SUPPLEMENTAL DATA

ASCE *Journal of Geotechnical and Geoenvironmental Engineering*

Application of MLR Procedure for Prediction of Liquefaction-Induced Lateral Spread Displacement

T. Leslie Youd

DOI: 10.1061/(ASCE)GT.1943-5606.0001860

www.ascelibrary.org

San Fernando Juvenile Hall Lateral Spread

T. Leslie Youd, Dist. M ASCE

The San Fernando juvenile Hall (SFJH) lateral spread, the first I investigated, illustrates typical spread effects and damage (Youd, 1971). During the 1971 San Fernando earthquake (M = 6.6), a lateral spread formed between a group of open fissures about 200 m above the northern wall of SFJH and the east bank of the Upper Van Norman Reservoir some 1.25 km downslope (Fig. S1). The ground slope from the head of the lateral spread to the reservoir bank was 1.2%; between San Fernando Road and I-5 (Golden State Freeway), the slope was 0.8%. Horizontal displacement within the lateral spread (measured by Youd 1973) increased from zero at the upper margin to a maximum of 1.7 m at San Fernando Road (Fig. S2). Along the axis of the spread, between San Fernando Road and the eastern bank of a 2.4-m-deep flood control channel west of I-5, average displacement was 1.5 m. At the west bank of the flood control channel, lateral displacement was about 0.2 m westward, indicating that as much as 1.3 m of the lateral spread displacement was absorbed by compression of the flood control channel. This compression disrupted the concrete lining and visibly offset the east bank (Fig. S3). The bottom of the channel also heaved upward as much as 0.6 m. Thus, the flood control channel acted as a partial toe for the lateral spread. Lateral displacements increased westward across the Sylmar Converter Station from 0.2 m at the east fence (adjacent to the flood control channel) to 0.7 m at the west fence near the east bank of the reservoir.

Figure S4 is an aerial photo of SFJH with annotation marking localities of significant damage. Figure S5 is a photo of a collapsed building that housed a court facility. Fissures and distorted ground in front of the collapse continued beneath the building and were caused by differential lateral displacement near the western margin of the lateral spread. In this instance, the right end of the building displaced about 0.9 m (toward the camera) relative to the left end which remained nearly in place. The shear deformation fractured the concrete floor slab and distorted building columns, causing the structure to collapse. Because the earthquake occurred at 6:00 am, that building was unoccupied and no deaths or injuries occurred. No deaths and only a few minor injuries occurred within SFJH.

Figure S6 is a view of the interior of a building, in the central part of SFJH, pulled apart by about 0.5 m of extensional ground displacement. No rebar is exposed in the fractured concrete indicating the slab was unreinforced. The building was sufficiently flexible, however to absorb the floor and building disturbance without collapse. A worker seated at a nearby desk as the floor fractured was mightily frightened but uninjured.

Figure S7 shows a segment of wall surrounding SFJH that was pulled apart due to extensional displacement near the head of the spread. About 50 inmates from the facility escaped through the wall opening shortly after the earthquake, requiring security officers to round up the escaped juveniles.

Figure S8 is an aerial view of damage in front of SFJH where the lateral spread displacement ruptured a trunk pipeline transporting natural gas into the San Fernando Valley. The pipeline ruptured at two adjacent localities, where escaping gas blew out craters in the soil above the pipe. Fortunately, the gas did not ignite so damage was limited to ruptured pipe, loss of gas, and unwanted craters in a parking area.

South of the railroad tracks (also distorted by the lateral spread), and across San Fernando Road, lateral spread ruptured a 200-mm-diameter waterline causing local flooding. Historically, lateral spread has been a major cause of pipeline damage during earthquakes.

References

Youd, T.L., 1971, "Landsliding in the vicinity of the Van Norman Lakes," The San Fernando, California, Earthquake of February 9, l971, U.S. Geological Survey *Prof. Paper* 733, p. 105-109.

Youd, T.L., 1973, "Ground movements in Van Norman Lake Vicinity during San Fernando, California, Earthquake of February 9, l971," *The San Fernando, California earthquake of February 9, 1971*, U.S. Dept. of Commerce, National Oceanographic and Atmospheric Administration, v. 3, p. 197-203.

