BAUER associates, inc.

GEOTECHNICAL CONSULTANTS

February 6, 2018
Job No. 3245.3

Ms. Flora Li
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Geotechnical Consultation
Addendum 2 – Post Nuns Fire
Lot S13, Sonoma Country Inn
Kenwood, California

This letter is in reference to the request by the County of Sonoma Permit and Resource Management Department (PRMD) for information regarding the threat of post-fire slope instability at the project site following the Nuns Fire of October 2017. A Watersheds Emergency Response Team (WERT, 2017) report was prepared for the Nuns Fire, which includes an overview of conditions observed after the fires. Based on PRMD's review of the WERT (2017) report, PRMD has requested site-specific information for the project site.

The project site consists of Lot S13 (hotel site) of the Sonoma Country Inn Subdivision (SCI), one of 13 lots within the SCI subdivision. Lot S13 comprises approximately 52 acres that includes the hotel site in hillside terrain, and a site on flatland areas bordering Highway 12. Our work was performed for the hotel site only. Graywood Ranch Subdivision is a 6-lot subdivision located adjacent to SCI on the west and north. We understand that Lots G1 through G4, and Lot G6, are owned by Tohigh Investment SF LLC (Tohigh). A *Composite Map*, dated April 2015 and prepared by Adobe Associates, Inc., shows both the SCI and Graywood subdivisions. The map is partially reproduced and shown on Plate 1.

The purpose of our work, as outlined in our agreement dated November 16, 2017 as Exhibit A and attached to the Supplemental Agreement Between Tohigh Investment SF LLC, dated December 4, 2017, was to provide geotechnical consultation services for the project.

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Specifically, PRMD requests: 1) how the project site (Lot S13) will be protected against threats of landslides and mudslides from the burned areas above and around the site; and 2) what actions will be taken to address potential debris flows moving from the project site to other properties below. The *Resort Site Fire Perimeter Map* shown on Plate 2 was provided to us by Tohigh and was included in the supplemental visibility report reportedly prepared by Don MacNair. Our scope of work included the following:

1. Review of selected geologic literature from our files, additional documents you have provided to us, and the U.S. Geological Survey Post-Fire Debris Flow Hazards webpage dated October 8, 2017 for the Nuns Fire (https://landslides.usgs.gov/hazards/postfire_debrisflow/detail.php?objectid=162).

2. Perform a site visit to observe the current surface conditions of the lot including the burn area.

3. Provide an opinion regarding the potential for debris flow hazard at the subject site.

4. Provide an opinion regarding whether construction and/or operation at the hotel site will significantly impact the risk of erosion or debris flows given the site conditions observed post fire.

5. Preparation of this letter along with recommendations for supplemental work, as appropriate.

No subsurface exploration was authorized or performed for this scope of work. Our scope of work did not include an evaluation of any potential hazardous waste contamination of soil or groundwater at the site. Further, our work did not include an evaluation of other lots within the subdivisions. Soil hydrophobicity testing was not performed during our work.

On December 6, 2017, our professional geologist met with Ms. Flora Li of Tohigh to perform a surface reconnaissance of Lot S13 and selected adjacent areas. A listing of the literature reviewed is presented in the *References* at the end of this report.

SITE CONDITIONS

The project site is located on the former Graywood Ranch property in Kenwood. Lot S13 comprises approximately 52-acre parcel accessed from Campagna Lane, oriented northeasterly off Highway 12. A contour map provided by Tohigh showing lot boundaries and elevation contours is partially reproduced and shown on Plate 3. Campagna Lane terminates at a cul-de-sac at the hotel site on Lot S13. Moon Watch Lane extends off the northern part of Campagna Lane and wraps around the northeastern portion of the project site. A water tank access road extends northeastward and uphill off Moon Watch Lane.

The project site is located on a gentle (under about 15%) topographic bench at approximately elevation 725 to 750 feet. A southeasterly plunging ridge is located on the west side of the project site. A drainage channel is located to the east of the site. The channel originates approximately on Lots S8/9 on the east, partially crosses the project site and flows downhill through an adjacent off-site parcel at 8017 Highway 12 that contains a private residence. The drainage channel exhibits evidence of what appears to be previous older, in-channel debris flow deposits. The deposits appear to be older based on vegetative cover. Some vegetation debris is within mostly off-site portions of the channel. Uphill and downhill terrain beyond the topographic bench is moderately to steeply sloping at gradients of about 15 to 50%. Volcanic rocks are strewn over the ground surface downhill of the bench. Vegetation on the benched area consists mostly of grassland with scattered oak trees. On the ridge and surrounding steeper terrain, vegetation consists of oak forest and chaparral. Several overgrown soil stockpiles from previous roadway construction are situated on the bench area at the hotel site. A bulldozer trail was excavated downhill from the hotel site. Earth berm water bars were excavated across the trail to divert runoff onto vegetated areas. The trail exposes bare earth and loose soils.

