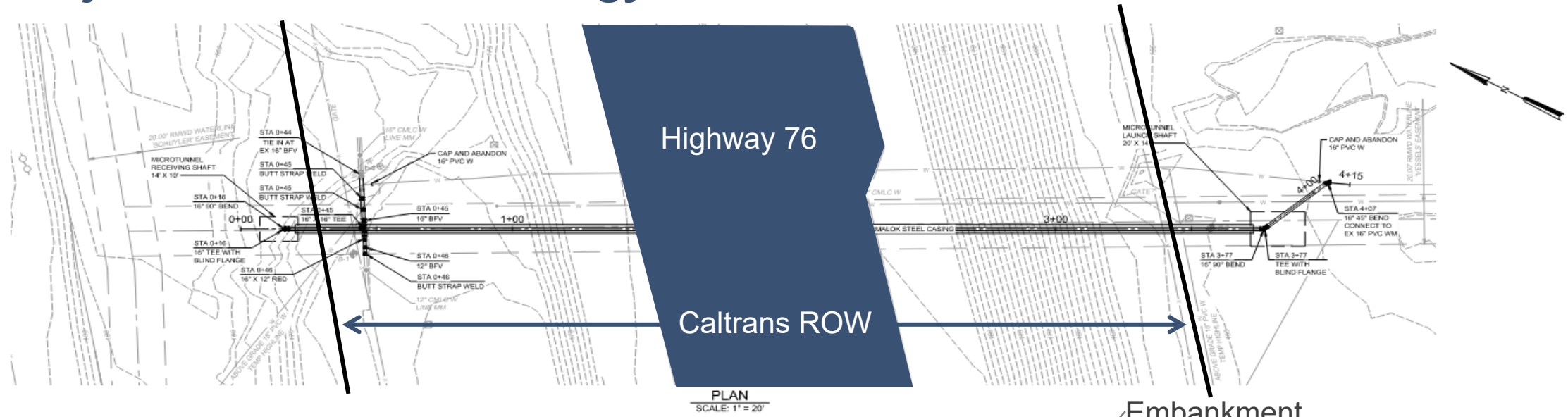


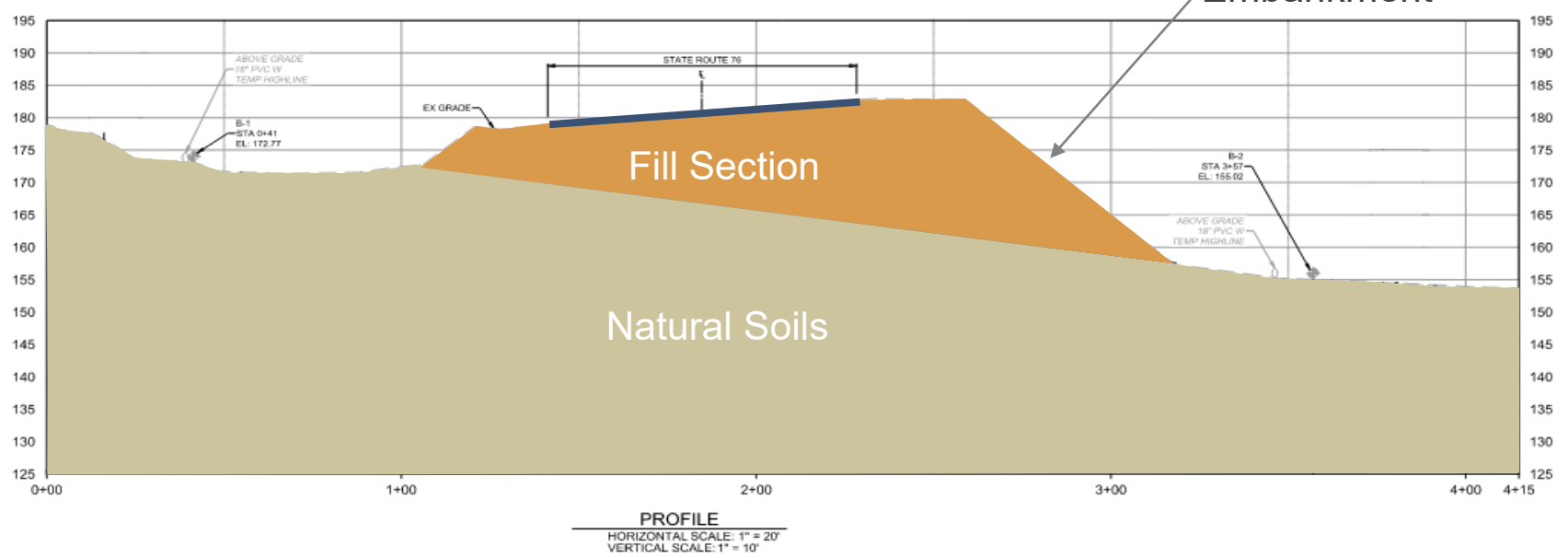
Project Location and Geology



