Appendix 6.0

Fault Hazard Evaluation Report for the Proposed Camelia Residential Community

EARTH STRATA GEOTECHNICAL SERVICES, INC.

June 8, 2016 Project No. 15805-10A

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Subject: **Fault Hazard Evaluation Report for the Proposed Camelia Residential Community, Assessor's Parcel Number 380-220-003, Located North/East of the Transition of Palomar Street to Washington Avenue, City of Wildomar, Riverside County, California**

Earth-Strata is pleased to present our fault evaluation report for the proposed Camelia residential development, Assessor's Parcel Number 380-220-003, north/east of the transition of Palomar Street to Washington Avenue, in the City of Wildomar, Riverside County, California. This work was performed in accordance with the scope of work described in our proposal, dated April 30, 2015. The purpose of this study is to evaluate the nature, distribution, engineering properties, and geologic strata underlying the site with respect to the proposed development.

Earth-Strata appreciates the opportunity to offer our consultation and advice on this project. In the event that you have any questions, please do not hesitate to contact the undersigned at your earliest convenience.

Respectfully submitted,

EARTH-STRATA, Inc.

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INTRODUCTION

Earth-Strata is pleased to present our preliminary geotechnical interpretive report for the proposed development. The purpose of this study was to evaluate the nature, distribution, engineering properties, and geologic strata underlying the site with respect to the proposed development, and then provide preliminary grading recommendations based on the plans you provided. The general location of the subject property is indicated on the Vicinity Map, Figure 1. The plans you provided were used as the base map to show geologic conditions within the subject site, see Geotechnical Map, Plate 1.

SITE DESCRIPTION

The subject property is located north/east of the transition of Palomar Street to Washington Avenue, and northeast of the intersection of Washington Avenue with the Wildomar/Murrieta border, in the City of Wildomar in Riverside County, California. The approximate location of the site is shown on the Vicinity Map, Figure 1.

The subject property is comprised of approximately 31 acres of undeveloped land. The has undergone various degrees of grading including; a large crescent shaped cut from the northern and western portion of Chaney Hill (the high point in the southern portion of the site) as part of grading/borrow excavations and which removed the original toe of the slope and dug down into the central portion of the site; as well as relatively minor grading associated with the existing dirt roads and small pad areas of former houses. Topographic relief at the subject property ranges from generally flat in the northwestern and central portions of the site, to relatively high in the northeastern portion of the site. From the generally flat areas the hills rise relatively steeply from near the northeast borders to the northeast, and rise moderately to the south, except for the steep cut slope in the approximate center of the southern hill. Elevations at the site range from approximately 1,190 to 1,270 feet above mean sea level (msl), for a difference of about 80± feet across the entire site. Drainage across the site is in all directions down from topographic highs, but predominant drainage is southwest from the hills bordering the northeastern portion of the site.

The site is currently bordered by Palomar Road/Washington Avenue to the west, open land to the north and northeast, and an existing residential development to the south and southeast. Most of the vegetation on the site consists of moderate to dense amounts of annual weeds/grasses, dense brush along natural slopes and some scattered trees.

PROPOSED DEVELOPMENT AND GRADING

The proposed residential development is expected to consist of concrete, wood or steel framed one- and/or two-story structures utilizing slab on grade construction with associated streets, landscape areas, pool, greenspaces/parks, associated utilities, a realignment of Palomar Street/Washington Avenue and northwest extension of Jefferson Avenue. The current development plans include numerous building pads positioned throughout the site.

The plans provided by you were utilized in our exploration and form the base for our Fault Hazard Investigation Site Plan, Plate 1.

GEOLOGIC SETTING

Regional Geology

Regionally, the site is located in the Peninsular Ranges Geomorphic Province of California. The Peninsular Ranges are characterized by northwest trending steep mountain ranges separated by sediment filled elongated valleys. The dominant structural geologic features reflect the northwest trend of the province. Associated with and subparallel to the San Andreas Fault are the San Jacinto Fault, Newport-Inglewood, and the Whittier-Elsinore Fault. The Santa Ana Mountains abut the west side of the Elsinore Fault while the Perris Block forms the other side of the fault zone to the east. The Perris Block is bounded to the east by the San Jacinto Fault. The northern perimeter of the Los Angeles basin forms part of a northerly dipping blind thrust fault at the boundary between the Peninsular Ranges Province and the Transverse Range Province.

The mountainous regions within the Peninsular Ranges Province are comprised of Pre-Cretaceous, metasedimentary, and metavolcanic rocks along with Cretaceous plutonic rocks of the Southern California Batholith. The low lying areas are primarily comprised of Tertiary and Quaternary non-marine alluvial sediments consisting of alluvial deposits, sandstones, claystones, siltstones, conglomerates, and occasional volcanic units. A map illustrating the regional geology is presented on the Regional Geologic Map, Figure 2.

Local Geology

Locally the site is located southwest of the small range of hills located between Interstate 15 and Palomar Street/Washington Avenue. While the range of hills as a whole is unnamed on geologic maps, the small hill comprising the high point in the southern corner of the site is mapped as "Chaney Hill" on some geologic maps. The range is related to uplift associated with the Wildomar Fault Zone which trends generally along the southwestern toe of the hills; while Chaney Hill likely represents a compression feature due to the strike slip movement within the fault zone.

Geologic units within the vicinity of the site generally consist of a southeast trending ridge of elevated bedrock units and southwest flowing alluvial deposits which let out into the northwest-southeast trending valley area where they incise and interfinger the alluvial valley deposits. Morton (2004) and Kennedy (2003) mapped the elevated hills as Quaternary Pauba Formation (shown on Morton as Qps, and on Kennedy as Qpfs); both Morton and Kennedy describe the Pauba formation as a moderately well indurated, cross-bedded sandstone with sparse cobble to boulder conglomerate beds. Both map low lying areas southwest of the elevated hills as Quaternary Young Alluvial Valley Deposits (Qyv). Approximately halfway through the Wildomar Fault Zone, northeast of the houses on the northeast side of Aubury Avenue, the faulted hills switch to Quaternary/Tertiary Wildomar Conglomerate (Morton as QTwc, Kennedy as QTcw). We have used the Morton (2004) as the base for our Regional Geology Map (see Figure 2).

Faulting

The project is located in a seismically active region and as a result, significant ground shaking will likely impact the site over the design life of the proposed project. The geologic structure of the entire southern California area is dominated by northwest-trending faults associated with the San Andreas Fault system, which accommodates for most of the right lateral movement associated with the relative motion between the Pacific and North American tectonic plates. Known active faults within this system include the Newport-Inglewood, Whittier-Elsinore, San Jacinto and San Andreas Faults.

The site is located within an Alquist-Priolo (AP) Earthquake Fault Zone for the Wildomar Fault (see Figure 3 – AP Fault Zone Map), established by the State of California to restrict the construction of new habitable structures across identifiable traces of known active faults. An active fault is defined by the State of California as having surface displacement within the past 11,000 years or during the Holocene geologic time period. Plate 1 shows the western extent of the AP zone across the site.

There are also several Riverside County faults shown projecting through various portions of the site as shown on the Riverside County GIS (see Figure 4 – Riverside County GIS Fault Map).

Previous Investigations

As part of our investigation, reports of previous investigations by other firms for the surrounding sites were reviewed. The locations of these investigations and their relation to the subject site and mapped fault traces are shown on Figure 4. The findings of investigations for four projects approved by the County of Riverside were used in our investigation. Combined with our investigation these approved reports provide coverage across the entirety of the subject site and adequately account for the location and activity of Fault Traces A through H presented on Figure 4.

- Inland Foundation (GEO 02360): Conducted for the now existing Sycamore Academy on the parcel south of the intersection of Palomar Street and Harwood Lane, approximately 0.42 miles north of the northern boundary of the subject site (see Figure 4). The report addresses the AP Zone for the Wildomar Fault as well as a Riverside County fault (Trace A on Figure 4) which, while unnamed, is generally associated with Wildomar Fault Zone. This investigation entailed excavation of one 4227-foot fault trench across the northeastern half of the site; perpendicular to Palomar Street and the general trend of faults in the area. The trench exposed unfaulted alluvium across the majority of the trench; however, at approximately Station 3+71 the trench exposed faulted Pauba Formation bedrock and faulted alluvium. The trend of the fault was measured as N45°W/90°, and the uplift of the Pauba formation indicates down-to-east displacement. The fault was located approximately 100 feet northeast of the location shown on the Riverside County GIS (Fault Trace A on Figure 4) and 36 to 55 feet northeast of the lineament shown on Figure 5. We have noted a southwest offset of Riverside County GIS from actual fault locations in two other reports completed for projects in the Murrieta/Temecula area (ESGS, 2016a, 2016b); this would appear to be an issue with the overall alignment of the fault overlays.

  The report established a 50-foot setback from the fault trace located in T-1. This investigation also cleared the site to the edge of Palomar Street (from the fault trace northeast) and established a setback 50-feet into the site from the edge of the fault trench. See Figure 5 for fault, trench and setback locations.

- T.H.E Soils (GEO 01231): Conducted for the parcel northwest of the subject site and southwest of Palomar Street at the intersection with Starbuck Circle (see Figure 4). This investigation entailed excavation of four fault trenches to a maximum depth of 25 feet below existing grades in the areas west and north of Starbuck Circle to cover the fault study zone and mapped lineaments across the site. The trenches encountered unfaulted alluvium, colluvium and Pauba Formation bedrock; though occasionally fractured, the Pauba Formation bedrock was without offsets in either the bedrock matrix itself or the contacts with the overlying alluvium. This fracturing is interpreted as fracturing typical to indurated, non-plastic materials which have undergone shaking and regional deformation common to seismically active areas. The investigation cleared the site of active faulting to the northeastern extent of fault trenches FT-1 and FT-1A; which extended to the western edge of Palomar Street. Since the investigation did not extend beyond Palomar Street, they were unable to clear the area beyond the site's northeastern property limit, and established a 50-foot setback from that property limit.

- Pacific Soils (GEO 00614): Conducted for the parcel north and northwest of the subject site, south of Starbuck Circle (see Figure 4). This investigation entailed excavation four fault trenches across the site to a maximum depth of 13 feet and encountered unfaulted alluvium, Pauba Formation and an unnamed sandstone bedrock unit, across the majority of the site; however, a fault trending N35°W/65°E was found in the southwestern portion of the site in Trench 3 at approximately Station 1+80; this fault projects southwest of the subject site, see Figure 7.

- Pacific Soils (GEO 00494): Conducted for the adjacent property southeast of the subject site (see Figure 4). This report covers the AP Zone for the Wildomar Fault and established the fault setbacks from the Wildomar Fault for the existing residential development. Trenching was used to identify and set back from two fault zones slightly offset from the locations shown on the Riverside County GIS; the fault zone trends from N55°W to N57°W, see Figures 4 and 8. This investigation cleared the areas outside of the fault setback zones shown on Figures 4 and 8.

SITE-SPECIFIC INVESTIGATION

Field Exploration

Subsurface exploration within the subject site was performed in June of 2015. An underground utilities clearance was obtained from Underground Service Alert of Southern California, prior to the subsurface exploration. The trenches were oriented to as closely as possible to trend perpendicular to the general southeastern trend of the faults mapped in the area (seen on the Regional Geologic Map – Figure 2, AP Zone Map – Figure 3, and Riverside County GIS Fault Map – Figure 4) and to maximize continuous trenching across the site. An excavator was utilized to excavate six (6) fault trenches to a maximum depth of 13 feet. Trenches ranged in length from approximately 45-feet (Fault Trench 6) to approximately 983 feet (Fault Trench 2). Total trenching across the entire site was approximately 1,851 linear feet.

In addition to the trenching, a truck mounted hollow-stem-auger drill rig was utilized on December 29, 2015, to drill ten (10) borings throughout the site to a maximum depth of 16½ feet. An underground utilities clearance was obtained from Underground Service Alert of Southern California, prior to the subsurface exploration.

Associated with the subsurface exploration was the collection of bulk (disturbed) samples and relatively undisturbed samples of earth materials for laboratory testing and analysis. The relatively undisturbed samples were obtained with a 3 inch outside diameter modified California split-spoon sampler lined with 1-inch-high brass rings. Samples obtained using a hollow stem auger drill rig, were mechanically driven with successive 30 inch drops of a 140-pound hammer. The blow count per one-foot increment was recorded in the boring logs. The central portions of the driven samples were placed in sealed containers and transported to our laboratory for testing and analysis. Test Results are presented on the boring logs.

Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488.

The approximate exploratory locations are shown on Plate 1 and descriptive logs are presented in Appendix B.

Subsurface Conditions

Earth materials encountered during our investigation include artificial fill, topsoil, Quaternary fan and alluvial deposits, and Pauba Formation bedrock. A general description of the dominant earth materials observed on the site is provided below:

- Artificial Fill, Undocumented (map symbol afu): Undocumented artificial fill materials were observed as drainage controls berms along the northwestern portion of the site and as piles of trash and debris scattered throughout the site. Minor surficial deposits of fill were encountered in Fault Trench 1, Fault Trench 5 and Fault Trench 6. Artificial fill was also encountered as large trench backfill in Fault Trench 2 and Fault Trench 4, and as relatively minor trench backfills of small trenches for pipes in Trenches 2, 4, and 5. These materials are typically locally derived from the native materials and generally consist of yellowish brown to dark brown silty sand and clayey sand. These materials are generally inconsistent, poorly consolidated fills.

- Topsoil (no map symbol): Surficial topsoil, encountered in the upper few inches up to 3 feet, blankets the majority of site and underlying alluvial and bedrock. These materials were noted to be generally yellowish to dark yellowish brown silty sands which were generally dry, loose and porous.

- Quaternary Young Alluvial Fan Deposits (map symbol Qyf): Quaternary young alluvial fan deposits were encountered below a veneer of artificial fill across the majority of FT-5 and FT-6, and ranged from 4 to 6 feet in thickness, and have been mapped in the northern portion of the site and in drainage swales to the northeast. This unit consisted primarily of yellowish brown to medium brown silty sands which were dry to slightly moist, and loose to medium dense. This unit had slight to moderate porosity and has undergone less soil development processes than the underlying older alluvial fan deposits. This unit has weak clay film development. The degree of soil development within the young alluvial fan deposits indicates this unit is generally Holocene in age, between 8,000 and 13,000 years old (Helms, 2015). Soil stratigraphy, while generally weak within this unit, indicates this unit is primarily sourced from the hills immediately to the northeast.

- Quaternary Older Alluvial Fan Deposits (map symbol Qof): Quaternary older fan deposits were encountered beneath the young alluvial fan deposits in trenches FT-5 and FT-6. This unit ranged in thickness from 1.5 to over 6 feet. These alluvial deposits consist predominately of interlayered medium brown, fine to coarse grained silty sand, with localized scour deposits consisting of silty gravel with sand or poorly graded sand with silt. These deposits were generally noted to be in a dry to slightly moist, medium dense state. Soil stratigraphy, while generally weak within this unit, indicates this unit is primarily sourced from the hills immediately to the northeast; however, the western portions of the unit (around stations 0+23 and 0+81) have several scour deposits which indicate relatively high energy channel flows down the valley (southeast), more or less perpendicular to direction of deposition of this unit. These channel deposits, and their absence in the overlying Young Alluvial Fan Deposits, suggest a wetter, Late Pleistocene climate. The degree of soil development within the older alluvial fan deposits indicates this unit is between 16,000 and 31,000 years old (Helms, 2015).

- Quaternary Old Alluvium (map symbol Qoa): Quaternary old alluvium was encountered as relic soils overlying the Pauba Formation bedrock in trenches FT-1, FT-2, FT-3 and FT-4, and as a truncated buried soil in trenches FT-5 and FT-6. These alluvial deposits consist predominately of interlayered reddish brown to strong brown, fine to coarse grained, clayey and silty sands with frequent basal scour deposits along contacts with the underlying Pauba Formation bedrock. A high degree of secondary clay accumulation consistently occurs in the upper portions of this unit which gradationally loses secondary clay with increasing depth. Generally sandier portions of this unit exhibit wavy sub-horizontal secondary clay deposition and oxidation indicative of wetting fronts and vertical infiltration of water; this is especially visible in FT-1 from Stations 1+92 to 2+54. This unit was generally noted to be in a dry to slightly moist and generally dense state.

  The prevalence of basal scour deposits and secondary clay deposition suggest a wetter, Late Pleistocene climate. The degree of soil development within the old alluvium indicates this unit is between 30,000 and 70,000 years old (Helms, 2015).

- Quaternary Pauba Formation (map symbol Qps): Pauba Formation bedrock was generally encountered below the topsoil and alluvial materials to the full depth of the exploration. These materials primarily consisted of olive gray to reddish or yellowish brown, fine to coarse grained sandstone with varying amounts of silt and clay, interbedded with silty to clayey gravel and cobble sized clast conglomerates with sandstone matrices, and rare interbedded claystone/siltstone. These materials were generally noted to be dry hard to very hard and well bedded. Occasionally, where the Pauba is overlain by the Old Alluvium; the upper foot of the Pauba Formation will be moderately to extremely weathered in-place to a residual soil which retains some of the structure of the parent material. Bedding within the unit was fairly consistent, ranging from N68°W to N75°W with dips ranging from 51° to 53°E across the majority of the site. However, west of the fault in FT-1 (Station 0+12) the bedding dips at a shallower 10° to 30°.

Lineament Review

A review of aerial imagery, topographic and geologic maps of the subject site dating back to 1949 was conducted to identify possible fault related lineaments and features that trend through or are mapped on the subject site. A list of stereographic aerial photo pairs as well as applicable maps reviewed for this project is included in Appendix A. The observed lineaments are grouped by the figures they are shown on and described below:

Figure 4: The Riverside County GIS Map shows approximate locations of seven fault traces which trend or project through the subject site. These traces are labelled A through G on Figure 4. Each trace is described below.

- Trace A – A Riverside County fault which ends northeast of Starbuck Court (approximately 0.24 miles northeast of the site boundary). This trace may be related to the slight rise in topography approximately half way through the long axis of the site as one progresses southwest from Palomar street; or to "Photo-lineament A" found in the referenced Inland Foundation investigation (GEO 02360) and shown on Figure 5, which was located approximately 38 to 58 feet southeast of the fault identified in that investigation.

  As the trace is slightly variable, a straight-line projection of Trace A could project through the site anywhere between Stations 0+85 and 1+25 in trench FT-1, and anywhere between Stations 1+40 and 1+80 in trench FT-2. As discussed in the trench log summaries there is no sign of offset geologic contacts or active faulting in these trench locations. Given this Trace A would seem to exhibit a 130 to 170-foot southwest offset from the actual fault trace shown on Figures 4 and 5 and on our Plate 1.

- Trace B - The most clearly defined lineament is formed by the sudden rise of the hills northwest Palomar Street, Trace B is undoubtedly intended to follow this lineament. This lineament is clearly seen on any aerial imagery of the site and is directly linked to the active trace of the Wildomar Fault. The trace of this feature in the across the base of the slopes is N55°W. This trace merges with Traces C and D near the properties southeastern boundary and was identified and setback from in Inland Geotechnical investigation (GEO 00494).

  The location and trend of this fault trace was found in trenches FT-4 (at Station 0+57), FT-5 (at Station 2+00) and FT-6 (at Station 0+40). The trend of the fault was very consistently N55°W with a slightly variable sub-vertical dip of 85° (east or west) to 90°.

- Trace C/D – Traces C and D are essentially the same trace of the main splay of the Wildmar Fault Zone. Trace C is a Riverside County fault trace for the Wildomar Fault Zone and Trace D is the main trace for the Alquist-Priolo Special Studies Zone for the Wildomar Fault. These traces trend through the northeastern portion of the site and along the southwestern portion of the fault setback zone established by Pacific Soils for the site southeast of the subject site (GEO 00494). While northeast of the subject site the trace follows the toe of the slopes and intersects our trenches FT-5 and FT-6 approximately where we encountered the fault; the location of these traces as they approach the southwest boundary of the site and as they project southwest of the site are suspect. Given the location of the traces on the Riverside County GIS the main traceof the fault should cross trench FT-2 between Stations 9+30 and 9+50, as discussed in our fault trench summaries our trenches exposed unfaulted geologic contacts and no indications of active fauliting in this area. In addition, the traces location relative to the centerline of the setback zone established by the Pacific Soils investigation for the development to the south (GEO 00494) are offset to the southwest, as evidenced by the fact the faults being setback from fail to meet the minimum 50-foot setback for the houses southwest of the setback zone and some houses actually lie on the trace. This would seem to be an example of the southwest offset of Riverside County GIS versus actual fault locations established by GEO reports.

- Trace E – A Riverside County fault trending N54°W through the subject site. This trace would seem to be offset from it's actual location as it traverses through the

- Trace F – A Riverside County fault trending approximately N55°W through the northeastern portion of the site. This trace is mapped over 100 feet northeast of the nearest proposed structure; however, given that the current location this trace traverses the entire row of houses northeast of Aubury Road, it seems likely that this location displays the southwest offset of Riverside County GIS from the actual fault location identified and setback from for the existing development, which is approximately 328-feet northeast of the mapped location. Regardless of the possible offset, we conclude this trace does not pose a ground rupture hazard to the proposed development.

- Trace G – A Riverside County fault trending N61°W through the northern most corner of the subject site. This trace is mapped approximately 270 feet north of the nearest proposed structure; however, given that this trace trends through the row of existing homes at the end of Brook Court, it seems likely that this trace displays the southwest offset of Riverside County GIS previously discussed and actually lies somewhere northeast of the mapped location; regardless, given these factors we conclude this trace poses no threat of ground rupture to the proposed development.

- Trace H – A Riverside County fault trending N54°W. This trace is mapped of this trace ends approximately 1,040 feet southeast of the nearest property line of the subject site. A northwest projection of this trace would traverse trench FT-4 around Station 0+25. As discussed in the trench summaries; the trench exposed unfaulted geologic contacts and no indicators of active faulting in this area.

