# Appendix 9. Tabulated Observations and Photographs of Ground Deformation Produced by the $M_w$ 6.0 South Napa Earthquake of August 24, 2014—Shaking-Induced Deformation Owing to Landslide Reactivation or Fill Settlement

## Introduction

The following pages contain maps and tables of descriptions, slip measurements, and photographs of ground deformation features obtained in the field at observation stations located in regions I, P, and R. Station locations are shown as circles in figures 9.1 to 9.3 and labeled by the Station ID number. To aid in locating a specific observation station, IDs increase numerically from south to north. Where multiple observations occur at the exact same locality, IDs are shown as a range (for example, 200–202 identifies stations 200, 201, and 202 all at the same location). Where stations are too closely spaced to be individually labeled in the figures, a single label is used for a group of stations, with the IDs or groups of IDs listed in a vertical column and the label leader pointing to the approximate midpoint of the group of closely spaced stations. Mappable fault rupture and surface deformation features are symbolized on the included maps as described in appendix 1.

Observations and (or) photographs collected at each station are tabulated by Station ID. Where stations occur at the same locality, earlier observations are listed first. Photographs taken at an observation station, if any, follow the station attribute information; high resolution images can be downloaded by clicking on the associated links. Station and photograph attributes are described in detail in appendix 1.

