APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL REPORT

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Attachment to and part of Report 51-1-10024-003

Date: March 8, 2012
To: City of Beverly Hills
Attn: Mr. Aaron Kunz

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors, which were considered in the development of the report, have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based on interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

April 22, 2012

Project No. 603314-002

Beverly Hills Unified School District
255 South Lasky Drive
Beverly Hills, California 90212-3697

Attention Dr. Gary W. Woods, Ed.D., Superintendent

Subject: **Fault Hazard Assessment of the**
West Beverley Hills Lineament
Beverly Hills High School
241 South Moreno Drive
Beverly Hills, California

As requested, Leighton Consulting, Inc. has completed an assessment of possible fault presence and activity at Beverly Hills High School campus located in western Beverly Hills, California. Our work included reviewing geologic maps and reports (Phase 1), drilling 21 borings and advancing 12 Cone Penetrometer Test (CPT) soundings across the campus (Phase 2a-2c) and excavating 4 trenches to expose possible near-surface faulting (Phase 2b). This work was authorized in various stages as the project proceeded

A recent geologic investigation for the proposed "Westside Subway Extension" (Parsons, 2011b) stated that a series of north-south active faults forming the West Beverly Hills Lineament (WBHL) trend through or toward Beverly Hills High School (BHHS) and several other district structures and adjacent properties. As authorized by the Beverly Hills School District, we undertook a several phase investigation to confirm or reject the Parsons (2011b) fault interpretation.

Based on site-specific trenching and logging, we found no active faults; rather, we exposed sediments and soils, dated by a variety of relative and numerical methods, as being unfaulted and substantially older than 11,500 years, the defining number for an active fault in California. Deep borings, recovery and interpretation of continuous cores and cone penetrometer data verify our observations and documentation of the on-site

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trench exposures. Accordingly, we conclude that no active faults associated with the WBHL have ruptured to the surface for at least 100,000 years and as such poses no hazard to the BHHS campus or nearby structures.

We appreciate the opportunity to be of service to Beverly Hills Unified School District. If you have any questions, please contact the undersigned directly at the e-mail addresses and phone extensions listed below, at 866-LEIGHTON.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

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Principal Engineering Geologist
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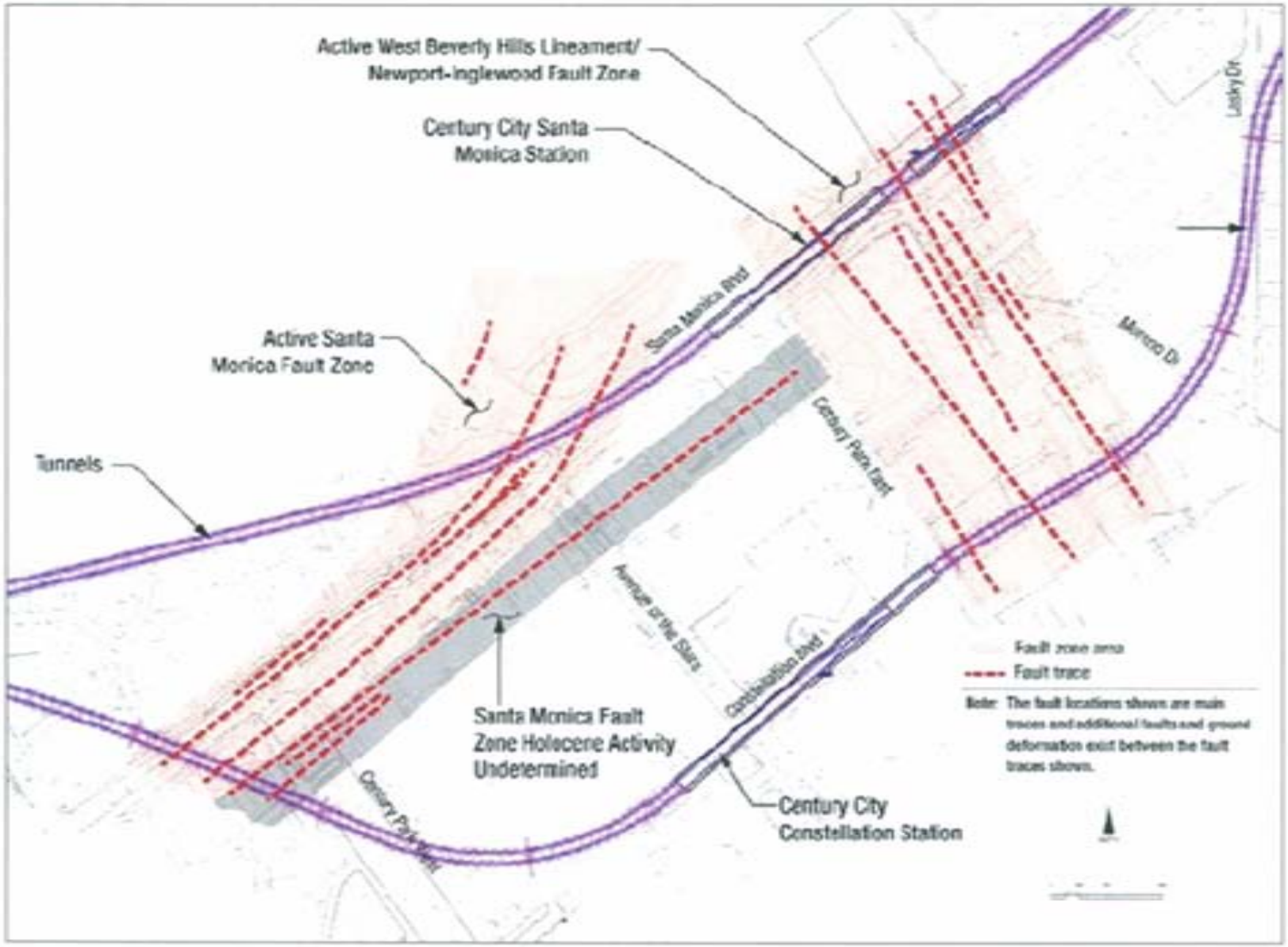
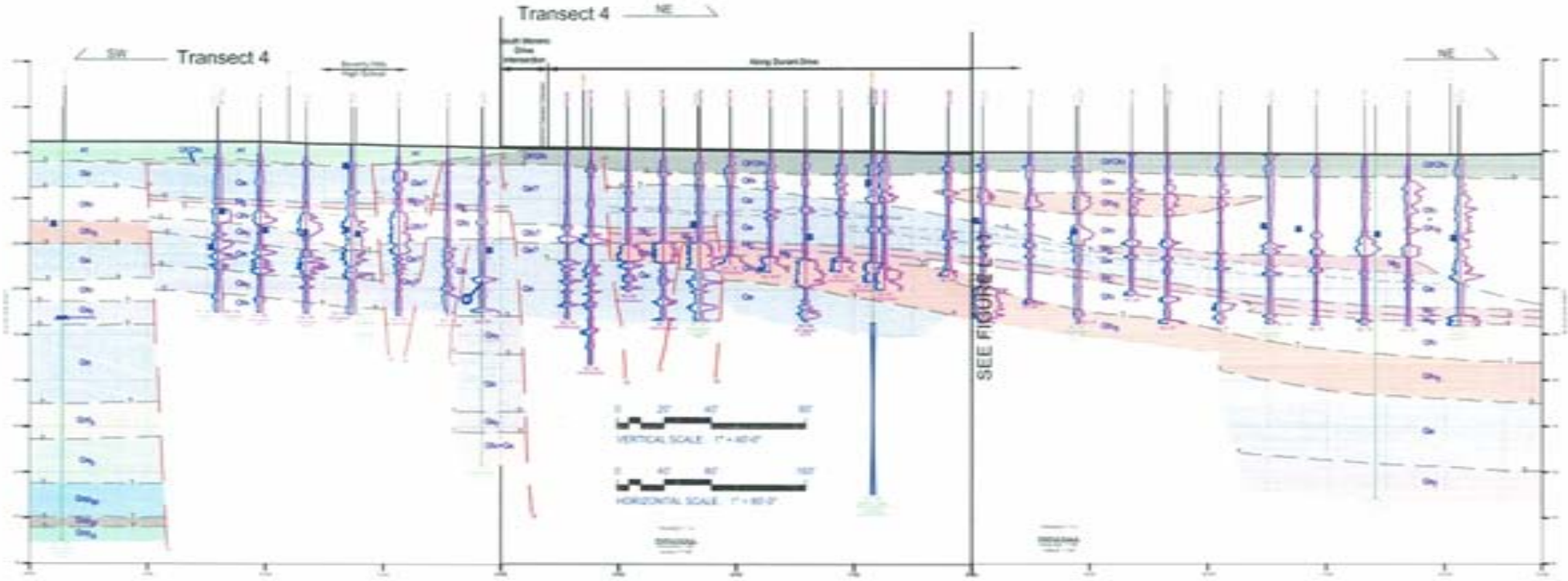
(1) Kenney Geoscience Attention: Dr. Miles Kenney
(1) Primesource Consulting, Attention: Mr. Tim Buresh
(1) Dr. Roy Shlemon
(1) Soil Tectonics, Attention: Mr. Glenn Bourchardt

PB's Active Fault Map

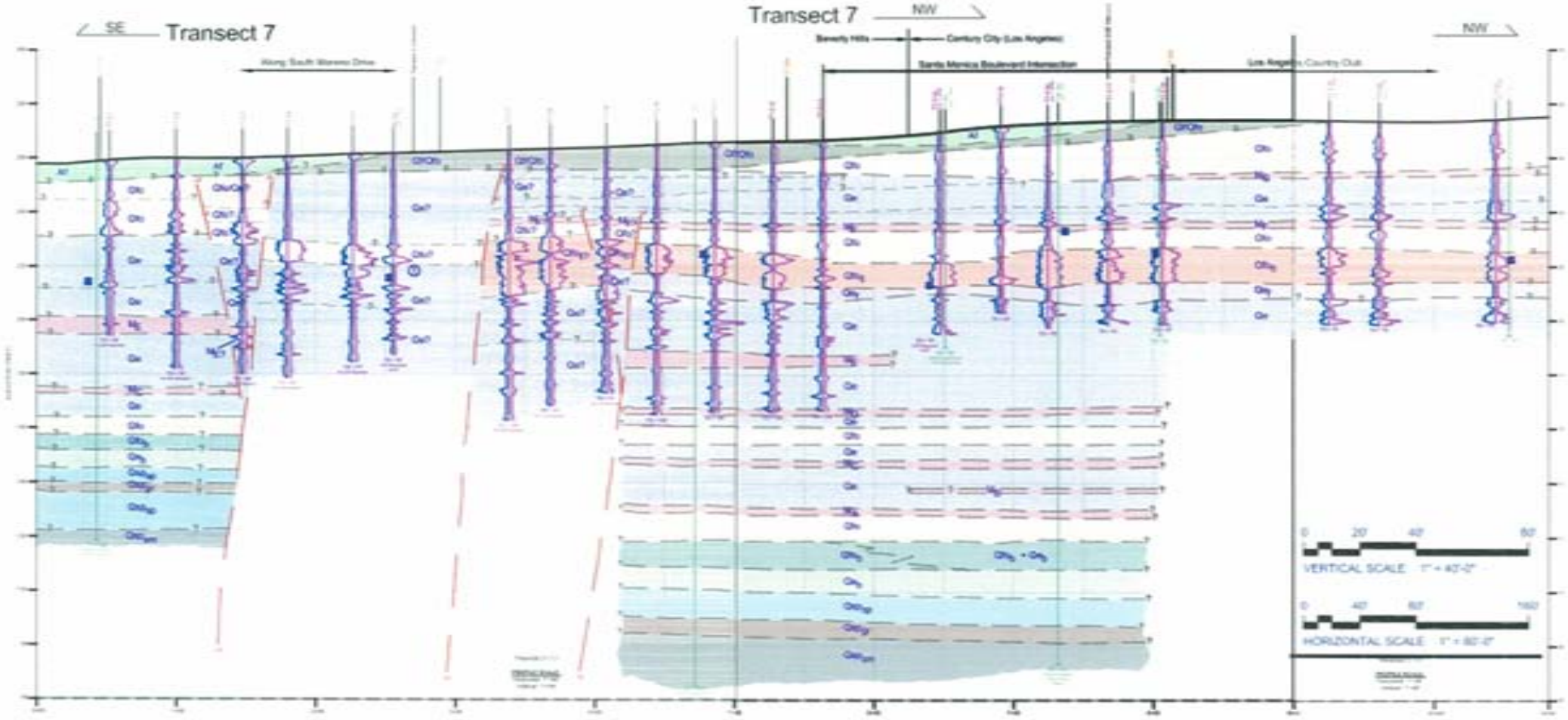


PB's Transect 4



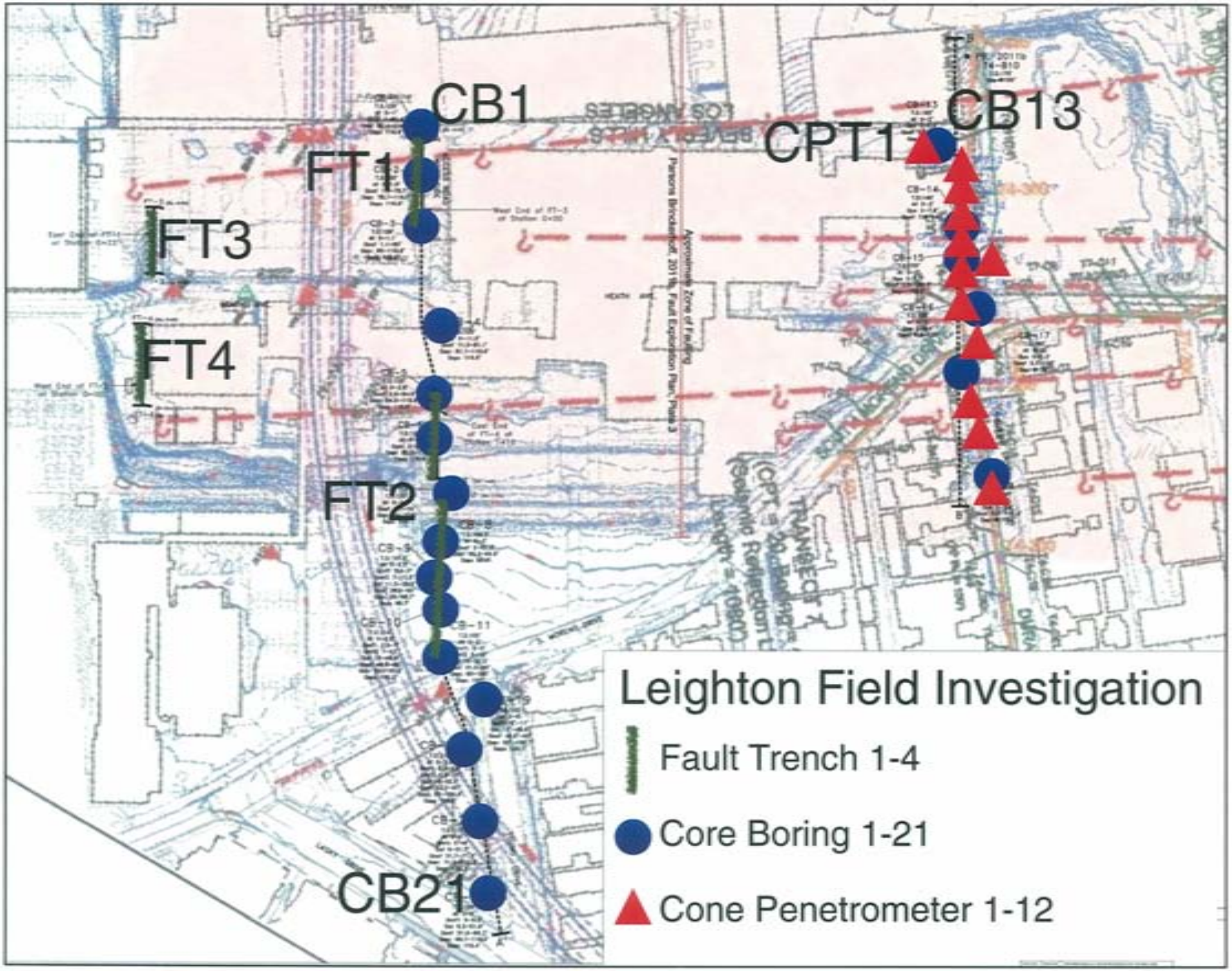
Durant Drive - many faults

PB's Transect 7

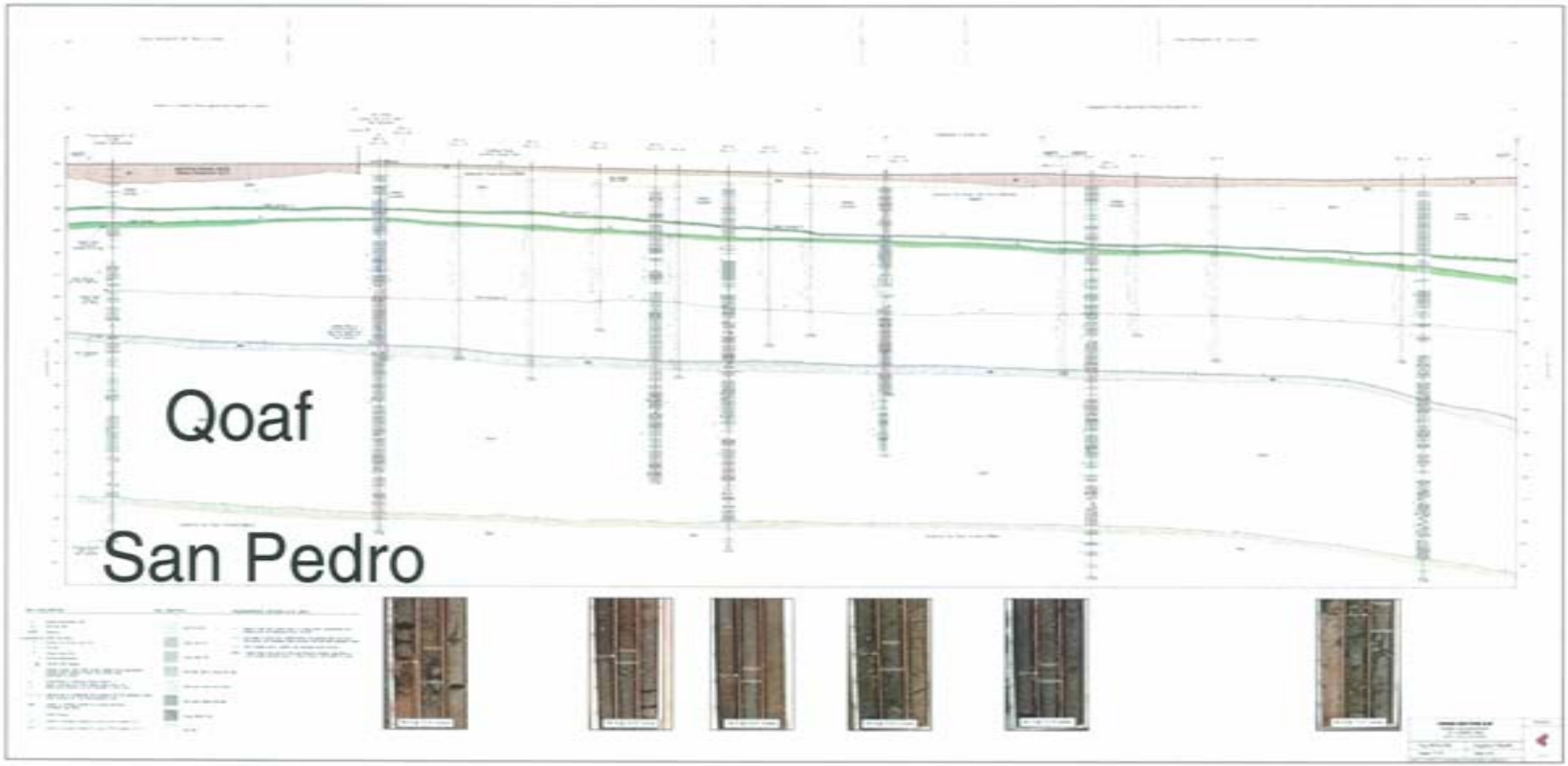


S. Moreno Drive – several faults

12.22.2011

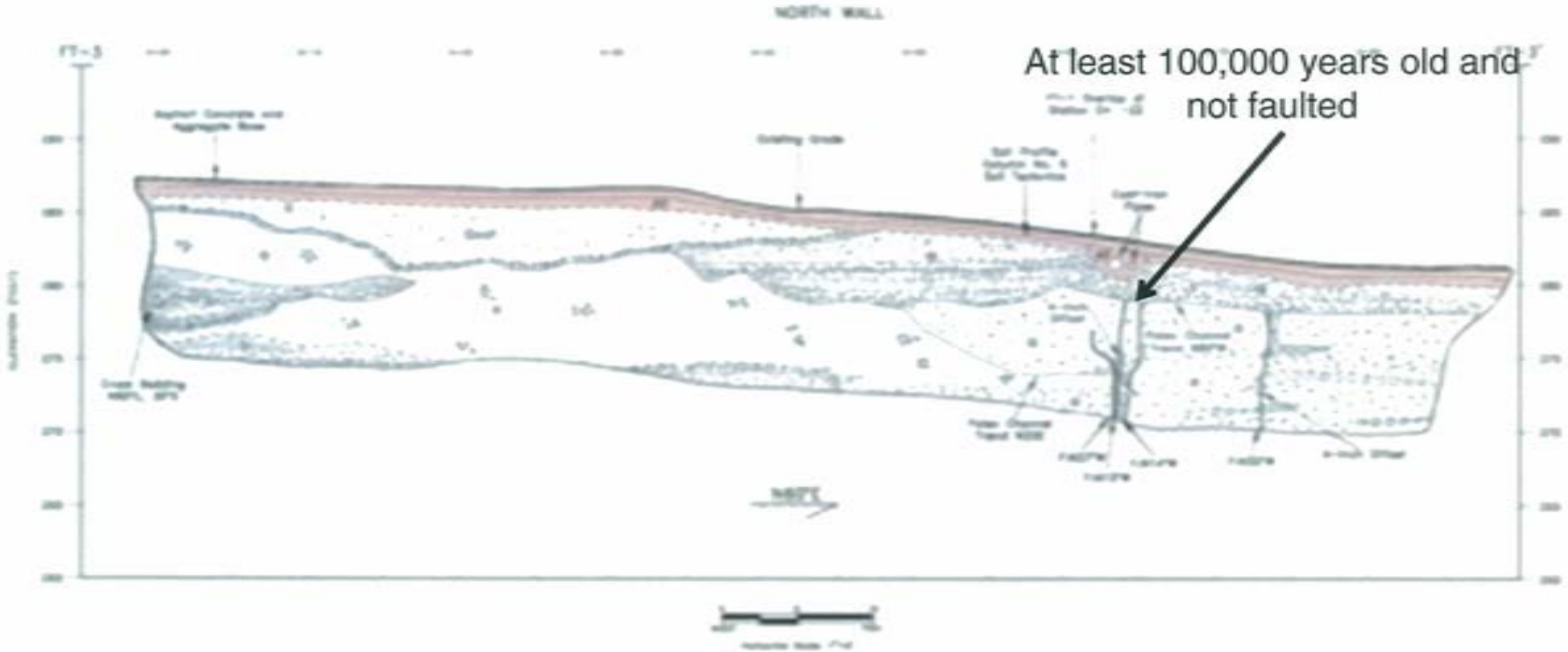

CB1
CB13
CPT1
FT1
FT2
FT3
FT4
CB21
Leighton Field Investigation
Fault Trench 1-4
Core Boring 1-21
Cone Penetrometer 1-12

Boring Correlation



Fault Trench FT-3

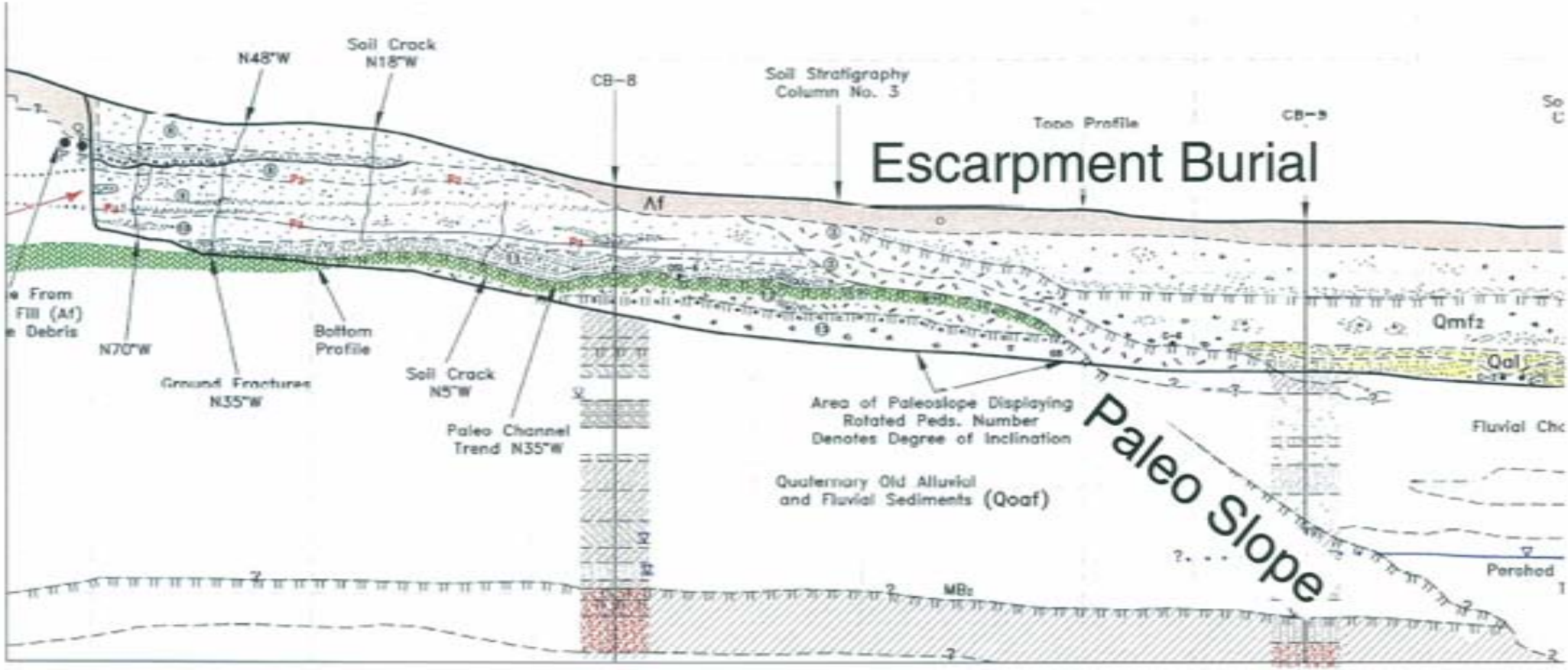
The only faults in any of the trenches



In CA, by law, an Active Fault is defined as ~11,000 years since last breaking surface

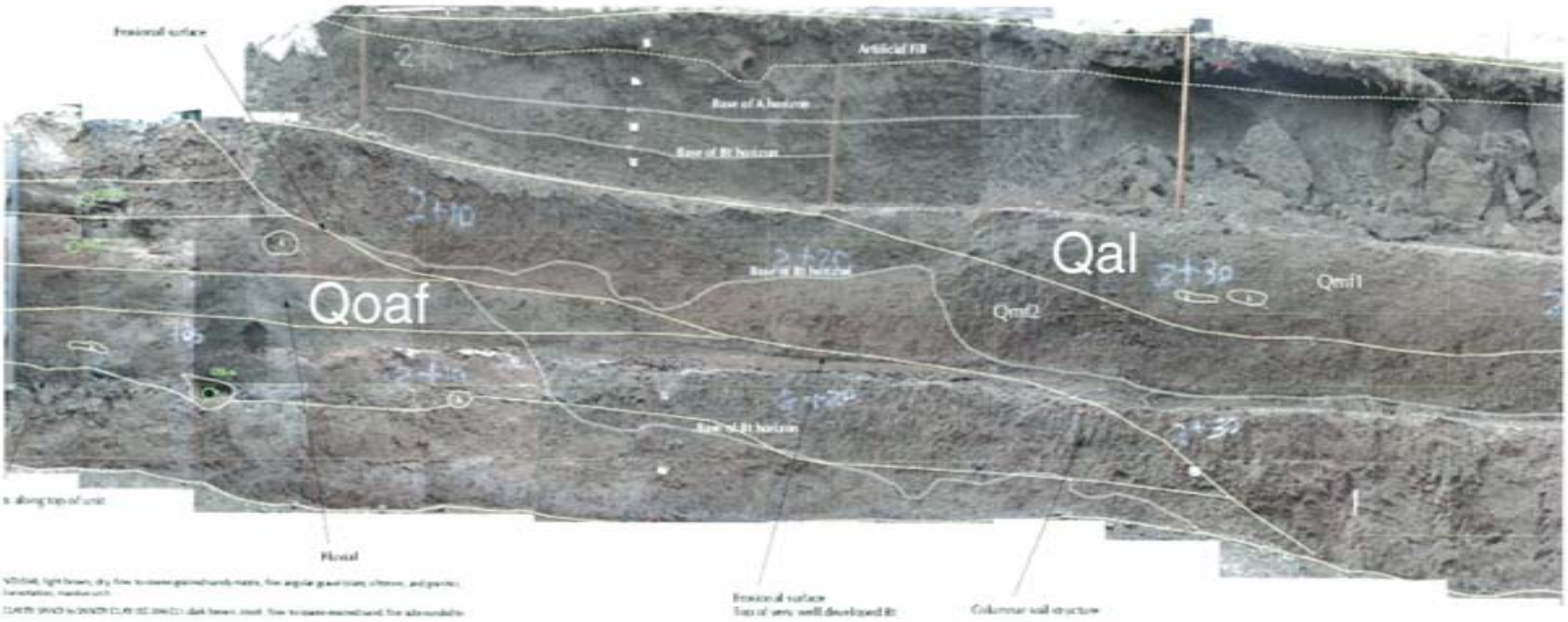
Fault Trench FT-2

The West Beverly Hills Lineament



The "Lineament" is shown to be a buried valley slope

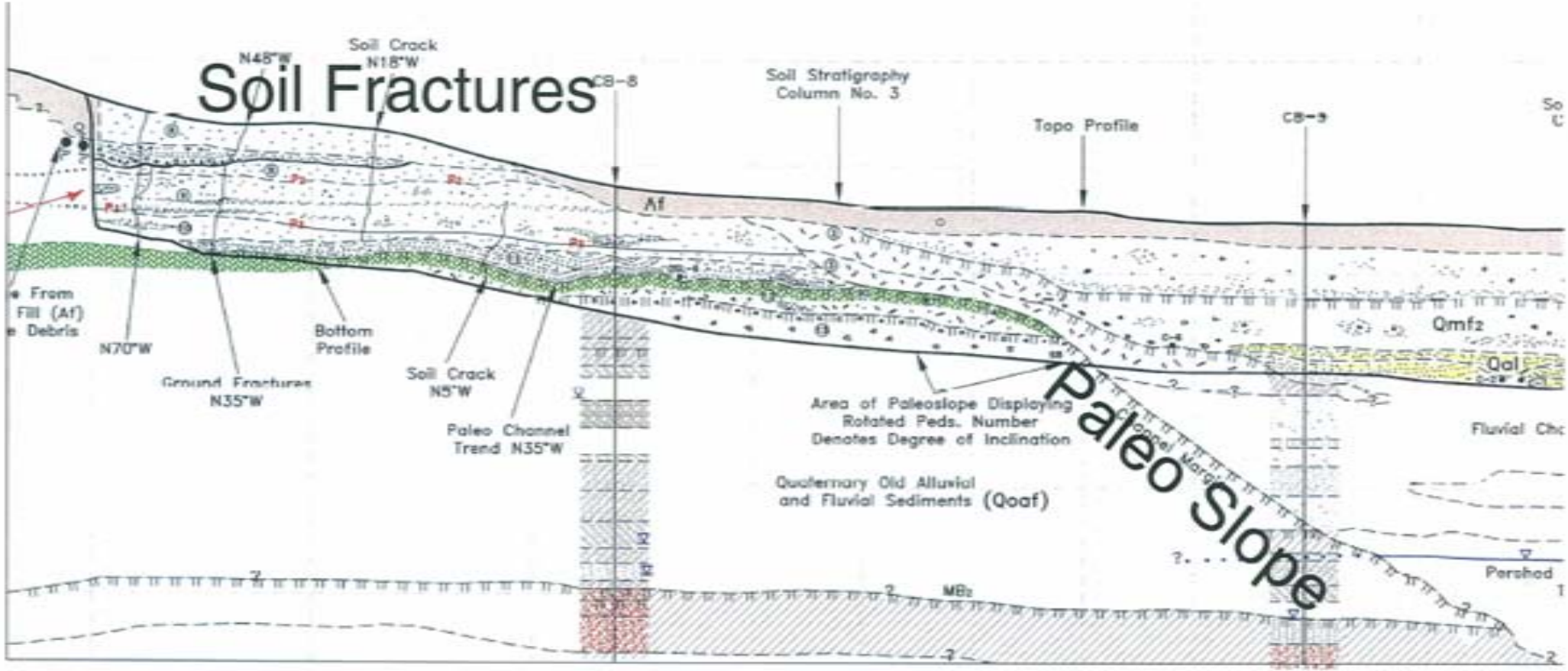
Trench 2 - Escarpment Burial



Trench 2 - Escarpment Burial

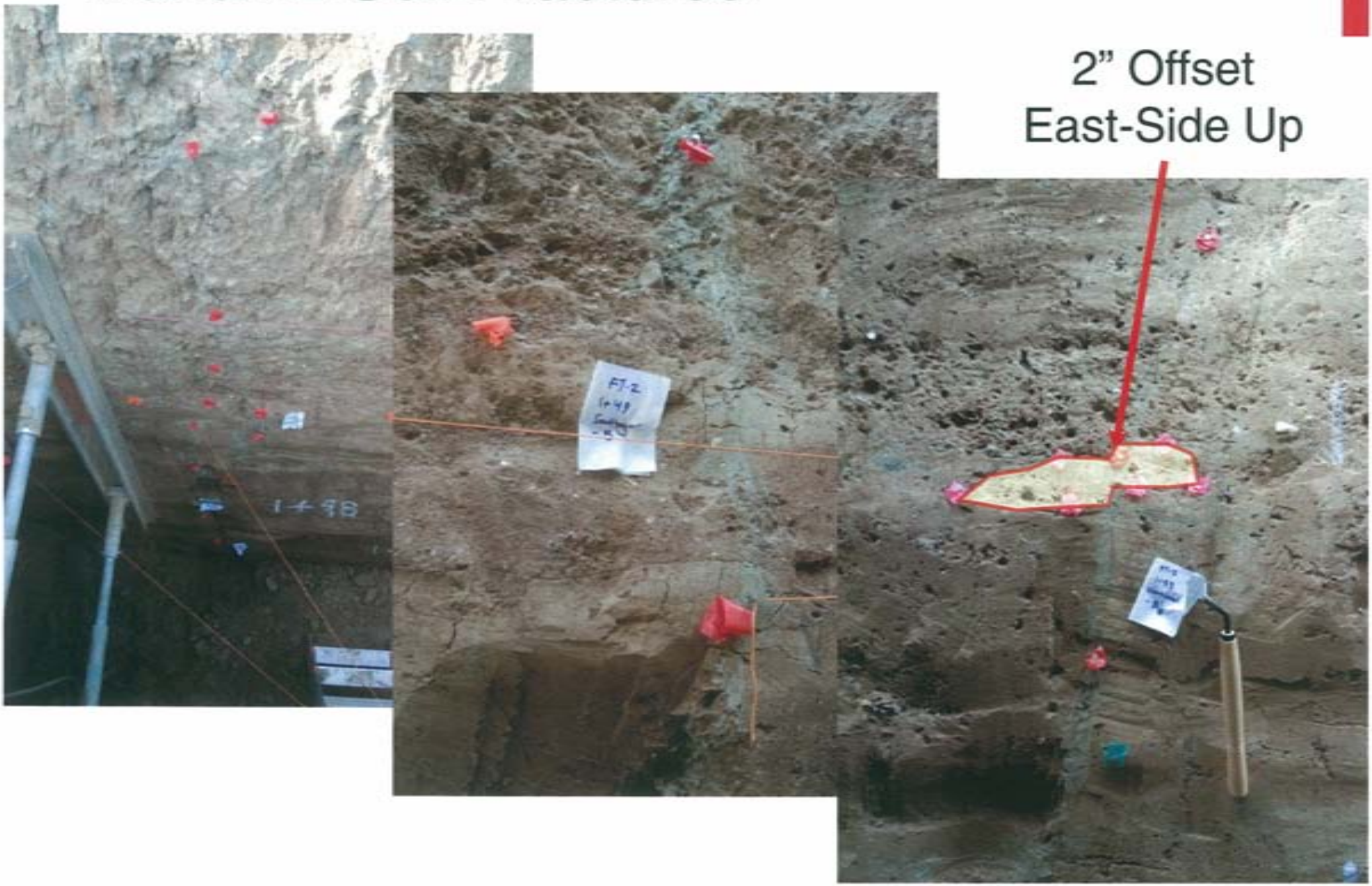
Fault Trench FT-2

The West Beverly Hills Lineament

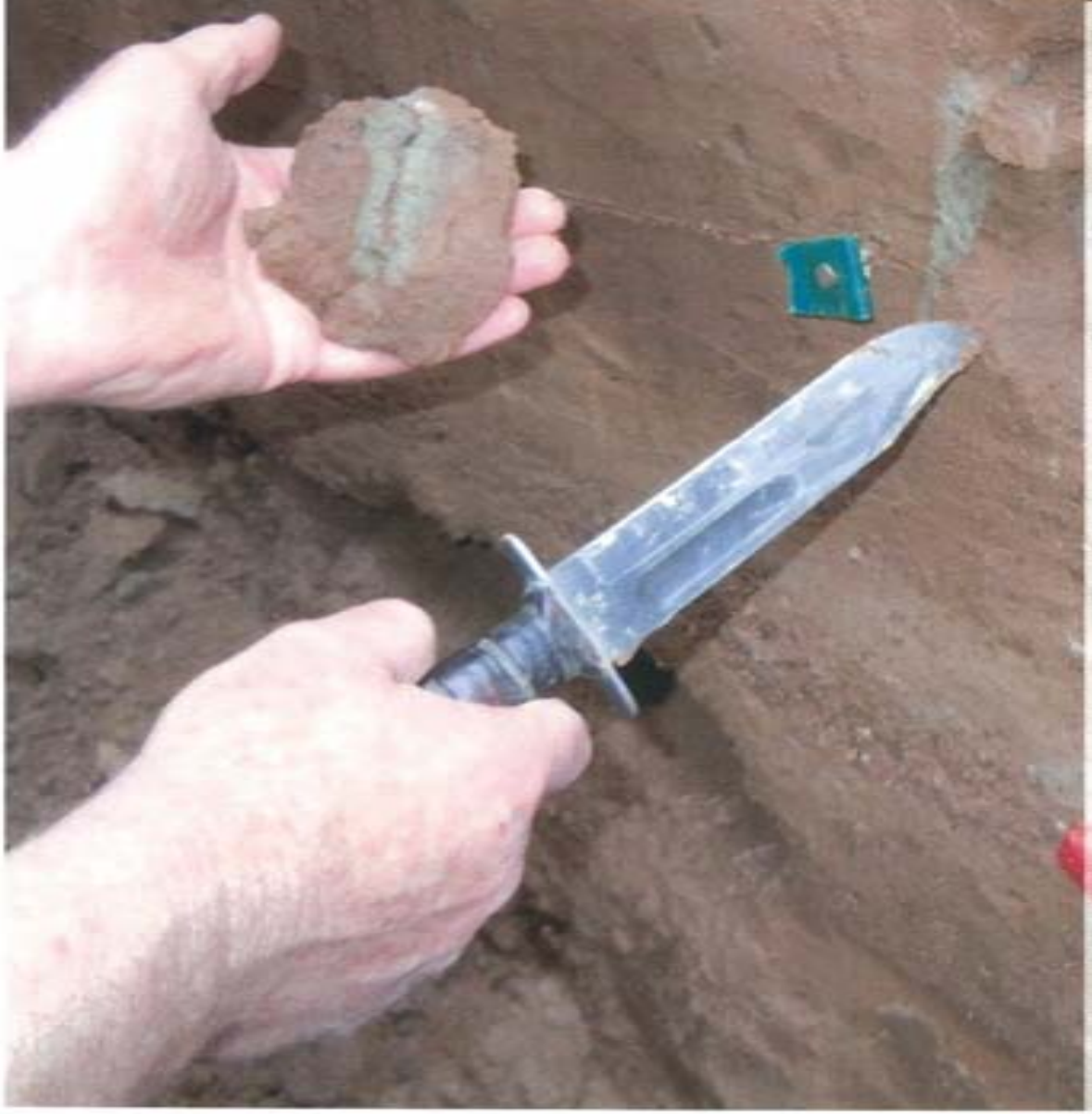


The Fractures are shown not to be faults

Trench 2 Soil Fractures



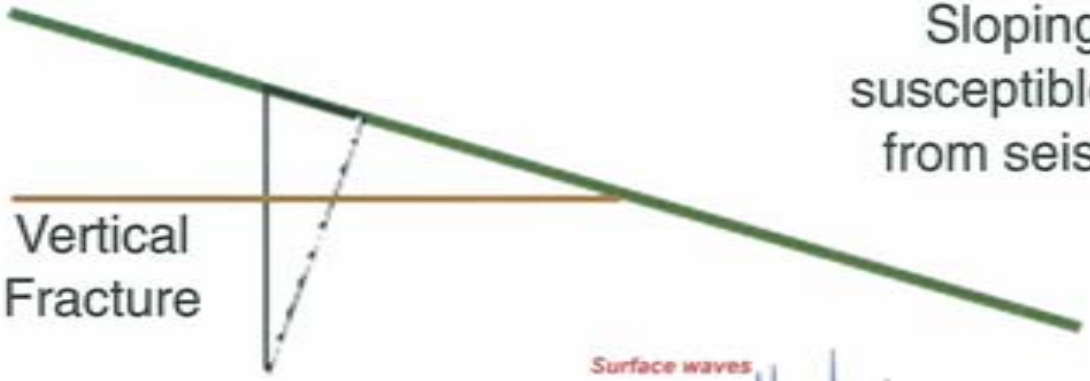
These are fractures, not faults



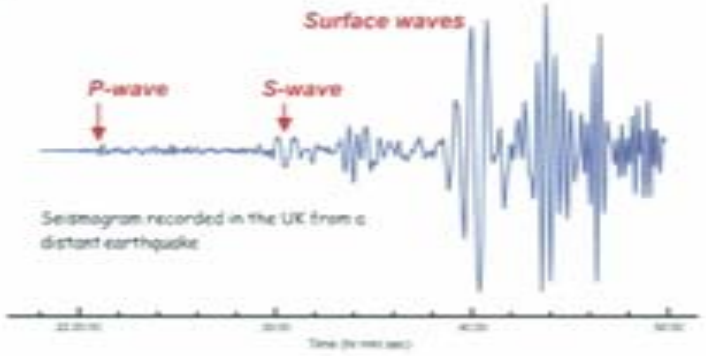
- They are irregular and not linear
- Most die out with depth
- No shearing within clays
- Clays are translocated from above
- Color is due to chemical reaction with water (redox)
- Soil properties within fractures require 10's of thousands of years to form
- They were probably generated by seismic shaking

Trench 2 Soil Fractures - seismic shaking origin

Sloping ground is susceptible to fracturing from seismic shaking

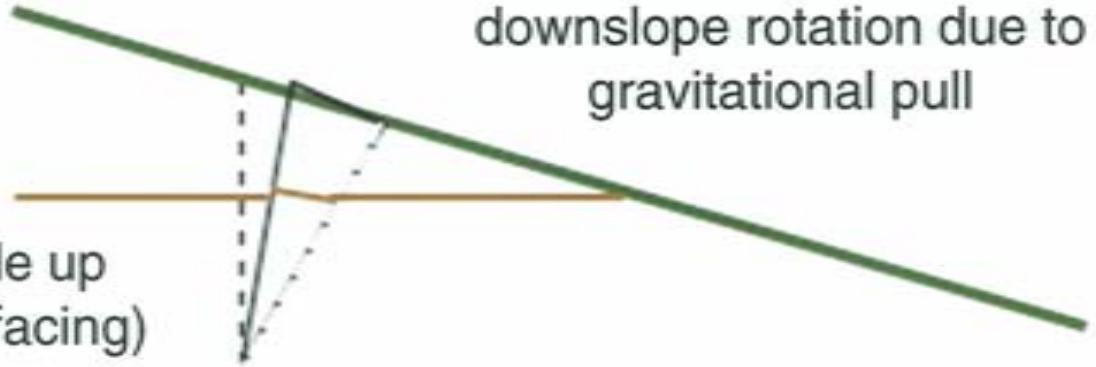


Vertical Fracture



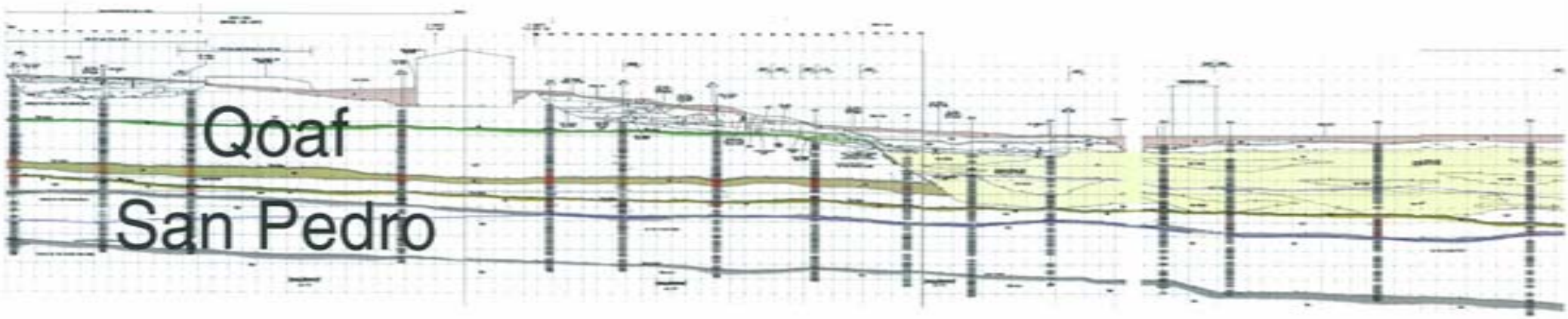
Seismic source

Seismic shaking induces a downslope rotation due to gravitational pull



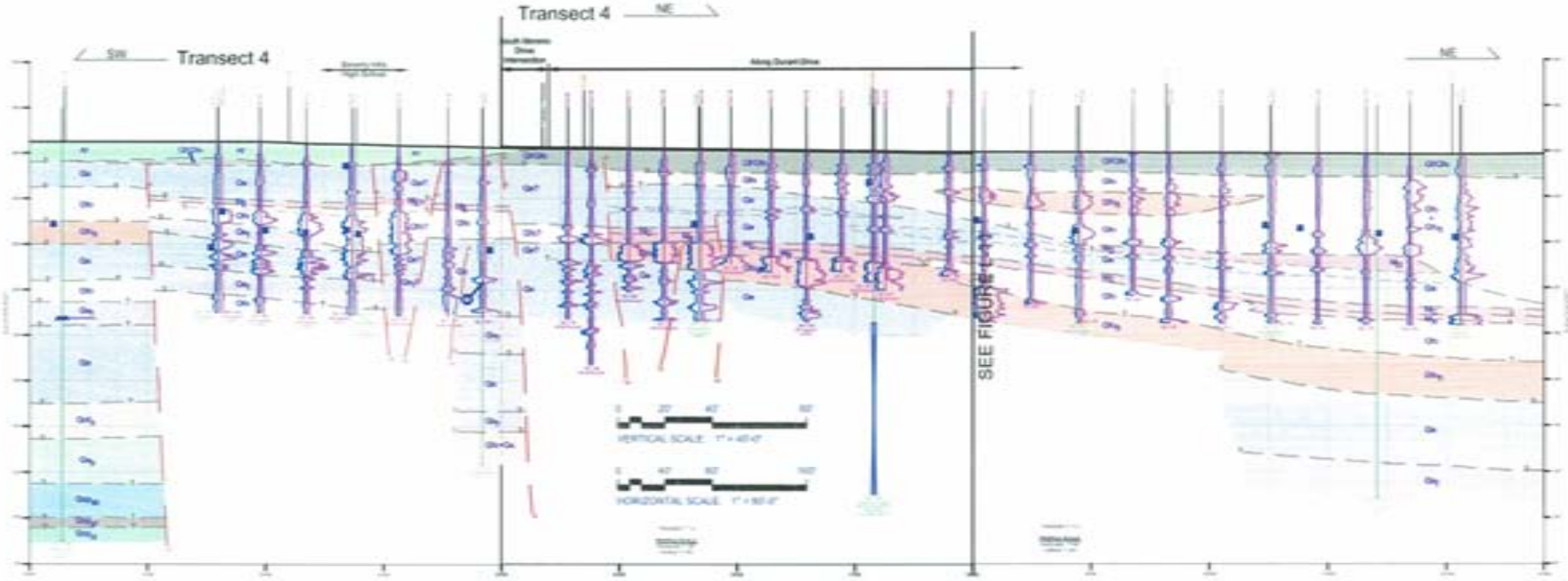
East-side up (upslope facing) fracture separation

Leighton Cross-section A-A'
E-W Across Mid-Campus



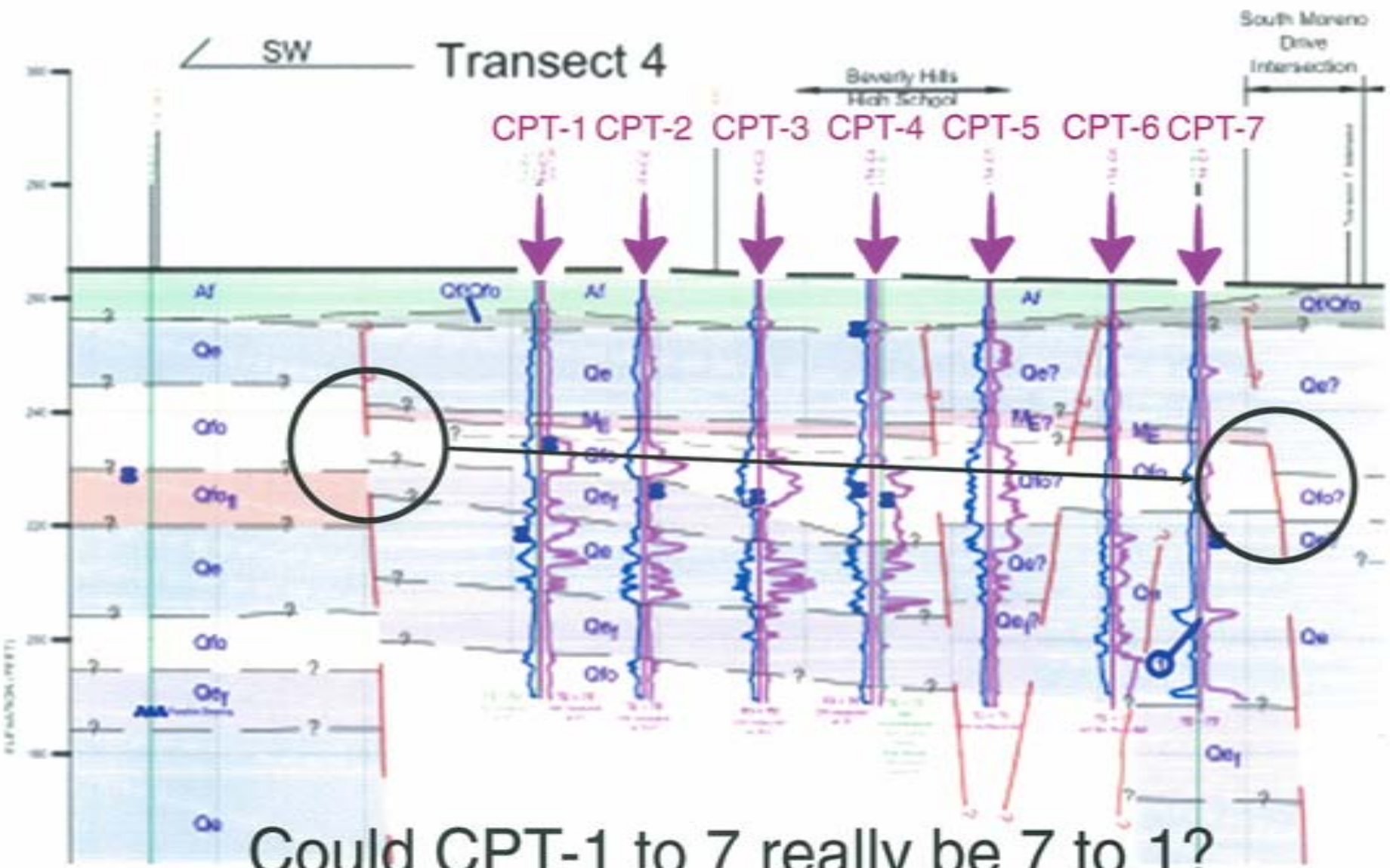
Continuous, gently-dipping sediments, show no evidence for faulting across entire width of BHHS

PB's Transect 4



Durant Drive - many faults

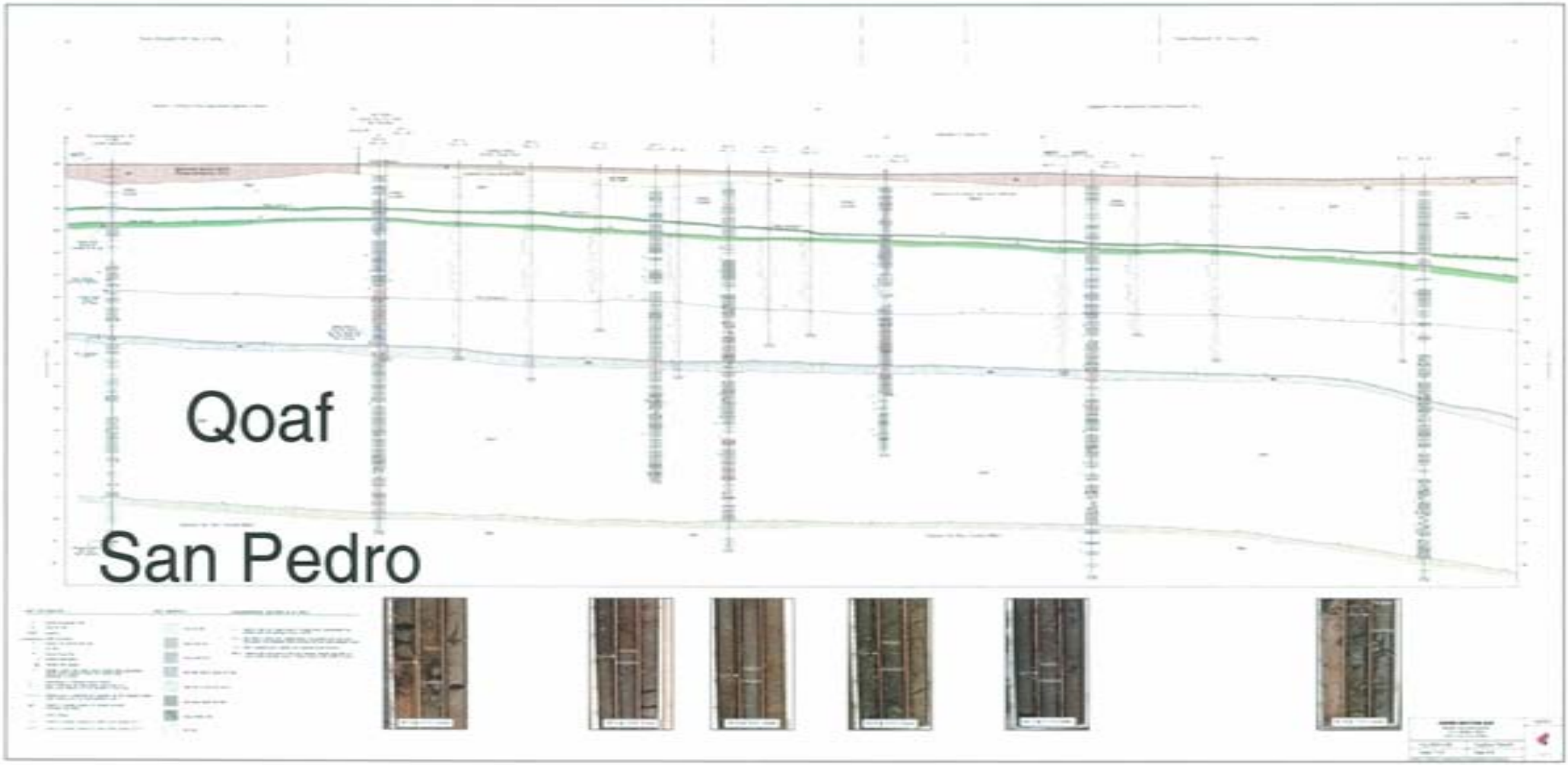
Might there be data QC problems?