The *Resort Site Fire Perimeter Map* shown on Plate 2 indicates that the majority of the project site is within an unburned area. This was confirmed during our reconnaissance. The portion of the project site near the eastern project boundary, including portions of the on- and off-site drainage channel, were intermittently burned with low to moderate and moderate to high severity. Although we did not determine soil hydrophobicity (soils that repel water) at the site, it appears hydrophobic soil conditions may be present based on the presence of localized areas of burned grasses and trees. Adjacent areas encompassing Lots S7 through S11 appear to be scorched to moderately burned. Variable areas appear to

exhibit hydrophobic soil conditions, however, during our reconnaissance we observed beginning intermittent regrowth of grasses in these burned areas. It appears the adjacent roadways, Campagna and Moon Watch Lanes, were a partial fire break around the project site. Lots G1, G2 and part of G3 to the north and west of the project site appear to be moderately to deeply burned, and exhibit hydrophobic-appearing soil conditions. A drainage ravine that originates off-site and west of Graywood Lot G1 flows downhill through the southwestern portion of Lot G1and between the boundary of Lots G2 and G3 and Campagna Lane east of the project site.

Our review of the WERT (2017) report indicates their work uses the results of burn severity maps along with empirical models to estimate the likelihood and potential volume of debris flows for select basins in response to design storms. A design storm is indicated in the report to have a peak 15-minute rainfall intensity of 24 millimeters per hour (0.94 inches). WERT (2017) indicates that the observations in their report are not intended to be fully comprehensive and/or conclusive, and serve as a preliminary tool to assist emergency responding agencies in the development of more detailed post-fire emergency response plans.

WERT (2017) contains Preliminary Hazard Assessment (PHA) maps that were prepared for estimates of the likelihood of debris flows, potential volumes, and combined relative debris flow hazard at fire-affected sites. At the project site (bench area), the PHA maps in WERT (2017) estimate the probability of debris flow hazard to be 40 to 60% with a hazard rating of moderate. At the drainage channel on the east, the PHA maps estimate the probability of debris flow hazard to be 20 to 40% on Lots S8/9, and 0 to 20% near the eastern parcel boundary. The PHA maps estimate the hazard rating of debris flow to be low. Portions of the PHA maps are shown on Plates 4 through 7.

The geologic map by Delattre et al. (2007) shows the site as being underlain by tuff breccia of the Sonoma Volcanics. Intercalated agglomerate and tuff is also described by the authors to be present within the tuff breccia unit. On higher terrain to the north, the volcanic rocks are mapped to be rhyolite with tuff and tuff breccia.

Mapping by the Natural Resources Conservation Service (NRCS) indicates the surface soils at the site consist of the Goulding (GgD, GgF) series. Per NRCS, the Goulding series is a clay and very gravelly clay loam on slopes of 5 to 30%. Runoff is considered by NRCS to be medium to rapid, and the hazard of erosion is moderate to high. Shattered bedrock derived from volcanic rocks is noted by NRCS to be 16 to 24 inches deep.

Work performed by The Geosciences Group (TGG), the previous geotechnical consultant for the development, and presented in their report dated June 6, 2003, indicates the site is underlain by volcanic bedrock. The test pit logs indicate volcanic bedrock was typically encountered within the upper 2 feet of the ground surface with isolated areas up to about 4 feet. In addition, work performed by TGG (2003) indicates that landslides do not underlie the property including the project site. This opinion by TGG was supported by the Environmental Impact Report (EIR) geologist, as presented in Section *5.7 Geology/Soils* of the EIR.

DISCUSSION AND CONCLUSIONS

Based on our work, we judge the risk of debris flow damage onto, and generated from, the project site is low to insignificant provided the site is graded and improved with suitable erosion control measures in accordance with approved project plans. Our judgment is based on the unburned condition on the majority of the project site, and localized revegetation of grasses observed within the burned areas. Revegetation is indicative of surface runoff infiltration and seed germination. Additional comments are summarized below.

1. Previous debris flows were not observed at or uphill of the project site.

2. The slopes surrounding the site and steeper uphill slopes are generally gentle and relatively uniform without incised channels or concentrated runoff oriented into the site.

3. The roadways at the site appear to have performed as a fire break around the project site.

4. Volcanic bedrock exposures are abundant across the subdivision. Regionally, the volcanic terrain that underlies the site is typically less susceptible to debris flows, and the surface soils are typically relatively thin (0 to 24 inches).

5. The project site is generally in an unburned area with the absence of hydrophobic soils except in the far eastern portion of the site. However,

steeper uphill areas (above Moon Watch Lane) do contain intermittent area of hydrophobic-appearing soils. This area should be monitored regularly, and mitigation implemented if soil erosion occurs.

6. The adopted conditions attached to the project approval, which are designed to address risks of erosion and slope stability, are adequate to reduce the risk of erosion or slope instability for construction of the hotel site in the post fire condition. There are no significant changed conditions that creates an increased risk of erosion or instability as related to the construction of the hotel site. Therefore, there are no additional fire-related geotechnical studies required by Bauer Associates, Inc. at this time.