## Region I

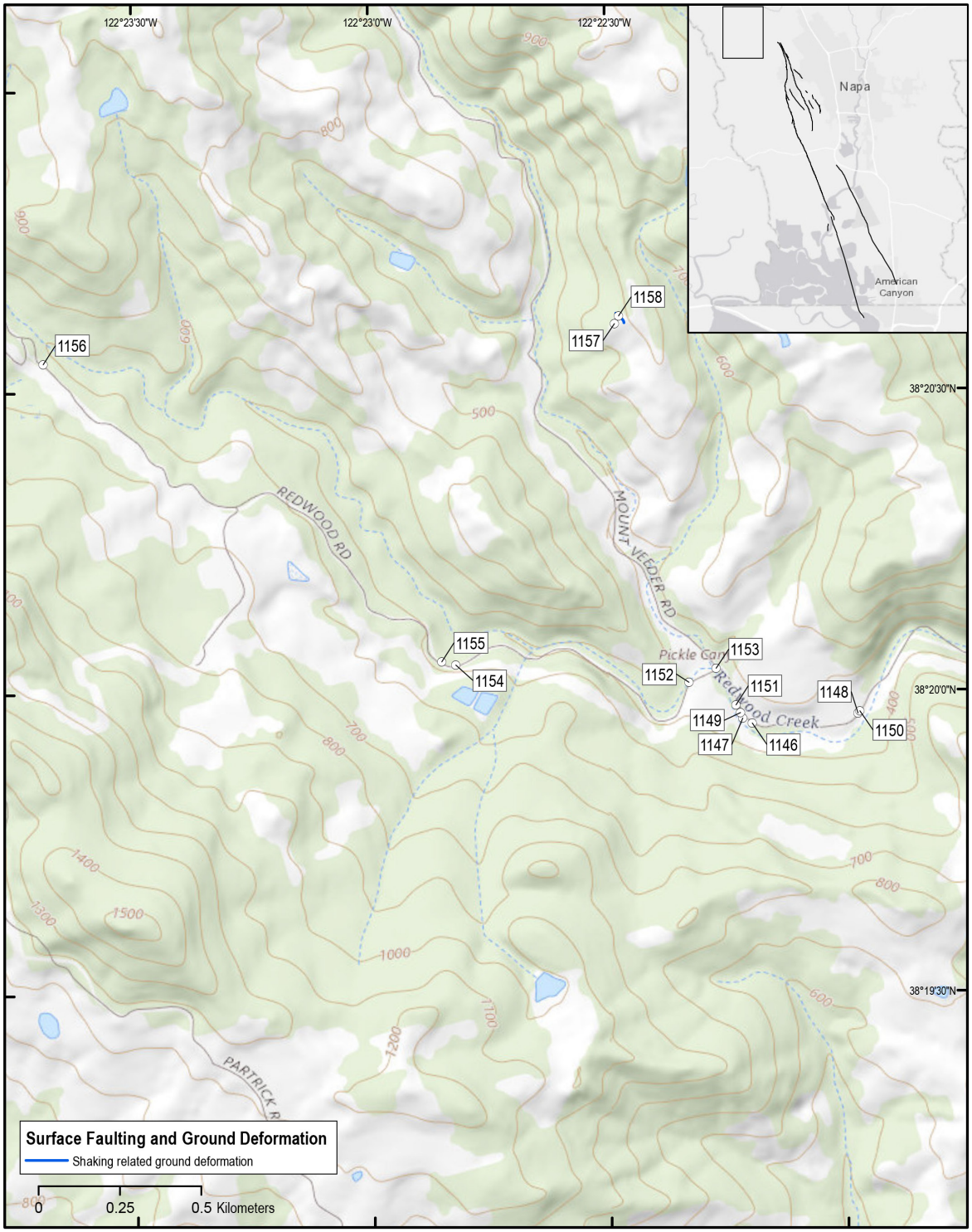



**Figure 9.1.** Ground deformation map showing locations of observation stations 1146–1158 in Region I of the West Napa Fault System, California, 1.6 km west of the northern terminus of Trace A. Inset shows location of fig. 9.1 relative to full extent of rupture. Shaded relief base from U.S. Geological Survey National Map https://viewer.nationalmap.gov/advanced-viewer/.

**Station ID: 1146** **Observer: Haydon/Wiegers**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:08:26 | 38.33245 | 122.36995 | Pavement | Shaking |

**Description**

Crack in Mt. Veeder Road.

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Haydon/Wiegers | 38.33244 | 122.36993 | 2014:08:26 14:31:45 |

High Resolution Photograph

**Station ID: 1147** **Observer: Haydon/Wiegers**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:08:26 | 38.33259 | 122.37028 | Pavement | Shaking |

**Description**

Crack in Mt. Veeder Road.

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Haydon/Wiegers | 38.33258 | 122.37027 | 2014:08:26 14:28:46 |

High Resolution Photograph

**Station ID: 1148** **Observer: Hudnut**

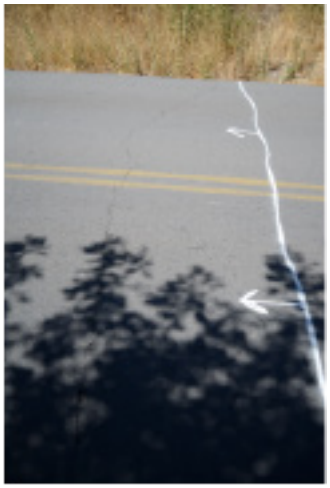
| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:08:28 | 38.33270 | 122.36622 | Pavement | Shaking |

**Description**

Fractures in paved road; non-tectonic; road has sag/bump with cracks on both sides of it.

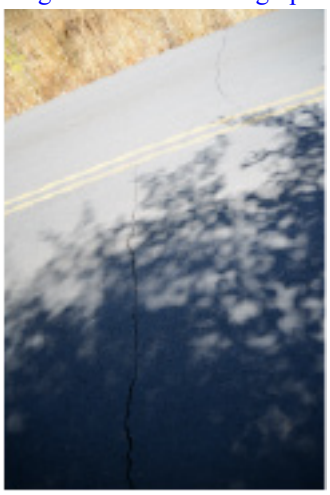
| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Hudnut | 38.33279 | 122.36610 | 2014:08:28 13:43:17 |

High Resolution Photograph



| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Hudnut | 38.33273 | 122.36617 | 2014:08:28 13:43:27 |

High Resolution Photograph



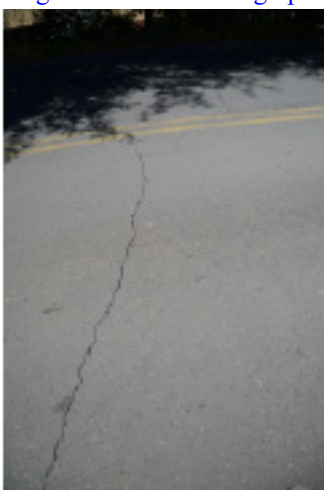
**Station ID: 1148** **Observer: Hudnut**