Project Location and Geology



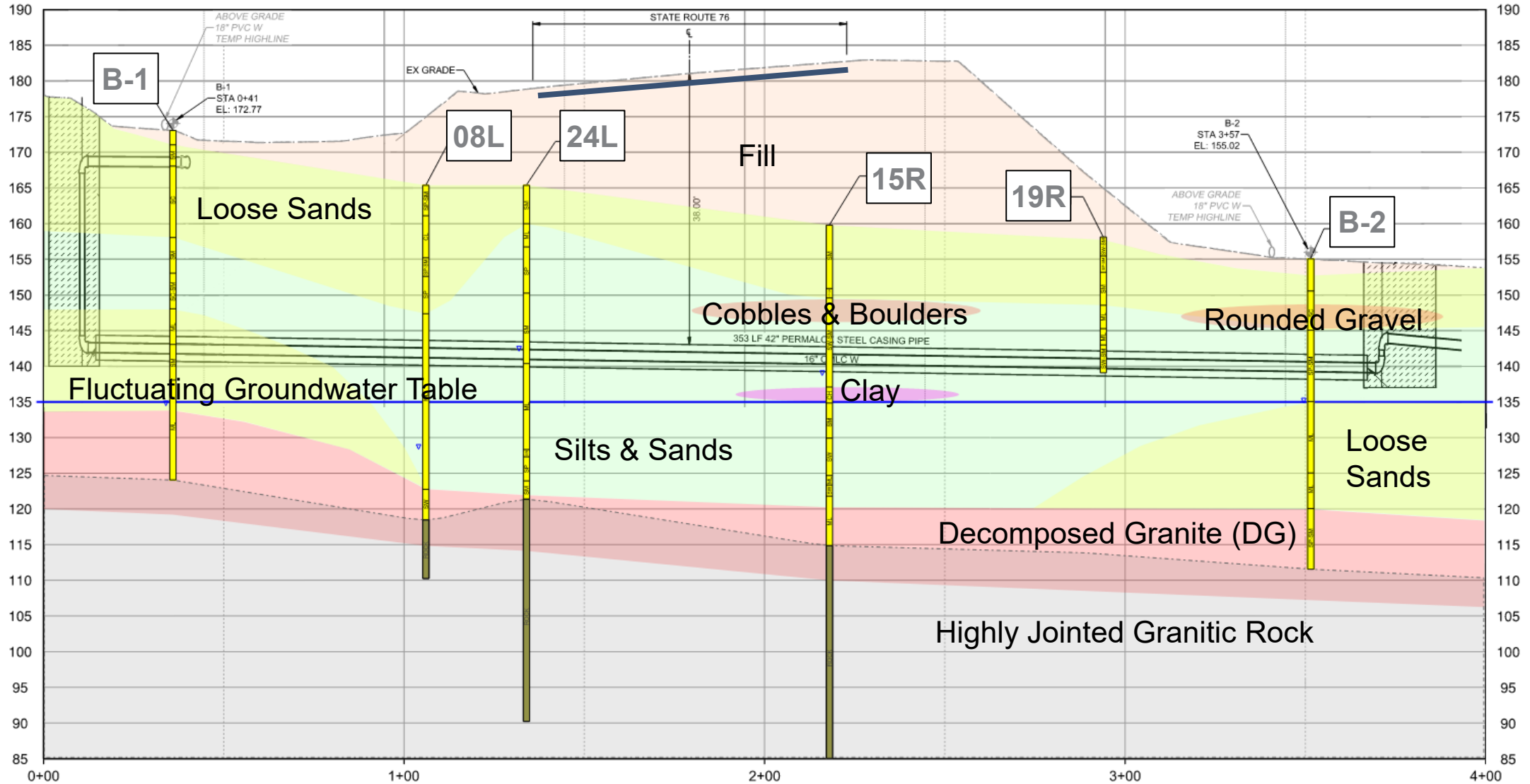
PLAN
SCALE: 1" = 20'