Could CPT-1 to 7 really be 7 to 1?

YES – because the Transect 4 CPTs could have been inverted
Transect 4 was reinvestigated

Leighton Cross-Section B-B'



Durant Drive - no faults

Conclusions

- The West Beverly Hills Lineament is an erosional feature and not of fault origin.
- We find direct geologic evidence that there has been no faulting associated with the West Beverly Hills Lineament at Beverly Hills High School for at least 100,000 years and perhaps more than 500,000 years.
- We have refuted the faults mapped by PB as part of the West Beverly Hills Lineament.
- Based on our study no fault-related structural setbacks associated with the WBHL are required for BHHS.

Why the differences?

- Geophysics is poor in the upper layers
- Poorly logged borings - no paleosols
- Poor delineation of the unit ages
- Poor use of borings to correlate across transects
- Almost total reliance on CPT correlations
- Conservative interpretation of those CPTs as faults
- CPTs have significant internal variation

Why this work is more conclusive

- Completely redid Transect 4 after questions emerged about its validity
- Supplemented the CPTs with substantially more borings
- Drilled those borings down to the San Pedro sand (~1 million years old)
- Trenched almost the entire width of the school, supplemented and extended east with borings
- Opened the trench site to California Geological Survey, U.S. Geological Survey, and other reviewing geologists
- Developed robust, multi-disciplinary age control on the sediments (OSL, 14C, soils)

PB's Geology

Epoch	Time Scale
Holocene	11,000 years ago to present
Pleistocene	1.8 million to 11,000 years ago

Table 1: Stratigraphic Units

Symbol	Stratigraphic Unit (Age) Description
af	ARTIFICIAL FILL (undocumented)
Qf/Qal	YOUNGER ALLUVIUM (Holocene)—predominantly sand, silt and clay
Qfo	OLDER ALLUVIAL SAND DEPOSITS (late Pleistocene)—sandy silt, clay, and sand with gravel
Qe	ESTUARINE DEPOSITS (late Pleistocene)—thin bedded to massive silty and clay with fine sand and occasional gravel
Qlw	LAKEWOOD FORMATION (late Pleistocene)—interbedded silty sands, silts, and clays with clayey sand and gravel layers
Qsp	SAN PEDRO FORMATION (mid Pleistocene)—predominantly greenish gray and bluish gray fine-grained Sands, medium to coarse Sands and some Silt Layers.

The sediments are very old

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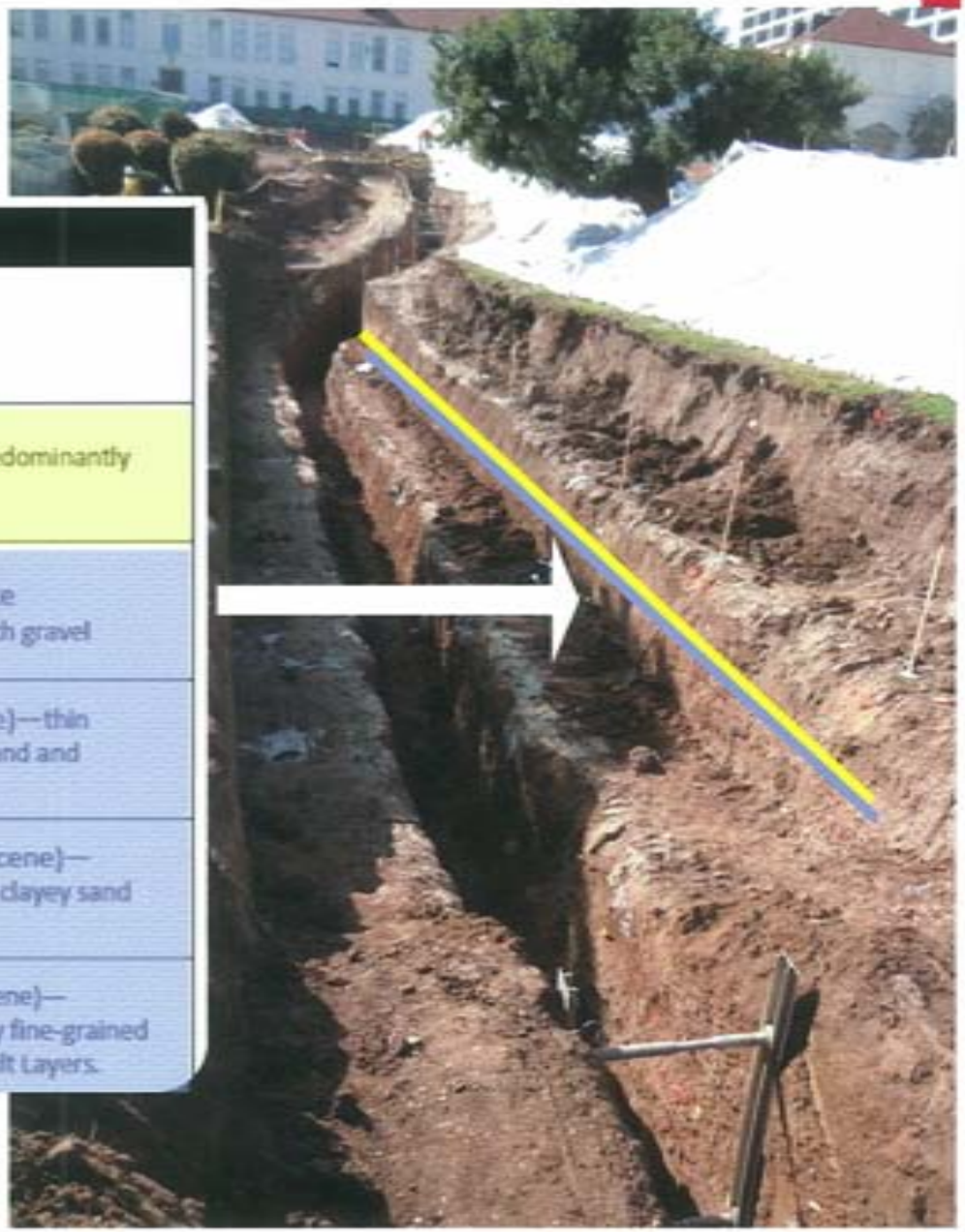
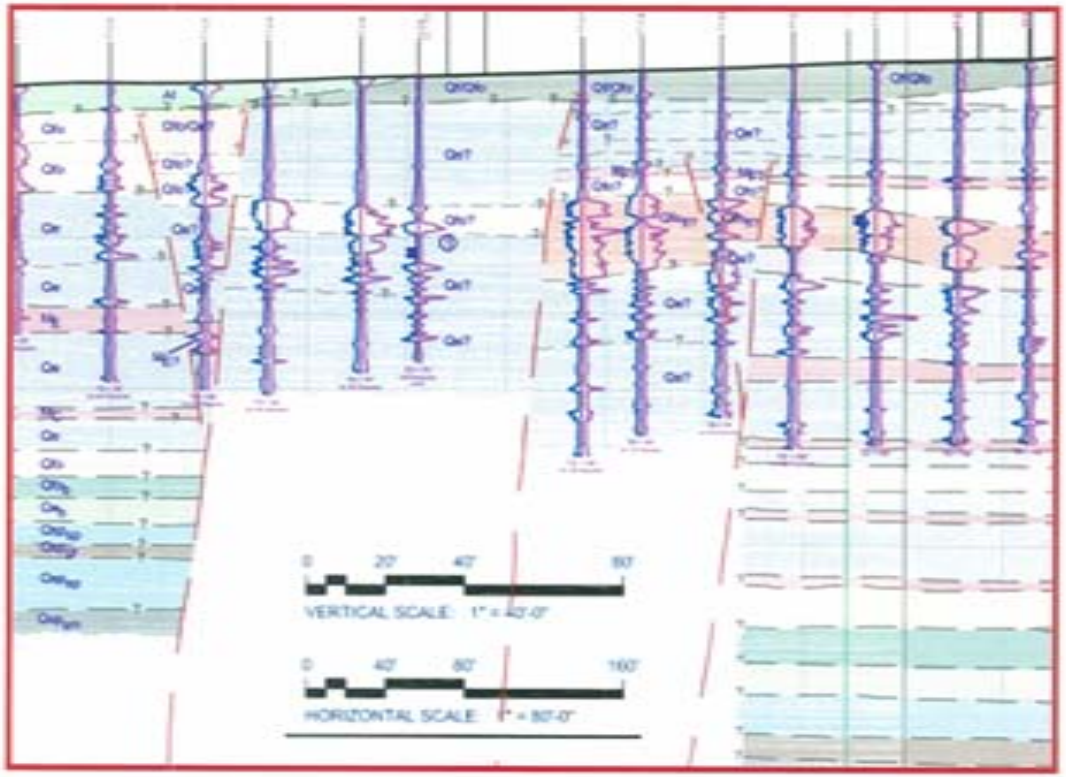
PB's geology

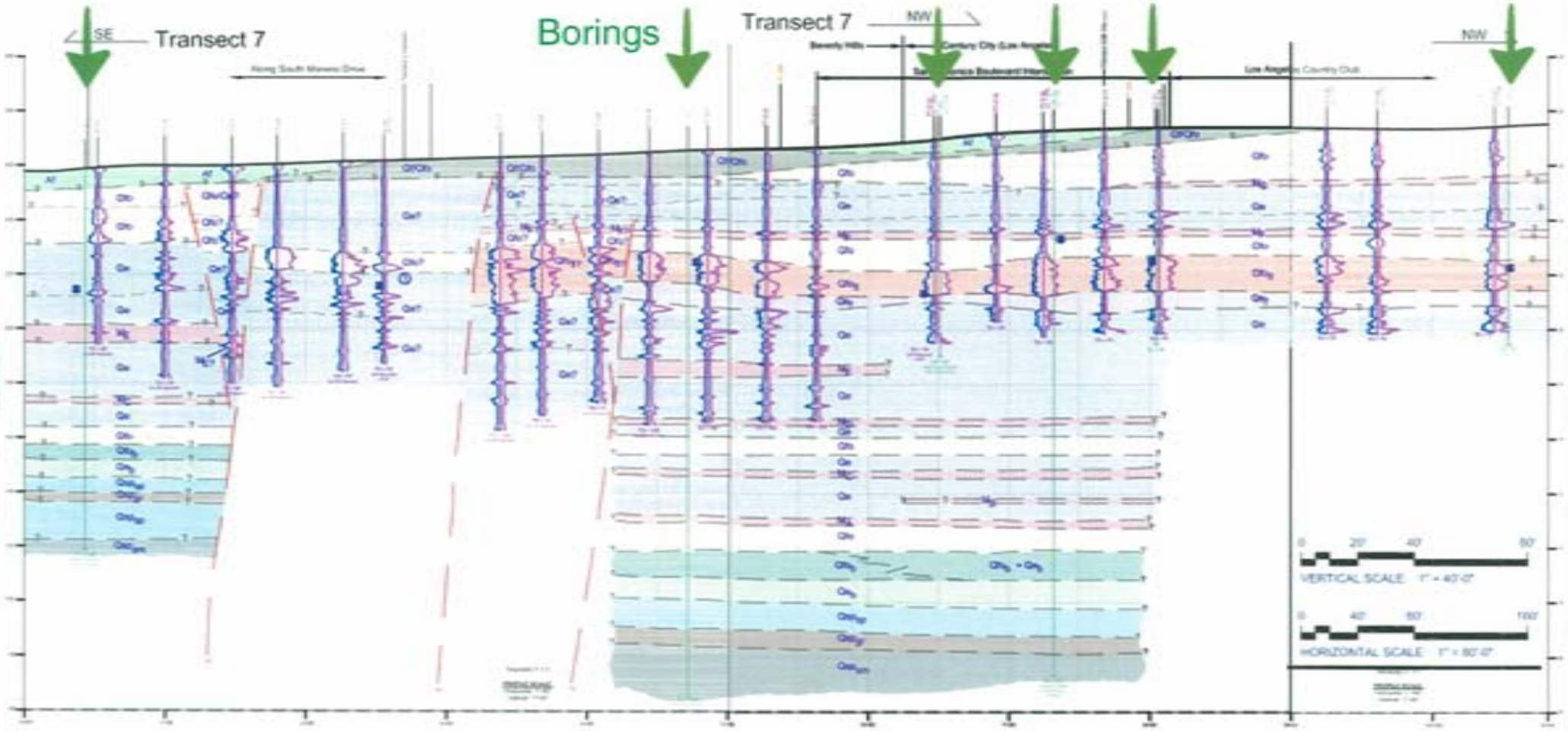


PB's faults are all in very old sediments

- Failure to quantify the sediment ages
- Active faults in CA are <11,000 years old
- These sediments are 100,000 to 1,000,000 years older
- Why call them "active" with no confirmation?
- A model-driven paradigm?

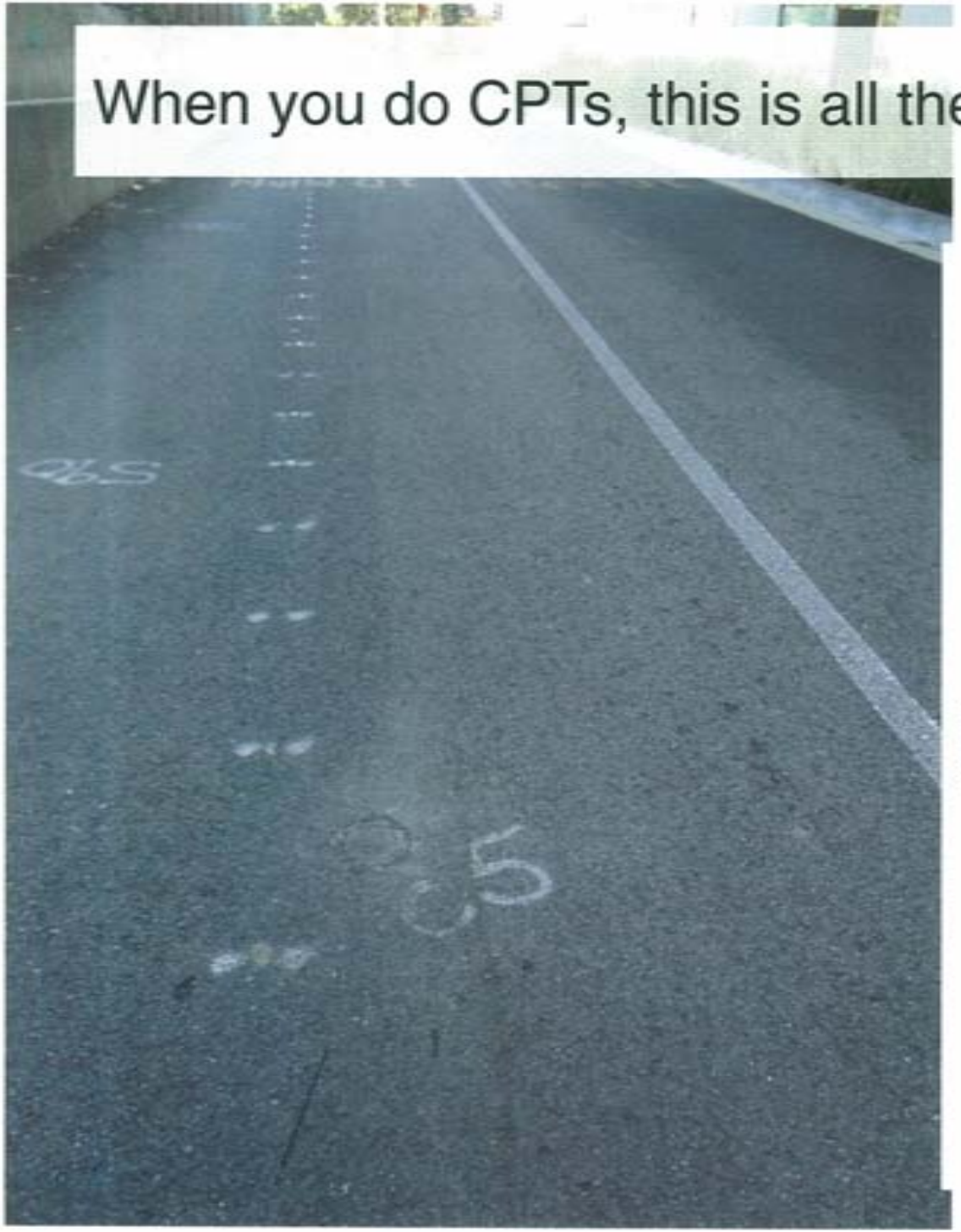


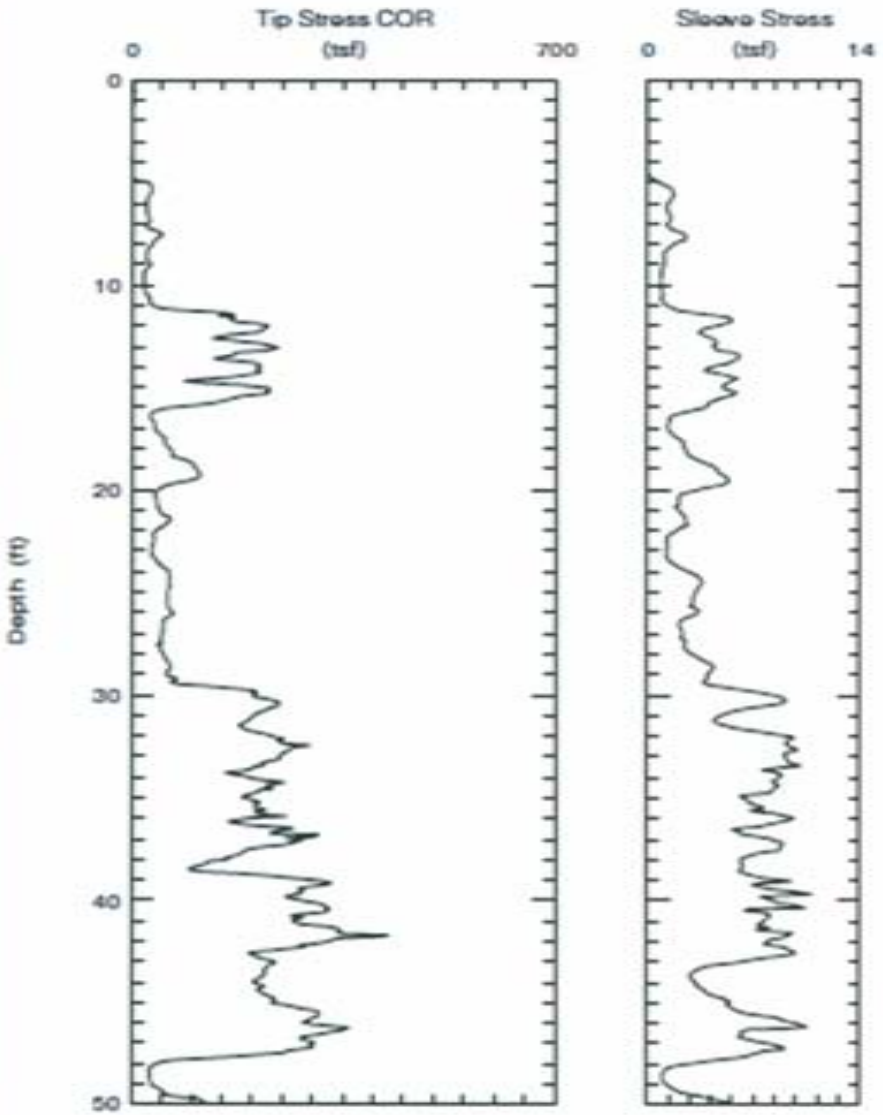
Metro's Transect 7



The faults are drawn where there are no borings
- CPT interpretations only

When you do CPTs, this is all the geology that you see





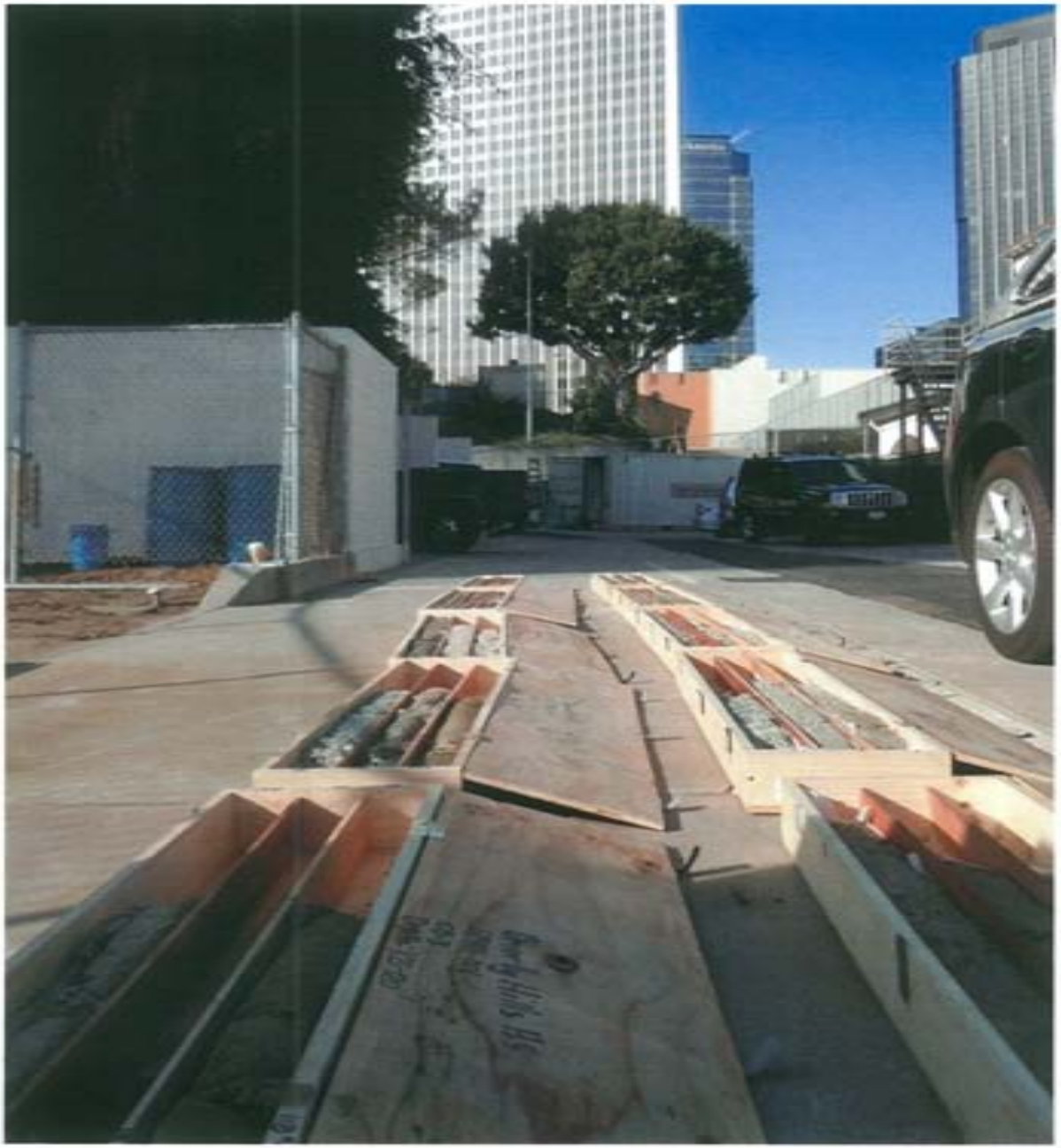
When you drill, this is what you see

When you trench, you see everything

And everyone else can see it too

Visual and Physical Correlation from Boring to Boring

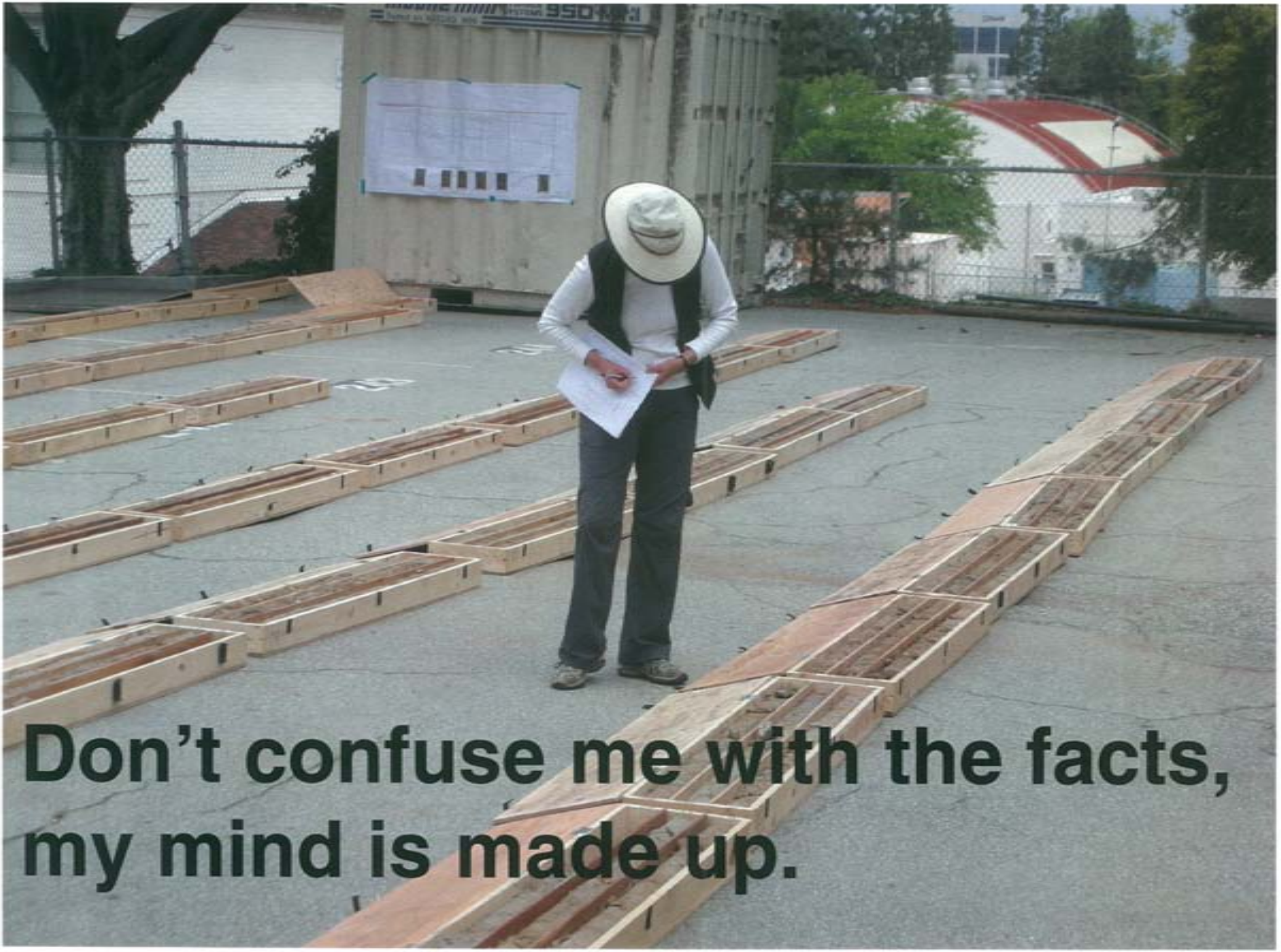
- Enhances confidence in the conclusions



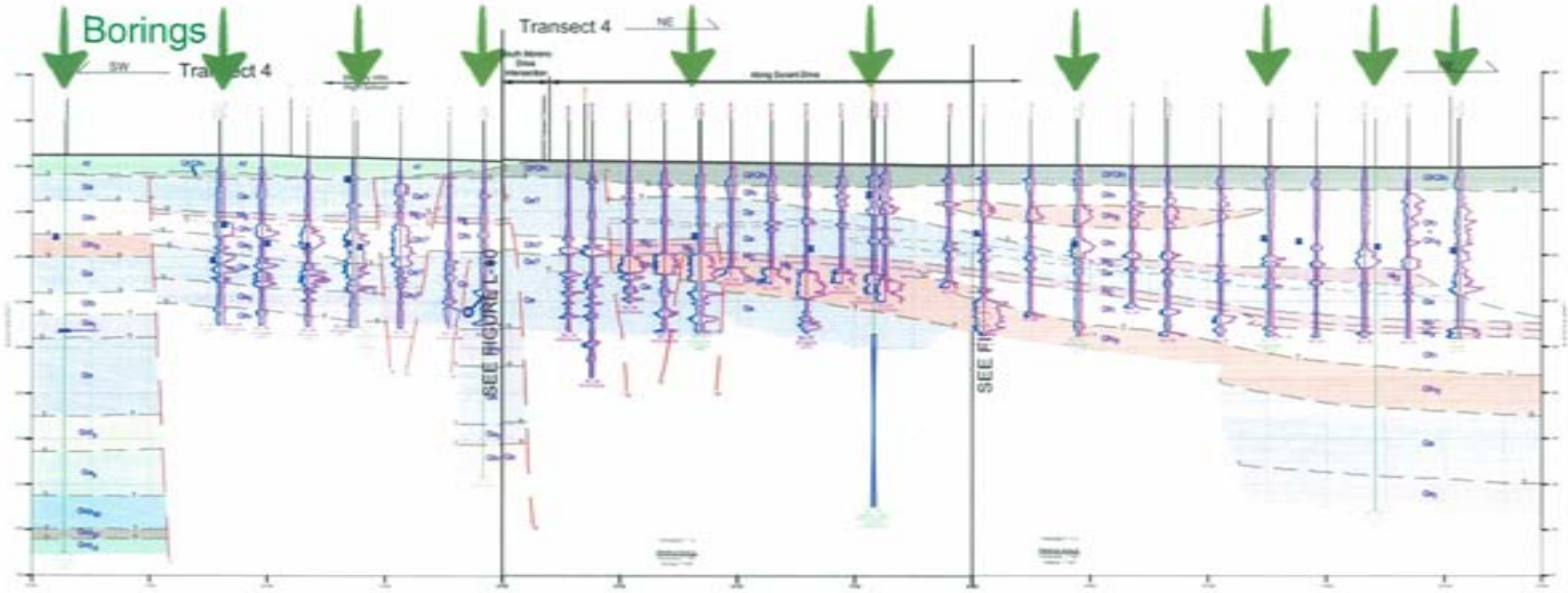
We (LC, ECI, CGS, Beverly Hills, PB, AMEC) spent days correlating from core to core

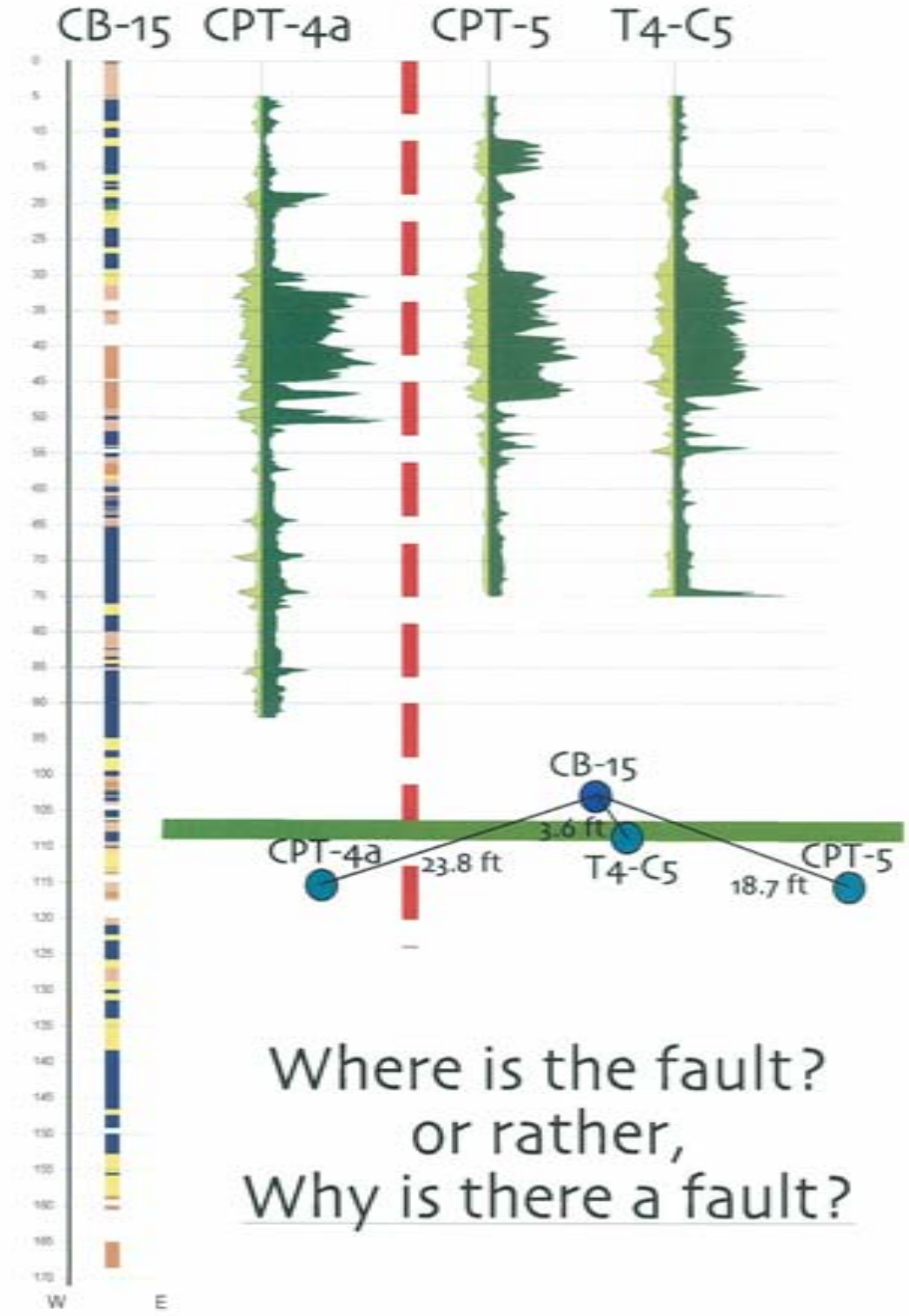
Why Bother?

- Despite an incredible data set of cores,
- Despite days of joint review,
- Despite hours of discussion, and
- Despite agreement in the field;
- Metro now says we have “confirmed” their faults


Don’t confuse me with the facts,
my mind is made up.

Metro's Transect 4



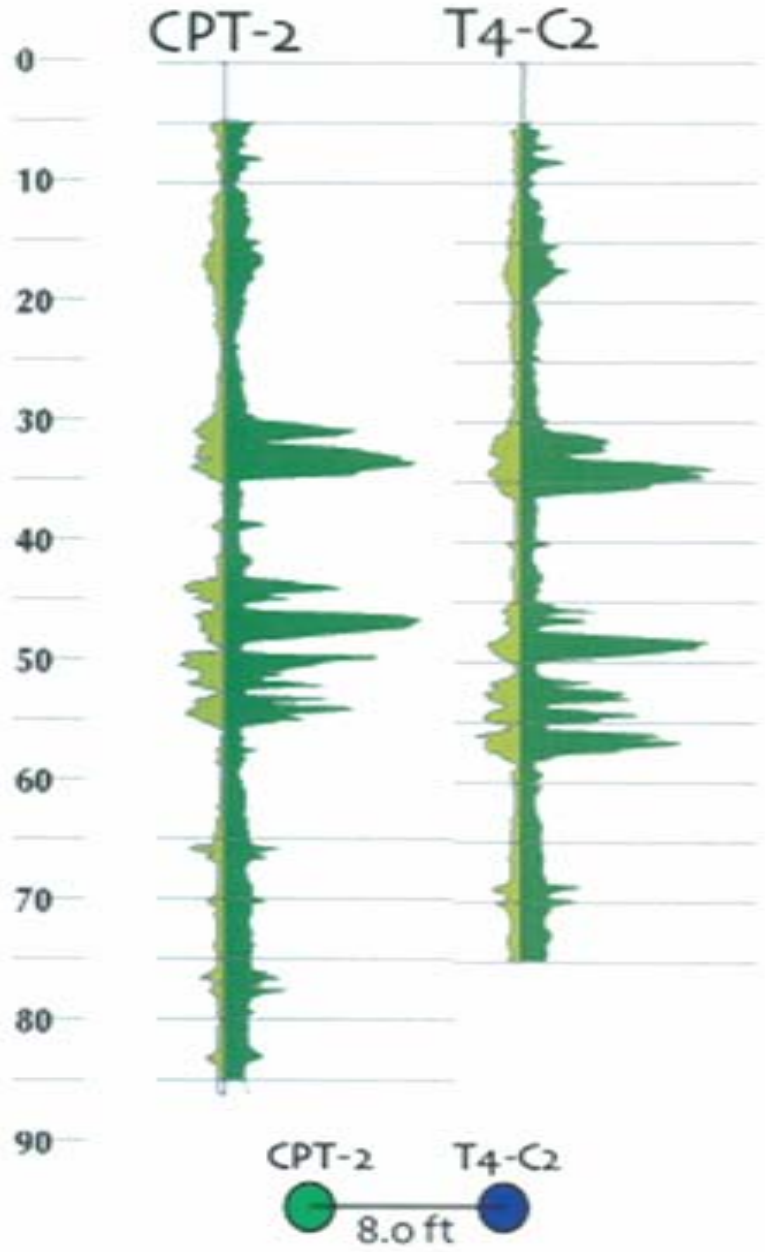


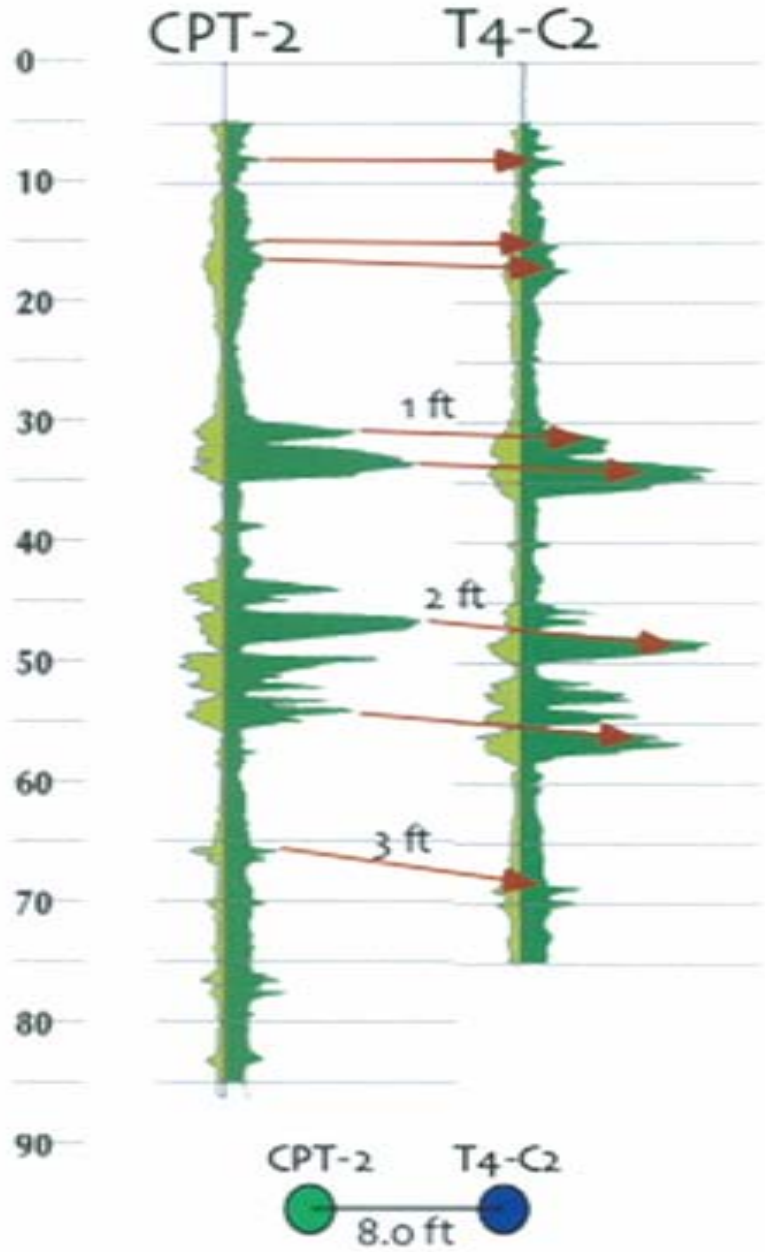
Where is the fault?
or rather,
Why is there a fault?

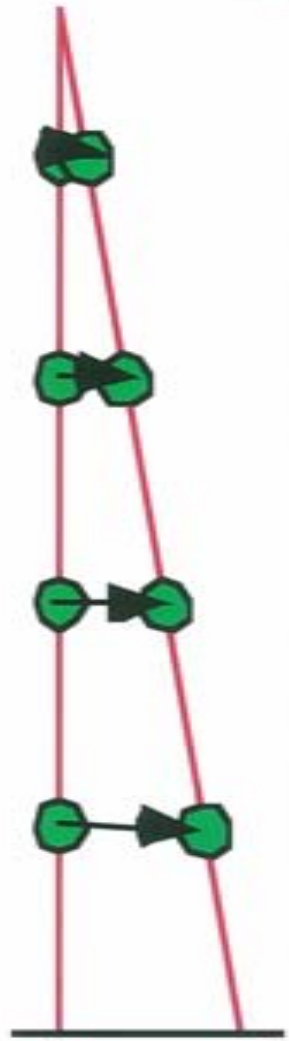
The Cone Penetrometer Evidence for Faults

- CPTs are only one tool
- CPTs have internal variation
- The sediments have lateral variation
- CPTs only image the subsurface
- You cannot know what the CPT is sensing

CPTs have inherent variability

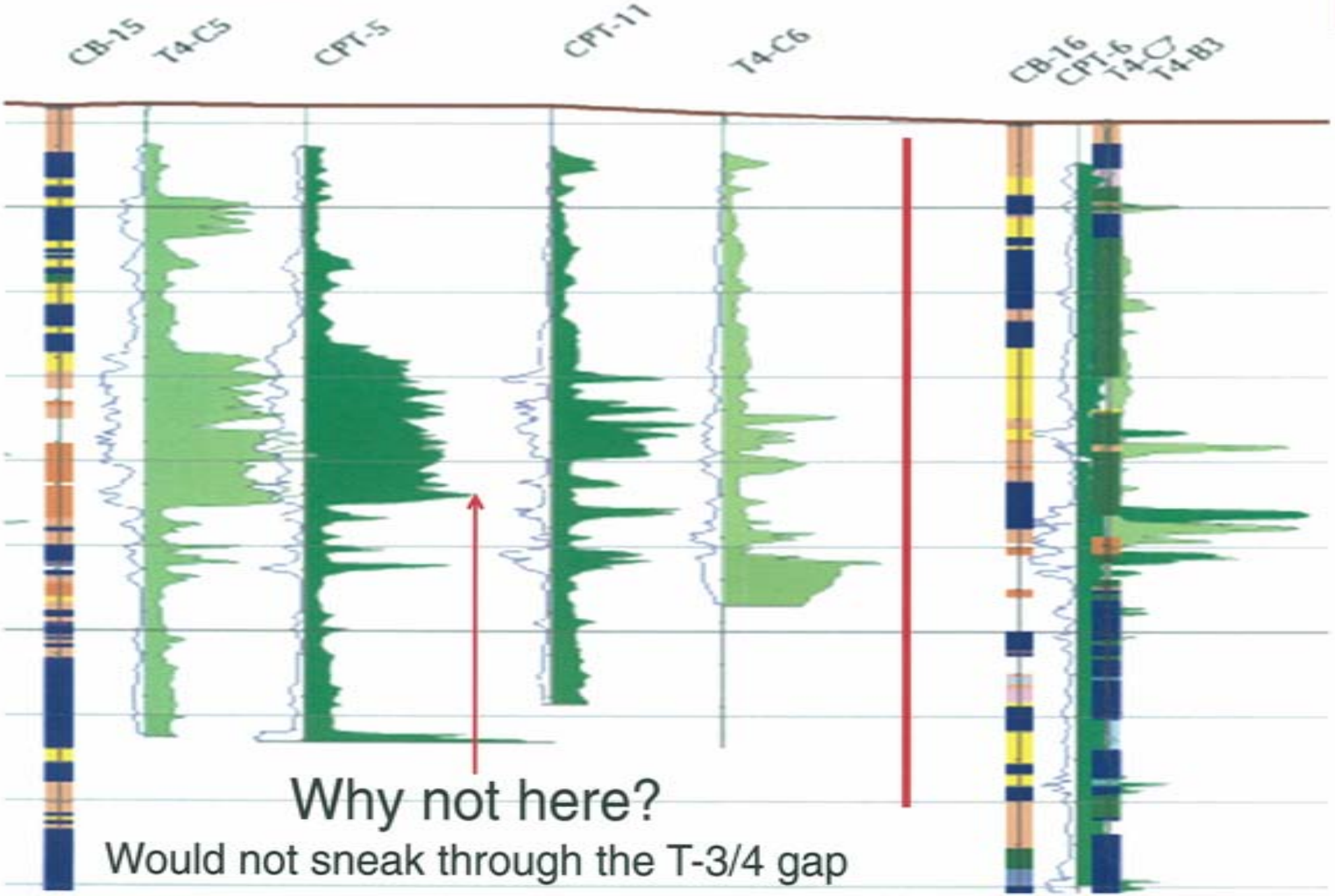




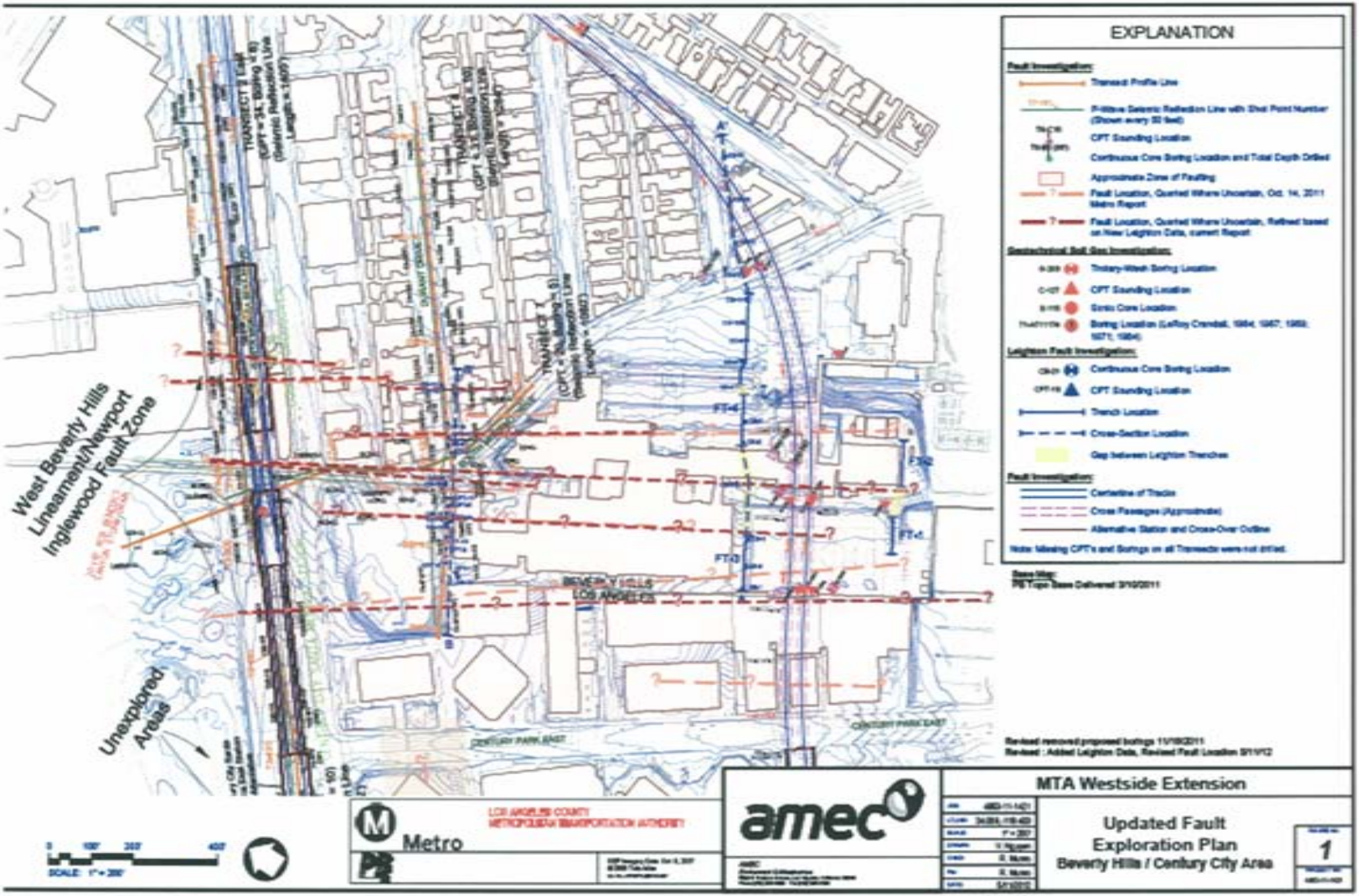


Metro's Fault Between Leighton's CPT-6 and CPT-11 (?)

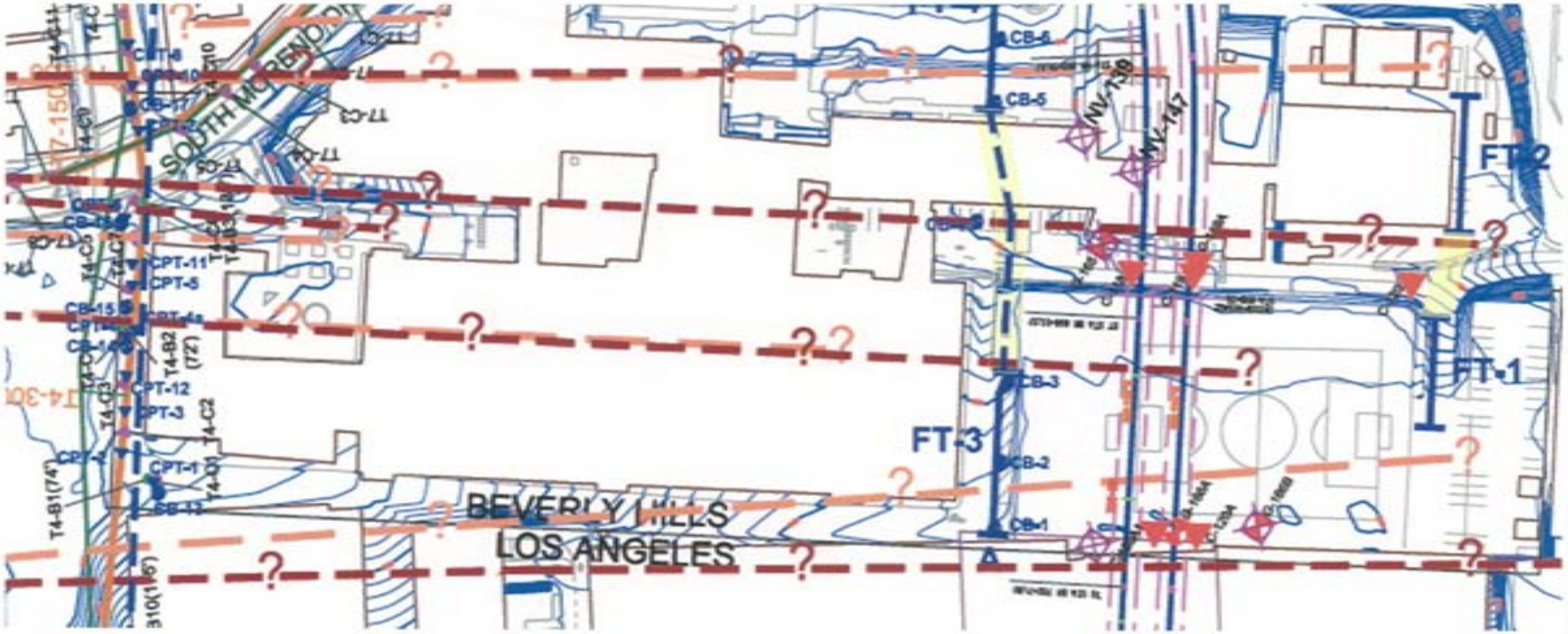
"... significant differences in signatures between Leighton's CPT 6 and CPT 11 ... clearly define the fault mapped on the basis of Metro CPT data at this location."