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Hudnut | 38.33266 | 122.36630 | 2014:08:28 13:43:54 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Hudnut | 38.33269 | 122.36616 | 2014:08:28 13:44:22 |

High Resolution Photograph



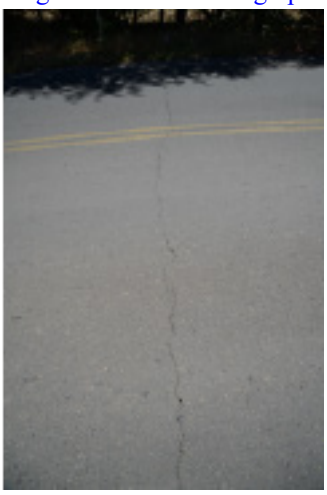
**Station ID: 1148** **Observer: Hudnut**

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Hudnut | 38.33280 | 122.36610 | 2014:08:28 13:44:32 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Hudnut | 38.33288 | 122.36605 | 2014:08:28 13:44:42 |

High Resolution Photograph



**Station ID: 1149** **Observer: Haydon/Wiegers**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:08:26 | 38.33273 | 122.37037 | Pavement | Shaking |

**Description**

Crack in Mt. Veeder Road.

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Haydon/Wiegers | 38.33273 | 122.37035 | 2014:08:26 14:24:33 |

High Resolution Photograph

**Station ID: 1150** **Observer: Haydon/Wiegers**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:08:26 | 38.33276 | 122.36616 | Pavement | Shaking |

**Description**

Dip in Mt. Veeder Road.

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Haydon/Wiegers | 38.33279 | 122.36621 | 2014:08:26 15:06:29 |

High Resolution Photograph

**Station ID: 1151** **Observer: Haydon/Wiegers**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:08:26 | 38.33294 | 122.37053 | Pavement | Shaking |

**Description**

Crack in Mt. Veeder Road.

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Haydon/Wiegers | 38.33294 | 122.37051 | 2014:08:26 14:19:52 |

High Resolution Photograph

**Station ID: 1152** **Observer: Haydon/Wiegers**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:08:26 | 38.33359 | 122.37217 | Pavement | Shaking |

**Description**

Bump in Redwood Road south of bridge at Redwood and Mt Veeder Road.

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Haydon/Wiegers | 38.33344 | 122.37221 | 2014:08:26 14:01:10 |

High Resolution Photograph

| Station ID: 1152 | | | Observer: Haydon/Wiegers |
|---|---|---|---|
| **Photographer** | **Camera Coordinates** | | **Photograph Date** |
| Haydon/Wiegers | 38.33368 | 122.37214 | 2014:08:26 14:07:18 |

High Resolution Photograph

| Station ID: 1153 | | | | Observer: Haydon/Wiegers |
|---|---|---|---|---|
| **Observation Date** | **Latitude** | **Longitude** | **Offset Feature** | **Inferred Origin** |
| 2014:08:26 | 38.33396 | 122.37121 | Pavement | Shaking |

**Description**

Bridge at Redwood and Mt Veeder road. New asphalt on north end of deck and road approach.

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Haydon/Wiegers | 38.33404 | 122.37127 | 2014:08:26 13:41:34 |

High Resolution Photograph

| Station ID: 1153 | | | Observer: Haydon/Wiegers |
|---|---|---|---|
| **Photographer** | **Camera Coordinates** | | **Photograph Date** |
| Haydon/Wiegers | 38.33386 | 122.37144 | 2014:08:26 13:45:15 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Haydon/Wiegers | 38.33395 | 122.37115 | 2014:08:26 13:45:54 |

High Resolution Photograph

| Station ID: 1154 | | | | Observer: Wills |
|---|---|---|---|---|
| **Observation Date** | **Latitude** | **Longitude** | **Offset Feature** | **Inferred Origin** |
| 2014:08:28 | 38.33410 | 122.38037 | Pavement | Shaking |

| Description |
|---|
| Pavement with right-lateral offset. |

| Fault Azimuth | Strike Slip | Strike-slip Sense | Extension | Compression | Vertical | Upthrown Side |
|---|---|---|---|---|---|---|
| | | RL | | | | |

| Station ID: 1154 | | | Observer: Wills |
|---|---|---|---|
| **Photographer** | **Camera Coordinates** | | **Photograph Date** |
| Wills | 38.33425 | 122.38038 | 2014:08:28 14:37:04 |

