Award # 04HQGR0006

TITLE: COLLABORATIVE RESEARCH WITH BOISE STATE UNIVERSITY AND OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES, EAST BANK FAULT GEOPHYSICAL CHARACTERIZATION INVESTIGATION, PORTLAND, OREGON

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Abstract

The East Bank fault is one of several NW-trending faults that traverse the Portland, Oregon metropolitan area. The fault was originally identified on the basis of stratigraphic offsets inferred from water well logs, and was later imaged by regional aeromagnetic mapping. This project sought to directly image the fault through detailed surface magnetic profiles and seismic reflection profiles at two locations in Portland.

The Oregon Department of Geology and Mineral Industries (DOGAMI) was responsible for site selection and permitting, logistical support for the geophysical studies and construction of geologic sections along the geophysical sections. Geophysical data collection and interpretation were the responsibility of Boise State University, and those results are presented in their final technical report.

We were able to successfully permit two transects across the purported location of the East Bank Fault, one on Union Pacific Railroad property, one on City of Portland property. Data collection proceeded successfully on both transects.

Geologic cross sections were constructed along both transects using all available locatable water well and engineering boring logs. In both instances, the sections show plausible offsets of Pliocene Troutdale Formation strata, and possible offset of the contact between the Troutdale Formation and latest Pleistocene-Holocene Missoula Flood deposits. Sparse well coverage , coupled with the irregularity of the contact between Troutdale and Missoula flood deposits limits the resolution of potential deformation.

Investigations undertaken

The goal of this project was to geophysically image the East Bank Fault in the Portland area. The fault is buried beneath Quaternary deposits, and is only known from stratigraphic offsets implied by borehole logs and aeromagnetic anomalies. One equivocal seismic reflection image was collected by Pratt and others (2001) (Figure 1). In our proposal we selected several possible sites for collecting seismic profiles (Figure 1) where we believed we could collect reasonably high quality data. Tasks in this collaborative proposal were divided, with geologic site characterization, permitting and logistics falling to DOGAMI, and seismic data collection processing and analysis carried out by Boise State University. Therefore this report will not include any seismic reflection results, which can be found in the companion Final Technical Report by Boise Sate University.

We were able to obtain permission to collect two seismic lines, one along the Union Pacific Railway right of way parallel to Interstate 84 (Figures 1, 2) and a second along a City of Portland pathway in Peninsula Park (Figures 1, 3).

Permitting for the Union Pacific line was complex and expensive, due to insurance requirements, but was ultimately successful, and we occupied the site for a single day (September 3). Union Pacific rules required that we pay for a flagger while on the right of way, and the cost (ca $900/day) precluded a second days occupation of the site. We were able to collect data over a line length of 800m. Data collection conditions were difficult along the Sullivan Gulch line, the gravel road (Figure 4) in which we operated made geophone placement difficult, train traffic periodically shut down data collection, and freeway noise was constant.

Permitting for the Peninsula Park line with the City of Portland was simple and free. We occupied the site on September 4 and 5, and collected 1700m of line. Data collection conditions at Peninsula Park were generally good (Figure 5) with easy geophone placement in native soils, and vehicular traffic only at a few cross streets. We also collected borehole data adjacent to the lines to provide geologic control of the imaged horizons.

Water well and engineering borings were located around each of the lines to provide geologic references for the seismic images. Wells were selected by examining images of logs available online at the Oregon Water Resources Department, and were located using address, tax lot or location map information from the images. Cross sections were then constructed along the seismic lines, and are shown in Figures 6 and 7.

At Sullivans Gulch (Figure 6), the geologic section consists of artificial fill over Missoula Flood silt and sand, over Missoula Flood gravel, over Pliocene Troutdale Formation conglomerate over Troutdale Formation mudstone. Few wells penetrated the mudstone, but based on the limited data, an east-side up offset of as much as 100 m of the top of the mudstone is plausible. It is very difficult to discern the contact between Troutdale conglomerate and Missoula Flood gravels in drillers logs, so the graphic logs of the wells show both units, but no contact was drawn. The base of the Missoula Flood silt and sand shows an apparent warp across the proposed fault location, but this surface is notoriously irregular, and the wells are projected from some distance, so this is likely an artifact.

