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January 6, 2012
Project 2010.0177

Ms. Mary Paxton
City of Hollister Redevelopment Agency
375 Fifth Street
Hollister, CA 95023

Subject: **Cumulative Assessment of Fault Hazard Data in Downtown Hollister**
Summary Letter Report and GIS Map Transmittal
Downtown Redevelopment Area
Hollister, California

Dear Ms. Paxton:

As requested, we are pleased to present our Summary Letter Report for Geologic Assessment of Fault Hazards in Downtown Hollister. The work product presented here includes a Geographic Information System (GIS)-based map compilation of previous fault investigations in the designated downtown study area (with relevant associated data) and this Summary Letter Report, in which we describe the scope, methods, and findings of the project. A brief discussion of the potential to clear additional property of fault rupture hazard based on the data reviewed for this study is included in this report.

INTRODUCTION

The revitalization of the downtown area of the City of Hollister is one of the goals of the City's Redevelopment Agency (RDA). The downtown area is characterized by many older structures, many of which are multi-story buildings. Re-zoning of these buildings for residential use on the upper stories is viewed by the City as a desirable milestone in paving the way for redevelopment and revitalization of the downtown area.

A significant portion of downtown Hollister lies within a California Geological Survey (formerly California Division of Mines and Geology, or CDMG) Earthquake Fault Zone (EFZ) developed around the east branch of the Calaveras fault (Figure 1). This map series addresses the potential for surface fault rupture along "sufficiently active and well-defined" faults for development sites within the State of California. The CGS Earthquake Fault Zones are defined by the Alquist-Priolo Earthquake Fault Zoning Act ("AP Act"), which became law in 1972. The AP Act specifically regulates developments classified as a "project", or a structure(s) for human occupancy. It is our understanding that redevelopment of existing buildings for residential use, as is planned for the downtown Hollister area, meets the definition of a "project", and as such is regulated by the Act (W.A. Bryant, personal communication, 2009).

Approval of a "project" within a CGS Earthquake Fault Zone requires establishing an acceptably low level of surface fault rupture hazard for the planned development. This is typically accomplished in a fault investigation by means of a trench excavated approximately perpendicular to the regional trend of the fault in question so as to intercept any geologically reasonable active fault that would pass through the project footprint. The width of the investigated interval is greater than the width of the project itself. The AP Act defines an "active" fault as having ruptured during Holocene time (approximately the last 11,000 years).

PURPOSE AND SCOPE

The purpose of this report is to assess the current state of knowledge regarding surface fault rupture hazard potential of the East Branch of the Calaveras fault in anticipation of proposed residential redevelopment within the designated assessment area. To that end, we completed the following tasks:

- Meeting with the City of Hollister Planning Department/Redevelopment Agency (RDA) to discuss project goals and define the assessment area boundary.
- Archival search of prior fault investigations prepared for development projects within the downtown study area, and provided to us by the City.
- Map compilation of properties previously investigated for surface fault rupture, including locations of exploratory trenches, geophysical lines, and borings.
- Digitization of data for inclusion in the City of Hollister Geographic Information System (GIS) database (the City presently uses the San Benito County GIS database).
- Preliminary assessment of which areas/parcels are likely cleared of surface fault rupture by prior investigations.
- Consultation with CGS regarding implementation of Alquist-Priolo Act criteria.
- Preparation of this Summary Letter Report.

METHODS

In the following sections, we discuss the methods and organizational approach to data collection for each of the key tasks of our assessment.

Designated Assessment Area

Based on our discussions with the City of Hollister Planning Division and RDA, the assessment area boundary for this project is defined as follows: an area bounded by North Street/Santa Ana Road on the north, West Street on the west, Hawkins Street on the south, and McCray Street on the east (Figure 1 – Earthquake Fault Zone Map). This area forms a rough outline of the area of interest for redevelopment. It should be noted that this area extends past the CGS EFZ boundaries on the east and west. Given the nature of this assessment, we primarily reviewed reports and data prepared for previous projects within the CGS EFZ, as this regulatory boundary is the driving factor for a fault investigation for most projects. The CGS EFZ developed around the East Branch Calaveras fault trends approximately north-northwest and varies between 800-900 feet in width in this area of Hollister. At the request of the City, we reviewed one report along the CGS EFZ for the West Branch Calaveras fault. We also reviewed a recent study (2008) prepared for the old Fremont School site (proposed new Courthouse site), which lies between, but not within, the EFZs for the East Branch and West Branch Calaveras faults. Aside from these outlying parcels, this assessment is concerned with projects situated exclusively within the EFZ established around the East Branch Calaveras fault.