Portions of the eastern project boundary (including the top of the narrow drainage channel that originates on Lot S8/9 and drains through the off-site drainage channel) were intermittently burned with low to moderate severity and a localized area zoned as moderate to high severity. The drainage channel generally flows off-site to a private residence at 8017 Highway 12 where the PHA maps in WERT (2017) estimate the likelihood of debris flow hazard to be 20 to 40% on Lots S8/9 and 0 to 20% off-site. WERT (2017) estimates the hazard of debris flow along the entire segment to be low. It should be noted that WERT (2017) does not designate the private residence at 8017 Highway 12 to be a Value-at-Risk site. However, it would be prudent for the occupant/owner to implement their own early warning systems and mitigation, as required.

Precautionary measures can be implemented, as needed, to reduce the risk of future debris flow hazards at the project site, as summarized below:

1. Monitor road drainage infrastructure, maintain cleared drainage V-ditches and culverts, and flush drop inlets to permit unobstructed flow and proper discharge of collected waters at and around the site to reduce blocking and clogging potential;

2. The eastern drainage should be cleared of vegetation debris to allow free-flowing conditions and to reduce the potential for debris pulses caused by breaching of debris dams.

3. Localized areas of burned soils were observed at and around the site. The NRCS *Soil Quality Information Sheet* (June 2000) indicates that regionally, the hydrophobic soil layer in burned areas typically vary across any given site but generally range from ½ to 3 inches deep. At the project site, the majority of the land was generally unburned with the exception of intermittent areas on the east that were burned with low to possibly moderate severity. As discussed previously, localized areas of grass regrowth were observed. NRCS (200) indicates that upper few inches of burned soils in gentle areas can be raked or hoed to break up the water repellant area to allow infiltration of surface runoff and promote seed germination and root growth;

4. Spread straw or mulch on gentle terrain. On sloping terrain, the straw should be anchored to the ground. In addition, utilize fiber rolls, hay bale check dams, silt fences, etc. to break up concentrated surface runoff during peak storms. Hydroseeding slopes and exposed soils, such as the fire trail downhill of the project site, can also be implemented. Similarly, downed or cut trees may be anchored across slopes. The project Civil Engineer should be consulted to provide recommendations for BMP practices and erosion and sediment control plans and installation; and

5. The soil stockpiles are currently overgrown locally with grasses and low shrubs. We understand these stockpiles will be removed and/or regraded during site development. Site grading should be performed in accordance with the geotechnical investigation report and under the observation of the geotechnical engineer. In the interim, the piles should be monitored for erosion during the rainy season and erosion control measures implemented, as appropriate.

6. With regard to construction, adherence to the adopted conditions of approval.

As with all sites on sloping terrain, on-going natural processes including erosion, landslides, and debris flows are inherent risks that gradually wear away the landscape. Such inherent hillside and slope risks are increased following wildfires and when rainfall intensity-duration thresholds are exceeded. Therefore, an early warning system should be

developed. The early warning system should include personnel responsible for diligent land management, regular inspection and monitoring procedures of the land, weather monitoring (NOAA/USGS radar precipitation estimates and thresholds for rainfall intensity-duration) during the rainy season and particularly before, during and after storm events (https://landslides.usgs.gov/hazards/warningsys.php), etc., over the long term and as approved by PRMD and/or other responsible agencies. If evidence of erosion or slope instability is observed, we should be contacted to provide recommendations for mitigation.

LIMITATIONS

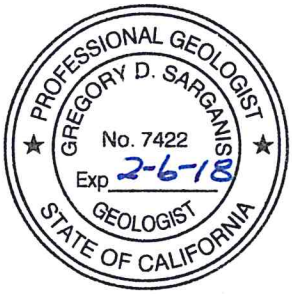
We performed this limited consultation service and prepared this letter in accordance with generally accepted standards of the geotechnical engineering profession. No other warranty, either express or implied, is given. Upon request, we would be pleased to prepare a proposal for more comprehensive studies.

We trust this is the information you require at this time. If you have questions or wish to discuss this further, please call.