At Peninsula Park the section is the same, but none of the wells penetrate the top of the Troutdale mudstone. The top of the Troutdale/Missoula Flood grave along this section appears to be slightly warped across the proposed fault location, and there is a plausible offset of about 50 m on the top of the Troutdale conglomerate.

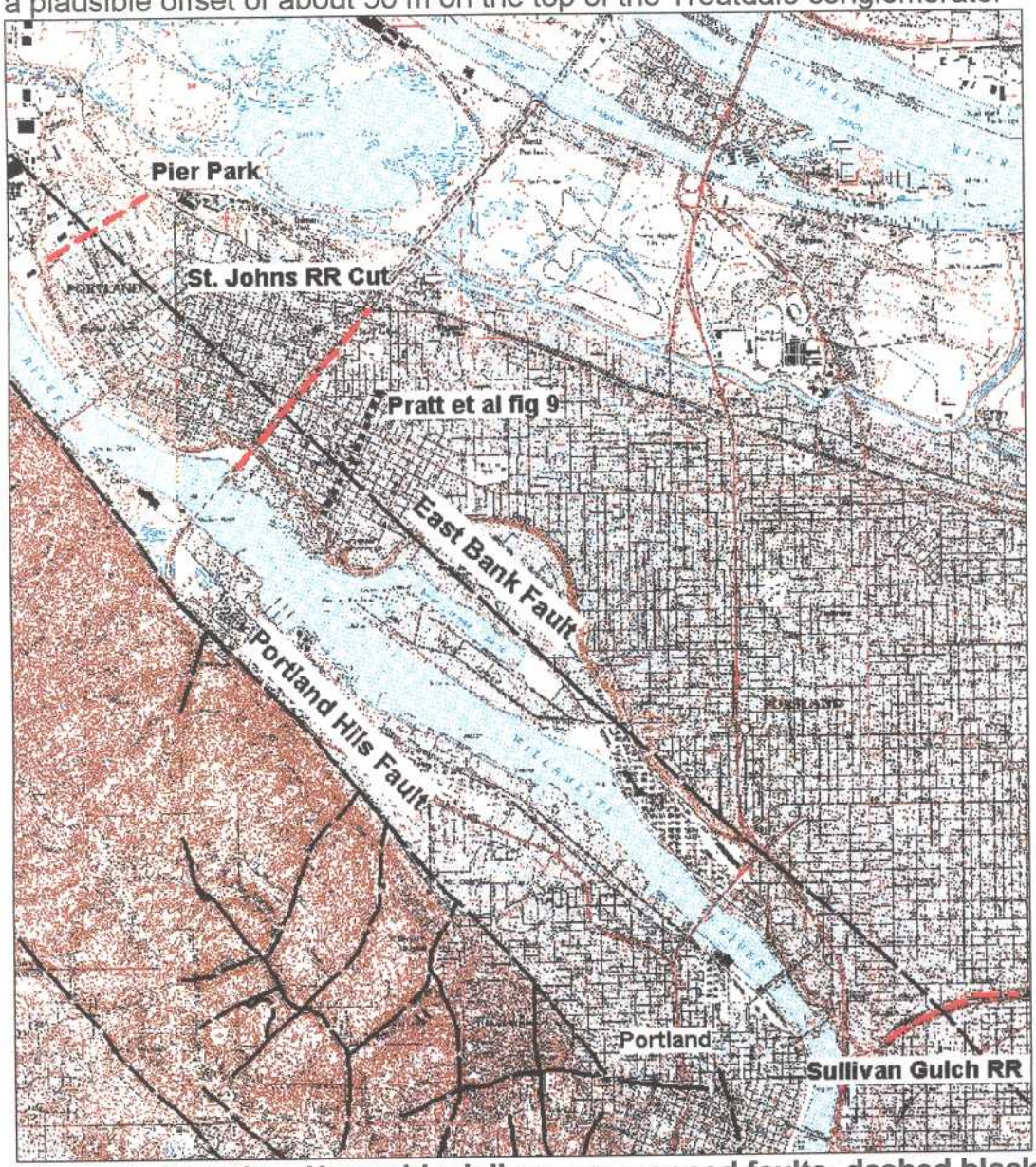


Figure 1. Location. Heavy black lines are mapped faults, dashed black line is seimic profile of Pratt and others, 2001, red dashed lines are proposed seicmi profile locations.