We have included in the database two additional studies situated immediately to the south of the designated assessment area, primarily because faulting was clearly identified in each of these studies. Because of the conspicuous absence of identified faulting in much of the

designated assessment area, inclusion of these two investigations lends confidence to the actual location of the fault at the southern end of the assessment area, as well as providing a good example of the style and geometry of faulting that appears to be typical of the East Branch Calaveras fault.

Archival Search

The primary and central task to this assessment was to perform an archival search of maps, literature, and fault investigations prepared for development sites in the designated assessment area. We reviewed the following information as part of our archival search:

- Fault investigation reports on file with the City of Hollister Development Services Department, Planning Division
- Alquist-Priolo reports on file with CGS
- Two CGS CD archives: *Fault Investigation Reports for Development Sites within Alquist-Priolo Earthquake Fault Zones in Northern California, 1974-2000*, and *Fault Evaluation Reports Prepared Under the Alquist-Priolo Fault Zoning Act*
- Reports not currently on file with the CGS or the City prepared by other engineering geologic and geotechnical consultants
- A preliminary working compilation of fault investigation reports through November 2008 in Kmz format (W.A. Bryant, personal communication, 2009)

We identified and reviewed a total of 17 reports as part of our assessment. These reports were prepared between 1978 and 2010. Some of the reports address multiple parcels. In some cases, our review of a report led to the discovery of additional reports referenced in that document that had not been filed with the City or State. One of these additional reports was unavailable for review, and is cited in the References section of this report.

For each investigation we identified, we briefly reviewed the text, site plans, and trench logs. We specifically focused on the outcome of the investigation (ie fault found/not found), location of exploratory trenching, quality of the report, and applicability of the exploration methods used to assess fault ground rupture. At the time of our review, we gathered relevant information for later inclusion as attributes in data tables linked to features included in the GIS files that accompany this report. As an example, for a given exploratory trench (a GIS database feature), we noted attributes such as outcome (fault found/not found), depth of excavation, any caving conditions encountered, maximum geologic age encountered, and C^{14} radiocarbon dates, amongst others.

During our file review we also made a preliminary assessment of the confidence in findings of the report and quality of data. As an example, a trench excavated at a very low angle to the mapped regional trend of the fault would be poorly situated to expose any faulting, and would result in a low level of confidence in the findings of the report.

Map Compilation

Selected graphical data gathered during our archival search was organized and compiled on a parcel base map derived from the San Benito County GIS database provided by the San Benito County Planning Department. These data were organized and compiled with the end goal of seamless integration of the map data into the City (County) GIS database. We compiled the following map features from each fault investigation report we reviewed, each of which is

included as a separate layer, or overlay, in the GIS database provided on a CD accompanying this report:

- Parcels with investigations (parcel outlines adopted from the San Benito County GIS database)
- Trenches (including geophysical lines)
- Borings
- Fault Traces
- Fault Zones
- Building Exclusion Zones (consultant's interpretation)

Graphics for each feature were scaled directly from the consultant's reports using a copy machine. Compilation was accomplished by tracing each scaled feature onto a paper copy of the San Benito County GIS parcel map at a scale of 1"=50'. Parcels were adopted from the current parcel outlines present on the San Benito County GIS database as of mid-2010. Fault traces mapped by the CGS are digitized from source maps with a scale of 1" = 2,000'.

Many of the reports we reviewed were copies or scans of previous copies. Multiple iterations of copying have resulted in scaling errors. For this reason, our compilation line work is a best estimate, and likely accurate within ±5 feet.

