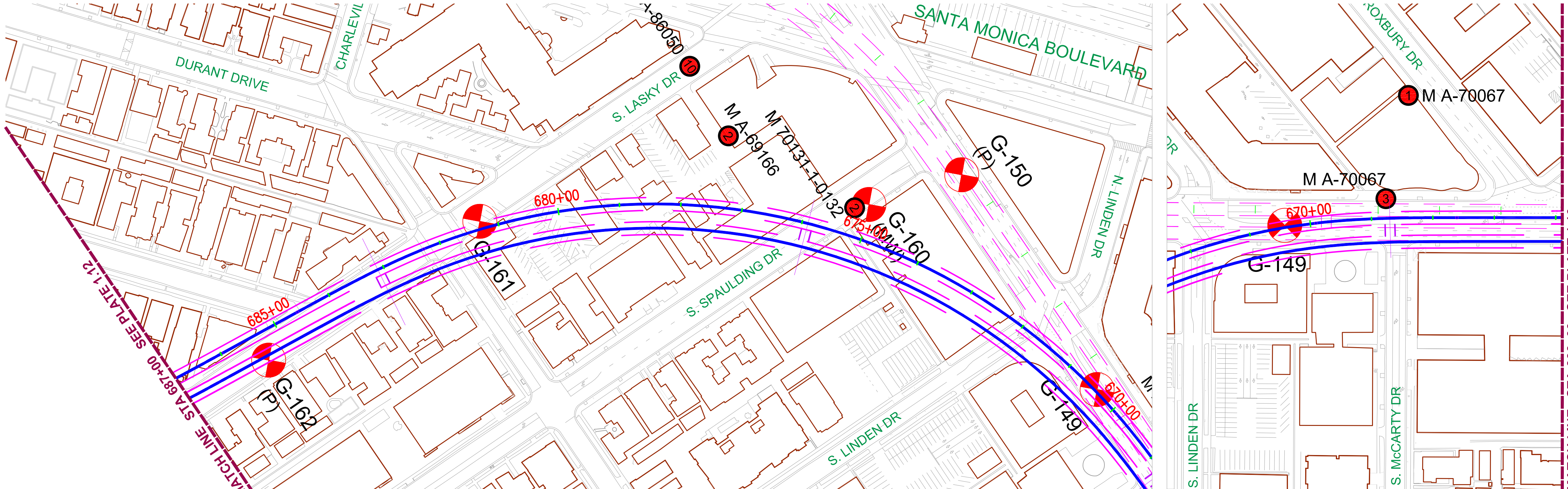
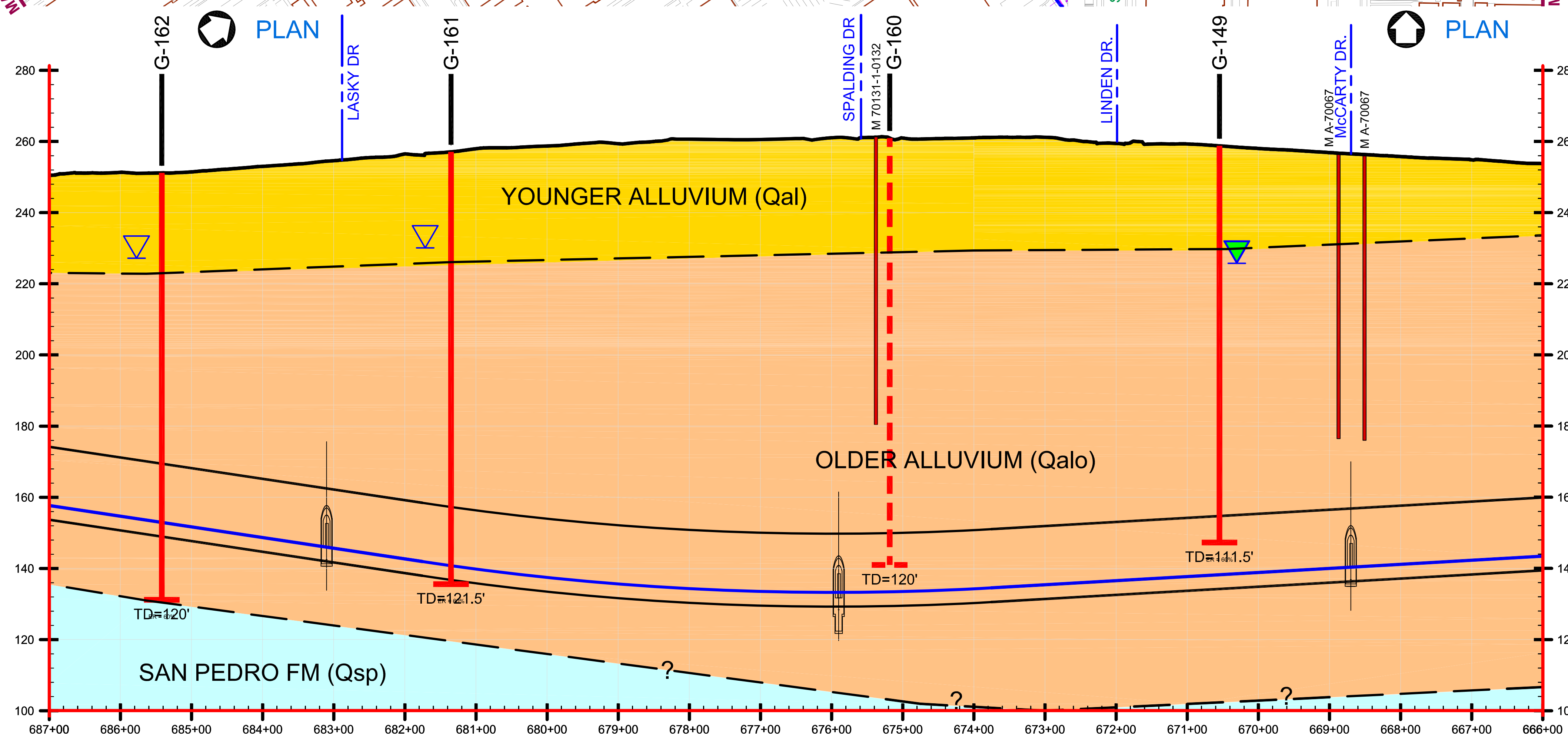




CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY

DRAWN BY L. MORLEY

CHECKED BY JAG / H.P.