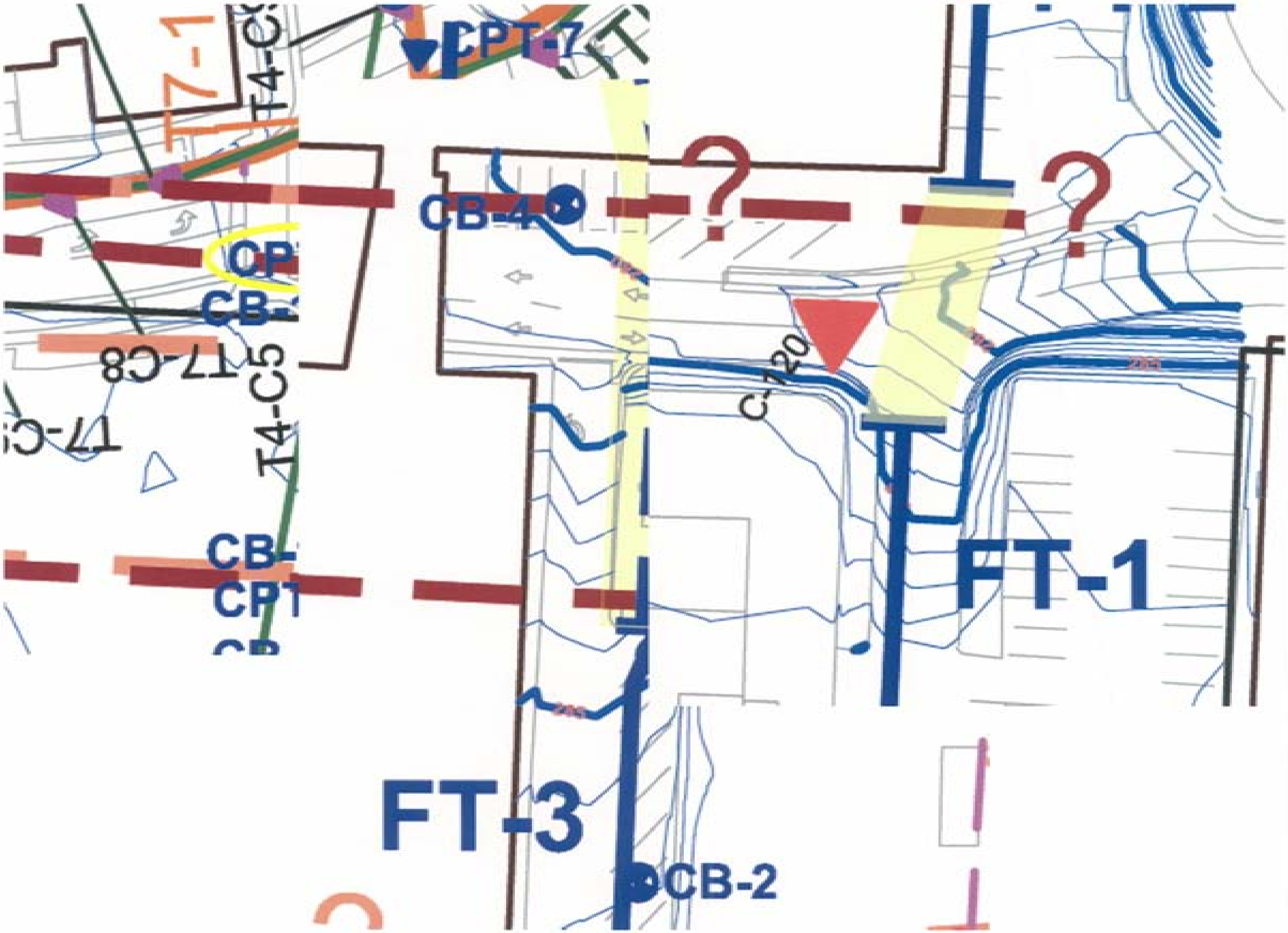


AMEC's New Fault Map

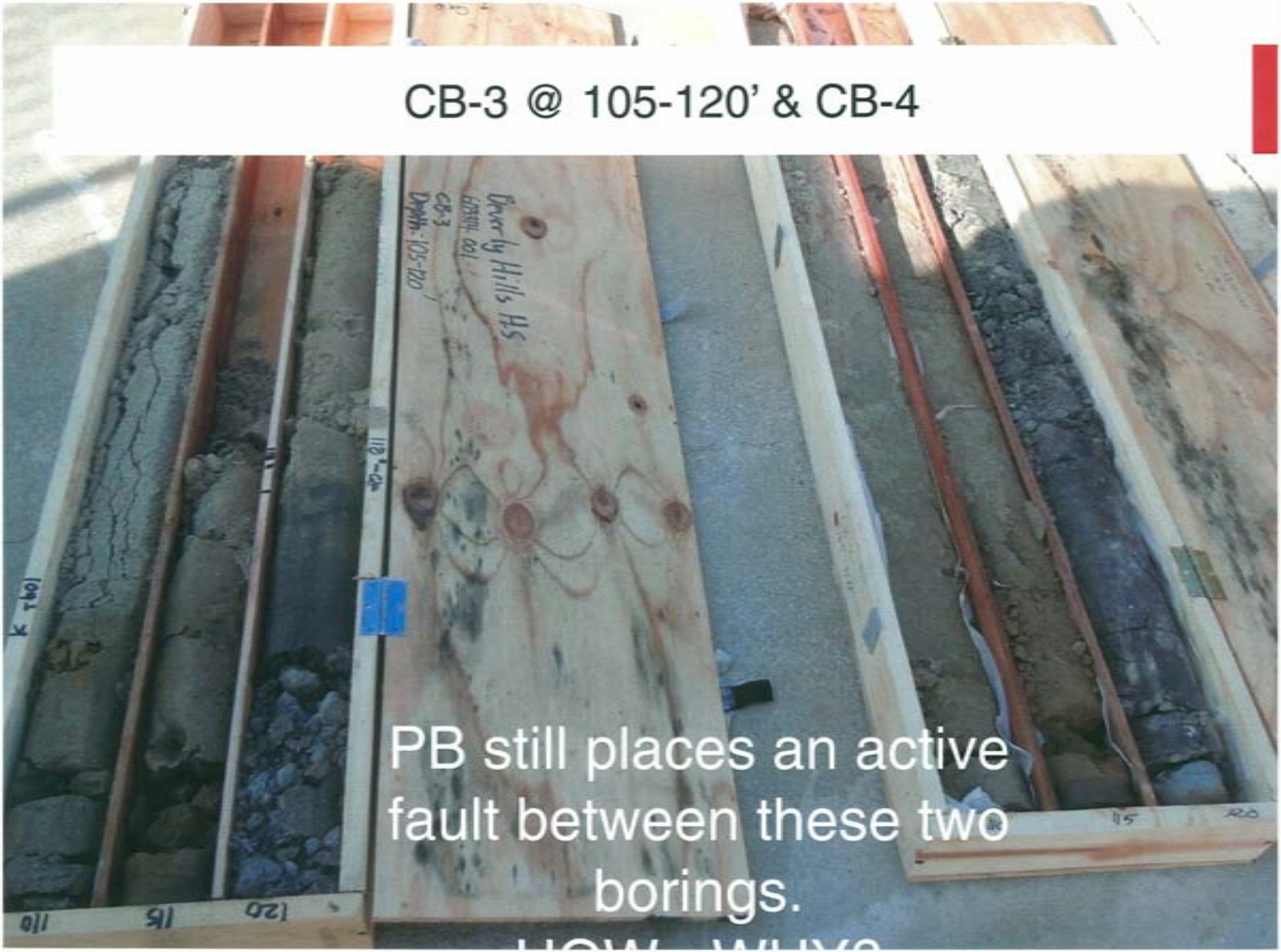


The “faults” are perfectly drawn to miss the trenches




CPT-7
CB-4
CP
CB-
T7-C8
T4-C5
CB-
CP1
C-720
FT-1
FT-3
CB-2

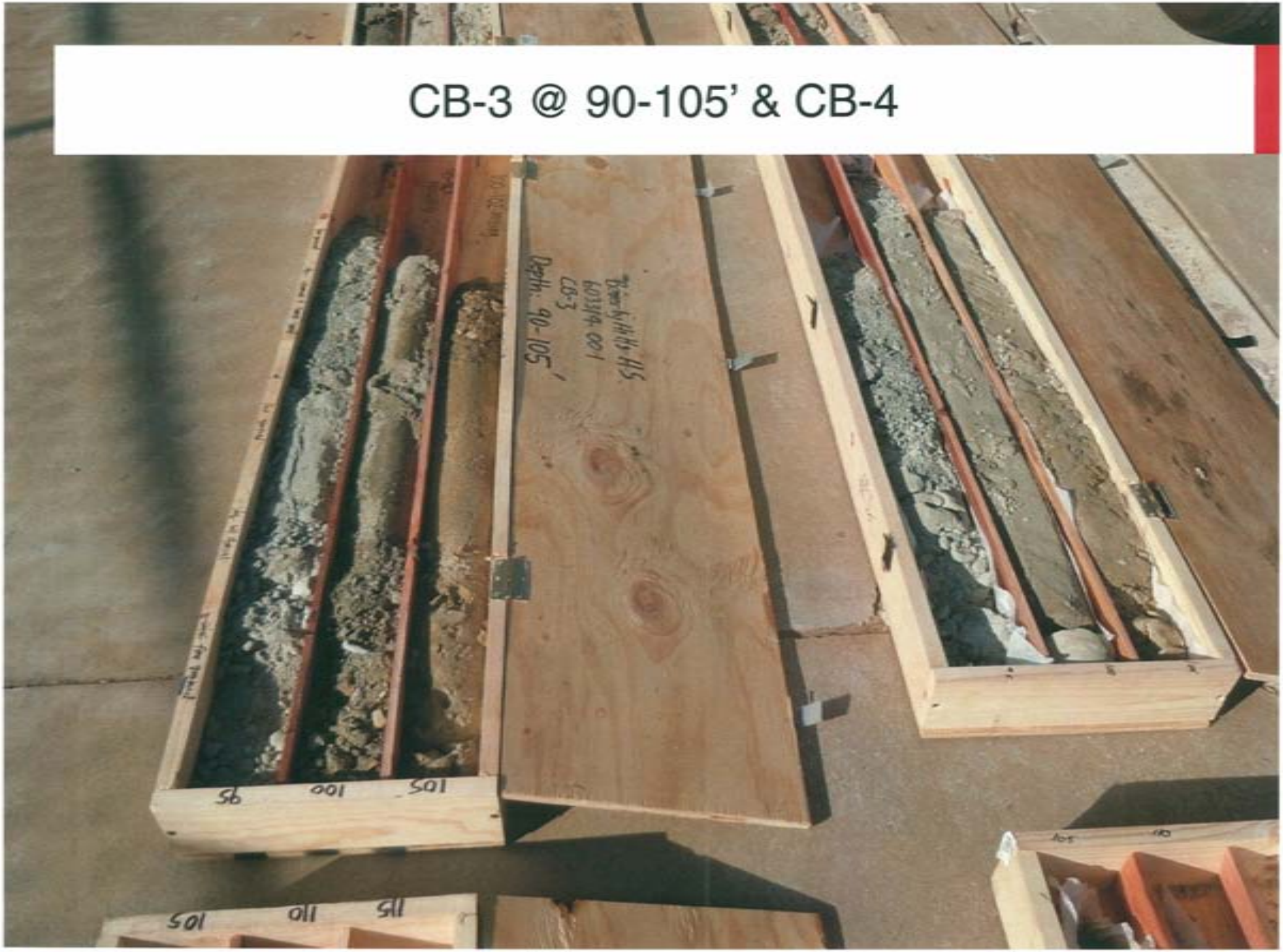
CB-3 @ 105-120' & CB-4



PB still places an active fault between these two borings.

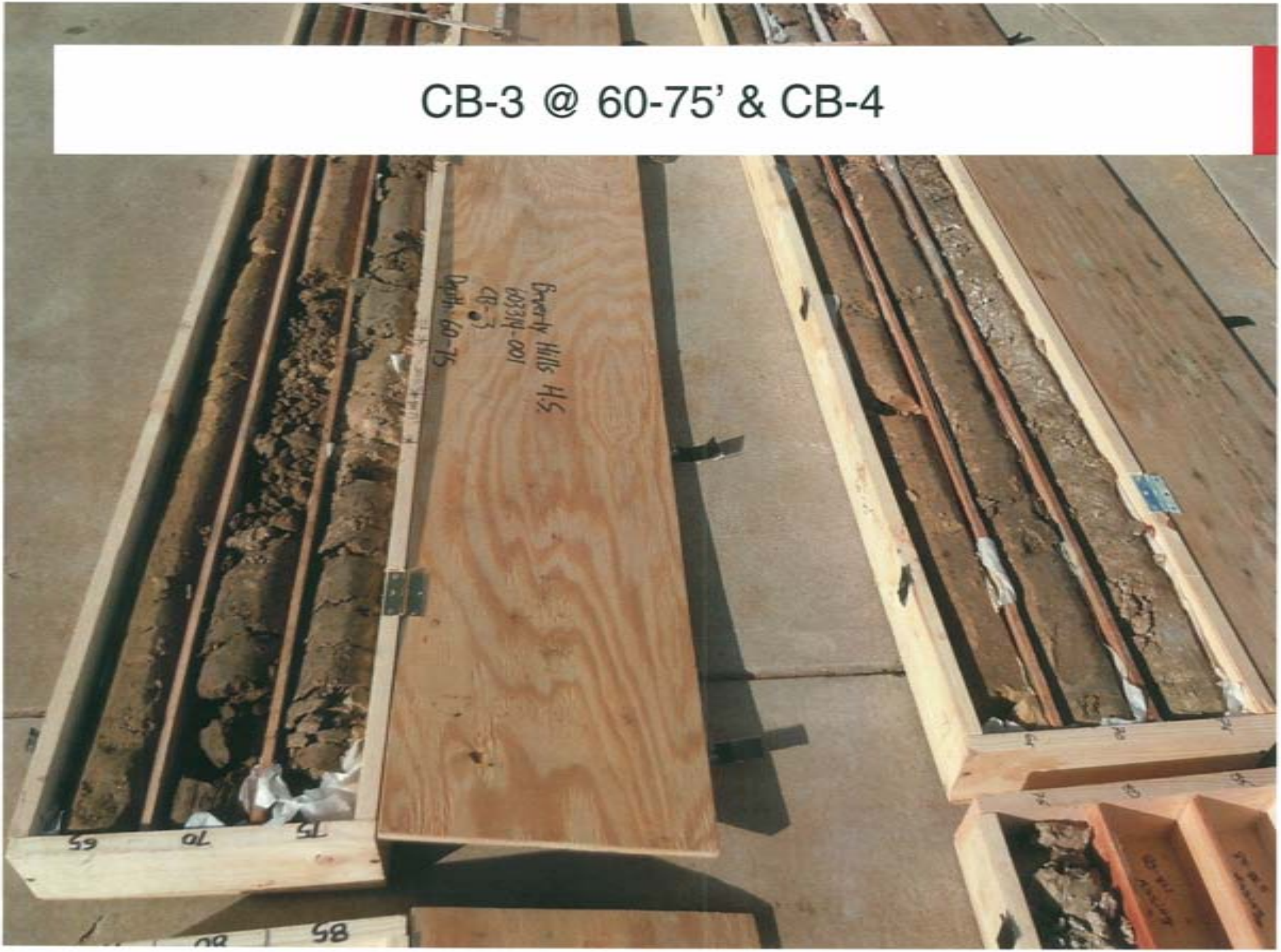
HOW – WHY?

CB-3 @ 90-105' & CB-4



CB-3 @ 75-90' & CB-4

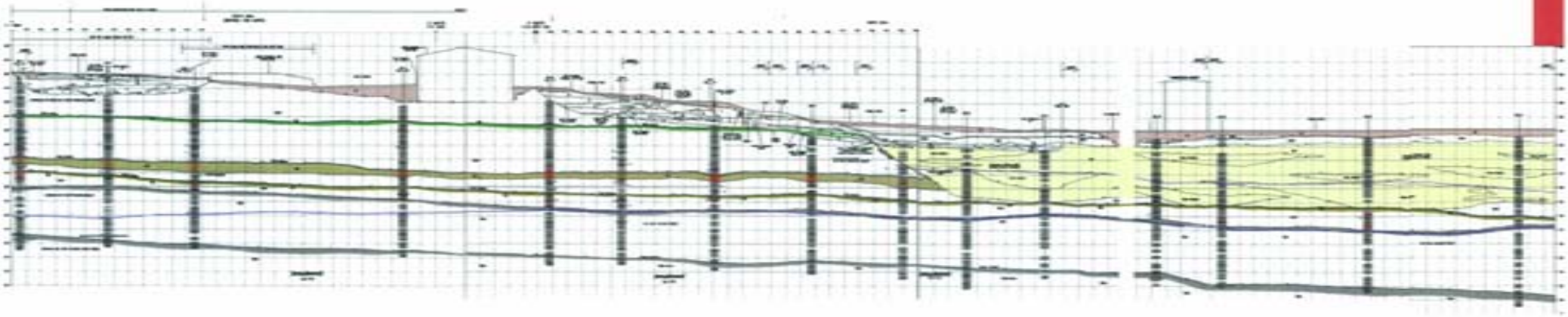
CB-3 @ 60-75' & CB-4



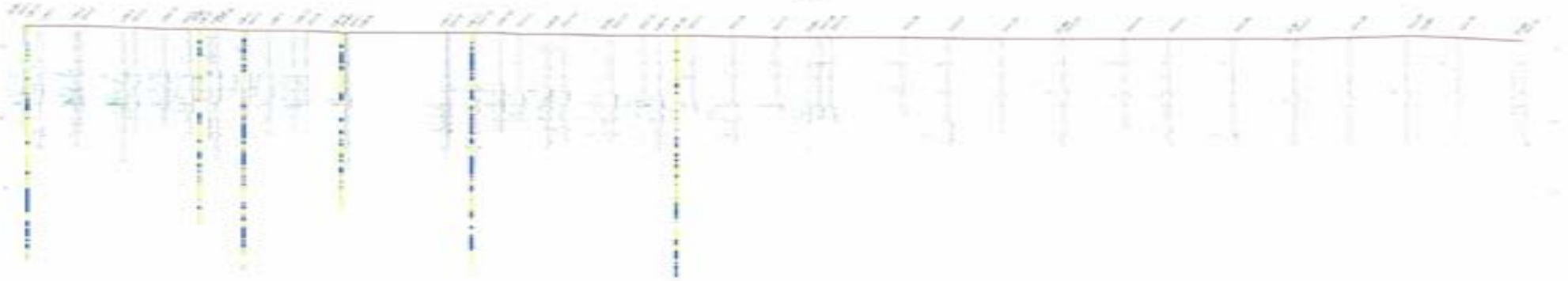
CB-3 @ 45-60' & CB-4


And then you go on to the next one, and the next one.

Leighton's Transect A (western half)

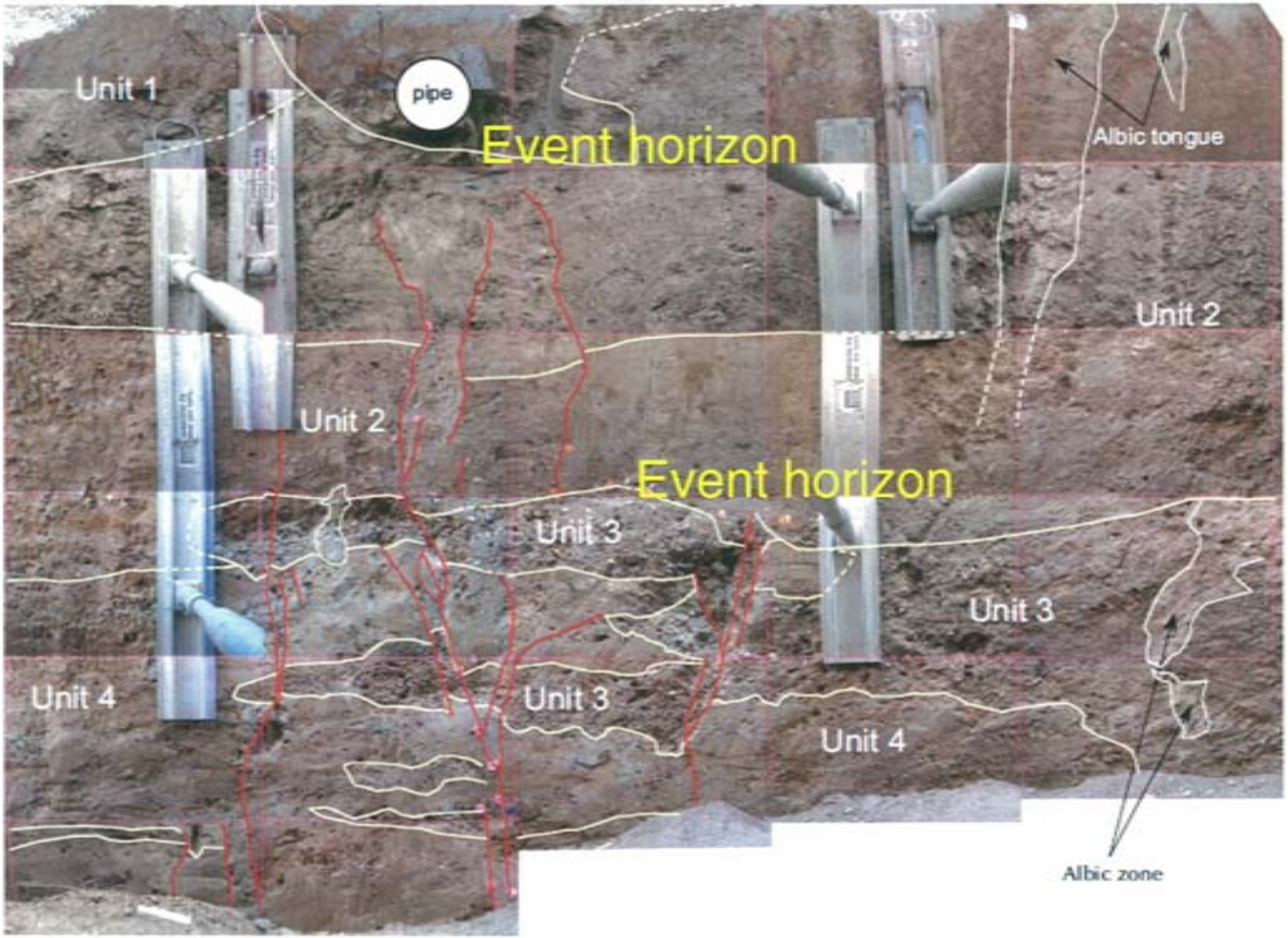


AMEC's Transect 4 and Leighton's B

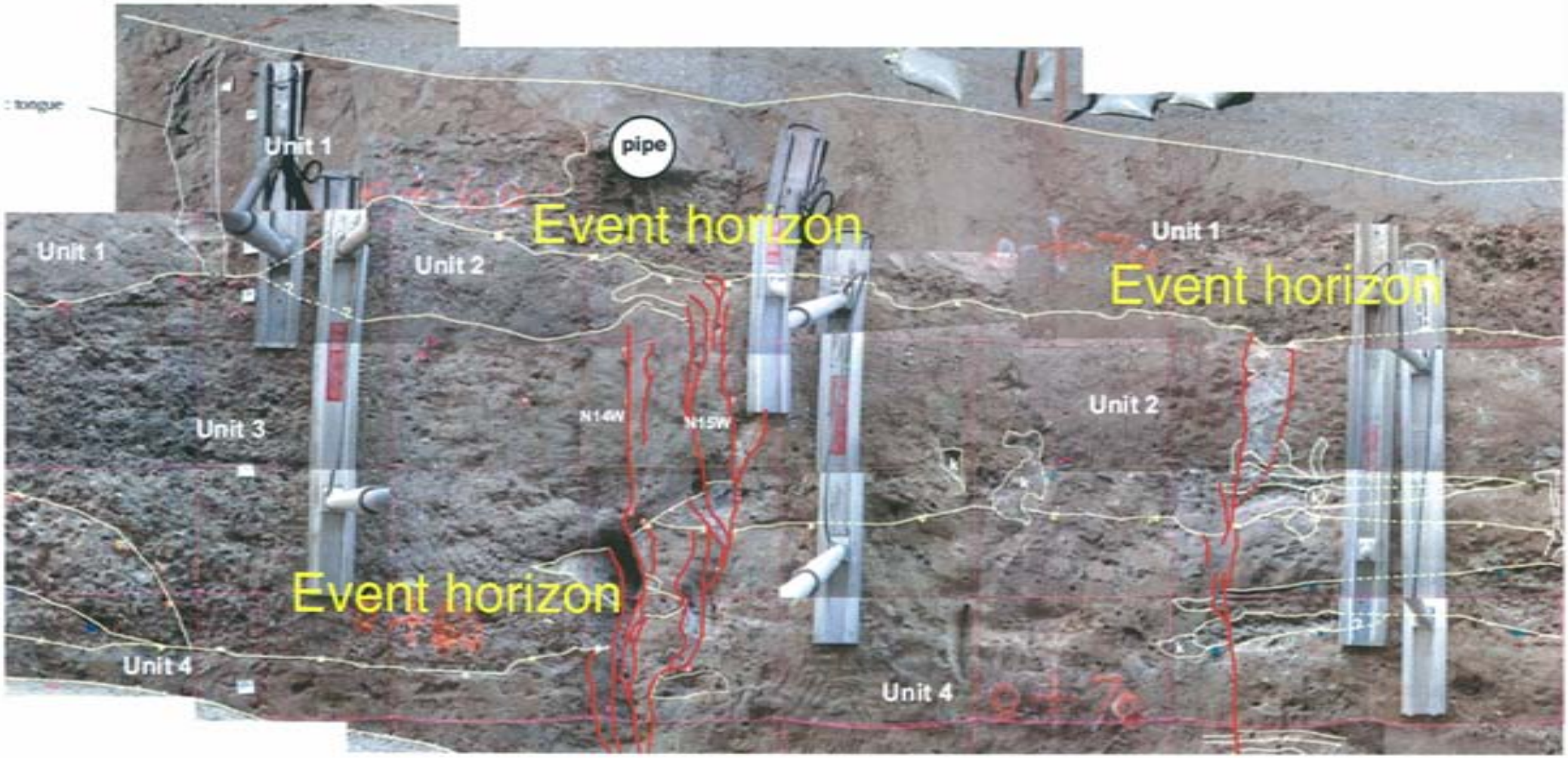


- **Leighton Transect A:** 1100 ft, 15 borings, & 675 ft of trench within school property
- **AMEC Transect 4:** 1300+ ft, 10 borings, 31 CPTs
- **Leighton Transect B:** 630 ft, 6 borings, 9 CPTs

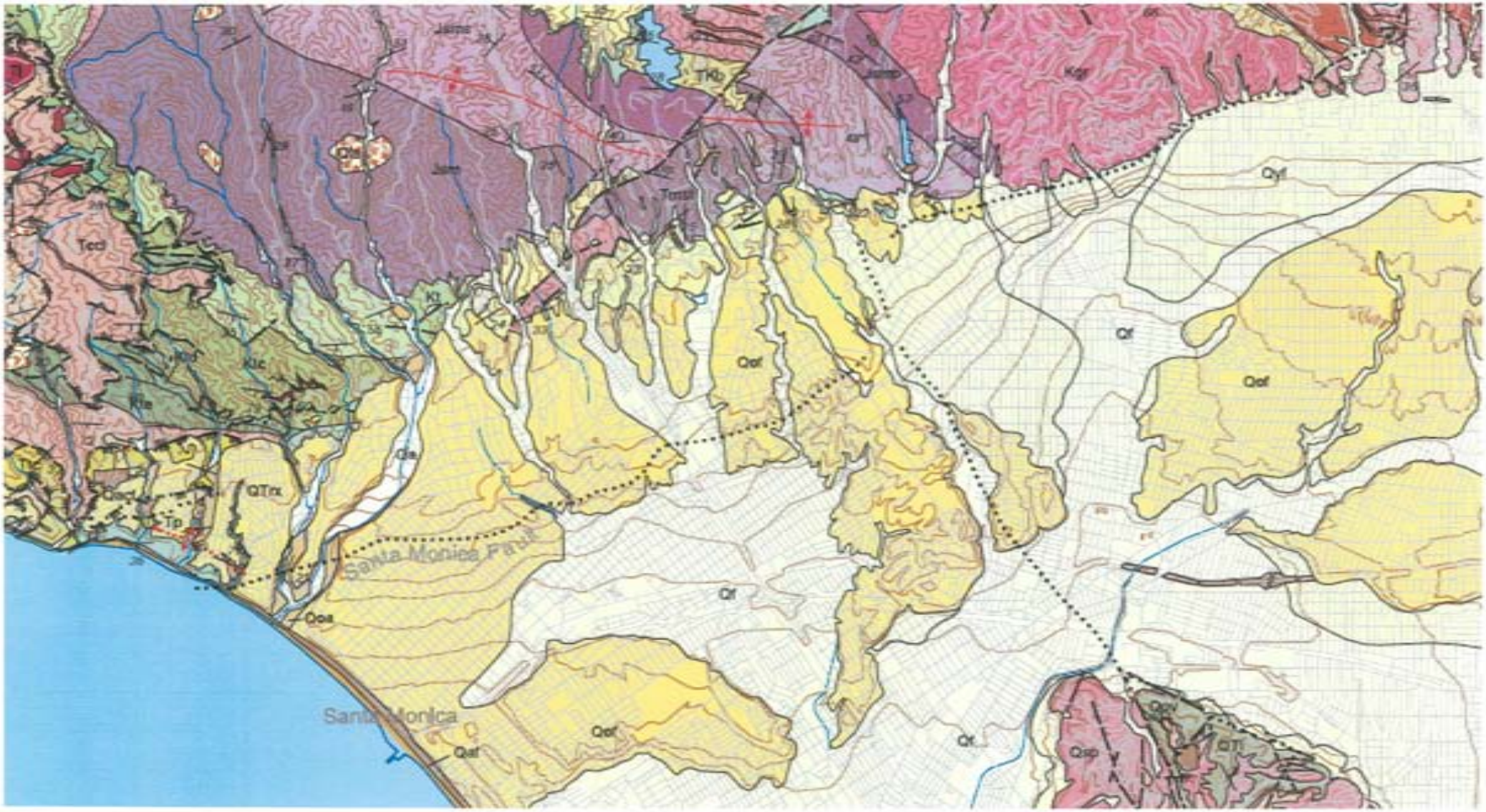
Trench 3 - South Wall



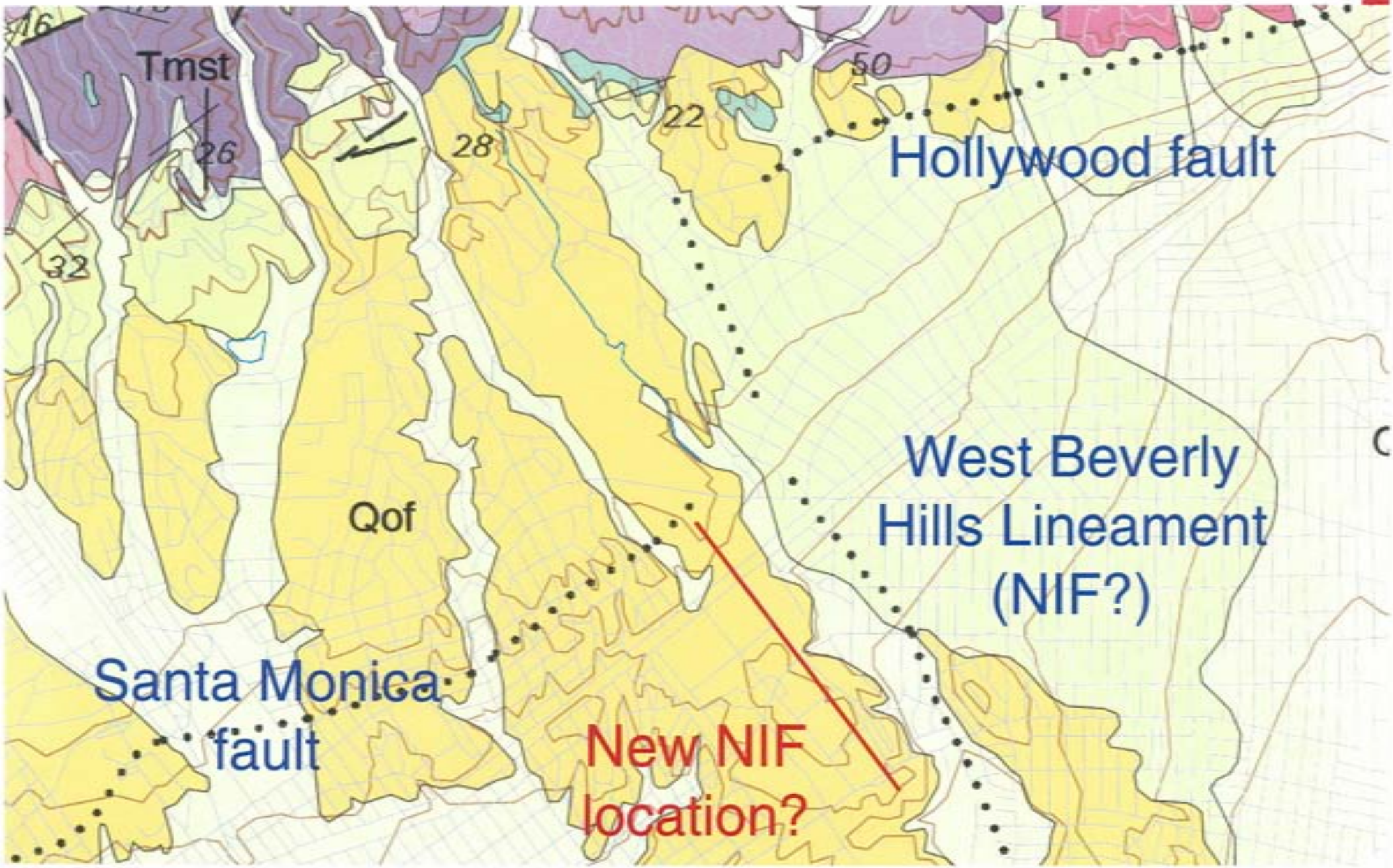
Trench 3 - North Wall



USGS Los Angeles Quad - Geology

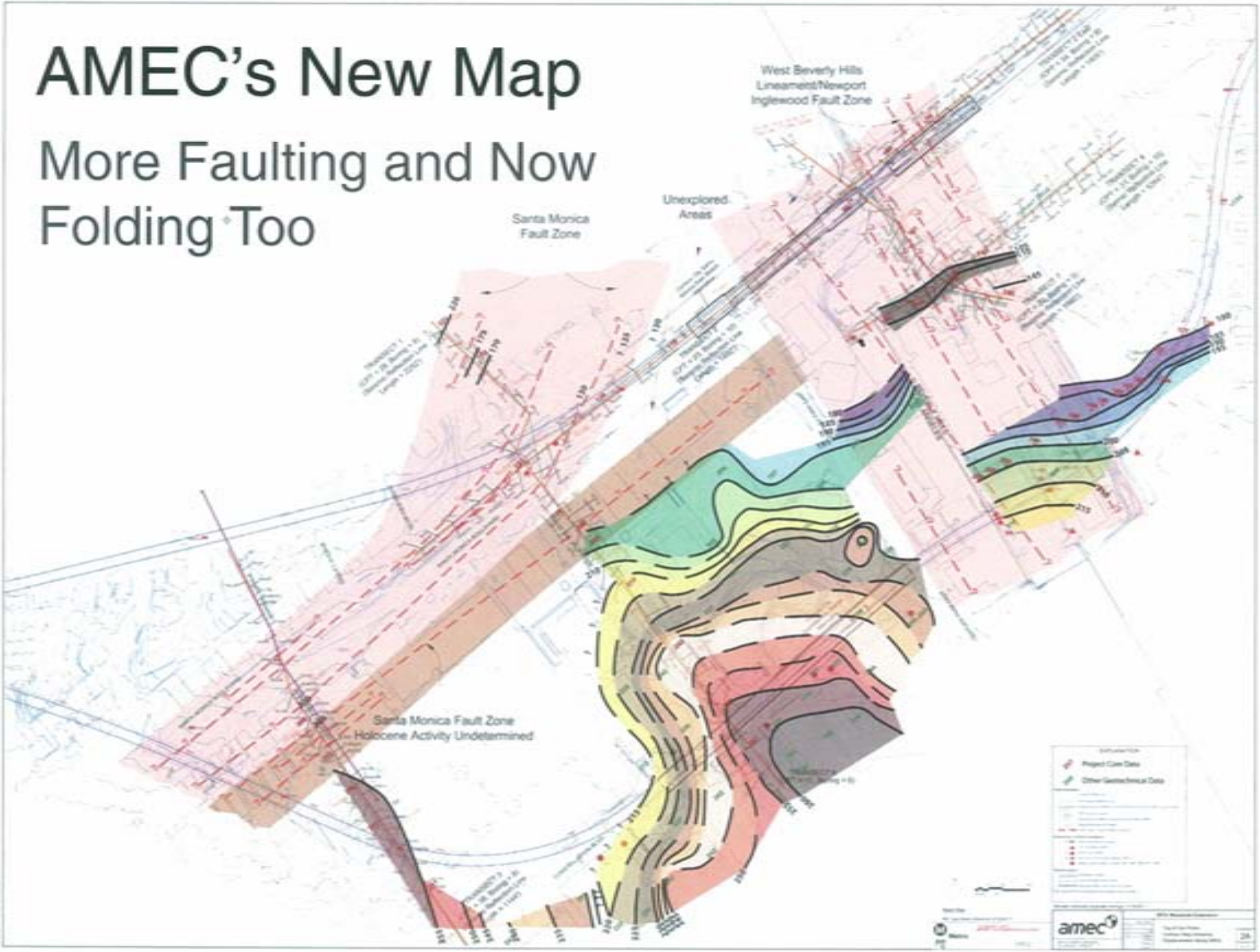


USGS Los Angeles Quad – Geology Map

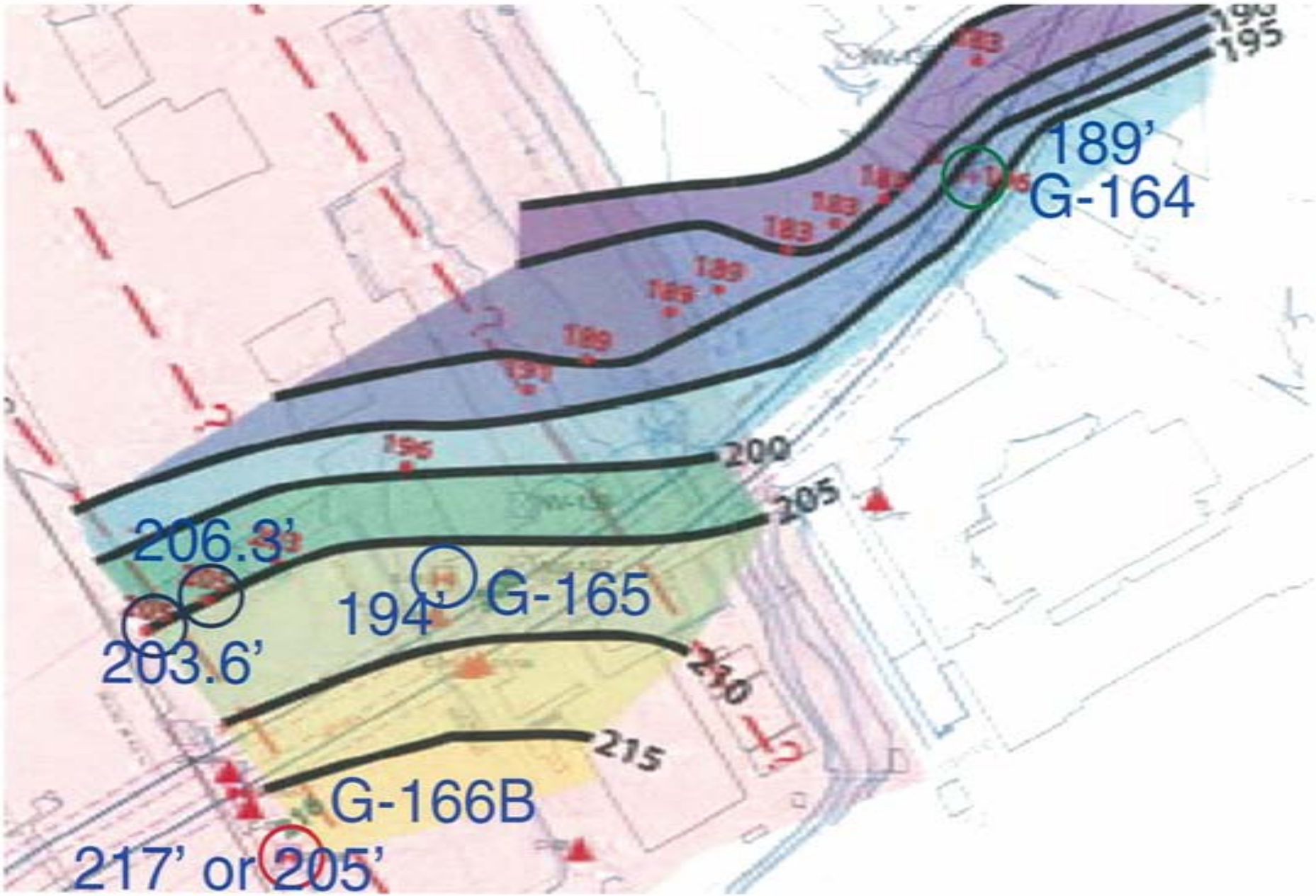


AMEC's New Map

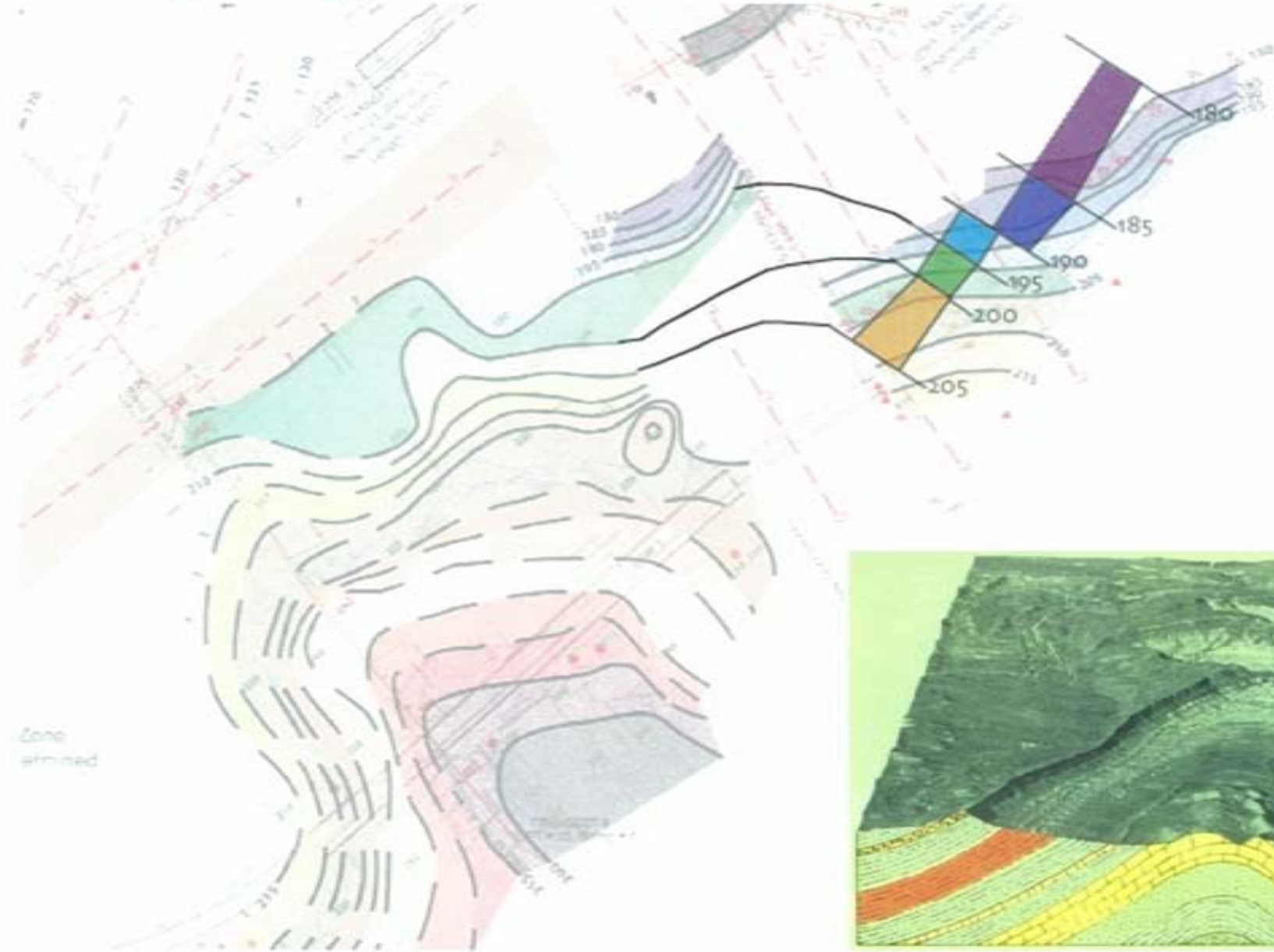
More Faulting and Now Folding Too

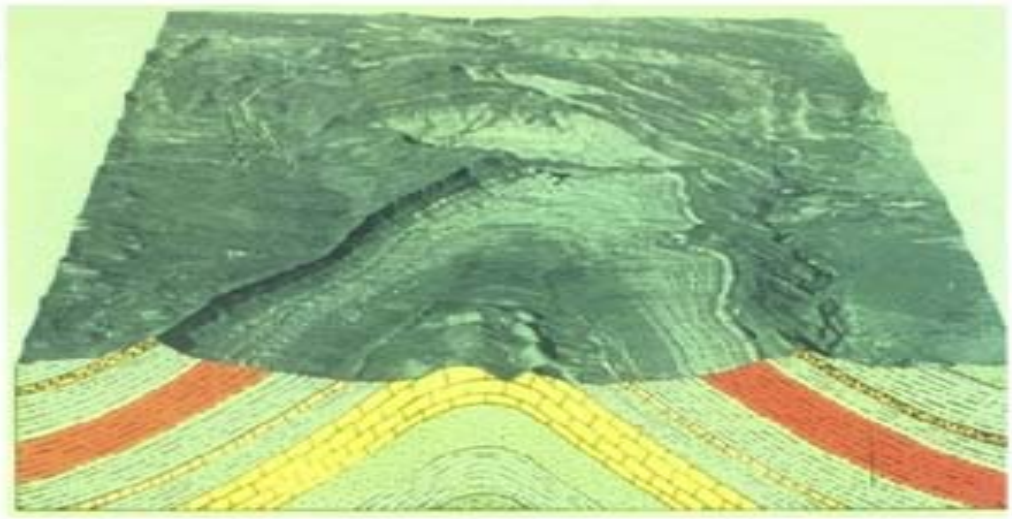


Issues with the data's interpretation



You can connect the dots in many different ways, and an anticlinal fold is the most consistent with the total site geology

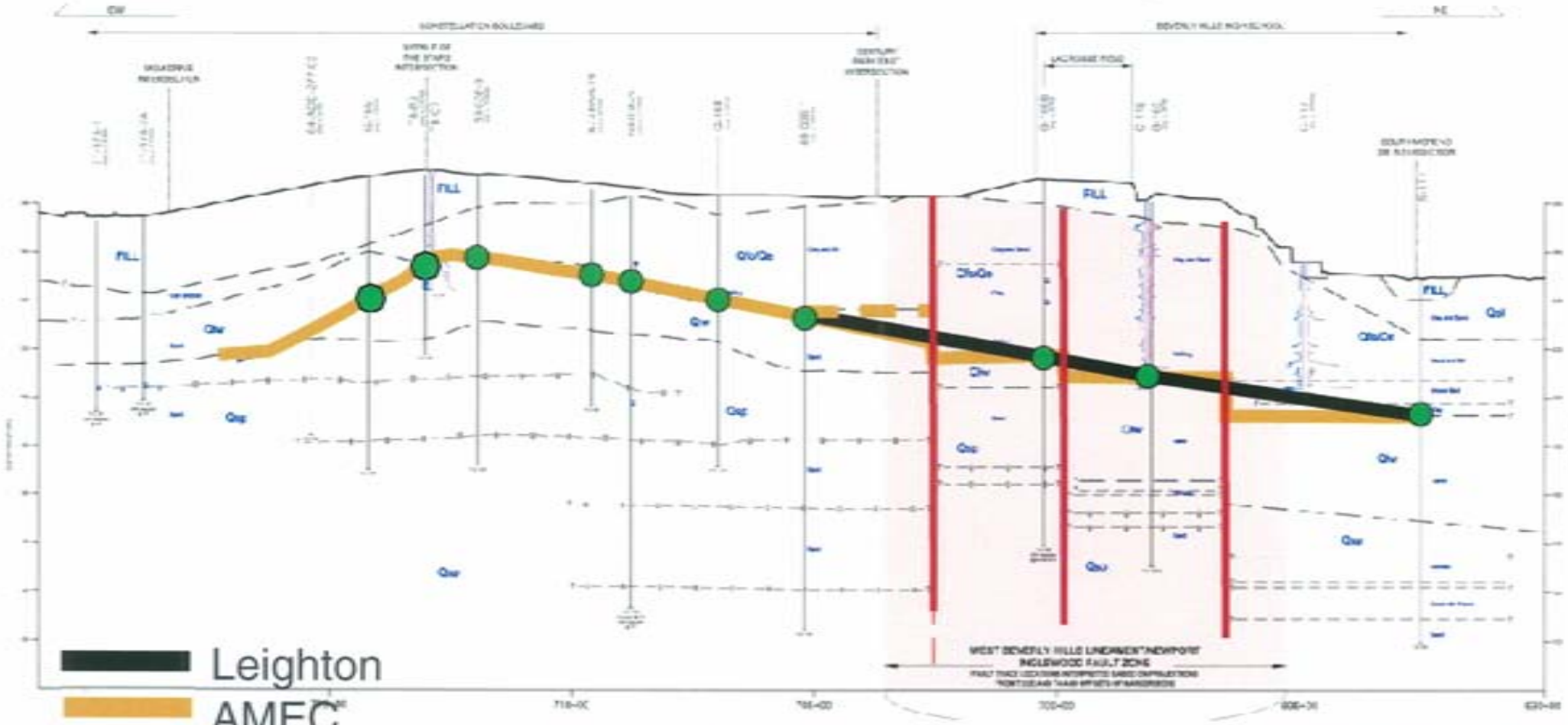




Now is there an active(?) fold through Constellation?

Constellation

BHHS



Leighton

AMEC

Data Point

AMEC Fault

Is an active NIFZ really here?

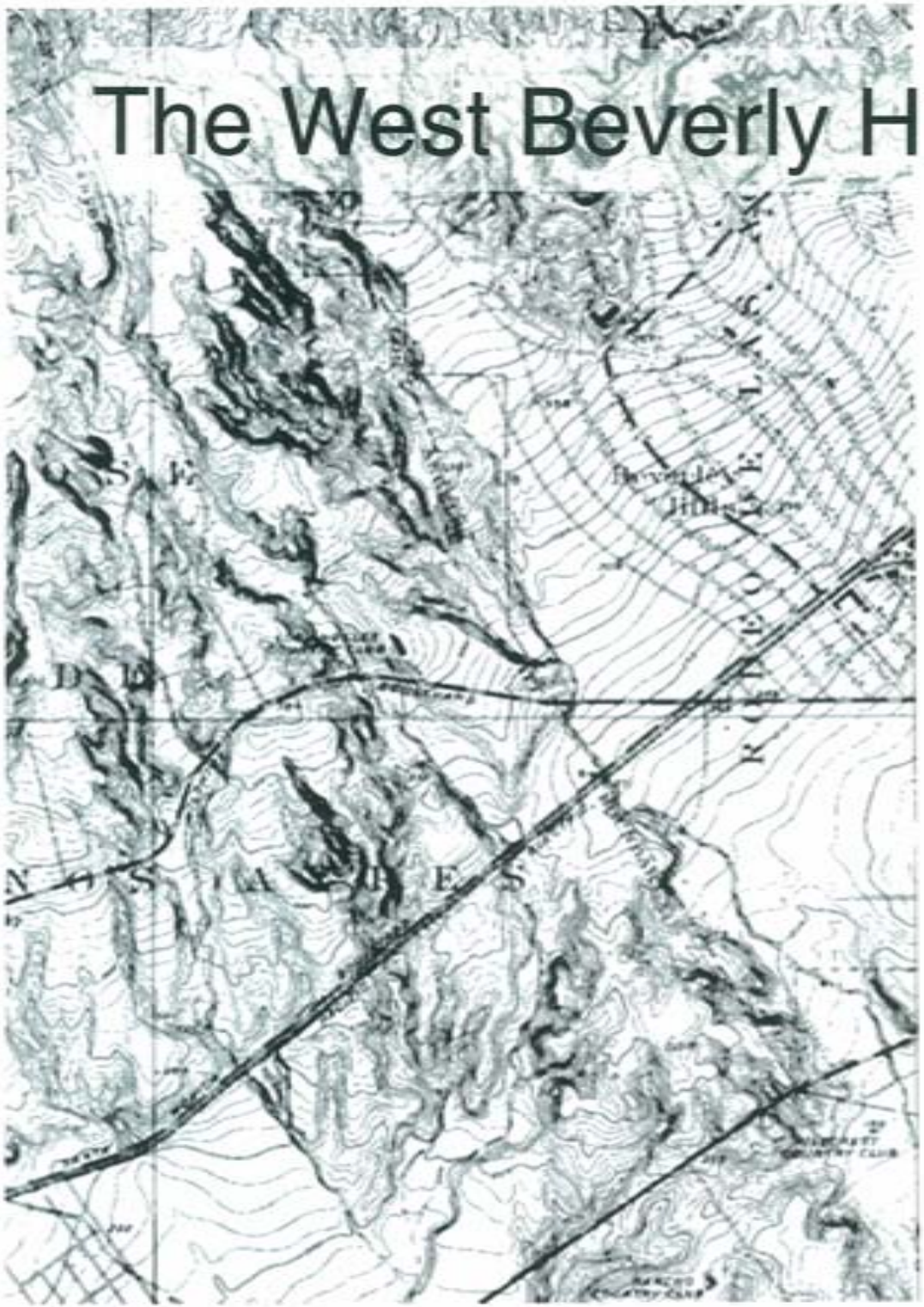
amec

Geologic Section

CONSTELLATION PROFILE

9

The West Beverly Hills Lineament



- Fault Uplift Origin
- River Erosion Origin
- Both

Beverly Hills High School Site

Fault Hazard Assessment

West Beverly Hills Lineament at
Beverly Hills High School

Metro Public Hearing
May 17, 2012

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Investigation Team Organization

BEVERLY HILLS UNIFIED SCHOOL DISTRICT

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KEVIN BROGAN

PRIMESOURCE
TIM BURESH, PE

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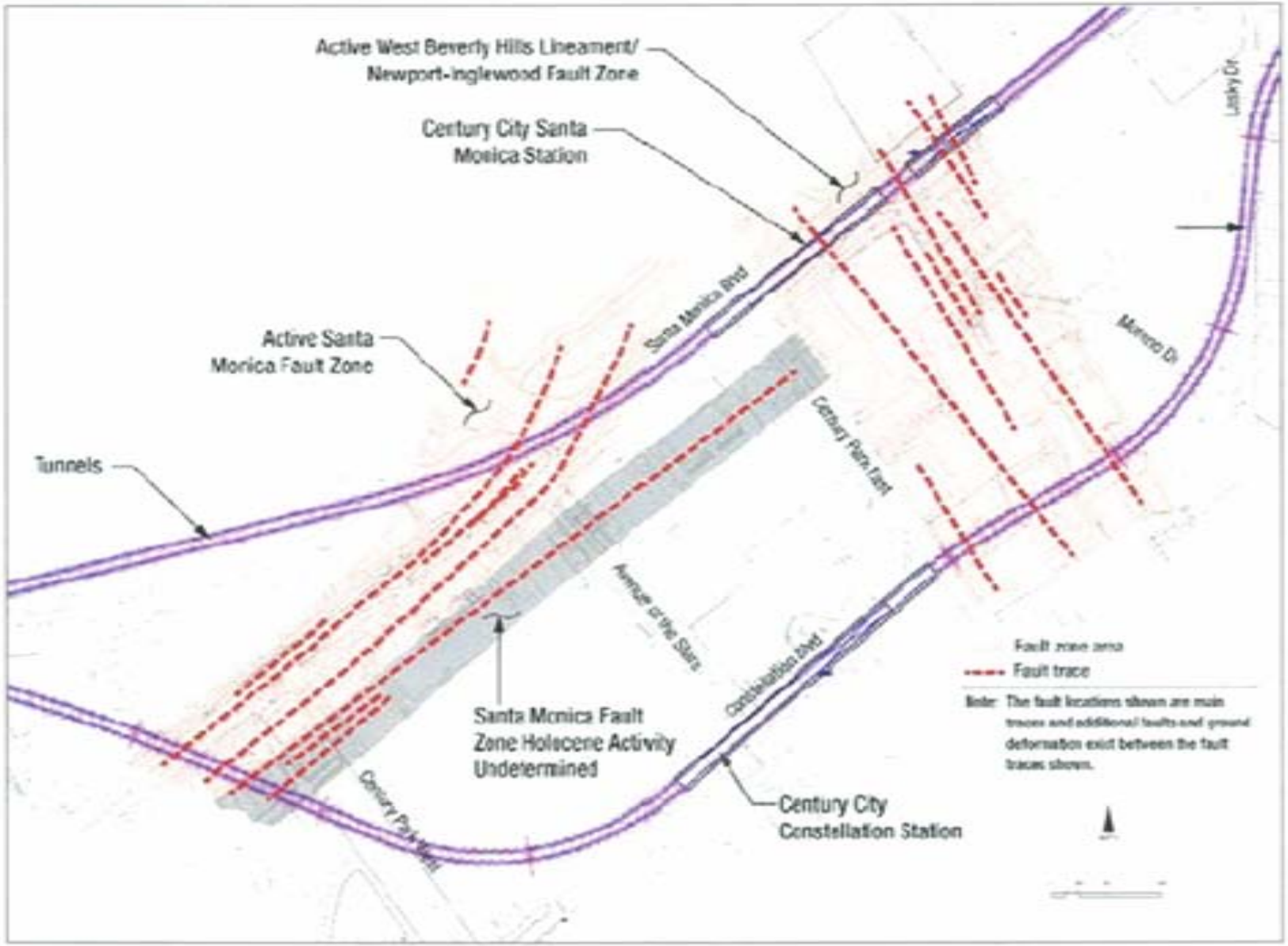
Pedochronologist

EDWARD J. RHOADES
UCLA
Sedimentation Optical
Stimulated Luminescence

Kenney GeoScience

MILES KENNEY, PG
Overview Consultant

PB's Active Fault Map



FAULT HAZARD ASSESSMENT OF
THE WEST BEVERLY HILLS LINEAMENT
BEVERLY HILLS HIGH SCHOOL
241 SOUTH MORENO DRIVE
BEVERLY HILLS, CALIFORNIA

Prepared For

BEVERLY HILLS UNIFIED SCHOOL DISTRICT
255 South Lasky Drive
Beverly Hills, California 90212-3697