Map features compiled as part of our assessment are presented in paper format as Figure 2 of this report, which uses the San Benito County GIS "parcel" and "street centerlines" layers as a base map. The map features presented on Figure 2 have been modified (color, shading, and line-weight changed) for clarity and presentation with this report. These features will appear as simple line, area, and point features in the digital dataset included on the CD accompanying this report. It is anticipated that color, shading, and lineweight modifications will be made at the discretion of the City once the data is merged with the City (County) GIS database.

Data Organization

Data compiled for each report was organized with a GIS end product in mind. Accordingly, each of the map features, or feature classes, discussed above is grouped into a separate layer (or overlay) of shapefiles (.shp files) within the data set. As an example, all of the "trenches" are grouped within a single layer/overlay that can be toggled on or off with the GIS software used to view the data. "Trenches" and "fault traces" were digitized as line features. "Parcels with investigations", "fault zones", "building exclusion zones", and "cleared areas" were digitized as area features. "Borings" were digitized as point features.

Each individual feature within a feature class (i.e trench, boring, fault trace, etc.) is accompanied by a linked attribute table (data table) that is accessed simply by clicking on the individual feature when viewed with GIS software. Typical attributes include site APN, site address, consultant, report date, etc. Key elements of attribute organization are presented as follows:

- *Common Attributes*: Site address and assessor's parcel number (APN) are assigned as common attributes for each feature to facilitate querying and efficient data management.
- *Trench Identification Number*: Each of the 66 trenches identified in the study are assigned a unique identification number to distinguish trench labels common to different investigations (ie many reports describe exploratory trenches as "T-1").

- *Report Title Code*: Each consultant's report is assigned a title code for ease of reference. Report title codes are sequential by report date, with the exception of the single report reviewed along the West Branch Calaveras fault (Report Title Code 17). Abbreviated report citations are included in each attribute table. Full report citations, listed by report title code, are presented in the references section of this report.

FINDINGS

Geologic Summary

Faulting was identified in four of the studies we reviewed, as follows:

- *Terratech, Inc., 1978 (321 and 341 First Street; Report Title Code 1)*: Two fault traces were identified during the investigation. This report was unavailable for our review. However, the exploratory trench and fault trace locations were referenced and included on the site map for a subsequent study of the same property by Pacific Rim Geologic in 2002 (341 First Street, Report Title Code 13), and are included here as part of our compilation. The presence of faulting identified in the 1978 study is disputed by the findings of the 2002 study, as no faulting was identified in the latter investigation. The fault traces identified in the 1978 investigation are the northernmost fault occurrences documented in the designated assessment area.
- *Terratech, Inc., 1987 (Report Title Code 4)*: Very good exposures of faulting were observed in seven trenches as part of this investigation. These exposures define a well-documented curvilinear fault zone. The consultant (Terratech) recommended a building exclusion zone based on their findings. The fault zone and associated building exclusion zone are both included in our compilation. The faulting identified in this study is the southernmost occurrence of faulting documented in this assessment.
- *Earth Systems Consultants, 1998 (East, South, Sally, and Seventh Streets; report title code 11)*: Faulting was identified at a depth of approximately 15 to 17 feet below ground surface. A C^{14} radiocarbon age of 2,650±80 years before present in warped and faulted sediments at a depth of approximately 15.5 feet below ground surface attests to a relatively young age of faulting and burial of the most recent faulting event by a thick accumulation of sediments.
- *Earth Systems Pacific, 2008 (East Park Street and Rancho Drive; Report Title Code 14)*: Fault traces were identified in three trenches on property adjacent to (east of) the Terratech, Inc. (1987) study.

Our archival search identified an additional reference to an investigation where faulting was identified at 49, 53, and 57 Hawkins Street (Applied Soil Mechanics, Inc., 1991a). This report was unavailable for our review. A full report citation is included in the references section of this report. We have not included this report in our GIS database.

We make the following noteworthy geologic observations based on the geologic findings of other consultants compiled in our assessment:

- No faulting has been identified between Seventh Street and the approximate area of First Street. Although most of the trenching has been conducted west of the State-mapped fault trace, at least one investigation (Report Title Code 6, 335 San Benito Street) trenched directly across the mapped CGS trace with no discovery of a fault.