Aerial photo and map lineaments located outside, but projected through, the subject site are shown on Figures 5 through 8; the approved Riverside County GEO reports and the trench logs of where the projections of these lineaments traverse our fault trenches demonstrate that many of these lineaments are not due to active faulting.

Figure 5: Photo-lineament A projects through the subject site at approximately Station 1+23 in trench FT-1 and Station 1+80 in trench FT-2; no faulted contacts or features indicative of active faulting are visible in the vicinity of this projection. However; as this photo-lineament is subparallel to the fault trace identified in the Inland Foundation investigation (GEO 002360) and only offset from the identified fault 38 to 58 feet to the southwest, the lineation is most likely geomorphically related to that fault.

<u>Figure 6:</u> For the three lineaments which project through the subject site, from southwest to northeast, the projection of those lineaments traverse the subject site as follows;

- Lineament A – projects through the southern corner of the site, south of the proposed structures and our recommended setbacks.
- Lineament B – projects through FT-1 at Station 2+00 and FT-2 at Station 2+70 – no faulted contacts or features indicative of active faulting are visible in the vicinity of this projection.
- Lineament C – projects through FT-1 at Station 3+45 and FT-2 at Station 4+10 – no faulted contacts or features indicative of active faulting are visible in the vicinity of this projection.

<u>Figure 7:</u> The photo-lineaments shown on this map does not project through the subject site. It is worthy of note that the no geomorphic expression of Trace A, Photo-lineament A, or the Inland Geotechnical Fault (from GEO 02360) is observed traversing the site.

<u>Figure 8:</u> The photo-lineaments shown on this plate were used as the basis for the Pacific Soils investigation (GEO 00494) which identified and set back from the active faults southwest of the subject site. The photo-lineaments trend from N47°W to N67°W at the intersection with the southeastern property line. The Pacific Soils investigation established the setbacks shown on Figure 4 and 8 as well as our Geotechnical Map, Plate 1.

<u>Fault Trench Summaries</u>

The following descriptions summarize the significant findings of the fault trenches conducted for this investigation across the subject site. Detailed logs are presented in Appendix B; per our conversations with the County Geologist we have included our hand drafted field logs and not digitally drafted logs. Trench locations with are presented along with fault orientations and locations on Plate 1.

<u>Fault Trench 1 (FT-1)</u>

Fault Trench 1 (FT-1) was located in the southern portion of the site and trended N50°E across the elevated hilltop area. This trench was approximately 354-feet in length and ranged from approximately 6 to 12.8 feet in depth. This trench exposed Pauba Formation bedrock (Qps); which was overlain by old alluvial deposits (Qoa) and a thin veneer of topsoil. The Pauba Formation bedrock was encountered throughout the trench and consisted of gray to yellowish brown sandstone (breaks down to Poorly-graded Sand) and silty sandstone (breaks down to Silty SAND) with general bedding attitudes of N70°W/52°N. The old alluvium was present from Station 0+28 to the end of the trench and had a slightly wavy erosional/weathering contact with the underlying Pauba Formation. The old alluvium consisted primarily of clayey sand in the upper 3 to 5 feet which grades down to silty sand in the deeper portions of the unit. The clay in the old alluvium consists of secondary clay deposits from groundwater infiltration which resulted in clay films coating and spanning sand grains and gradual loss of clay with depth. A soil age profile was conducted at Station 2+00 to obtain relative minimum age dates for the exposed units. From the degree of soil development, the old alluvium is estimated to be between 30,000 and 70,000 years old (Helms, 2015).

The Pleistocene age of the old alluvium unit capping the fractured but unfaulted Pauba Formation bedrock and the prescence of an unfaulted and undisplaced contact across the majority of the trench allow us to confidently state that active faulting does not traverse the *majority* of the trench. However; at Station 0+12 this trench exposed a vertical to subvertical fault with approximately 6 feet of down to east offset and a trend of N46°W. This fault propagates nearly to the surface of the trench wall. This fault aligns with the fault in FT-2 at Station 0+56. The two trench exposures align very well with the fault identified in the Inland Foundations investigation (GEO 02360) and the FT-1 exposure displays similar down-to-east sense of motion. The sense of motion is not discernable in FT-2 due to a heavily eroded upper contact with the old alluvium. The lack of soil above this fault preclude our ability to prove inactivity; as such we recommend a 50-foot setback from this fault. See Plate 1.

Fault Trench 2 (FT-2)

Fault Trench 2 (FT-2) was located in the southern portion of the site and had a variable but generally northeasterly trend of N36°E from the southern corner of the site up the hill to the relatively flat hilltop area, it the trended generally N50°E across the hilltop area and down the slope, and then angled eastward trending approximately N74°E to the end of the trench. This trench was approximately 984-feet in length and ranged from approximately 5 to 8 feet in depth. This trench exposed Pauba Formation bedrock (Qps); which was overlain by old alluvial deposits (Qoa) and a thin veneer of topsoil. The trench also encountered relatively minor amounts of artificial fill. The Pauba Formation bedrock was encountered throughout the trench and consisted of olive gray to yellowish brown sandstone (breaks down to Poorly-graded Sand) and silty sandstone (breaks down to Silty SAND) interbedded with silty gravel conglomerate, with general bedding attitudes of N70°W/52°N. The old alluvium was present throughout the length of the trench and had a slightly to very wavy erosional/weathering contact with the underlying Pauba Formation bedrock with occasional gravel rich scour deposits at the base and fining upward sequences. The old alluvium consisted primarily of clayey sand in the upper 3 to 5 feet which graded down to silty sand in the deeper portions of the unit. The clay in the old alluvium consists of secondary clay deposits from groundwater infiltration which resulted in clay films coating and spanning sand grains and gradual loss of clay with depth. From the degree of soil development, the old alluvium is estimated to be between 30,000 and 70,000 years old (Helms, 2015).

The Pleistocene age of the old alluvium unit capping the fractured but unfaulted Pauba Formation bedrock and the prescence of an unfaulted and undisplaced contact across the majority of the trench allow us to confidently state that active faulting does not traverse the *majority* of the trench. However; at Station 0+56 this trench exposed a vertical to subvertical fault which trends N46°W. Gouged/sheared material form this fault propagates nearly to the surface of the trench wall. This fault aligns with the fault in FT-1 at Station 0+12. The two trench exposures align very well with the fault identified in the Inland Foundations investigation (GEO 02360) and the FT-1 exposure which display down-to-east senses of motion. The lack of soil above this fault preclude our ability to prove inactivity; as such we recommend a 50-foot setback from this fault. See Plate 1.

Another small down to east offset was noted at Station 0+88 in FT-2. This fault displayed approximately 6 inches of down to east movement. However, this fault did not propagate to the surface or break the contact with the older alluvium. A projection of the fault to FT-1 traverses through the area around 0+43, however no correlating offset was seen in FT-2 and the geologic contacts in FT-1 are not offset in this area. Given this information we conclude that the fault at Station 0+88 is inactive and does not require a setback.

Fault Trench 3 (FT-3)

Fault Trench 3 (FT-3) was located in the central-east portion of the site near the southwest property line and trended N56°E. This trench was approximately 81-feet in length and averaged 4 to 6.5 feet in depth. This trench exposed Pauba Formation bedrock (Qps); which was overlain by old alluvial deposits (Qoa) and a thin veneer of topsoil. The Pauba Formation bedrock was encountered throughout the trench and consisted of olive gray to olive brown silty sandstone (breaks down to Silty SAND). The old alluvium was present from Stations 0+15 to 0+65 and had a wavy erosional/weathering contact with the underlying Pauba Formation bedrock with several gravel rich scour deposits at the base and fining upward sequences. The old alluvium consisted primarily of silty sand with less secondary clay deposition than the deposits seen in FT-1 and FT-2.

The age of the old alluvium unit capping the fractured but generally unfaulted Pauba Formation bedrock and the presence of an unfaulted and undisplaced contact across the majority of the trench allow us to confidently state that active faulting does not traverse the *majority* of the trench. However; at Station 0+56 this trench exposed a vertical fault with approximately 6-inches of down-to-west offset, which trends N55°W. The fracture along which there is displacement extends up to the topsoil of this trench and appears to be active. The location and trend of this fault match very well with the location and trend of the faults found in FT-5 and FT-6. Given the activity of this fault and alignment with the other fault traces found in FT-5 and FT-6, we recommend a 50-foot habitable structure setback from the trend of this fault. See Plate 1.

Fault Trench 4 (FT-4)

Fault Trench 4 (FT-4) was located in the northeastern portion of the site near the southwest property line and trended N26°E. This trench was approximately 170-feet in length and averaged 3.5 to 8 feet in depth. This trench exposed Pauba Formation bedrock; which was overlain by old alluvial deposits, artificial fill, and a thin veneer of topsoil. The Pauba Formation bedrock was encountered throughout the trench and consisted of interbedded olive gray to yellowish brown silty sandstone (breaks down to Silty SAND) and silty gravel conglomerate. The old alluvium was present from Stations 0+18 to 0+88 and had a wavy erosional/weathering contact with the underlying Pauba Formation bedrock. The old alluvium consisted primarily of a clayey sand unit which had eroded out an older poorly-graded sand unit with less secondary clay deposition than the deposits seen in FT-1 and FT-2.

The age of the old alluvium unit capping the fractured but unfaulted Pauba Formation bedrock and the presence of an unfaulted and undisplaced contacts allow us to confidently state that active faulting does not traverse the trench.

Fault Trench 5 (FT-5)

Fault Trench 5 (FT-5) was located in the northwestern portion of the site near the northwest property line and trended N41°E. This trench was approximately 203-feet in length and averaged 10 to 11.5 feet in depth. This trench exposed 4 to 6 feet of young alluvial fan deposits (Qyf) overlying 1.5 to 6 feet of older alluvial fan deposits (Qof) which were found to overlie the old alluvial deposits to the maximum depth explored. These units had slightly wavy erosional contacts that were unfaulted and continuous. A soil age profile was conducted to obtain minimum relative ages for the exposed units; of key importance is that this profile indicated the upper surface of the older fan deposits (Qof) has a minimum age of 16,000 years (Helms, 2015). This upper surface which also represents the young alluvial fan deposits/older alluvial fan deposits contact is continuous and unbroken across almost the entire trench; as such the minimum 16,000-year age of this contact allows us to conclude with a high degree of certainty that there is no active faulting across the majority of the trench. However, at Station 2+00 the trench encounters the main trace of the Wildomar Fault which propagates to the surface of the trench, trending N55°W with a dip of 85° to 90° and has an unknown amount of down-to-west fault offset. The location and trend of this fault correlate very well to faults found in FT-6 and FT-3. Given the activity of this fault we recommend a 50-foot offset from the trace of this fault, see Plate 1.

Fault Trench 6 (FT-6)

Fault Trench 6 (FT-6) was located in the northwestern portion of the site near the northwest property line and trended N33°E. This trench was approximately 45-feet in length and averaged 11.5 feet in depth. This trench exposed 4 to 5 feet of young alluvial fan deposits (Qyf) overlying 5 to 6 feet of older alluvial fan deposits (Qof). These units had slightly wavy erosional contacts that were unfaulted and continuous. The upper surface of the older fan deposits (Qof), which also represents the young alluvial fan deposits/older alluvial fan deposits contact is continuous and unbroken across almost the entire trench; as such the minimum 16,000-year age of this contact allows us to conclude with a high degree of certainty that there is no active faulting across the majority of the trench. However, at Station 0+40 the trench encounters the main trace of the Wildomar Fault which propagates to the surface of the trench; the fault trends N55°W with a dip of 85° to 90° and has an unknown amount of down-to-west fault offset. The location and trend of this fault correlate very well to faults found in FT-5 and FT-3. Given the activity of this fault we recommend a 50-foot offset from the trace of this fault, see Plate 1.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on the results of our site-specific investigation, geologic and map review and the approved Riverside County GEO reports for the surrounding sites it is our opinion that the subject property is considered suitable for the proposed development, provided the conclusions and recommendations are incorporated into the plans and are implemented during construction.

Fault Setbacks

The traces of two faults affect the proposed building area; the western fault which trends N46W through FT-1 and FT-2 and the eastern fault which trends through FT-3, FT-5 and FT-6. Given the activity of these faults it is our opinion that 50-foot setbacks be set along the trend of these faults, as seen on Plate 1.

If the proposed development changes it Earth-Strata should be notified immediately so that we can ensure the new proposed development does not encroach on unexplored or setback areas.

GRADING PLAN REVIEW AND CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of **Camelia Developments** and their authorized representative. It likely does not contain sufficient information for other parties or other uses. Earth-Strata should be engaged to review the final design plans and specifications prior to construction. This is to verify that the recommendations contained in this report have been properly incorporated into the project plans and specifications. Should Earth-Strata not be accorded the opportunity to review the project plans and specifications, we are not responsibility for misinterpretation of our recommendations.

We recommend that Earth-Strata be retained to provide geologic and geotechnical engineering services during grading and foundation excavation phases of the work. In order to allow for design changes in the event that the subsurface conditions differ from those anticipated prior to construction.

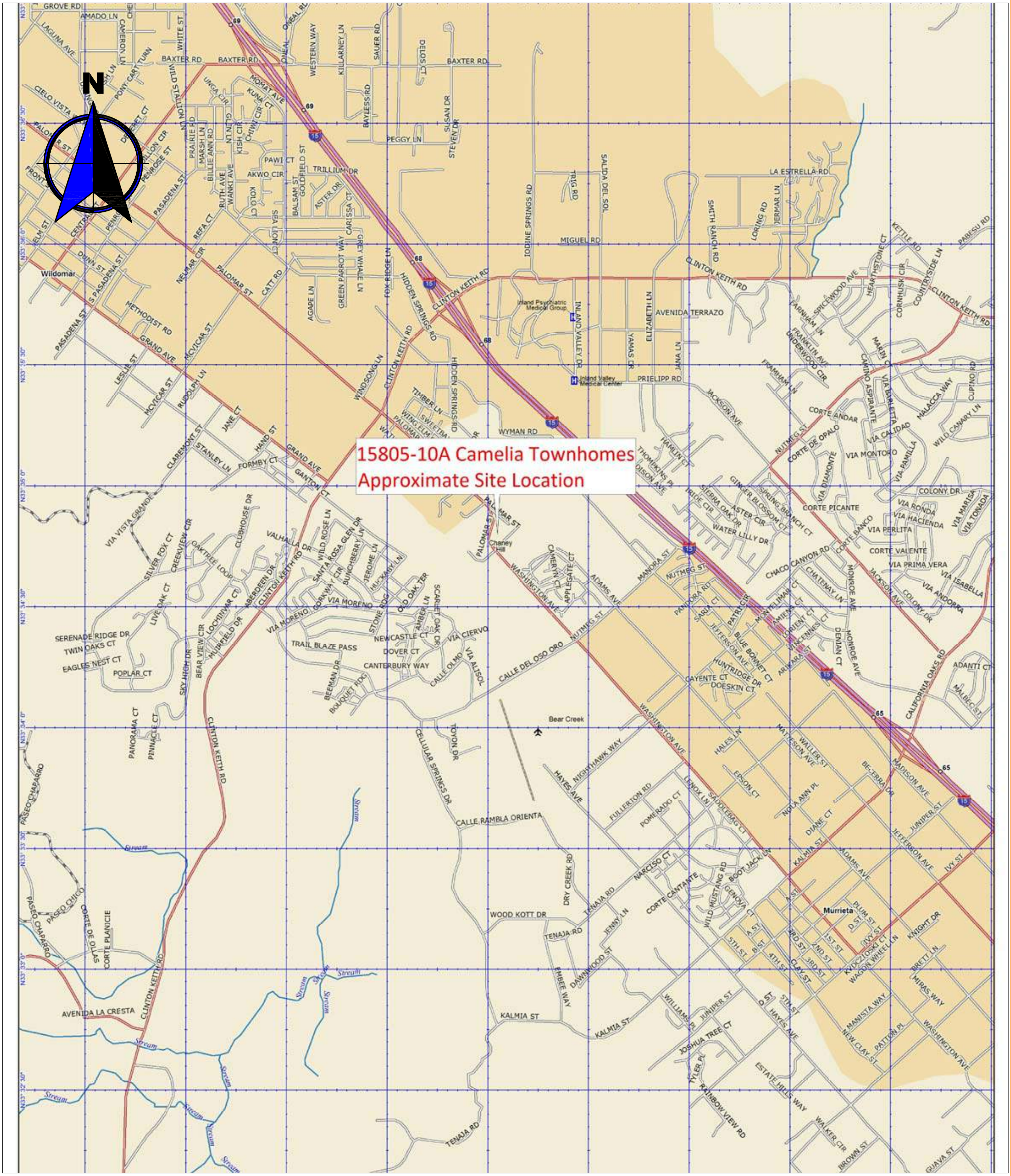
Earth-Strata should review any changes in the project and modify and approve in writing the conclusions and recommendations of this report. This report and the drawings contained within are intended for design input purposes only and are not intended to act as construction drawings or specifications. In the event that conditions encountered during grading or construction operations appear to be different than those indicated in this report, this office should be notified immediately, as revisions may be required.

REPORT LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists, practicing at the time and location this report was prepared. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

Earth materials vary in type, strength, and other geotechnical properties between points of observation and exploration. Groundwater and moisture conditions can also vary due to natural processes or the works of man on this or adjacent properties. As a result, we do not and cannot have complete knowledge of the subsurface conditions beneath the subject property. No practical study can completely eliminate uncertainty with regard to the anticipated geotechnical conditions in connection with a subject property. The conclusions and recommendations within this report are based upon the findings at the points of observation and are subject to confirmation by Earth-Strata based on the conditions revealed during grading and construction.

This report was prepared with the understanding that it is the responsibility of the owner or their representative, to ensure that the conclusions and recommendations contained herein are brought to the attention of the other project consultants and are incorporated into the plans and specifications. The owners' contractor should properly implement the conclusions and recommendations during grading and construction, and notify the owner if they consider any of the recommendations presented herein to be unsafe or unsuitable.



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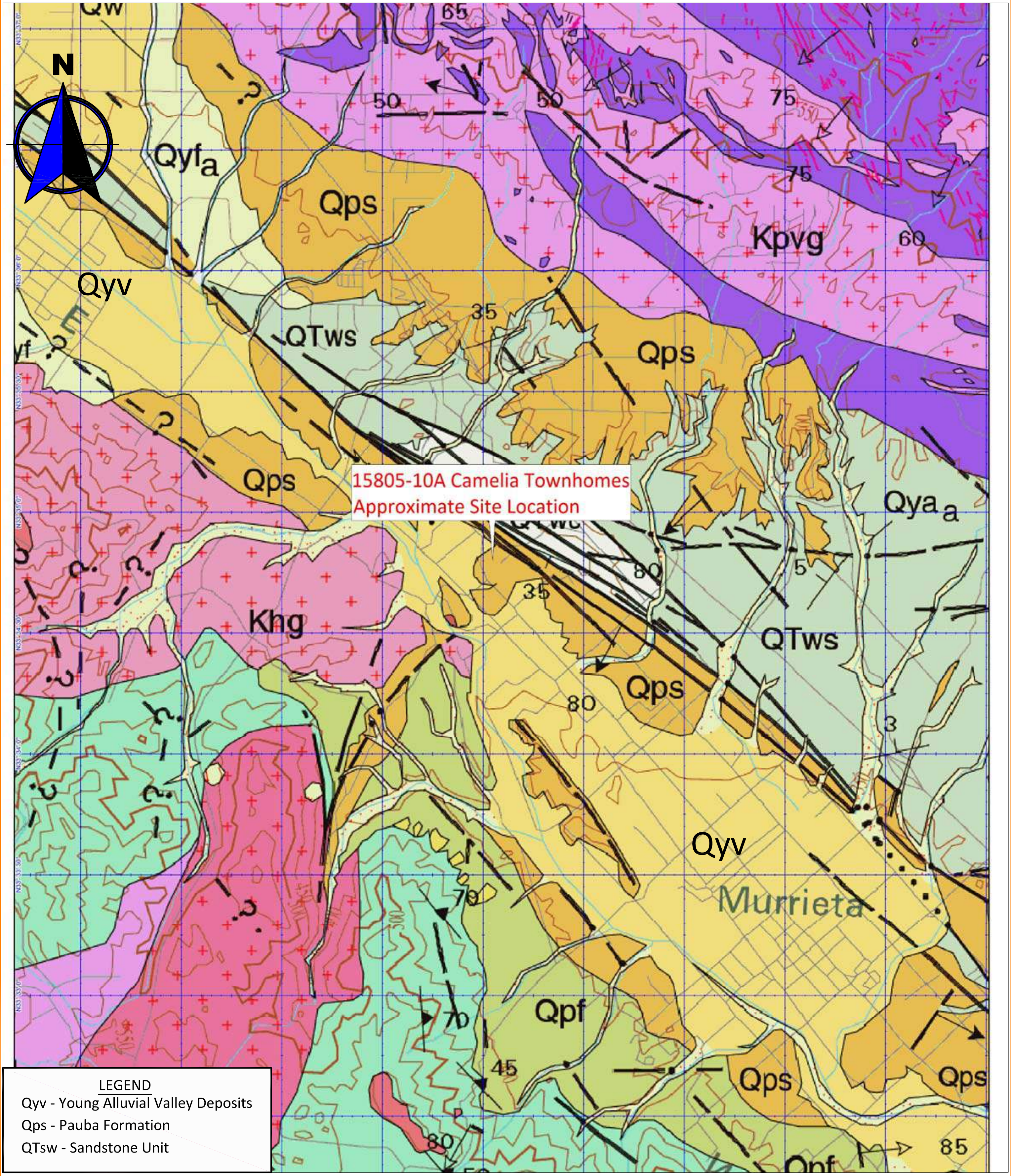
CAMELIA DEVELOPMENT		15805-10A
VICINITY MAP	SCALE 1:40,625	
	JUNE 2016	FIGURE 1



LEGEND
Qyv - Young Alluvial Valley Deposits
Qps - Pauba Formation
QTsw - Sandstone Unit

REFERNCES: Morton, D.M., Hauser, Rachel M., and Ruppert, Kelly R., 2004, Preliminary Digital Geologic Map of the Santa Ana 30' x 60' Quadrangle, Southern California, Version 2.0: U.S. Geological Survey Open-File Report 99-0172.
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CAMELIA DEVELOPMENT		15805-10A
REGIONAL GEOLOGIC MAP	SCALE 1:40,625	
	JUNE 2016	FIGURE 2

STATE OF CALIFORNIA SPECIAL STUDIES ZONES, CDMG. MURRIETA QUADRANGLE 7.5 MIN SERIES, JANUARY 1, 1980.
"© 2007 DeLorme (www.delorme.com) Topo USA®".