IN CHARGE M. HUDSON

DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

STATION 666+00 to 687+00
LOCALLY PREFERRED ALIGNMENT (LPA)
ALONG CONSTELLATION BOULEVARD

CONTRACT NO

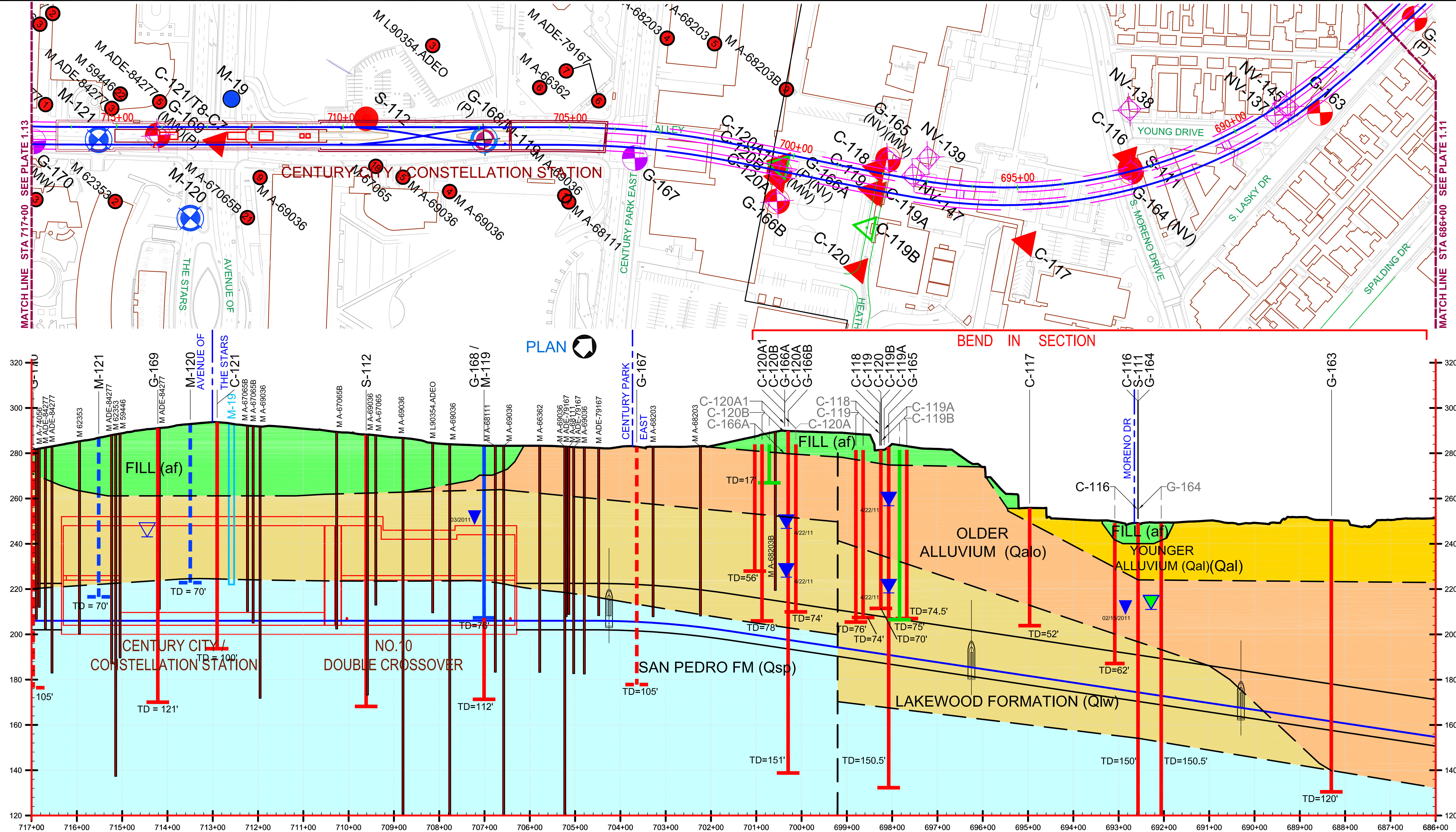
DRAWING NO PLATE 1.11

REV

SCALE 1" = 200' (11x17" Sht.)

SHEET NO

UserName: LAMORLEY Aug 09, 2011 @ 7:28pm FileName=> C:\Users\LAMorley\Documents\CAD\4953-10-1561_WSE\4953-10-1561_P&P-Prfl(2011.07.30).dwg [B11]



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
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IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