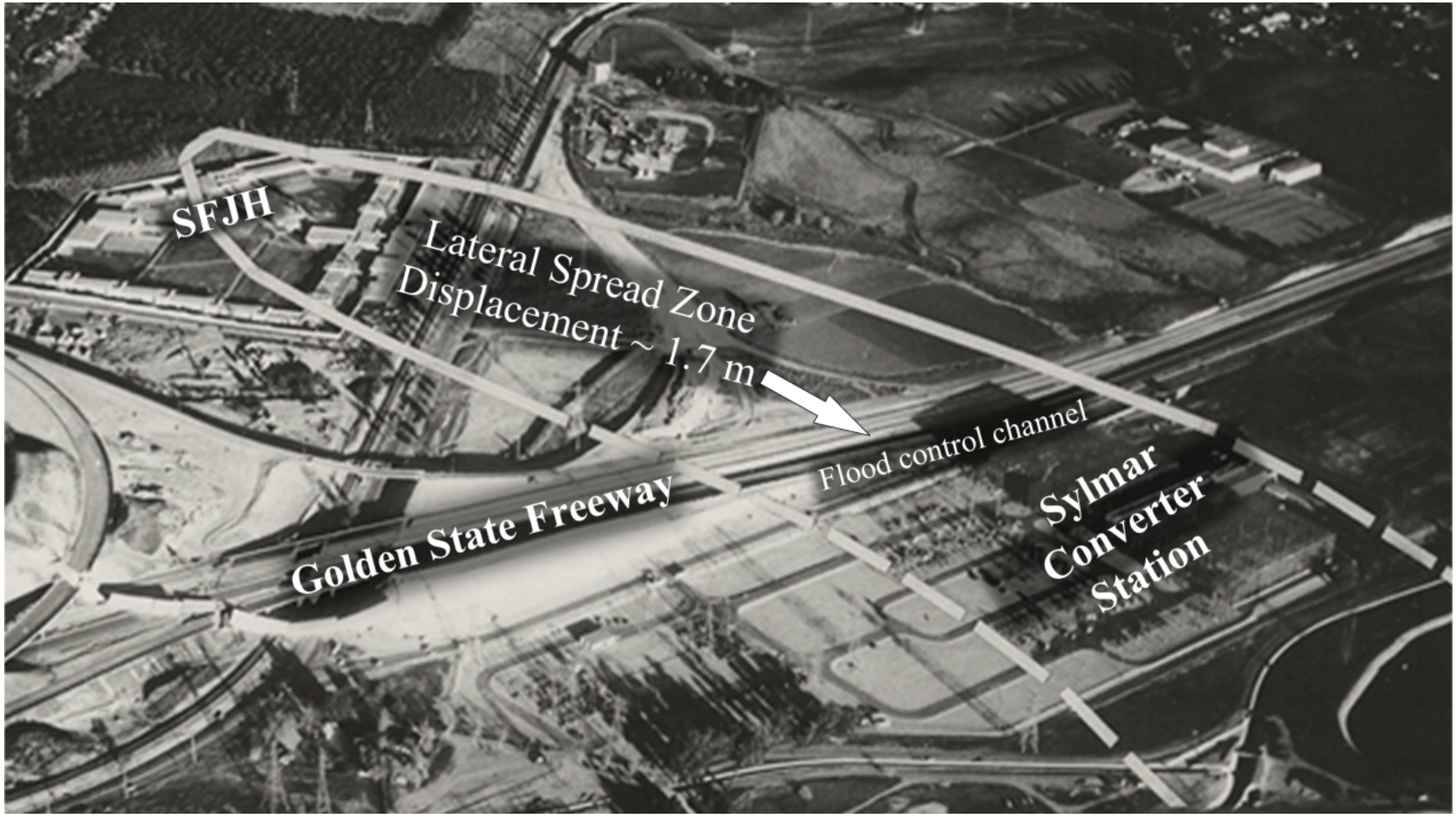

Fig. S1. Aerial photograph of San Fernando Juvenile Hall (SFJH) with annotated boundaries of SFSH lateral spread generated by the 1971 San Fernando earthquake (M = 6.6) (USGS photo)