Figure 2. Sullivan Gulch Line. Detailed location of 800m long line collected along Union Pacific rail line

Figure 3. Peninsula Park Line. 1700 m long line collected along pathway in City Park SE of St. Johns railroad cut of Figure 1.

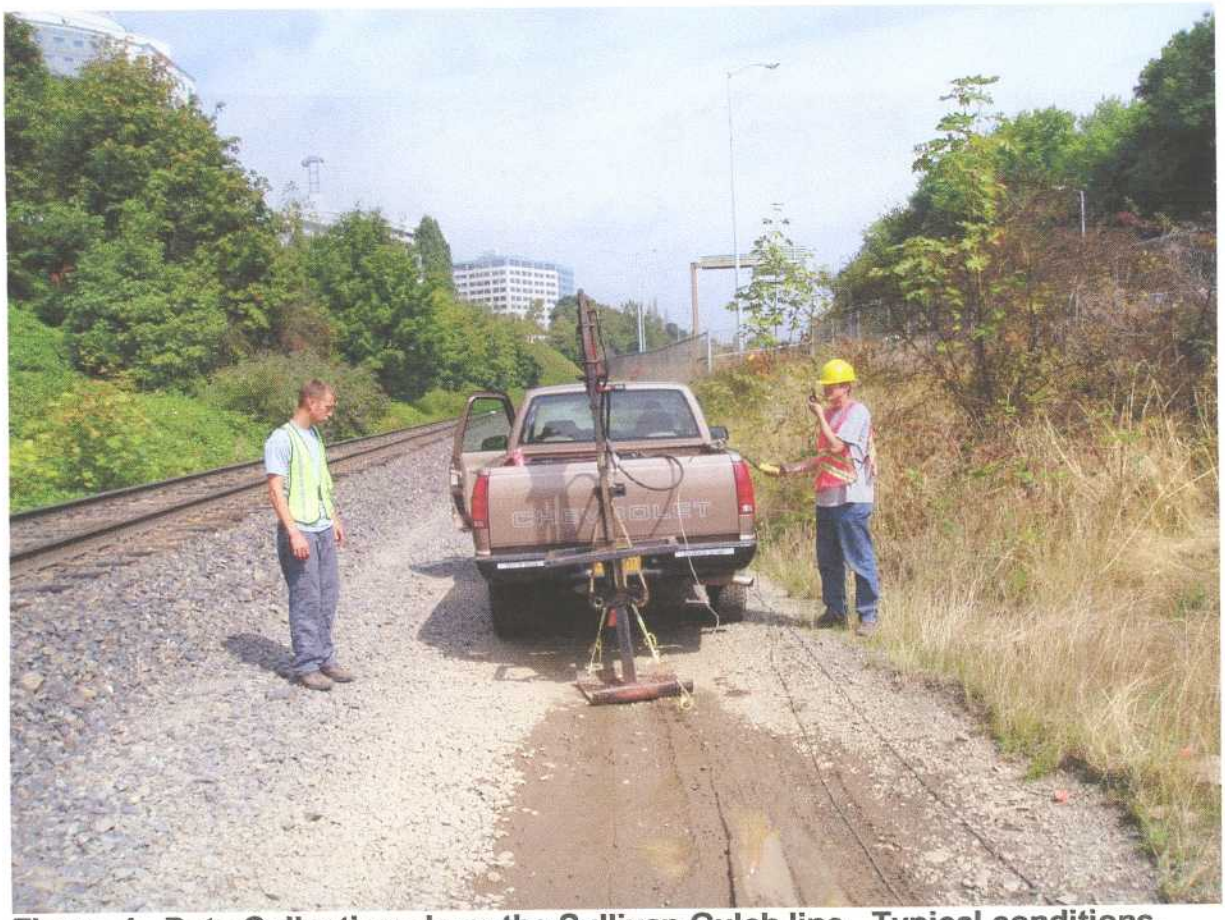
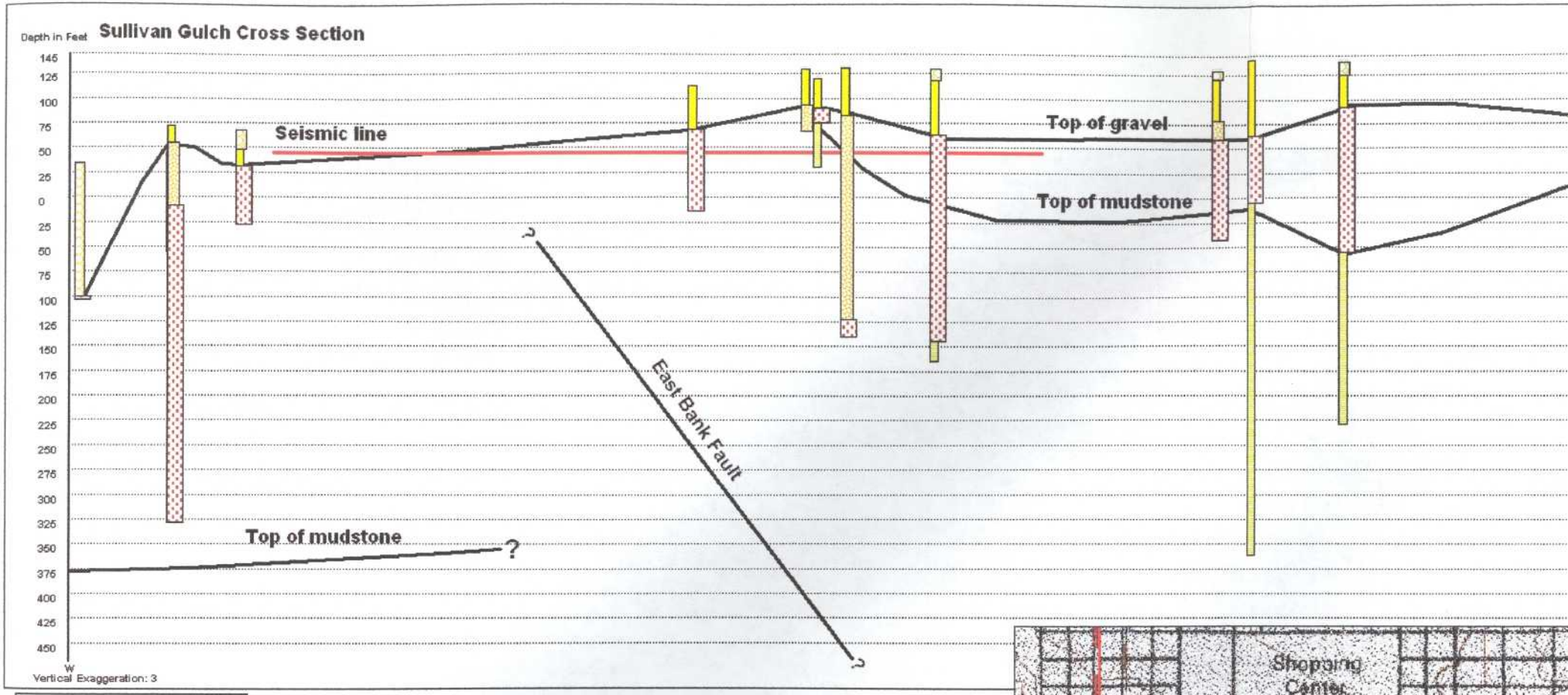