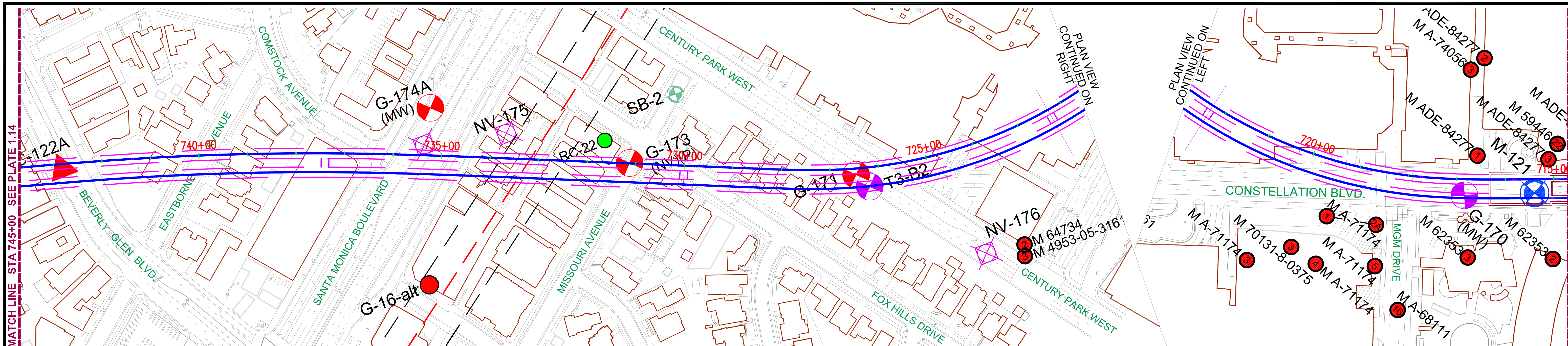
Metro

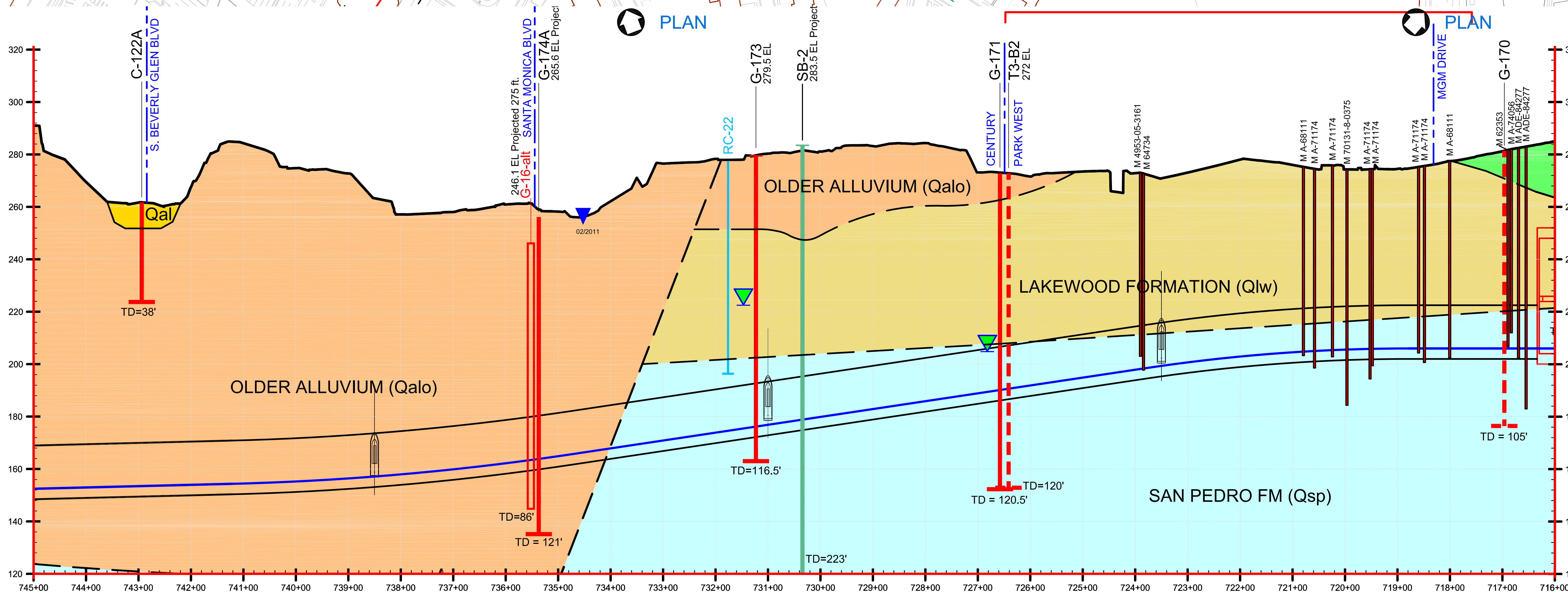
LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE
STATION 686+00 to 717+00
LOCALLY PREFERRED ALIGNMENT (LPA)
ALONG CONSTELLATION BOULEVARD

CONTRACT NO
DRAWING NO PLATE 1.12
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO





CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY

DRAWN BY L. MORLEY

CHECKED BY JAG / H.P.

IN CHARGE M. HUDSON

DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING

BORING PLAN AND GEOLOGIC PROFILE

STATION 716+00 to 745+00
LOCALLY PREFERRED ALIGNMENT (LPA)
ALONG CONSTELLATION BOULEVARD

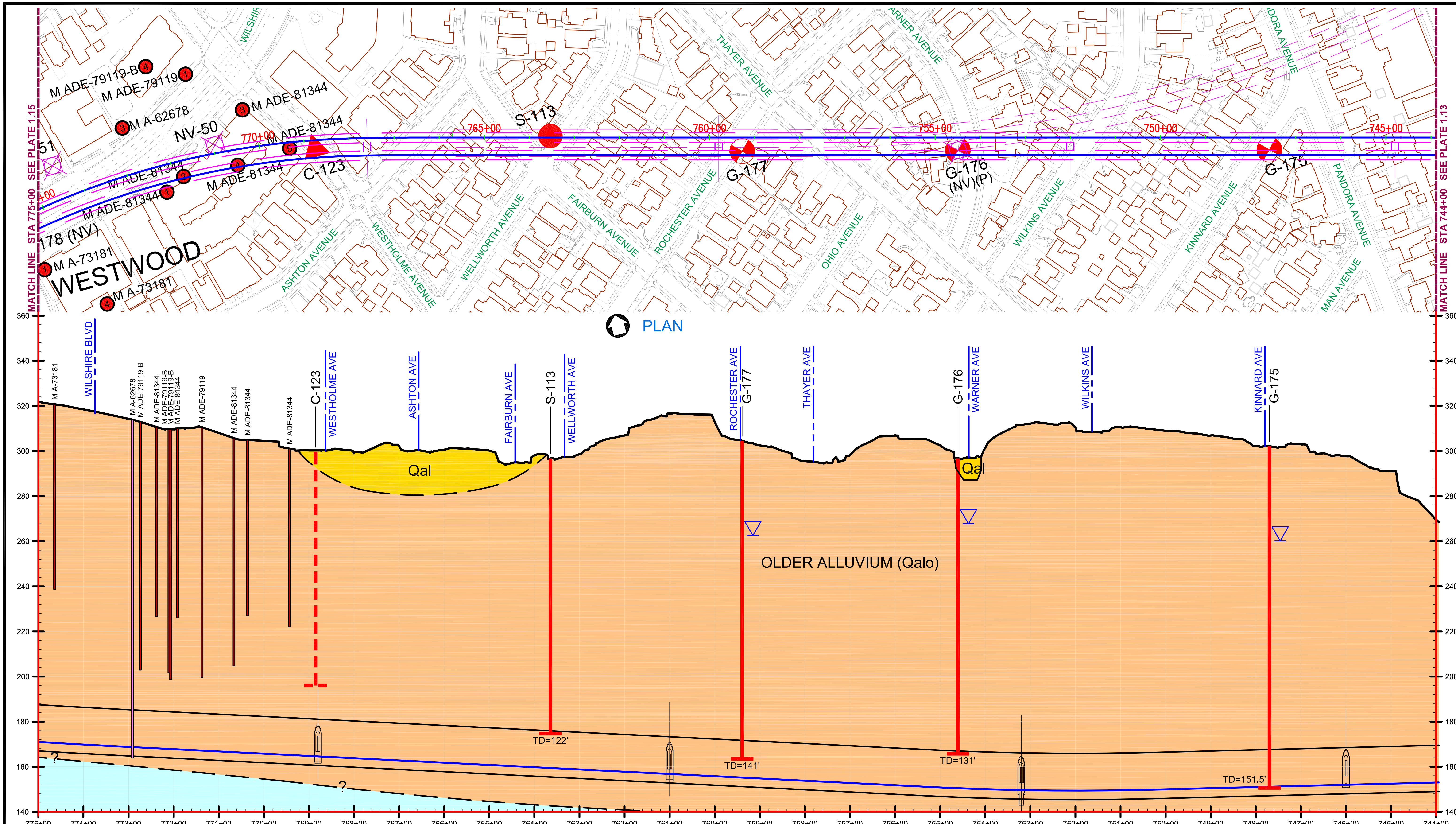
CONTRACT NO

DRAWING NO PLATE 1.13

REV

SCALE 1" = 200' (11x17" Sht.)