Very truly yours,

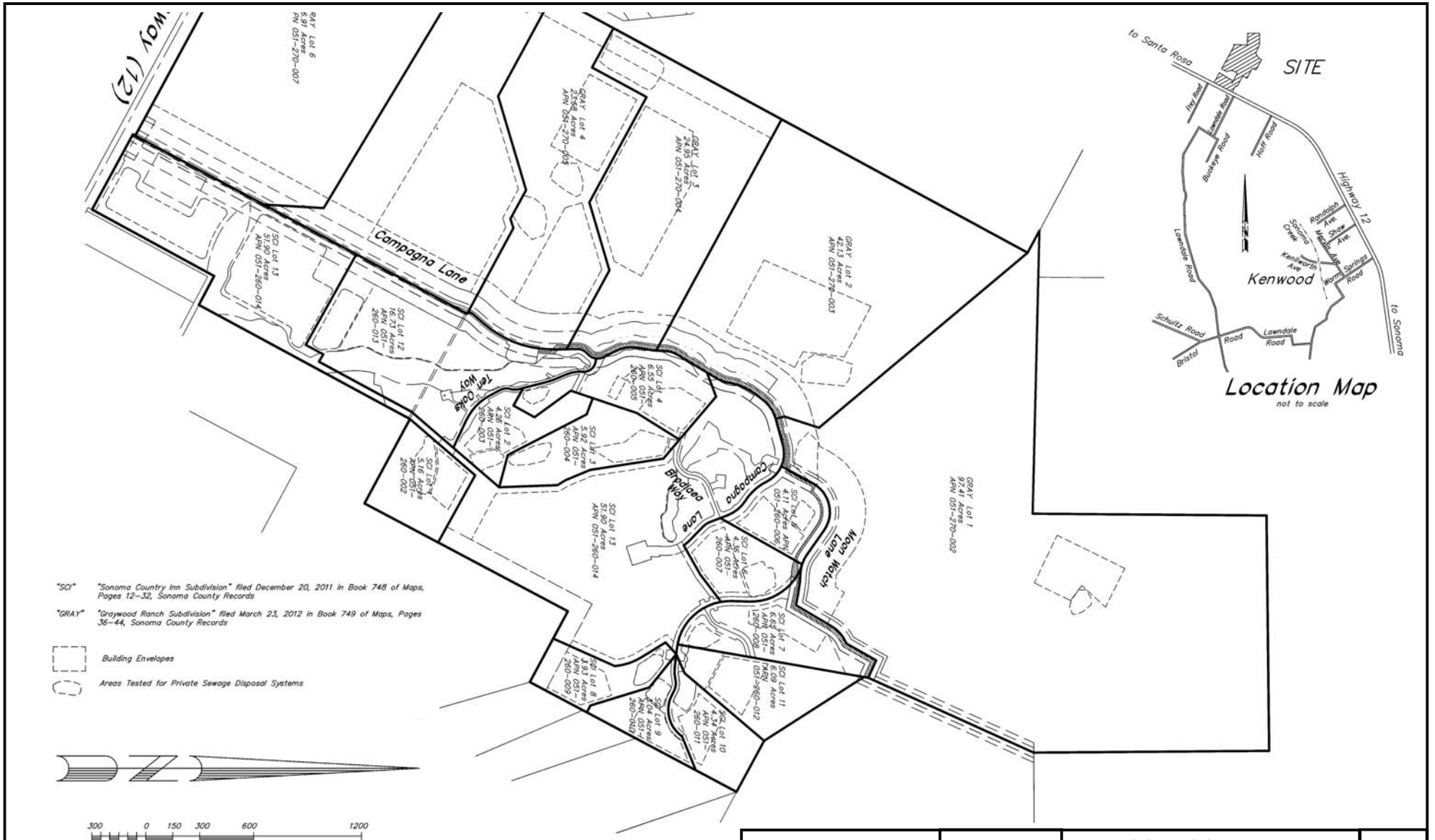
BAUER ASSOCIATES, INC.