PROFILE
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 10'

Geological Profile

Two Borings Performed at Site (B-1 & B-2) and Four Caltrans Borings (08L, 24L, 15R, 19R)



Geophysical Investigation Challenges

Available Methods

- **Seismic: Seismic Refraction, Seismic Reflection**
- **Electrical: Electrical Resistivity**
- **Magnetic: Magnetometer, GPR**

Geophysical tools work well when:

- sensor arrays can be installed in long uninterrupted lengths;
- Ground conditions transition from the surface down in distinct layers from loose to dense (seismic/resistivity shadow zones)
- Area of interest is shallow;
- Area of interest is above the groundwater level.

Line
N-N

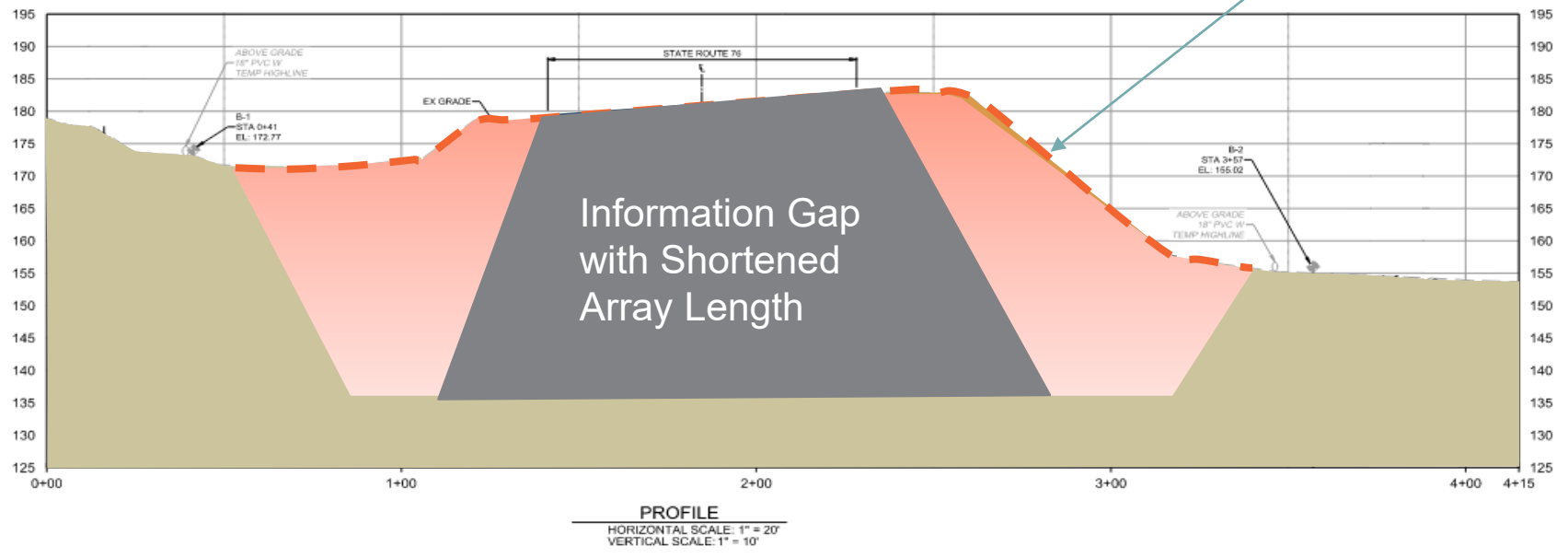
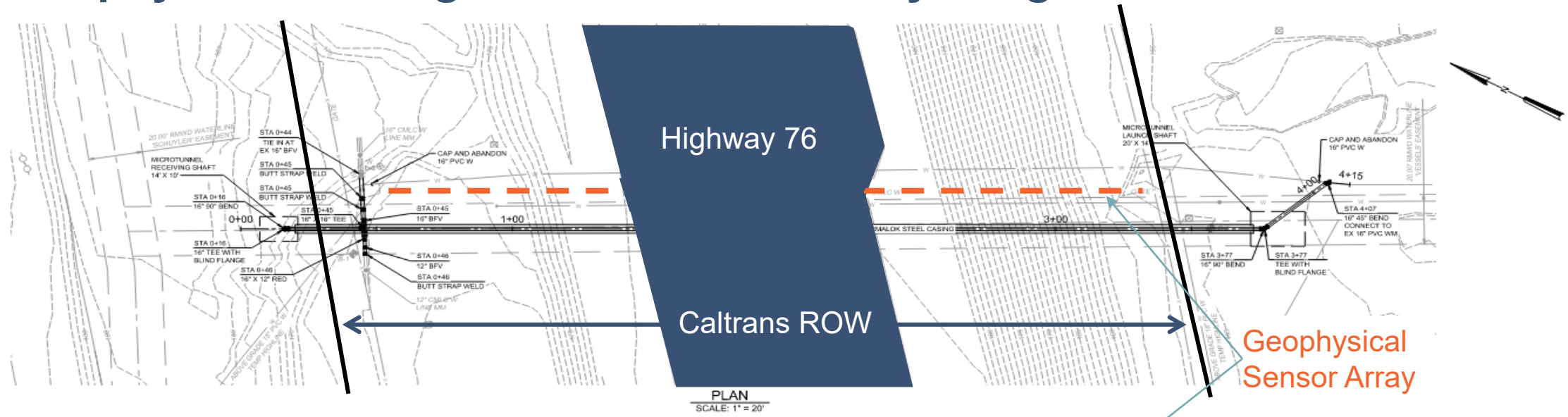
N/A