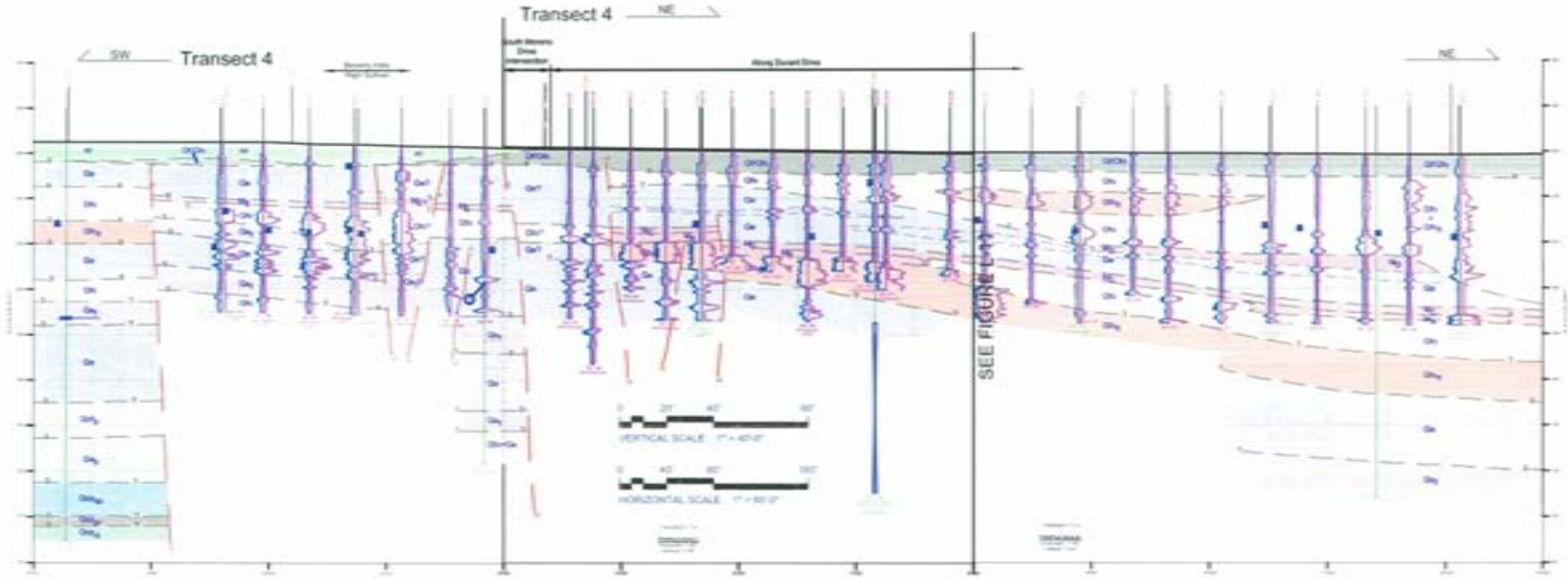
April 22, 2012

Project No. 603314-002

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

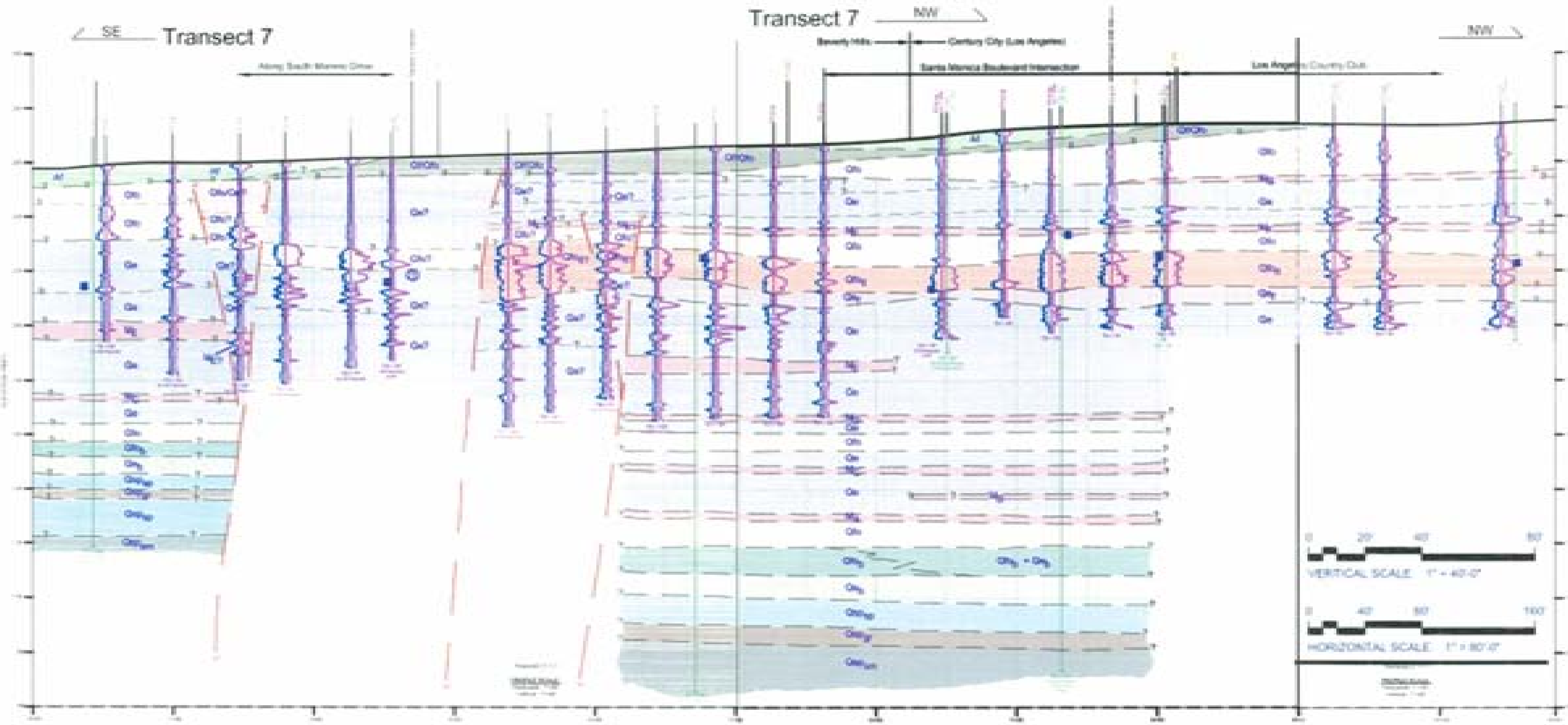
Report has been delivered to School District and California Geological Survey

PB's Transect 4



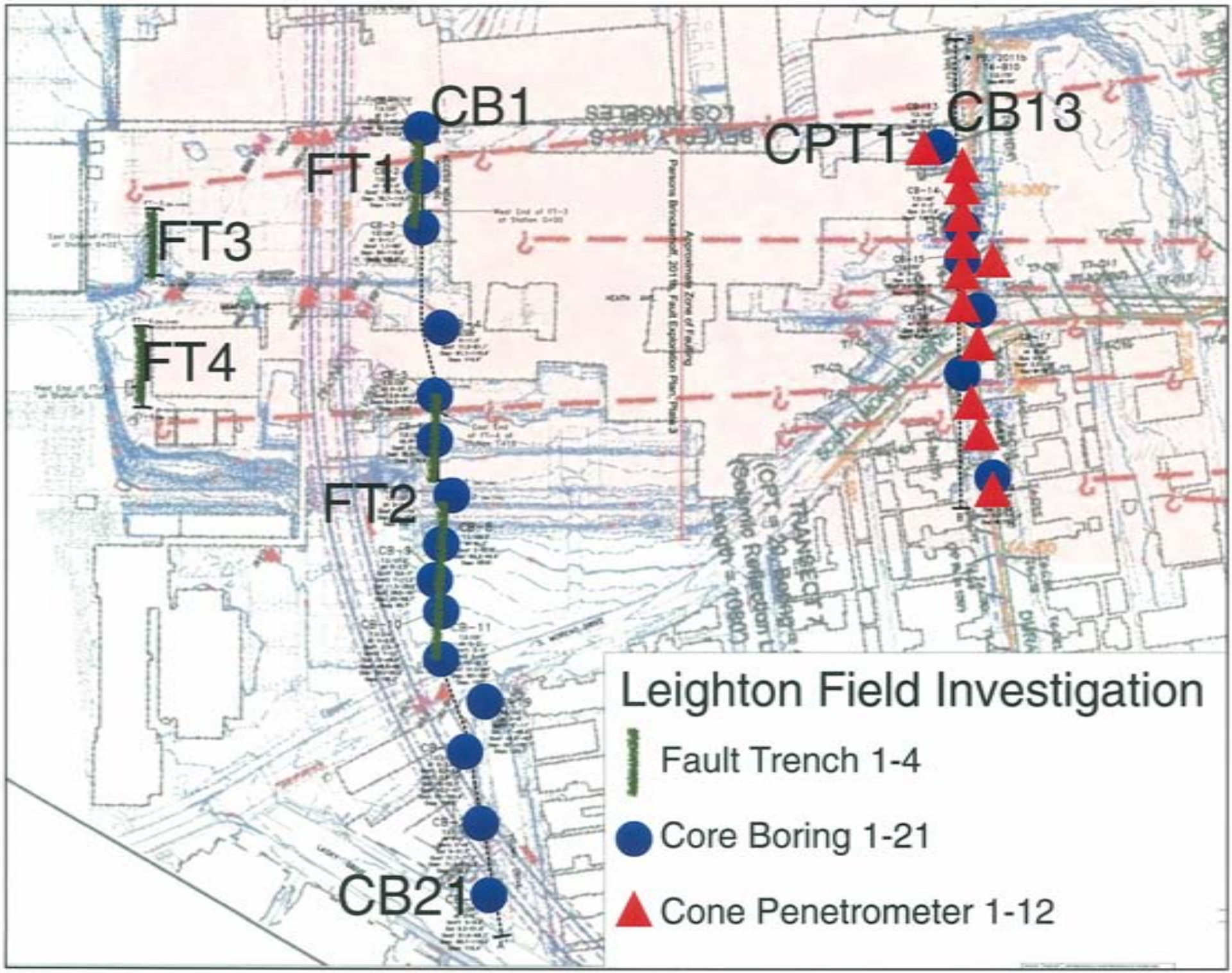
Durant Drive - many faults

PB's Transect 7



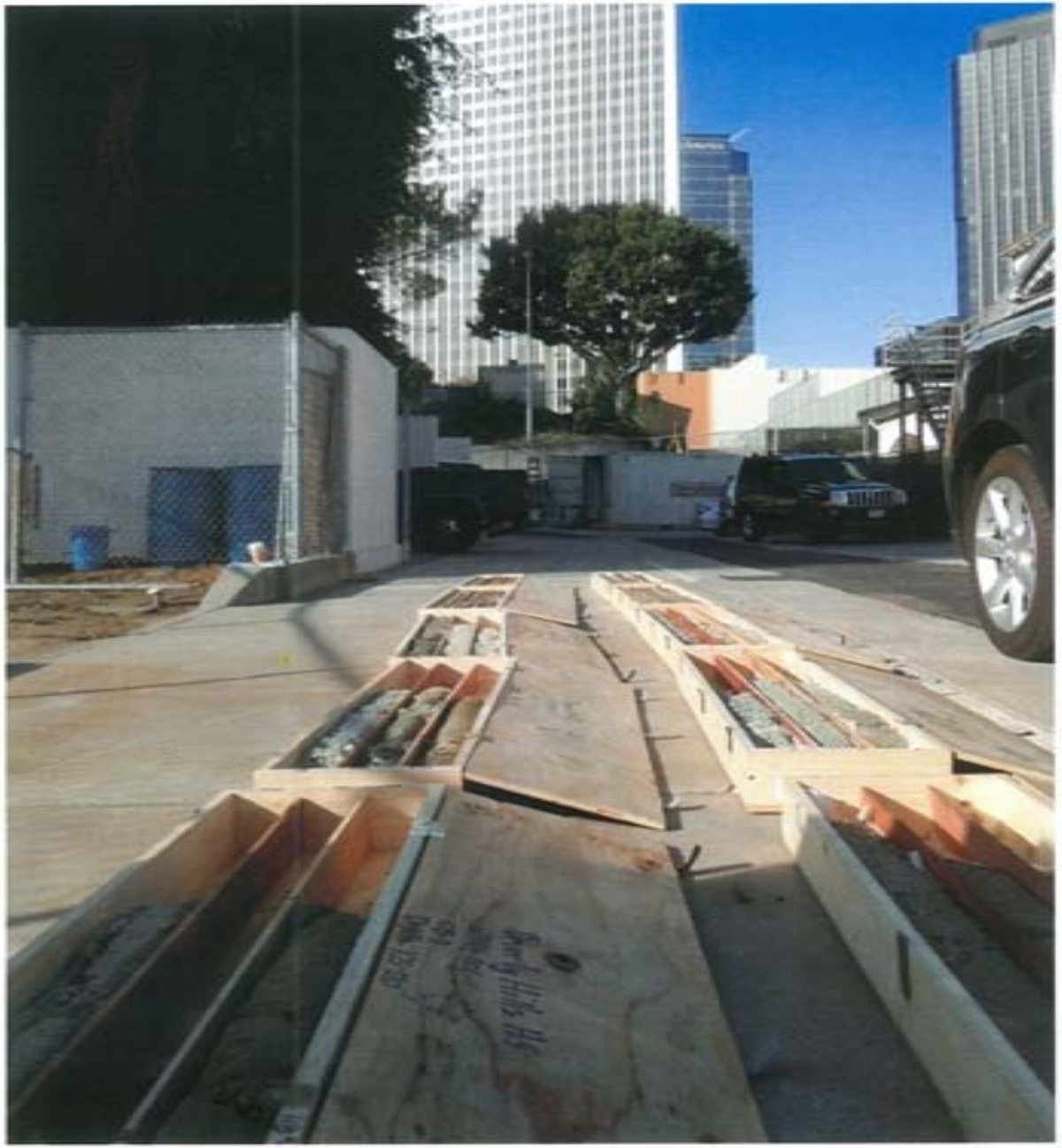
S. Moreno Drive - many faults

12.22.2011


CB1
CB13
CPT1
FT1
FT3
FT4
FT2
CB21
Leighton Field Investigation
Fault Trench 1-4
Core Boring 1-21
Cone Penetrometer 1-12

Visual and Physical Correlation from Boring to Boring

- Enhances confidence in the conclusions



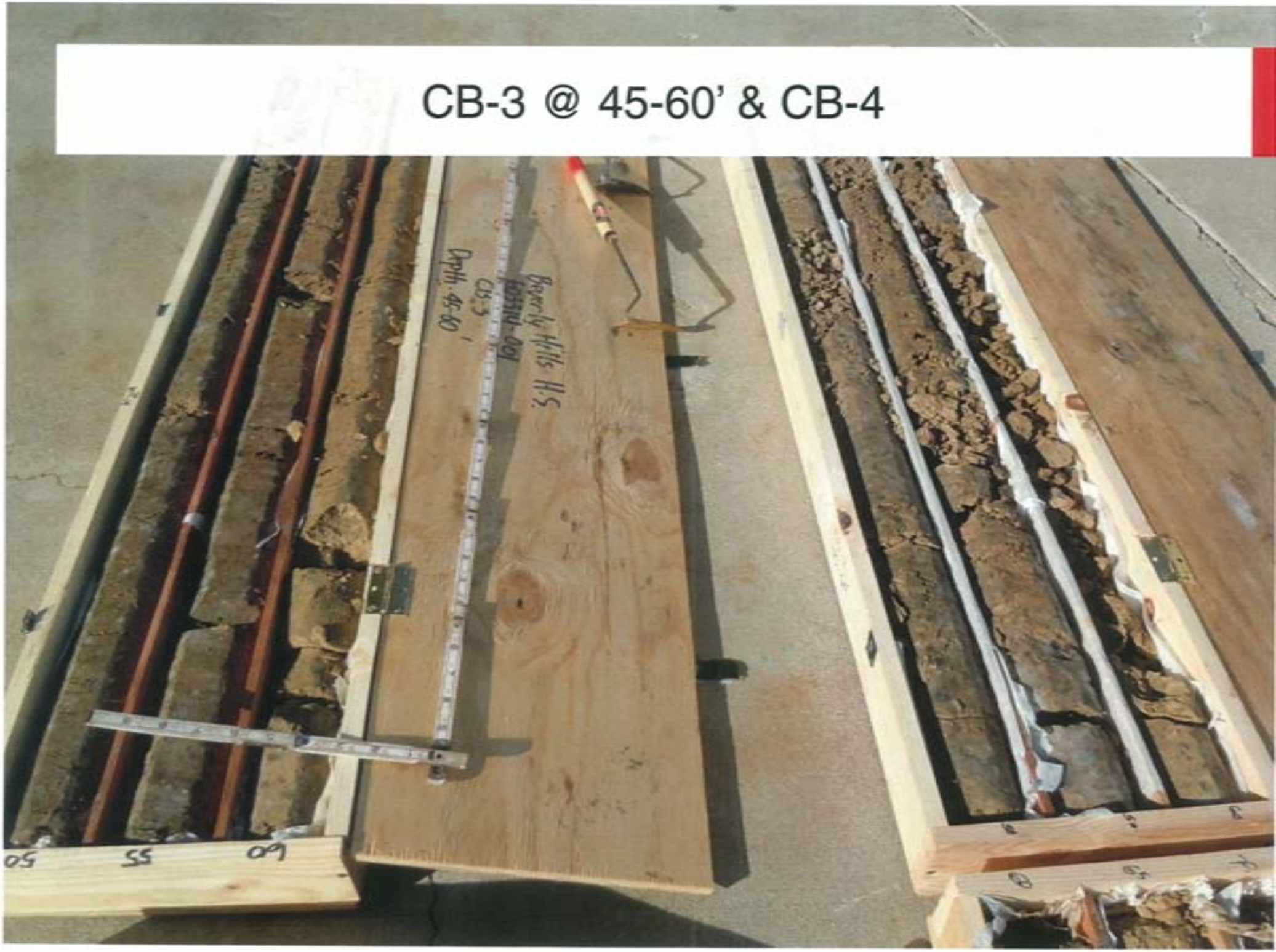
CB-3 @ 105-120' & CB-4

CB-3 @ 90-105' & CB-4

CB-3 @ 75-90’ & CB-4

CB-3 @ 60-75' & CB-4

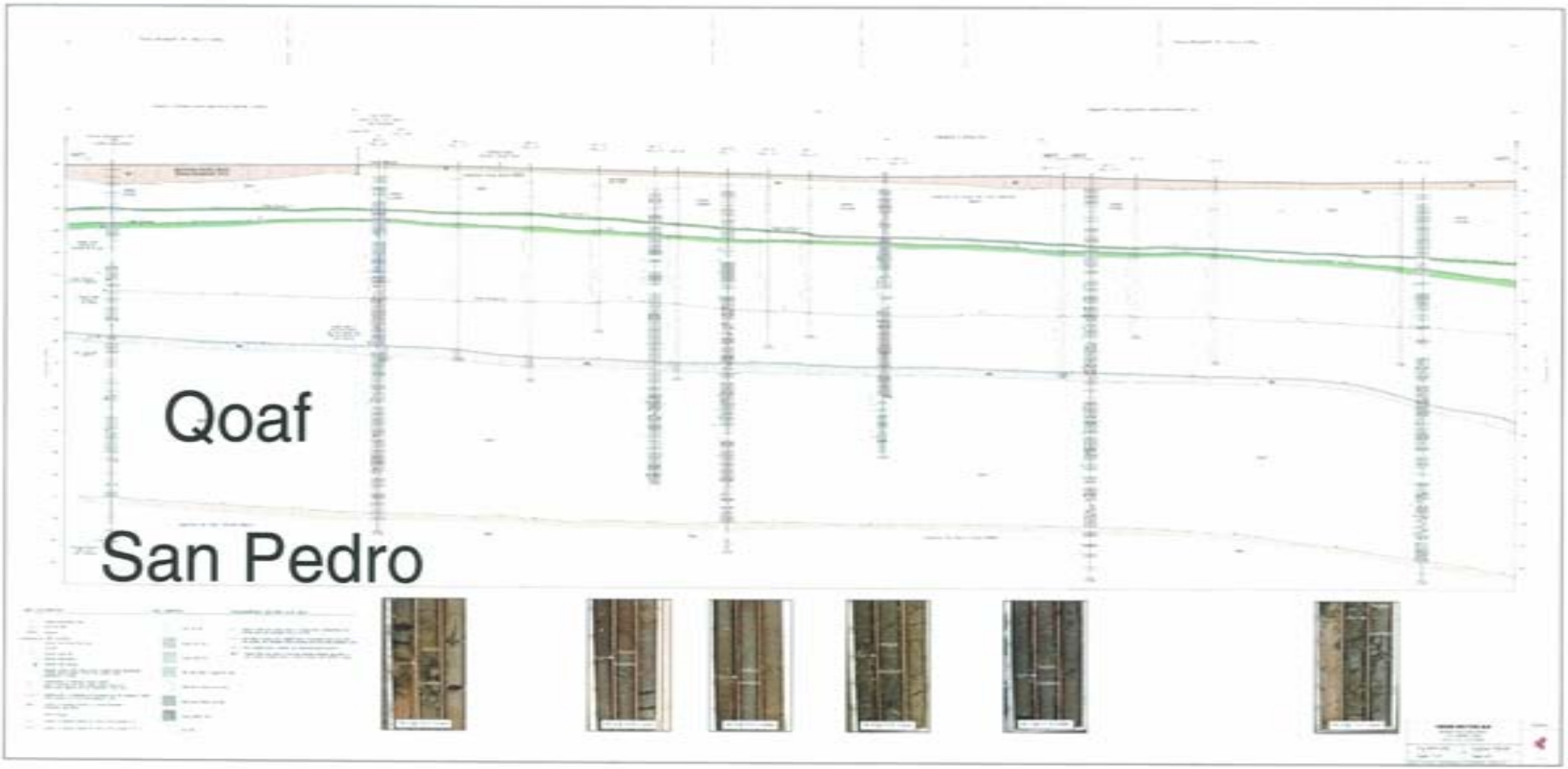
CB-3 @ 45-60' & CB-4




And then you go on to the next one, and the next one.

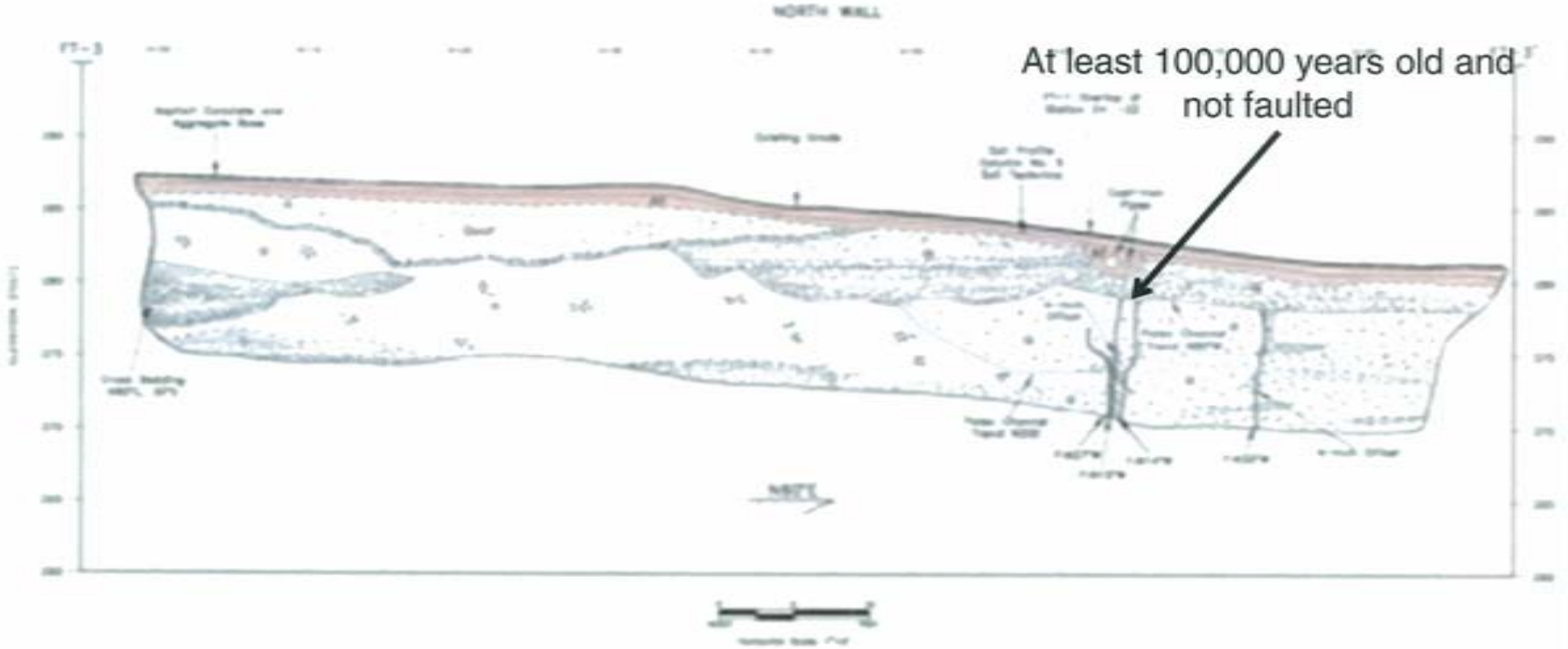

Leighton CB-13
PB T4-B10
160
165
170
155
150
145
145
150
155

Boring Correlation



Fault Trench FT-3

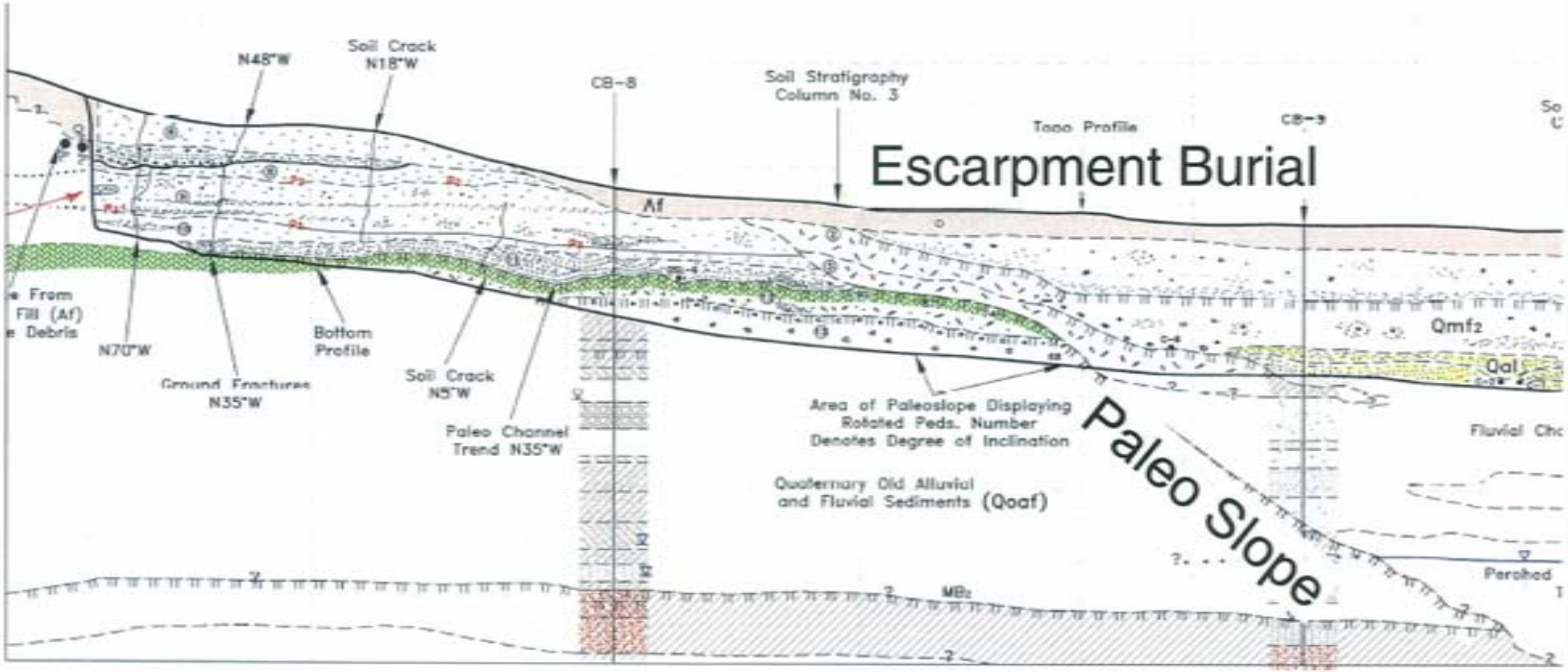
The only faults in any of the trenches



In CA, by law, an Active Fault is defined as ~11,000 years since last breaking surface

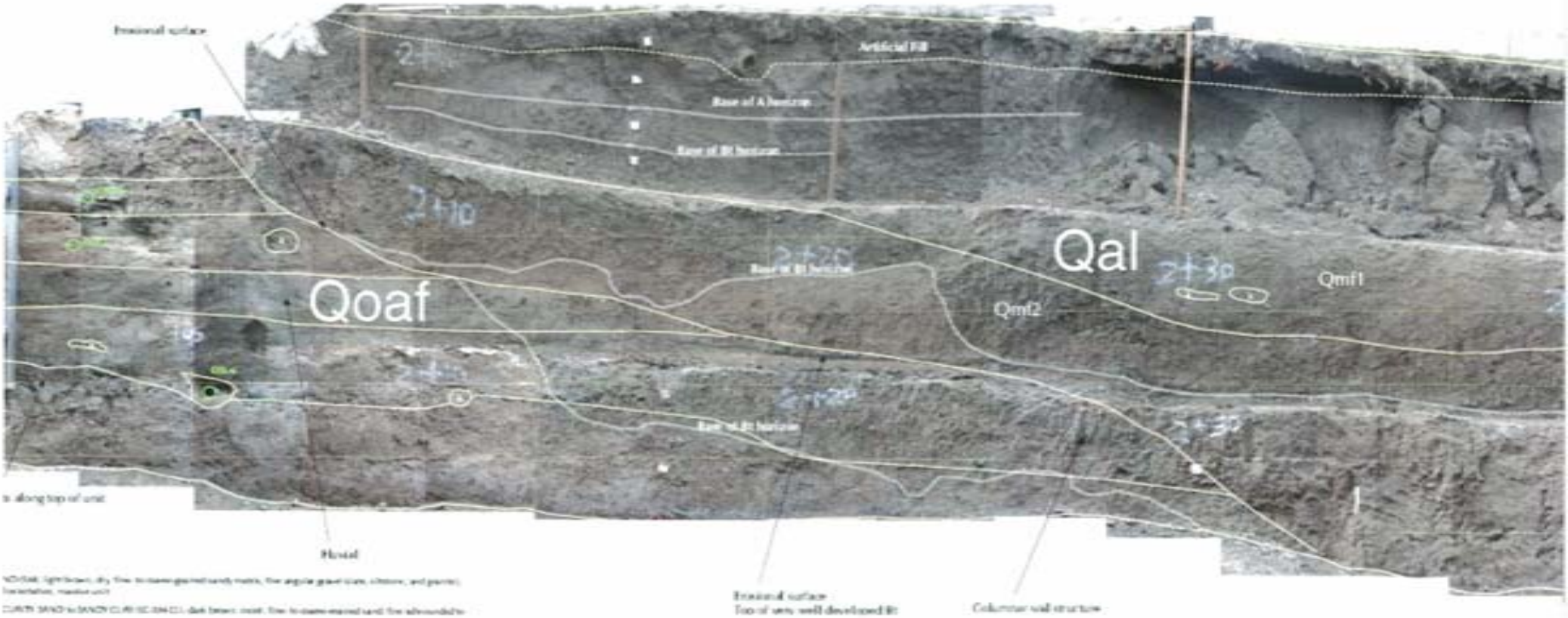
Fault Trench FT-2

The West Beverly Hills Lineament

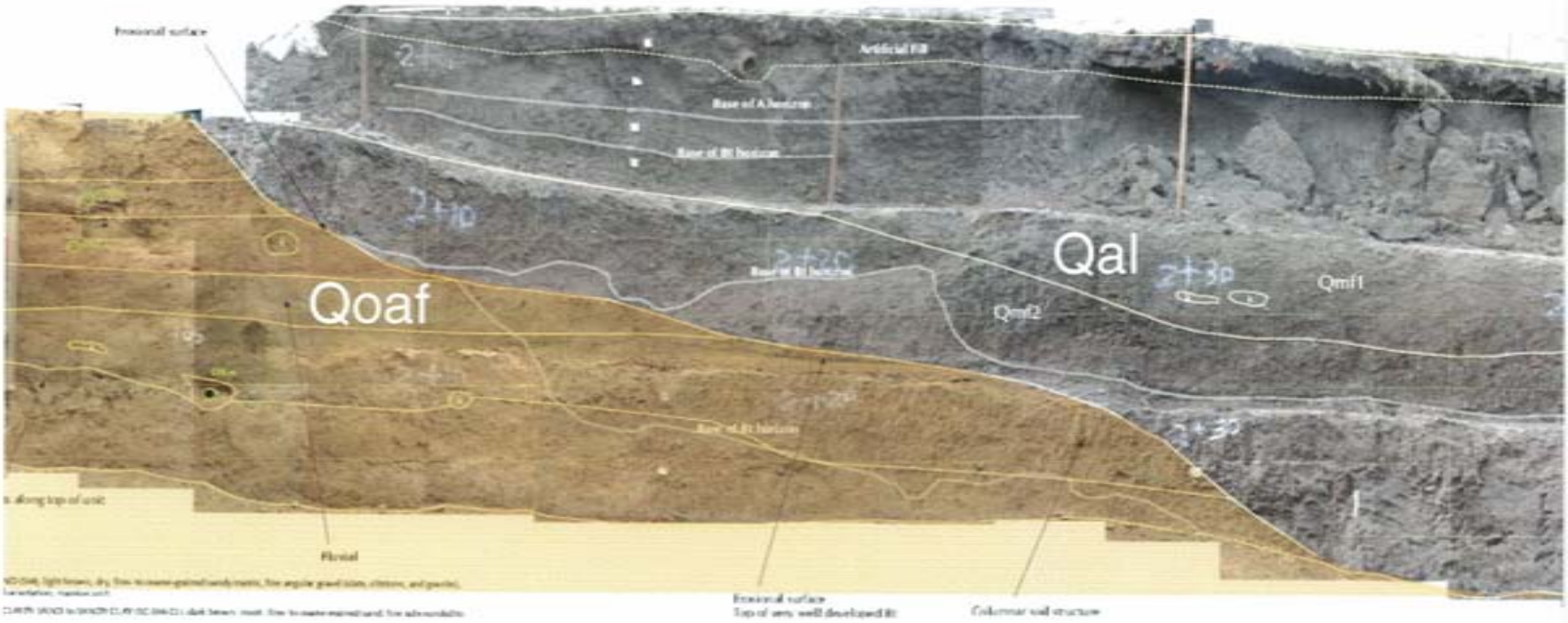


The "Lineament" is shown to be a buried valley slope

Trench 2 - Escarpment Burial

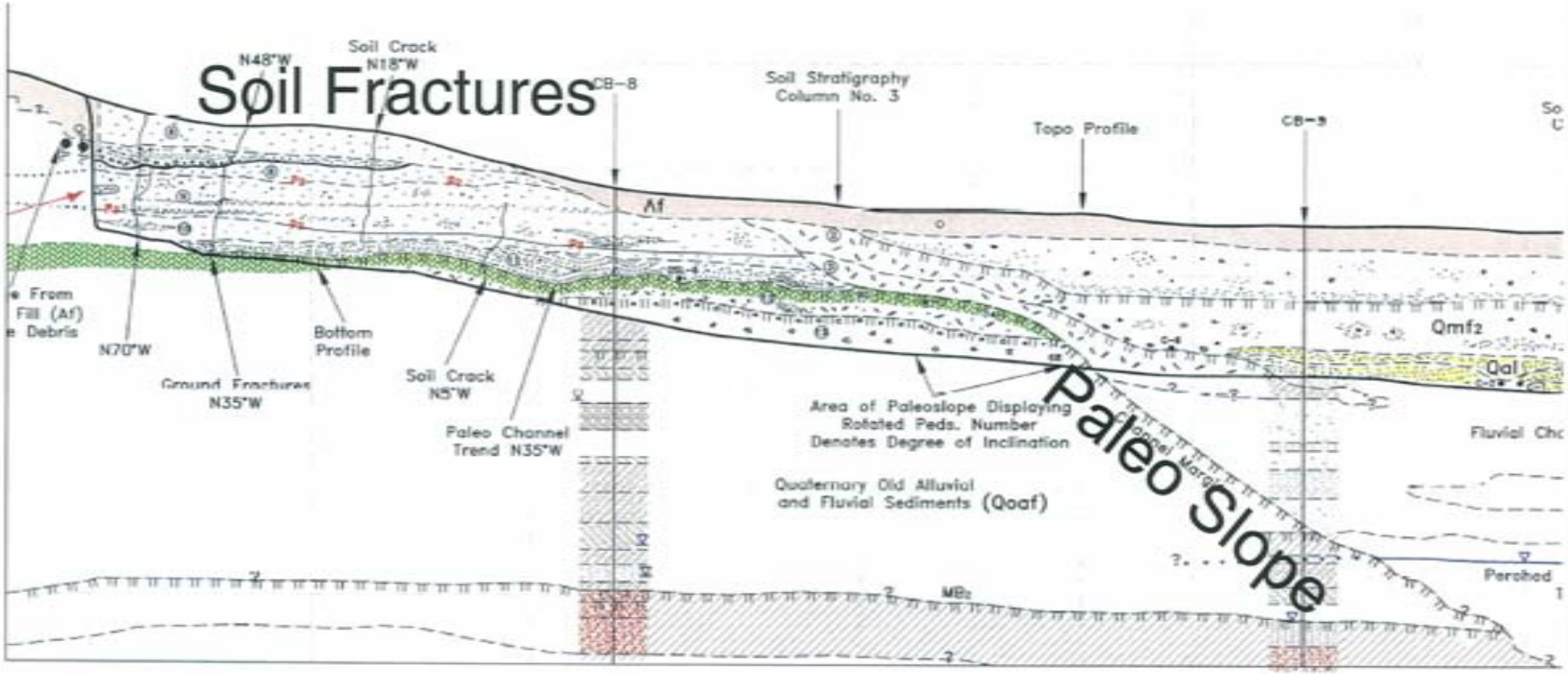


Trench 2 - Escarpment Burial



Fault Trench FT-2

The West Beverly Hills Lineament



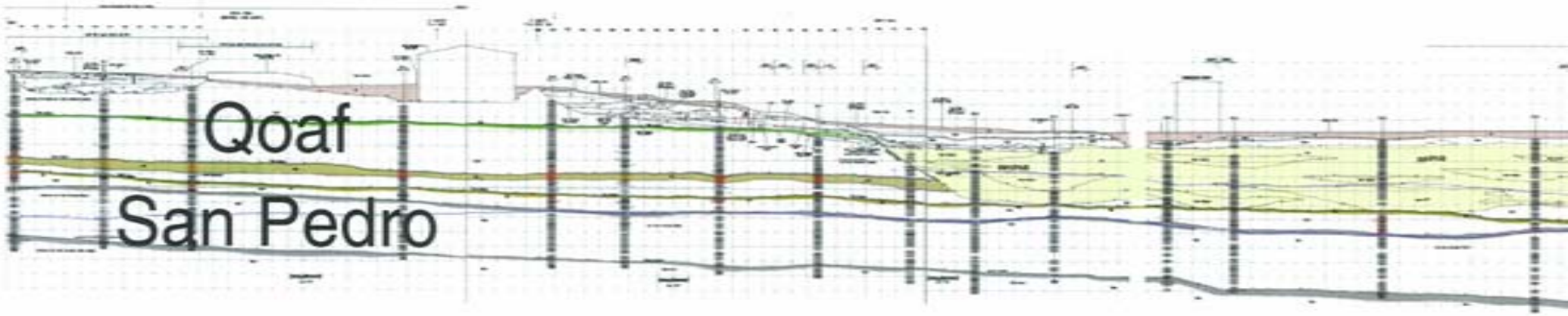
The Fractures are shown not to be faults

Trench 2 Soil Fractures

These are fractures, not faults

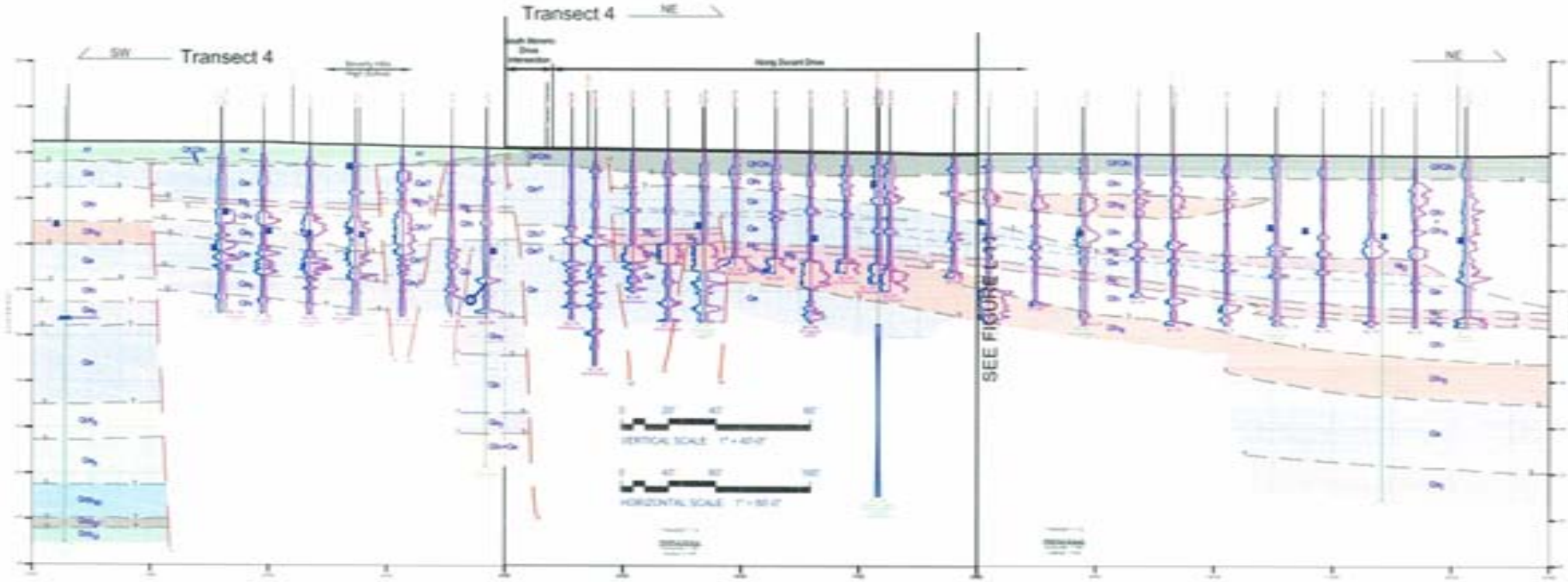
- They are irregular and not linear
- Most die out with depth
- No shearing within clays
- Clays are translocated from above
- Color is due to chemical reaction with water (redox)
- Soil properties within fractures require 10's of thousands of years to form
- They were probably generated by seismic shaking

Leighton Cross-section A-A'
E-W Across Mid-Campus



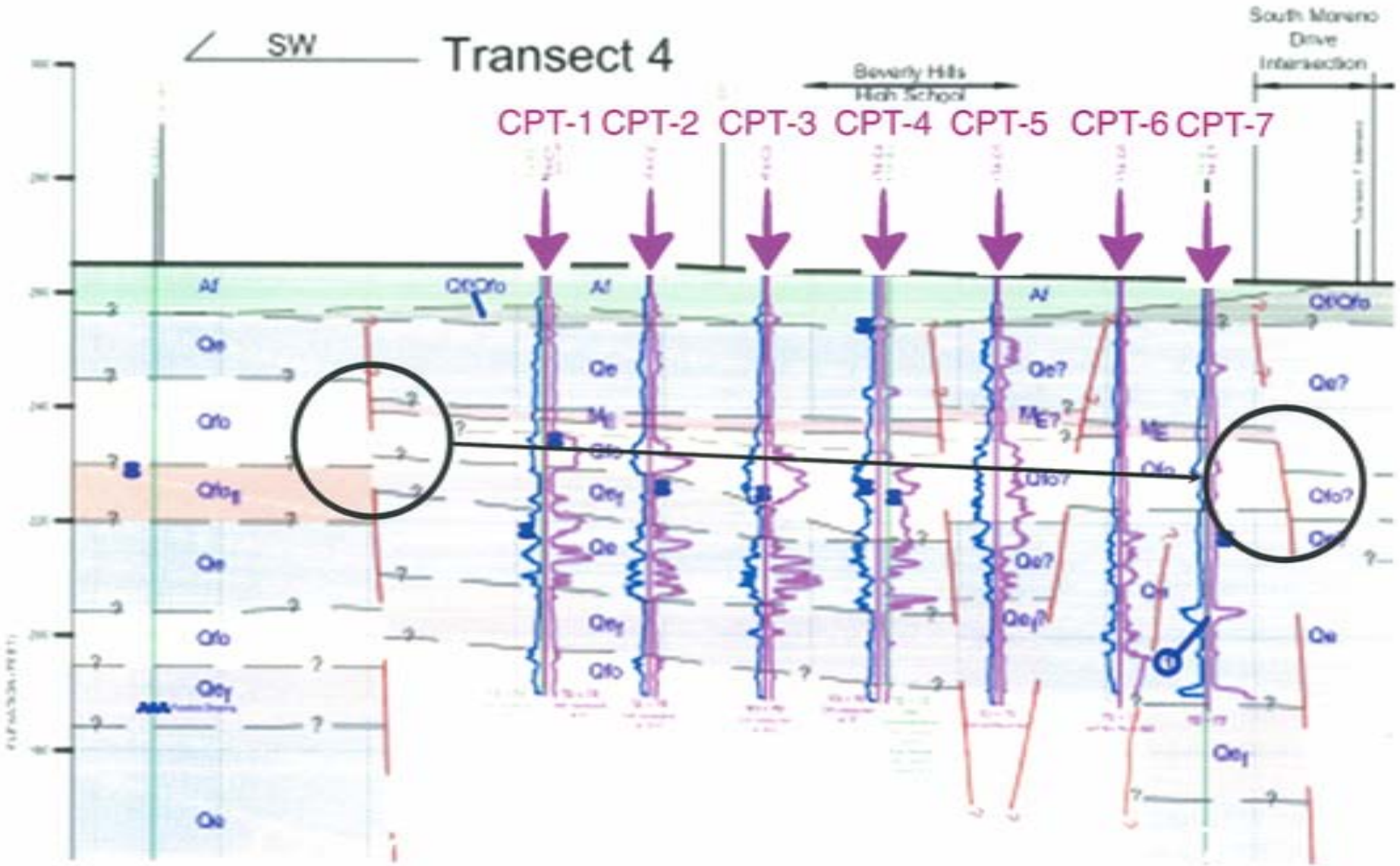
Continuous, gently-dipping sediments, show no evidence for faulting across entire width of BHHS

PB's Transect 4

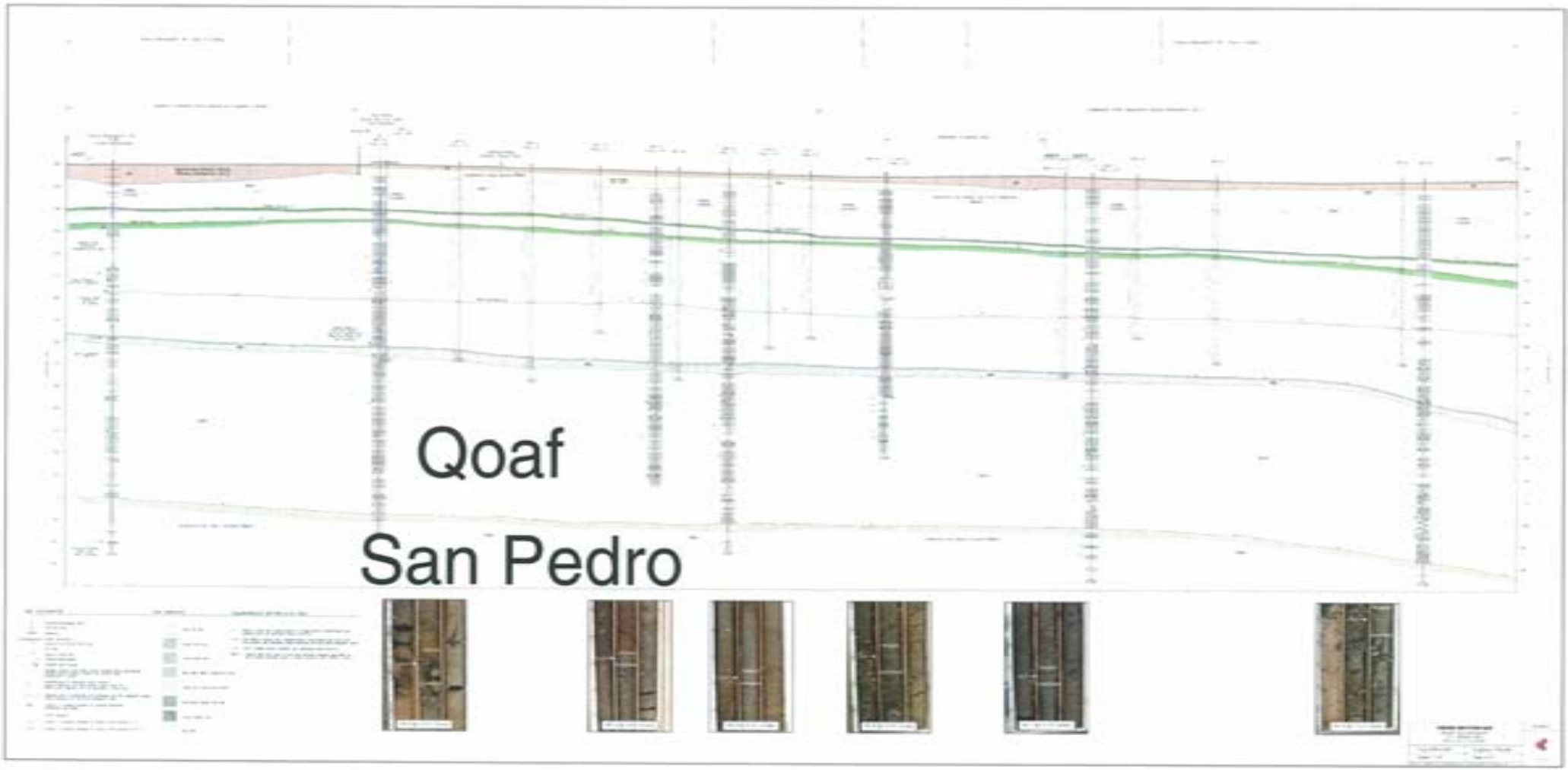


Durant Drive - many faults

Might there be data QC problems?



Leighton Cross-Section B-B

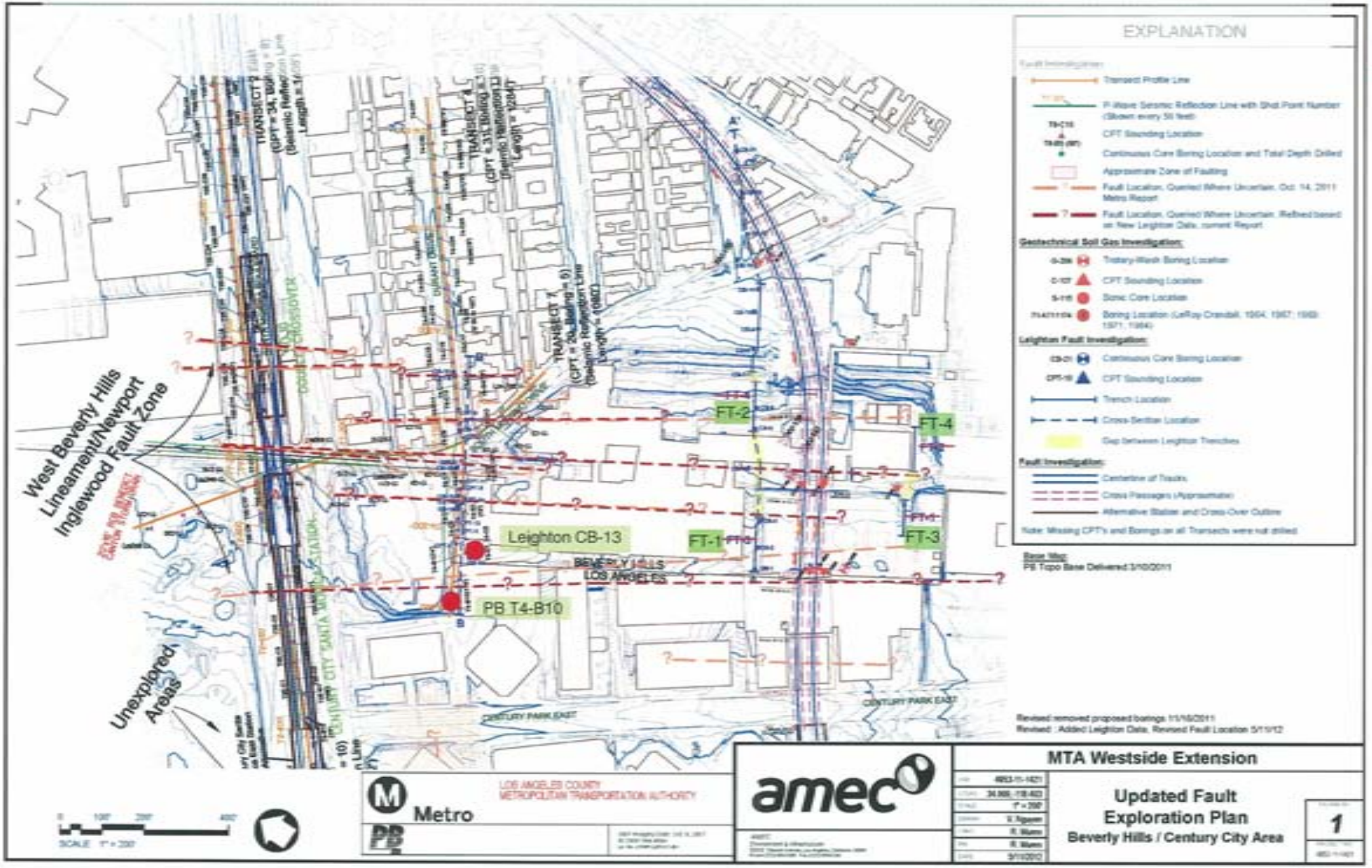


Durant Drive - no faults

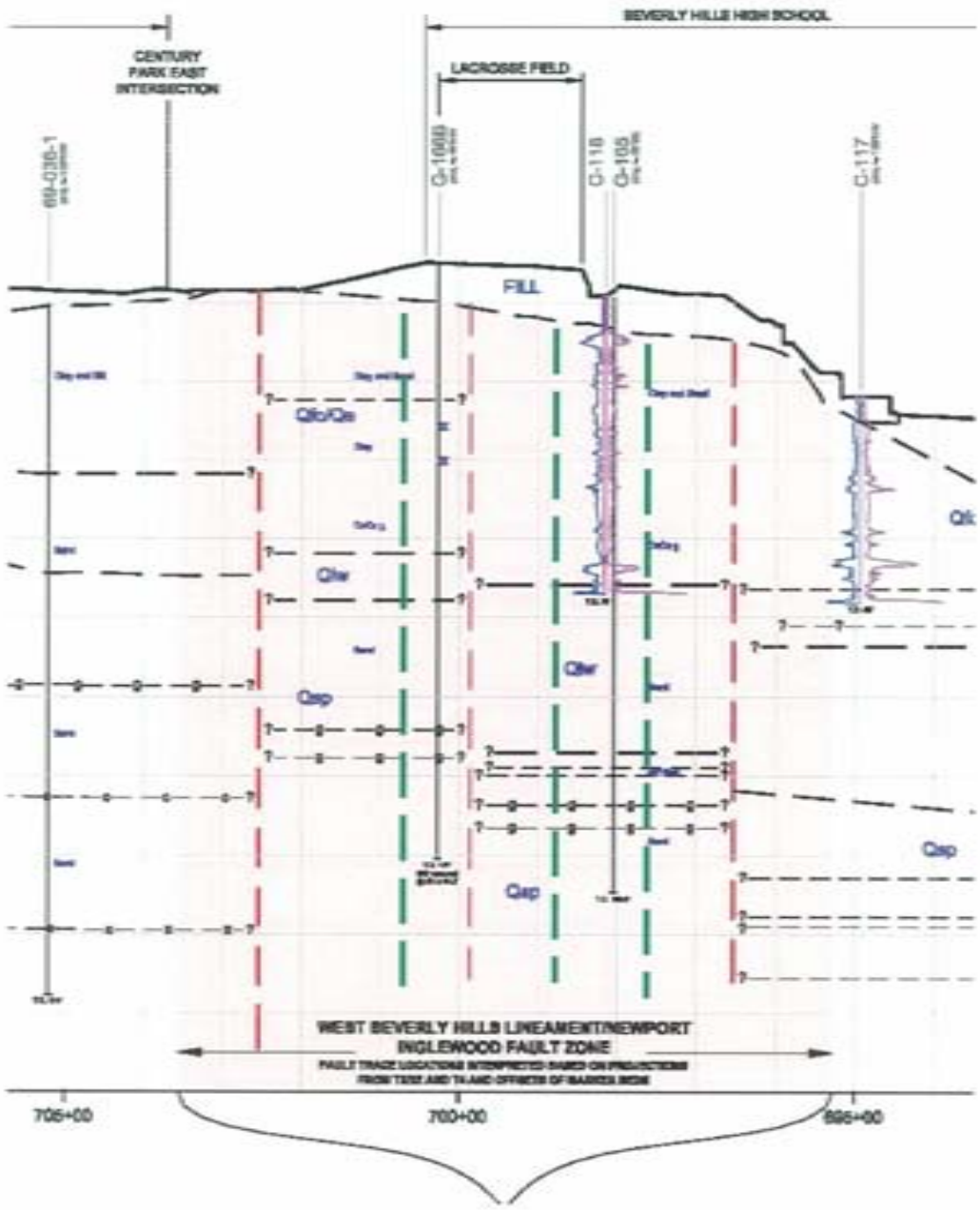
Conclusions

- The West Beverly Hills Lineament is an erosional feature and not of fault origin.
- We find direct geologic evidence that there has been no faulting associated with the West Beverly Hills Lineament at Beverly Hills High School for at least 100,000 years and perhaps more than 500,000 years.
- We have refuted the faults mapped by PB as part of the West Beverly Hills Lineament.
- Based on our study no fault-related structural setbacks associated with the WBHL are required for BHHS.