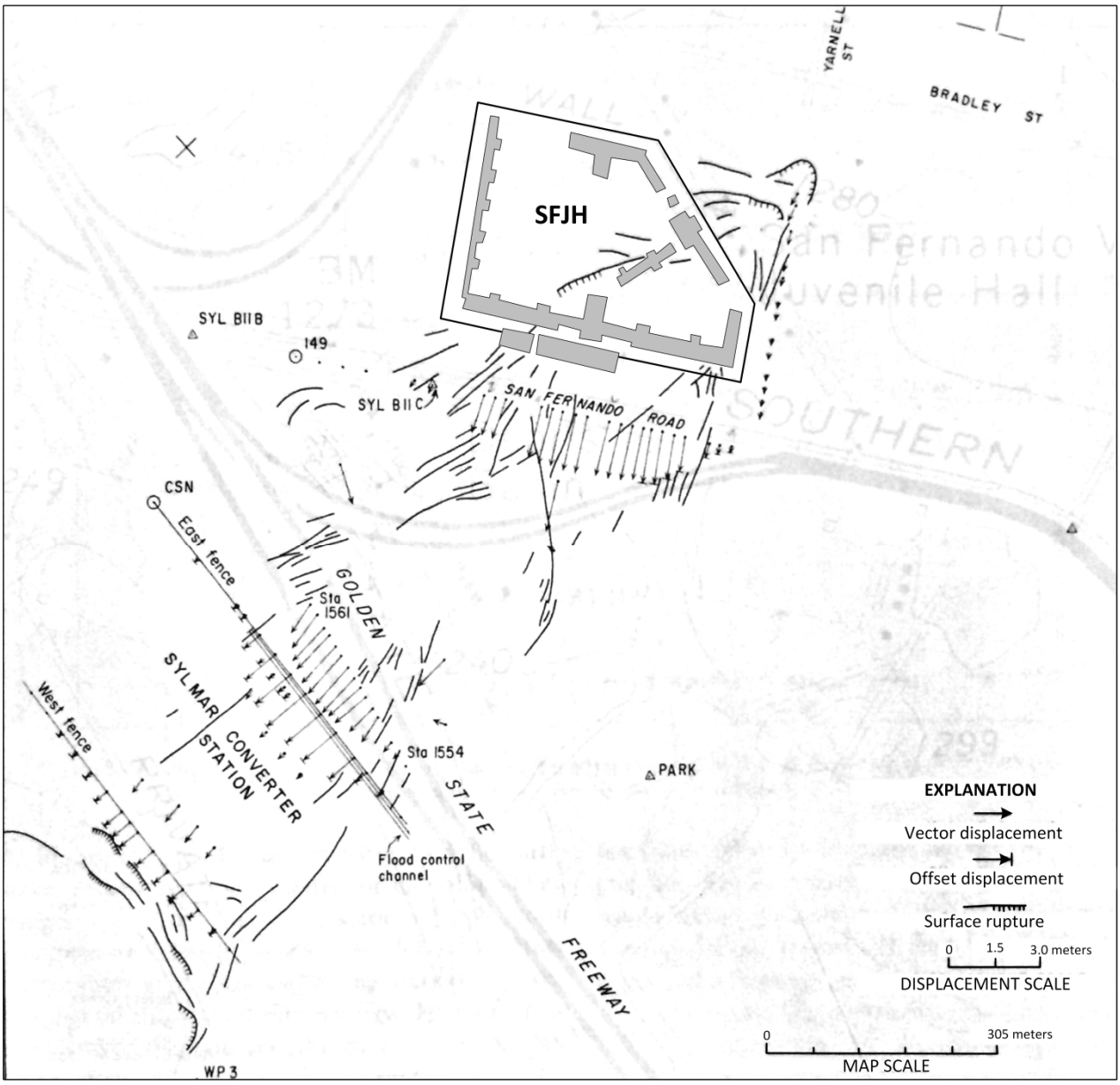

Fig. S2. Map of SFJH area with measured lateral spread displacements and mapped ground fissures (Youd 1973)

Fig. S3. Flood control channel compressed by SFJH lateral spread; channel acted as a partial toe for the spread (T.L. Youd photo)