SHEET NO



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
DRAWN BY L. MORLEY
CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

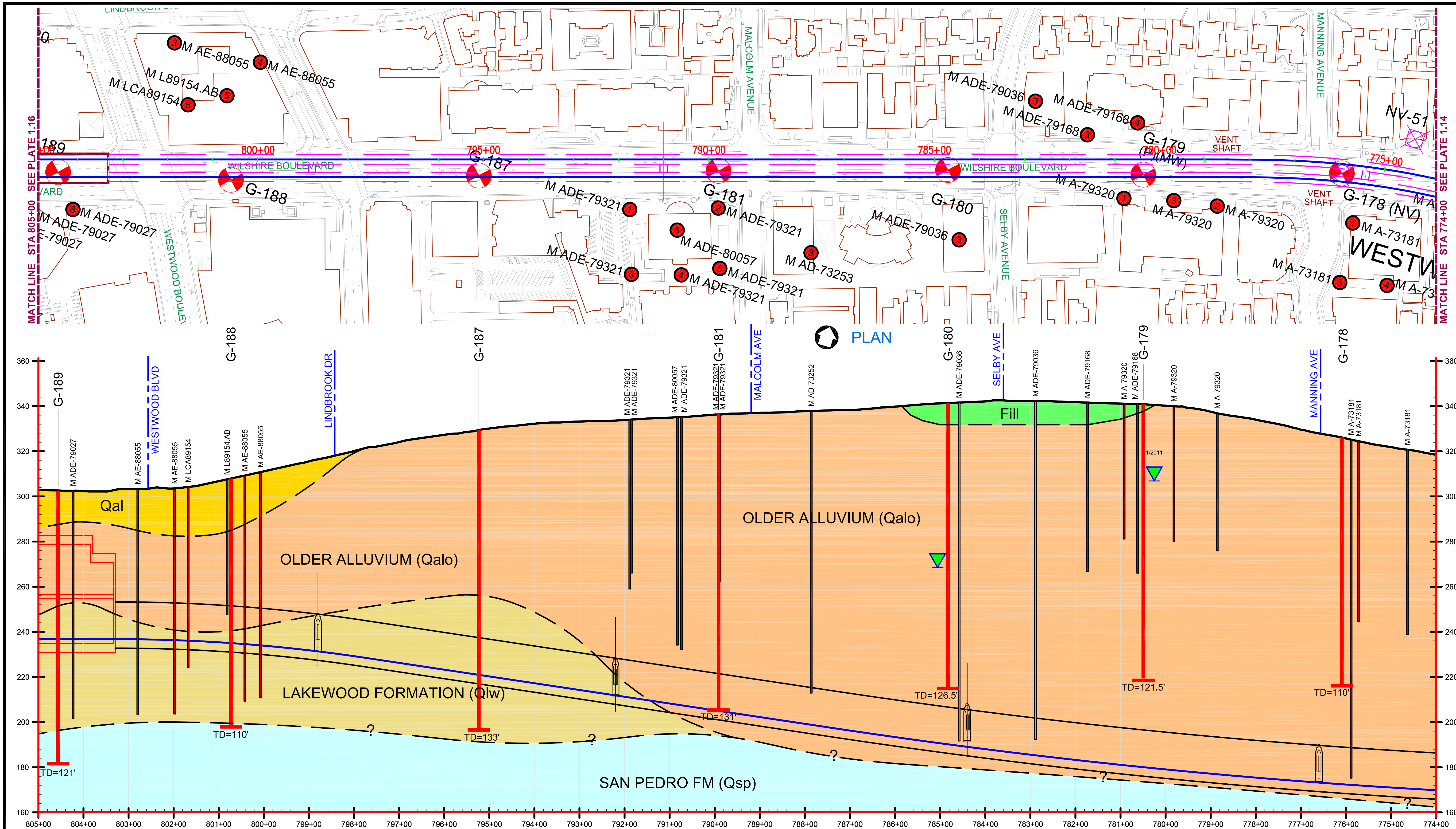
LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE
STATION 744+00 to 775+00
LOCALLY PREFERRED ALIGNMENT (LPA)
ALONG CONSTELLATION BOULEVARD

CONTRACT NO
DRAWING NO PLATE 1.14
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
DRAWN BY L. MORLEY
CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

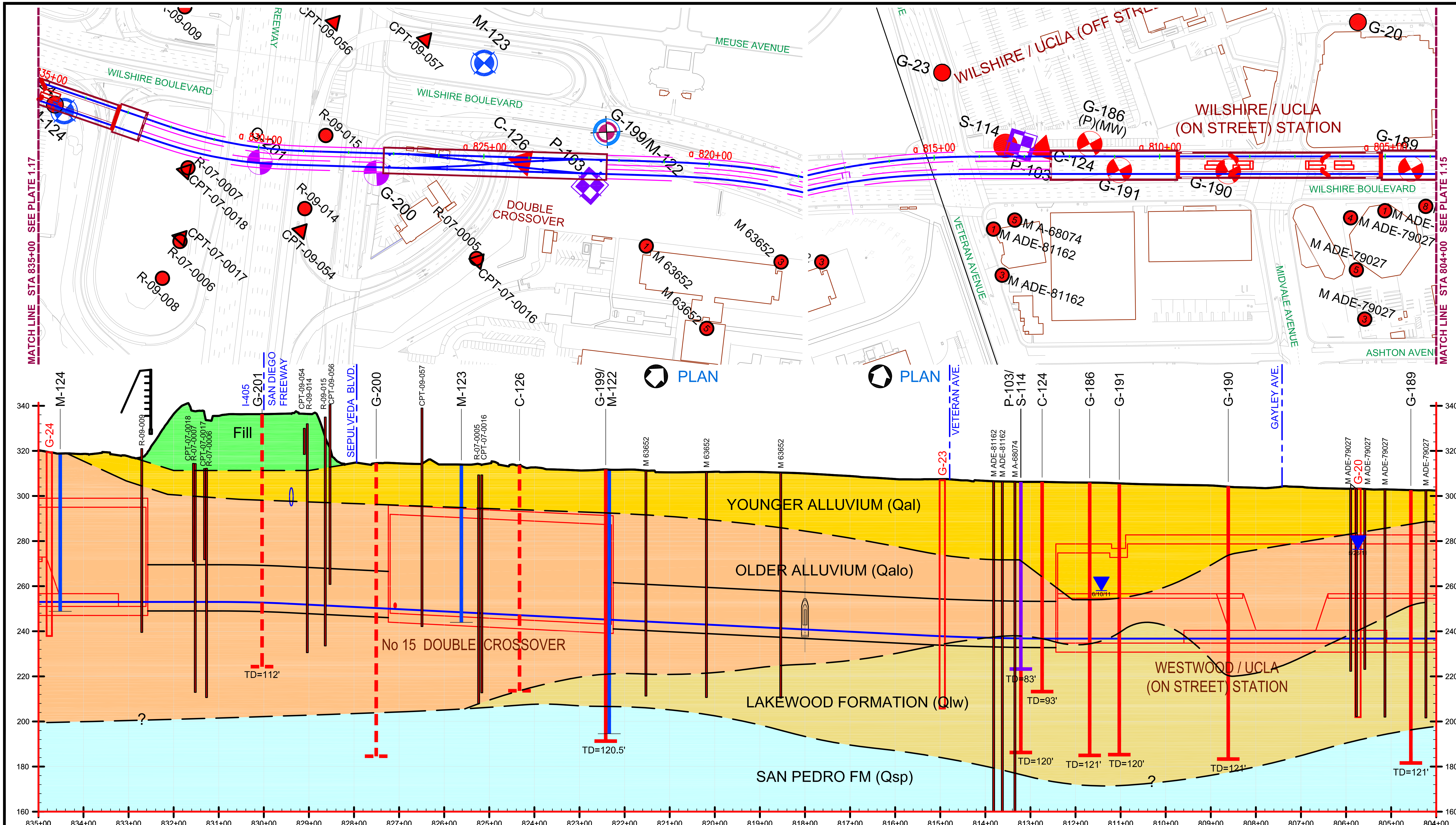
PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