Likewise, no other evidence of faulting, such as warped sedimentary bedding, was observed in the trench logs we reviewed in this area.

- No evidence of a fault scarp is present between Seventh Street and the vicinity of First Street, whereas a well-defined, albeit degraded fault scarp is present south of Seventh Street and is so noted in several of the investigations we reviewed. Our review of LiDAR (Light Detection and Ranging) hillshade imagery using different illumination angles also suggests that the fault scarp is not present north of Seventh Street (GeoEarthScope NoCal dataset, www.opentopography.org).
- Most of the investigations in the downtown area encountered a thick accumulation of relatively young sedimentary deposits. Applied Soil Mechanics performed extensive investigations in the downtown area in 1991. These studies consistently cite Late Pleistocene to Early Holocene soils for the downtown area based on radiocarbon dates obtained in several of the investigations. Only one study (Report Title Code 8) cites a Pleistocene radiocarbon date (18,110±190 years before present); all other radiocarbon dates in the study area reveal Holocene ages.
- Successful exploration for a fault is routinely performed with great difficulty in the downtown area. Loose, caving conditions in sandy soil, combined with the apparent thick accumulation of relatively young sediments have proven to be significant obstacles in fault investigations. In many cases, it appears that the base of the Holocene is not within reach of a normal backhoe (about 15 feet). As an example, faulting was identified at depths between 15 and 17 feet below ground surface at the San Benito Foods warehouse near Seventh Street (Report Title Code 11). A late Holocene radiocarbon date (2,570±50 years before present) was recovered at a depth of 17 feet in faulted sediments at this locality. These are challenging conditions in the streetscape setting of downtown, where deeper, benched excavations are not feasible.

The conspicuous absence of documented Holocene faulting between Seventh Street and the approximate area of First Street may be due to any number of reasons. Most of the trenching completed to date has been conducted in the western portion of the EFZ, leaving room for the fault to pass through the eastern half of the EFZ. However, based on the geologic observations noted above, we suggest that the fault is likely buried, or simply dies out northward, in this part of downtown Hollister.

Property Clearance

Property "clearance" of fault rupture hazard in the downtown area is one of the central aims of the City of Hollister RDA. Accordingly, we present the following generalized approach to property clearance using the results of this assessment.

Our approach is based on establishing a reasonable "shadow" of coverage for any given exploratory trench. We established a "shadowed", or "cleared" area by using the observed and/or mapped local variation in fault trend to define a polygon around each exploratory trench on the map. A fault is assumed to be present passing immediately adjacent to either end of the trench, with a possible trend within the local mapped range of variation of fault trend. In the absence of a parallel trench nearby, a single trench "clears" a trapezoid, with ends tapering away from the trench (see Figure 2). For the majority of the assessment area, we used a variation in fault trend between N34°W and N09°W based on the variation in trend as mapped on the CGS EFZ map. In the vicinity of North Street, where the State-mapped fault trends more westerly, we used a variation between N43°W and N09°W. At the southern end of our assessment area, we used a variation between N19°W and N10°E. This latter variation reflects

the north-northeast trend of faulting indentified in two studies in the vicinity of Rancho Drive (Report Title Codes 4 and 14). These trapezoids, or polygons, are presented on a separate GIS layer, or overlay, in the GIS database that accompanies this report.

It should be noted that our approach to property clearance is necessarily generalized, and is presented as a starting point for the City to make educated decisions regarding clearance of properties of fault rupture hazard. Our approach is not intended to provide a blanket clearance of properties. Rather, it is intended that the findings of this study, and in particular the "cleared" polygons presented therein, are to be used in concert with the engineering geologic judgment of practicing consulting geologists in the study of any given parcel. It should also be noted that the following assumptions were made as part of our approach to property clearance:

- "Cleared" zones are drawn around all trenches, except where building exclusion zones are already established by the consultant around trenches in which faulting was encountered. In the case of trench ID#45 (Report Title Code 11), in which a fault was observed, no building exclusion zone was established by the consultant. We placed cleared polygons around those portions of the trench set back 50 feet perpendicular from either side of the fault.
- No "cleared" polygons were drawn around trenches for the two investigations on the south side of First Street (Report Title Codes 1 and 13). Faulting was identified in Report 1, but was disputed in Report 13.
- A "cleared" zone does not indicate City or State approval. Many of the studies we reviewed did not include proof of either City approval or State review.
- Some trenches caved during or soon after excavation, in some cases prohibiting logging of the trench in detail. Caved trenches are so described in the notes section of the attribute table for the trench in question. In some cases, these caved trenches were used by the consultant to clear the site of fault rupture hazard. "Cleared" polygons are drawn for these caved trenches regardless of the caving conditions encountered. However, we have assigned a "low" confidence rating in the attribute table of each caved trench.

CONCLUSIONS AND RECOMMENDATIONS

Based on the compilation work conducted as part of this study, and our generalized approach to property clearance, we suggest that a select portion of the downtown assessment area presents a likely candidate for blanket clearance of multiple properties of fault rupture hazard. This target area is roughly bounded by the State-mapped trace of the East Branch Calaveras fault on the east, the western edge of the East Branch Calaveras EFZ boundary on the west, Fourth Street on the north, and Sixth Street on the south. The closely-spaced distribution of exploratory trenches and associated "cleared" polygons in this area makes the probability of a through-going fault in this area highly unlikely. While there are some narrow gaps between trenches and cleared areas, the probability that a fault passes through all of them is judged to be low. We preliminarily suggest that this area be considered as potential ground that could be cleared of fault rupture hazard with little or no further exploratory trenching.

The area west of the CGS-mapped fault trace between Sixth and South streets also has a closely-spaced distribution of trenches and associated "cleared" polygons, making it another likely candidate for property clearance. We also suggest that the adjacent trenches and

associated "cleared" polygons at Fremont Way and San Benito Street could be linked to form a larger area of "cleared" ground (Report Title Code 6).

One of the best opportunities to efficiently and strategically clear additional ground in the downtown area is present along Fifth Street, which passes directly through the aforementioned target area. Between San Benito Street and East Street, nearly half of the block along Fifth Street has been trenched, with no fault found (Applied Soil Mechanics, 1991; Report Title Code 7). Between East and Sally Street, a significant portion of the block was recently trenched for the City of Hollister Fire Station No. 1 project (Earth Systems Pacific, 2010; Report Title Code 16) with no faulting identified. Supplemental trenching between these two studies across East Street would have the potential to clear nearly two thirds of the width of the East Branch Calaveras EFZ along Fifth Street with continuous trench.

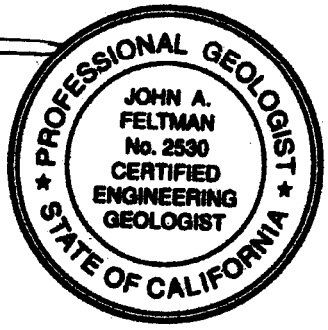
We look forward to discussing these and other potential strategies for clearance of downtown Hollister with you in the near future.

If you have any questions, please contact us.

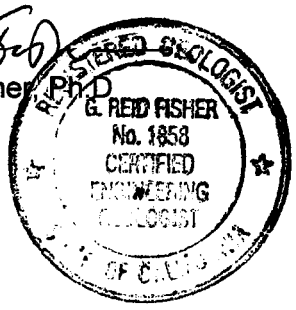
Sincerely,

PACIFIC GEOTECHNICAL ENGINEERING

John Feltman
CEG #2530



G. Reid Fisher, Ph.D.
CEG #1858



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Reviewed Reports (listed by Report Title Code):