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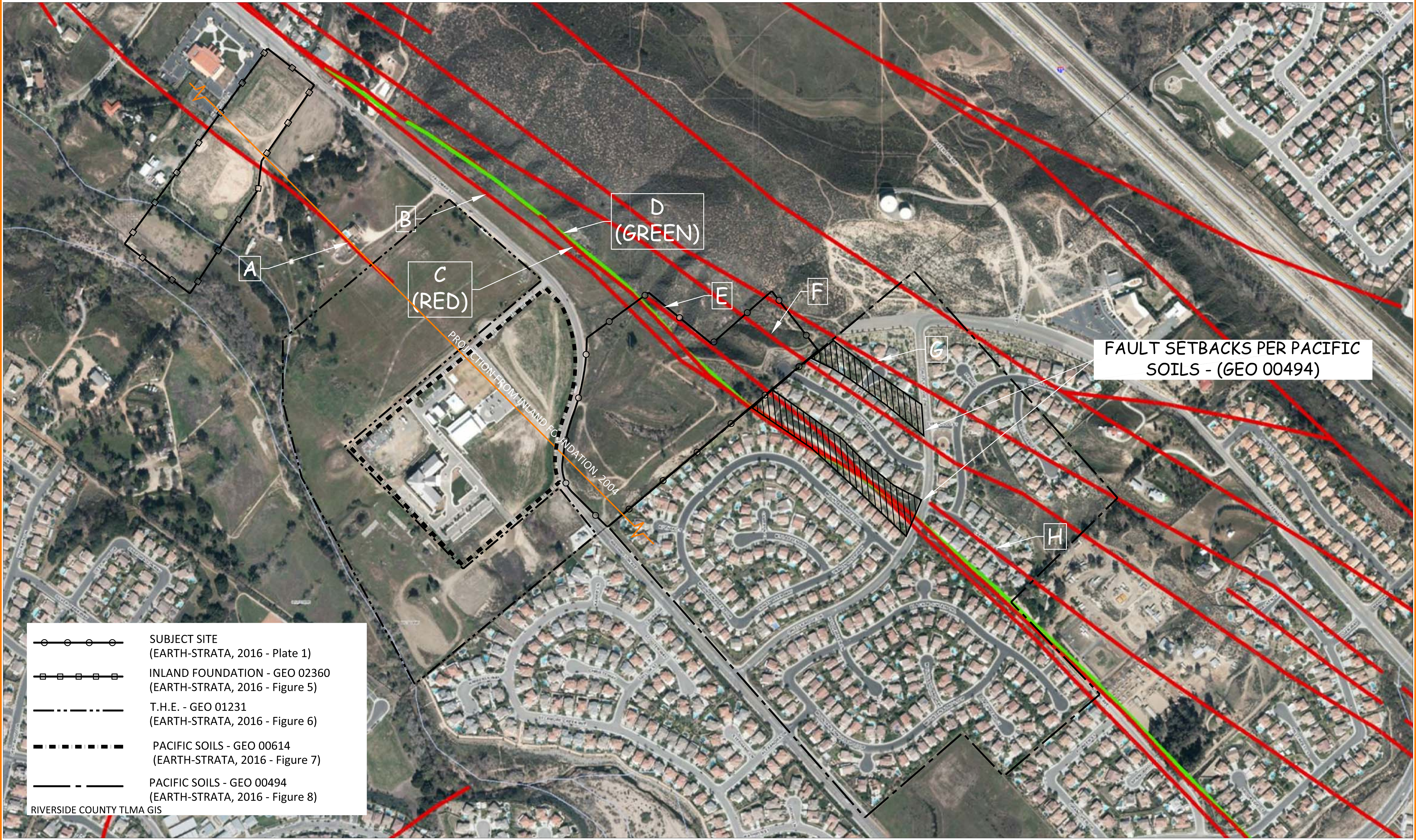
CAMELIA DEVELOPMENT		15805-10A
Alquist-Priolo Zone Maps	SEE BAR SCALE	
	JUNE 2016	FIGURE 3



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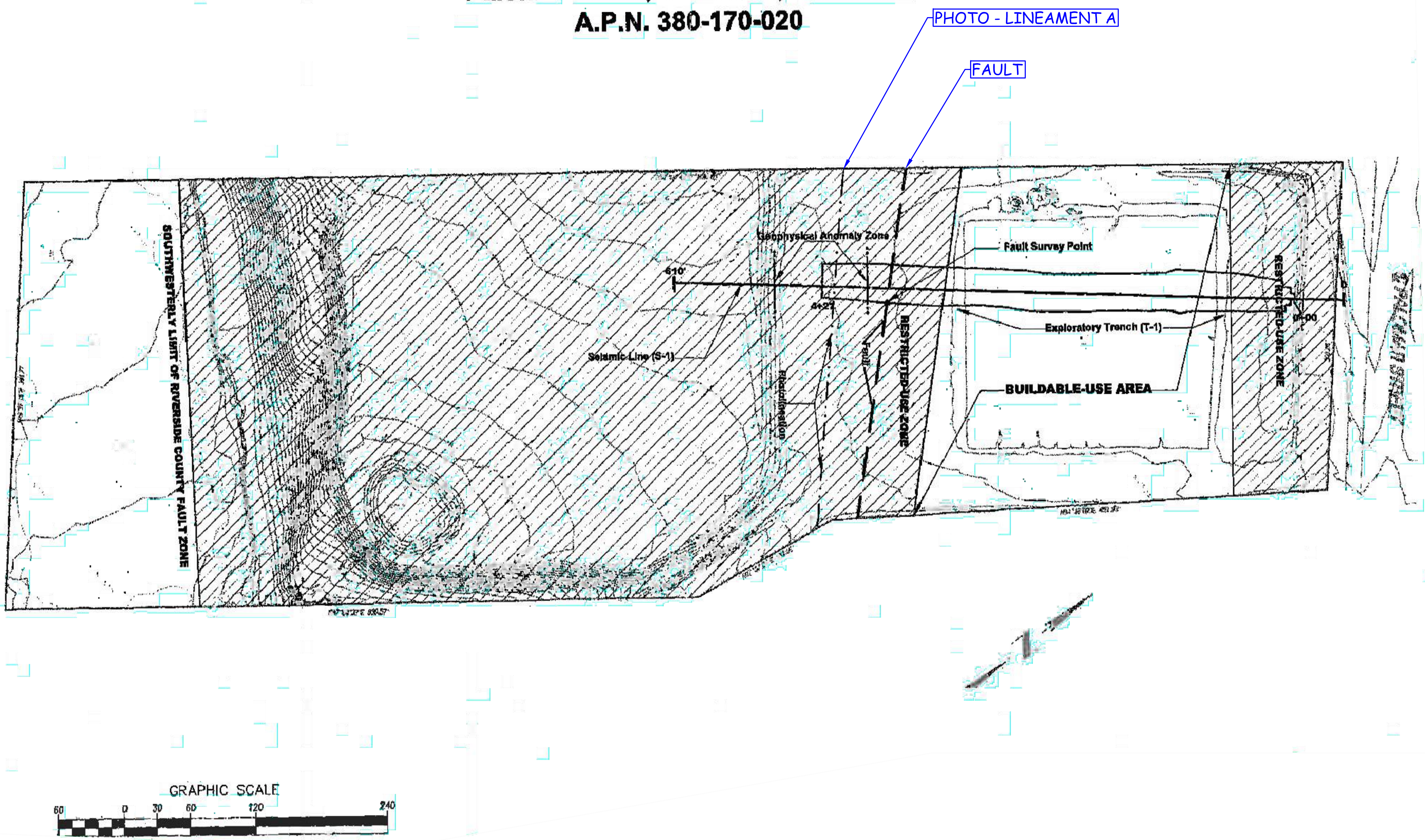
CAMELIA DEVELOPMENT		15805-10A
RIVERSIDE COUNTY GIS FAULT MAP	NOT TO SCALE	
	JUNE 2016	FIGURE 4

SITE FAULT MAP
PROPOSED SYCAMORE ACADEMY
Palomar Street, Wildomar, California
A.P.N. 380-170-020



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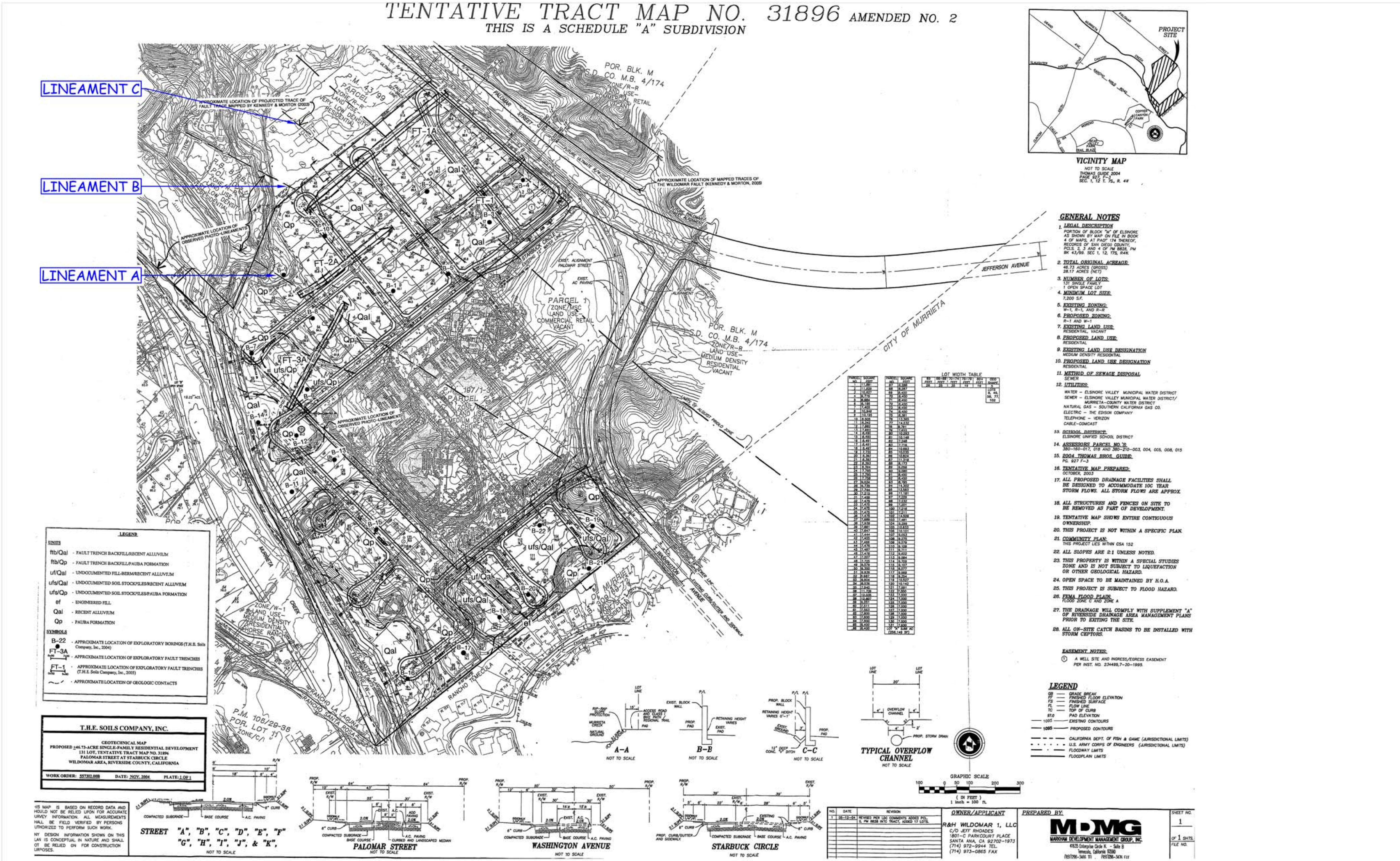
CAMELIA DEVELOPMENT		15805-10A
INLAND FOUNDATION - SITE FAULT MAP (GEO 02360)	SEE BAR SCALE	
	JUNE 2016	FIGURE 5



CAMELIA DEVELOPMENT		15805-10A
T.H.E. - GEOTECHNICAL MAP (GEO 01231)	SEE BAR SCALE	
	JUNE 2016	FIGURE 6

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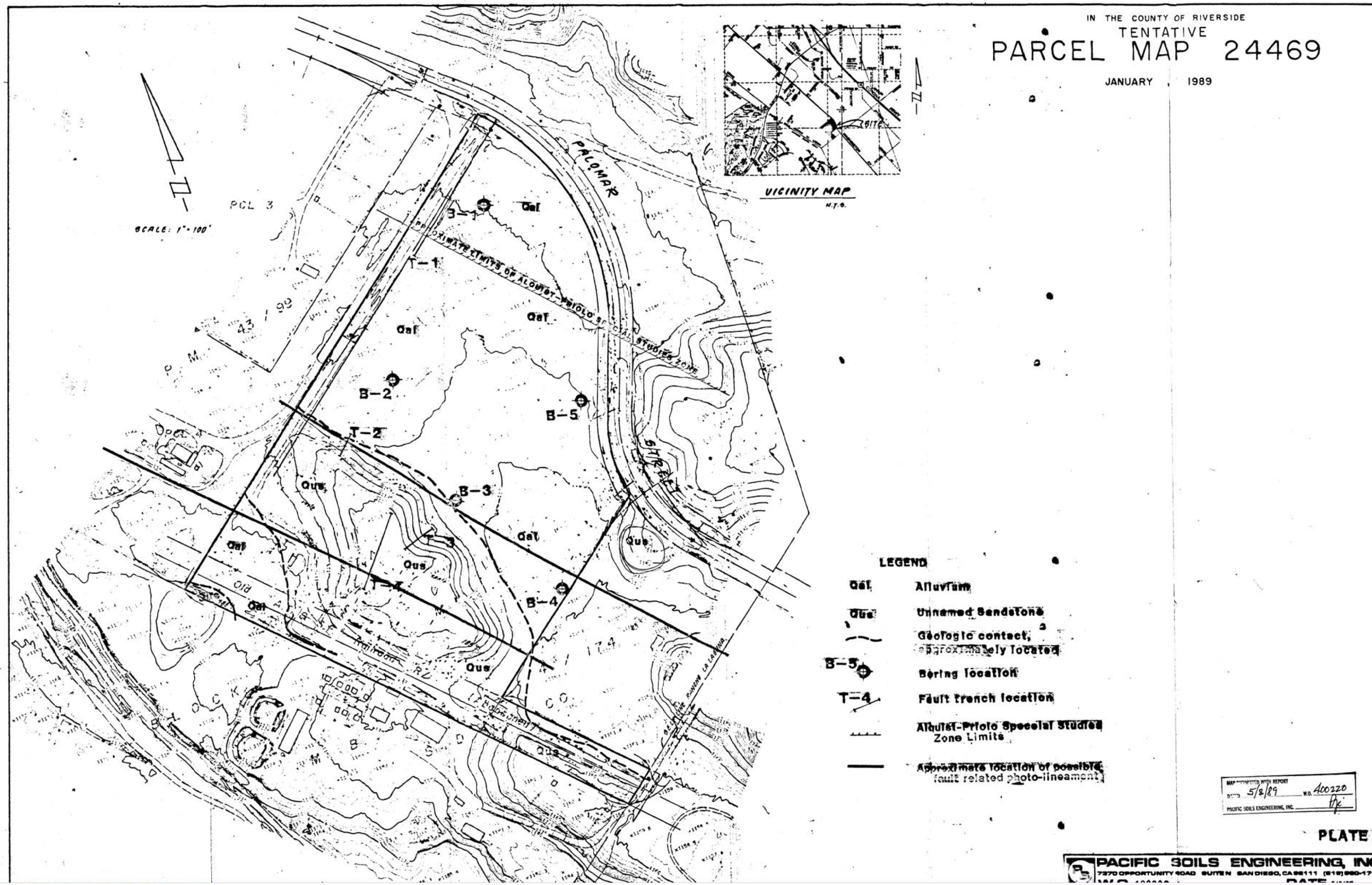

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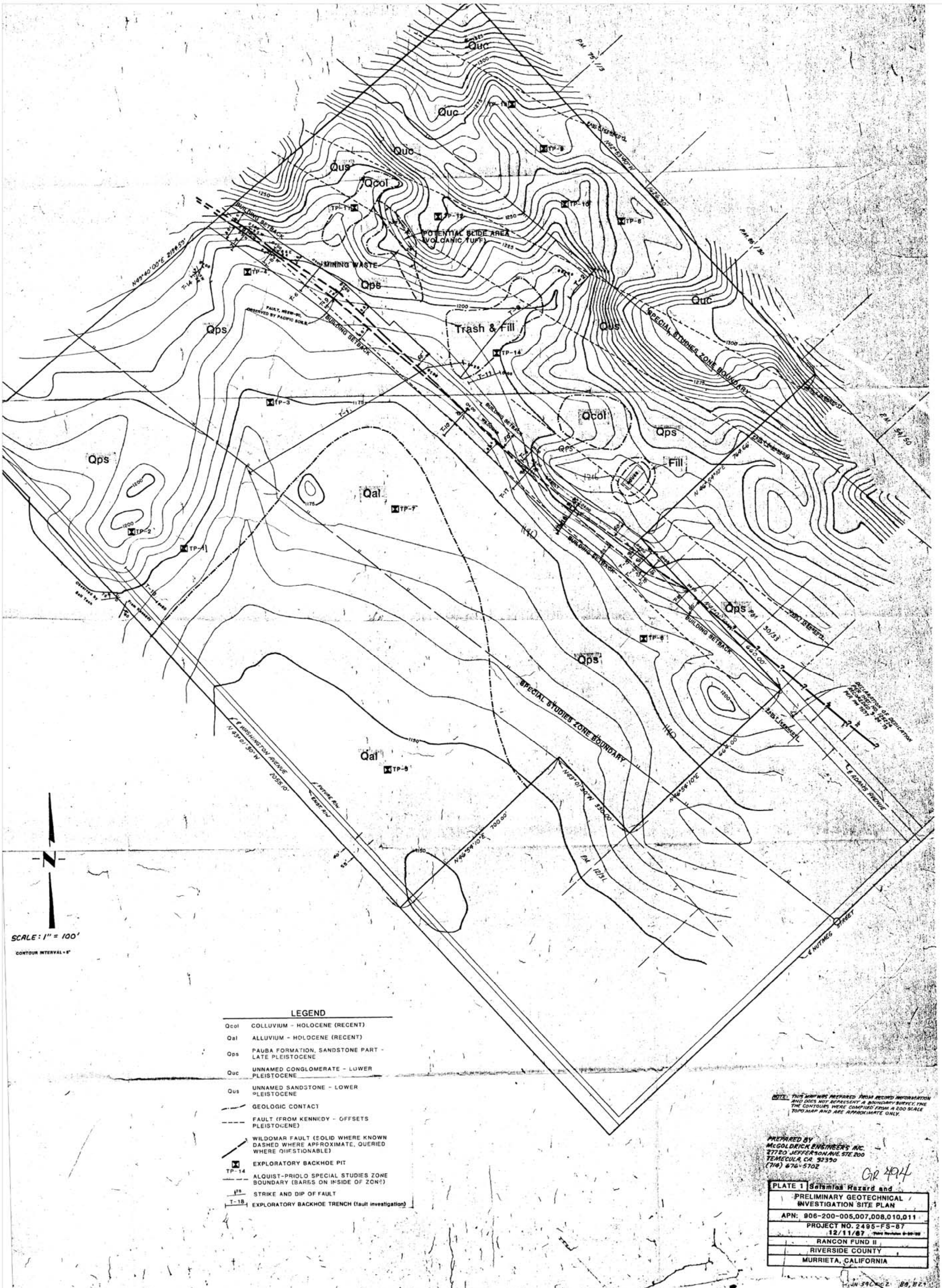
CAMELIA DEVELOPMENT		15805-10A
PACIFIC SOILS - GEOTOECHNICAL / SITE MAP - GEO 00614	NOT TO SCALE	
	JUNE 2016	FIGURE 7



CAMELIA DEVELOPMENT
PACIFIC SOILS - GEOTECHNICAL MAP - GEO 00494

15805-10A	
NOT TO SCALE	
JUNE 2016	FIGURE 8

APPENDIX A

References

APPENDIX A

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T.H.E. (GEO 01231), *Lot Layouts in Regards to Fault Setback Line, Proposed Residential Development, Lots 8&9 of Tentative Map No. 31896, Palomar Street Wildomar Area, Riverside County, California,* dated March 31, 2006.