N/A

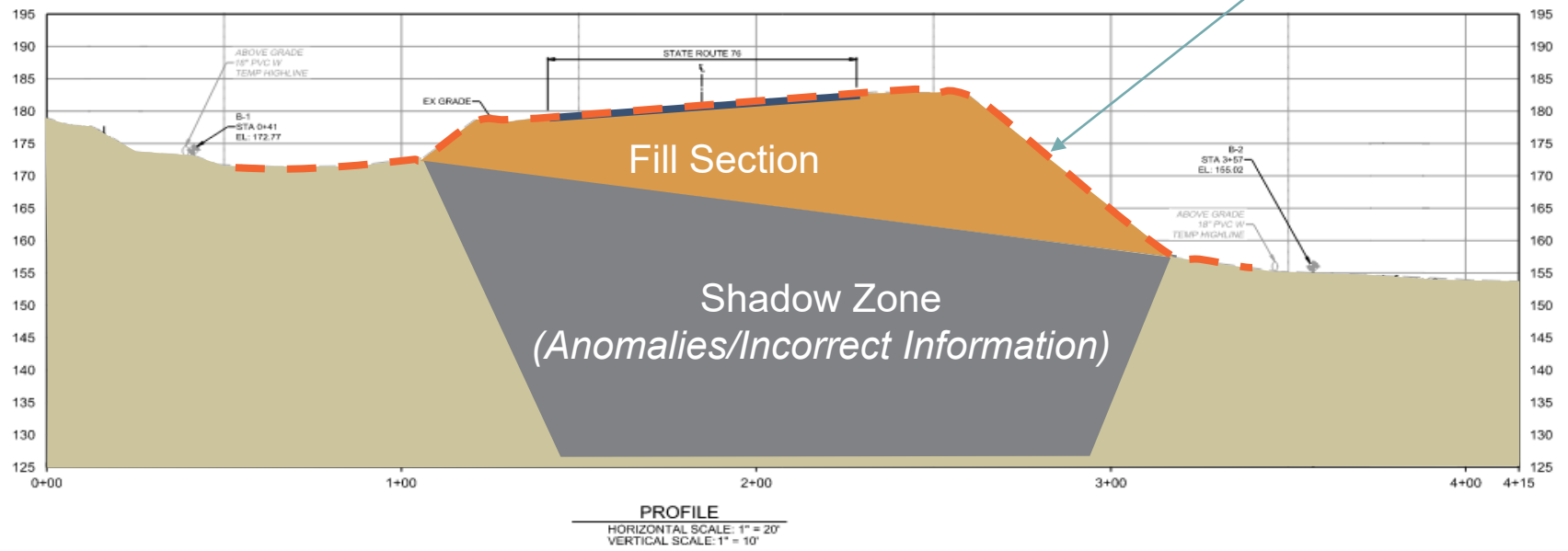
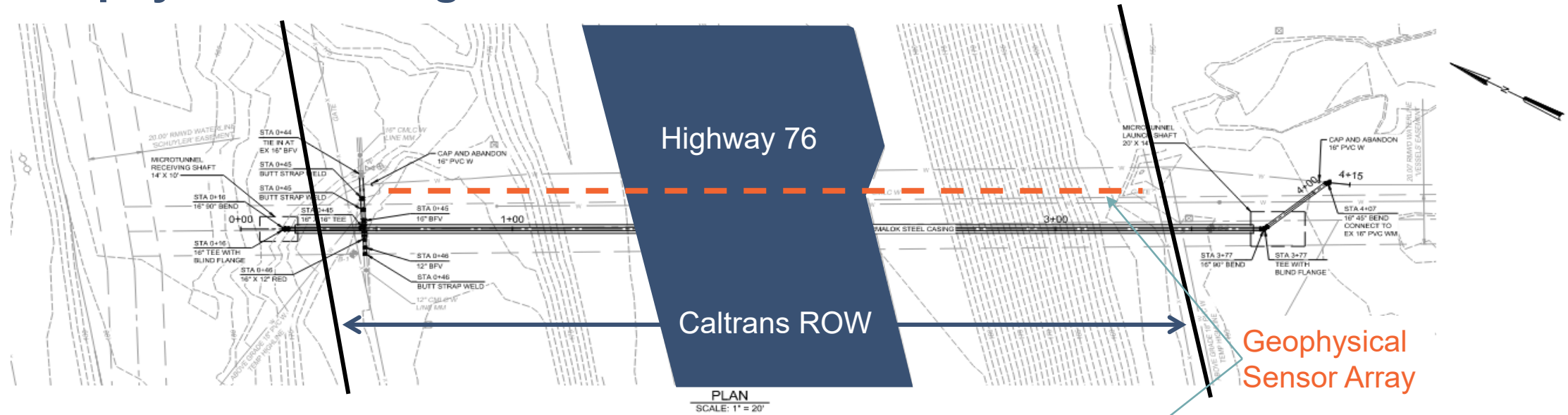
N/A

?