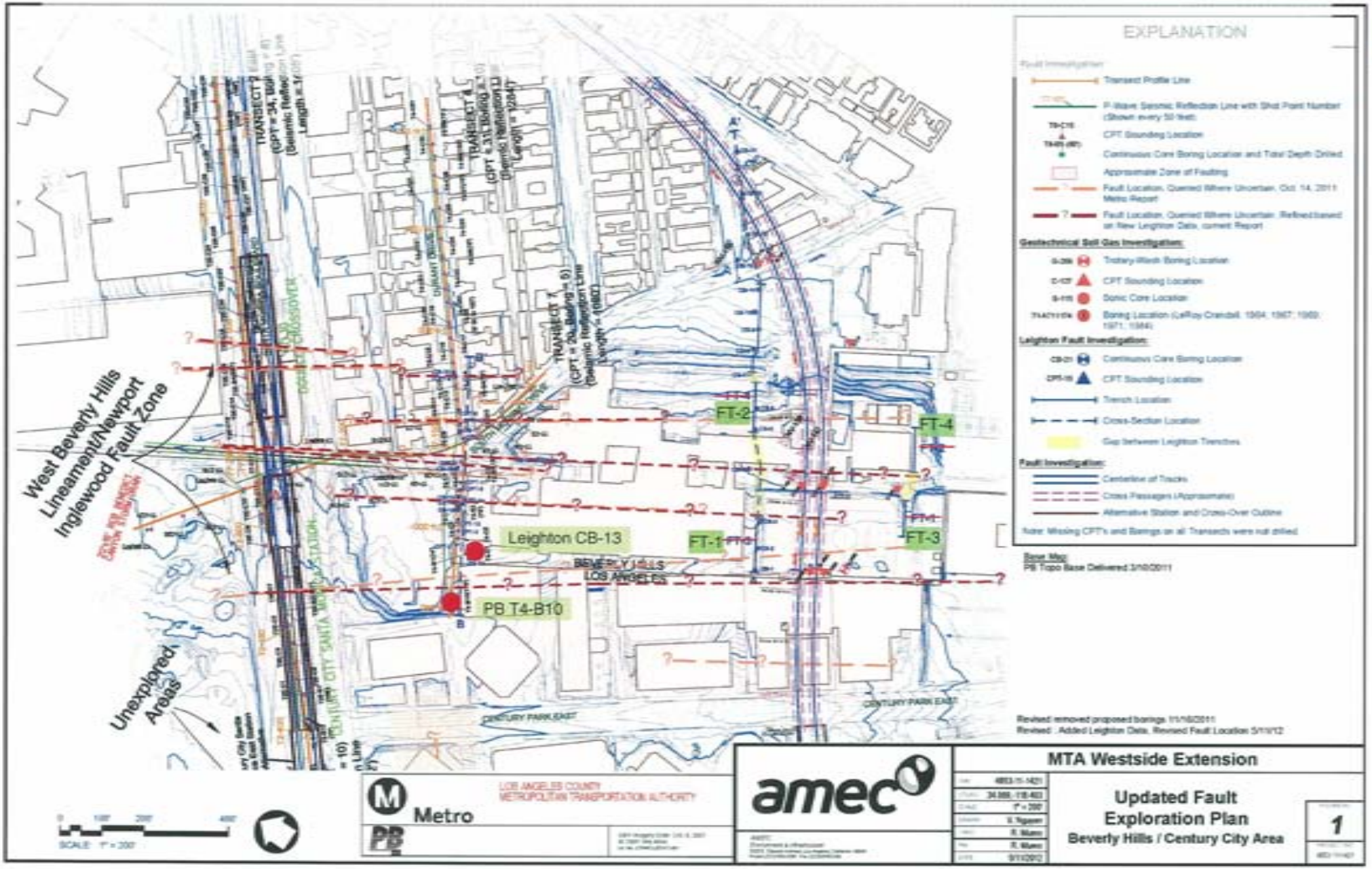
PB's May 14 Response to Leighton Report



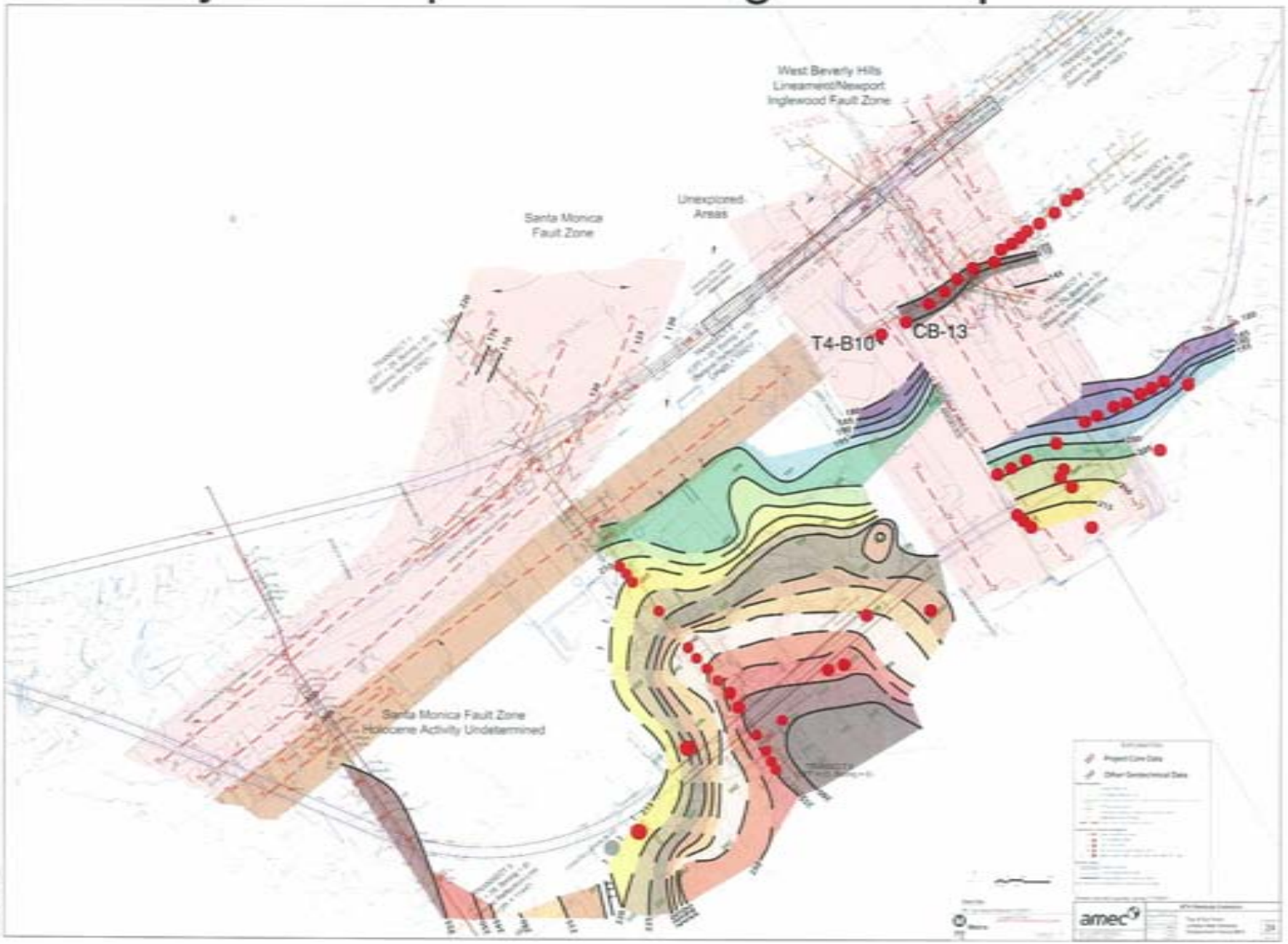
Constellation Profile



PB's May 14 Response to Leighton Report

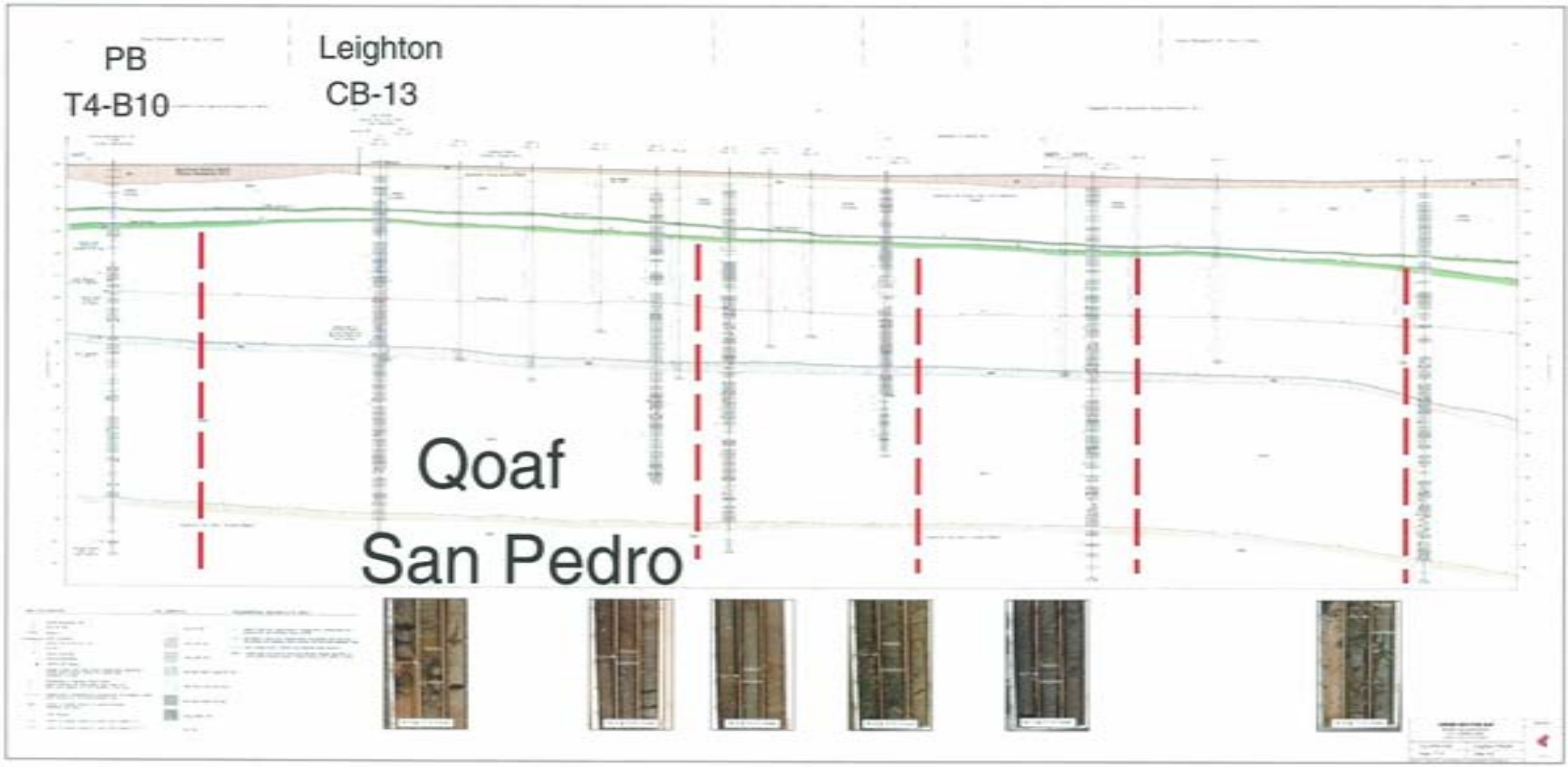


PB's May 14 Response to Leighton Report




Leighton CB-13
PB T4-B10

Leighton Cross-Section B-B with PB's (May 14) Revised Faults



PB's May 14 Response to Leighton Report

- Page 3:
  - "Metro again notes that trenching is not the single most definitive tool to determine the activity or inactivity of faults. One must integrate all lines of evidence (geomorphic, seismicity, geophysical, borings, CPT and trenching) to judge fault activity".
- Page 4:
  - "In the absence of continuous trench exposure showing unbroken deposits or soils of known age, it is not possible to prove that any particular fault strand that Metro identified within the WBHL is active or inactive. Such data can only be gleaned from trenches that provide continuous exposure of the entire width of the potential fault zone".

PB's May 14 Response to Leighton Report

- Page 3:
  Given the urban infrastructure and logistical constraints, especially the presence of subsurface infrastructure (e.g., storm drains, water mains, gas, sewer, and electric lines), it will be impossible to confirm that all of the faults that Metro has identified along the WBHL are inactive, particularly in the area of Santa Monica Boulevard.

Thank you for your time

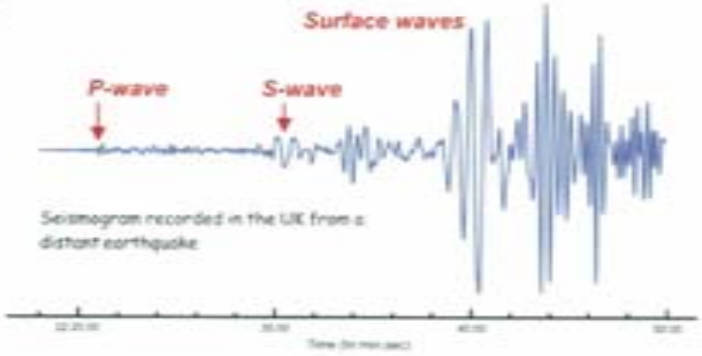
Why the differences?

- Geophysics is poor in the upper layers
- Poorly logged borings - no paleosols
- Poor delineation of the unit ages
- Poor use of borings to correlate across transects
- Almost total reliance on CPT correlations
- Conservative interpretation of those CPTs
- CPTs possibly mis-plotted on Transect 4

Trench 2 Soil Fractures - seismic shaking origin

Sloping ground is susceptible to fracturing from seismic shaking

Vertical Fracture



Seismic source

Seismic shaking induces a downslope rotation due to gravitational pull

East-side up (upslope facing) fracture separation

Why this work is more conclusive

- Completely redid Transect 4 after questions emerged about its validity
- Supplemented the CPTs with substantially more borings
- Drilled those borings down to the San Pedro sand (~1 million years old)
- Trenched almost the entire width of the school, supplemented and extended east with borings
- Opened the trench site to California Geological Survey, U.S. Geological Survey, and other reviewing geologists
- Developed robust, multi-disciplinary age control on the sediments (OSL, 14C, soils)

PB's Geology

Epoch	Time Scale
Holocene	11,000 years ago to present
Pleistocene	1.8 million to 11,000 years ago

Table 1: Stratigraphic Units

Symbol	Stratigraphic Unit (Age) Description
af	ARTIFICIAL FILL (undocumented)
Qf/Qal	YOUNGER ALLUVIUM (Holocene)—predominantly sand, silt and clay
Qfo	OLDER ALLUVIAL SAND DEPOSITS (late Pleistocene)—sandy silt, clay, and sand with gravel
Qe	ESTUARINE DEPOSITS (late Pleistocene)—thin bedded to massive silty and clay with fine sand and occasional gravel
Qlw	LAKEWOOD FORMATION (late Pleistocene)—interbedded silty sands, silts, and clays with clayey sand and gravel layers
Qsp	SAN PEDRO FORMATION (mid Pleistocene)—predominantly greenish gray and bluish gray fine-grained Sands, medium to coarse Sands and some Silt Layers.

The sediments are considerably older

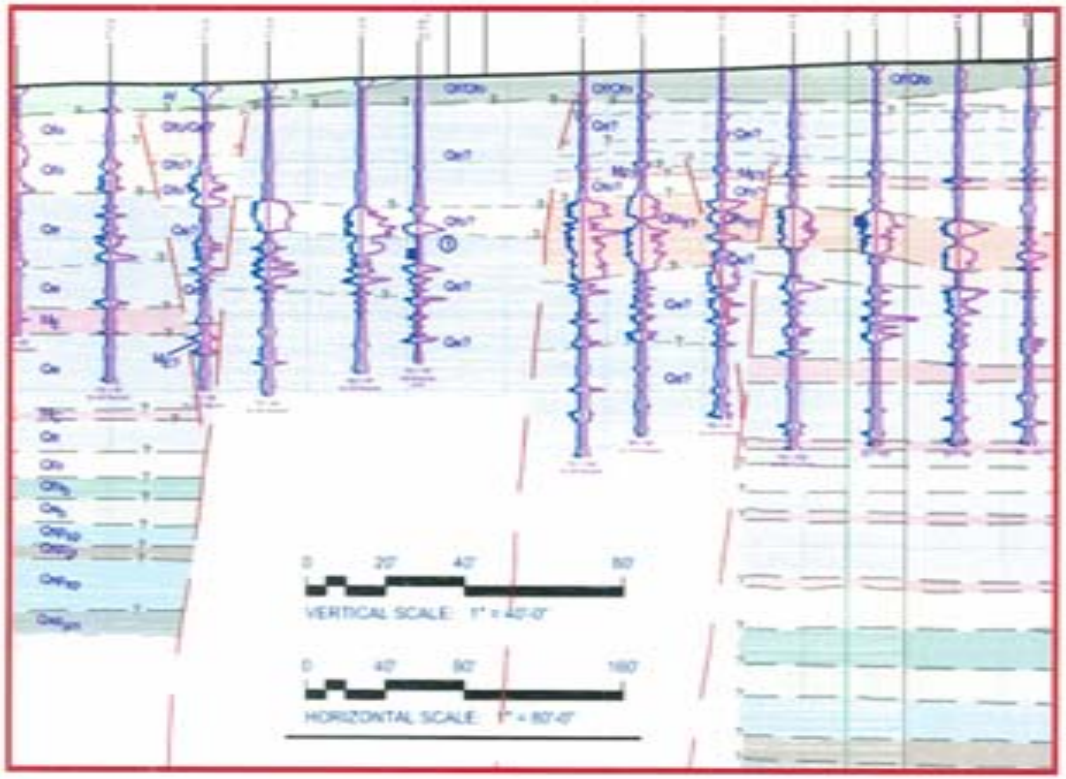
Epoch	Time Scale
Holocene	11,000 years ago to present
Pleistocene	1.8 million to 11,000 years ago

Symbol	Stratigraphic Unit (Age) Description
af	**ARTIFICIAL FILL** (undocumented)
Qf/Qal	**YOUNGER ALLUVIUM** (Holocene)—predominantly sand, silt and clay
Qfo	**OLDER ALLUVIAL SAND DEPOSITS** (late Pleistocene)—sandy silt, clay, and sand with gravel
Qe	**ESTUARINE DEPOSITS** (late Pleistocene)—thin bedded to massive silty and clay with fine sand and occasional gravel
Qlw	**LAKEWOOD FORMATION** (late Pleistocene)—interbedded silty sands, silts, and clays with clayey sand and gravel layers
Qsp	**SAN PEDRO FORMATION** (mid Pleistocene)—predominantly greenish gray and bluish gray fine-grained Sands, medium to coarse Sands and some Silt Layers.

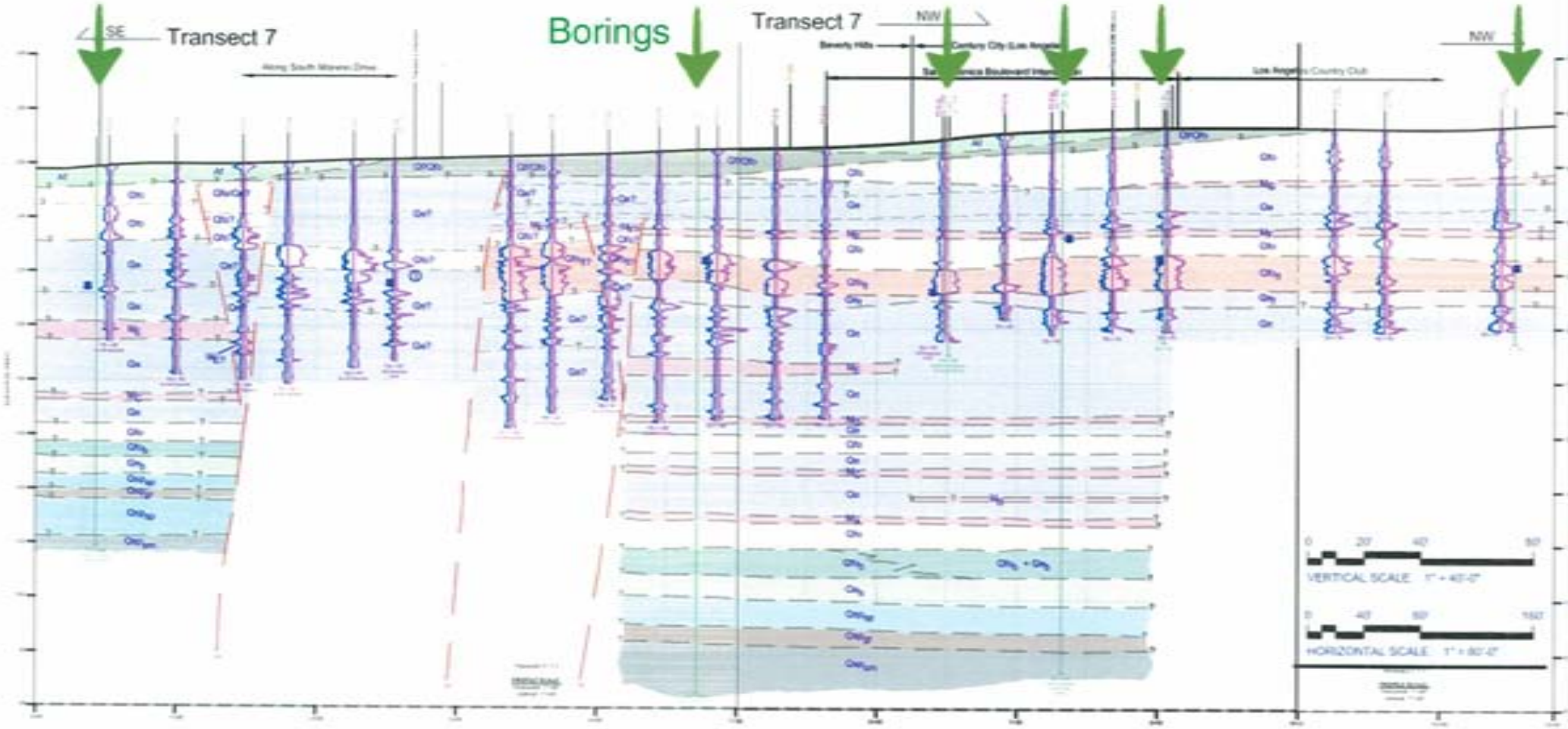
PB's geology

PB's faults are all in old sediments

- Failure to understand the sediment ages
- Active faults in CA are <11,000 years old
- These sediments are 10x to 100x older
- Why call them "active" with no confirmation?

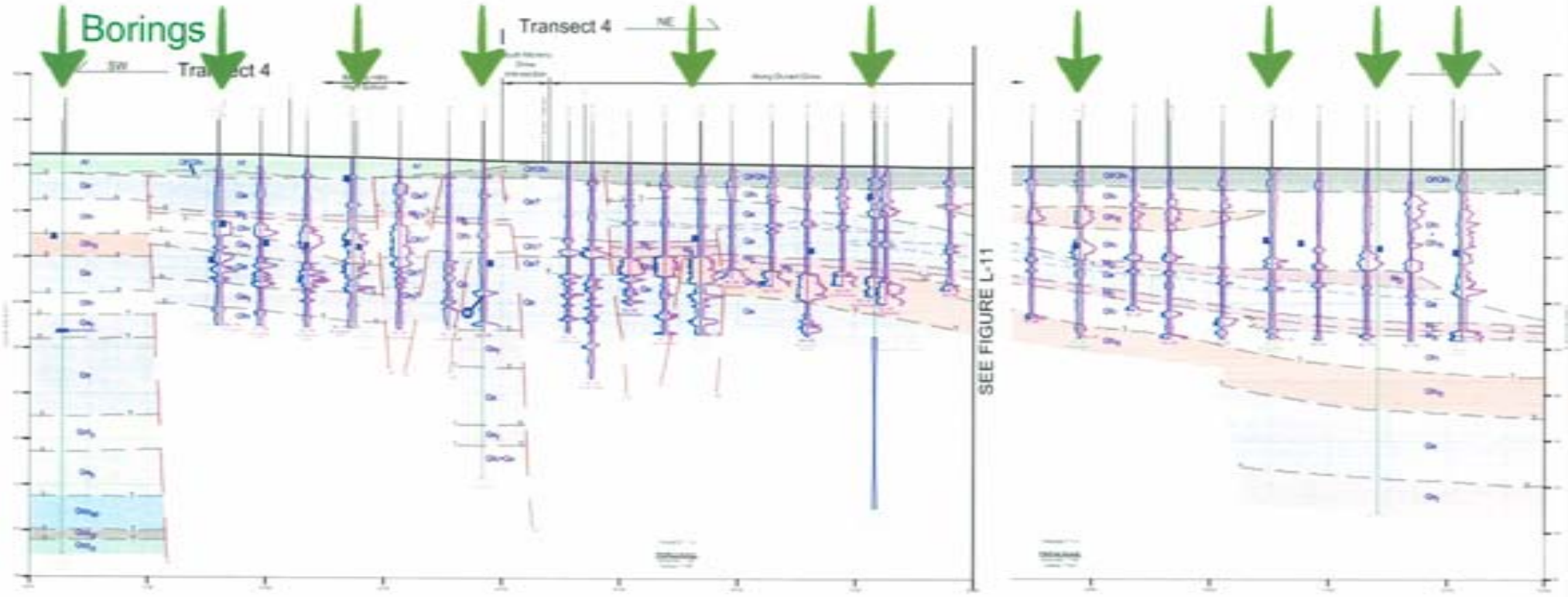


Metro's Transect 7



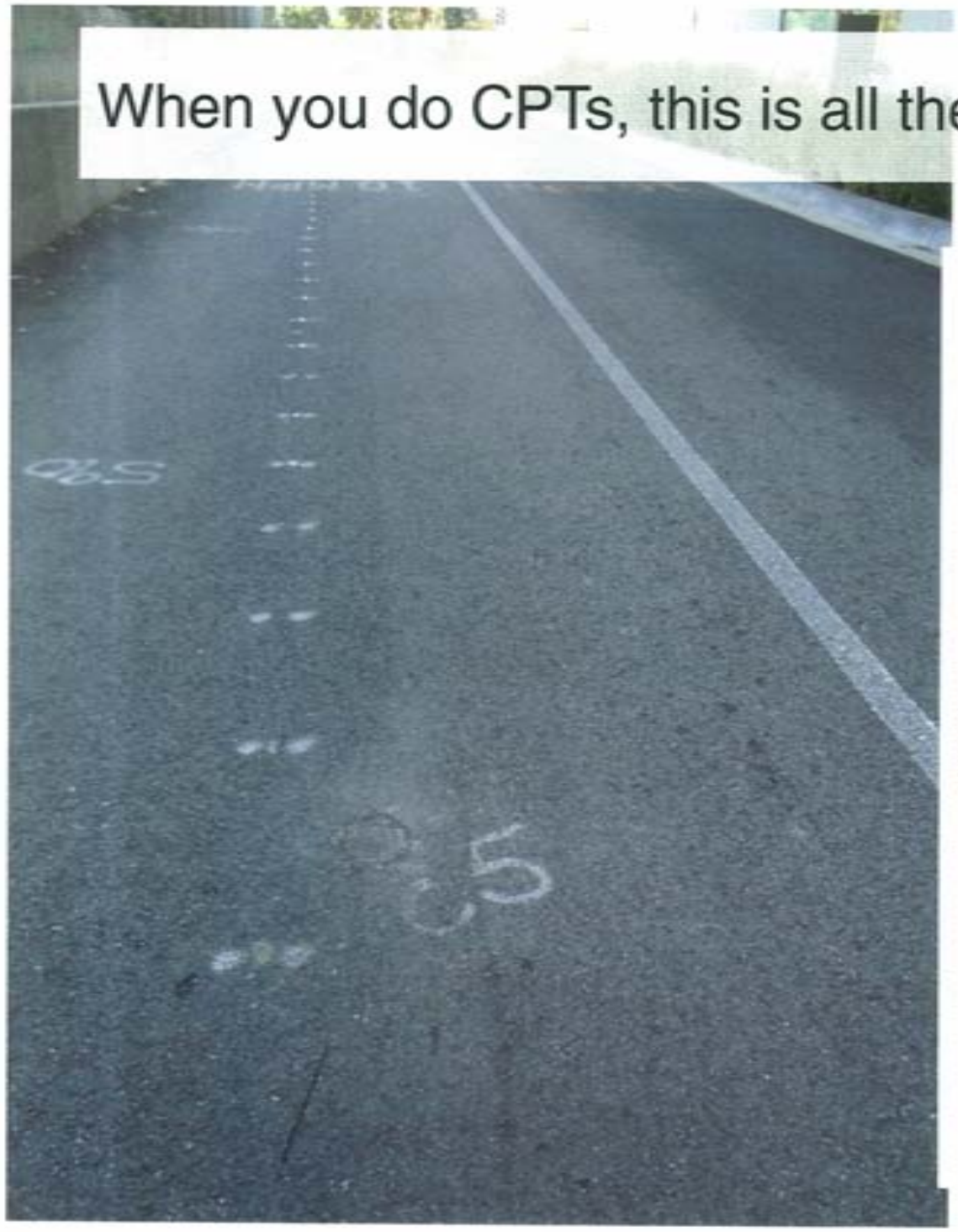
The faults are drawn where there are no borings
- CPT interpretations only

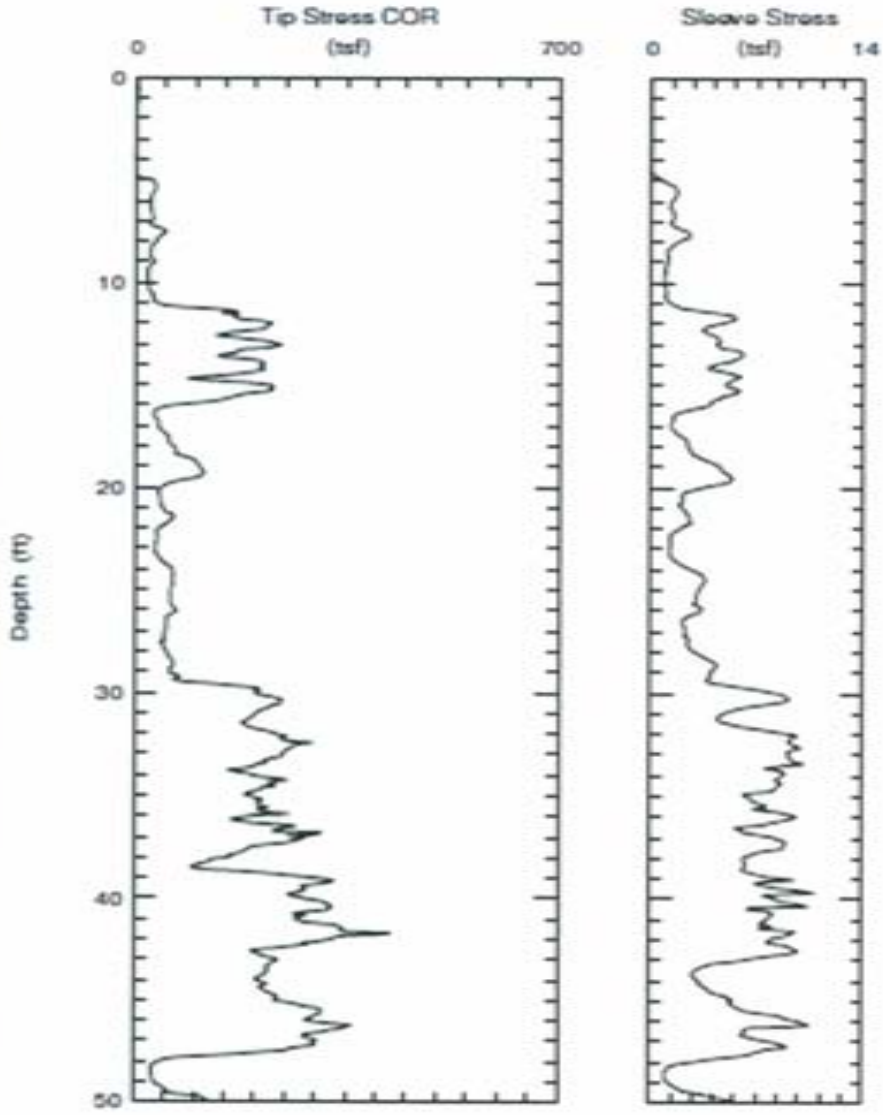
Metro's Transect 4



YES – because the Transect 4 CPTs could have been inverted Transect 4 was reinvestigated

When you do CPTs, this is all the geology that you see





When you drill, this is what you see

When you trench, you see everything

And everyone else can see it too

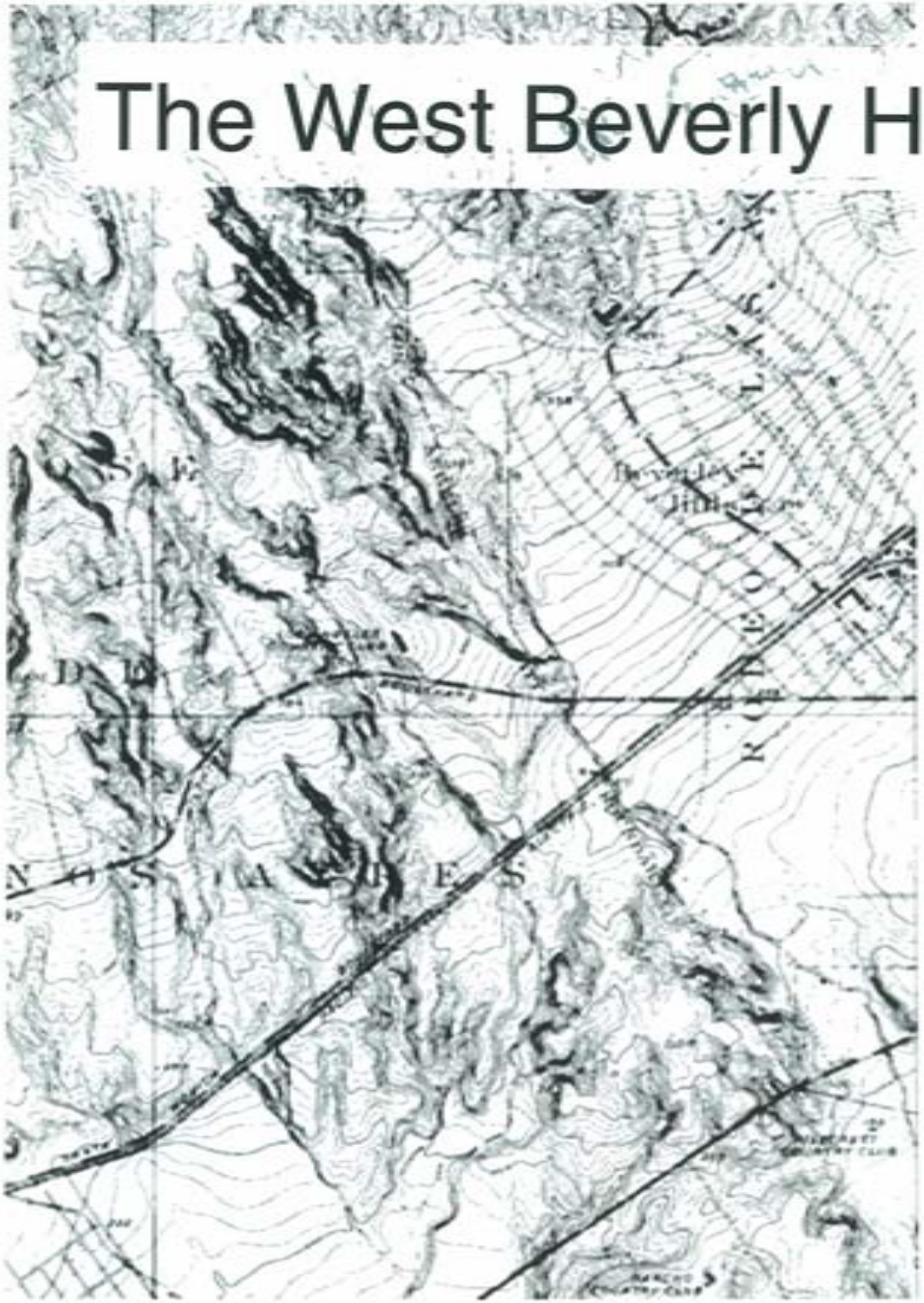
El Rodeo


B
A
A'
B'
DRAFT
GEOLOGIC MAP
El Rodeo School
605 Whittier Drive
Beverly Hills, California
Plate 1
Date: April, 2012
EXPLANATION

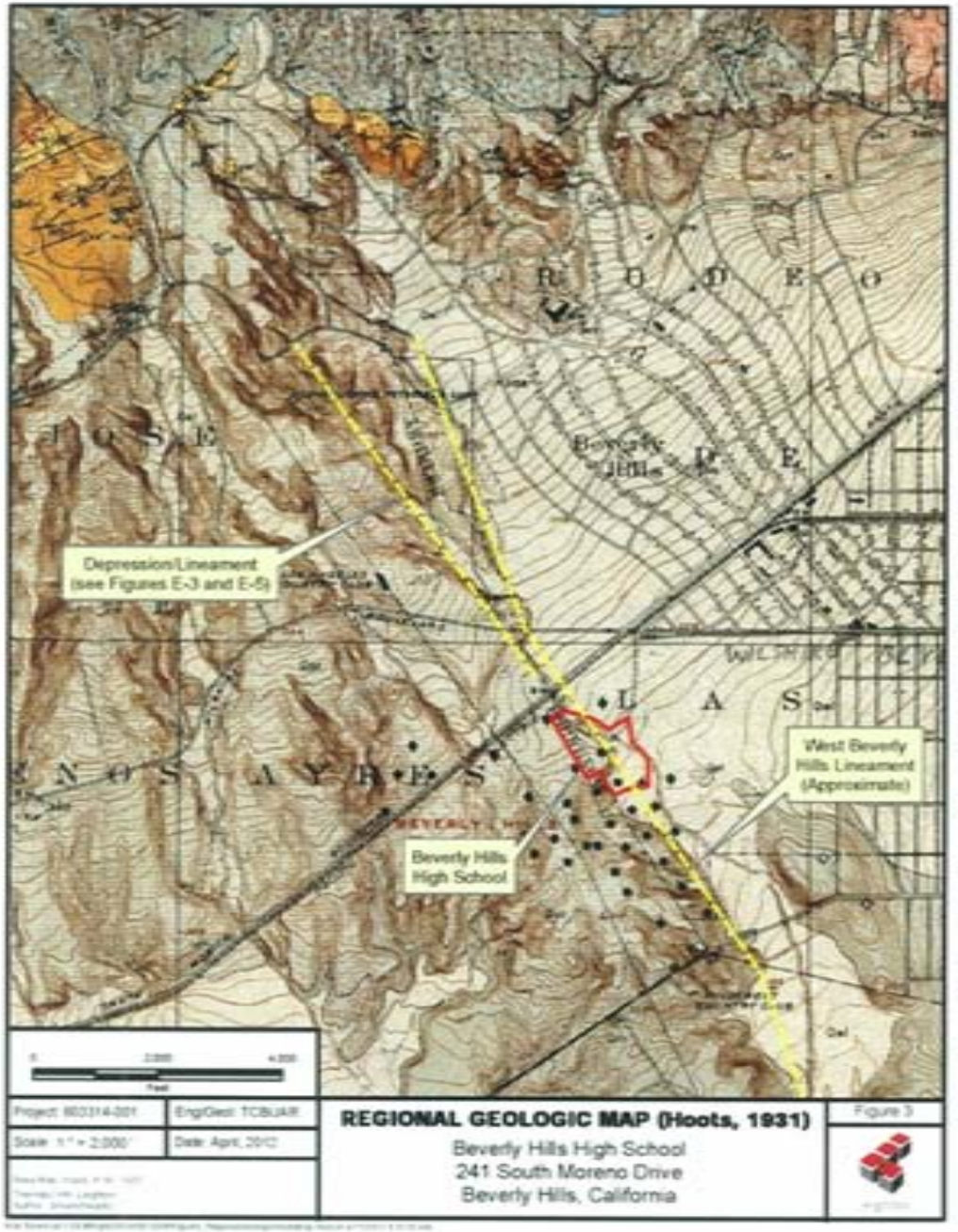
Project Timing

2011	
14-Oct	PB issues Westside Extension Fault Report
10-Nov	BHUSD authorization to perform Phase I research
6-Dec	BHUSD authorizes Phase 2A and 2B for drilling and trenching activity at BHHS
16-Dec	Begin drilling with several contractors along mid campus transect on west and east sides of the HS.
2012	
3-Jan	Begin excavation of fault trenches on campus
25-Jan	AMEC core review at their offices
26-Jan	Site visit from CGS (several visits over next 2 weeks)
1 -Feb	Site visit from USGS - and CGS
16-Feb	Begin drilling northern transect borings and CPT
5-Mar	Backfill of trenches FT-1 through FT-4 complete, hardscape restored in parking areas
20-Mar	Begin drilling additional 3 borings at east mid-campus
22-Apr	Fault Hazard Assessment Report completed
24-Apr	Fault Hazard Assessment Report Delivered to CGS

The West Beverly Hills Lineament

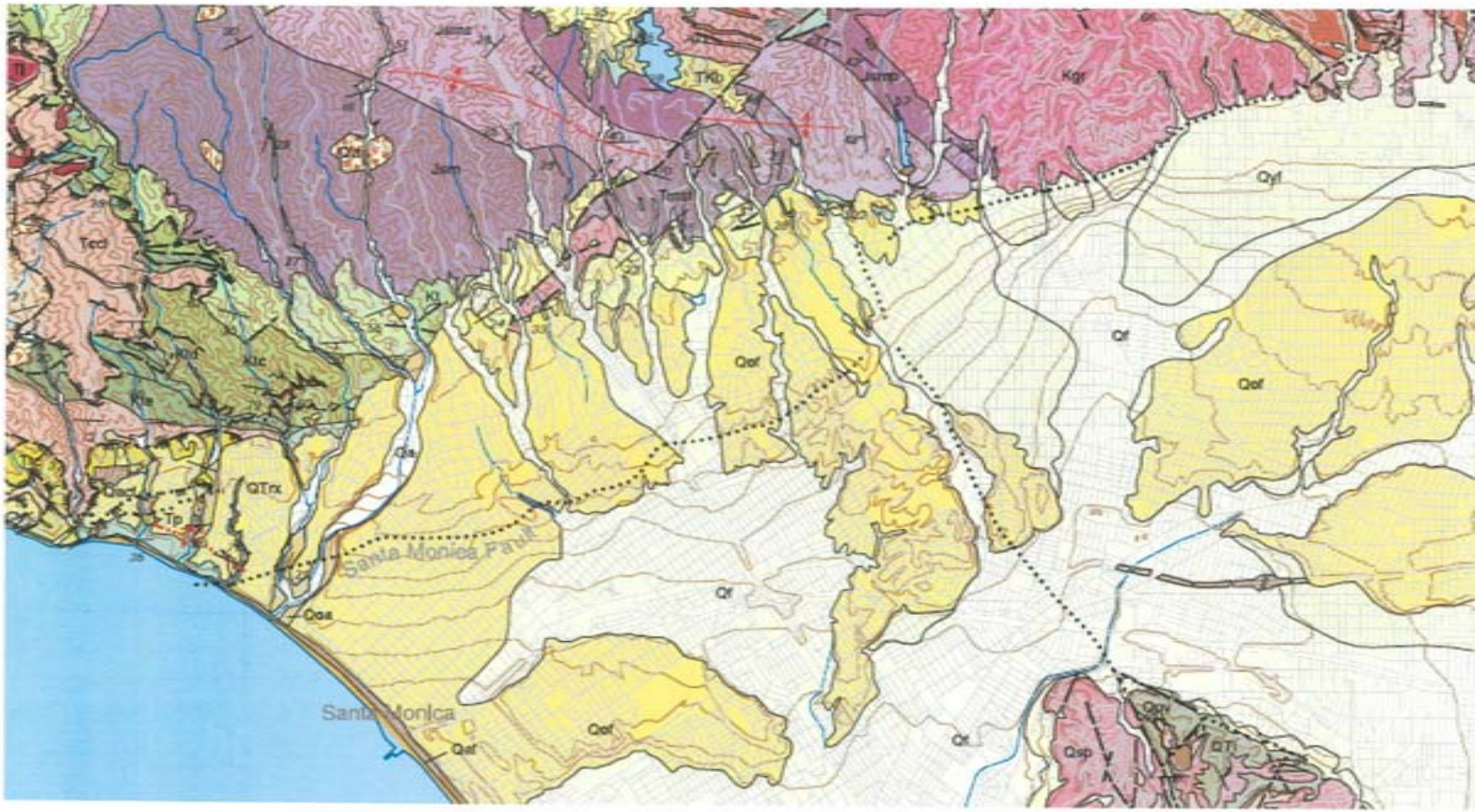


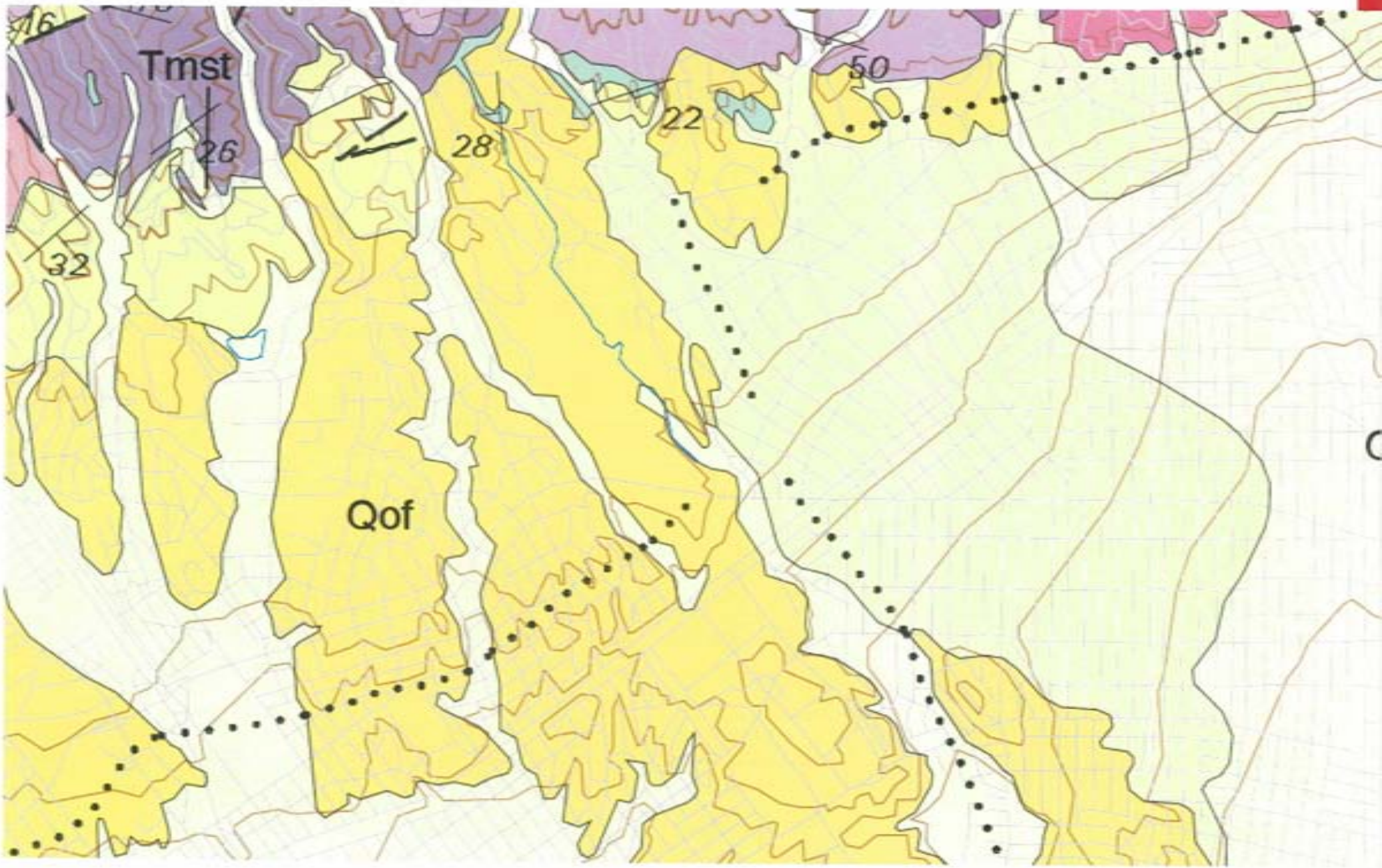
- Fault Uplift Origin
- River Erosion Origin
- Both


Depression/Lineament
(see Figures E-3 and E-5)
West Beverly
Hills Lineament
(Approximate)
Beverly Hills
High School
Project: 802314-001
Eng/Geol: TCB/JAR
Scale: 1" = 2,000'
Date: April, 2012
REGIONAL GEOLOGIC MAP (Hoots, 1931)
Beverly Hills High School
241 South Moreno Drive
Beverly Hills, California
Figure 3

Beverly Hills High School Site

USGS Los Angeles Quad - Geology

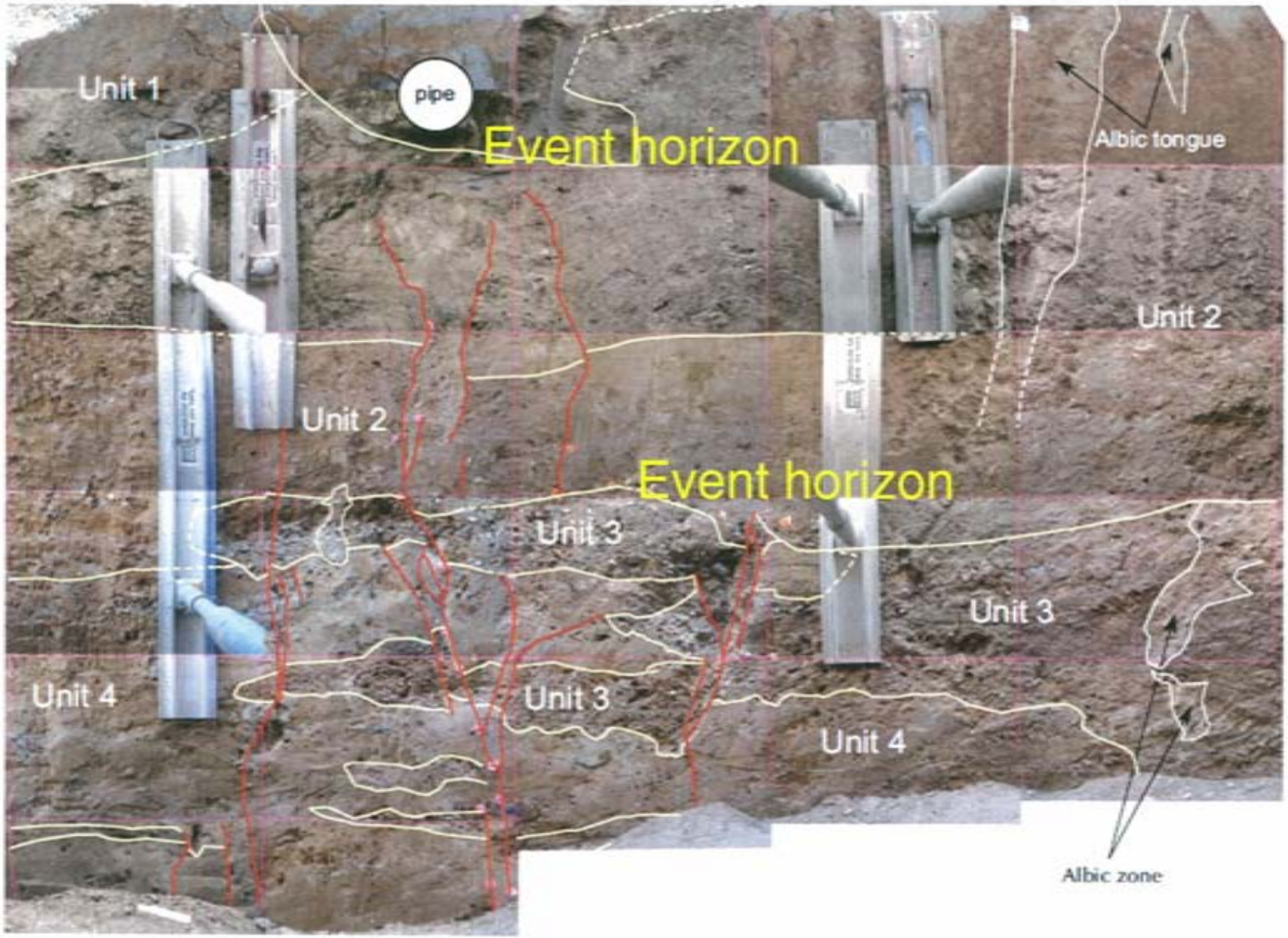



Tmst
Qof
16
26
28
22
50
32

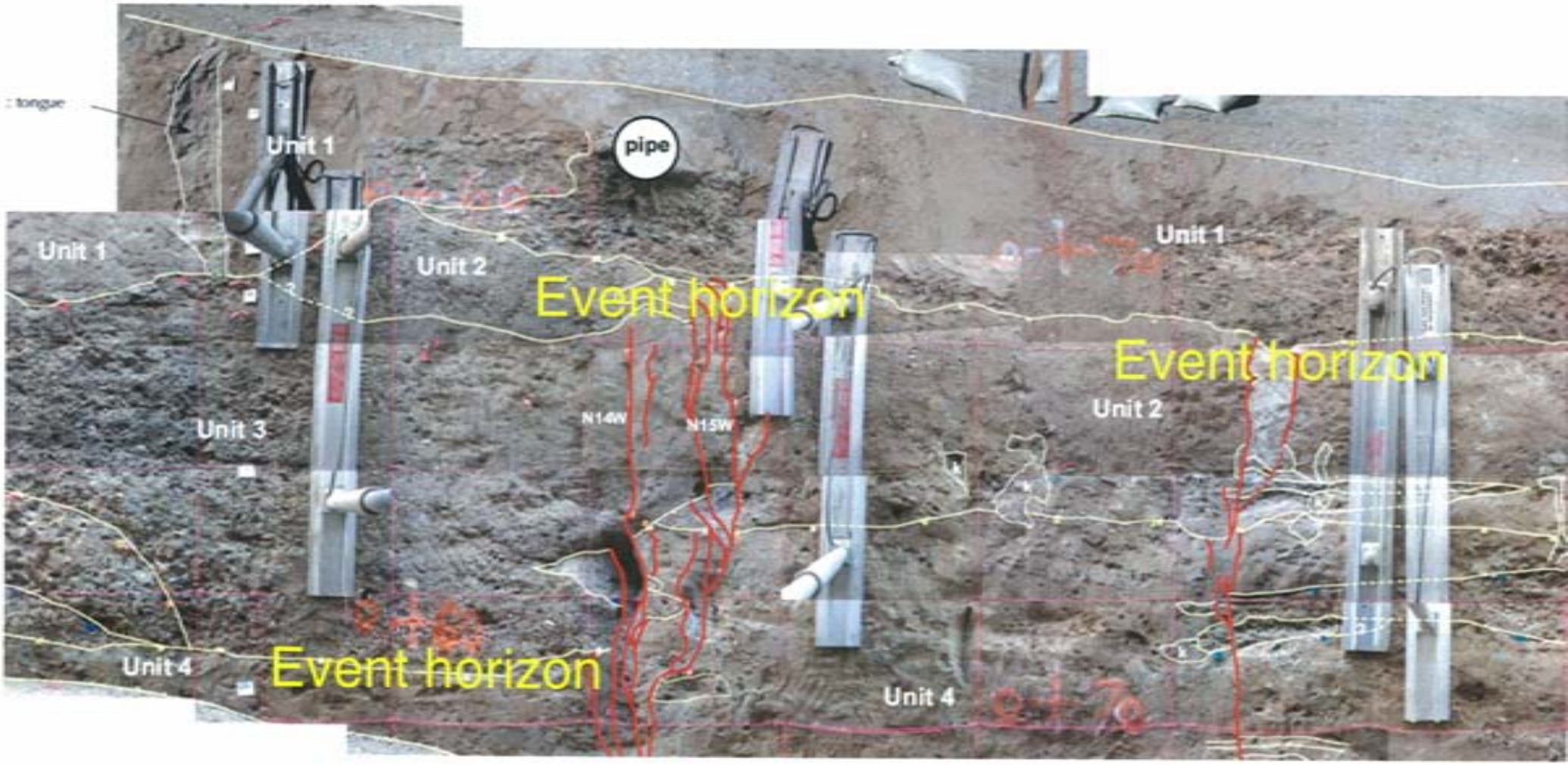
Fault Investigations
Methods and their difficulties

- Geophysics - difficult to see the shallow sediments
- Cone Penetrometers (CPT) - difficult to interpret complex alluvial deposits
- Borings - difficult to get good recovery
- Trenching - difficult site access

Trench 3 - South Wall



Trench 3 - North Wall



Good Route Alignment Selection Depends on Balancing Multiple Factors…

The balancing starts with macro level ridership modeling …

Figure 3-7. Origins and Destinations for Transit Travel Times

Macro level demand modeling identifies centers of ridership-like Century City

Table 3-7. Daily Station Boardings

Station	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	MOS 1	MOS 2
1. Wilshire/Crenshaw	4,215	4,320	4,676	4,025	4,356	3,435	3,986
2. Wilshire/La Brea	3,722	3,808	4,064	3,239	3,423	3,937	3,569
3. Wilshire/Fairfax	6,071	6,209	6,629	5,031	5,361	3,435	5,792
4. Wilshire/La Cienega	6,433	6,608	7,072	5,088	5,418	—	6,114
5. Wilshire/Rodeo	4,642	4,585	4,857	6,386	6,649	—	7,682
6. Century City	6,681	6,498	6,568	6,424	6,390	—	8,333
7. Westwood/UCLA	14,313	12,629	11,039	13,894	11,978	—	—
8. Westwood/VA Hospital	—	8,070	6,120	8,762	6,662	—	—
9. Wilshire/Bundy	—	—	5,120	—	5,759	—	—
10. Wilshire/26th	—	—	5,034	—	5,630	—	—
11. Wilshire/16th	—	—	3,886	—	4,323	—	—
12. Wilshire/4th	—	—	5,872	—	6,639	—	—
13. Hollywood/Highland	—	—	—	5,957	7,360	—	—
14. Santa Monica/La Brea	—	—	—	2,438	2,628	—	—
15. Santa Monica/Fairfax	—	—	—	2,125	2,270	—	—
16. Santa Monica/San Vicente	—	—	—	1,829	1,905	—	—
17. Beverly Center Area	—	—	—	2,818	2,933	—	—
Total Station Boardings	46,075	52,665	70,936	68,013	89,684	17,506	35,475

Source: Metro Travel Demand Model

The macro-level MTA Travel Demand Model does not work at the station level…

WESTSIDE SUBWAY EXTENSION PROJECT

Technical Report
Summarizing the Results of
the Forecasted Alternatives

Figure 1-1: Refined Coding of Century City Station Lo

Figure 2-1: Century City Station Options Year 2035 Jobs within ¼ Mile and ½ Mile Catchment Areas around Stations

Santa Monica/Century Park East		
	¼ Mile Buffer	½ Mile Buffer
Number of Jobs	10,936	34,795
Jobs per s.q. mile	55,745	44,315

Constellation/Ave of Stars		
	¼ Mile Buffer	½ Mile Buffer
Number of Jobs	24,989	67,192
Jobs per s.q. mile	126,960	85,578

Data Source: SCAG RTP08 Socio-economic Data, converted by LA Metro to Metro zone structure

BJ's is not the center of the center and the station serves more than Century City

The "Walk Access Study" compounds the confusion…

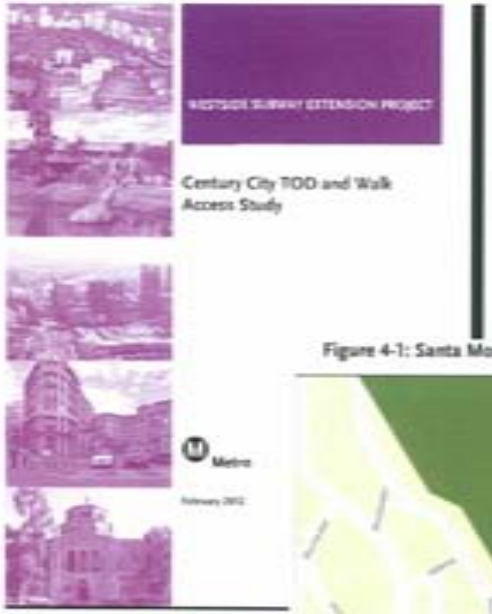


Table 5-1: Ridership Estimate and Sensitivity Analysis—Full Development

Walkshed	Santa Monica/ Century Park East Station			Constellation/ Avenue of the Stars Station			Santa Monica/ Avenue of the Stars Station		
	Pop.	WMATA	Moudon	Pop.	WMATA	Moudon	Pop.	WMATA	Moudon
0 to 600 feet	8,070	2,825	1,614	13,670	4,785	2,734	6,840	2,394	1,368
600 feet to 1/4 mile	5,670	1,340	549	23,960	5,675	2,314	14,080	3,262	1,396
1/4 to 1/2 mile	34,950	3,980	1,632	20,350	3,545	658	31,940	3,702	1,476
Total	48,690	8,145	3,795	57,980	14,005	5,706	52,860	9,359	4,240
Metro Forecast		5,492			8,566			No Forecast	

Pop. = employees plus residents. Table WMATA estimates are based upon total population, and the Moudon estimates are based only on employment.