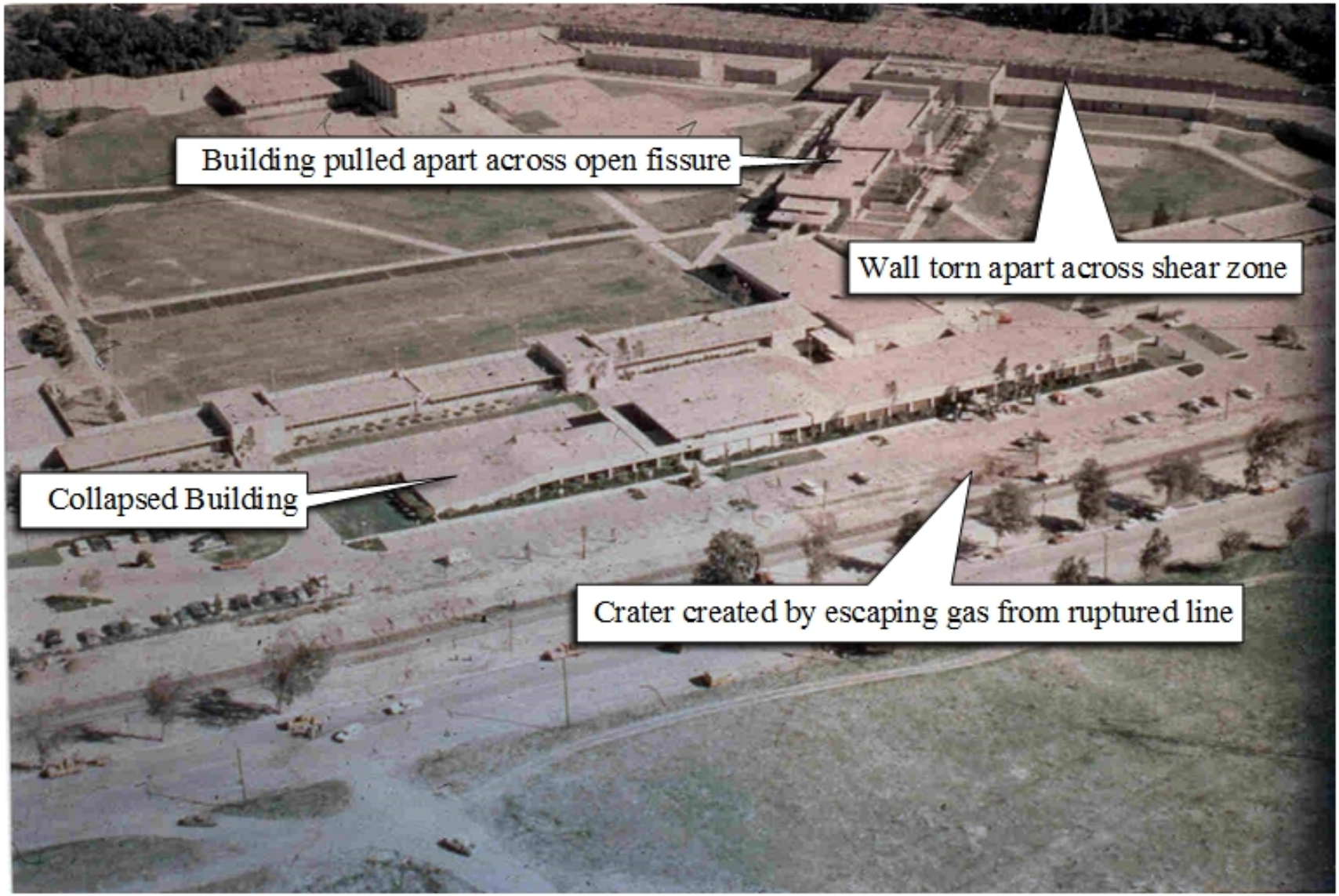

Fig. S4. Aerial photograph of SFJH with annotations noting localities of specific damage (USGS photo)

Fig. S5. Collapsed court building at SFJH; collapse caused by differential shear displacement beneath the building; right end of the building displaced about 0.9 m toward the camera relative to the left end which remained nearly in place (T.L. Youd photo)

Fig. S6. Segment of floor slab pulled apart by extensional ground displacement beneath a SFJH building due to lateral spread movement (T.L. Youd photo)