STATION 774+00 to 805+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.15
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

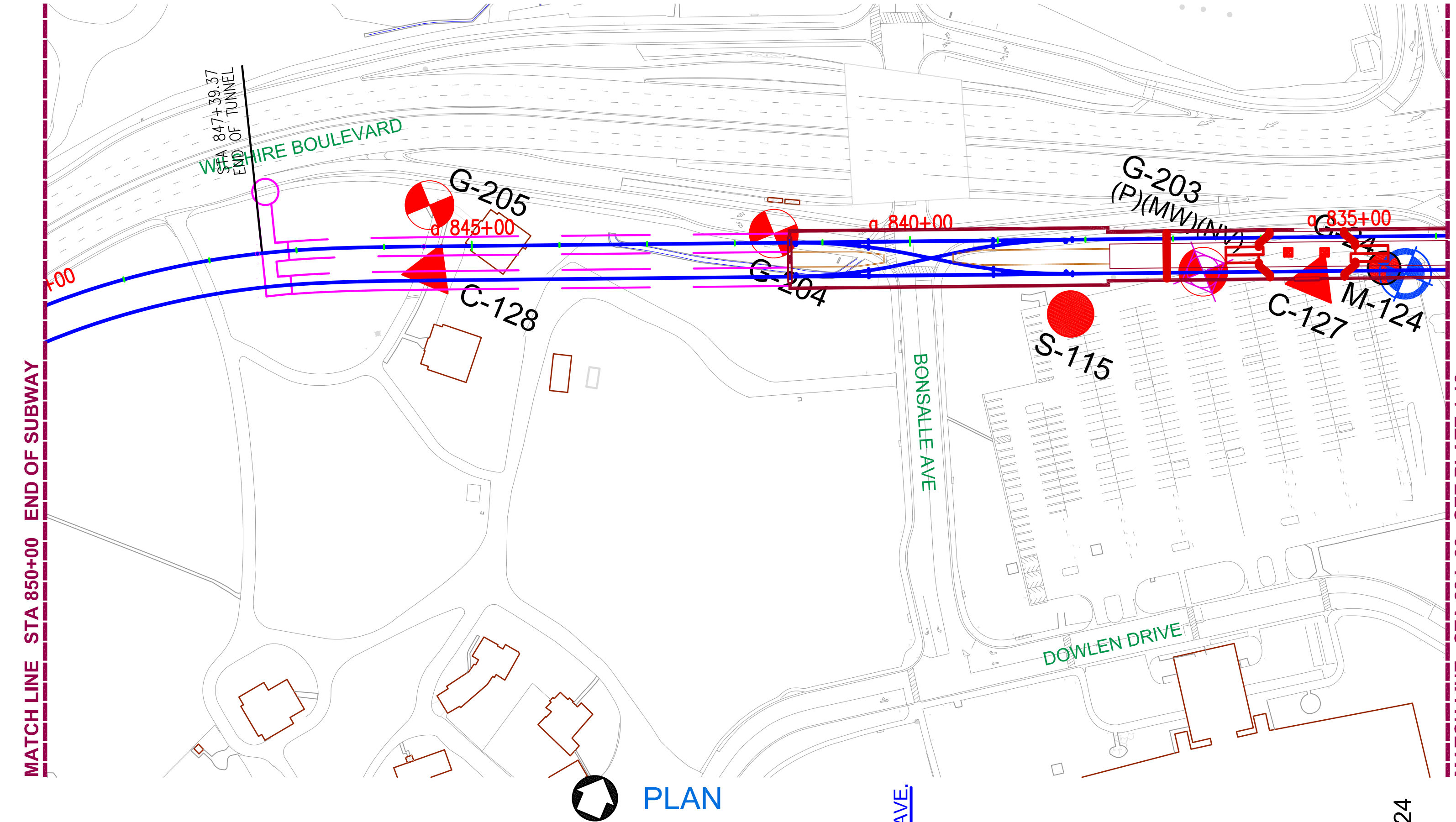
REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

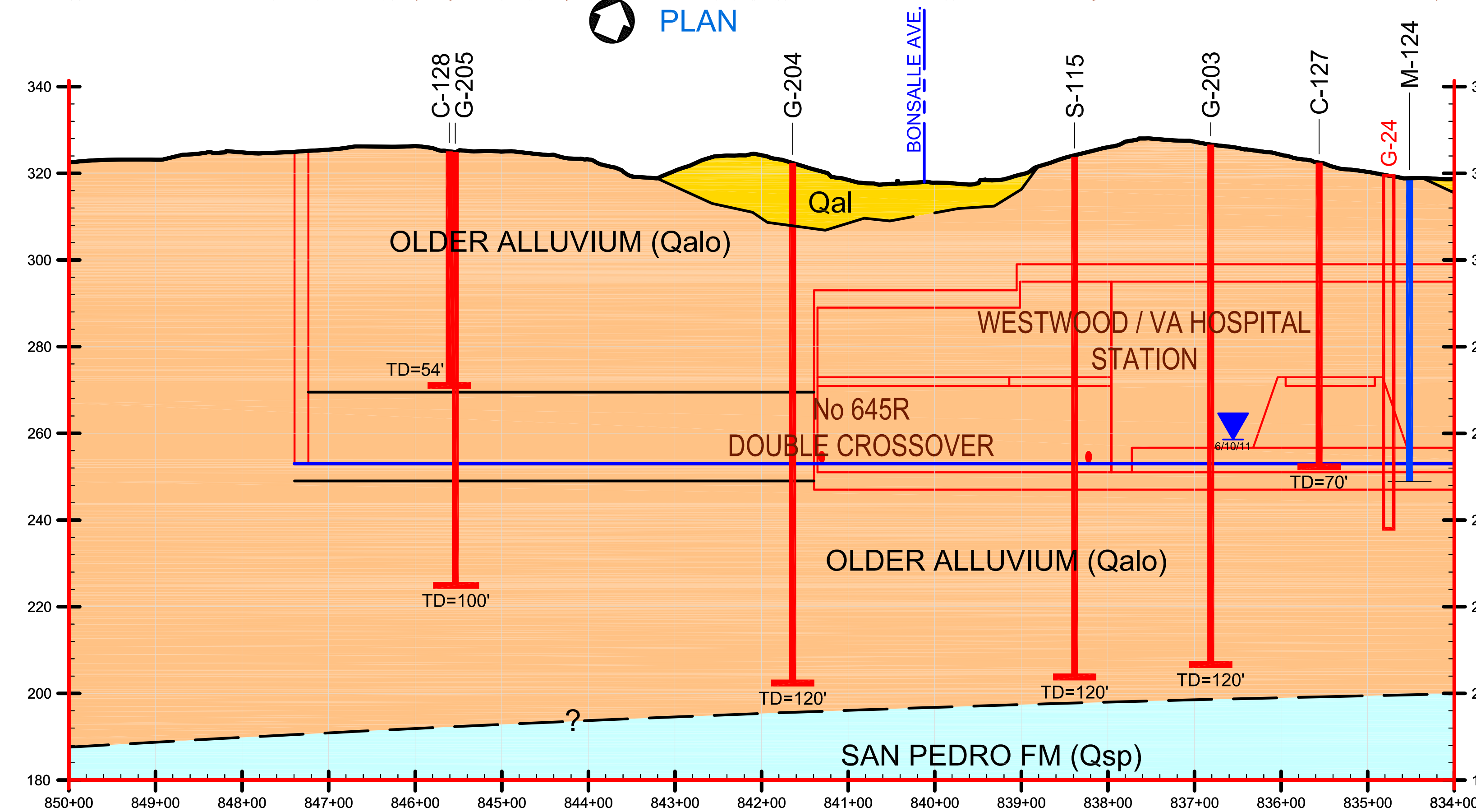
DESIGNED BY
DRAWN BY: L. MORLEY
CHECKED BY: JAG / H.P.
IN CHARGE: M. HUDSON
DATE: AUGUST 8, 2011