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2. Geoconsultants, Inc., Geologic Hazard Investigation for Proposed Commercial Development, Park Hill and San Benito Streets, Hollister, CA: unpublished report prepared for Mr. Ronald J. Koll c/o Mr. James Paxton, Attorney at Law. Project No. G221-01
3. Jo Crosby and Associates, 1983, Fault Trace Study, 29 Hawkins Street near Prospect Avenue, Hollister, California: unpublished report prepared for Joe Piini Realty. File No. 3232 A-7
4. Terratech, Inc., 1987, Investigation of the East Branch of the Calaveras Fault, Prune Street School Site (Rancho San Justo Tandem School Site), Hollister, California: unpublished report prepared for Hollister School District. Project 7973.
5. Terratech, Inc., 1990, Limited Geologic Evaluation, Lands of Reardon and Whittrock, Southeast Corner of Park Hill, Hollister, California: unpublished report prepared for Mr. Chris Reardon c/o Conservative Developers, Inc. Project 8286.
6. Applied Soil Mechanics, Inc., 1991, Fault Study, Poletti Property, 335 San Benito Street, Hollister, California: unpublished report prepared for City of Hollister Redevelopment Agency. File No. A0-2279-S1
7. Applied Soil Mechanics, Inc., 1991, Fault Study, Sites 1, 3-6, and 10, City of Hollister, California: unpublished report prepared for City of Hollister Redevelopment Agency. File No. A0-2280-S1
8. Applied Soil Mechanics, Inc., 1991, Fault Study, Bruhn and Peterson Properties, Building Sites 7 & 8, 515, 525, and 530 San Benito Street, Hollister, California: unpublished report prepared for City of Hollister Redevelopment Agency. File No. A0-2281-S1
9. Applied Soil Mechanics, Inc., 1991, Fault Study, "600 - block" Properties, SE Corner of Sixth and San Benito Streets, Hollister, California: unpublished report prepared for City of Hollister Redevelopment Agency. File No. A0-2323-S1
10. Applied Soil Mechanics, Inc., Fault Study, Building Site 9, Showcase Theatre, 705 San Benito Street, Hollister, California: unpublished report prepared for City of Hollister Redevelopment Agency. File No. A0-2282-S1.
11. Earth Systems Consultants Northern California, 1998, Geologic Fault Study, San Benito Foods Storage Building, Hollister, California: unpublished report prepared for San Benito Foods. File No. NHW-7197-01
12. Pacific Rim Geologic, 1998, Fault Investigation of the East Branch of the Calaveras Fault, Ranchers Feed, 354 First Street, Hollister, California: unpublished report prepared for Mr. Don Marcus, Marcus Building Systems, Inc. Project 1058
13. Pacific Rim Geologic, 2002, Fault Location and Engineering Geologic Investigation, Grace Property - Parcel 1, APN 54-19-09, 341 First Street, Hollister, California: unpublished report prepared for Mr. Michael Grace. Project 1093
14. Earth Systems Pacific, 2008, Geological Fault Investigation, Vista Meadows Senior Apartments, East Park Street and Rancho Drive, APN 056-290-001, Hollister, California; with Supplemental Geologic Fault Investigation: unpublished report prepared for South County Housing Corporation. File No. SH-10941-GA
15. William Lettis and Associates, Inc., 2008, Fault Rupture Hazard Study, Fremont School Site, Hollister, California (Draft Report): unpublished report prepared for City of Hollister.
16. Earth Systems Pacific, 2010, Exploratory Trench Location Map, Hollister Fire Station No. 1, 110 Fifth Street, Hollister, California: unpublished report for City of Hollister

Redevelopment Agency (report in progress June 2010). File No. SH-11132-GA
17. Weber and Associates, 1989, Geologic Investigation of the Siletto Property, APN 55-14-21, 1202 West Street, Hollister, San Benito County, California: unpublished report prepared for Dave Ames, Coldwell Banker/Pavetti Real Estate. Job # 89089-SB

Additional References:

Applied Soil Mechanics, Inc., 1991a, Geologic Evaluation, Proposed Three-Lot Subdivision, 49, 53, and 57 Hawkins Street, Hollister, California: unpublished report prepared for Dean Rodrigues. File No. A0-2303-S1 *(unavailable for review)*