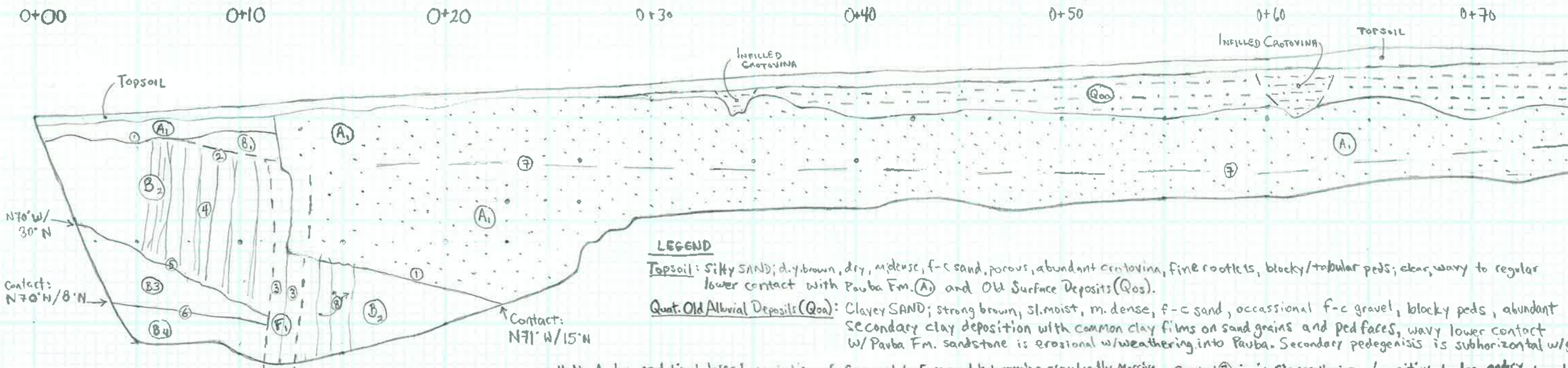
Aerial Photographs

DATE	FLIGHT NUMBER
5/8/49	AXM-6F-9
5/8/49	AXM-6F-10
5/15/67	AXM-3HH-77
5/15/67	AXM-3HH-78
2/15/74	PC-C15-5-18
2/15/74	PC-C15-5-18
8/10/79	79163-27
8/10/79	79163-28
5/8/86	86119-7
5/8/86	86119-8
2/8/88	88045-10
2/8/88	88045-12
9/23/88	C-80 63A-10
1/13/89	89019-13
11/30/89	89264-1
5/4/90	90114-27
5/4/90	90114-29
2/20/91	91033-12
2/20/91	91033-13
5/14/93	C90-6-194
5/14/93	C90-6-195
9/11/97	C116-41-249
9/11/97	C116-41-251
4/19/99	C-136-42-97
4/19/99	C-136-42-98

APPENDIX B

Fault Trench Logs

15805-10A
FT-1
Trench Bearing: N50°E
North Wall



Zone 3: Trends N46°W/90° (85°-N to 85°S)

LEGEND

Topsoil: Silty SAND; d.y. brown, dry, m.dense, f-c sand, porous, abundant crotovina, fine rootlets, blocky/tabular peds; clear, wavy to regular lower contact with Pauba Fm. (A_1) and Old Surface Deposits (Qos).

Quat. Old Alluvial Deposits (Qoa): Clayey SAND; strong brown, sl. moist, m. dense, f-c sand, occassional f-c gravel, blocky peds, abundant secondary clay deposition with common clay films on sand grains and ped faces, wavy lower contact w/ Pauba Fm. sandstone is erosional w/weathering into Pauba. Secondary pedegenisis is subhorizontal w/ground surface.

Pauba Formation Units (Qps):

A_1 - Clayey SANDSTONE; reddish brown, dry, hard, f-c sand, few f-c gravel → irregular but sharp lower contact 1 with $B_{1/2}$, contact is dark reddish brown and extremely oxidized with abundant secondary clay deposition

→ Unit A_1 has gradational lateral variation of f-c sand to f-m sand but remains structurally massive → Contact 7 is in-situ weathering transition to less 2ndary clay deposition at depth

→ Clay consists of abundant secondary deposits as clay films coating and spanning grains - especially in upper ~3', below which unit is more friable (below Contact 7)

B_1 - Silty SANDSTONE; yellowish brown, dry, hard, f-c sand, f-c gravel - irregular, gradational contact 2 with B_2

B_2 - Silty SANDSTONE; y. brown, dry, hard, f. sand, trace m-c sand, trace clay - irregular contact with A across Zone 3 - partially mixed at center to distinct units at edges. Unit B_2 preserves evidence of fracturing - especially in Zone 4

→ Heavy caliche deposits preserved in South Wall exposure.

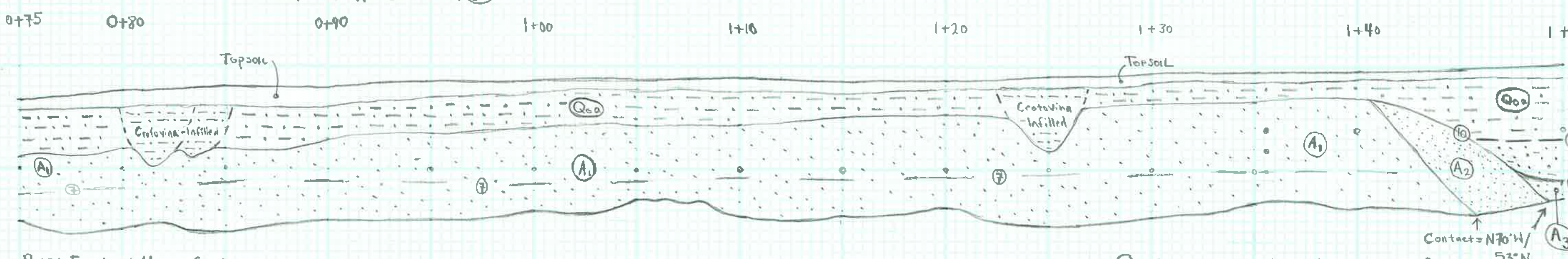
Zone 4 - consisting of subvertical continuous fractures with variable degrees of oxidation
- No visible offsets across fractures - fractures not visible below contact 5
- Variable fracture spacing of 0.5-2"

F_1 - Fracture w/ abundant caliche deposits and ~6' of apparent offset of Contact 1. Subvertical, trends N46°W

Zone 8 - Subvertical hairline fractures - extend 1-2" above Contact 1

B_3 - Silty SANDSTONE with gravel; m. brown, sl. moist, hard, f-c sand, f-c gravel, friable, wavy upper contact w/ B2

B_4 - Silty SANDSTONE; m. brown, sl. moist, hard, f-c sand, friable



Pauba Formation Units Cont'd:

A_2 - Silty SANDSTONE; greenish gray, dry, hard, f. sand, few m-c sand, sharp/clear upper & lower contacts with A_1 and A_3, abundant caliche deposits, erosional scour contact 10 with Qoa

A_3 - Silty SANDSTONE; y. brown, dry, hard, f-c sand, friable, sharp upper erosional/scour contact 10 with Qoa

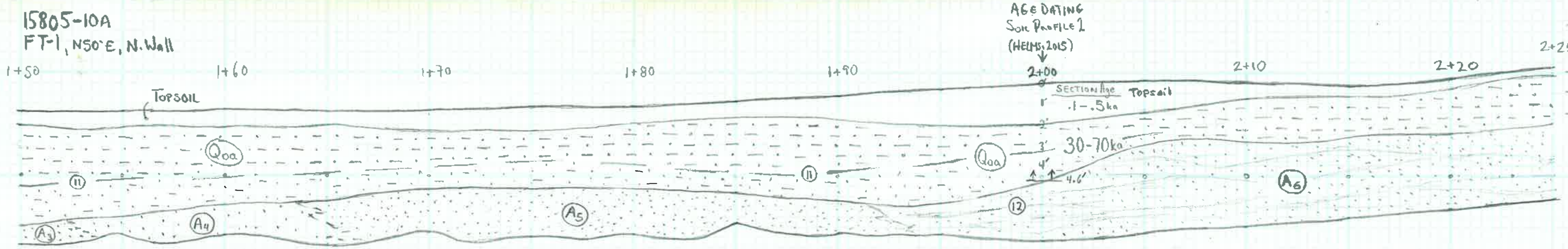
Contact 11 - Approximate gradational transition from more clayey upper to lower unit with less secondary clay deposition

1" = 5' (Horizontal & Vertical)

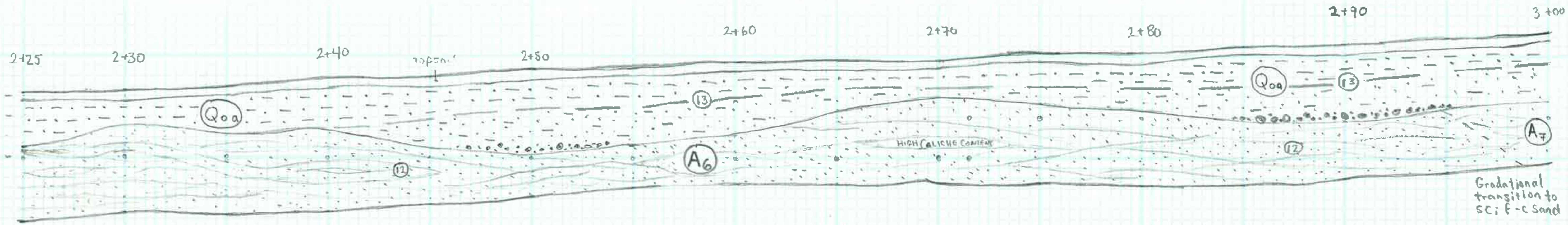
Earth-Strata, 2016
FT-1
Pg. 1 of 2
AGW

Symbols
— - Geologic Contact
-- - Weathering/Gradational Contact
⊙ - Level Line Anchor point
)(- Fracture - No Offset Unless Noted

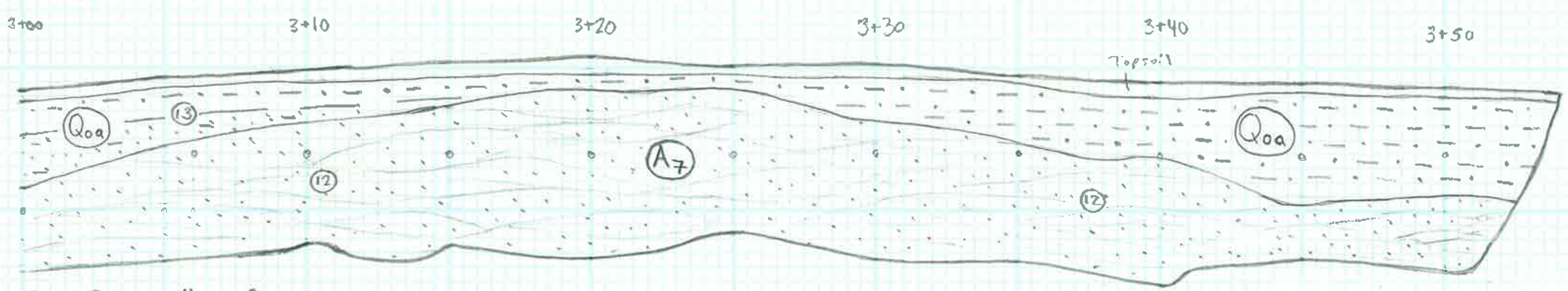
15805-10A
FT-1, N50°E, N. Wall



Gradational Contacts between A_3, A_4, A_5, A_6 and A_7 are generally similar ~ N70°W/52°N



Gradational transition to SC; f-c Sand



PAUBA FORMATION UNITS CONT'D

(A4) - SANDSTONE; y. brown, dry, hard, f-c sand, slight to moderate cementation, subhorizontal oxidation banding, Gradational contacts w/ A_3 & A_5, clear upper contact with Qoa - erosional

(A5) - Silty SANDSTONE; y. brown, dry, hard, f-m sand, gradational contacts with A_4 & A_6, clear/sharp upper contact with Qoa - erosional contact

(A6) - SANDSTONE; y. brown, dry, hard, f-c sand, subparallel banding of secondary clay deposition from vertical infiltration (wet, Pleistocene climate)

(A7) - Silty SANDSTONE; y. brown to r. brown, dry, hard, f-c sand, concentrations of secondary clay deposition in subparallel bands

Zone (12) - Subhorizontal wavy bands of clay and occassional $CaCO_3$ deposition - secondary depositions from H_2O infiltration

Contact (13) - Approximate transition in fining upward sequence with basal scours and occasional basal fine to coarse gravel deposits.

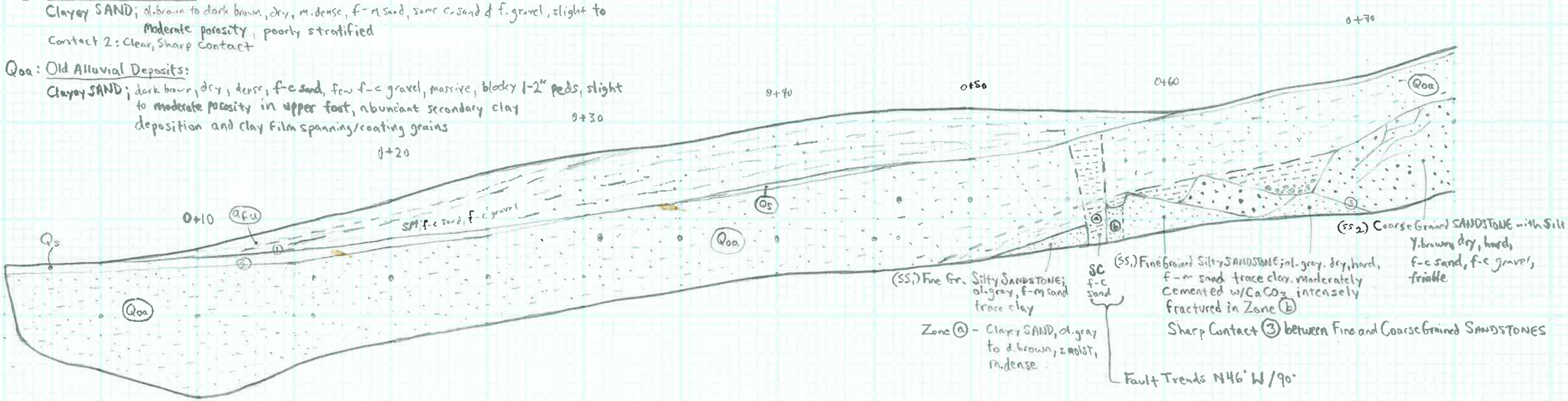
Earth-Strata, 2016
FT-1
Pg. 2 of 2
AGW
1" = 5' (Horiz. & Vert.)

15805-10A
Fault Trench 2
N36°E
N. Wall

afu: Artificial Fill, Undocumented:
Silty SAND; y.brown, dry, loose, f-c sand, f-c gravel, abundant rootlets, abundant porosity, occasional trash
Contact 1: Clear, sharp Contact

Q_s: Slope Wash Deposits:
Clayey SAND; ol.brown to dark brown, dry, m.dense, f-m sand, some c.sand & f. gravel, slight to moderate porosity, poorly stratified
Contact 2: Clear, Sharp Contact

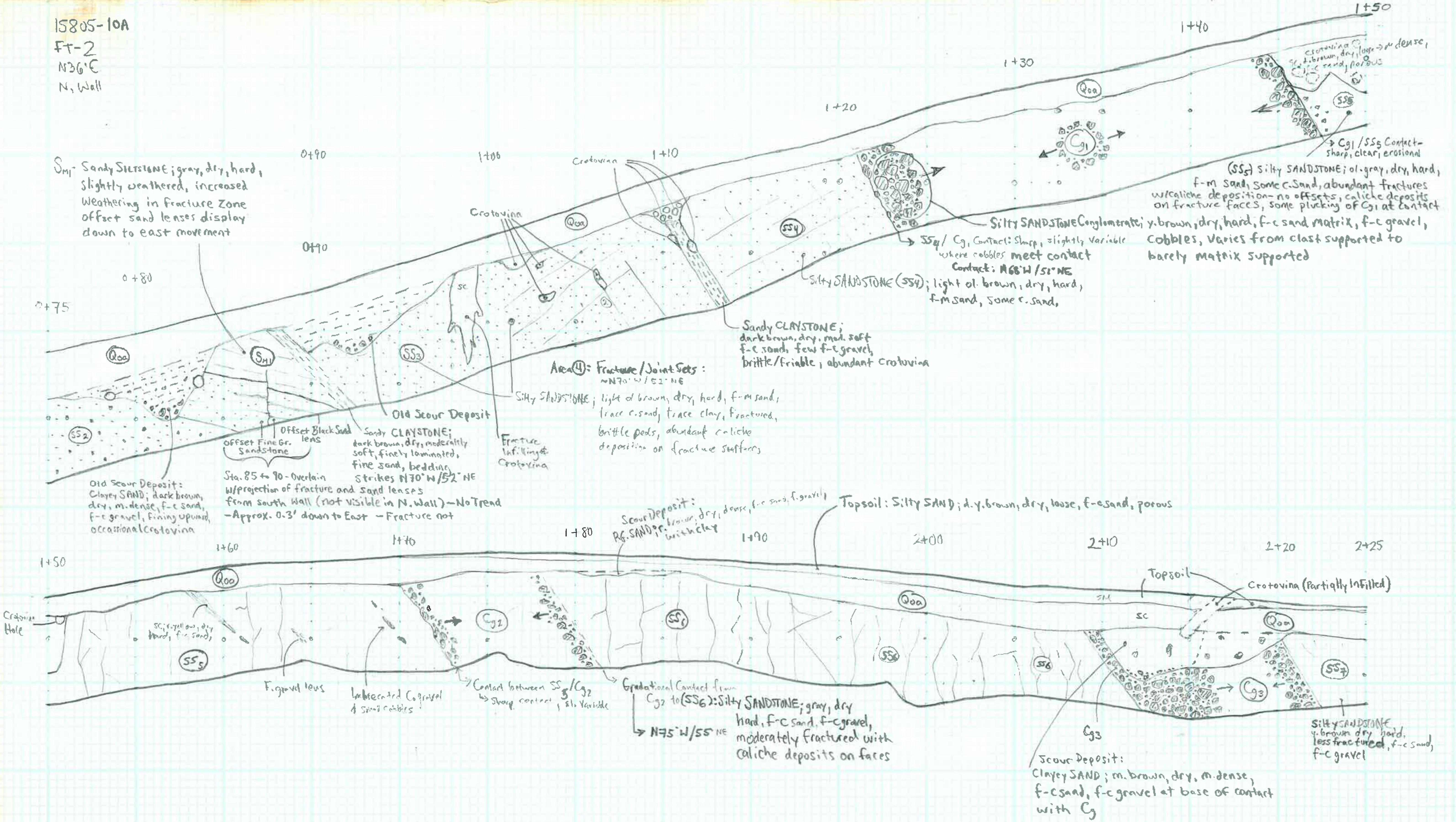
Qoa: Old Alluvial Deposits:
Clayey SAND; dark brown, dry, dense, f-c sand, few f-c gravel, massive, blocky 1-2" peds, slight to moderate porosity in upper foot, abundant secondary clay deposition and clay film spanning/coating grains



— - Geologic Contact
-- - Weathering/Gradational Contact
o - Level Line Anchor Point
- Silty SAND (SM)
- Clayey SAND (SC)
- Fine-grained Sandstone (SS)
- Coarse-grained Sandstone (SS)
- Conglomerate (Cg)

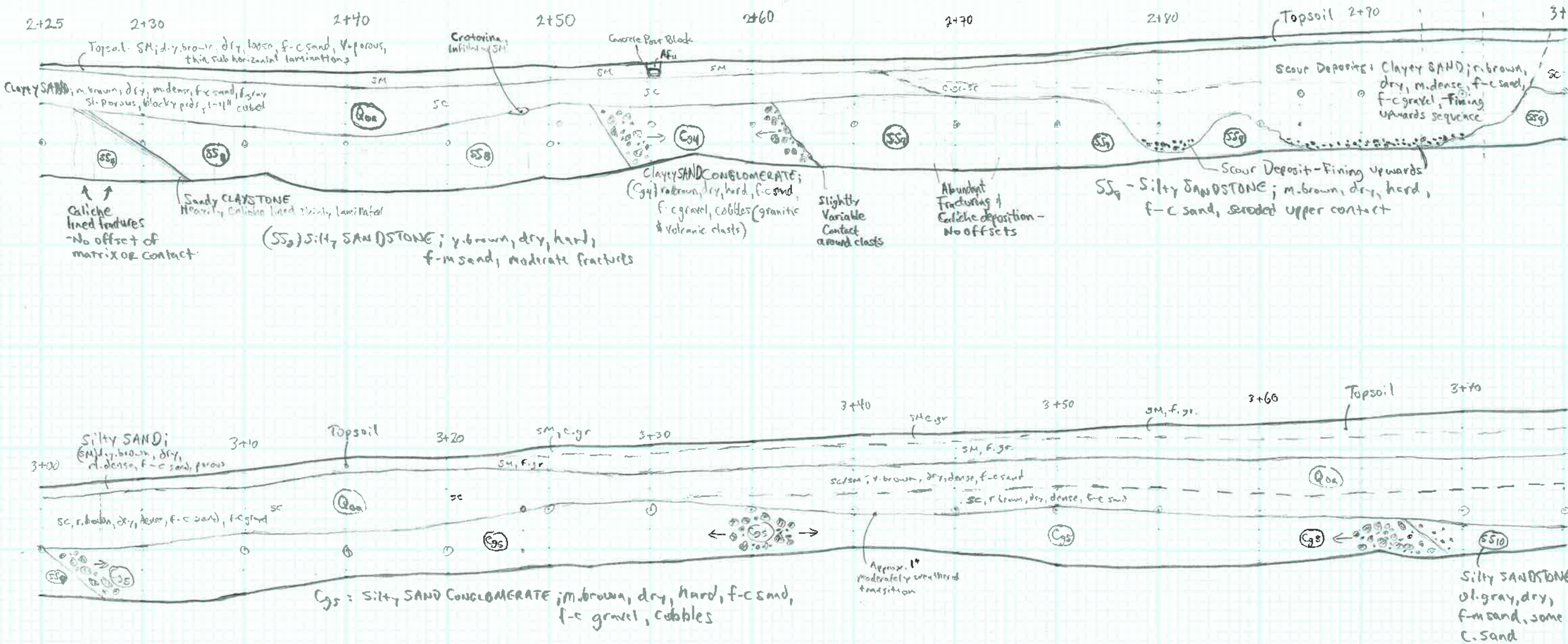
Earth-Strata, 2016
FT-2
Pg. 1 of 6
AGW
1" = 5' (Horiz. & Vert.)