Metro
LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION AUTHORITY
PB
PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE
STATION 804+00 to 835+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO: PLATE 1.16
REV
SCALE: 1" = 200' (11x17" Sht.)
SHEET NO





PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
DRAWN BY L. MORLEY
CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

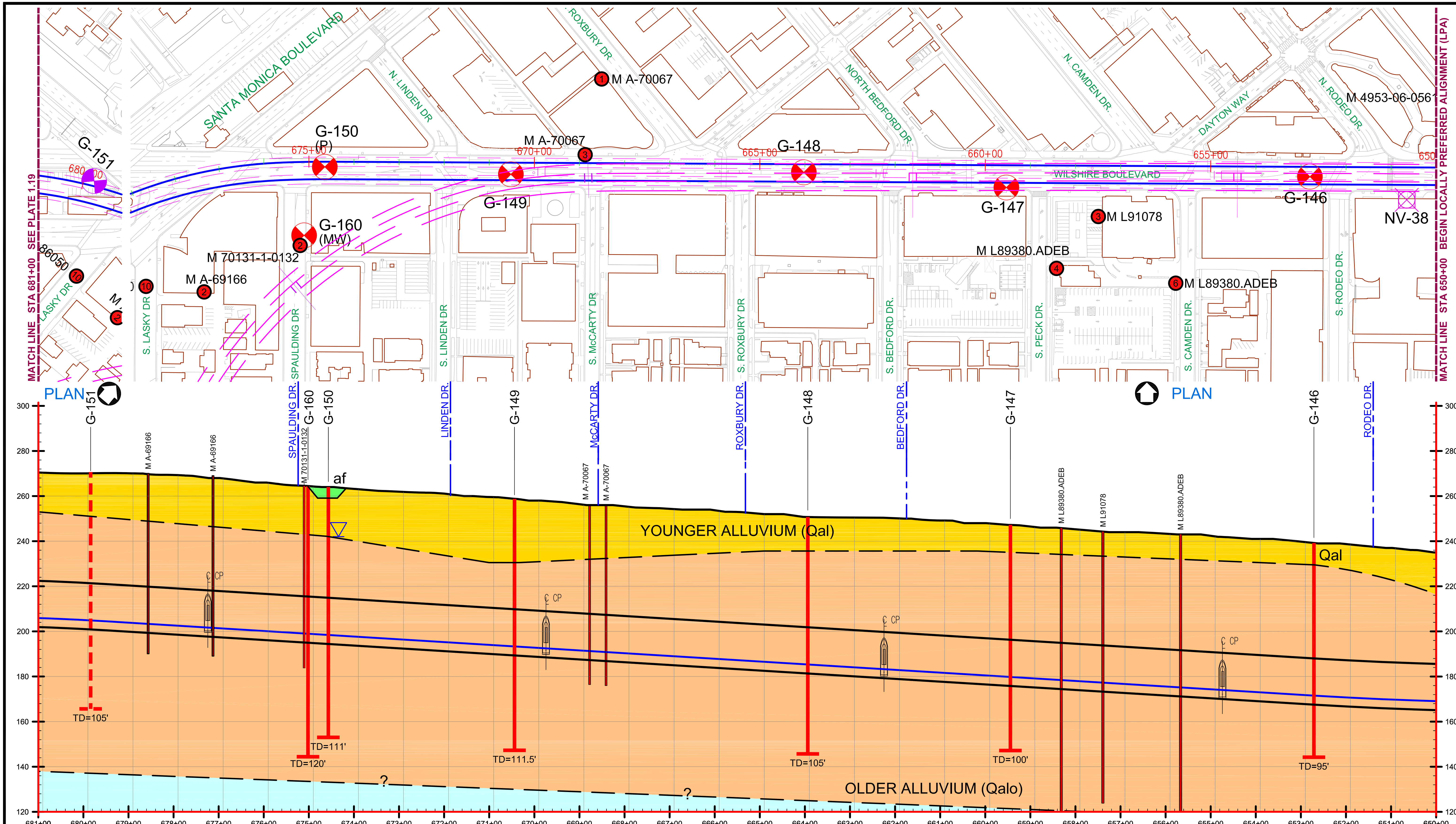
Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE
STATION 834+00 to 850+00
LOCALLY PREFERRED ALIGNMENT (LPA)

CONTRACT NO
DRAWING NO PLATE 1.17
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
DRAWN BY L. MORLEY
CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING

BORING PLAN AND GEOLOGIC PROFILE

STATION 650+00 to 681+00
LPA WITH SANTA MONICA OPTION

CONTRACT NO

DRAWING NO PLATE 1.18

REV

SCALE 1" = 200' (11x17" Sht.)