Geophysical Investigation Methods – Array Length

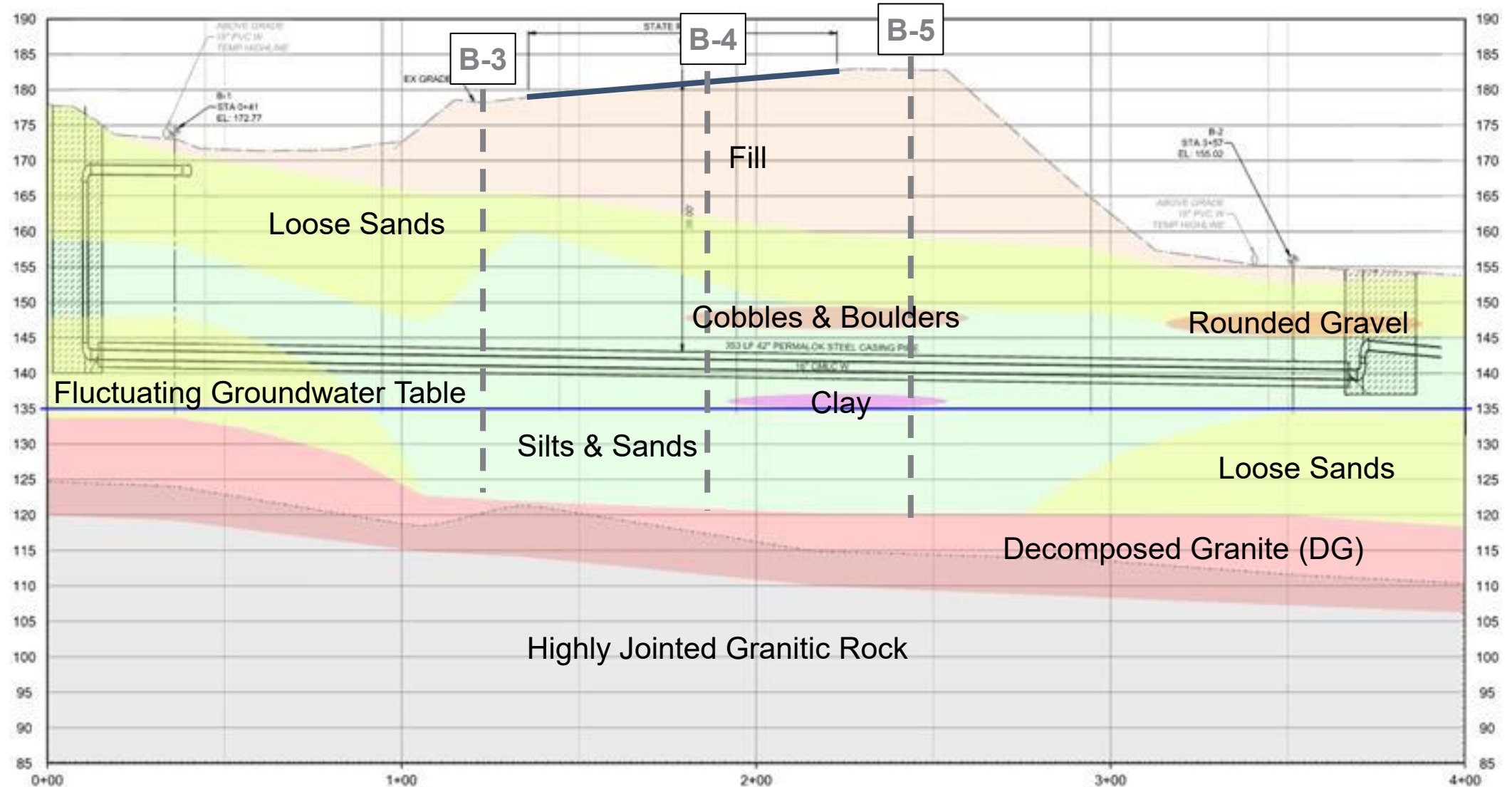


Geophysical Investigation Methods – Shadow Zones



Geological Profile and Additional Investigation Options (Data Confirmation)

Additional Investigation In and Near Traffic Corridor Requires Caltrans Permit



Ground Risk

Legend

Eliminates Risk:

Mitigates Risk:

Risk Unmitigated:

Highly Variable Ground

Fill

Alluvium

- Loose Fine Sands
- Soft Coarse Silts
- Rounded Gravel
- Boulders

Rock

- Decomposed Granite
- Highly Jointed Granitic Rock

Subsurface Conditions

High Groundwater

Running/Flowing Ground Behavior

Highly Permeable Rock (Fluid Loss)

Tunnel Methods

HDD (Eliminated)