Fig. S7. Wall at JFSH pulled apart by lateral spread movement; about 50 juvenile inmates escaped through the fractured wall immediately after the earthquake (T.L. Youd photo)

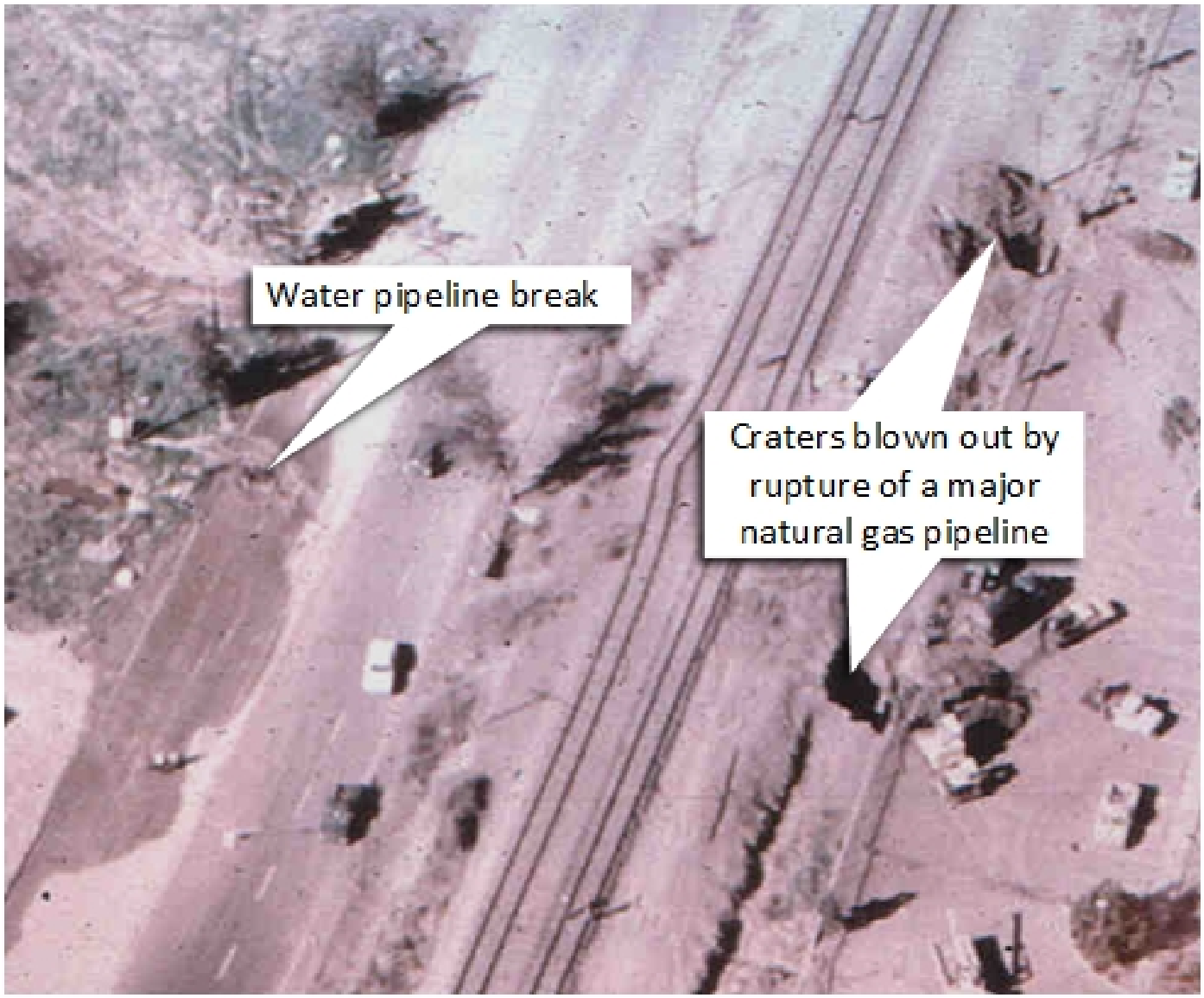

Fig. S8. Aerial photograph of localities of pipeline damage in front of SFJH (T.L. Youd photo)