Figure 4-1: Santa Monica/Century Park East Station Walksheds and General Plan Designations

Actual walk time is important but the FEIS/EIR methods are too crude and full of errors – an over simplistic and false reassurance. Multiple bad studies are all still bad.

Doing ridership the right way means recognizing what is unique about Century City…

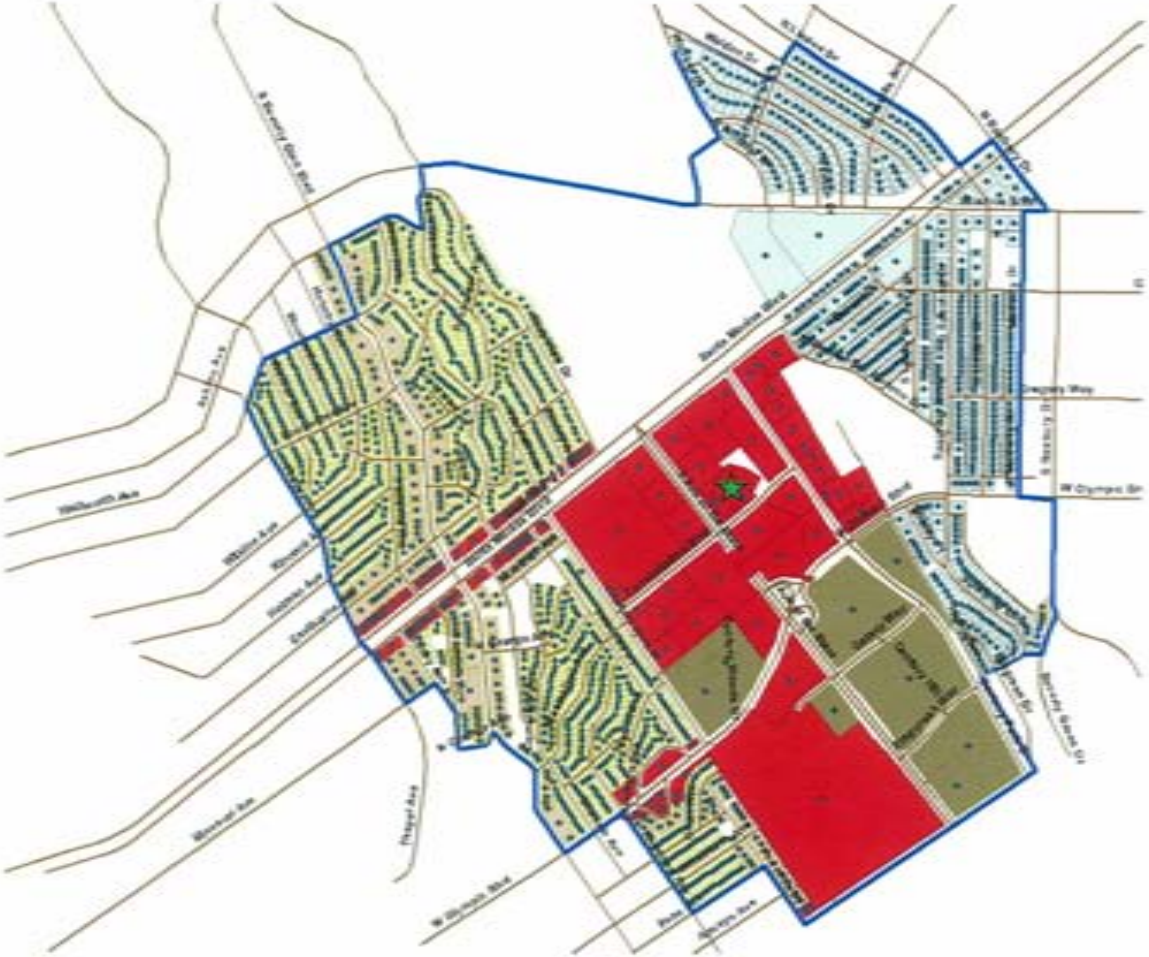
If the MTA approach in Century City is so good, why wasn't it used anywhere else?

The green lines are the 600 foot walk limits used by Moudon in Century City

The same MTA techniques would drastically reduce ridership at Westwood/UCLA and Wilshire/Fairfax

Doing micro modeling the right way…

Good micro-modeling requires a matched pair, impedance loaded GPS model and multiple iterations to test preconceptions like single entrance designs

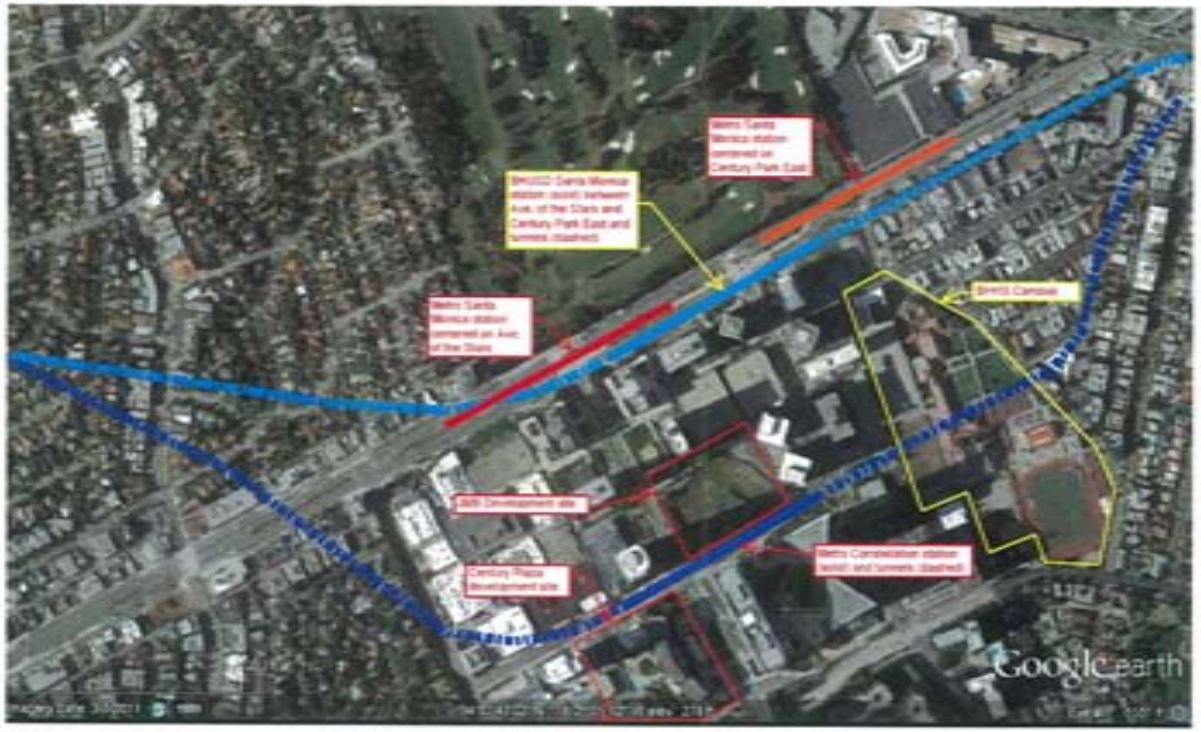


The Ridership conclusion: Santa Monica and Constellation are essentially equal in the short term. Santa Monica will have greater long term ridership.

Why can't the FEIS/EIR clearly explain the cost difference between Constellation and Santa Monica?

- **Constellation is $20.5 million more expensive** *FEIS/EIR Section 09 Chapter 6 Cost and Financial Analysis – Table 6-1*
- **Santa Monica is $26.5 million more expensive** *FEIS/EIR Section 09 Chapter 6 Cost and Financial Analysis – Table 6-1*
- **Constellation is $25 million more expensive** *FEIS/EIR 09 Chapter 6 Cost and Financial Analysis – Section 7-3*
- **Constellation is $81 million more expensive** *FEIS/EIR Technical Report 08. Cost and Financial Analysis – Tables 3-1 and 3-2*
- **Constellation is $45.5 million more expensive** *FEIS/EIR Technical Report 08. Cost and Financial Analysis – Tables 3-1 and 3-2*
- **Constellation is $81 million more expensive** *Final Capital Cost Estimate Report (120F) - Tables 6-1 and 6-2*
- **Constellation is $45.5 million more expensive** *Final Capital Cost Estimate Report (120F) - Tables 6-1 and 6-2*
- **Constellation is $4.1 million more expensive** *FEIS/EIR Technical Report 06. Comparative Benefits and Costs Analysis – Table 5-1*
- **Constellation is $23.5 or $33.8 or $26.2 or $32.7 or $3.5 or $20.5 million more expensive** *FEIS/EIR Technical Report 06. Comparative Benefits and Costs Analysis – Tables 6-4 and 6-5*
- **Constellation is $19.9 million more expensive** *FEIS/EIR Technical Report 38. Century City Station Location Report – Table 2-2*
- **Constellation is $58.6 million more expensive** *FEIS/EIR Technical Report 38. Century City Station Location Report – Table 2-2*
- **Santa Monica is $64.4 million more expensive** *FEIS/EIR Technical Report 38. Century City Station Location Report – Table 2-2*
- **Santa Monica is $25.7 million more expensive** *FEIS/EIR Technical Report 38. Century City Station Location Report – Table 2-2*

Fact: The alignment to serve Constellation is longer. That must cost more.



Any alignment that serves Constellation must be longer than the equivalent alignment serving Santa Monica. That must cost at least $45-65 million more.

The Santa Monica station is less expensive than Constellation – if you put it in the right place…

The cost differences are significantly in favor of Santa Monica

- Each station platform, crossover tunnel, and mechanical space should be exactly the same size – staff has Santa Monica longer by 230 feet.
- Santa Monica can be shallow, Constellation must be deeper because of topography and utilities.
- Santa Monica is not gassy; Constellation is gassy.
- The tunnels serving Santa Monica are not gassy; the tunnels serving Constellation are gassy.
- Staff wants a subterranean plaza prior to entering the concourse. Santa Monica could be placed in the median; Constellation must buy land.
- Santa Monica could be built without a temporary construction deck. Constellation must have a temporary deck. Building in the open air is faster and less expensive. Building under a deck is like building a ship in a bottle.

The Cost Conclusion: A Santa Monica station and tunnels will cost <u>at least</u> $100 million less than a Constellation station and tunnels.

The Significance of the MTA Seismic Fault Study Report…

The FEIS/EIR does not say that Constellation is better – it simply rules out Santa Monica because of the Seismic fault Study Report.

But what if the MTA Seismic Fault Study is wrong?

Why should you believe the school district process more than the MTA process?

Why should you believe the school district process more than the MTA process?

- We assembled a team of multidisciplinary registered professionals
- We were not biased by preconceptions
- We ensured critical reasoning throughout
- We ensured proper QA/QC throughout
- We maintained transparency
- We were under the regulatory oversight of the California Geological Survey throughout

The School Board direction to the geologists:

1. We do not take chances with the safety of children. Ever. Tell us whether our children are safe or not. We do not care what the answer is as long as it is right.
2. Tell us whether we can build out our sites or if any setbacks are required. We do not care what the answer is as long as it is right.
3. After you answer Questions 1 and 2, tell us what the implications are for the subway.

Sometimes preconceptions and first impressions can lead to the wrong conclusion….

Sometimes a fault looks like a fault (the San Andreas)

Sometimes what looks like a fault is not (the WBHL)

Sometimes what looks really simple is actually more complicated (the SMFZ)

Science requires an open mind and critical reasoning subject to the criticism of others. MTA has failed to meet this standard.

This is how a good team works together – Leighton, ECI, Soil Tectonics, California Geological Survey, and USGS at the high school trenching

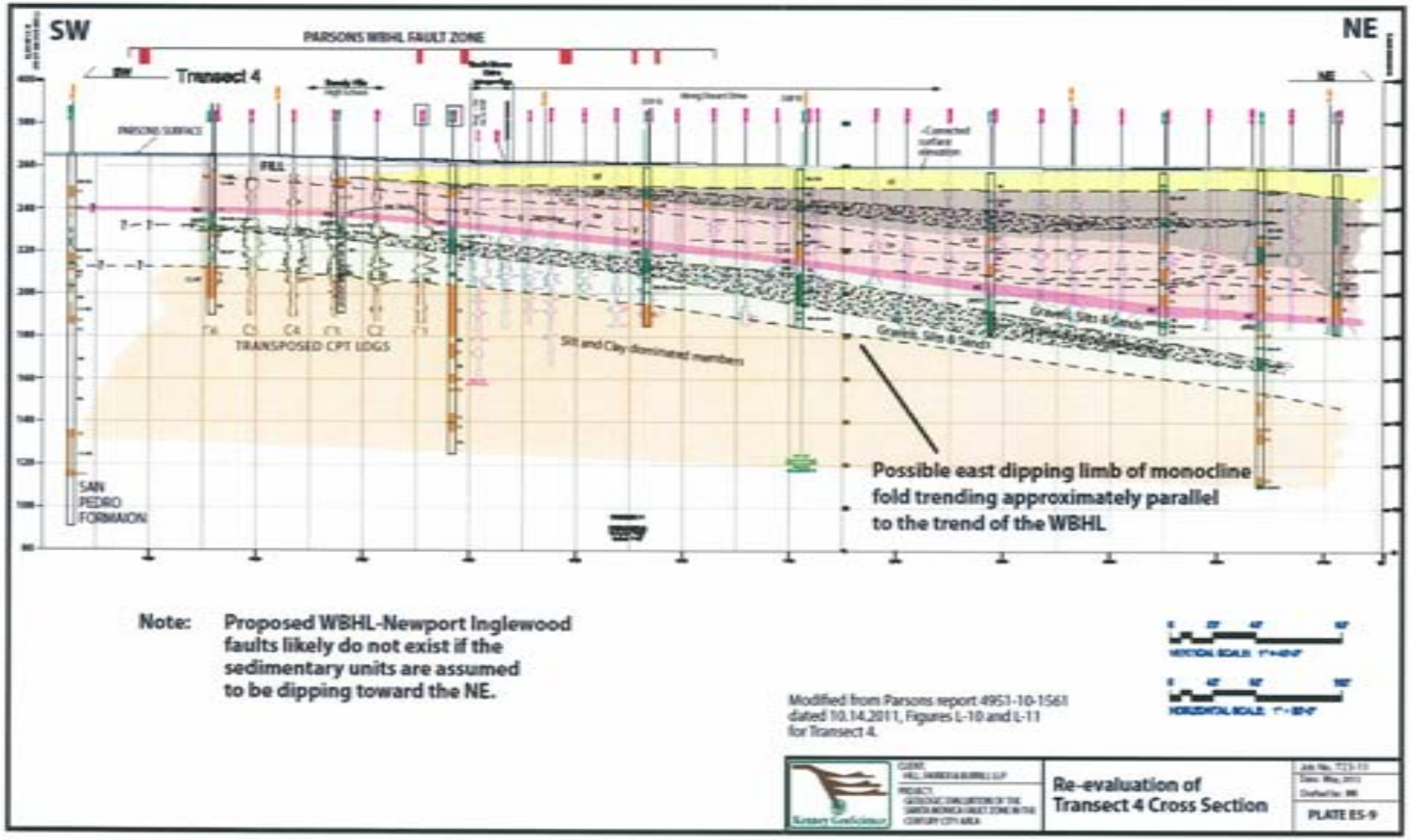
MTA failed to do proper QA/QC resulting in errors. MTA preconceptions compounded those errors.

Soil interpretation is subtle and painstaking. There are no shortcuts. Good work withstands critical scrutiny and results in consensus. MTA skipped this step.

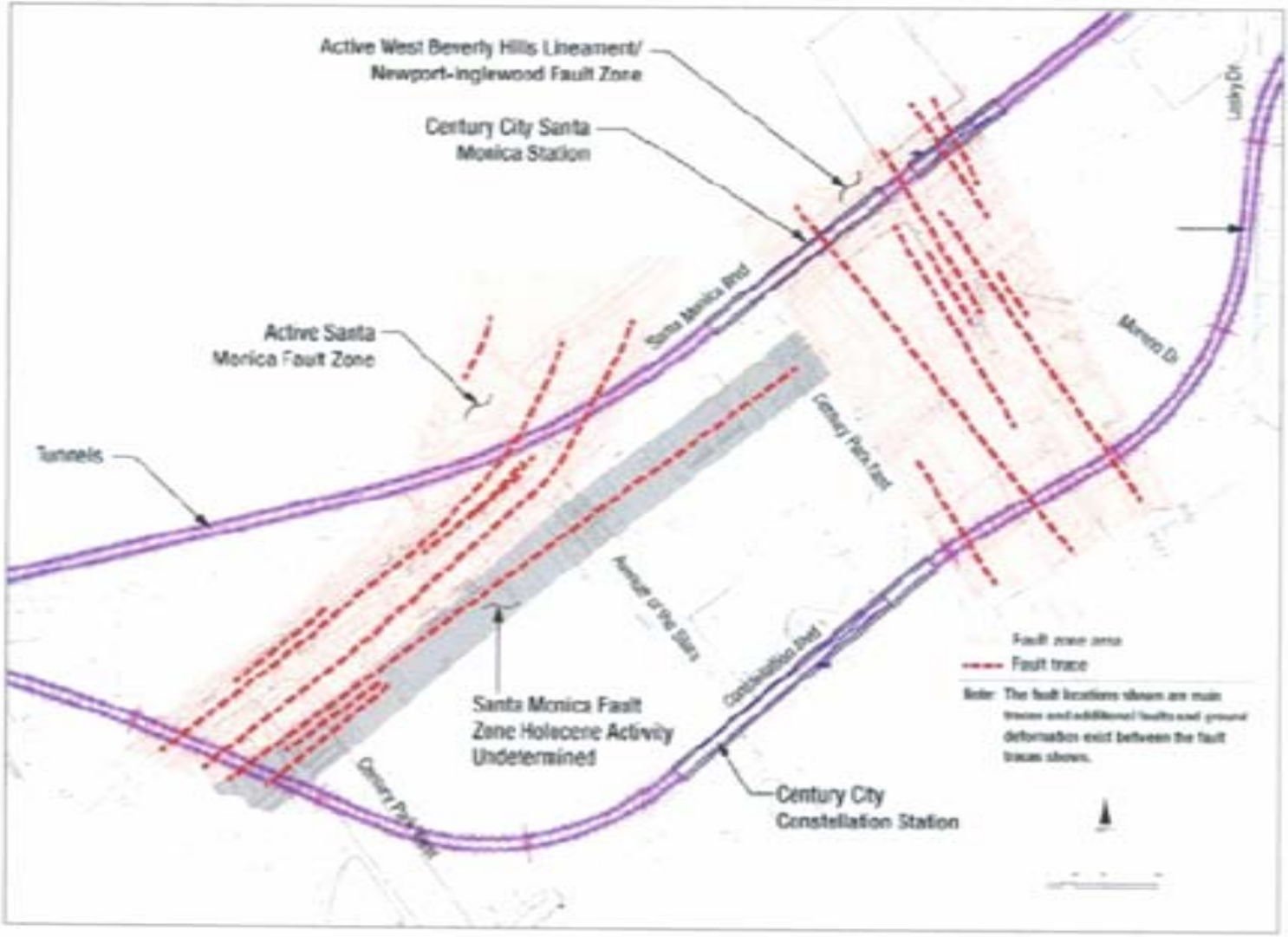
MTA was over-reliant on CPT data, and failed to ensure its accuracy.

Leighton testing confirms that the MTA CPT runs were substantially out of plumb giving false and inconsistent elevations of soil layers. MTA automatically presumed that these inconsistencies were caused by faults – not operator error.

MTA assumed that the world is flat. It is not. Soil logging inconsistencies and errors hid the plain truth.

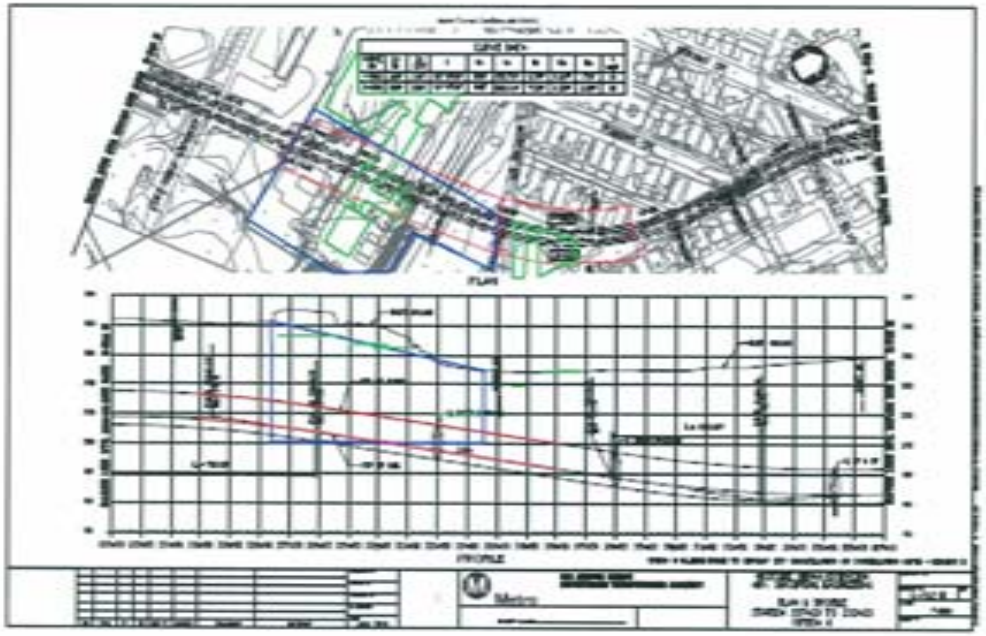


MTA pulled the Alquist-Priolo fire alarm.



The seismic conclusion: the MTA Seismic fault Study is seriously flawed and incomplete and is not a sufficient reason to exclude Santa Monica.

MTA has ignored the impact to the school's future – despite being warned



The school district informed MTA of its specific master plan requirements for growth and sustainability of the high school campus in April 2011. The MTA FEIS/EIR ignores these requirements altogether .

MTA has refused to acknowledge the long term impact and conflict at the high school.

Reference: Spence, 2/17/1930, E-4064 Leighton Consulting, Inc. 603314-001 Figure E-6

The high school has operated for a century. With protection, it is sufficient to meet the education mission for another century.

The high school opened with 700 students and tripled in size the first century. It will double in size In the next century.

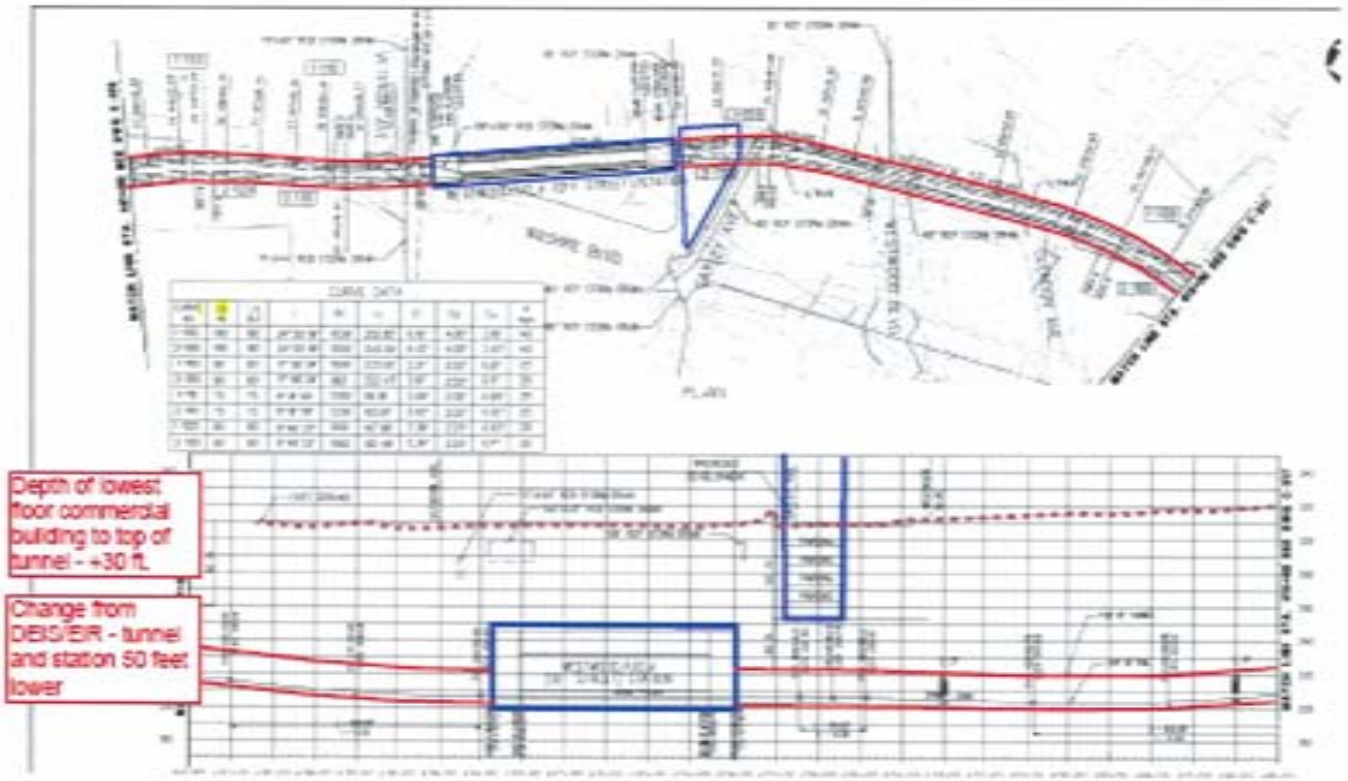
When the high school opened, Century City was a barn. It is easy to dismiss how much growth will occur in the next century.

MTA has ignored inconvenient facts about the high school.

- This will be the only high school serving the community for the next century
- The high school cannot move or expand the campus
- Future building must be concentrated in mid-campus
- Future structures are limited in height and must build into the slope and underground
- The high school population will double
- The community services functions now on campus will also expand

MTA has changed the design near developers with underground construction plans

Subway Alignment Under Westwood Hotel



The subway was dropped well below the planned Westwood hotel the planned Westfield Mall – but not under the high school.

It is not easy to put a subway under a school

Name of School	School Type	School Built	Tunnel Built	Tunnel Nearby
Rooftop K-8 Middle School, San Francisco	Public (Field Act Compliant)	1953	1918	MUNI Light Rail - very deep cover +200 ft
West Portal Elementary School, San Francisco	Public (pre-Field Act, pre-building code)	1927	1918	MUNI Light Rail - deep cover 60-70 ft
Camino Nuevo Charter Academy, Los Angeles	Charter (non-Field Act, standard building code)	1994	1993	Red Line Heavy Rail - cover at least +40 ft
Bentley School, Oakland	Private school (standard building code)	1928	1970's	BART Heavy rail - very deep cover +100 ft
The Northwest School, Seattle	Private school (standard building code)	1905	2012	Sound Transit Light Rail-cover +60 ft
East Sylvan Middel School, Portland	Public School (standard building code)	Prior to tunnel	1990's	Trimet Light Rail - cover +50 ft
Beverly Hills High School	Public (Field Act Compliant)	2014	???	Red Line Heavy Rail - cover 0-10 ft

It has not been done under the Field Act by MTA or anyone else in the state. The complications are not to be underestimated.

The conclusion: the MTA has made very little effort to understand or accommodate the long term requirements of the campus. The proposed subway will seriously compromise the long term sustainability of the high school campus and will cause irreparable harm.

Conclusion: Santa Monica will save the MTA at least $100 million and increase long term ridership.

The seismic truth will come out at Santa Monica.

Santa Monica will avoid irreparable harm to the high school campus.

Preliminary geomorphic, stratigraphic and structural evaluation of the Century City area

Miles Kenney, PhD, PG

Kenney GeoScience

May 17, 2012

Kenney GeoScience

Interim Conclusions

Miles Kenney, PhD. PG

- A reasonable re-evaluation of the existing data suggests that faults associated with the West Beverly Hills Lineament (Newport-Inglewood fault zone) do not exist.

- At least one fault identified by Parsons within the WBHL fault zone is likely real, but is considered part of the Santa Monica Boulevard fault zone (strikes more EW compared to NS). Fault F.

- The Santa Monica Boulevard faults likely do exist, but they may be:
  - Dominantly strike-slip normal
  - Secondary upper plate faults to the Santa Monica Fault Zone proper
  - Inactive

Review of the Existing Data

- Published scientific reports and maps
- Subsurface work by
  - MACTEC,
  - Parsons Brinkerhoff (Parsons),
  - Leighton (LCI),
  - Earth Consultants International (ECI),
  - Soil Tectonics
  - Kenney GeoScience (KGS)

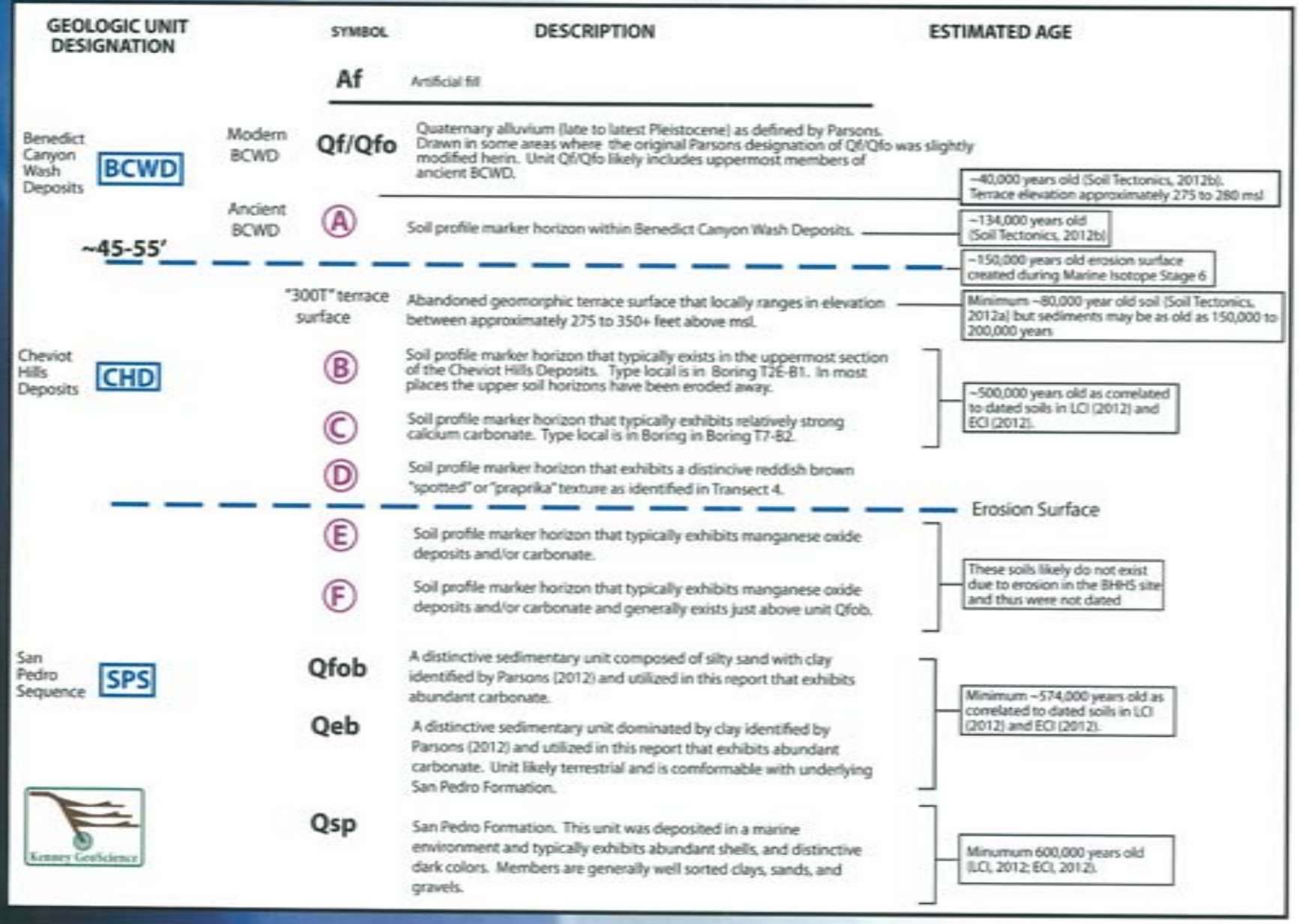
Kenney GeoScience

Local Stratigraphy - key to understanding faulting

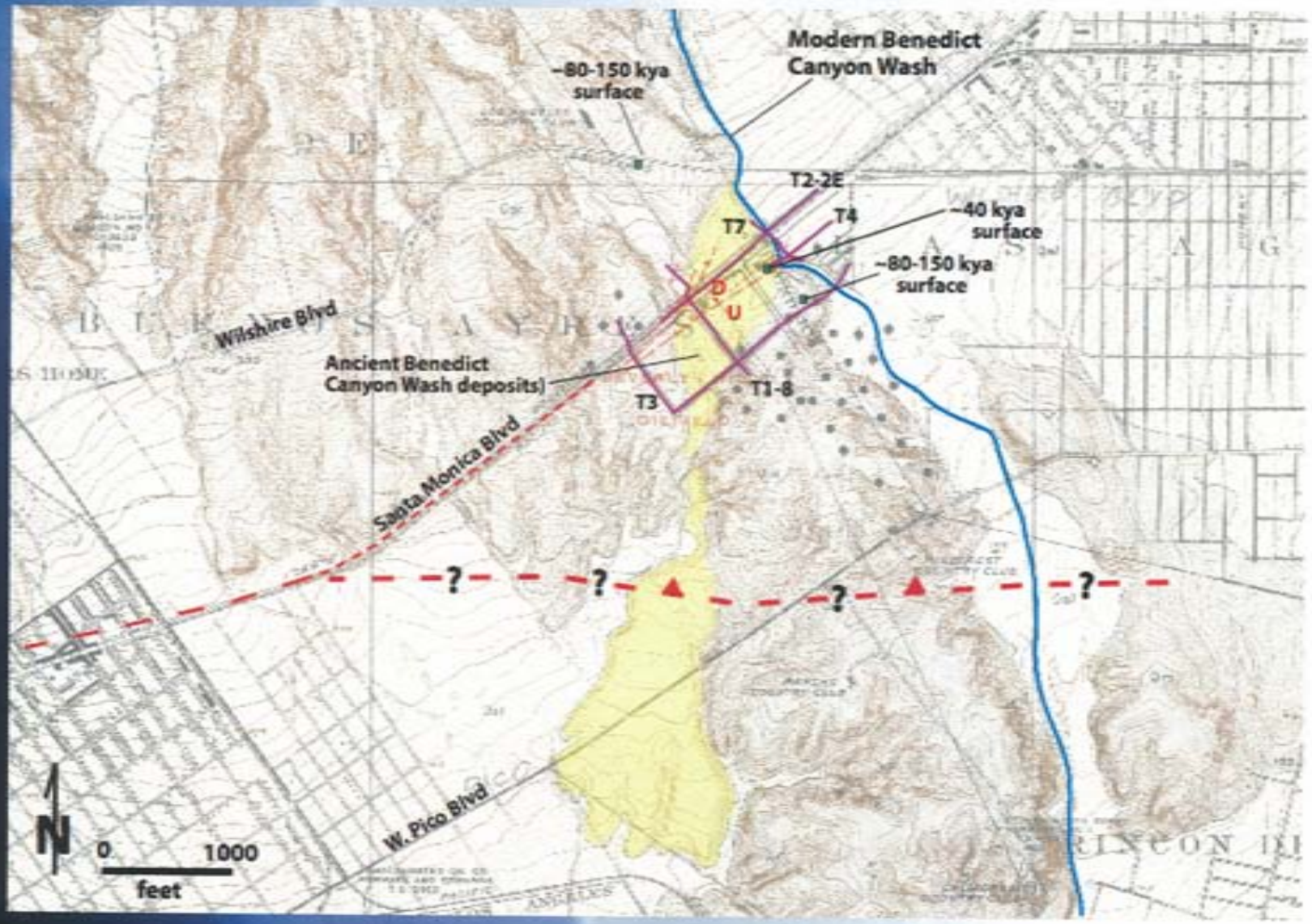
In order to understand local faulting behavior, location and activity, it is critical to understand the age and characteristics of the local stratigraphy

Kenney GeoScience

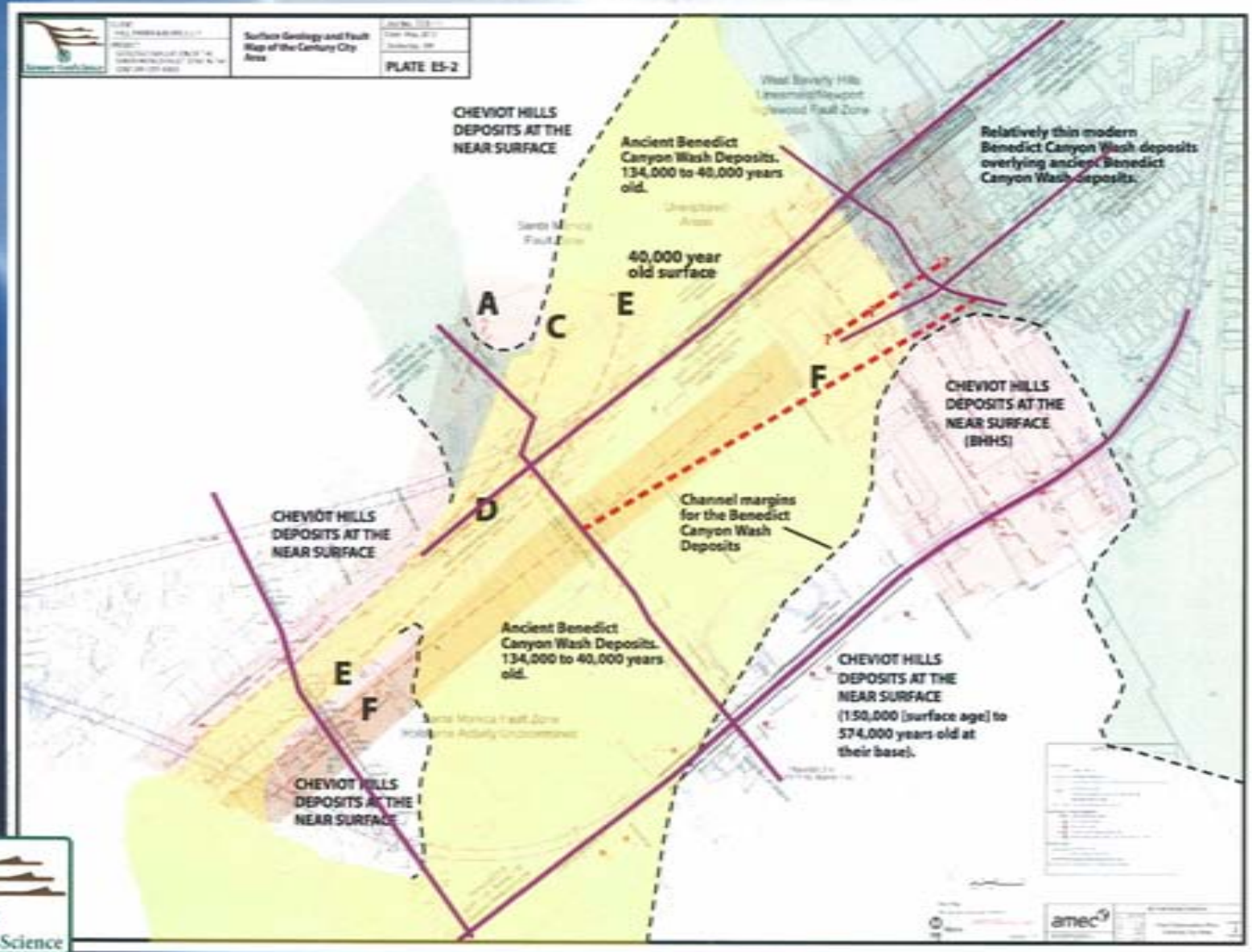
Site Stratigraphy



Ancient Benedict Canyon Wash

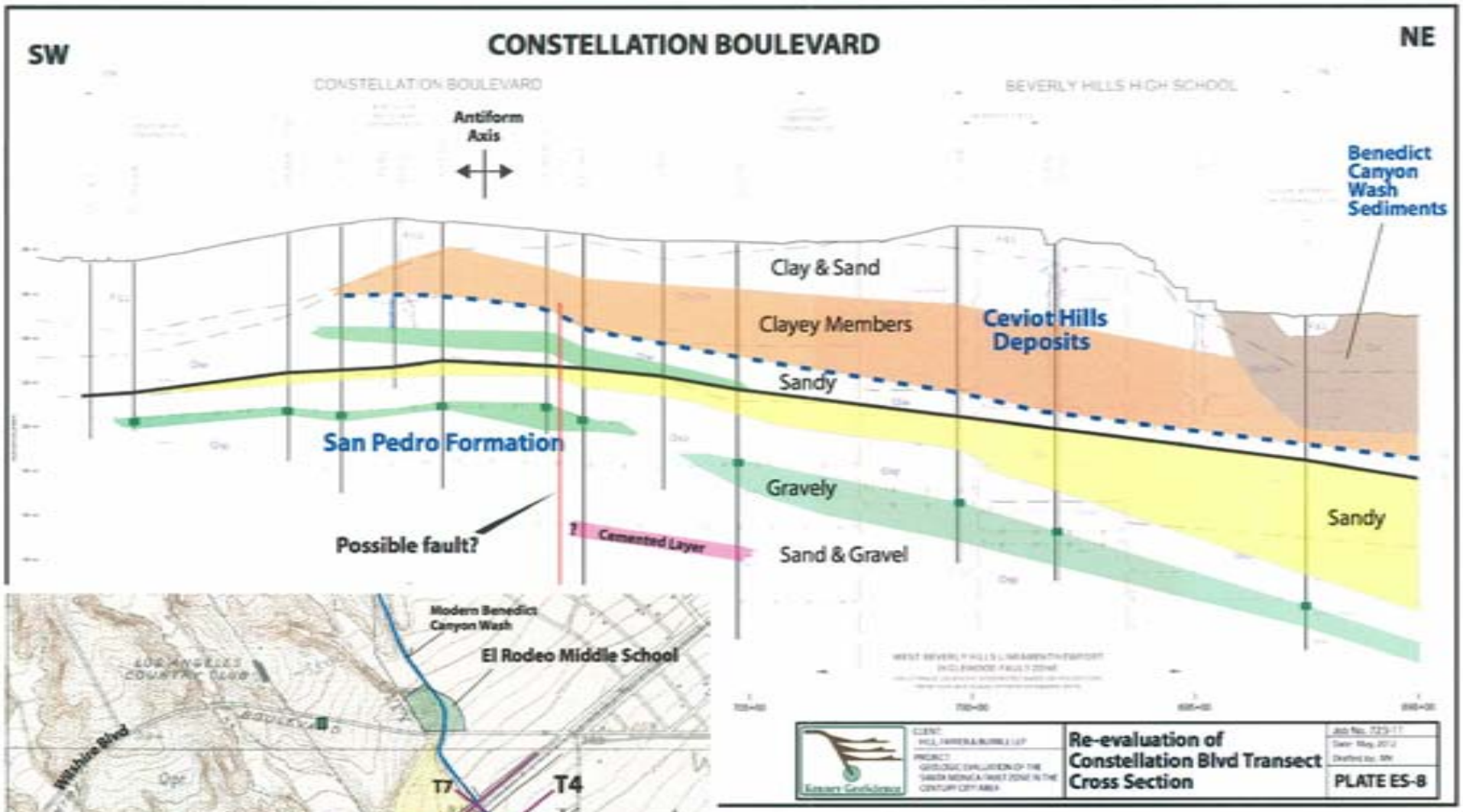


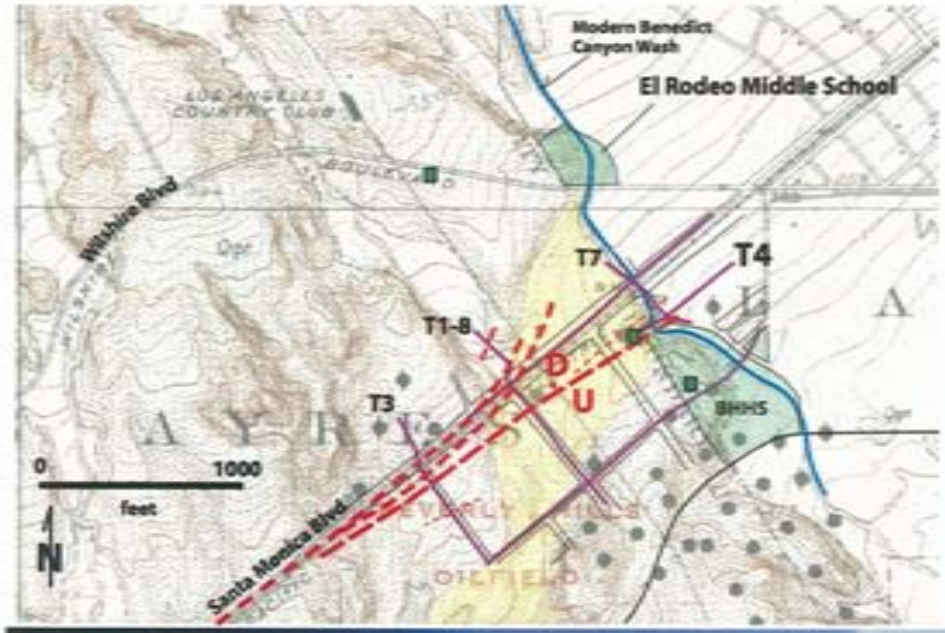
Site Geologic Map - I think the first one made to date!



Kenney GeoScience

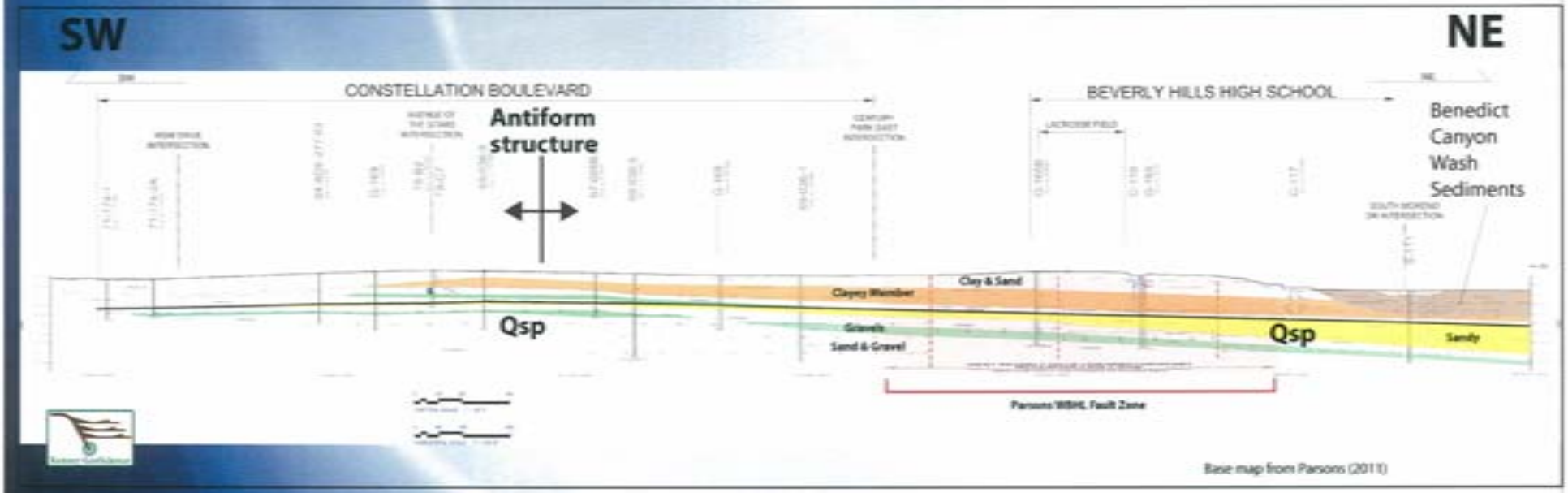
Do the West Beverly Hills Lineament Faults really exist?



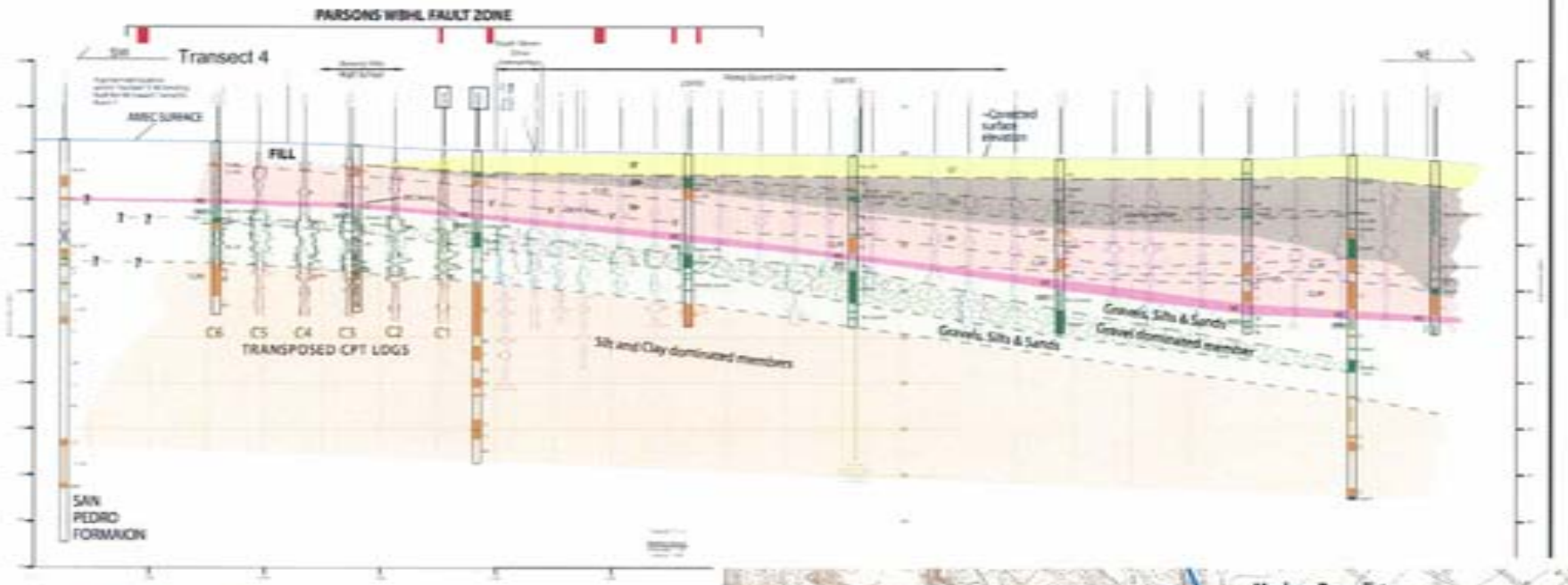


Kenney GeoScience

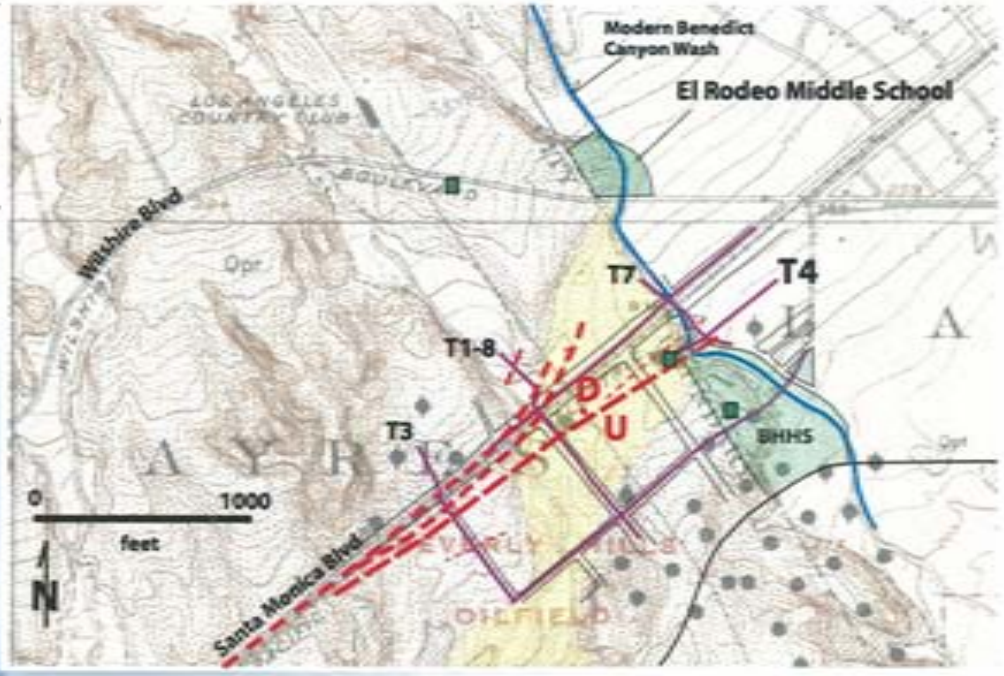
Constellation Transect - Geologic composition evaluation
Scale 10x vertical exaggeration



SW TRANSECT 4 OF PARSONS - ALTERNATIVE EVALUATION NE



Modified from Parsons report 4951-10-1561 dated 10.3 for Transect 4.