SHEET NO

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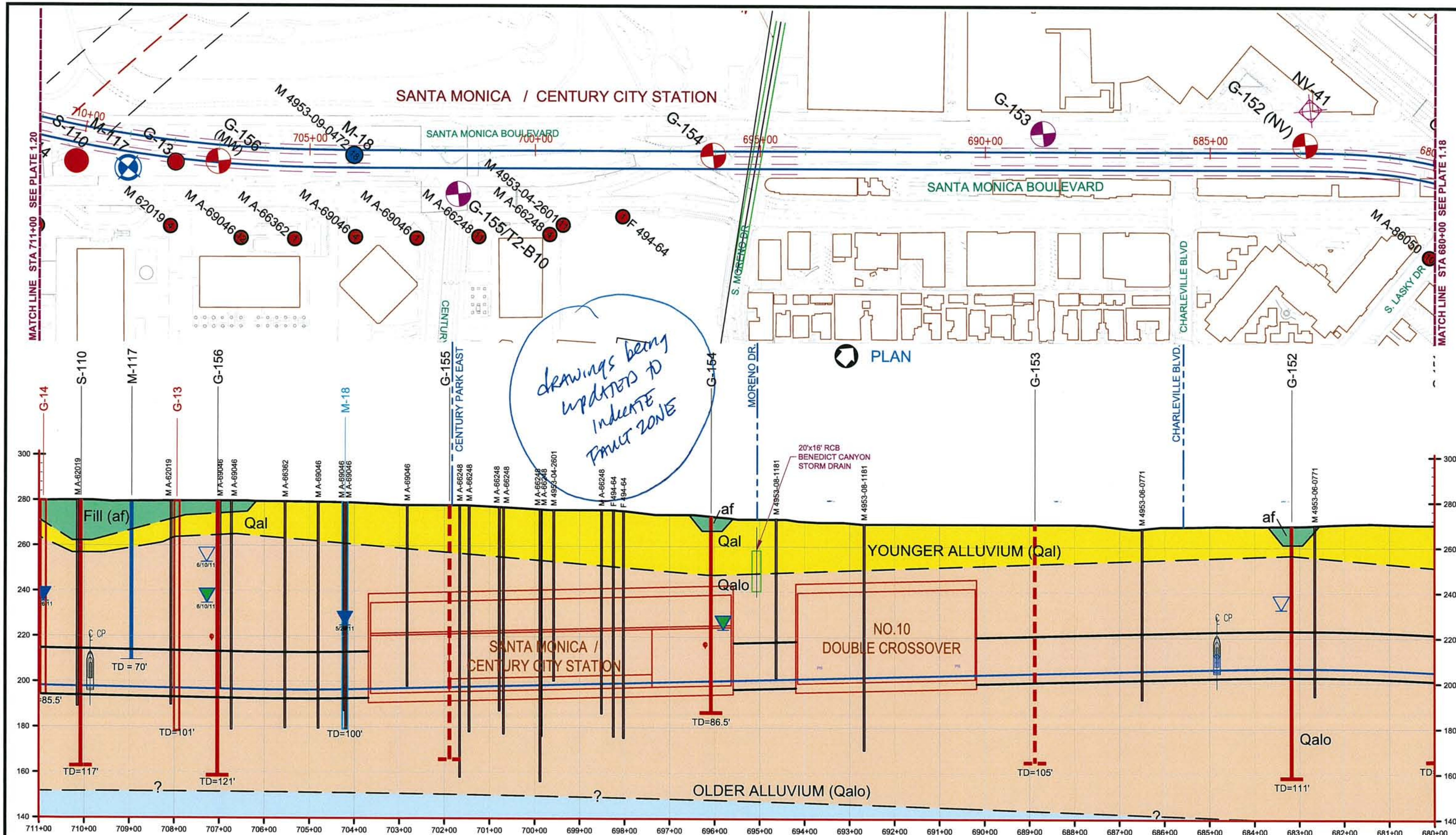


CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
DRAWN BY L. MORLEY
CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION AUTHORITY

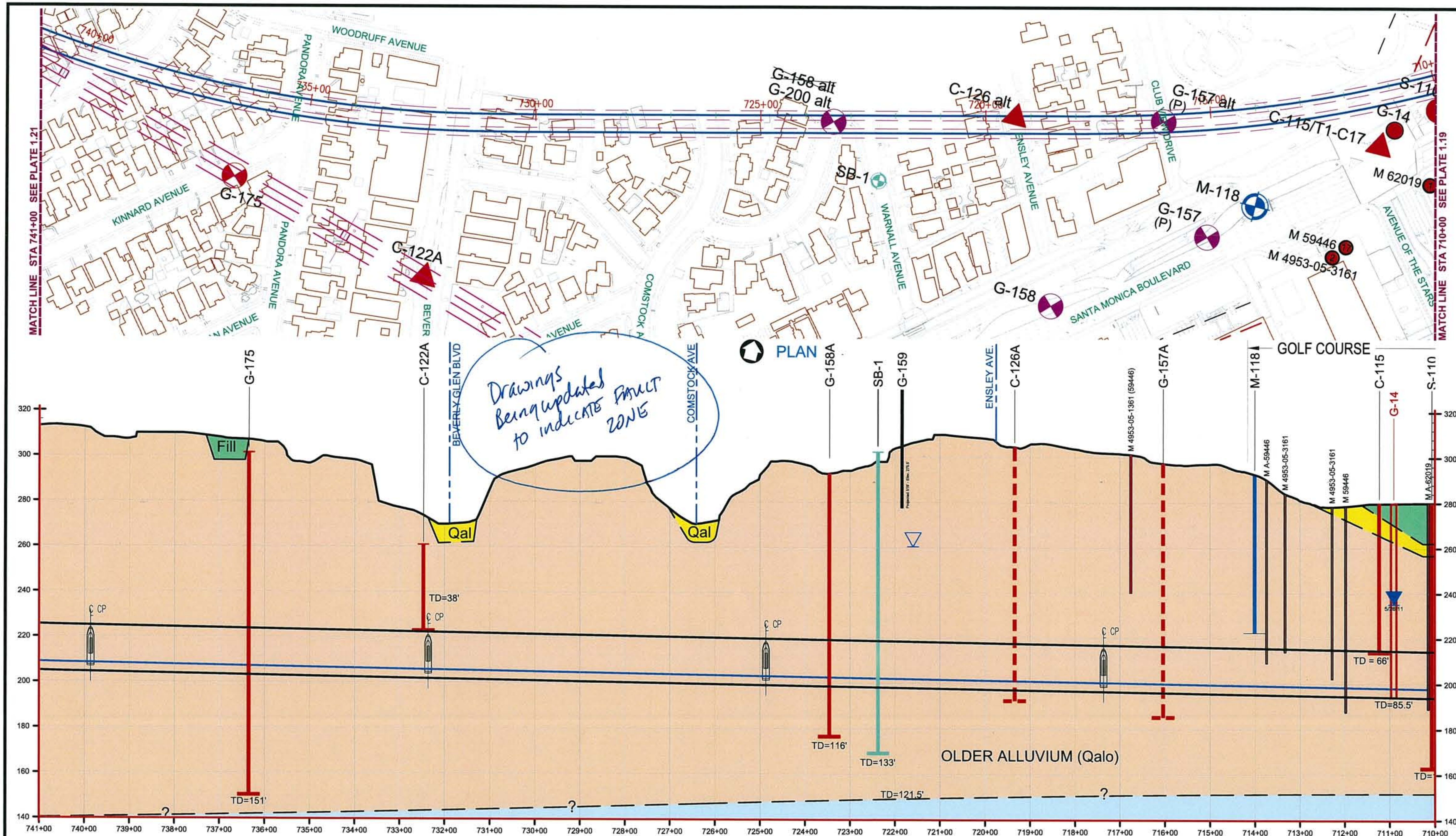
PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

STATION 680+00 to 711+00
LPA WITH SANTA MONICA OPTION

CONTRACT NO
DRAWING NO PLATE 1.19
REV
SCALE 1" = 200' (11x17" Sht.)
SHEET NO



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY
DRAWN BY L. MORLEY
CHECKED BY JAG / H.P.
IN CHARGE M. HUDSON
DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION AUTHORITY

PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING
BORING PLAN AND GEOLOGIC PROFILE