High Resolution Photograph

| Station ID: 1155 | | | | Observer: Wills |
|---|---|---|---|---|
| **Observation Date** | **Latitude** | **Longitude** | **Offset Feature** | **Inferred Origin** |
| 2014:08:28 | 38.33419 | 122.38087 | Pavement | Shaking |
| | | **Description** | | |
| Deformation of pavement. | | | | |
| **Photographer** | **Camera Coordinates** | | **Photograph Date** | |
| Wills | 38.33418 | 122.38085 | 2014:08:28 14:34:32 | |

High Resolution Photograph

| Station ID: 1155 | | | Observer: Wills |
|---|---|---|---|
| **Photographer** | **Camera Coordinates** | | **Photograph Date** |
| Wills | 38.33418 | 122.38085 | 2014:08:28 14:34:38 |

High Resolution Photograph


| Station ID: 1156 | | | | Observer: Wills |
|---|---|---|---|---|
| **Observation Date** | **Latitude** | **Longitude** | **Offset Feature** | **Inferred Origin** |
| 2014:08:28 | 38.34248 | 122.39483 | Pavement | Shaking |
| | | **Description** | | |
| West edge of dip in road at recent landslide pavement patch 100 ft. to east; no recent cracking. | | | | |

| Station ID: 1157 | | | | Observer: Wills |
|---|---|---|---|---|
| **Observation Date** | **Latitude** | **Longitude** | **Offset Feature** | **Inferred Origin** |
| 2014:08:28 | 38.34353 | 122.37470 | Soil | Shaking |
| | | **Description** | | |
| Other edge of slide? Rumple in road surface; not cracked? | | | | |

| Station ID: 1158 | | | | Observer: Wills |
|---|---|---|---|---|
| **Observation Date** | **Latitude** | **Longitude** | **Offset Feature** | **Inferred Origin** |
| 2014:08:28 | 38.34373 | 122.37456 | Soil | Shaking |
| | | **Description** | | |
| Extensional crack across road about 5 cm open; downslope side of road wider. Up 2 in. to south and open 2 ft. deep on upslope side of road. | | | | |

| Fault Azimuth | Strike Slip | Strike-slip Sense | Extension | Compression | Vertical | Upthrown Side |
|---|---|---|---|---|---|---|
| | | | 5* | | 5* | N |

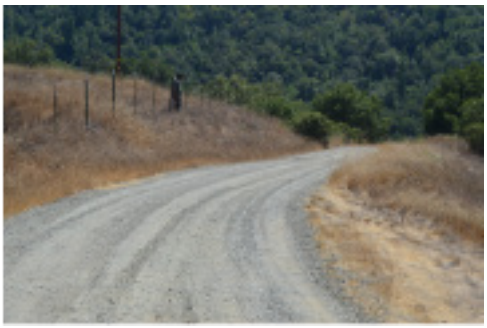
**Station ID: 1158** **Observer: Wills**

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Wills | 38.34374 | 122.37457 | 2014:08:28 15:25:18 |

High Resolution Photograph

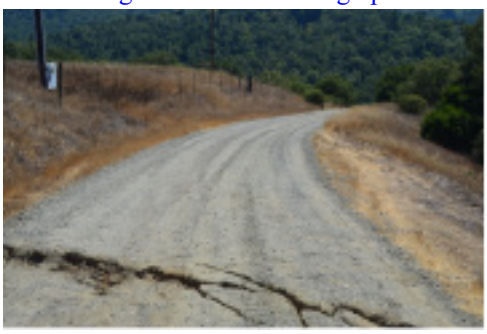
| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Wills | 38.34374 | 122.37457 | 2014:08:28 15:25:21 |

High Resolution Photograph



| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Wills | 38.34374 | 122.37457 | 2014:08:28 15:25:23 |