Gregory D. Sarganis
Professional Geologist



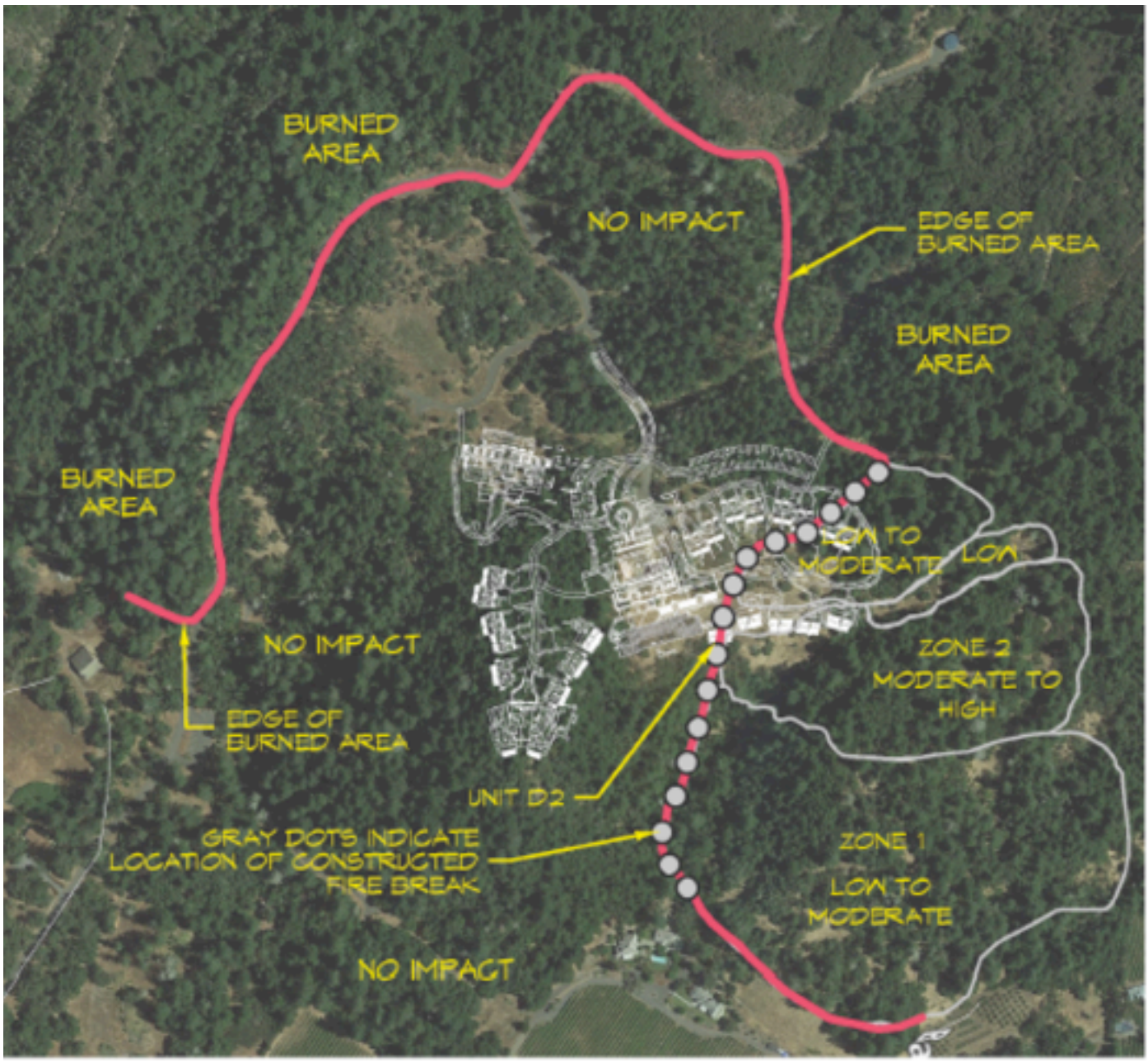
Bryce Bauer
Geotechnical Engineer

GDS/BB (consul/sci fire)
Attachments – Plates 1 through 7
Email: Flora Li (flora.li@tohighinvestment.com)



Reference: "Composite Map," dated April 2015, prepared by Adobe Associates, Inc.
Note: The locations of all features are approximate and may vary.

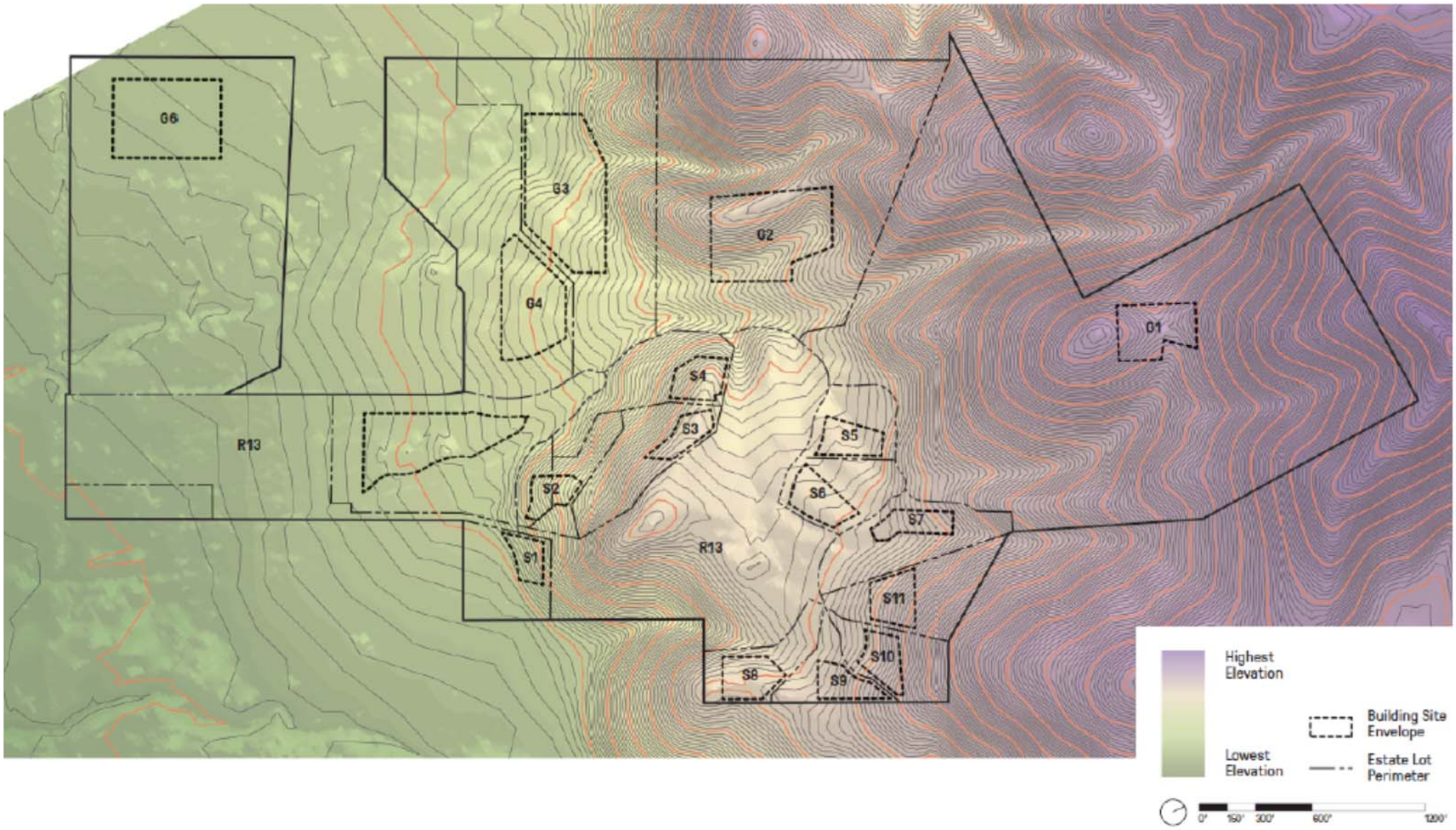
BAUER ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	Job No: 3245.3 Date: 1/18 By: GDS	**COMPOSITE MAP** LOT S13, SONOMA COUNTRY INN Kenwood, California	PLATE **1**