Auger Boring

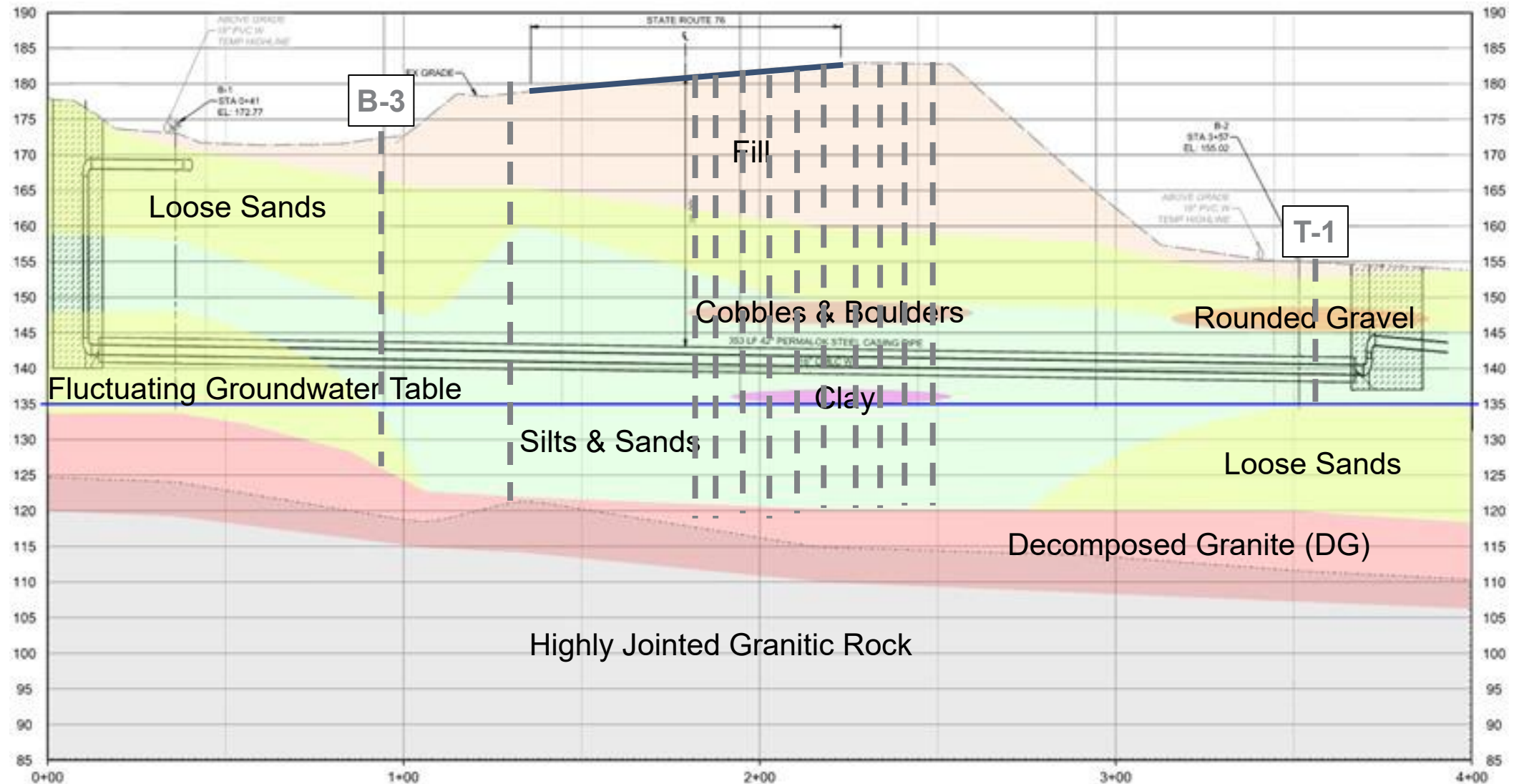
- Jack and Bore
- Pilot Tube

Microtunneling

		Tunnel Elev	Auger Boring	Micro-tunneling
1	Hazard: Settlement of Road Structure (2"- 4") Cause: Loose Fine Sands Ground Loss from Running/Flowing Behavior	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Hazard: Uncontrollable Groundwater Inflow Cause: High Groundwater Pressure Hydraulically connected to San Luis Rey River	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Hazard: Sink Hole in Highway Cause: Rounded Gravel Ground Loss from Running/Flowing Behavior	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4	Hazard: Highway Embankment Failure Cause: Fill Section Material Underlain by Easily Consolidating Sands	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	Hazard: Work Stoppage/Obstruction Cause: Boulders Obstruction Potential (>24")	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Hazard: Work Stoppage/Hydrolock Cause: Jointed/Decomposed Rock Casing Friction Locked due to Loss of Slurry/ Loss of Cutting Annular	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Alternative Investigation Option (Expedited)

Proposed Alternative Investigation which can be performed without Caltrans Permit



Questions