High Resolution Photograph



## Region P

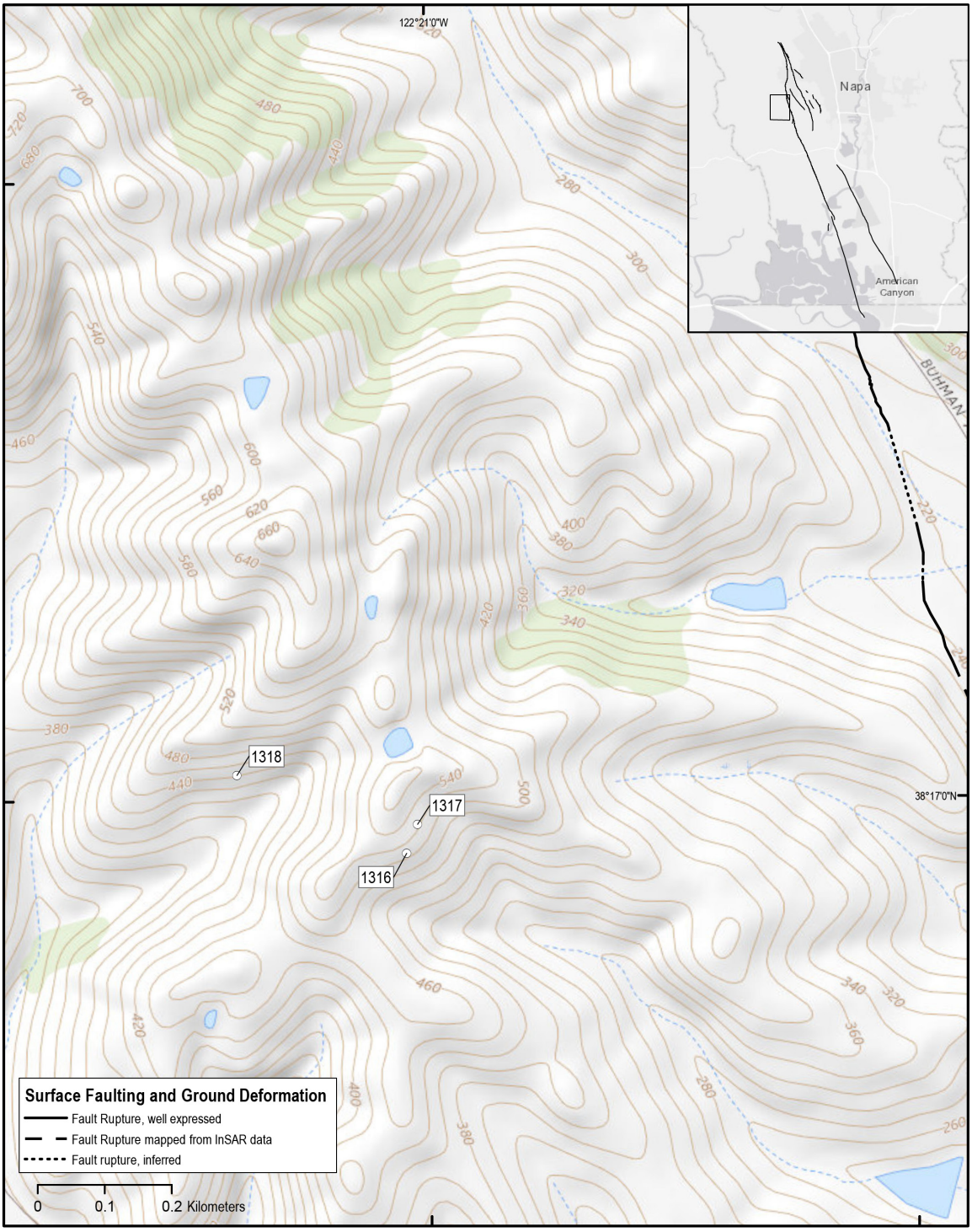



**Figure 9.2.** Ground deformation map showing locations of observation stations 1316–1318 in Region P of the West Napa Fault System, California, 1.1 km west of intersection of Congress Valley Road and Buhman Avenue. Inset shows location of fig. 9.2 relative to full extent of rupture. Shaded relief base from U.S. Geological Survey National Map https://viewer.nationalmap.gov/advanced-viewer/.