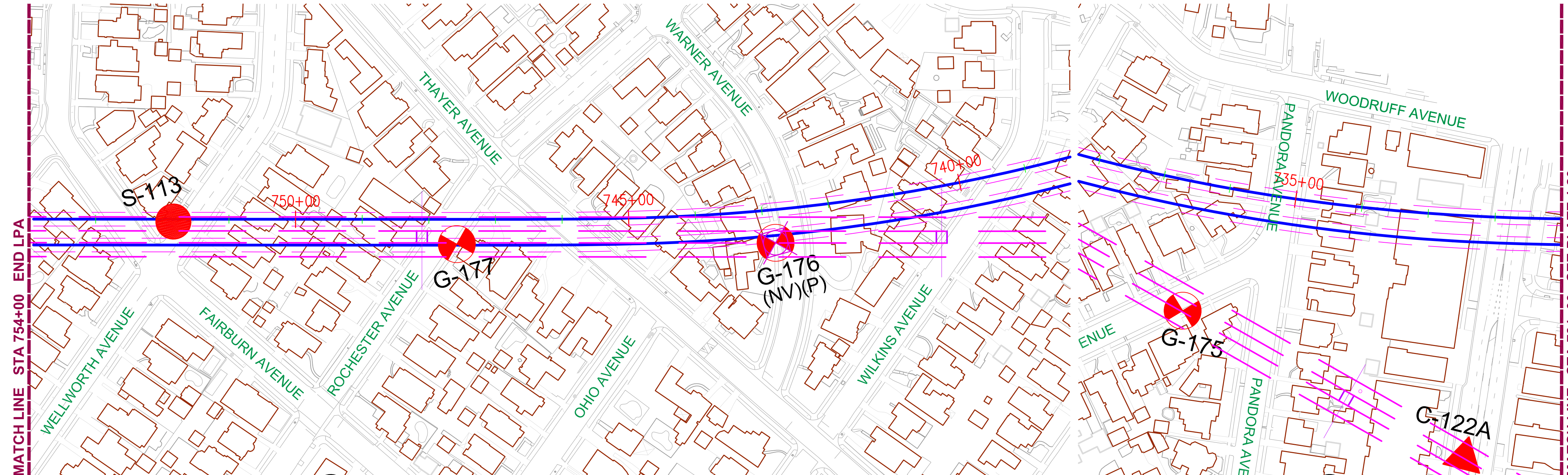
STATION 710+00 to 741+00
LPA WITH SANTA MONICA OPTION

CONTRACT NO

DRAWING NO PLATE 1.20 REV

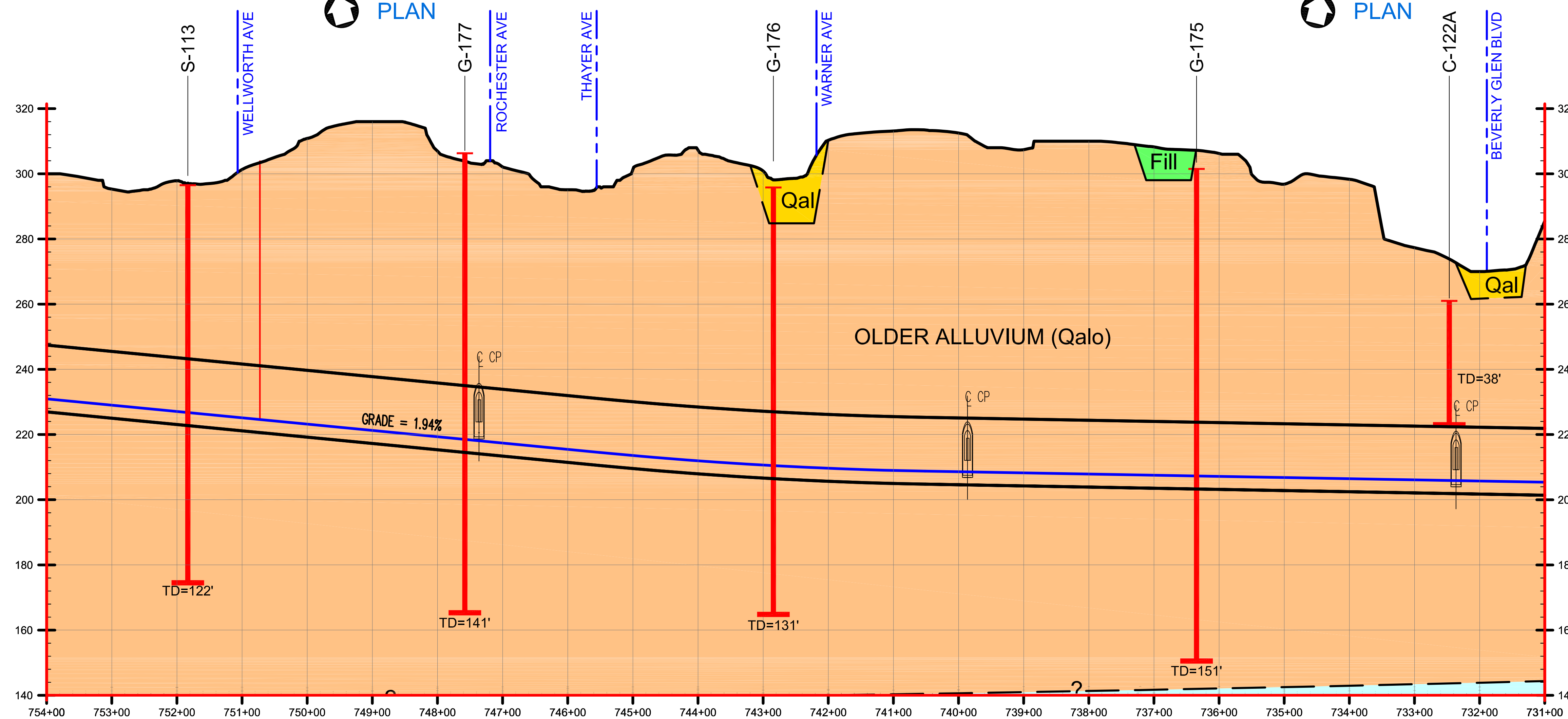
SCALE 1" = 200' (11x17" Sht.)

SHEET NO



PLAN

PLAN



CONCEPTUAL ONLY - SUBJECT TO CHANGE DURING PE AND FINAL DESIGN.

PROFILE: H=200', V=40' VERTICAL EXAGGERATION = 5:1

REV	DATE	BY	APP	REG NO	EXPIRES	SEAL HOLDER	DESCRIPTION

DESIGNED BY

DRAWN BY L. MORLEY

CHECKED BY JAG / H.P.

IN CHARGE M. HUDSON

DATE AUGUST 8, 2011

Metro

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

PB

PROJECT MANAGER

WESTSIDE SUBWAY EXTENSION
PRELIMINARY ENGINEERING

BORING PLAN AND GEOLOGIC PROFILE

STATION 731+00 to 754+00
LPA WITH SANTA MONICA OPTION

CONTRACT NO

DRAWING NO PLATE 1.21

REV

SCALE 1" = 200' (11x17" Sht.)

SHEET NO