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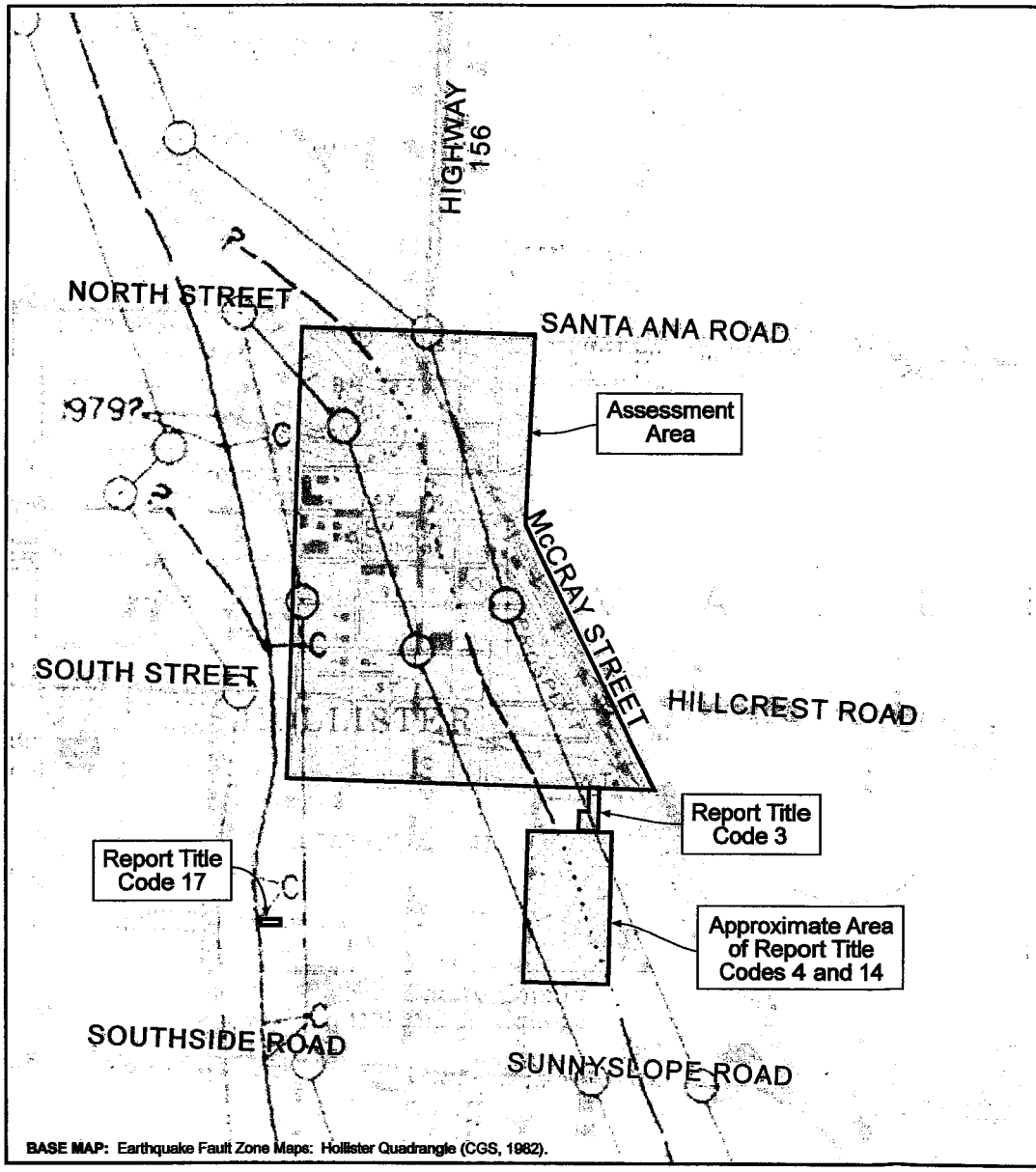

BASE MAP: Earthquake Fault Zone Maps: Hollister Quadrangle (CGS, 1982).

EXPLANATION

Potentially Active Faults

Faults considered to have been active during Quaternary time; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated recent or C for displacement caused by creep or possible creep.

Aerial photo lineaments (not field checked): based on youthful geomorphic and other features believed to be the results of Quaternary faulting.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect consecutively numbered turning points so as to define one or more special studies zone segments.

-N-

0 1000 ft

NOTE: Report Title Codes refer to reports reviewed as part of this assessment.