| Station ID: 1316 | | | | Observer: Wills |
|---|---|---|---|---|
| **Observation Date** | **Latitude** | **Longitude** | **Offset Feature** | **Inferred Origin** |
| 2014:08:28 | 38.28261 | 122.35039 | Soil | Shaking |
| | | **Description** | | |
| Minor slope-parallel crack; not continuous. | | | | |

| Station ID: 1317 | | | | Observer: Wills |
|---|---|---|---|---|
| **Observation Date** | **Latitude** | **Longitude** | **Offset Feature** | **Inferred Origin** |
| 2014:08:28 | 38.28300 | 122.35020 | Soil | Shaking |
| | | **Description** | | |
| Minor discontinuous crack on steep slope above small slump block. | | | | |

| Station ID: 1318 | | | | Observer: Wills |
|---|---|---|---|---|
| **Observation Date** | **Latitude** | **Longitude** | **Offset Feature** | **Inferred Origin** |
| 2014:08:28 | 38.28368 | 122.35328 | Soil | Shaking |
| | | **Description** | | |
| Discontinuous cracks; mostly animal burrows. | | | | |

## Region R

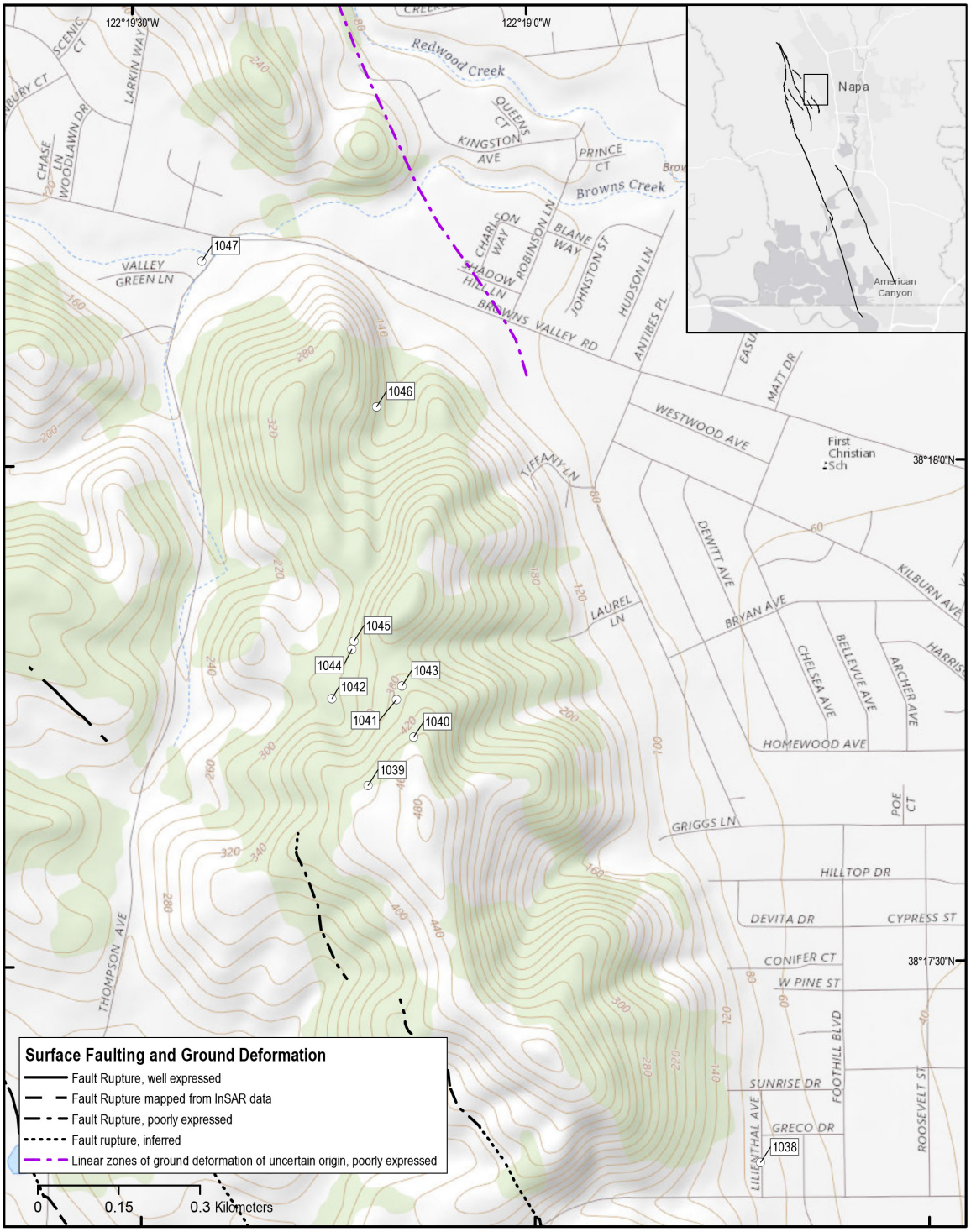



**Figure 9.3.** Ground deformation map showing locations of observation stations 1038–1047 in Region R of the West Napa Fault System, California, from intersection of Old Sonoma Road and Lilienthal Avenue 2.2 km north to Kingston Avenue. Inset shows location of fig. 9.3 relative to full extent of rupture. Shaded relief base from U.S. Geological Survey National Map https://viewer.nationalmap.gov/advanced-viewer/.

## Station ID: 1038 — Observer: Holzer

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:08:25 | 38.28834 | 122.31190 | Pavement | Uncertain |

**Description**

Lilienthal Avenue: water line break; hairline crack in and orthogonal to street.

| Photographer | Camera Coordinates | Photograph Date |
|---|---|---|
| Holzer | | 2014:08:25 19:40:56 |

High Resolution Photograph

| Photographer | Camera Coordinates | Photograph Date |
|---|---|---|
| Holzer | | 2014:08:25 19:41:59 |

High Resolution Photograph

## Station ID: 1039 — Observer: Seitz

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:09:03 | 38.29466 | 122.32014 | Soil | Shaking |

**Description**

Minor cracking across path in dirt with N24E orientation. Minor opening extends for a distance of about 14 m. Pavement to the south 3 m away does not seem cracked.

| Fault Azimuth | Strike Slip | Strike-slip Sense | Extension | Compression | Vertical | Upthrown Side |
|---|---|---|---|---|---|---|
| 24 | | | | | | |