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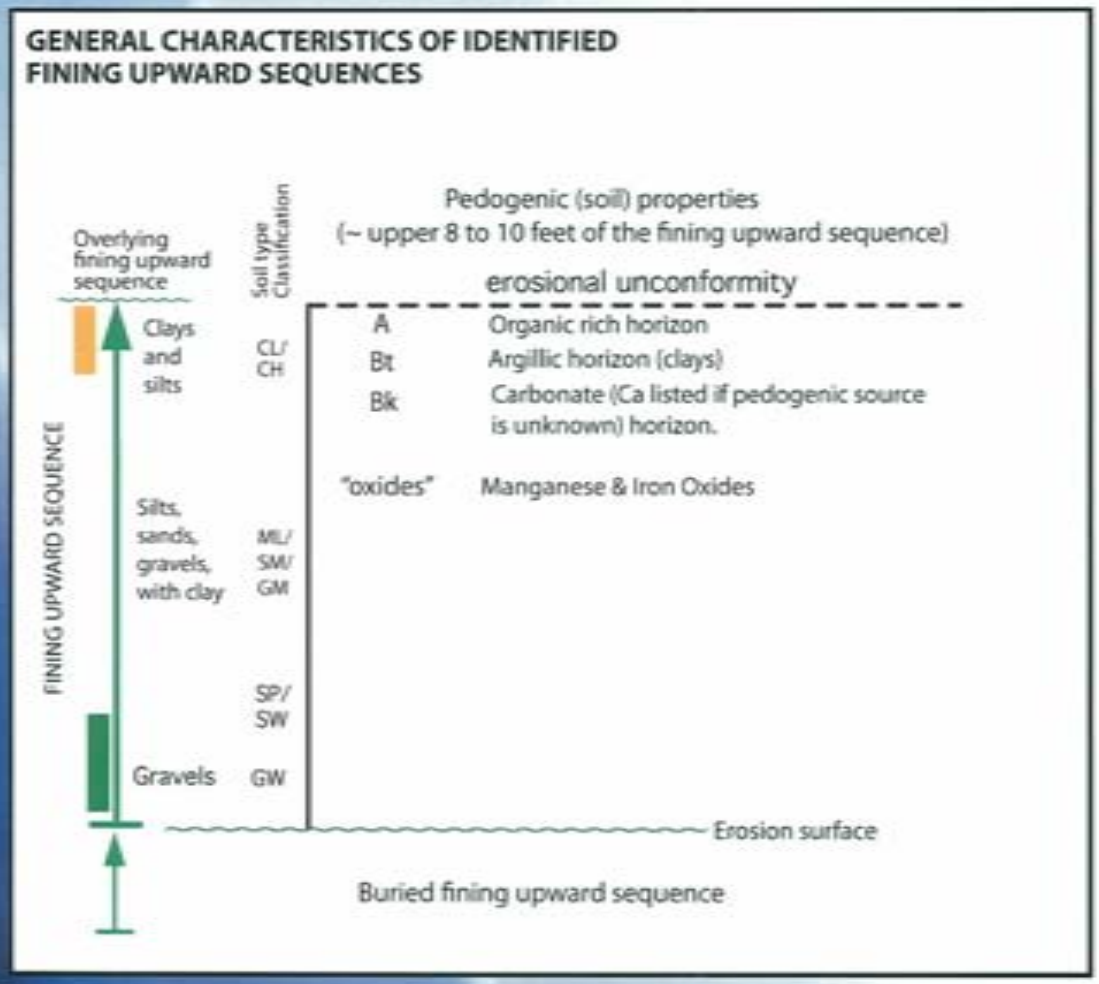
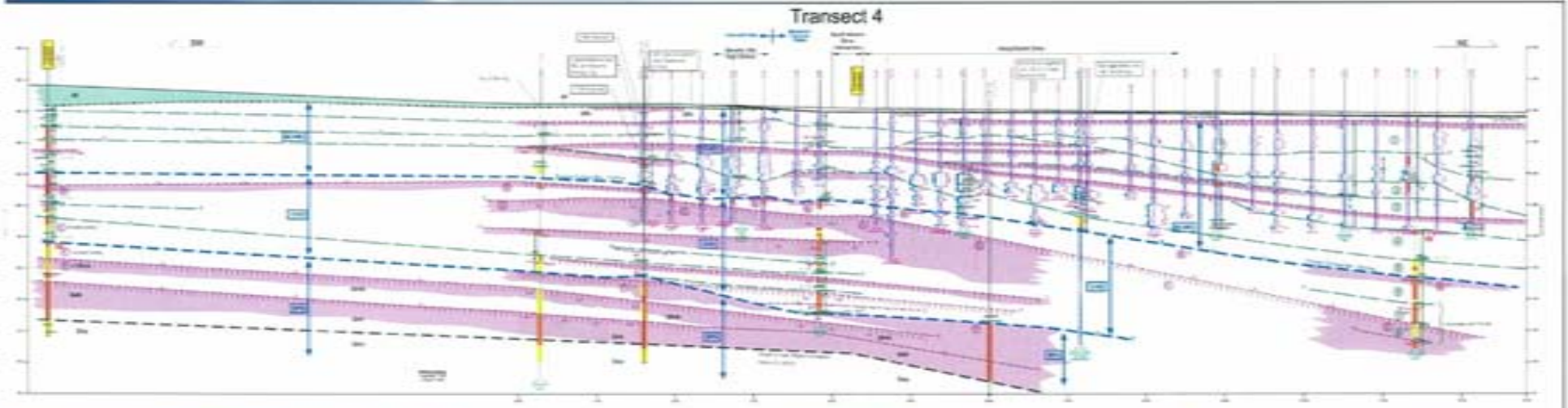
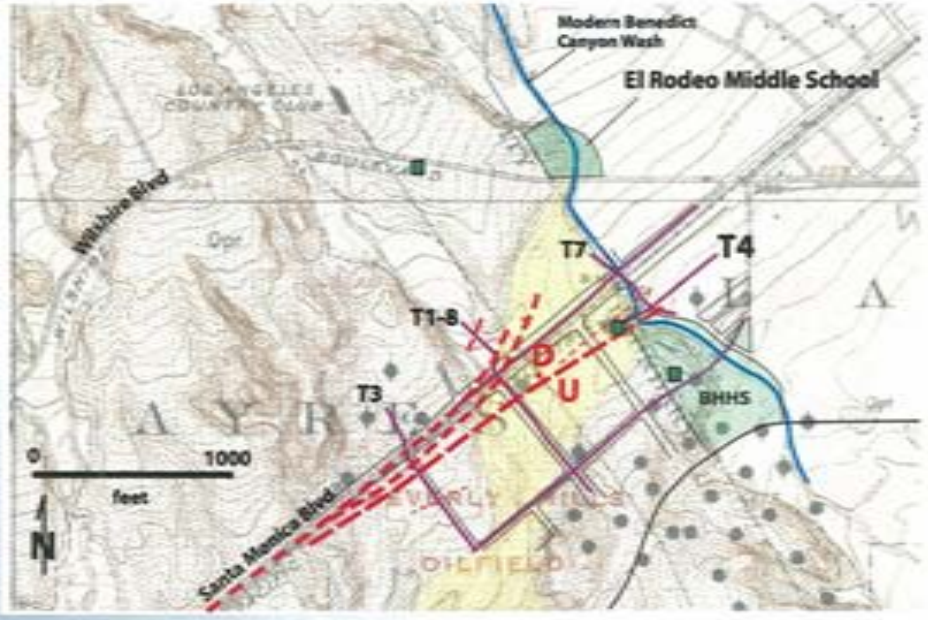
Evaluation of Fining Upward Sequences (FUS) along Parsons Transects



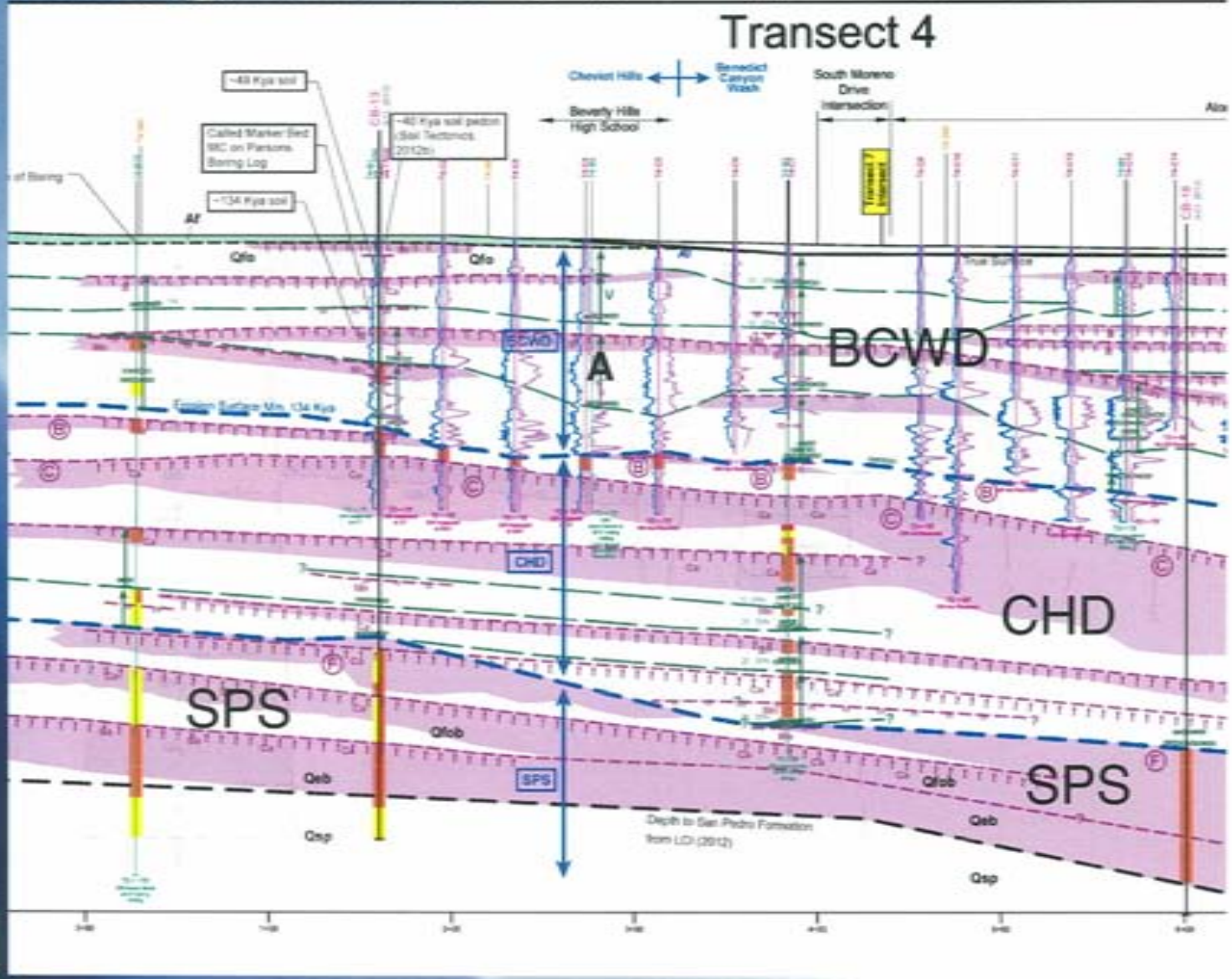
Transect 4 FUS





Kenney GeoScience

Transect 4 FUS - WBHL FZ



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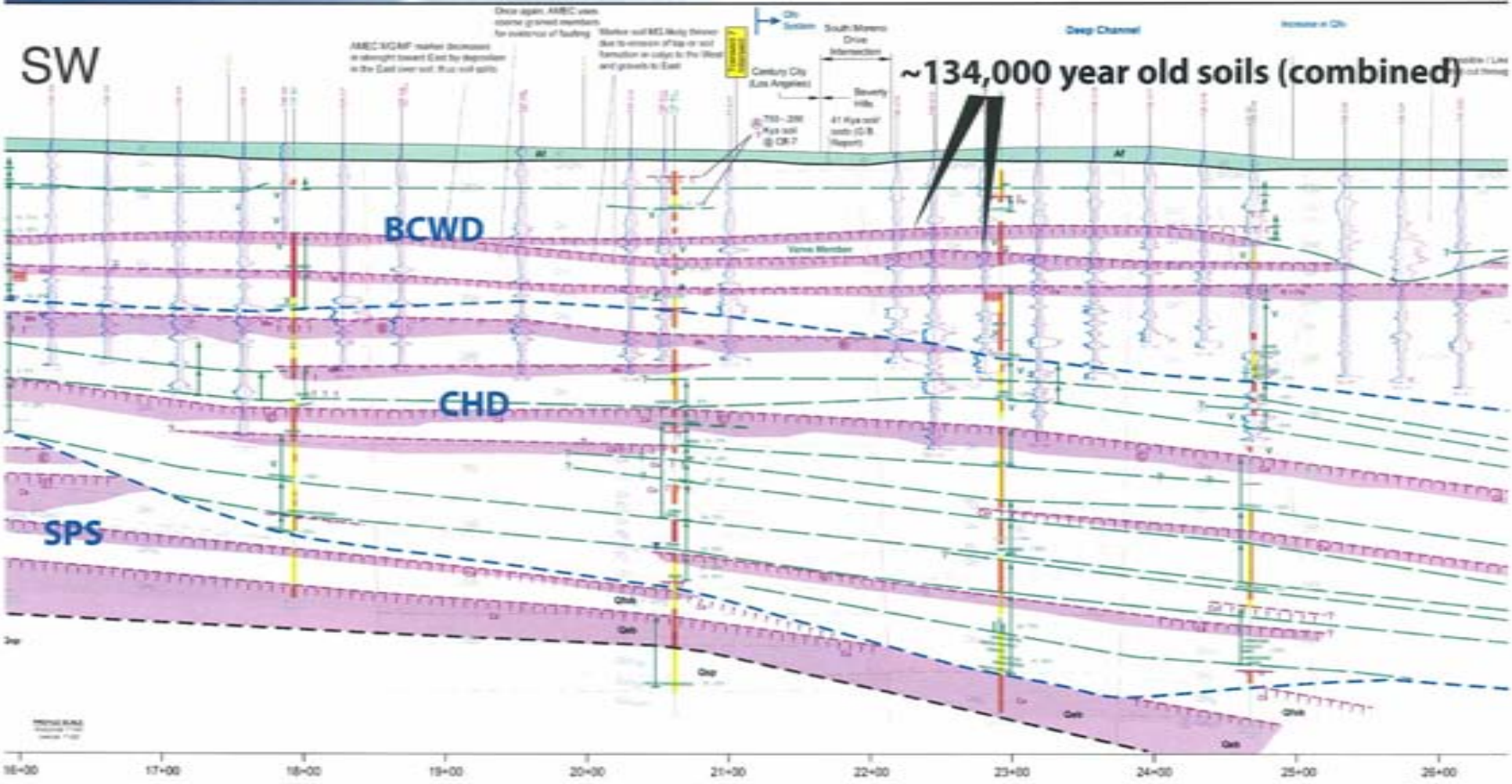
Transect 2E FUS - WBHL FZ



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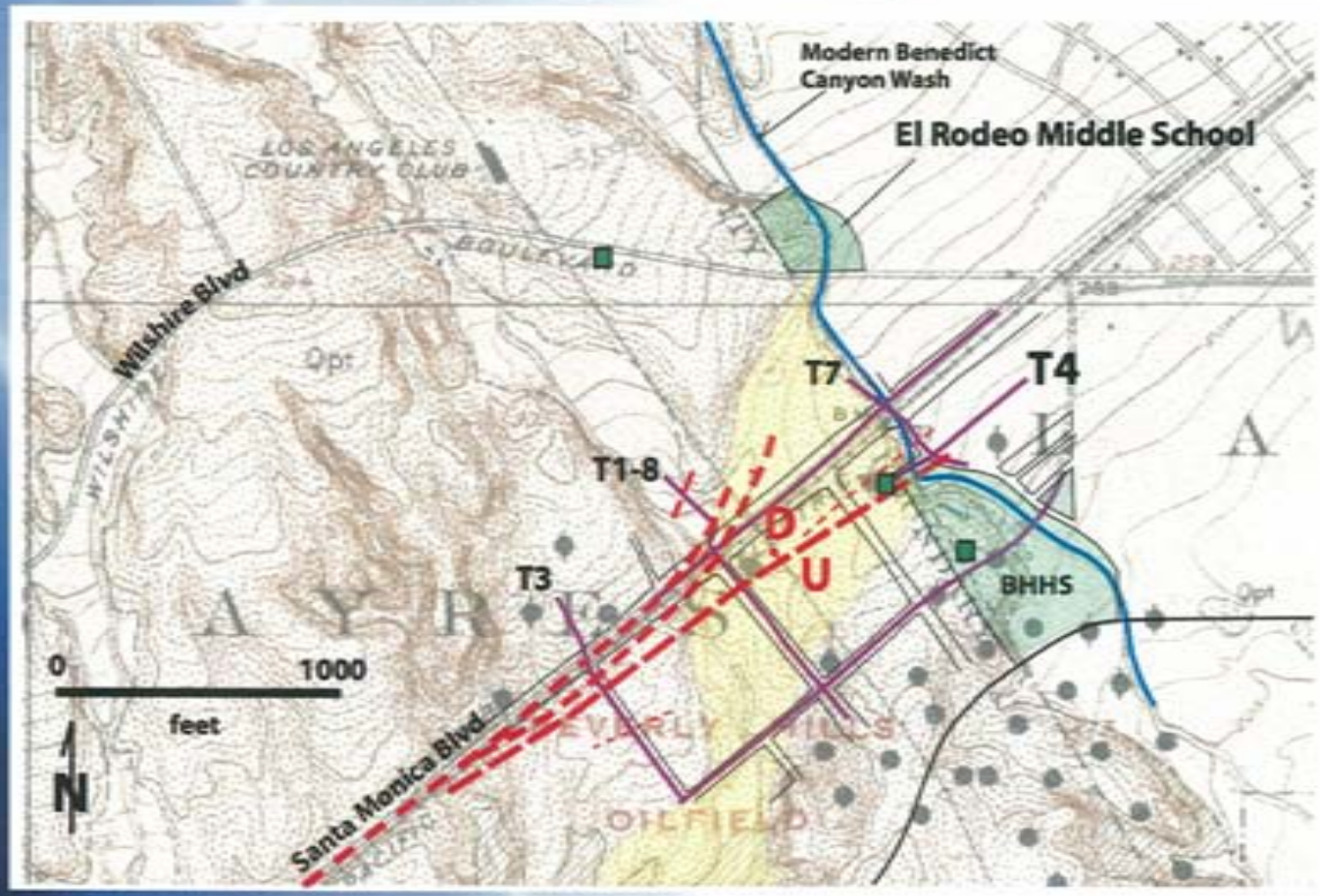
One and possibly two faults were however identified in the WBHL FZ area along Transect 7.

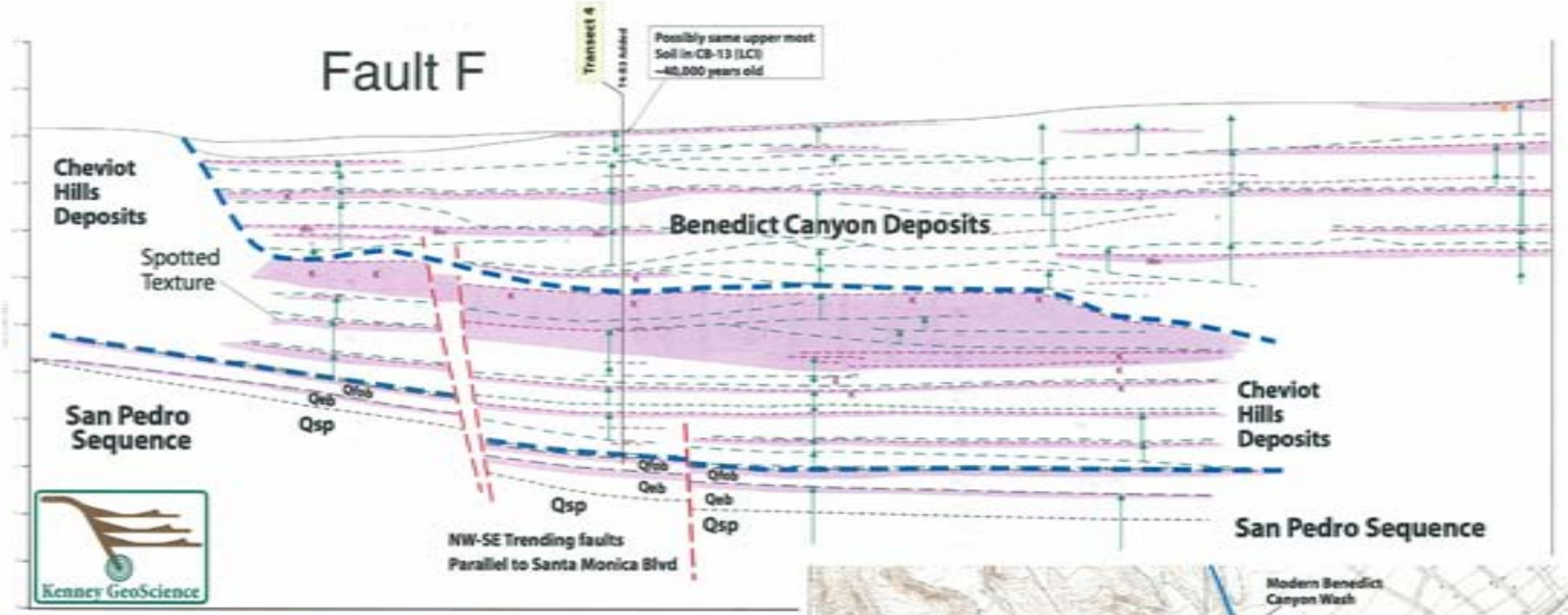


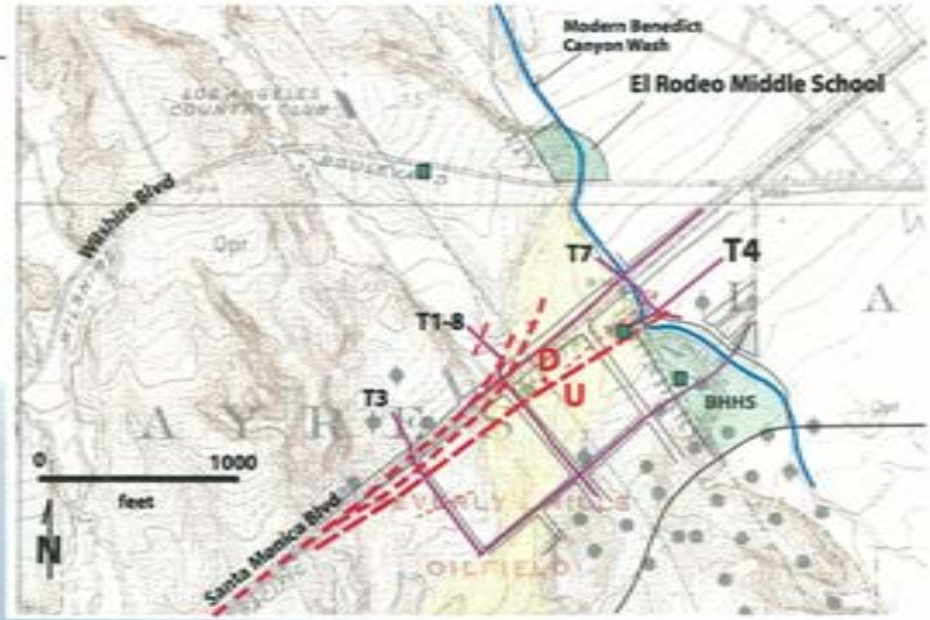
Kennedy GeoScience

SE

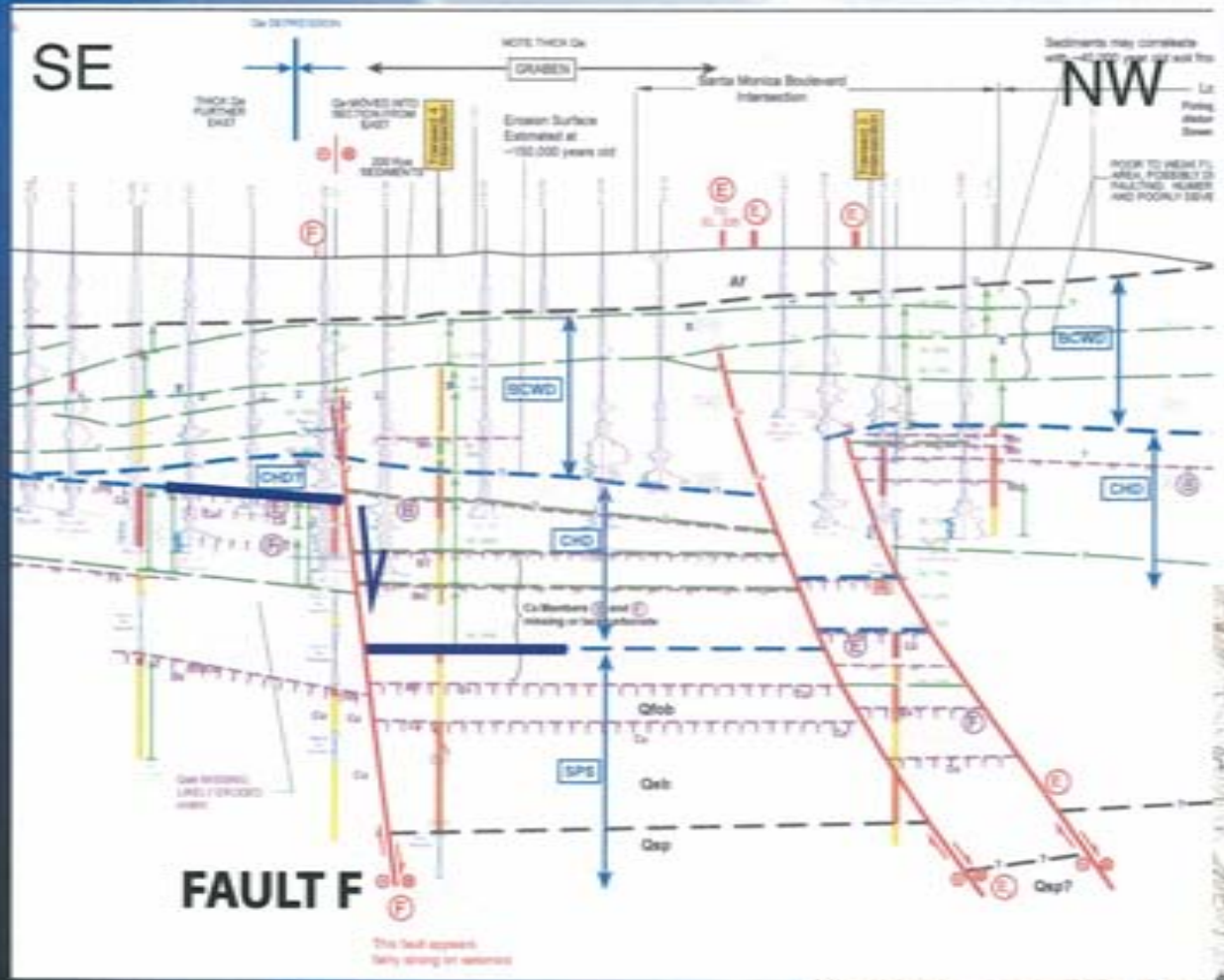
ALTERNATIVE EVALUATION OF PARSONS TRANSECT 7

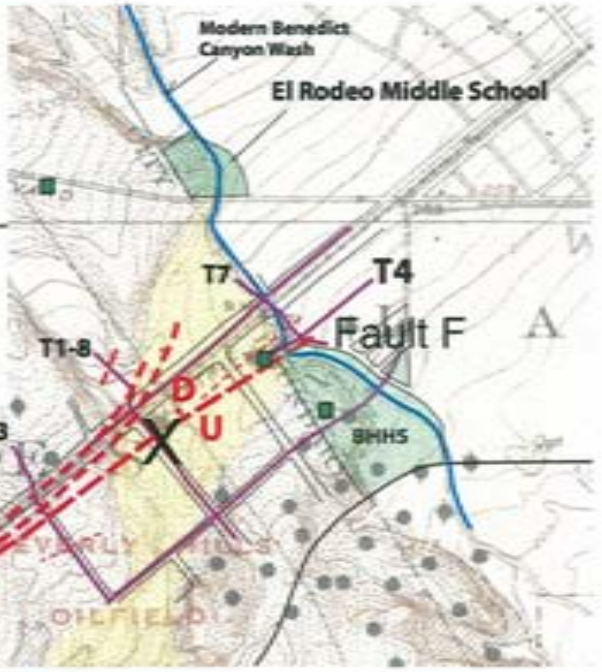
NW





Transect 1-8 FUS - Close up of Fault F





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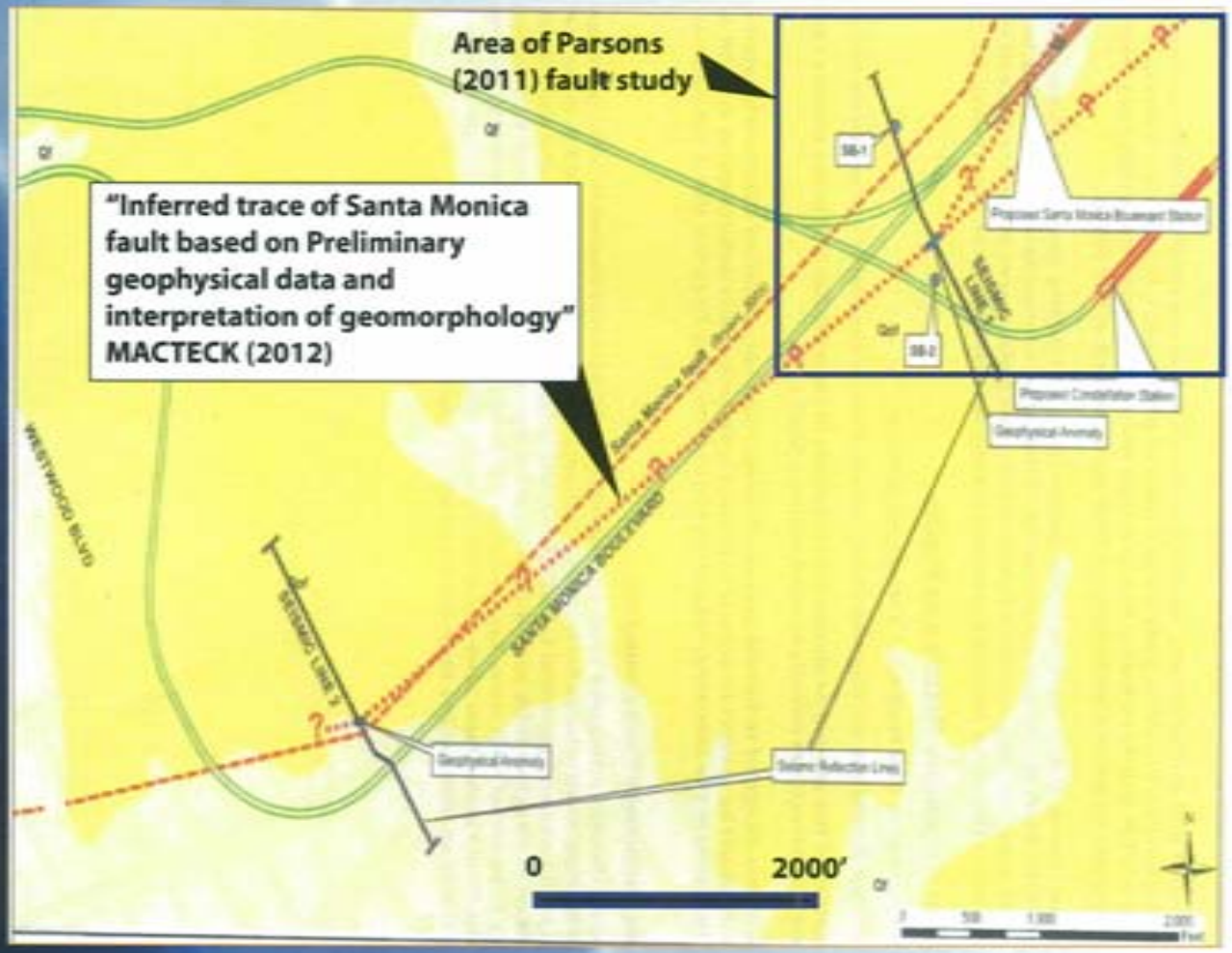
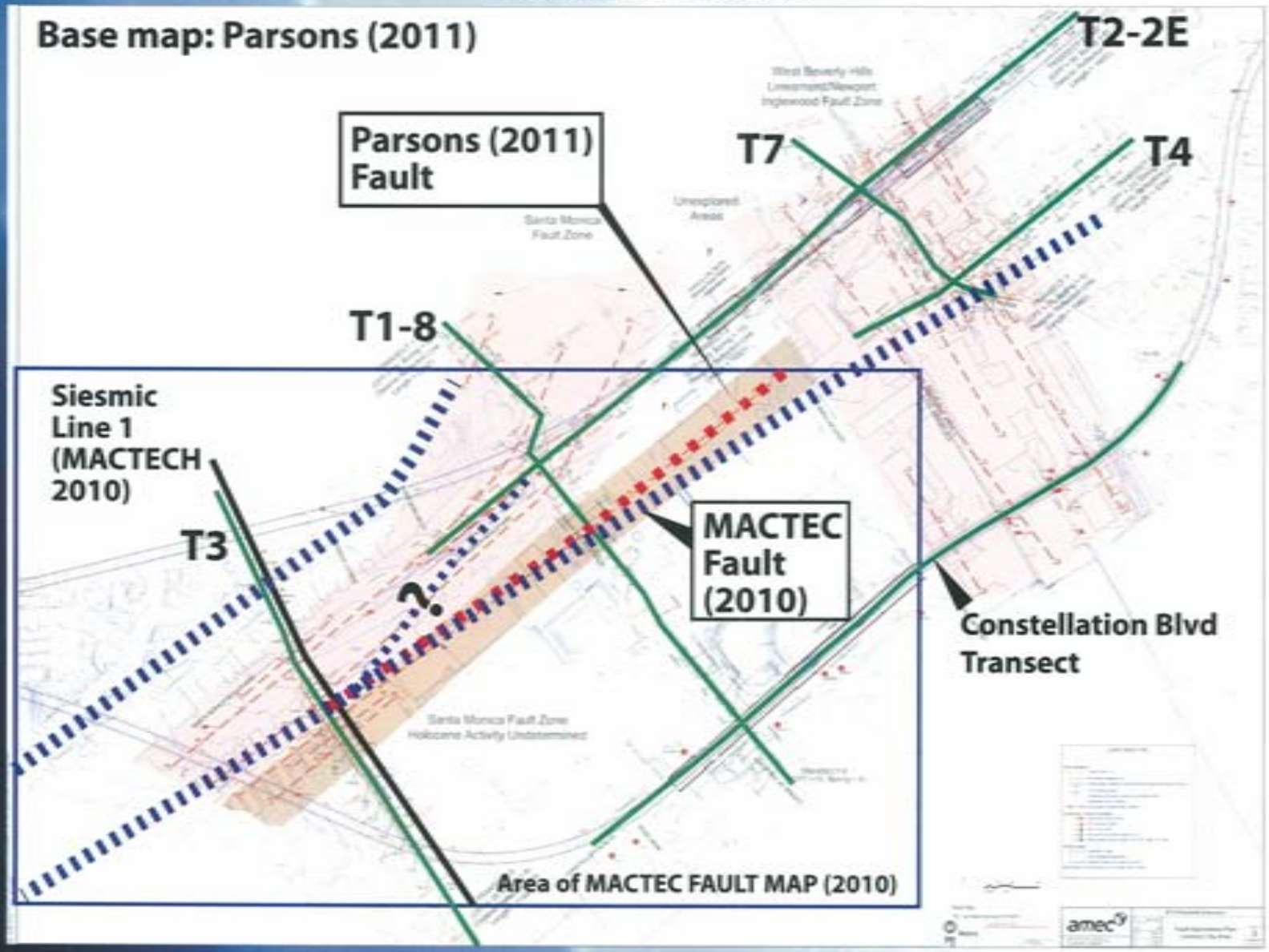
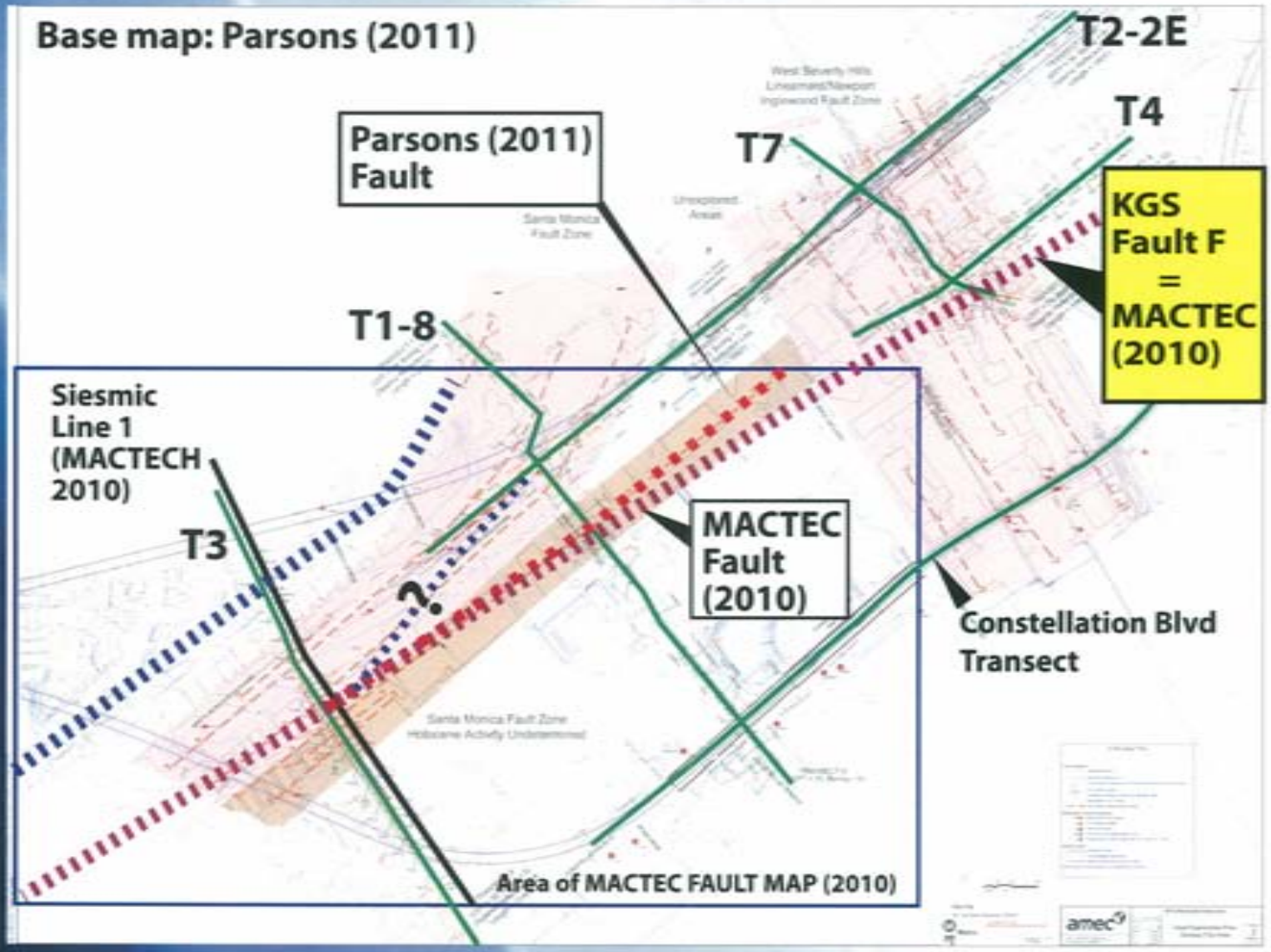
Additional evidence for Fault F to reach Transect 7
Fault F was already mapped by MACTECH (2010)



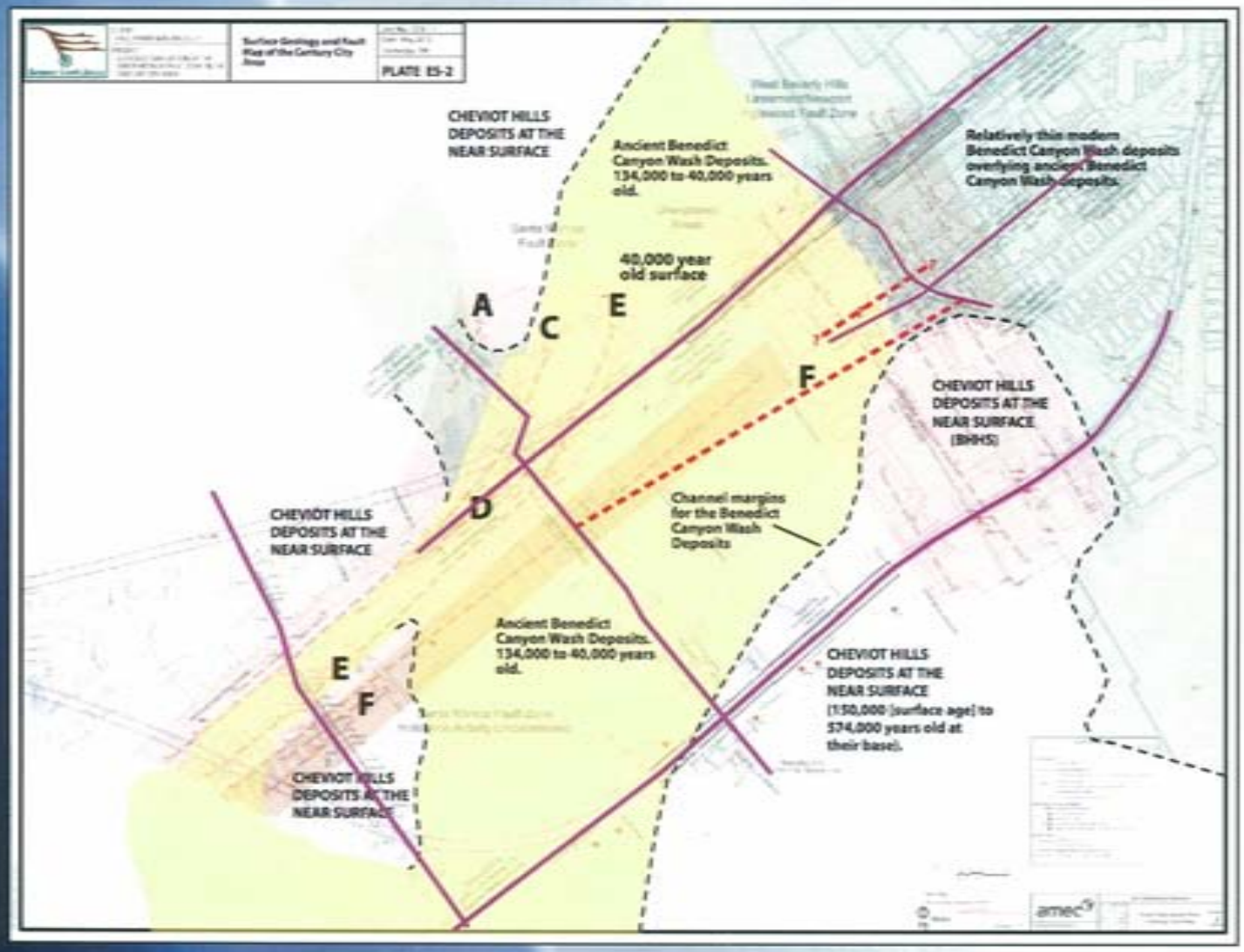
Fault Map Overlay - MACTECH AND PARSONS



Fault Map Overlay - MACTECH AND PARSONS



Fault F to Transect 7



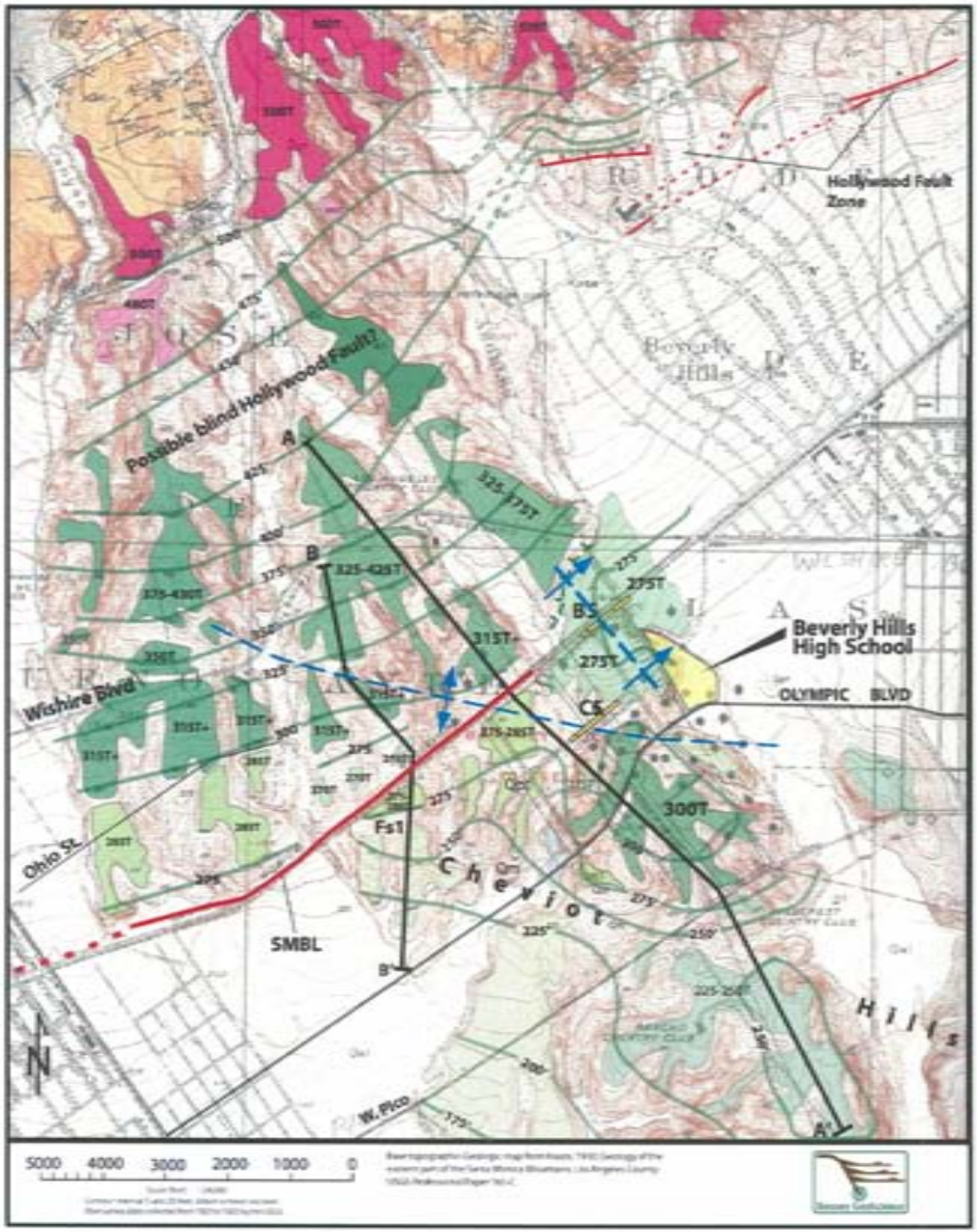
Interim Summary

- The WBHL faults likely do not exist.
- Our analysis indicates that at least one fault mapped within the WBHL by Parsons is likely real, but strikes NE-SW and is part of the SMBFZ (Fault F).

Geomorphic Analysis

- Preserved terrace surfaces across Santa Monica Boulevard - Cross Sections
- Drainage analysis
- Lineament analysis along Santa Monica Blvd
- Preserved terrace surfaces overlying faults

Kennedy GeoScience



Terrace Surfaces

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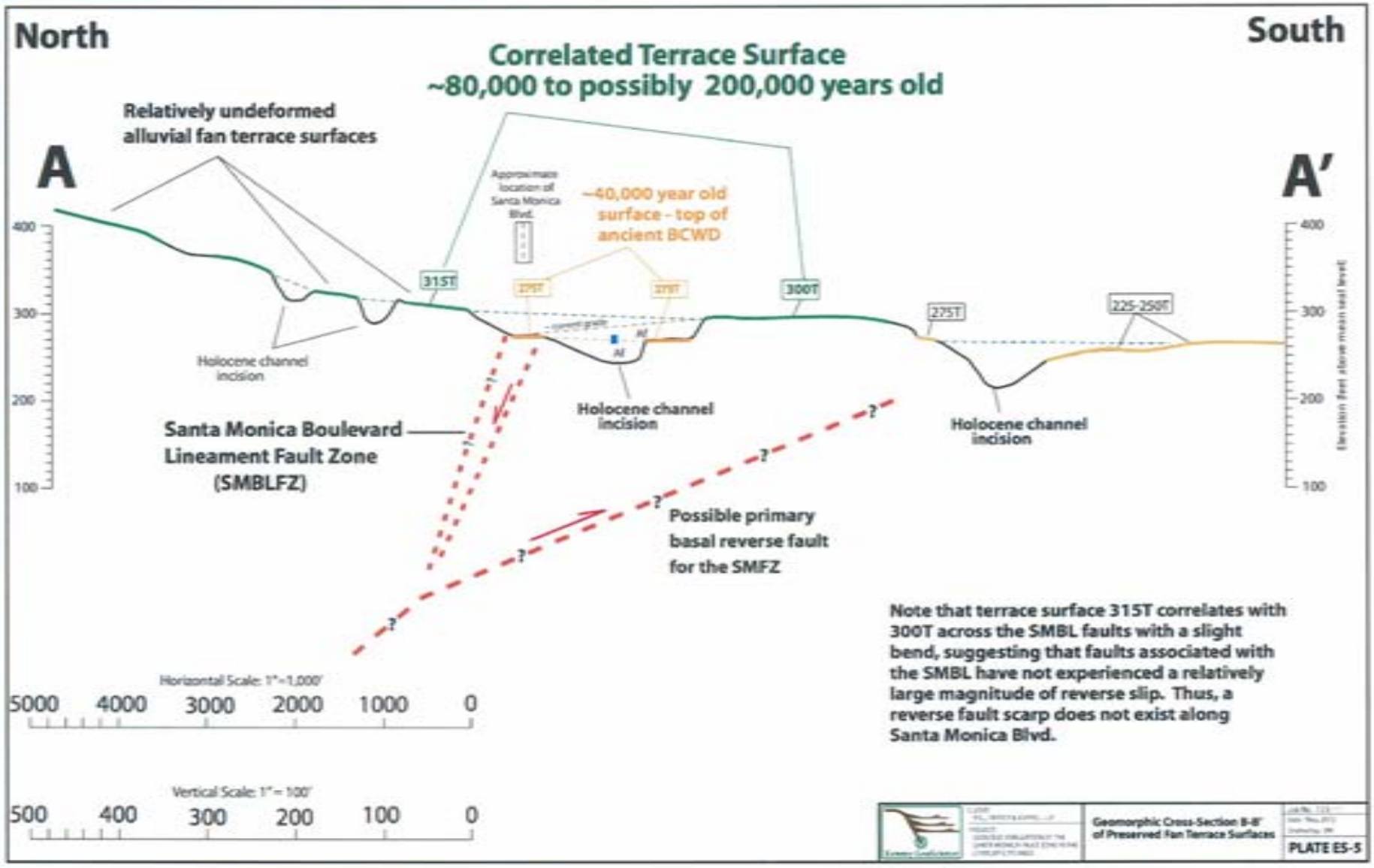
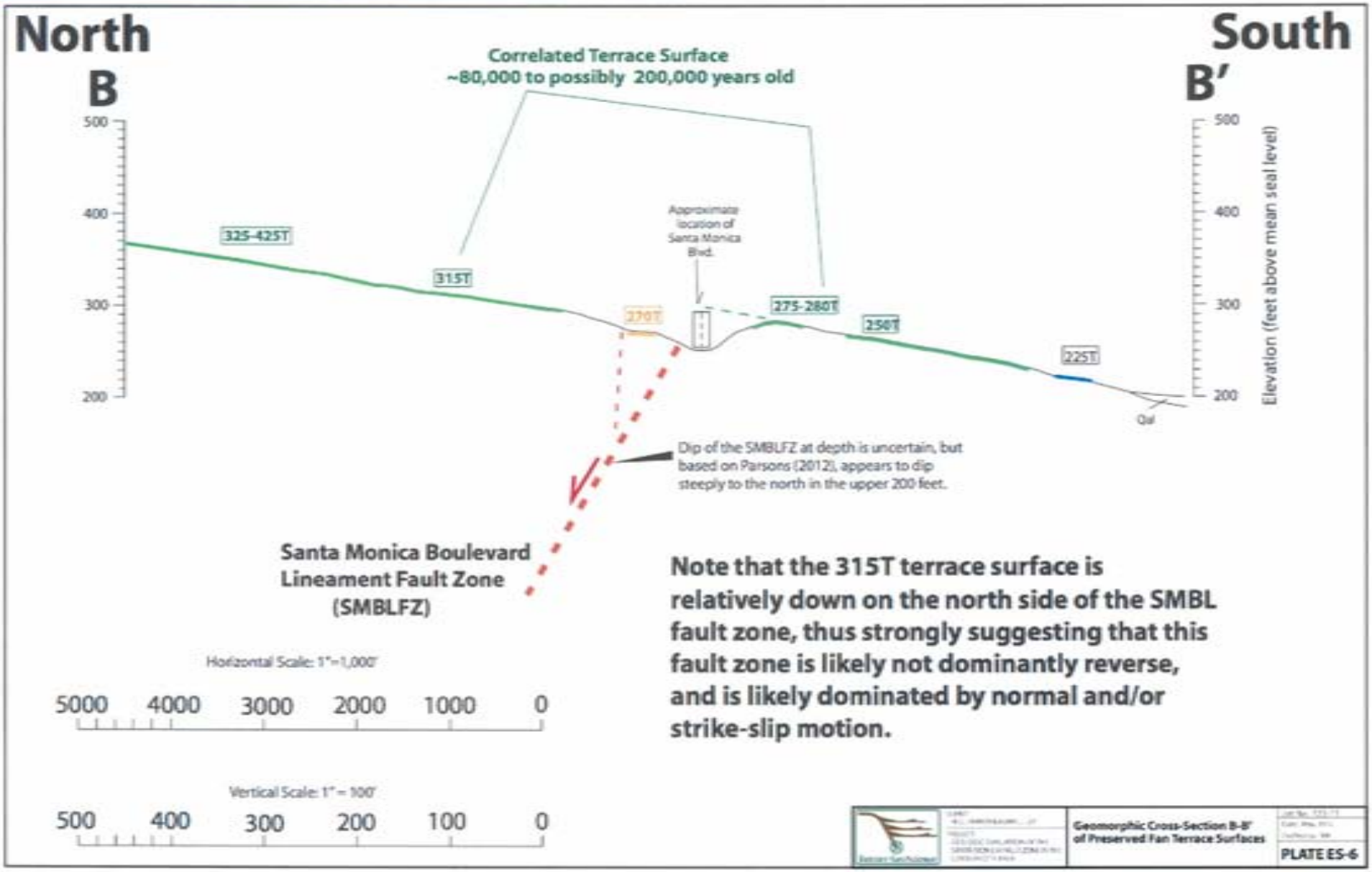

North
South
Correlated Terrace Surface
~80,000 to possibly 200,000 years old
Relatively undeformed
alluvial fan terrace surfaces
A
A'
Approximate location of Santa Monica Blvd.
~40,000 year old surface - top of ancient BCWD
315T
300T
275T
225-250T
Holocene channel incision
Holocene channel incision
Holocene channel incision
Santa Monica Boulevard Lineament Fault Zone (SMBLFZ)
Possible primary basal reverse fault for the SMFZ
Note that terrace surface 315T correlates with 300T across the SMBL faults with a slight bend, suggesting that faults associated with the SMBL have not experienced a relatively large magnitude of reverse slip. Thus, a reverse fault scarp does not exist along Santa Monica Blvd.
Horizontal Scale: 1"=1,000'
5000 4000 3000 2000 1000 0
Vertical Scale: 1" = 100'
500 400 300 200 100 0
Geomorphic Cross-Section B-B' of Preserved Fan Terrace Surfaces
PLATE ES-5
Kenney GeoScience


North
B
South
B′
Correlated Terrace Surface
~80,000 to possibly 200,000 years old
500
400
300
200
325-425T
315T
270T
Approximate location of Santa Monica Blvd.
275-280T
250T
225T
Qal
Elevation (feet above mean seal level)
Dip of the SMBLFZ at depth is uncertain, but based on Parsons (2012), appears to dip steeply to the north in the upper 200 feet.
Santa Monica Boulevard Lineament Fault Zone (SMBLFZ)
Horizontal Scale: 1"=1,000'
5000 4000 3000 2000 1000 0
Vertical Scale: 1" = 100'
500 400 300 200 100 0
Note that the 315T terrace surface is relatively down on the north side of the SMBL fault zone, thus strongly suggesting that this fault zone is likely not dominantly reverse, and is likely dominated by normal and/or strike-slip motion.
Geomorphic Cross-Section B-B' of Preserved Fan Terrace Surfaces
PLATE ES-6

Results

Faults along Santa Monica Boulevard have not exhibited significant reverse faulting