Reference: Resort Site Fire Perimeter Map provided to us by Tohigh Investment SF LLC, and prepared by Don MacNair.

Note: The location of all features is approximate and may vary. No Scale

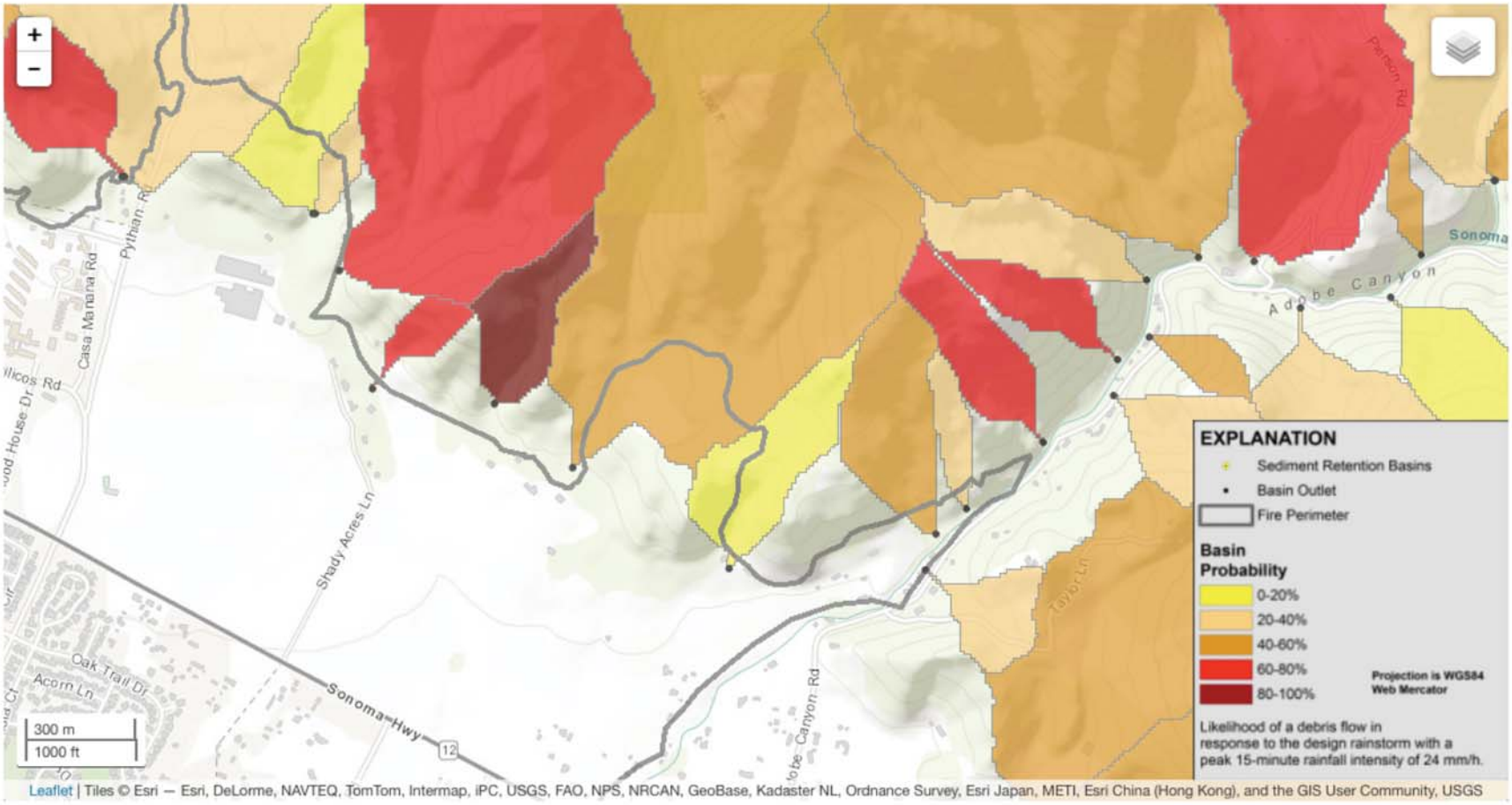
BAUER ASSOCIATES GEOTECHNICAL CONSULTANTS	Job No: 3245.3 Date: 1/18 By: GDS	**RESORT SITE FIRE PERIMETER MAP** LOT S13, SONOMA COUNTRY INN Kenwood, California	PLATE **2**