**Station ID: 1040** **Observer: Seitz**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:09:03 | 38.29545 | 122.31917 | Soil | Uncertain |

**Description**

Minor cracking across dirt road appears to be gravity-induced. N71E orientation; open about 1.5 cm.

| Fault Azimuth | Strike Slip | Strike-slip Sense | Extension | Compression | Vertical | Upthrown Side |
|---|---|---|---|---|---|---|
| 71 | | | 1.5* | | | |

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29546 | 122.31915 | 2014:09:03 11:07:00 |

High Resolution Photograph

**Station ID: 1041** **Observer: Seitz**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:09:03 | 38.29608 | 122.31952 | Soil | Shaking |

**Description**

Ground crack with opening and extension trend N15W. 8 cm maximum opening extension direction N68E.

| Fault Azimuth | Strike Slip | Strike-slip Sense | Extension | Compression | Vertical | Upthrown Side |
|---|---|---|---|---|---|---|
| 345 | 1 | LL | 8 | | | |

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29608 | 122.31951 | 2014:09:03 10:53:11 |

High Resolution Photograph

**Station ID: 1042** **Observer: Seitz**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:09:03 | 38.29610 | 122.32089 | Soil | Shaking |

**Description**

Two cracks across path N11E. Orientation cracks are open, spaced about 1.5 m apart; trend N80E. Opening about 2 cm can be traced about 15 m.

| Fault Azimuth | Strike Slip | Strike-slip Sense | Extension | Compression | Vertical | Upthrown Side |
|---|---|---|---|---|---|---|
| 11 | | | 2* | | | |

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29612 | 122.32085 | 2014:09:03 11:29:53 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29615 | 122.32085 | 2014:09:03 11:30:01 |

High Resolution Photograph

**Station ID: 1042** **Observer: Seitz**

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29615 | 122.32085 | 2014:09:03 11:30:12 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29610 | 122.32087 | 2014:09:03 11:31:05 |

High Resolution Photograph

**Station ID: 1042** **Observer: Seitz**

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29610 | 122.32087 | 2014:09:03 11:31:08 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29617 | 122.32085 | 2014:09:03 11:32:24 |

High Resolution Photograph

**Station ID: 1042** **Observer: Seitz**

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29617 | 122.32083 | 2014:09:03 11:33:43 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29617 | 122.32083 | 2014:09:03 11:33:45 |