15805-10A
FT-2
N36°E
N, Wall



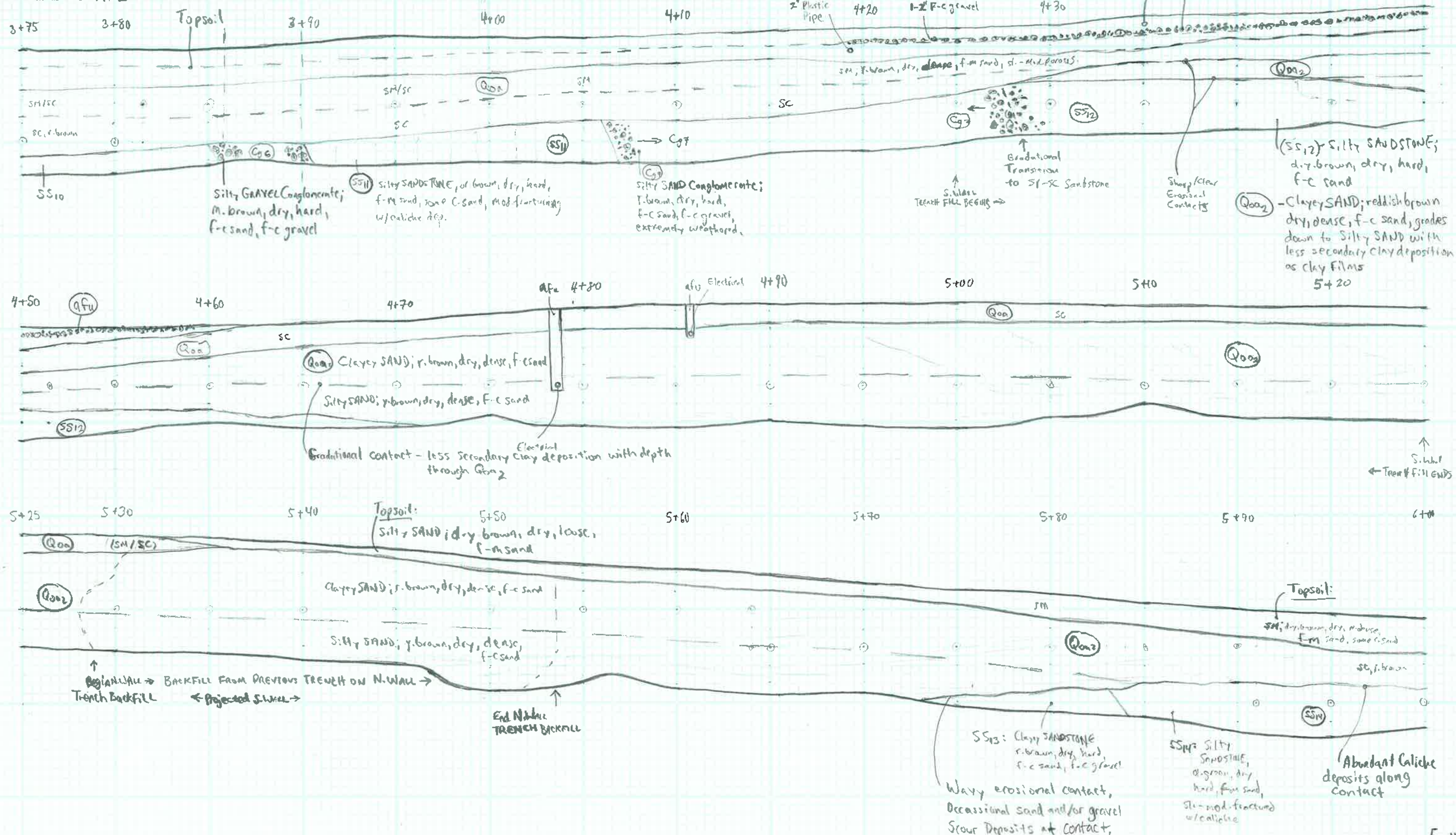
Earth-Strata, 2016
FT-2
Pg. 2 of 6
AGW
1" = 5' (Horz. & Vert.)

IS805-10A
FT-2
Varible ~ N36°E
N. Wall



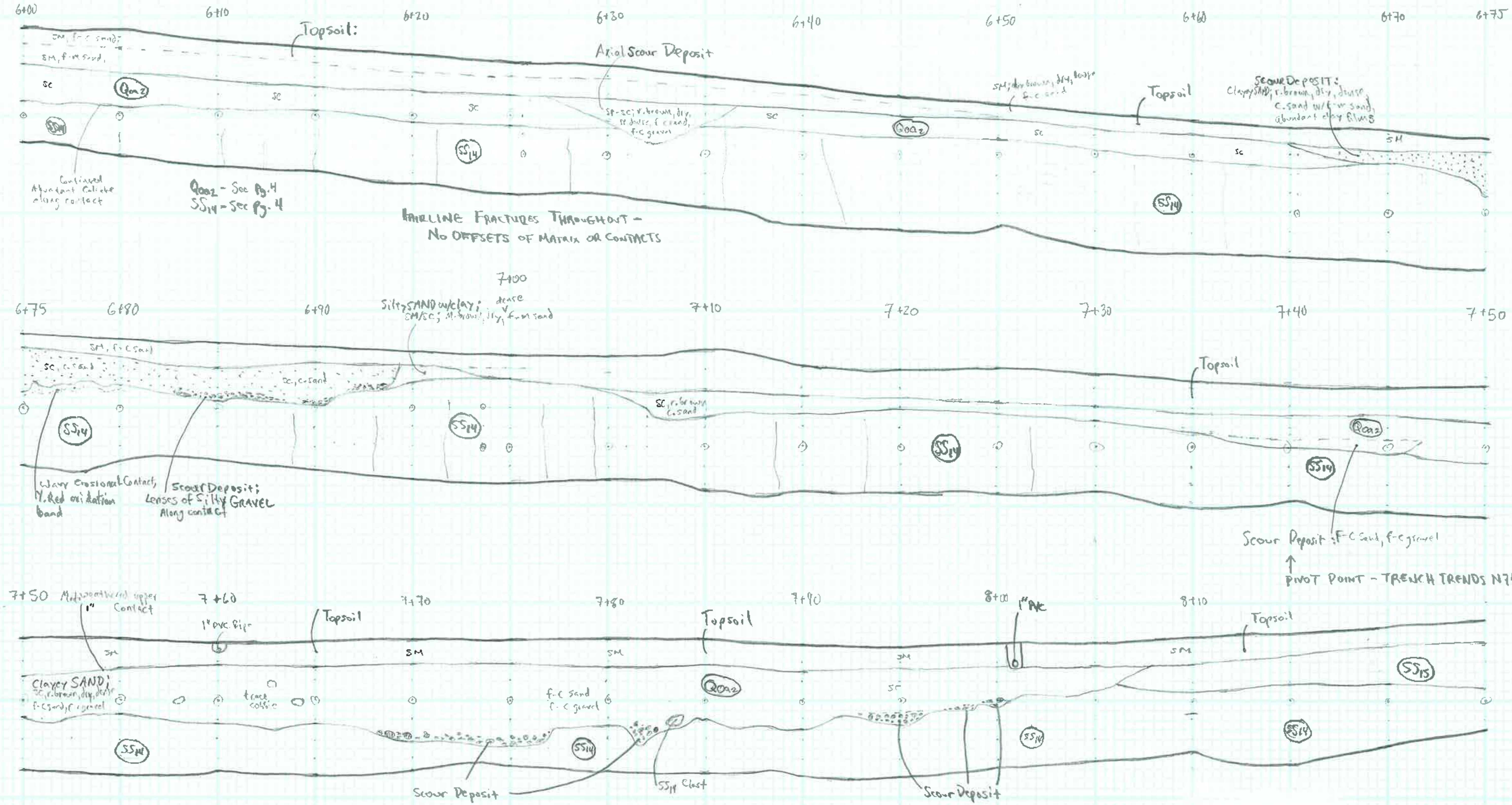
Earth-Strata, 2016
FT-2
Pg. 3 of 6
AGW
1" = 5' (Horz & Vert.)

15805-10A
FT-2
Variable ~ N41°E



Earth-Strata, 2016
FT-2
Pg. 4 of 6
AGW
1" = 5' (Horiz. + Vert.)

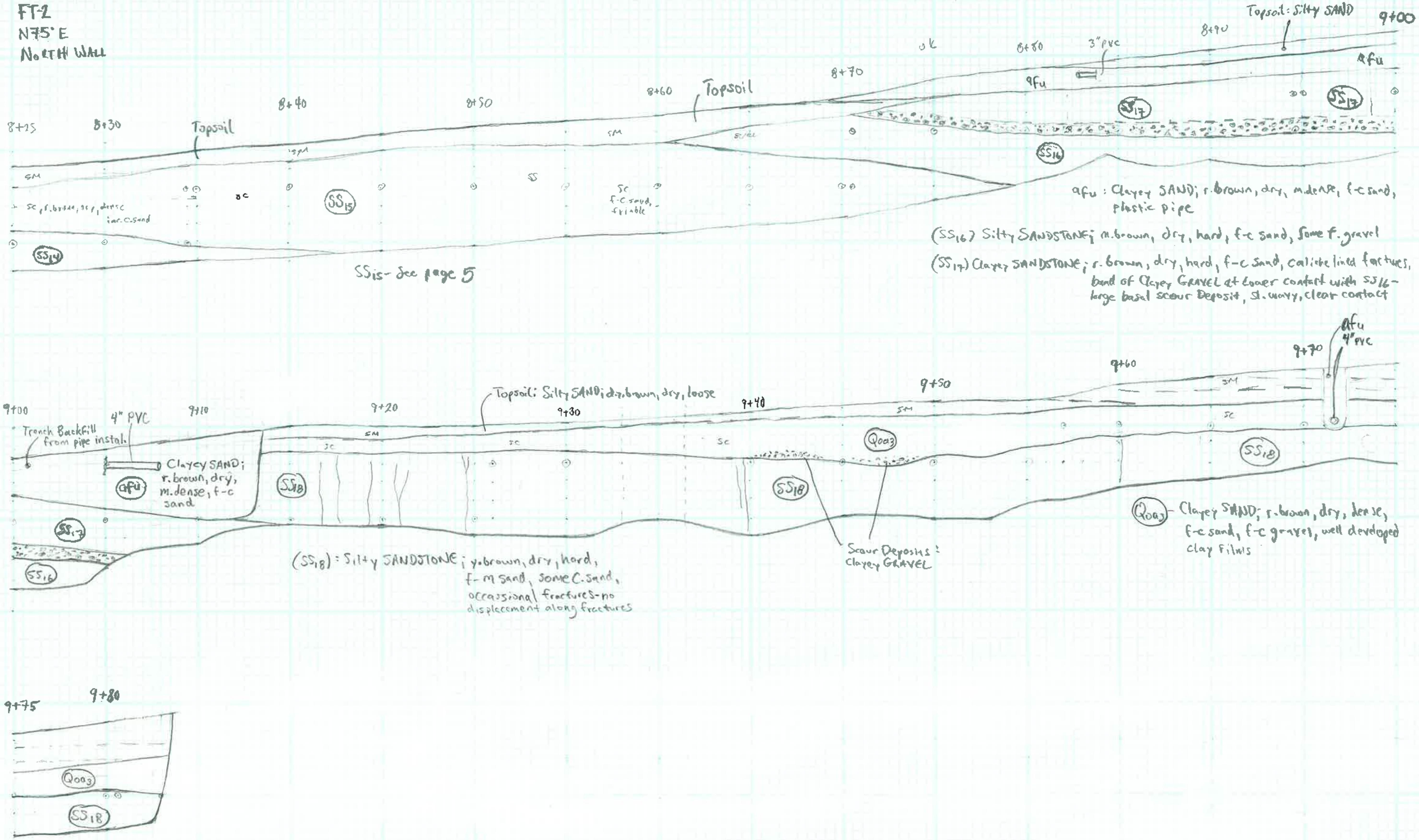
15805-10A
FT-2 ~N50°E / N. Wall



(SS15) Clayey SANDSTONE; reddish brown, dry, hard, f-c sand, apparent dip shallows beyond pivot point as Trench trench approaches bedrock Trends of N70°W to N75°W

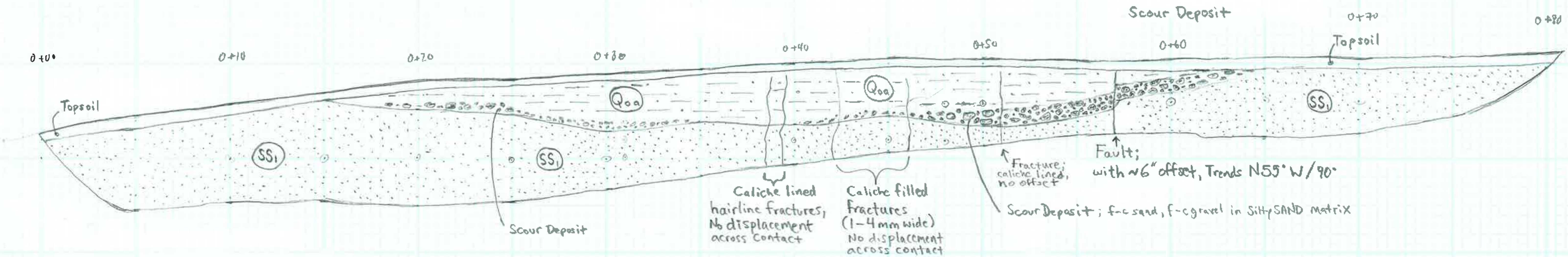
Earth-Strata, 2016
FT-2
Pg. 5 of 6
AGW
1" = 5' (Horz & Vert)

15805-10A
FT-2
N75°E
NORTH WALL



Earth-Strata, 2016
FT-2
P.6 of 6
AGW
1" = 5' (Horiz. & Vert.)

15805-10A
Fault Trench 3
N56°E
North Wall



LEGEND:

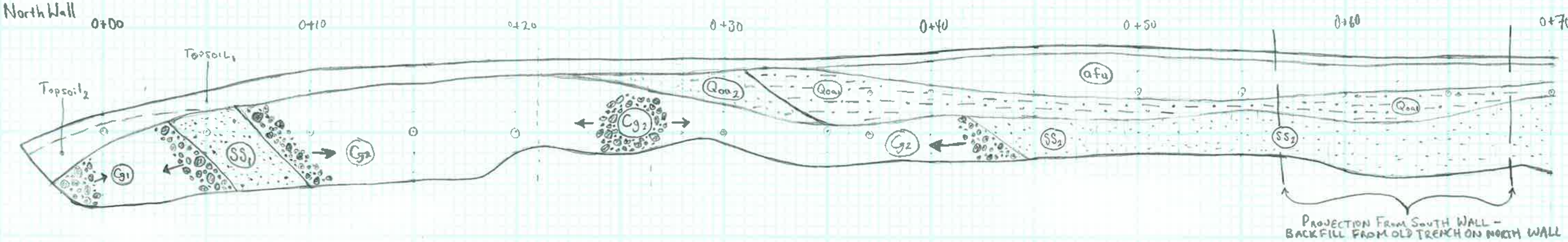
Topsoil: Clayey SAND; ol. brown, dry, m. dense, f-c sand, rootlets; clear, sharp lower contact with Qoa and Qps

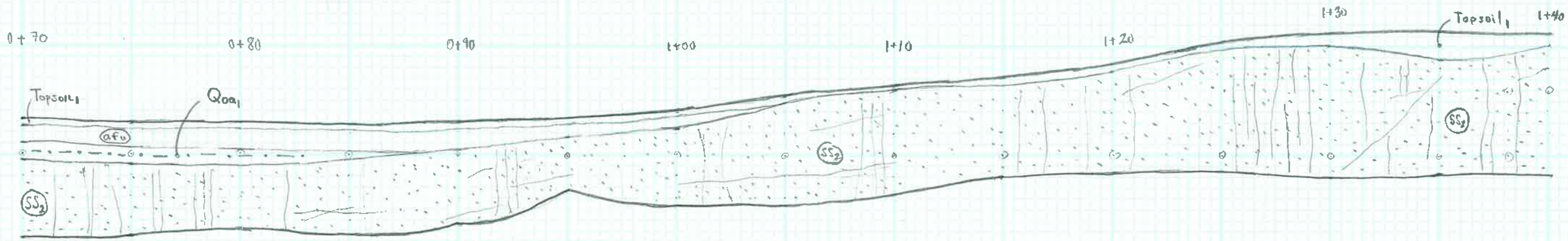
Quat. Old Alluvial Deposits (Qoa): Silty SAND; m. brown, dry, dense, f-c sand, f-c gravel, fining upward sequence, basal scour contact with Pauba Formation, concentrations of f-c gravel at basal scour. Caliche lined fractures extend down into Pauba. Fault with offset (~6", down to West) trends N50° W, at Sta. 0+57

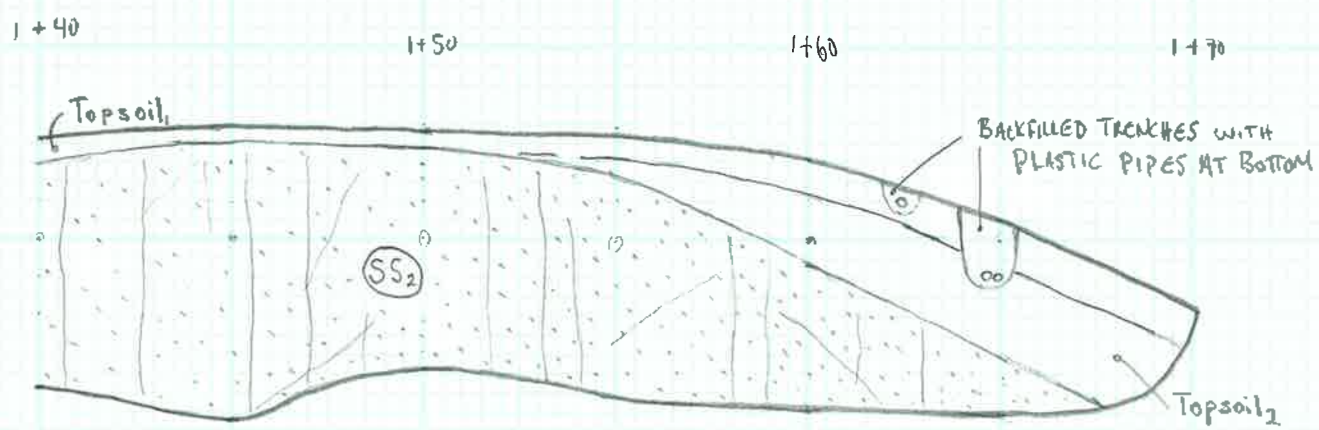
Quat. Pauba Formation (Qps): Silty SANDSTONE (SS_1); olive gray to ol. brown, dry, hard f-m sand, some c. sand, abundant hairline fractures with caliche infilling

Earth-Strata, 2016
FT-3
Pg. 1 of 1
AGW
1" = 5' (Horz & Vert)

15805-10A
Fault Trench 4
N26°E
North Wall







LEGEND

Topsoil$_1$: Silty SAND; dark yellowish brown, dry, loose, f-c sand, f-c gravel, porous

Topsoil$_2$: Silty GRAVEL; d.y. brown, dry, loose, f-c sand, f-c gravel,

Artificial Fill, Undocumented (afu): Silty SAND: gray, dry, loose, f-c sand, f-c gravel, broken Sandstone clasts

Quat. Old Alluvial Deposits: Qoa$_1$: Clayey SAND; r. brown, dry, dense, f-m sand, some c. sand, occassional caliche in lower 4". Sharp, clear, erosional contact with underlying Pauba Fm., 2-3" wide blocky peds

Qoa$_2$: Poorly-graded SAND with clay; r. brown, dry, dense, f-c sand, few fine gravel, blocky peds

Pauba Formation Units (Qps):

Cg$_1$ – Silty GRAVEL CONGLOMERATE; grayish brown, dry, v. hard, f-c sand, f-c gravel, cobbles

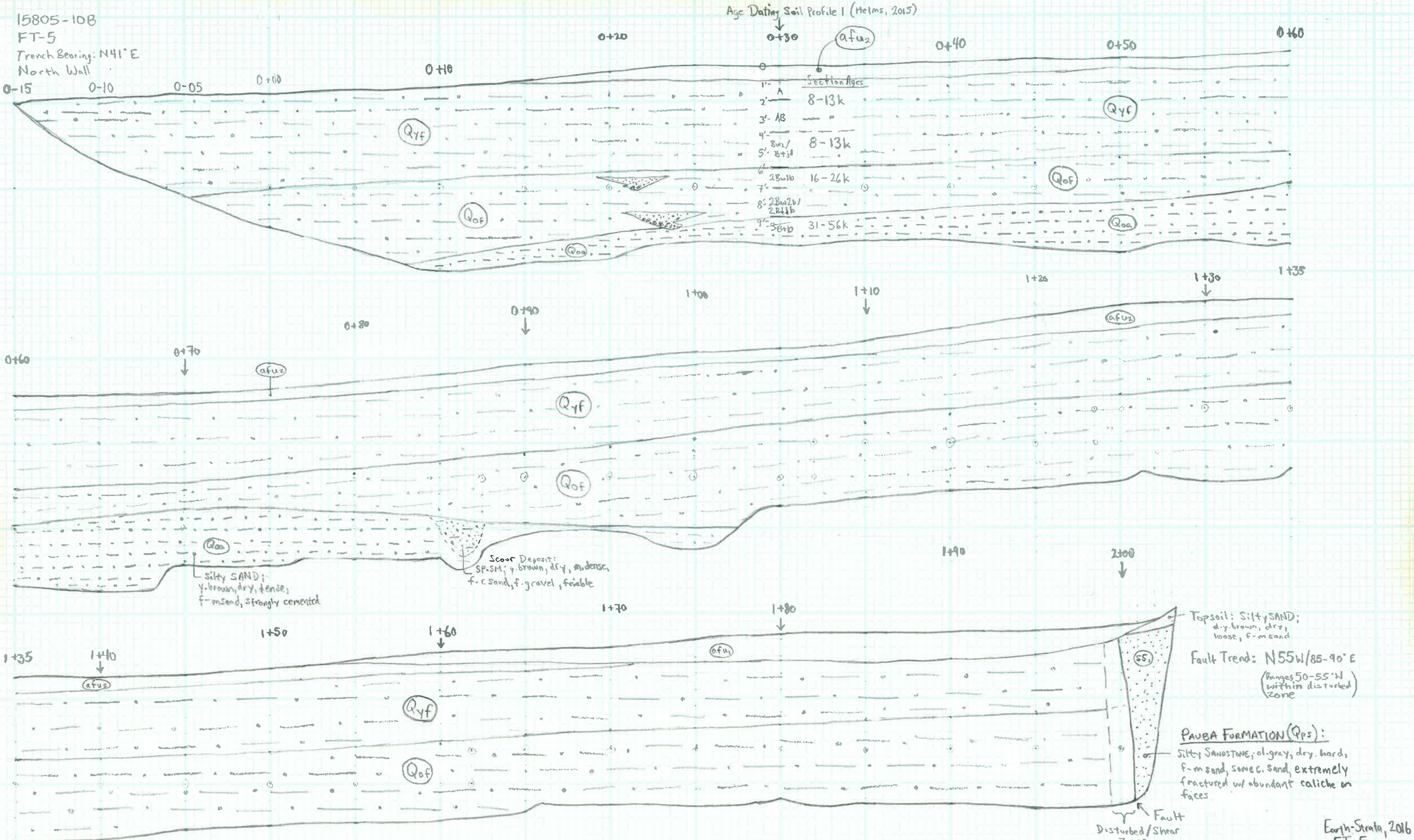
SS$_1$ – Silty SANDSTONE; y. brown, dry, hard, f-c sand, some f-c gravel, clear contacts between Cg$_1$ and Cg$_2$

Cg$_2$ – Silty GRAVEL CONGLOMERATE; y. brown, dry, hard, f-c sand, f-c gravel, clear, sharp contacts

SS$_2$ – Silty SANDSTONE; ol. gray, dry, hard, f-m sand, abundant hairline fractures without offset

Earth-Strata, 2016
FT-4
Pg. 1 of 1
AGW
1"=5' (Horiz & Vert.)