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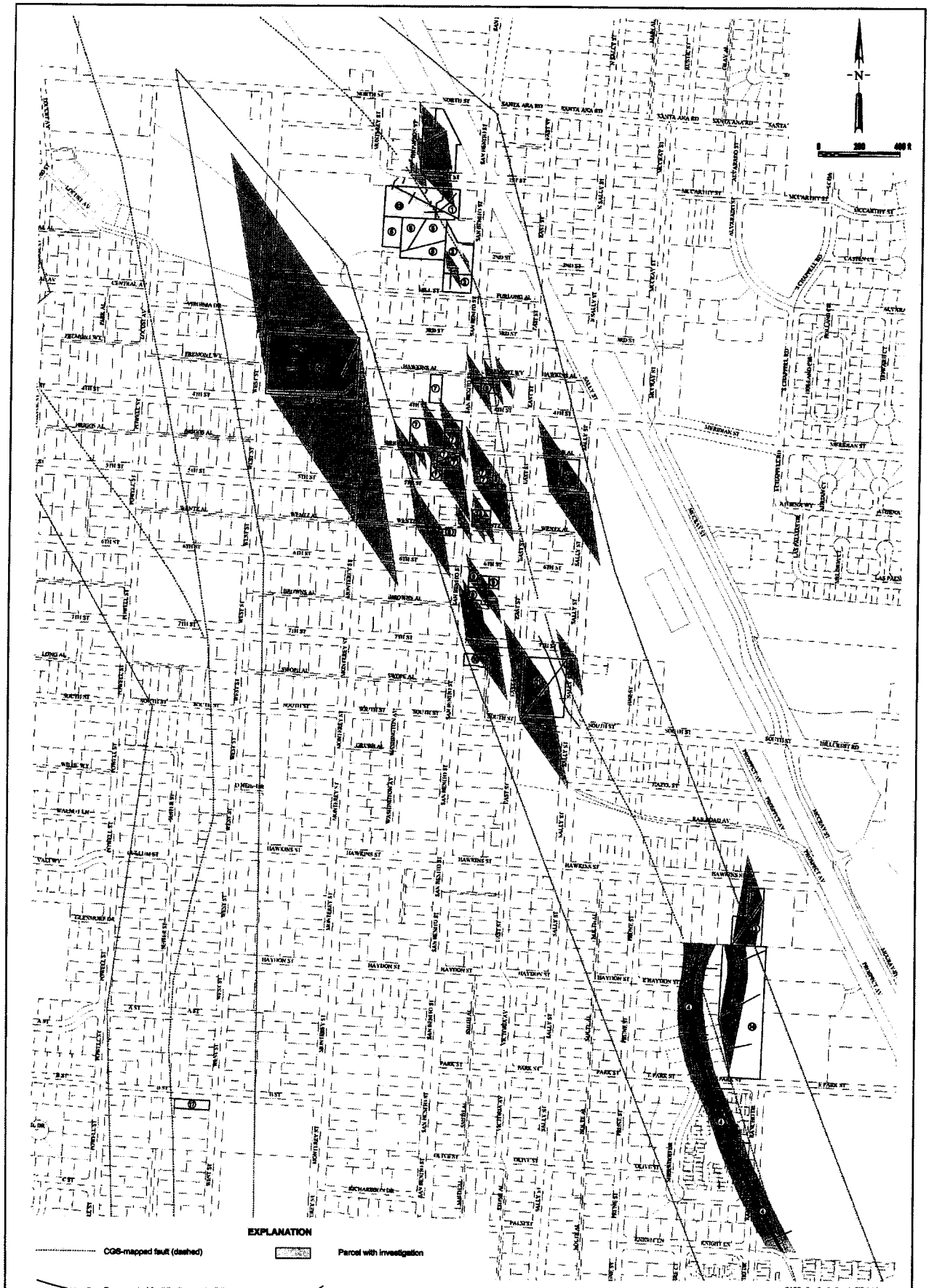

PACIFIC GEOTECHNICAL ENGINEERING	DATE JANUARY 2012	FAULT HAZARD MAP HOLLISTER FAULT ASSESSMENT HOLLISTER, CALIFORNIA	FIGURE 2 PROJECT 2010.0177