Figure 4. Data Collection along the Sullivan Gulch line. Typical conditions, operating on a gravel roadway with railroad tracks to one side, six-lane Interstate Highway on the other.

Figure 5. Data collection along the Peninsula Park Line. Typical conditions, operating in native soils along a paved bike path.

References

Pratt, T.L., Odum, J., Stephenson, W., Williams, R., Dadisman, S., Holmes, M., and Haug, B., 2001, Late Pleistocene and Holocene tectonics of the Portland Basin, Oregon and Washington, from high-resolution seismic profiling; Bulletin of the Seismological Society of America, v. 91, p. 637-650.



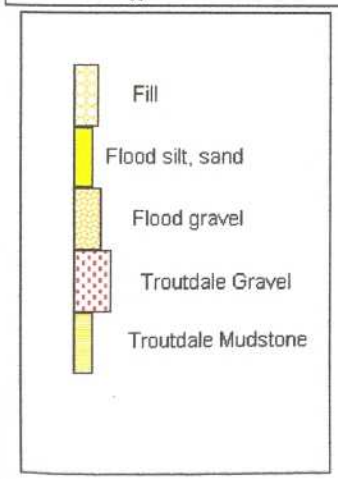


Figure 6. Sullivan's Gulch cross section. Inset to right shows seismic line in red, located borings as blue diamonds.