15805-10B
FT-5
Trench Bearing: N41°E
North Wall



LEGEND:

afu1 - Artificial Fill, Undocumented: Silty SAND; yellowish brown, dry, m.dense, fine to coarse sand, occasional trash

afu2 - Artificial Fill, Undocumented: Silty SAND; medium brown, dry, loose, fine to coarse sand, occasional metal trash, plastic hose

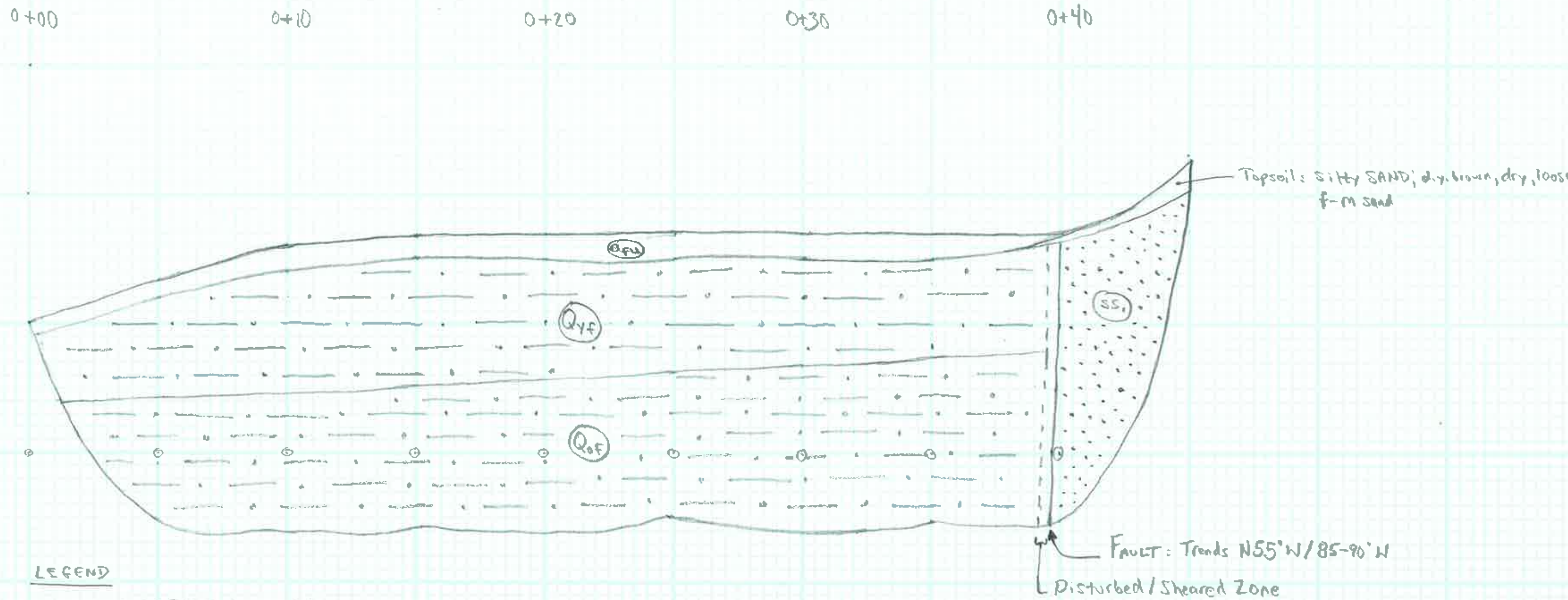
Qyf - Young Alluvial Fan Deposits: Silty SAND; dark yellowish brown, sl. moist, loose to m.dense, f-c sand, few f. gravel, sl. porosity, few clay films

Qof - Older Alluvial Fan Deposits: Silty SAND; m.brown, sl. moist, m.dense, f-c sand, few f. gravel, lenses of SAND w/ gravel Scour Deposits, moderate 2ndary clay deposition

Qoa - Old Alluvial Deposits: Clayey SAND; Strong brown, sl. moist, dense, f-m sand, some c. sand, few f. gravel

Earth-Strata, 2016
FT-5
Pg. 1 of 1
AGW
1"=5' (Horz & Vert.)

15805-10B
Fault Trench #6
Trench Bearing N33°E
North Wall



LEGEND

Afu – Artificial Fill, Undocumented: Silty SAND; y. brown, dry, m. dense, fine to coarse sand

Qyf – Quat. Young Alluvial Fan Deposits: Silty SAND; dark yellowish brown, dry, loose upper foot to m. dense, f-c sand, occasional f-c gravel, slight porosity, few clay films spanning/coating grains

Qof – Quat. Older Alluvial Fan Deposits: Silty SAND; medium brown, slightly moist, m. dense, f-c sand, occasional f-c gravel, moderate clay films spanning/coating grains

PAUBA FORMATION (Q_{ps}):

SS1 – Silty SANDSTONE; olive gray, dry, hard, fine to medium sand, occasional coarse sand, extremely fractured, fractures lined with abundant caliche on faces

Earth-Strata, 2016
FT-6
Pg. 1 of 1
AGW
1" = 5' (Horz. & Vert.)

APPENDIX C

Exploratory Boring Logs

Geotechnical Boring Log B-1

Date: December 29, 2015	**Project Name: Sun Belt Communities** **Page: 1 of 1**
Project Number: 15805-10A	**Logged By: SNJ**
Drilling Company: Drilling It	**Type of Rig: CME45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 1,193	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Pauba Formation (Qps):**
					SM	Silty SANDSTONE; brown, dry, very dense, fine to coarse sand
	53	2.5'	111.1	3.3		
5	58	5'	110.6	5.3		Dark brown and slightly moist at 5 feet
	124/9"	7.5'	124.8	6.2		Grayish brown, dry, very dense, medium to coarse sand, trace gravel
10	129/9"	10'	128.1	8.2		
						End of Boring 11.3 feet
						No Groundwater
15						
20						
25						
30						

Geotechnical Boring Log B-2

Date: December 29, 2015	**Project Name: Sun Belt Communities** **Page: 1 of 1**
Project Number: 15805-10A	**Logged By: SNJ**
Drilling Company: Drilling It	**Type of Rig: CME45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 1,195	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0		0-5'				**Quaternary Young Alluvial Fan Deposits (Qyf):**
					SM	Silty SAND; dark brown, dry, dense, some coarse sand w/ gravel, caliche cementation
	98	2.5'	113.9	4.3		
5	39	5'	116.9	4.5		Tan brown with fine to medium sand at 5 feet
					SP	Poorly-Graded SAND; brown, slightly dry, medium dense, mostly fine to medium sand, some coarse sand, some silt
	24	7.5'	108.5	4.7		
						Quaternary Older Alluvial Fan Deposits (Qof):
10	67	10'	114.1	6.1	SM	Silty SAND; medium brown, moist, very dense, fine to coarse sand with clay
						Quaternary Old Alluvium (Qoa):
15	123/9"	15'	112.9	13.6	SC	Clayey SAND; strong brown, slightly moist, very dense, fine to medium sand, some coarse sand
						End of Boring 16.3 feet
						No Groundwater
20						
25						
30						

Geotechnical Boring Log B-3

Date: December 29, 2015	**Project Name: Sun Belt Communities** **Page: 1 of 1**
Project Number: 15805-10A	**Logged By: SNJ**
Drilling Company: Drilling It	**Type of Rig: CME45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 1,228	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0		0-2.5'				**Quaternary Old Alluvial Deposits (Qoa):**
					SM	Silty SAND; light brown, dry, very dense, fine to medium sand, with clay
	107/8"	2.5'	121.6	7.7		
						Quaternary Pauba Formation (Qps):
5	61	5'	108.9	3.9	SM	Silty SANSTONE; yellowish brown, dry, very dense, fine to coarse sand
	112/9"	7.5'	101.5	5.6		Slightly wet below 9 feet
10	70/5"	10'	124.9	8.3		
						End of Boring 10.4 feet
						No Groundwater
15						
20						
25						
30						

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Geotechnical Boring Log B-4

Date: December 29, 2015	Project Name: Sun Belt Communities Page: 1 of 1
Project Number: 15805-10A	Logged By: SNJ
Drilling Company: Drilling It	Type of Rig: CME45B
Drive Weight (lbs): 140	Drop (in): 30 Hole Diameter (in): 8
Top of Hole Elevation (ft): 1,225	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Old Alluvial Deposits (Qoa):**
					SM	Silty SAND; reddish brown, dry, very dense, fine sand, trace clay,
	70	2.5'	106.6	2.1		caliche cementation
						Quaternary Pauba Formation (Qps):
5	70/5"	5'	-	2.4	SM	Silty SANDSTONE; reddish brown, dry, very hard, fine to coarse sand
	70/3"	7.5'	-	6.8		
10	70/3"	10'				
						End of Boring 10.3 feet
						No Groundwater
15						
20						
25						
30						

Geotechnical Boring Log B-5

Date: December 29, 2015	**Project Name: Sun Belt Communities** **Page: 1 of 1**
Project Number: 15805-10A	**Logged By: SNJ**
Drilling Company: Drilling It	**Type of Rig: CME45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 1,210	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Old Alluvial Deposits (Qoa):**
					SC	Clayey SAND; reddish brown, moist, very dense, fine to coarse sand,
	70/5"	2.5'	-	5.2		fine to coarse gravel, caliche cementation
5	132/10"	5'	107.9	6.5		**Quaternary Pauba Formation (Qps):**
					SP	Poorly-Graded SANDSTONE; olive green, moist, very dense, fine to coarse sand
	70/5"	7.5'	111.1	6.6		
						End of Boring 7.9 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log B-6

Date: December 29, 2015	**Project Name: Sun Belt Communities** **Page: 1 of 1**
Project Number: 15805-10A	**Logged By: SNJ**
Drilling Company: Drilling It	**Type of Rig: CME45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 1,193	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Pauba Formation (Qps):**
					SM	Silty SANDSTONE; brown, dry, hard, fine to medium sand
	50	2.5'	111.3	3.7		
5	70/5"	5'	107.1	3.8		Very hard below 5 feet
						Dark brown, semi moist, some coarse sand below 7 feet
	104/10"	7.5'	123.4	5.2		
10	97/8"	10"	114.6	7.0		
	70/5"	15'	122.9	7.5		
15						
						End of Boring 15.4 feet
						No Groundwater
20						
25						
30						

Geotechnical Boring Log B-7

Date: December 29, 2015	**Project Name: Sun Belt Communities** **Page: 1 of 1**
Project Number: 15805-10A	**Logged By: SNJ**
Drilling Company: Drilling It	**Type of Rig: CME45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 1,195	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Pauba Formation (Qpf):**
					SM	Silty SANDSTONE; reddish brown, slightly moist, very dense, fine to medium sand,
						some coarse sand, trace clay
	103/10"	2.5'	115.1	7.9		
5	70/5"	5'	107.1	5.7		
	70/5"	7.5'	109.0	11.5	SM	Tan, dry, very dense, fine to medium sand,
		8-10'				
10	70/1"	10'	118.5	8.3		
15	70/5"	15'	-	-		
						End of Boring 15.4 feet
						No Groundwater
20						
25						
30						

Geotechnical Boring Log B-8

Date: December 29, 2015	**Project Name: Sun Belt Communities** **Page: 1 of 1**
Project Number: 15805-10A	**Logged By: SNJ**
Drilling Company: Drilling It	**Type of Rig: CME45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 1,195	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Pauba Formation (Qps):**
					SM	Silty SANDSTONE; tan, dry, very hard, fine sand, some very coarse sand and gravel
	70/5"	2.5'	106.1	7.4		
5	70/1"	5'	-	4.8		
	70/5"	7.5'	103.7	8.0		
		8-10'				
10	70/4"	10'	109.0	7.5		
						End of Boring 10.3 feet
						No Groundwater
15						
20						
25						
30						

Geotechnical Boring Log B-9

Date: December 29, 2015	Project Name: Sun Belt Communities — Page: 1 of 1
Project Number: 15805-10A	Logged By: SNJ
Drilling Company: Drilling It	Type of Rig: CME45B
Drive Weight (lbs): 140	Drop (in): 30 — Hole Diameter (in): 8
Top of Hole Elevation (ft): 1,197	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Pauba Formation (Qpf):**
					SM	Silty SANDSTONE; brown, dry, very dense, fine sand
	70/5"	2.5'	104.4	4.5		
5	70/5"	5'	121.6	5.6		Reddish brown, slightly dry, coarse sand, gravel, and clay at 5 feet
						Moist at 7 feet
	116/10"	10'	108.6	8.8		
10	70/5"	10'	105.1	6.6	SP	Poorly-Graded SANDSTONE; reddish tan brown, slightly moist, very hard, fine to coarse sand
		11-15'				
15	70/5"	15'	105.9	6.9		
						End of Boring 15.4 feet
						No Groundwater
20						
25						
30						

Geotechnical Boring Log B-10

Date: December 29, 2015	**Project Name: Sun Belt Communities** **Page: 1 of 1**
Project Number: 15805-10A	**Logged By: SNJ**
Drilling Company: Drilling It	**Type of Rig: CME45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): 1,201	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Young Alluvial Fan Deposits (Qyf):**
					SM	Silty SAND; dark brown, dry, very dense, fine to medium sand, caliche cementation
	108/9"	2.5'	108.1	3.4		
5	67	5'	103.5	4.2		Some coarse sand at 5 feet
	27	7.5'	105.4	4.9		Slightly moist, medium dense at 7 feet
						Quaternary Older Alluvial Fan Deposits (Qof):
10	52	10'	118.4	6.2	SM	Silty SAND; medium brown, moist, very dense, fine to coarse sand with clay
						Quaternary Old Alluvium (Qoa):
15	78	15'	118.0	6.2	SC	Clayey SAND; strong brown, slightly moist, very dense, fine to medium sand,
						some coarse sand
						End of Boring 16.5 feet
						No Groundwater
20						
25						
30						

APPENDIX D

Soil Stratigraphy and Relative Age Estimates

(Helms, 2015)

Soil Stratigraphy Study And Relative Age Estimates For A Fault Rupture Hazard Investigation At The Proposed Camelia Development, APN: 380-220-003 Located North / East Of The Transition Of Palomar Street To Washington Avenue, City of Wildomar, Riverside County, California

Prepared by:

John Helms, CEG
40344 Wood Court, Palmdale, California 93551
Voice & FAX (661) 206-5860

Submitted to:

Mr. Aaron Wood
Earth Strata, Inc.
42217 Rio Nedo Road, Suite A-104A
Temecula, CA 92590

September 18, 2015

John Helms, CEG
40344 Wood Court, Palmdale, CA 93551; (661) 206-5860

Mr. Aaron Wood
Earth Strata, Inc.
42217 Rio Nedo Road, Suite A-104A
Temecula, CA 92590

September 18, 2015

Subject: **Soil Stratigraphy Study And Relative Age Estimates For A Fault Rupture Hazard Investigation At The Proposed Camelia Development, APN: 380-220-003 Located North / East Of The Transition Of Palomar Street To Washington Avenue, City of Wildomar, Riverside County, California**

Dear Mr. Wood:

I am pleased to present to you this soil stratigraphic study and relative-age determinations to be used with your fault rupture hazard assessment of the proposed Multi-family Camelia Development located north/east of the transition of Palomar Street to Washington Avenue in the City of Wildomar, Riverside County, California (APN: 380-220-003).

Earth Strata retained John Helms CEG to assist in correlations and descriptions of the soil stratigraphy from a two separate trench exposures (FT-5 and FT-1) and to assign relative age dates for the deposits identified across the site. Trench exposure FT-5 extends across a younger inset surface and alluvial apron in the northern portion of the project site area, and trench exposure FT-1 extends across an elevated and degraded spur / pressure ridge in the southern portion of the project site area. Soil profile 1 was described in the western and deepest end of the trench exposure FT-5 (at station 30 feet) and soil profile 2 was described near the western-central portion of trench exposure FT-1 (at stations 195 and 200 feet). The soil profile 1 and soil profile 2 soil descriptions are used to calculate soil development indices (or SDI). The SDI values were then compared to the SDI values from similar described soils with known ages to estimate age ranges for the soils understudy.

The attached report classifies the described soil profiles, identifies stratigraphic relationships, defines soil chronosequences, and estimates relative ages for the soil profiles across the project site area. Calculated SDI values show strong correlations to the SDI values of other published, described, and dated soil profiles with similar parent materials.

In trench FT-5, the surface soil and first buried soil can both be correlated across the entire length of the trench exposure. The surface soil in Trench FT-5 contains a well preserved and weakly developed argillic soil profile that ranges in relative age from 8 – 13 ka. The first buried soil in Trench FT-5 is a highly truncated and weakly developed argillic soil profile that ranges in relative age from 16 – 26 ka. The basal and second buried soil observed in trench FT-5 is a highly truncated and well developed soil remnant that ranges in relative age from 31 – 56 ka. The first buried soil observed in Trench FT-1 is a highly eroded, residual, and well developed argillic soil profile that ranges in relative age from 30 – 70 ka. Please see Table 6 in the attached report for a summary listing of all of the determined relative ages across the project site area.

Thank you for this opportunity to be of service. Should you have any questions or require additional information, please do not hesitate to contact me.

Sincerely,

John Helms, CEG 2272

REGISTERED GEOLOGIST
JOHN G. HELMS
No. 2272
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

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Tables

Figures

SOIL STRATIGRAPHY STUDY AND RELATIVE AGE ESTIMATES FOR A FAULT RUPTURE HAZARD INVESTIGATION AT THE PROPOSED CAMELIA DEVELOPMENT, APN: 380-220-003 LOCATED NORTH / EAST OF THE TRANSITION OF PALOMAR STREET TO WASHINGTON AVENUE, CITY OF WILDOMAR, RIVERSIDE COUNTY, CALIFORNIA

INTRODUCTION

Two soil profiles have been studied for geomorphic characteristics and relative degrees of weathering to estimate surficial and / or deposit relative-ages. The relative age estimates are based on index value comparisons with other published and dated soil profile descriptions. The comparative soils used are from areas with a similar climate and similar parent material to this study area. The estimated relative ages are used in this report to place the mapped Quaternary units in context and will be used within the attached fault rupture hazard report to assess the recency and recurrence of faulting across the study area. Alluvial units are assessed chronostratigraphically across a two separate trench exposure that span the entire project site area. In this study, the soil stratigraphy is defined with soil field description data, and no laboratory data. This study identifies the soil stratigraphy and estimates the relative age of two soil profiles that span the entire project site area. Trench exposure FT-5 is located across a subdued (and lightly graded) and inset alluvial apron geomorphic surface. Trench exposure FT-1 is located across an eroded and elevated spur or pressure ridge and pediment geomorphic surface.