Reference: Contour Map provided to us by Tohigh Investment SF LLC.
Note: The locations of all features are approximate and may vary.

BAUER ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	Job No: 3245.3 Date: 1/18 By: GDS	**CONTOUR MAP** LOT S13, SONOMA COUNTRY INN Kenwood, California	PLATE **3**

Preliminary Hazard Assessment



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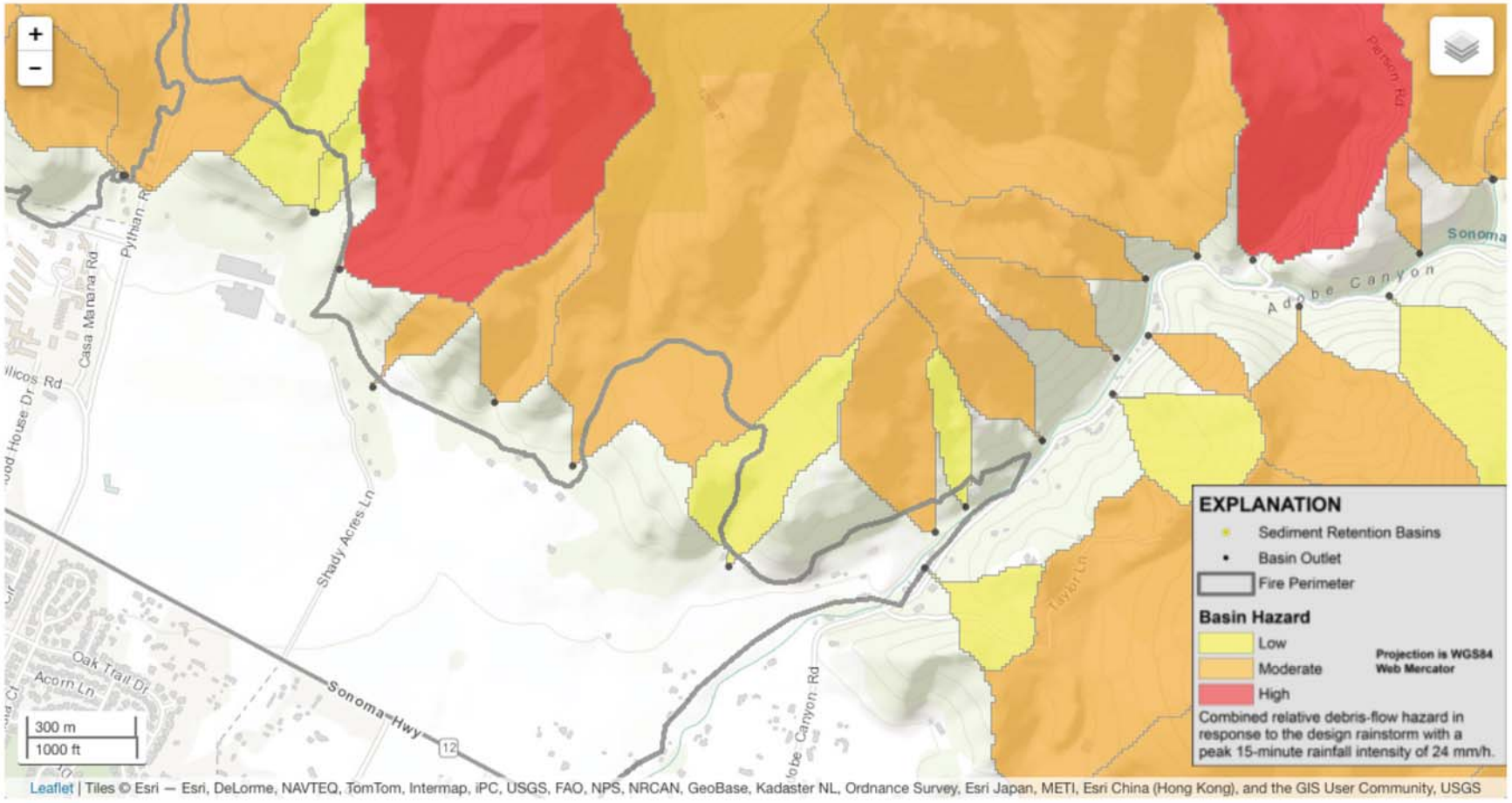
Reference North