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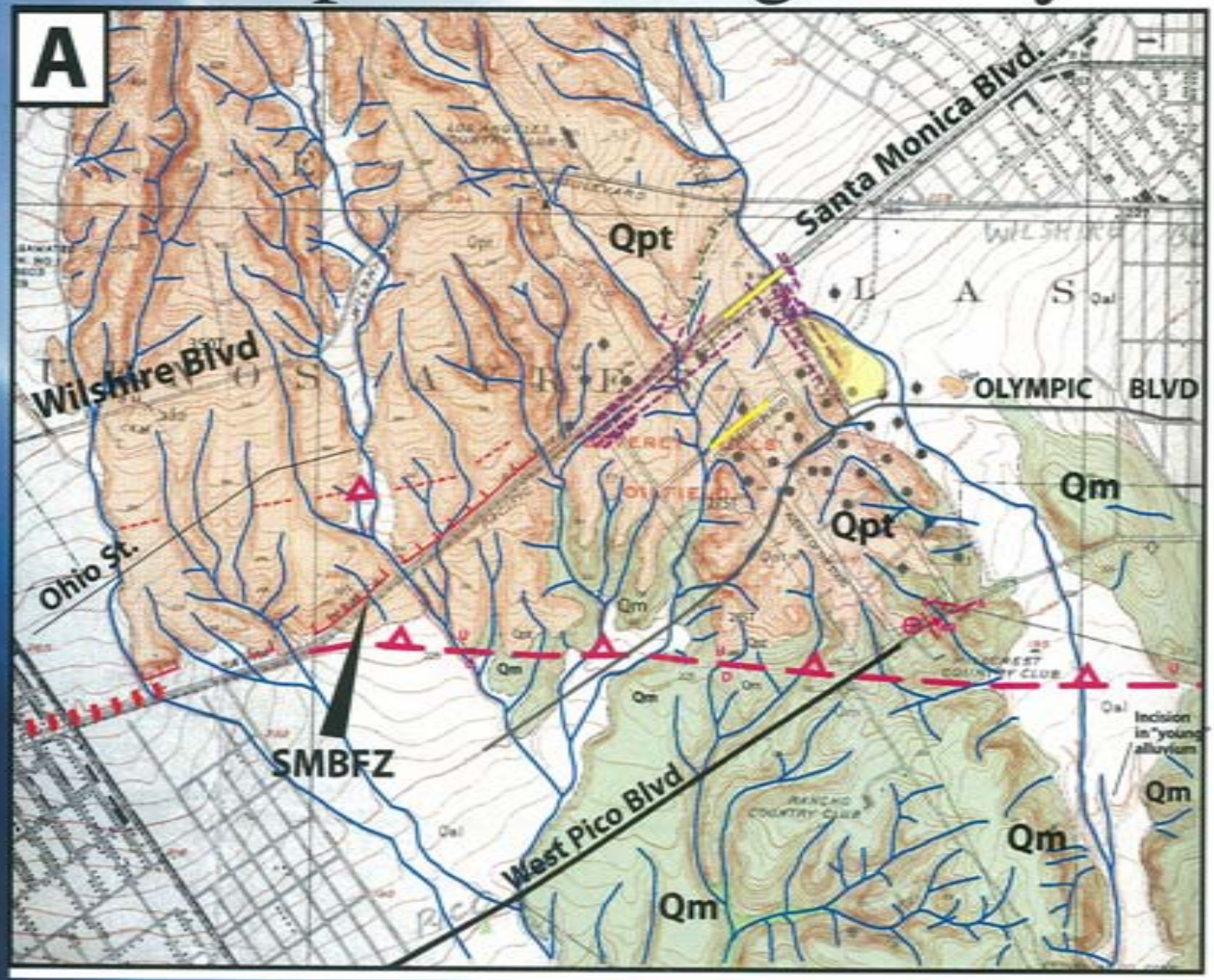
Geomorphic drainage analysis



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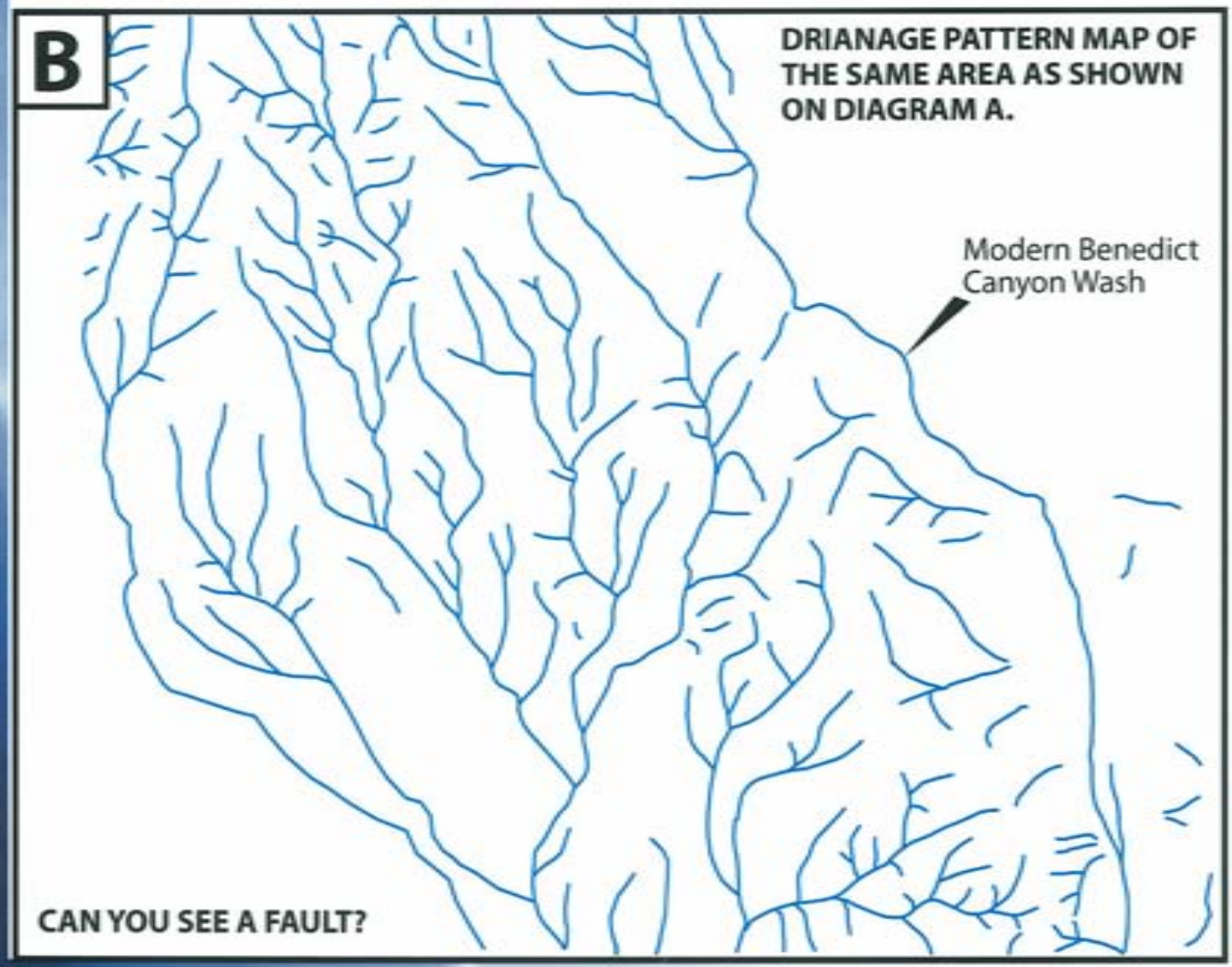
Geomorphic Drainage Analysis



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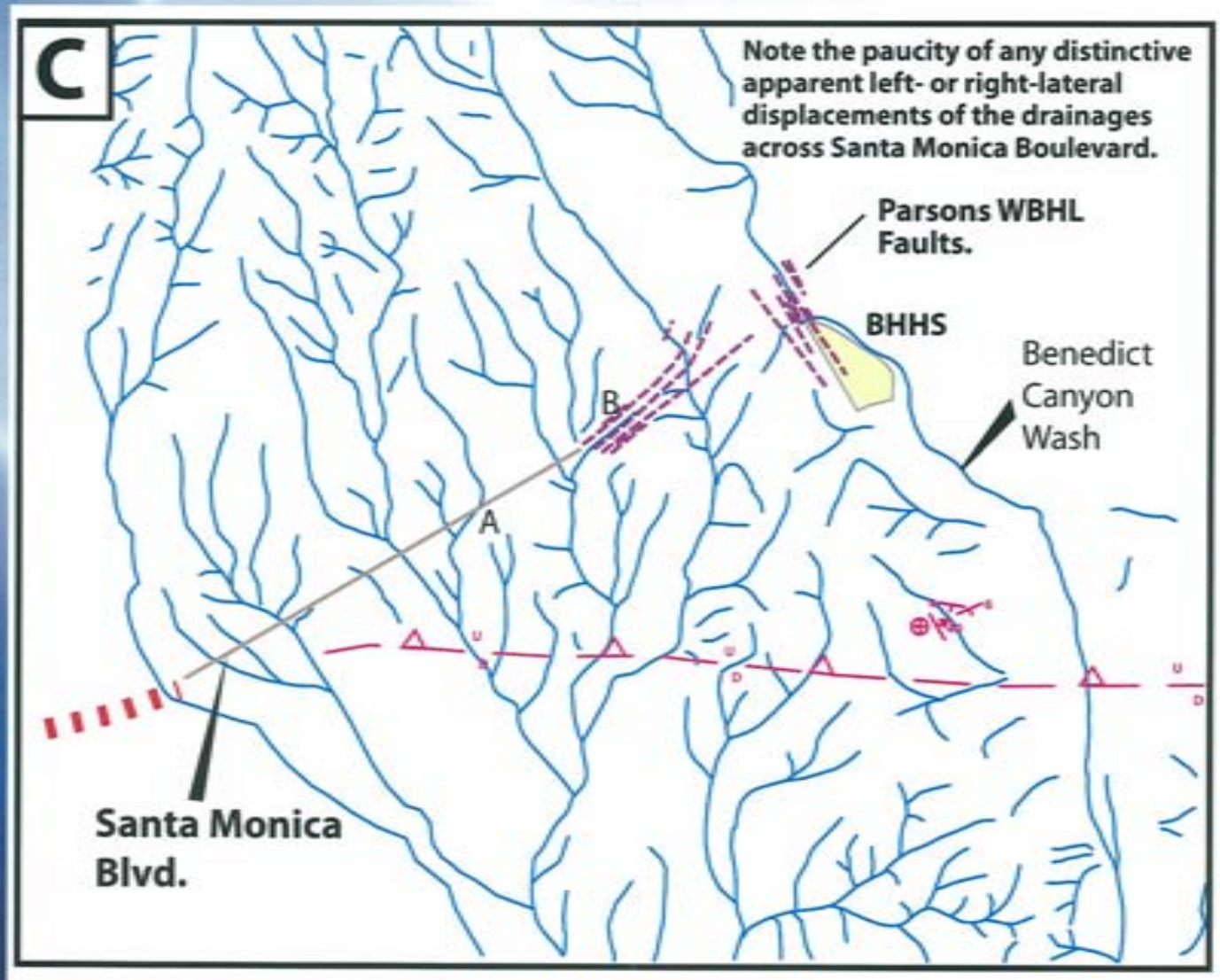
Geomorphic Drainage Analysis



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Results of drainage analysis

- Tributary system does not appear systematically offset by either right- or left lateral displacement.

- Infers that the Santa Monica Blvd Lineament appears dominated by erosion and depositional processes – thus possibly not active

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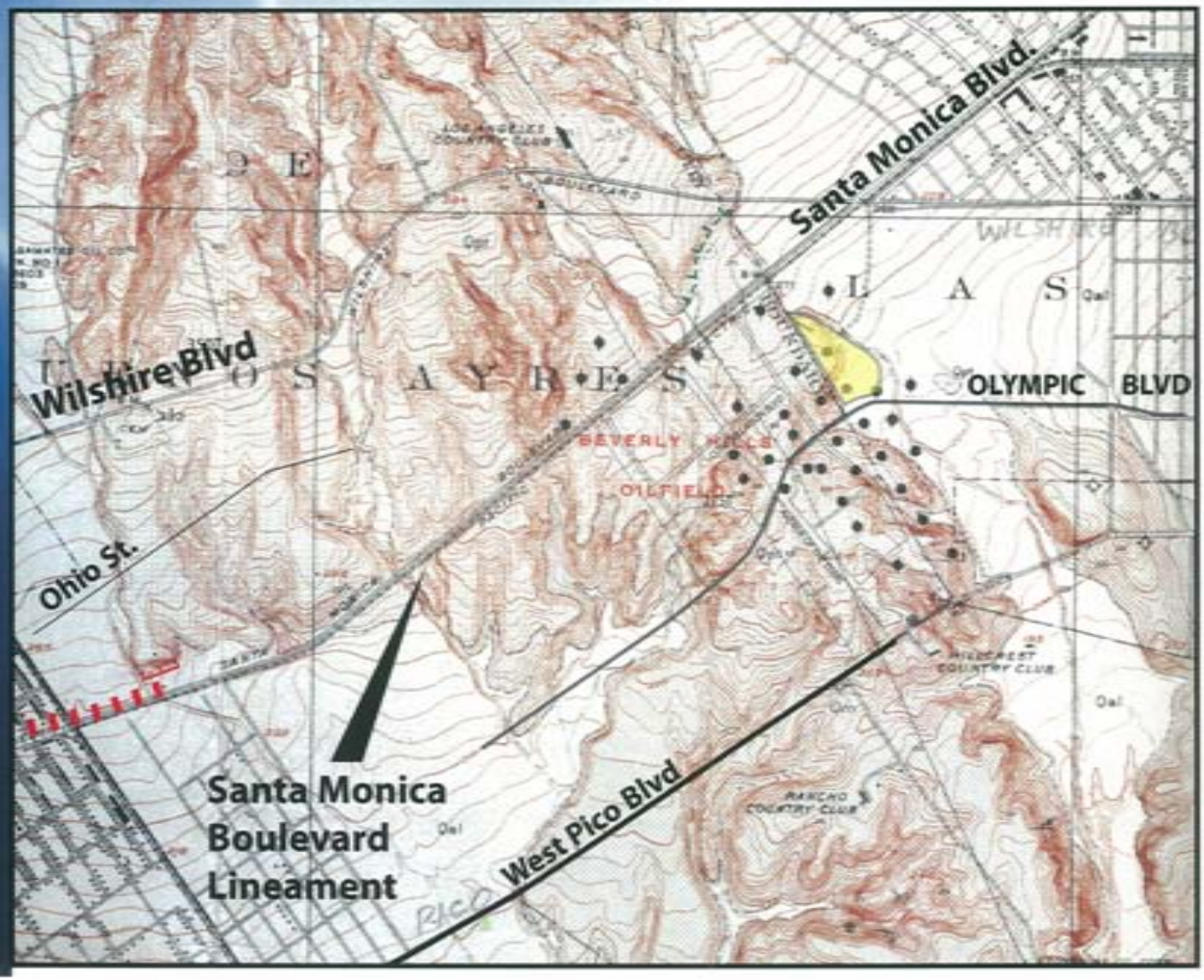
Is there a lineament along SMB?
Yes, and it is VERY linear,
suggesting dominantly strike-slip motion



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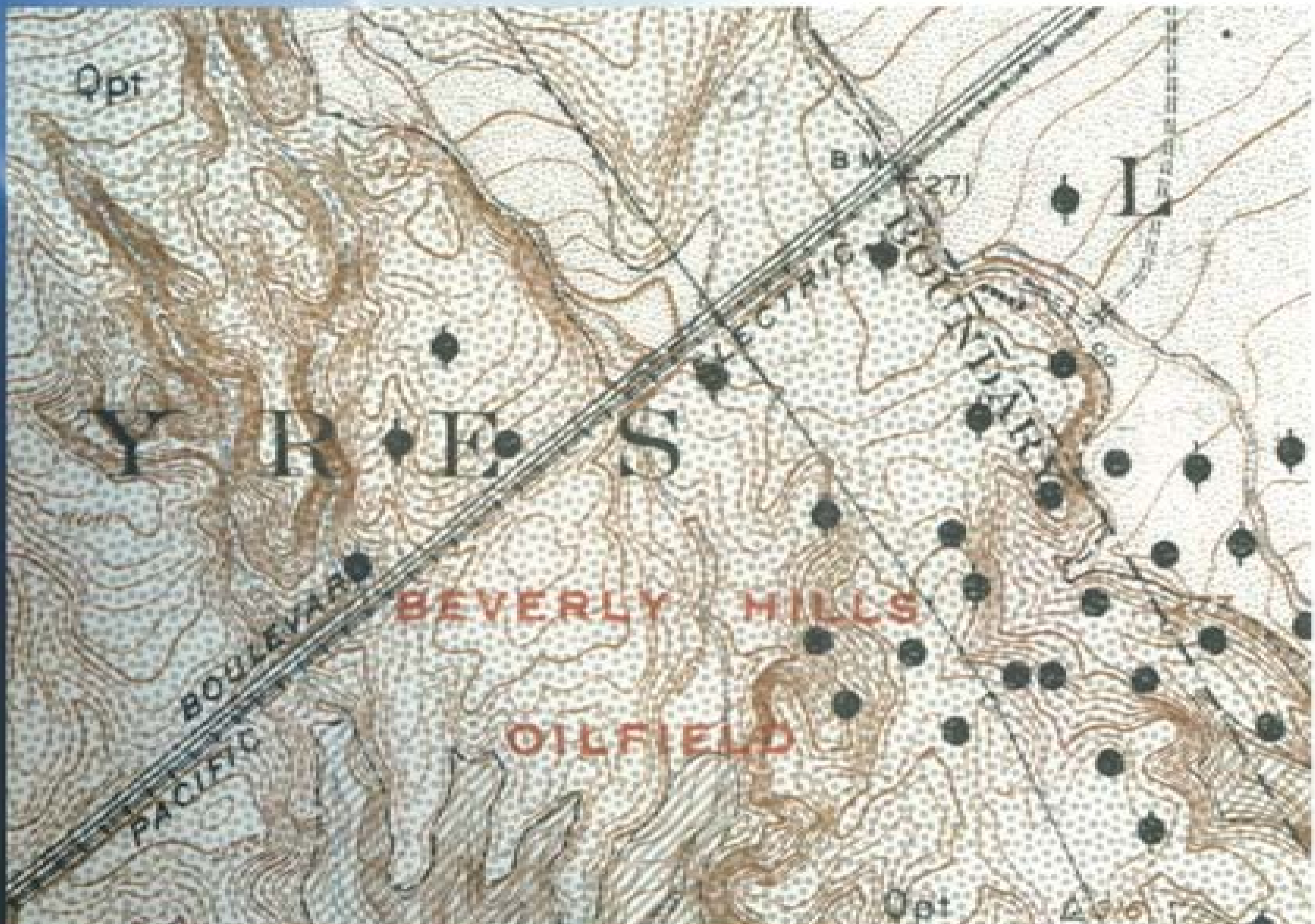
Any well defined fault scarps in the ~40,000 years old terrace surface? = **NO**



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Results of Lineament Analysis

- Straight trend of the Santa Monica Boulevard Lineament suggests **strike-slip displacement** as apposed to dip-slip but not offset drainages **= suggesting inactive**

- No well defined scarps associated with the SMBFZ or proposed WBHL fault zone on the ~40,000 year old terrace surface. **= suggesting inactive**

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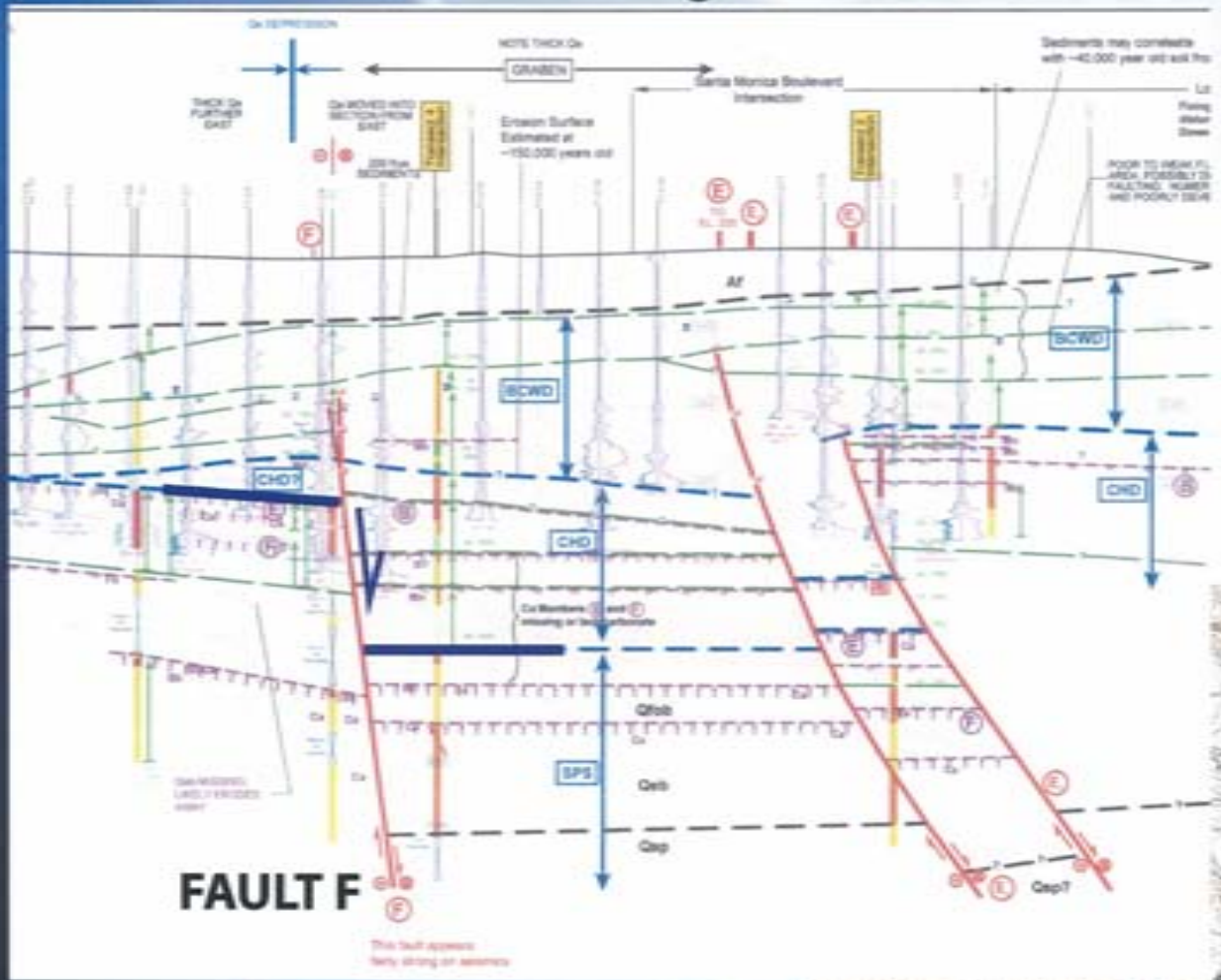
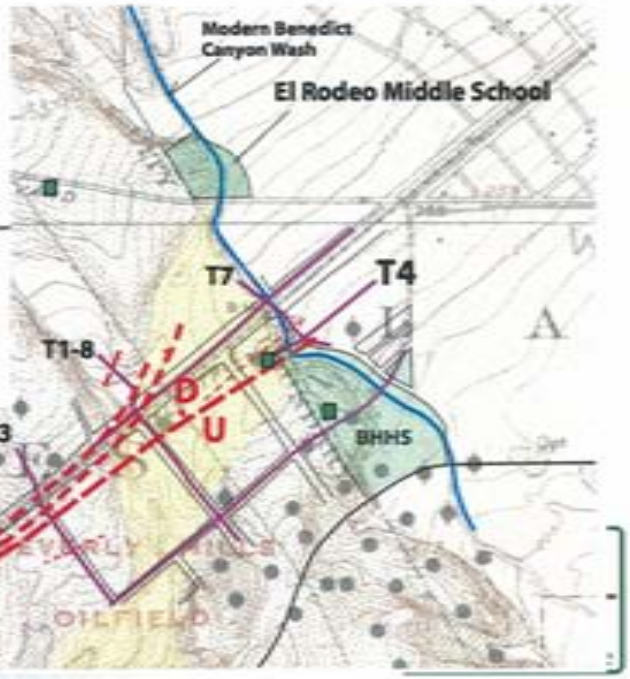
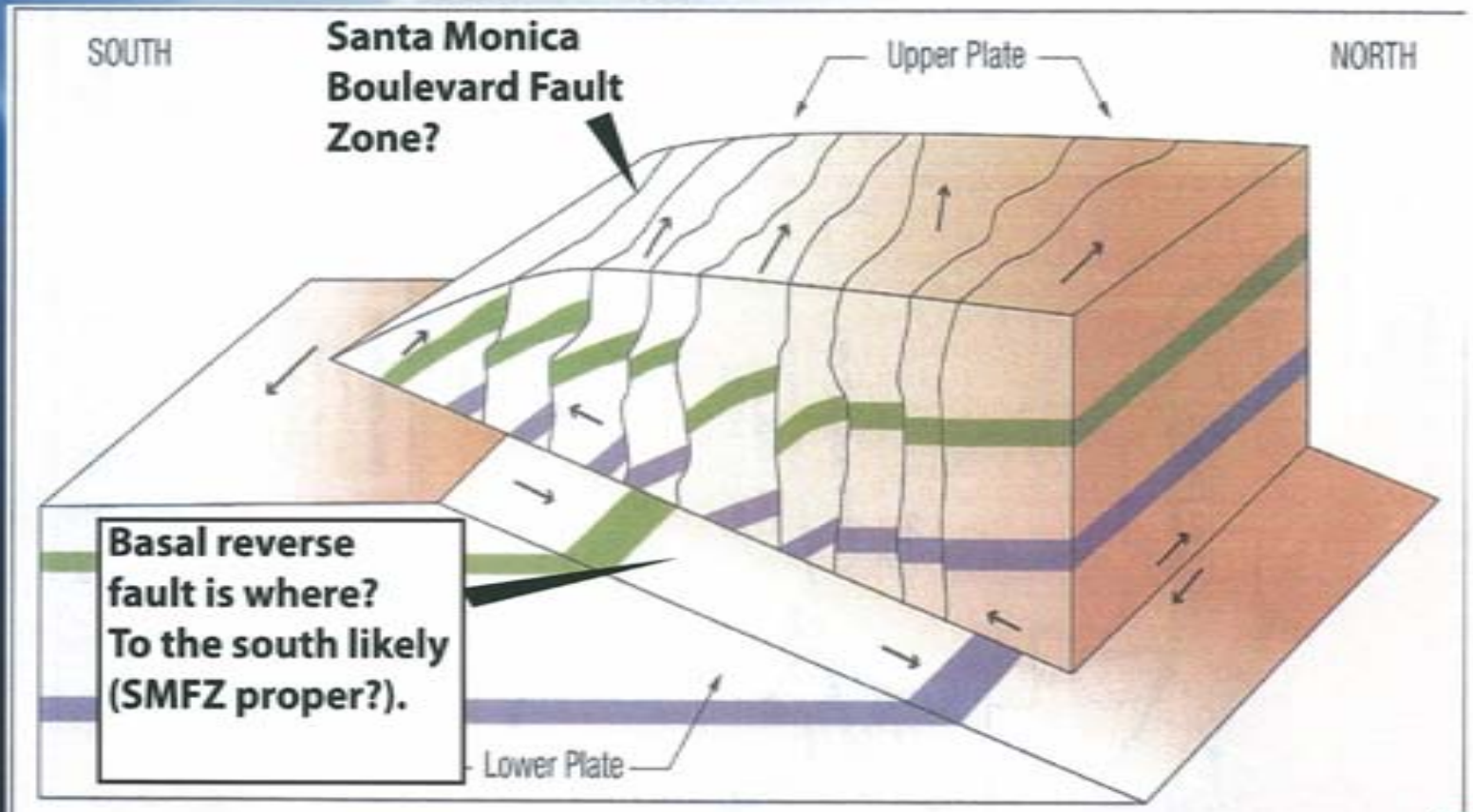
Are the faults along Santa Monica Boulevard inactive?





Is the SMBFZ a "secondary" upper plate fault?



Schematic block diagram of the Santa Monica Fault Zone, an oblique left-lateral reverse fault zone.

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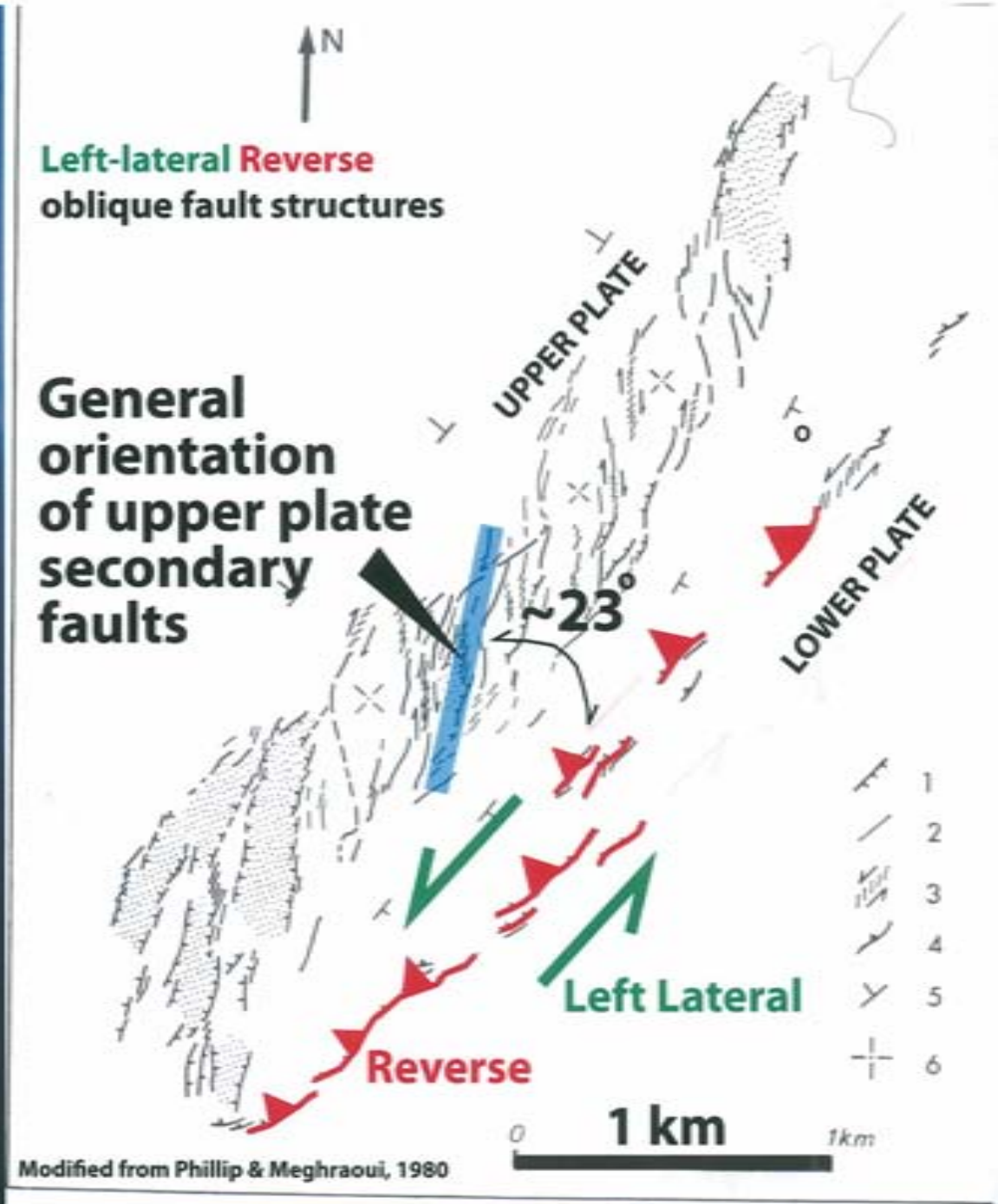

Is the SMBFZ a secondary upper plate fault?

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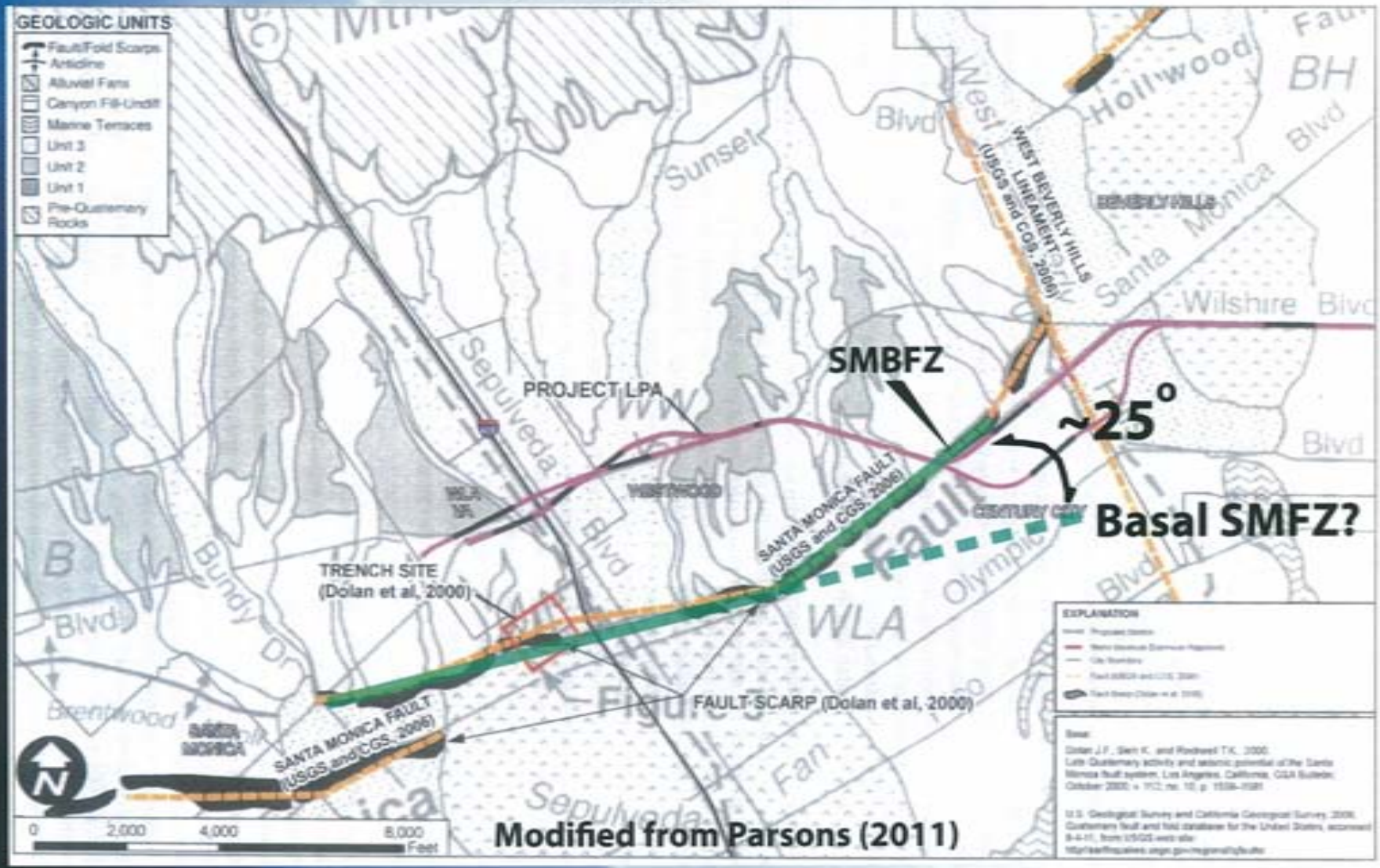
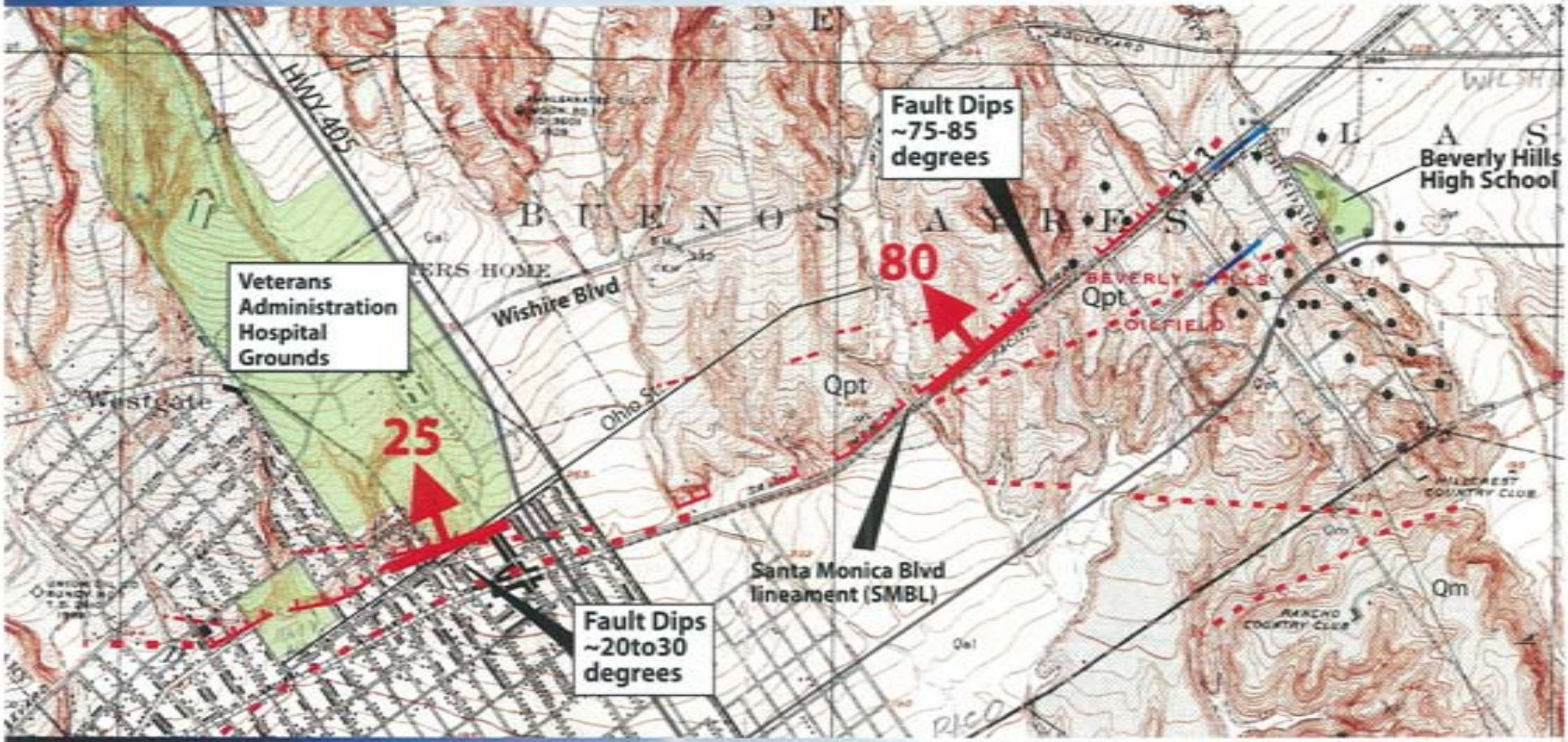
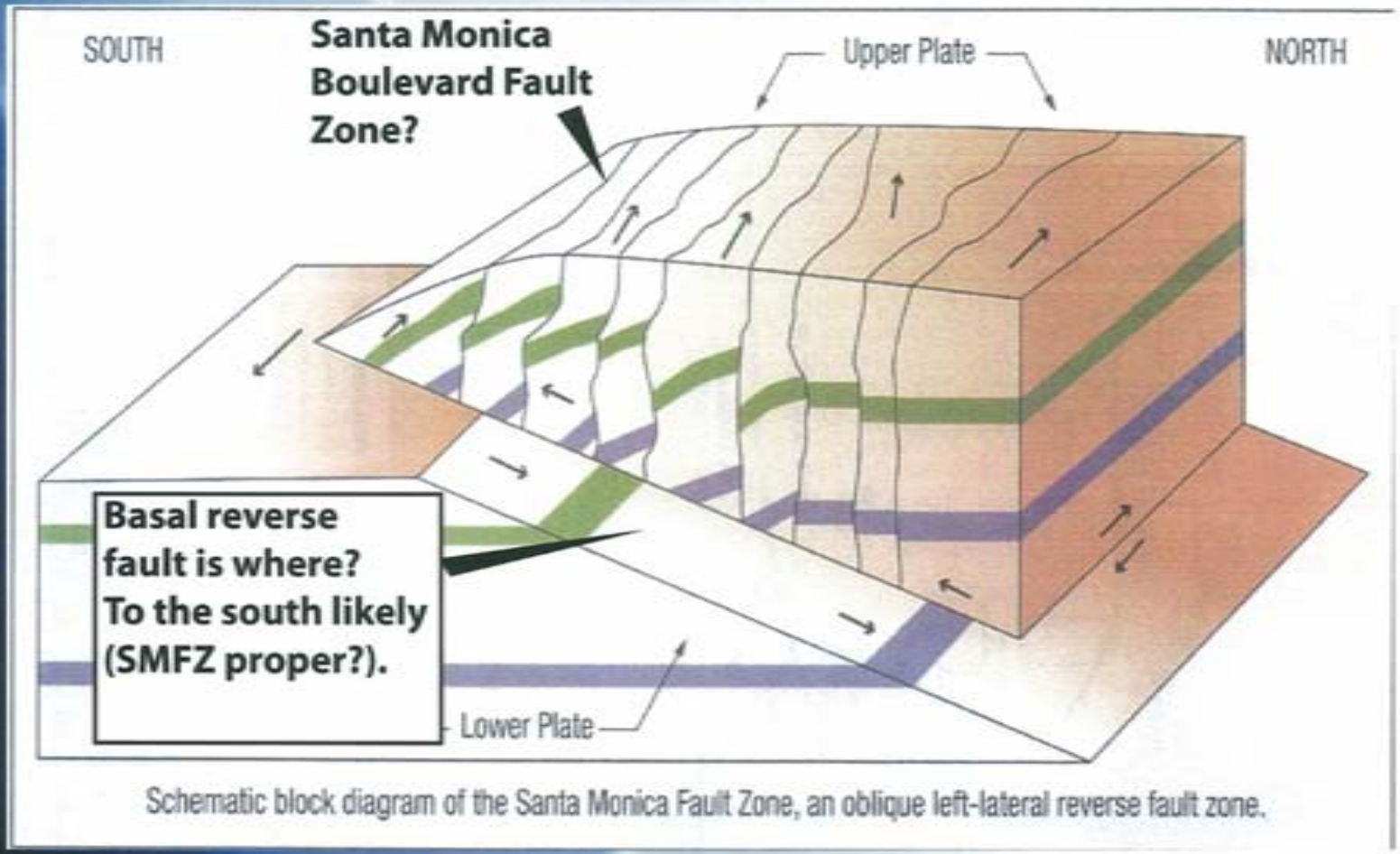
Is the SMBFZ a secondary upper plate fault?



Is the SMBFZ a secondary upper plate fault? - Continued
Lets look dips

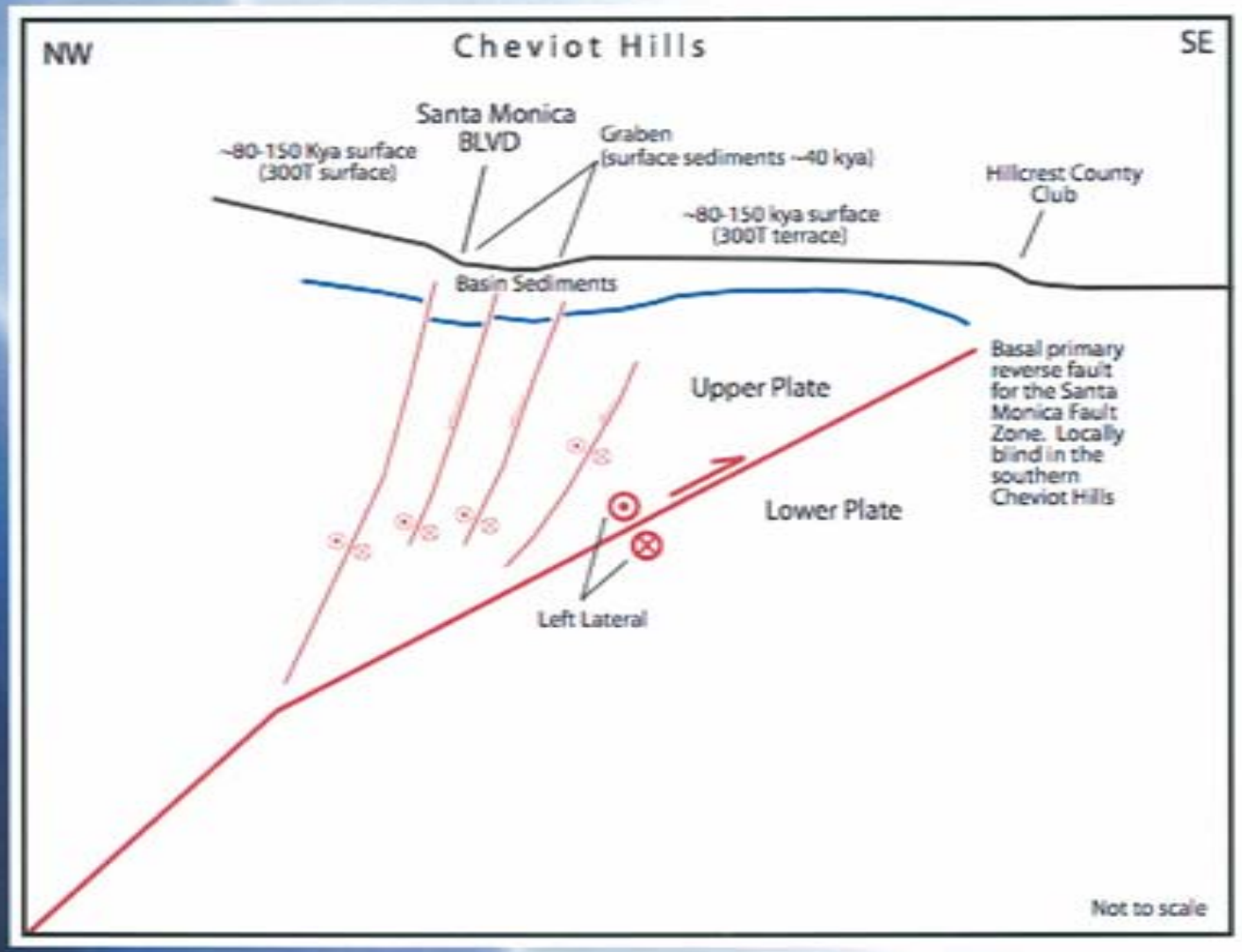


Is the SMBFZ an upper plate fault?



Schematic block diagram of the Santa Monica Fault Zone, an oblique left-lateral reverse fault zone.

Proposed cartoon model of local faulting in the Cheviot Hills



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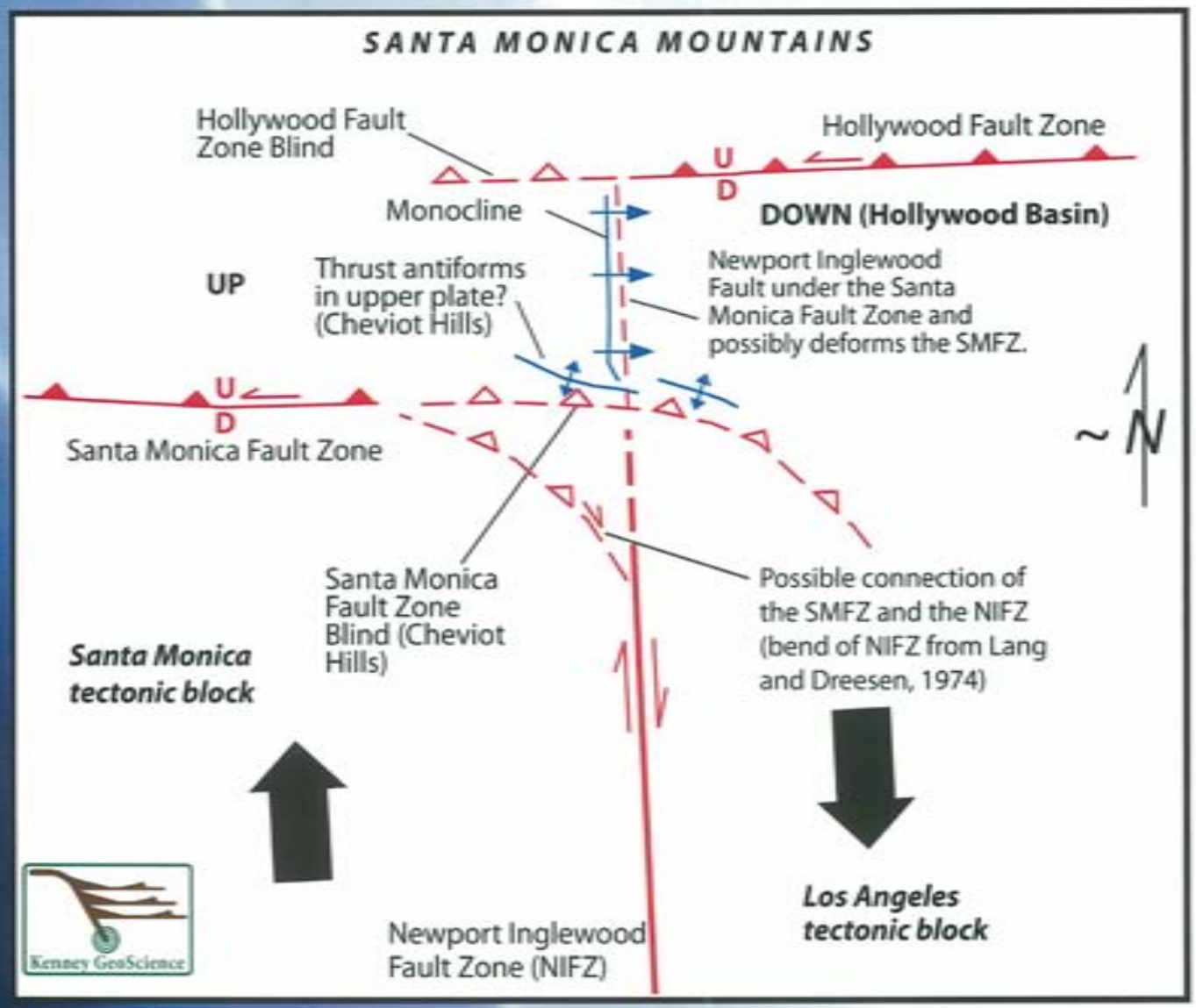
Proposal for Regional Kinematic Model



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Interim Conclusions

Miles Kenney, PhD. PG

- A reasonable re-evaluation of the existing data suggests that faults associated with the West Beverly Hills Lineament (Newport-Inglewood fault zone) do not exist.

- At least one fault identified by Parsons within the WBHL fault zone is likely real, but is considered part of the Santa Monica Boulevard fault zone (strikes more EW compared to NS). Fault F.

- The Santa Monica Boulevard faults likely do exist, but they may be:
  - Dominantly strike-slip normal
  - Secondary upper plate faults to the Santa Monica Fault Zone proper
  - Inactive

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May 21, 2012

Via Hand Delivery

Members of the Metro Board of
Directors
Los Angeles Metropolitan
Transportation Authority
One Gateway Plaza
Los Angeles, CA 90012-2952

Re: **FEIS/EIR on Westside Subway Extension Project**

Dear Honorable Chair and Members of the Metro Board:

At the May 17, 2012 hearing, conducted pursuant to Public Utilities Code Section 30639, the City of Beverly Hills presented compelling expert testimony establishing that the West Beverly Hills Lineament was formed by erosion, not faulting, and that the claimed faults plotted (and replotted) by Parsons Brinckerhoff on the Beverly Hills Lineament and the Santa Monica Fault Zone were either nonexistent or occurred well before the Holocene Period, rendering them likely inactive and irrelevant for the purposes of Alquist-Priolo.

Both the quality and quantity of expert commentary on these issues conclusively demonstrates that further scientific investigation is warranted to confirm the viability of both the Constellation Station and Santa Monica Boulevard Station alternatives from a seismic perspective. This investigation may include both borings and trenching based on site availability, etc. The precise location and testing methodology required can quickly be developed by the scientists given their current familiarity with the site.

The Beverly Hills Unified School District requests the Metro Board defer any further approvals on the Project and immediately convene a meeting of all retained expert geologists who have studied these locations, including geologists from the California Geological Survey,

to formulate a consensus on the appropriate testing protocol necessary to resolve the outstanding pertinent questions.

Very truly yours,

KEVIN H. BROGAN
OF
HILL, FARRER & BURRILL LLP

HFB 1146411.1 B3902002

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May 16, 2017

Tim Buresh, PE
PrimeSource Consulting
5 Singletree Lane
Rolling Hills Estates, CA 90274

Subject: Westside Subway – Century City Station Ridership Forecast

Dear Tim:

Per your request we have reviewed the FEIS/FEIR for the Westside Subway Extention Project and its supporting technical reports. We particularly focused on three reports that establish ridership (boarding) data for the Century City station alternatives.

- **Updated Direct Ridership Forecasting Report, MTA, September 2011, page 18, Table 4-1.**
  This report on page 18, Table 4-1 establishes the difference between Santa Monica and Constellation station sites as less than 1,000 boardings per day (11,230 vs 10,300).
- **Technical Report Summarizing the Results of the Forecasted Alternatives, MTA, March 2012.**
  This report makes two key travel model assumptions. On page 1-4, Table 1-1 the centroid of the traffic analysis zone is assumed to be centered in the block of Santa Monica Boulevard, Avenue of the Stars, Constellation Boulevard, Century Park West. On page 1-5, Table 1-2 the walk access time to the station for the core of Century City uses was estimated to be 3 minutes for Constellation and 8 minutes for Santa Monica. On page 1-6 the walk access time was increased to 13 minutes for the Santa Monica Station alternative. The result was 2035 daily boardings presented on page 1-11, Table 1-5 of 8,566 for Constellation and 5,492 for Santa Monica.
- **Century City Station Location Report, MTA, February 2012.**
  This report restates the boarding data (above) on page 2-17, Table 2-6 and uses it to justify the Constellation Station recommendation.

Based upon our analysis, the ridership difference between the Santa Monica and Constellation station sites would not be as large as reported in the 2012 updated reports (noted above) and would not justify on its own merit the selection of the Constellation station site. Our analysis aligns more closely with the MTA study noted above from September 2011 which indicates that there would be a difference of less than 1,000 daily boarding between stations. Further, because of the extensive auto-oriented development near Constellation (over 21,000 parking spaces within 1,000 feet - more than double the count within 1,000 feet of the Santa Monica station) and the potential for future development sites along Santa Monica Boulevard (including the Robinson May site) the future for transit oriented development is greater for Santa Monica station site.

Relative to the analysis of walking distances to the two Century City station sites, the over estimation of walk access times in the March 2012 report (noted above resulting in a 10 minute walk access penalty for the Santa Monica station site) results in overstated ridership differences between the two station alternatives. This is based on the following facts:

DKS

1. **Walk distance from building front door to station portals for the two stations do not result in a 10 minute penalty.** Measuring the actual walk distance from front door to station portal for sites within a 1,700 foot walk average 1,040 feet for Constellation (with a portal on the NE corner of Constellation/Avenue of the Stars) and 1,120 feet for Santa Monica (with a portal on the SW corner of Santa Monica/Century Park East and one on the SE corner of Santa Monica/Avenue of the Stars). The MTA report is based on a highly generalized centroid location and not actual walk distances for the individual buildings. This roughly 80 foot difference. At roughly 4 feet per second typical walking speeds this is a 20 second difference in access time. The result would be ridership difference similar to the MTA report of September 2011. The 1,700 foot walking distance is equivalent to the researched walk access lengths from the BART 2008 Station Profile Study. The Century City station would be an urban station with primarily non-home trips – station with these characteristics reflect well over 50% (or average) conditions for walk access.

2. **Commute time walk activity can indicate propensity for transit access.** The number of people walking in areas near transit stations can be a back check for ridership potential. Greater levels of pedestrian activity commonly result in higher ridership, lower levels would indicate potential for greater differences. In Century City we counted AM and PM commute pedestrian activity at crosswalks on Santa Monica/Avenue of the Stars, Santa Monica/Century Park East and Constellation/Avenue of the Stars. Near the Santa Monica station site peak hour pedestrian volumes of 100-200 pedestrians were observed. At the Constellation station site pedestrian volumes of 120-230 pedestrians exist. These are very similar, slightly larger at Constellation. This would generally align with the MTA September 2011 findings on ridership (about a 10% difference) rather than the March 2012 56% difference.

3. **Excess parking affects transit oriented development.** The Constellation station site has nearly double the parking spaces within 1,000 feet of the station compared to the Santa Monica station site. This affects transit ridership significantly and even with parking costs, the provision of validated parking can significantly hamper ridership potential. This is extremely important in future transit oriented development. Along Sanata Monica, redevelopment would likely be substantially less auto dependant and more complementary for future transit ridership as compared to the Constellation site. Additionally, the Santa Monica station has several sites where future transit oriented development could readily occur where as for Constellation there is only one readily redevelopable site within 1,000 feet (and it is adjacent to over 21,000 parking spaces even if it does not add a single parking space).

Sincerely,
DKS Associates

Ransford S. McCourt, PE, PTOE
Principal