For the Quaternary geologist, a soil can be defined as a natural body that consists of horizons of organic and/or mineral constituents which differ from its parent material in some way (Birkland, 1984). A chronosequence is a group of soils for which all soil forming factors (such as topography, parent material, vegetation, and climate) except time is relatively equal (Jenny, 1941). Recent geologic studies in the coastal region of southern California provide age constraints for several deposits and geomorphic surfaces ranging in age from middle Pleistocene to recent (McFadden, 1982; Rockwell, 1988; and WLA, 1998). Often it has proven difficult to date older deposits due to changes in past climatic regimes. Studies on the impacts of glacial to interglacial climatic changes on soil development in specific regions (McFadden, 1982; Birkland, 1984; McFadden, 1988) indicate that soil development has occurred throughout the Quaternary.

The soils encountered in this study classify as alfisols that relative age estimates range from 31.0 to 56.0 ka for the stratigraphic section studied in soil profile 1 (Trench FT-5 at station 30 feet), and from 30.1 to 70.5 ka for the stratigraphic section studied in soil profile 2 (Trench FT-1 at station 195 and 200 feet). Soil relative age estimates have broad ranges, dependent upon the pool of comparative data used. The soils across the study area fall into great group classifications (Soil Conservation Service, 2000) of Typic Haploxeralfs and Typic Palexeralfs. The soil descriptions locations are indicated on the trench logs and geologic map provided with the fault rupture hazard report.

MATERIALS AND METHODS

Two soil profiles from separate backhoe trenches were described, sampled, classified, and quantified within the study area. The attached Table 1.1 and Table 2.1 illustrate the soil profiles described. The SDI calculation sheets in Table 1.2 and Table 2.2 shows the methods used to estimate the soil relative ages.

The study is concerned with a portion of the southwestern Temescal Mountains and Paris structural block, which is in within the northern Peninsular Ranges Geomorphic Province. In this region the Elsinore fault zone forms a series of complex of pull-apart basins. The project site area is located along the northeastern margin of the Temecula Valley where the Wildomar Fault forms a strong physiographic step in the topography. The surface deposit within the alluvium (Trench FT-5) indicates that the incised ground surface across the northern margin of the study area is covered by Middle Holocene aged (8.0 – 13.0 ka) debris flow deposit (Qyf). The debris flow deposit is characterized by a massive, coarse-grained, and organic-rich soil. The surface debris flow deposit buries and severely truncates a similar Latest Pleistocene (16.0 – 26.0) aged debris flow deposit (Qof). This buried debris flow deposit is characterized by a massive, coarse-grained, and slightly oxidized soil that truncates a section of old alluvium (31.0 – 56.0 ka) (Qoa). The soil horizon exposed within the old alluvium is characterized by a moderately well oxidized, very hard, fine- to medium-grained sand with moderately strong sub angular and angular blocky ped structure. The soils developed on the pediment surface (Trench FT-1) indicate that the elevated ground surface across the southern margin of the study area is covered by a Late Pleistocene aged residual soil that formed (30.1 – 70.5 ka) into the exposed Pauba Formation bedrock.

The present climate of the study area is semiarid with most moisture arriving in the winter months (Western Regional Climate Center, 2006). Typically average annual air temperature ranges from 50° to 78° F (Western Regional Climate Center, 2006). Mean annual precipitation is from 12 to 15 inches (Western Regional Climate Center, 2006). Vegetation across the study area is of annual grasses, forbes, and scattered oaks. Bioturbation is present across the project site area.

Both soil profiles were located within backhoe trenches located across the project site. The soils were described in the field, using guidelines set by the Soil Survey Staff (1991 and 1999). Soil horizons were sampled as to prevent contamination from adjacent horizons (Soil Survey Staff, 1991). Sample sizes varied according to the gravel content of the soil horizons. Soil horizons thicker than 2 feet were sampled on a 1-foot interval.

Soil profile field description values quantify soil properties that are used to develop a soil development index (or SDI) value as outlined by Harden (1982). Points are assigned to descriptive data for each of several observed soil properties, such as dry color, moist color, texture, structure, dry and wet consistence, clay film content, and calcium carbonate stage level, for every horizon in a soil profile relative to this horizon's thickness normalized to a common depth. Tables 1.1 and 2.1 lists the soil descriptions for the studied surfaces in longhand format. Tables 1.2 and 2.2 lists the soil descriptions using soil conservation service notation and shows the SDI calculations. These tables show the calculated SDI values, the soil profile description, and the normalization values for raw alluvium. SDI values are calculated by assigning point values to described soil properties. The points are summed for each soil horizon and divided by the total number of descriptive properties used. This equals the mean horizon index value (or HI). HI values are multiplied by the corresponding soil horizon thickness. The SDI value equals the sum of the normalized horizon indices. Tables 1.2 and 2.2 lists all of the determined HI, SDI, and MHI values for the soils under study.

SDI values have shown significant correlations to soil age in many recent studies (Harden, 1981; Rockwell *et al.*, 1985; Reheis *et al*., 1990; Rockwell *et al.*, 1994). The soils described in this study are compared to soils described and dated by McFadden (1982 and 1987) in

San Bernardino County near Mission Creek, by Rockwell (1988) in the Ventura River basin, and by William Lettis and Associates, Inc. (1998) in West Hollywood. Table 3 lists the comparative soil profile descriptions, age, and determined SDI values. SDI values are calibrated to a common depth of 7 feet.

The changes in the subsurface pedogenic properties of the alfisols soil order allows for relative age determinations by emphasizing specific soil properties (such as color and clay film content) that are most diagnostic. Soil properties that express themselves well through time are most often used in the assessment of soil relative ages through a specific soil property index such as the clay film index, the color index, and the calcium carbonate index. MHI is a comparison of a soil pedons master (or diagnostic) subsurface horizon (typically an argillic or cambic horizon). Independent of horizon thickness, the MHI directly compares the properties of the soil profiles strongest soil horizon. The color index (Rockwell *et al.,* 1985, 1994) is used to quantify observed colors (in Mussel notation) of each profile in order to compare relative degrees of reddening. The color index is simply the summation of an entire profile’s horizon index values for dry colors. The clay film index (Rockwell *et al.,* 1985, 1994) is used to quantify field descriptions of this soil property in order to compare relative profile maturity. The clay film index is simply the summation of an entire soil profile’s horizon index values for clay films. Due to the arid climate, weathering rates are slow and translocation of clay is limited. The calcium carbonate index is a way to quantify concentrations of and formation rates for this salt. The calcium carbonate index is simply the soil profile’s horizon index values for calcium carbonate summed for an entire soil profile or deposit. Table 4 lists the calculated and normalized indices for the soil profiles under study.

SOIL RELATIVE AGE METHODS

Soil relative ages are calculated and compared independently for each soil profile described. The study area includes the northern Temecula Valley and associated alluvial deposits, and the southwestern Temescal Mountains and associated bedrock. Punctuated and stacked soils with weak to moderate pedogenic structure and illuvial clays characterize the alluvial soil profiles on this project site. Degraded, hard, clayey soils with advanced pedogenic structure and illuvial clays characterize the residual soil profiles on this project site.

The soil profiles described has a surface age implied by estimating the time of inception for the exposed surficial soil. The alluvial soils within this study area also contain a stacked or series of buried soils within the soil profile. In this case, a deposit age assessment is obtained by identifying and isolating the different parent materials. Then comparing a set of abridged calculated indices to an additional suite of similar soils that have been radiometrically dated yields the equivalent to a surface age estimate. Such burial relationships are common along range fronts; especially where soils developed into alluvial fan or apron deposits where debris flows can bury or locally truncate soils that have developed previously in older alluvial fan sediments. A cumlic soil profile estimated age can assess landform age, and has potential to assess rates of erosion, rates of landform evolution, and rates of tectonic activity across the study area.

The described soil profiles have associated SDI values, which are used to estimate the soil relative age. Cumuli relative age estimates for a stacked or buried soil profile are specifically referred to as “deposit ages”. The relative age estimate for the surface profile or modern soil is referred to as the “surface age”.

DISCUSSION AND RESULTS

This section presents the data and age derived from both described soil profiles. The section contains a brief write up with tables designated for each of the described soil profiles. The geomorphic surface description of each soil profile, soil profile descriptions (Tables 1.1 and 2.1), and the SDI calculation results (Tables 1.2 and 2.2).

The attached Tables 1.1 and 2.1 presents the soil profile descriptions in longhand format. Tables 1.2 and 2.2 presents the results of the calculated SDI values. Table 3 is a compilation of the comparative data in a format that compares to the data generated for this study. Table 4 lists the SDI values and estimated relative age summary for the soil profile under study. Table 5 is a key for understanding the shorthand soil description nomenclature utilized in tables 1, 2 and 3. Lastly, Table 6 is a trench log unit to soil relative age date correlation chart.

Soil Profile 1
Trench FT-5, Station 30 feet

Soil profile 1 is located in trench FT-5 at station 30 feet, which is in the western portion of the trench exposure. This surface is geomorphically inactive and the surface deposits consists chiefly of an organic-rich debris flow deposit over a stacked and truncated debris flow deposit and old stream terrace deposit. The debris flow deposits are coarse-grained, with minor amounts of secondary clay, and the surface soil displays a subdued surface morphology from past grading activities. The surface soil profile is classified as a Haploxeralf, and is characterized by an organic- and silt-rich massive A – AB – Bw1 – Btj / Bw2 horizon sequence. Diagnostic subsurface soil horizon properties observed within this soil include thin and slightly oxidized juvenile argillic horizon that is slightly hard, coarse-grained with weak medium sub angular blocky structure. A relative age estimate of 8 to 13 ka for this surface soil in soil profile 1 was obtained by comparing SDI and MHI values to the to more mature soil from profile S-4 in the Mission Creek soil chronosequence (McFadden, 1988) and the less mature soil from profile Qt3 also in the Ventura river basin soil chronosequence (Rockwell, 1985). The soil development indices for this surface deposit are listed in Table 4.

The first buried soil profile encountered in the trench exposure is stacked and truncated (buried and eroded beneath the surficial soil). This soil profile is poorly preserved, and also classifies as a Haploxeralf. The soil is characterized by a juvenile argillic diagnostic subsurface soil horizon. The 2Bwb1 - 2Btjb / 2Bwb2 horizons include slightly oxidized, coarse-grained, weak clay film development, and weak fine sub angular blocky soil structure. This deposit has scoured out or eroded into the underlying older alluvium. A relative age estimate of 8 to 13 ka for the first buried soil in soil profile 1 was obtained by comparing SDI and MHI values to the to more mature soil from profile S-4 in the Mission Creek soil chronosequence (McFadden, 1988) and the less mature soil from profile Qt3 also in the Ventura river basin soil chronosequence (Rockwell, 1985). The soil development indices for this surface deposit are listed in Table 4.

The second and lowest buried soil profile encountered in the trench FT-5 exposure is highly truncated (eroded and buried). This soil profile is classified as a Paleoxeralf, and is characterized by a single moderately well-developed argillic (3Btb) diagnostic sub surface horizon remnant. Diagnostic properties here include moderately strong oxidation and moderately strong medium angular blocky soil structure. A relative age estimate of 15.0 – 30.0 ka for this remnant in soil profile 1 was obtained by comparing SDI and color index values to less mature soils from profile Qt5a in the Ventura river basin soil chronosequence (Rockwell, 1985) and to more mature soil from profile Qt5b in the Ventura river basin soil chronosequence (Rockwell, 1985). The soil development indices for this buried deposit are listed in Table 4.

In conclusion, the entire section of soil profile 1 in trench FT-5 is estimated to be 31.0 to 56.0 ka. Most of this age resides within the lowest portion (8.5 to 10.1 feet in depth) of the exposure.

TABLE 1.1 Soil Profile – 1, Trench FT-5 at Station 30 Feet
Earth-Strata, Inc.'s Fault Rupture Hazard Study for the Proposed Camelia Development, City of Wildomar, Riverside County, California

Soil Classification: Stacked Typic Haploxeralfs over a buried and truncated Typic Paleoxeralf
Geomorphic Surface: Alluvial fan / alluvial apron
Parent Material: Alluvium
Vegetation: Grasses, sparse Trees
Described By: John Helms
Exposure Type: Backhoe Trench

Horizon	Depth (ft)	Thickness (ft)	Description of FT-5 At Station No. 30
A_f	0 – 0.9	0.9	Artificial Fill – Not Described
A	0.9 – 2.0	1.1	Dark Brown (10YR 3/3d, 2/2m), loam, hard, friable, slightly sticky, slightly plastic, medium-grained moderately well sorted sand, with few fine sub angular sandstone gravel, organic and silt rich, highly bioturbated and massive, moderately strong medium and coarse sub angular to angular blocky structure, few to common fine and few medium pores, humus films very dark grayish brown (10YR 3/2d, 2/1m) few thin lining pores, few thin on ped faces, and few thin coating clasts, cumulic or stacked surface soil (Qyf - top), alluvial apron deposit, gradational wavy lower boundary to;
AB	2.0 – 3.8	1.8	Brown (10YR 4/3d, 10YR 3/2m), sandy loam to loam, slightly hard, friable, slightly sticky, non- to slightly plastic, medium-grained moderately well sorted sand with few fine sub angular sandstone gravel, slight organics, locally bioturbated, massive with weak fine and medium sub angular blocky structure, few fine and common medium pores, predominate humus films very dark grayish brown (10YR 3/2d, 2/1m) common fine and few moderately thick coating clasts and lining pores, and lesser clay films very dark yellowish brown (10YR 3/4d, 2/2m) few thin on ped faces, transitional surficial soil horizon (Qyf), gradational wavy lower boundary to;

Horizon	Depth (ft)	Thickness (ft)	Description of FT-5 At Station No. 30 (Cont.)
Bw1	3.8 – 5.4	1.6	Dark yellowish brown (10YR 4/4d, 10YR 3/3m), loam, hard to very hard, friable, slightly to moderately sticky, slightly plastic, coarse-grained poorly sorted sand with very few fine sub angular sandstone gravel, slightly oxidized, slight organics, massive to crudely stratified with weak fine sub angular blocky structure, few medium pores, clay films yellowish brown (10YR 5/4d, 10YR 4/3m) very few thin on ped faces, very few thin coating clasts, and many clay stains, strong cambic subsurface soil horizon (Qyf), gradational wavy lower boundary to;
Bw2 / Btj1	5.4 – 5.8	0.4	Dark yellowish brown (10YR 4/4d, 10YR 3/3m), loam, hard, friable, moderately sticky, slightly to moderately plastic, medium-grained moderately well sorted sand with very few fine sub angular sandstone gravel, slightly well oxidized, massive and weak to moderately strong fine and medium sub angular blocky structure, few medium pores, clay films yellowish brown (10YR 5/4d, 10YR 4/3m) few thin lining pores and few thin on ped faces, and few thin coating clasts, juvenile argillic diagnostic subsurface soil horizon (Qyf – base), gradational wavy lower boundary to;
2Bw1b	5.8 – 7.0	1.2	Brown (10YR 4/3d, 10YR 3/2m), sandy loam, slightly hard, friable, slightly sticky, non-plastic, medium- to coarse-grained poorly sorted sand with few fine sub angular sandstone gravel, massive and weak to moderately strong fine and medium sub angular blocky structure, few medium and large pores, common clay stains on grains and few clay stains on ped faces, truncated soil, weak cambic subsurface soil horizon (Qof - top), gradational boundary to;
2Bw2b / 2Btjb	7.0 – 8.5	1.5	Dark yellowish brown (10YR 4/4d, 3/3m), loam, hard, friable, slightly sticky, slightly to moderately plastic, medium- to coarse-grained poorly sorted sand with common fine sub angular sandstone gravel, slightly well-oxidized, massive to crudely stratified and weak to moderately strong fine, medium, and coarse angular and sub angular blocky structure, clay films yellowish brown (10YR 5/4d, 10YR 4/3m) common very thin on ped faces and coating clasts, scour deposit, juvenile argillic diagnostic subsurface soil horizon (Qof – base), clear smooth boundary to;

Horizon	Depth (ft)	Thickness (ft)	Description of FT-5 At Station No. 30 (Cont.)
3Btb	8.5 – 10.5+	2.0+	Strong brown (7.5YR 4/6d, 7.5YR 3/4m), clay loam, very hard, friable, moderately to very sticky, moderately plastic, fine- to medium-grained moderately well sorted sand, very few fine sub angular sandstone gravel, moderately well oxidized, massive and weak, fine and medium angular blocky structure, clay films brown (7.5YR 4/4d, 7.5YR 3/3m) common thin and few moderately thick on ped faces, and common moderately thick coating clasts, truncated soil, argillic diagnostic subsurface soil horizon (Qoa – top), undetermined lower boundary.

TABLE 1.2 - Soil Development Index Calculation Sheet
Soil Profile - 1, Trench FT-5 At Station 30 Feet

Unit	Thickness (Feet)	Color				Texture		Structure		Consistence				Clay Films		Carbonate Stage		Horizon Values	Mean Hor. Values
		Dry		Moist						Dry		Wet							
Raw Alluvium	*3*	*2.5Y 7/2*	*X/10*	*10YR 6/3*	*X/10*	*s*	*X/5*	*sg*	*X/6*	*lo*	*X/5*	*so, po*	*X/6*	*0*	*X/15*	*0*	*X/5*		
Profile 1																			
A	1.1	10YR 3/3	0.1	10YR 2/2	0	l	0.6	2 abk - sbk	0.67	h	0.6	ss, ps	0.33	0	0	0	0	0.33	0.36
AB	1.8	10YR 4/3	0.1	10YR 3/2	0	sl-l	0.5	1 sbk	0.33	sh	0.4	ss, po-ps	0.25	v1fpf	0.17	0	0	0.25	0.45
Bw1	1.6	10YR 4/4	0.2	10YR 3/3	0	l	0.6	1 sbk	0.33	h-vh	0.7	ss-s, ps	0.42	v1fpf, v1fcl	0.23	0	0	0.35	0.57
Bw2 / Btj	0.4	10YR 4/4	0.2	10YR 3/3	0	l	0.6	1-2 sbk	0.42	h	0.6	s, ps-p	0.58	1fpf, 2fpo, 1fcl	0.42	0	0	0.40	0.16
2Bwb1	1.2	10YR 4/3	0.1	10YR 3/2	0	sl	0.4	1-2 sbk	0.42	sh	0.4	ss, po	0.17	2vnpf	0.23	0	0	0.25	0.29
2Bwb2 / 2Btjb	1.5	10YR 4/4	0.2	10YR 3/3	0	l	0.6	1-2 sbk - abk	0.5	sh-h	0.5	s, ps-p	0.58	v1fpf, 2vncl	0.33	0	0	0.39	0.58
3Btb	2.0	7.5YR 4/6	0.5	7.5YR 3/4	0.2	cl	0.8	1 sbk-abk	0.42	vh	0.8	s-vs, p	0.75	1dpf, 2dcl	0.43	0	0	0.56	1.11

INDEX VALUES AND DETERMINED AGES (ka)

Soil Member	MHI	Mean Soil Index	SDI @ 7 feet	Color Index	Clay Film Index	Soil Age Estimate ka	Section Age Estimate ka	Stratigraphic Unit
Surface Soil	**0.40**	**1.54**	**20.94**	**0.6**	**0.82**	**8 - 13**	**8.0 - 13.0**	**Qyf**
Buried Soil 1	**0.39**	**0.88**	**21.60**	**0.3**	**0.56**	**8 - 13**	**16.0 - 26.0**	**Qof**
Buried Soil 2	**0.56**	**1.11**	**37.14**	**0.7**	**0.43**	**15 - 30**	**31.0 - 56.0**	**Qoa**

Soil Profile 2
Trench FT-1, Stations 195 and 200 feet

Soil profile 2 is located in trench FT-1 in between stations 195 and 200 feet, which is near the central portion of this trench exposure. This surface is geomorphically inactive and the surface deposits consists chiefly of an organic- and silt-rich eolian deposit over a residual soil that has formed into bedrock. The Pauba Formation bedrock is coarse-grained and well bedded. The pediment surface displays a subdued surface morphology from past grading activities. The organic rich surface soil profile is not classified and is characterized by an organic- and silt-rich massive A / AB horizon. There is no diagnostic subsurface horizon present in this surface soil. A relative age estimate of 0.1 to 0.5 ka for the surface soil at profile 2 was obtained by comparing the color index and SDI values to the more mature soil from profile S-7 in the Mission Creek soil chronosequence (McFadden, 1988). The soil development indices for this surface deposit are listed in Table 4.

The first buried soil profile encountered in the trench exposure is a degraded and residual soil that has formed into the Pauba Formation sandstone and conglomerate bedrock. This soil profile is moderately well preserved, and classifies as a Paleoxeralf. The soil is characterized by a highly eroded and well developed argillic diagnostic subsurface soil horizon that overlies a mature laminar BC transitional soil horizon. The 2Btb – 2BCb lam horizons include moderately well oxidized, coarse-grained, strong clay film development, and moderately strong medium prismatic and angular blocky soil structure. This soil has formed into the underlying Pauba Formation bedrock and soil formation rates are partially lithological dependent. The soil changes nature along the strike of the differing beds within this rock unit. A relative age estimate of 30 to 70 ka for this residual soil in profile 2 was obtained by comparing SDI and color index values to less mature soils from profile Qt5b in the Ventura river basin soil chronosequence (Rockwell, 1985) and the more mature soil from profile S-2 in the Mission Creek soil chronosequence (McFadden, 1988). The soil development indices for this buried deposit are listed in Table 4.

In conclusion, the entire section of soil profile 2 in trench FT-1 is estimated to be 30.1 to 70.5 ka. Most of this age resides within the central portion (2.0 to 4.6 feet in depth) of this exposure.