High Resolution Photograph

**Station ID: 1043** **Observer: Seitz**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:09:03 | 38.29631 | 122.31940 | Soil | Shaking |

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29626 | 122.31942 | 2014:09:03 10:52:03 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29627 | 122.31942 | 2014:09:03 11:03:39 |

High Resolution Photograph

**Station ID: 1043** **Observer: Seitz**

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29630 | 122.31939 | 2014:09:03 11:03:54 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29635 | 122.31937 | 2014:09:03 11:04:35 |

High Resolution Photograph

**Station ID: 1044** **Observer: Seitz**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:09:03 | 38.29692 | 122.32045 | Soil | Shaking |

**Description**

Two cracks across dirt road open 1 to 2 cm. Trend N60E; 2 cm separation.

| Fault Azimuth | Strike Slip | Strike-slip Sense | Extension | Compression | Vertical | Upthrown Side |
|---|---|---|---|---|---|---|
| 60 | | | 1-2* | | | |

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29693 | 122.32042 | 2014:09:03 10:41:57 |

High Resolution Photograph

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29694 | 122.32037 | 2014:09:03 10:43:51 |

High Resolution Photograph

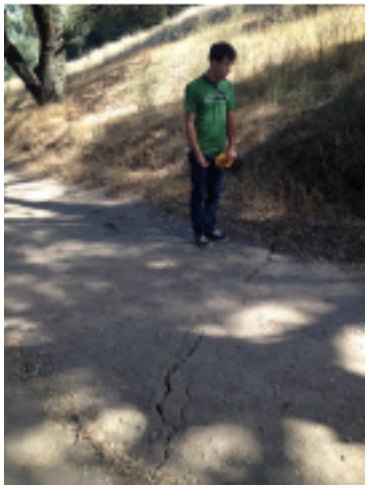
**Station ID: 1044** **Observer: Seitz**

| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29690 | 122.32045 | 2014:09:03 10:44:08 |

High Resolution Photograph

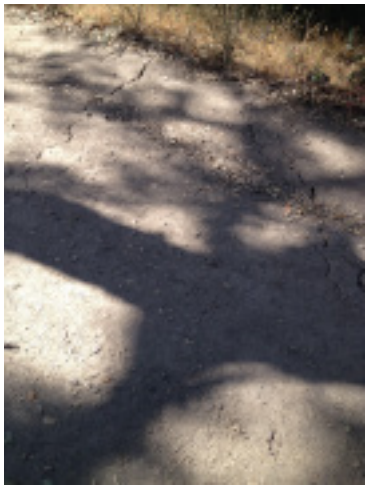
| Photographer | Camera Coordinates | | Photograph Date |
|---|---|---|---|
| Seitz | 38.29690 | 122.32046 | 2014:09:03 10:44:17 |

High Resolution Photograph



| Station ID: 1044 | | | Observer: Seitz |
|---|---|---|---|
| **Photographer** | **Camera Coordinates** | | **Photograph Date** |
| Seitz | 38.29697 | 122.32038 | 2014:09:03 10:44:34 |

High Resolution Photograph



**Station ID: 1045** **Observer: Seitz**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:09:03 | 38.29706 | 122.32041 | Soil | Shaking |

**Description**

Continuation of these cracks across the road to the north.

**Station ID: 1046** **Observer: Seitz**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:09:03 | 38.30095 | 122.31990 | Soil | Uncertain |

**Description**

Minor cracking across the entire roadway along old desiccation cracks but trending northwest. Compiler note: location places site at/near a private drive that appears unpaved.

**Station ID: 1047** **Observer: Wells**

| Observation Date | Latitude | Longitude | Offset Feature | Inferred Origin |
|---|---|---|---|---|
| 2014:08:30 | 38.30340 | 122.32357 | Curb/Sidewalk | Uncertain |

| Photographer | Camera Coordinates | Photograph Date |
|---|---|---|
| Wells | | 2014:08:30 |

High Resolution Photograph

| Station ID: 1047 | | Observer: Wells |
|---|---|---|
| **Photographer** | **Camera Coordinates** | **Photograph Date** |
| Wells | | 2014:08:30 |

High Resolution Photograph