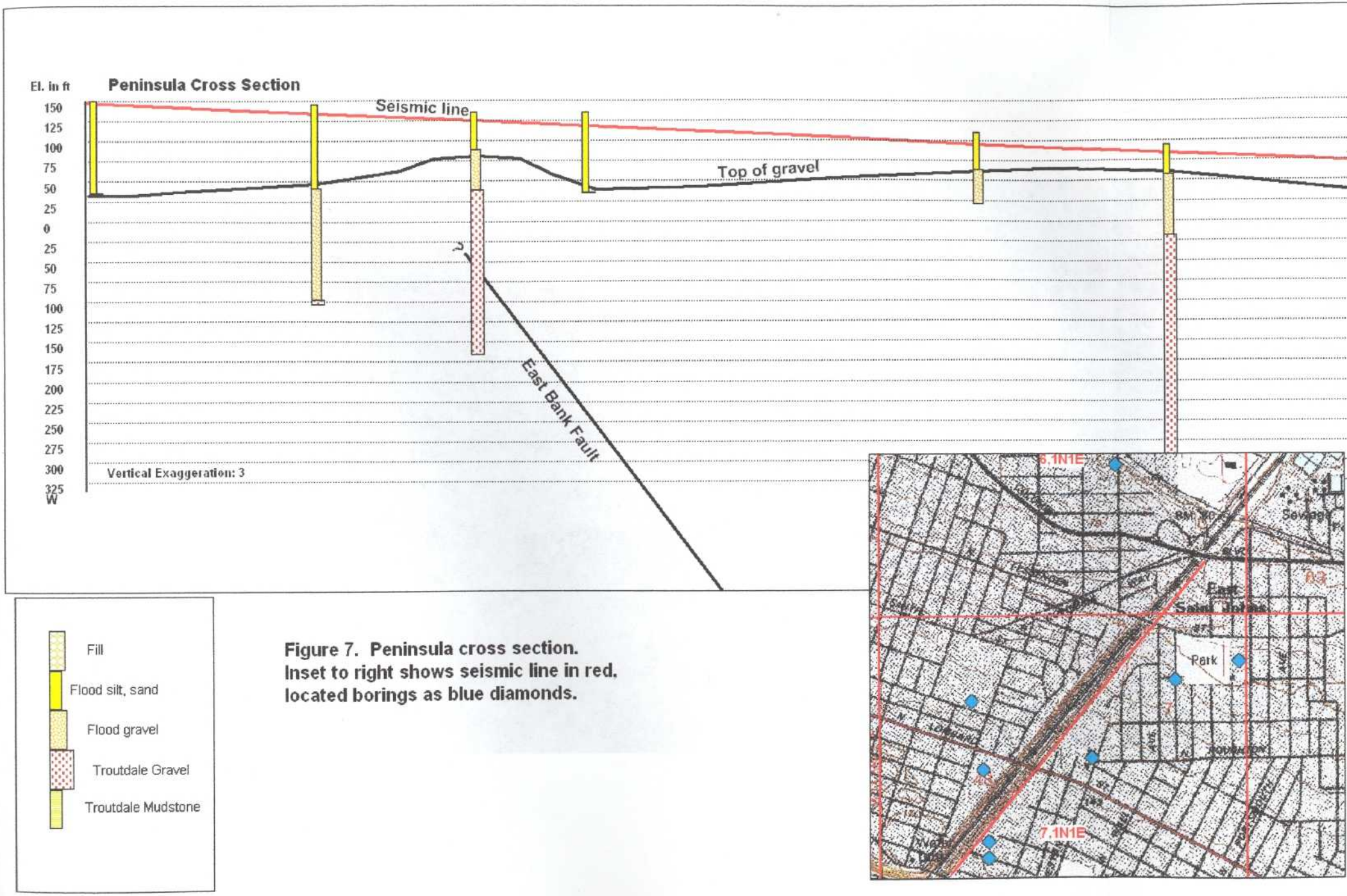


Figure 7. Peninsula cross section. Inset to right shows seismic line in red. located borings as blue diamonds.