TABLE 2.1 Soil Profile – 2, Trench FT-1 at Station 195 to 200 Feet
Earth-Strata, Inc.'s Fault Rupture Hazard Study for the Proposed Camelia Development, City of Wildomar, Riverside County, California

Soil Classification: Severely truncated residual Typic Paleoxeralf
Geomorphic Surface: Top of Pressure Ridge, eroding surface
Parent Material: Pleistocene-aged Pauba Formation, sandstone and conglomerate members
Vegetation: Grasses
Described By: John Helms
Exposure Type: Backhoe Trench

Horizon	Depth (ft)	Thickness (ft)	Description of FT-1 At Station No. 195 – 200 feet
A / AB	0.0 – 2.0	2.0	Dark Brown (10YR 3/3d, 2/2m), loam, hard, friable, slightly sticky, slightly plastic, medium-grained moderately well sorted sand, with few fine sub angular sandstone gravel, organic and silt rich, highly bioturbated and massive, moderately strong medium and coarse sub angular to angular blocky structure, few to common fine and few medium pores, humus films very dark grayish brown (10YR 3/2d, 2/1m) few thin lining pores, few thin on ped faces, and few thin coating clasts, young surface soil (Qys), organic rich and eolian -rich deposit, clear irregular lower boundary to;
2Btb	2.0 – 3.2	1.2	Strong brown (7.5YR 4/6d, 7.5YR 3/4m), clay loam, very hard, friable, very sticky, moderately to very plastic, coarse-grained poorly sorted sand, very few fine angular sandstone fragments, moderately well oxidized, massive and moderately strong, fine and medium prismatic and angular blocky structure, clay films brown (7.5YR 4/4d, 7.5YR 3/3m) common thick and many moderately thick on ped faces, and common thick coating clasts, residual soil, exhumed argillic diagnostic subsurface soil horizon (Qoa – top), irregular wavy lower boundary to;
2BCb lam	3.2 – 4.6	1.4	Matrix is Yellowish brown (10YR 5/4d, 10YR 4/3m), loamy sand, soft to slightly hard, very friable, non-sticky, non-plastic, coarse-grained poorly sorted sand with few fine sub angular sandstone gravel, crudely stratified and single grained structure, Laminations are wavy and slightly continuous, 1.5 to 2.5" thick, spaced 1.0 – 3.0" apart, lams are Strong brown (7.5YR 4/6d, 7.5YR 3/4m), moderately well oxidized, coarse-grained, slightly hard to hard, clay films brown (7.5YR 4/4d, 7.5YR 3/3m) common moderately thick on ped faces, and few thick bridging sand grains, laminated transitional subsurface soil horizon (Qoa - base), undetermined lower.

TABLE 2.2 - Soil Development Index Calculation Sheet
Soil Profile - 2, Trench FT-1 At Station 195 and 200 Feet

Unit	Thickness	Color				Texture		Structure		Consistence				Clay Films		Carbonate		Horizon	Mean Hor.
	(Feet)	Dry		Moist						Dry		Wet				Stage		Values	Values
Raw Alluvium	*3*	*2.5Y 7/2*	*X/10*	*10YR 6/3*	*X/10*	*s*	*X/5*	*sg*	*X/6*	*lo*	*X/5*	*so, po*	*X/6*	*0*	*X/15*	*0*	*X/5*		
Profile 2																			
A / AB	2.0	10YR 3/3	0.1	10YR 2/2	0	l	0.6	2 abk - sbk	0.67	h	0.6	ss, ps	0.33	0	0	0	0	0.33	0.66
2Btb	1.2	7.5YR 4/6	0.6	7.5YR 3/4	0.2	cl	0.8	2 pr-abk	0.75	vh	0.8	vs, p-vp	0.92	2kpf, 2kcl	0.6	0	0	0.67	0.80
2BCb lam	1.4	10YR 5/4	0.3	10YR 4/3	0	ls	0.2	1 sbk	0.33	sh	0.4	so-ss, po	0.08	2dpf, 1dbr	0.53	0	0	0.26	0.37

INDEX VALUES AND DETERMINED AGES (ka)

Soil Member	MHI	Mean Soil Index	SDI @ 7 feet	Color Index	Clay Film Index	Soil Age Estimate ka	Section Age Estimate ka	Stratigraphic Unit
Surface Soil	**0.33**	**0.66**	**21.94**	**0.1**	**0.00**	**0.1 - 0.5**	**0.1 - 0.5**	**Qys**
Buried Soil 1	**0.67**	**1.17**	**29.97**	**1.1**	**1.13**	**30.0 - 70.0**	**30.1 - 70.5**	**Qoa**

CONCLUSIONS

The soils observed across the study area are alfisols that have developed both in alluvial and bedrock environments. In the alluvial environment surfaces that have been stable long enough to form a robust soil, can suddenly be buried by a new deposit, or scoured out (truncated) and possibly infilled with younger material. In the bedrock environment lateral variability in the soils is dependent upon the underlying lithology.

In trench FT-5, the surface and first buried Haploxeralf soils with juvenile argillic sub surface soil horizons are weakly developed. These soils typically have 10YR colors with small amounts of secondary (pedogenic) clay in a sequence of buried and / or truncated cambic (Bw) and juvenile argillic (Btj) diagnostic subsurface horizons The lowest Paleoxeralf soil within this trench exposure is well-developed. This soil remnant has 7.5YR color hues, moderately strong oxidation, and moderately strong angular pedogenic structure.

The soil horizon boundaries observed in the trench FT-5 exposure are flat lying and generally parallel to the ground surface. This indicates that these soils formed in place and have not been appreciably tilted (or uplifted), or eroded. Table 4 summarizes the soil profile index values respective to their determined relative ages. There is a clear progression in index values with relative age.

In trench FT-1, a residual Paleoxeralf soil with a strong argillic sub surface soil horizon is highly degraded and well developed. This soil typically has 7.5YR colors and is plugged with secondary (pedogenic) clay in an argillic (Bt) diagnostic subsurface horizon with moderately strong prismatic and angular pedogenic structure. The soil horizon boundaries observed in the trench FT-1 exposure are wavy but generally parallel to the ground surface. This indicates that these soils formed in place and have not been appreciably tilted (or uplifted), or eroded. Table 4 summarizes the soil profile index values respective to the determined relative ages. There is a clear progression in index values with relative age.

These soil relative age determinations are consistent with the general geologic and pedogenic observations of soils in southern California. Strongly developed, well horizonated, thick, and oxidized alfisols can be as much as 200 ka in age. Erosion tends to act as a rejuvenating aspect in soil development, by decreasing the strength of the soil development properties consequent age estimates are younger. In that past magnitudes and rates of erosion is difficult to assess the soil relative age estimates are utilized as minimum ages.

Table 3 lists the comparative data used in this study, and shows comparisons to the values derived for this study. Table 5 is a key to help decipher the soil conservation service’s nomenclature and soil field description abbreviations listed in tables 1 and 2.

In conclusion, the buried soils exposed in both trench exposures are Pleistocene in age. In Trench FT-5 the first buried soil displays thick diffuse soil horizons that have some argillic horizon development. This buried soil (Qof) that was exposed across the entire trench exposure at a depth of approximately 6 feet below the ground surface contains a weakly developed juvenile argillic diagnostic sub surface soil horizon and is classified as Typic Haploxeralf, and is grouped into a 16 to 26 ka relative age setting. In Trench FT-1 the bedrock residual soil displays compact soil horizons that have advanced argillic horizon development. This soil (Qoa) that was exposed across the entire trench exposure at a depth of approximately 2 feet below the ground surface contains an argillic diagnostic sub surface soil horizon and is classified as Typic Paleoxeralf, and is grouped into a 30.1 to 70.5 ka relative age setting.

LIMITATIONS

The conclusions and recommendations presented herein are the results of an inherently limited scope. Specifically, the scope of services consisted of an assessment of relative age and did not participate in many mapping or logging activities at the site. The conclusions and recommendations contained in this report are professional opinions derived in accordance with current standards of professional practice. No warranty is expressed or implied.

This report has been prepared for the exclusive use of Earth Strata Inc. and applies only to the Fault Rupture Hazard Study located at the proposed Camelia Development, APN: 380-220-003, in the City of Wildomar. In the event that significant changes in the interpretations of this study to be made, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed by John Helms, CEG, and the conclusions and recommendations of this report are verified in writing.

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Table 3. Comparison Soil Data Indices Value Summary

(McFadden) Mission Creek Soils	SDI At 7'	MHI	Reddening Index	Clay Film Index
S7 0-1000 yrbp	5.9	0.12	0	0
S5 4-13 ka	10.2	0.3	0.1	0
S4 13-70 ka	31.4	0.37	3.94	7.37
S2 70-250 ka	56.10	0.61	4.80	6.24
S2a 250-700 ka	25.70	0.39	6.20	10.31

(Rockwell) Ventura River Basin Soils	SDI At 7'	MHI	Reddening Index	Clay Film Index
Qt3 4 - 8 ka	17	0.17	0.5	0
Qt4 10 -15 ka	27	0.43	2	4
Qt5a 15 – 20 ka	28	0.37	3.5	4.2
Qt5b 30 ka	32	0.46	5	7

(WLA) West Hollywood Buried Soils	SDI At 7'	MHI	Reddening Index	Clay Film Index
Qol1 100 ka	21.4	0.42	1.05	1.99
Qol2 100-300 ka	73.5	0.8	8.2	13.2

Table 4. Soil Relative-Age Summary

Trench / Profile No.	Soil Horizons	Soil Depths (Feet)	MHI Value	SDI Value	Color Index	Clay Film	Soil Age Estimate (ka)	Section Age Estimate (ka)	Soil Classification	Stratigraphic Unit
FT-5	A, AB, Bw1, Bw2 / Btj	0.9 - 5.8	0.40	20.94	0.6	0.82	8 - 13	**8.0 - 13.0**	Haploxeralf	**Qyf**
Soil Profile 1	2Bwb1, 2Bwb2 / 2Btjb	5.8 - 8.5	0.39	21.60	0.3	0.56	8 - 13	**16.0 - 26.0**	Haploxeralf	**Qof**
	3Btb	8.5 - 10.5+	0.56	37.14	0.7	0.43	15 - 30	**31.0 - 56.0**	Paleoxeralf	**Qoa**
FT-1	A / AB	0.0 - 2.0	0.33	21.94	0.1	0.00	0.1 - 0.5	**0.1 - 0.5**	--	**Qys**
Soil Profile 2	2Btb, 2BCb lam	2.0 - 4.6+	0.67	29.97	1.1	1.13	30 - 70	**30.1 - 70.5**	Paleoxeralf	**Qoa**

TABLE 5. Soil Field Description Abbreviation Key

Texture		Structure		Consistence						Clay Films		Calcium Carbonate	
				Dry		Moist		Wet				(Pedogenic CaCO3)	
S	- sand	m	- massive	l	- loose	vfr	-very friable	so	non stickey	v1	veryfew	sl dis	slightly dissemenated
LS	- loamy sand	sg	- single grained	so	-soft	fr	-friable	ss	slightly stickey	1	few	I	slight coatings common on clast bottoms
SL	- sandy loam		OR	sh	-slightly hard	fi	-firm	s	moderately sitecke	2	common	II	moderately thick coatings on clast bottoms; few medium common fine
L	- loam	1	- weak	h	-hard	vfi	-very firm	vs	very stickey	3	continuous	III	thick coatings common on clast bottoms, common medium nodules, common fine pendants, many fine nodules
CL	- clay loam	2	- moderate	vh	-very hard				AND		AND	VI	many thick coatings on clasts bottoms common coarse pendants few clasts completely enveloped
SCL	- sandy clay loam	3	- strong	eh	-extremely hard			po	non plastci	vn	stains	V	many thick coatings on clasts bottoms, many coarse pendants common clasts completely enveloped-petrocalcic
C	- clay		AND					ps	slightly plastic	n	thin	V+	many thick coatings on clasts bottoms, many coarse pendants many clasts completely enveloped, completely disseminated in matrix -
Si	- silt	vf	- very fine					p	moderately plastic	mk	moderately thick		
SiL	- silt loam	f	- fine					vp	very plastic	k	thick		
SiCL	- silt clay loam	m	- medium								AND		
SiC	- silty clay	c	- coarse							cl	coating clasts		
		vc	- very coarse							pf	ped faces		
			AND							br	brodgeing sand grains		
		gr	- granular							po	lining pores		
		pl	- platty										
		pr	-prismatic										
		abk	-angular blockey										
		sbk	- sub angular blockey										

Table 6. Trench Log Unit Correlation

Trench Log Unit	Trench	Soil Horizon	Age (ka)
Qyf	FT-5	Surface Debris Flow Deposit	8.0 - 13.0
Qof	FT-5	Buried Debris Flow Deposit	16.0 - 26.0
Qoa	FT-5	Buried Old Alluvial Deposit	31.0 - 56.0
Qys	FT-1	Surface (or Top) soil	0.1 - 0.5
Qoa	FT-1	Old Alluvium/Residual Bedrock Soil	30.1 - 70.5

Proposed Camelia Development, CIty of Wildomar

Soil Profile 1, Trench FT-5, Station 30 feet

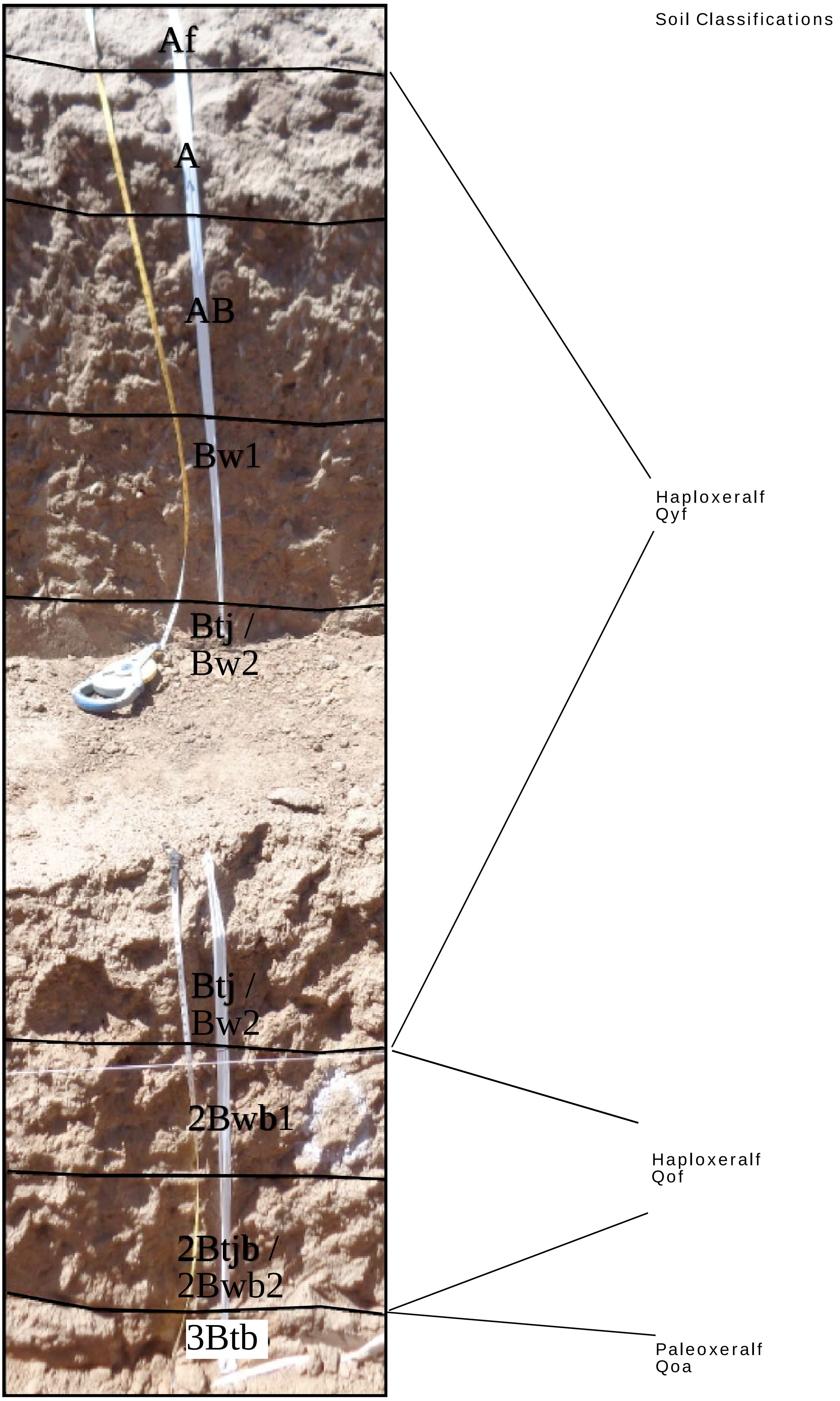


FIGURE 1. Soil Profile 1

Proposed Camelia Development, CIty of Wildomar

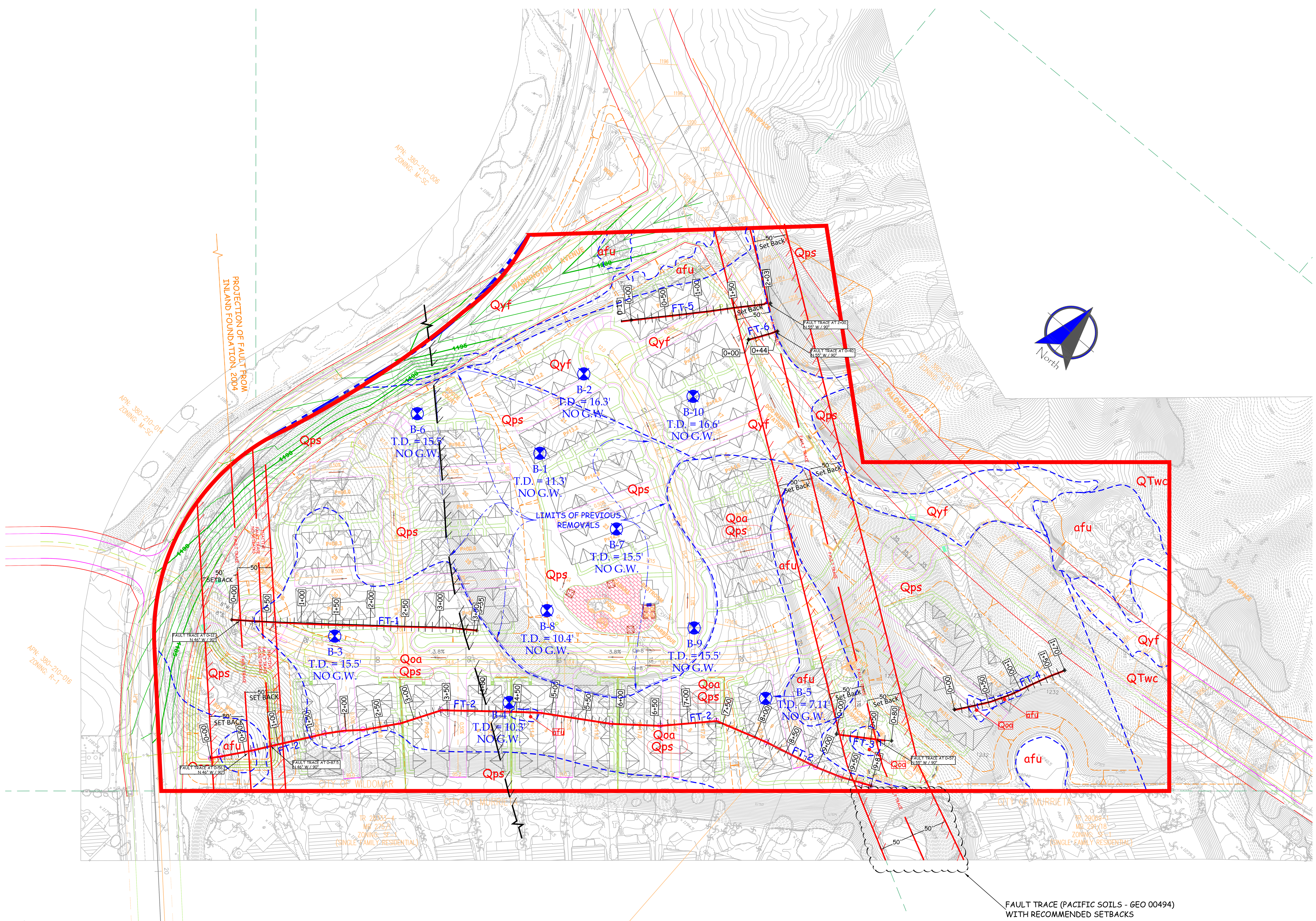
Soil Profile 2, Trench FT-1, Station 195 - 200 feet

Soil Classifications

Paleoxeralf
Q**oa**

FIGURE 2. Soil Profile 2

View of FT-1 pediment surface from the inset FT-5 Alluvial Surface (Qyf).



LEGEND

Locations are Approximate

Geologic Units

afu	-	Artificial Fill, Undocumented
Qyf	-	Young Alluvial Fan Deposits
Qoa	-	Old Alluvium
Qps	-	Pauba Formation (Circled Where Buried)
QTwc	-	Wildomar Conglomerate

Symbols

- Limits of Report
- Geologic Contact
- Limits of Previous Grading
- 0+00 0+50 1+00 1+50 1+56 - Fault Trench Location
- Fault Trace
- Limited Use Zone (with Recommended Setbacks)
- Western Limits of AP Zone
- B-10 T.D. = 16.6' NO G.W. - Boring Location Including Total Depth and Depth to Groundwater

FAULT HAZARD INVESTIGATION SITE PLAN

LOCATED NORTH / EAST OF THE TRANSITION OF PALOMAR STREET TO WASHINGTON AVENUE
APN 380-220-003, CITY OF WILDOMAR, RIVERSIDE COUNTY

PROJECT	CAMELIA TOWNHOMES		
CLIENT	SUNBELT COMMUNITIES		
PROJECT NO.	15805-10A		
DATE	JUNE 2016		
SCALE	1:70		
DWG XREFS			
REVISION			
DRAWN BY	GW	PLATE	1 OF 1

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Geotechnical, Environmental, and Materials Testing Consultants