Reference: https://landslides.usgs.gov/hazards/postfire_debrisflow/detail.php?objectid=162
Note: The locations of all features are approximate and may vary. Scale as shown

BAUER ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	Job No: 3245.3 Date: 1/18 By: GDS	**DEBRIS FLOW PROBABILITY** LOT S13, SONOMA COUNTRY INN Kenwood, California	PLATE **4**

Preliminary Hazard Assessment



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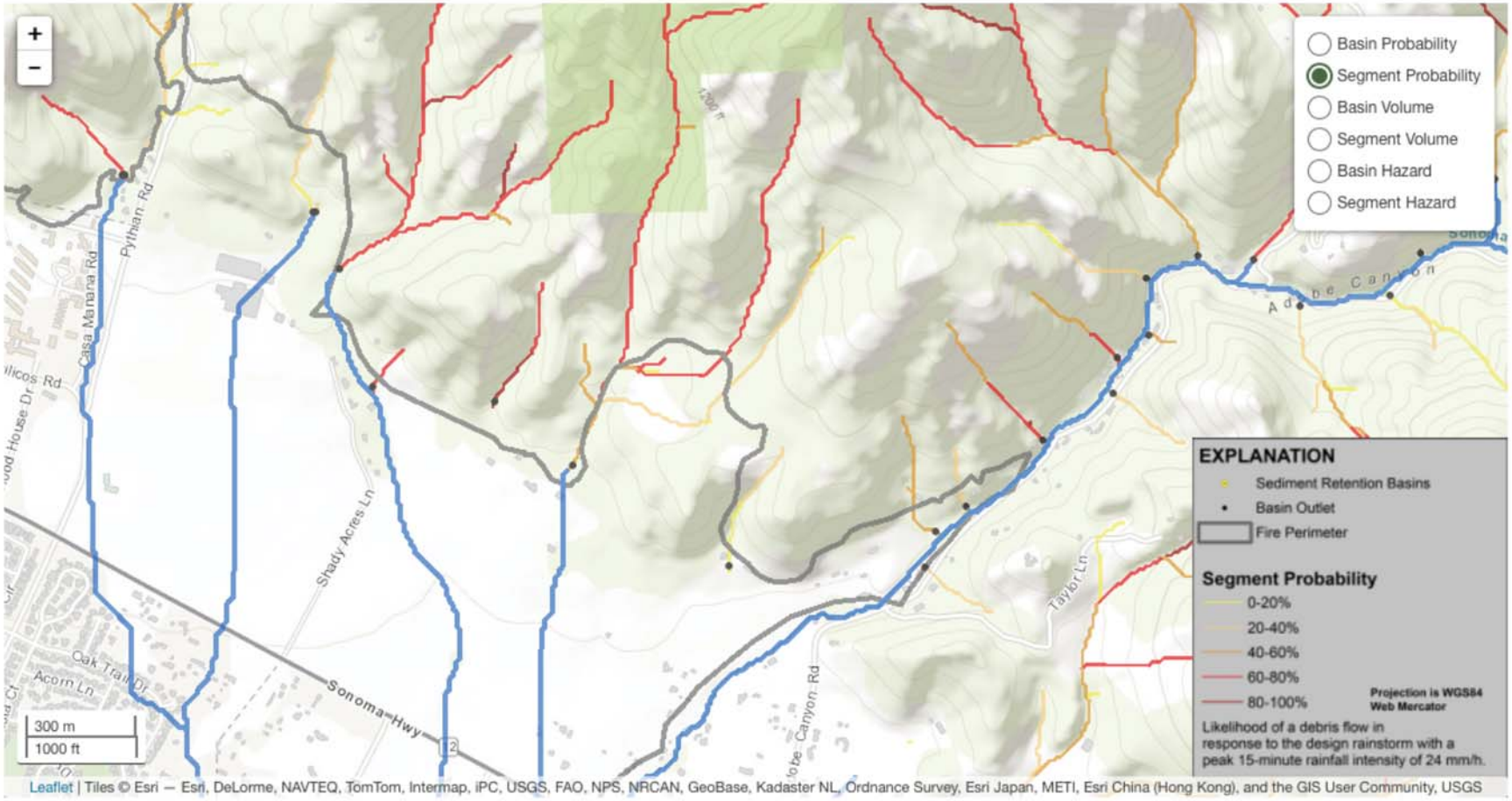
Reference: https://landslides.usgs.gov/hazards/postfire_debrisflow/detail.php?objectid=162
Note: The locations of all features are approximate and may vary. Scale as shown

BAUER ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	Job No: 3245.3 Date: 1/18 By: GDS	**DEBRIS FLOW HAZARD RATING** LOT S13, SONOMA COUNTRY INN Kenwood, California	PLATE **5**

Preliminary Hazard Assessment



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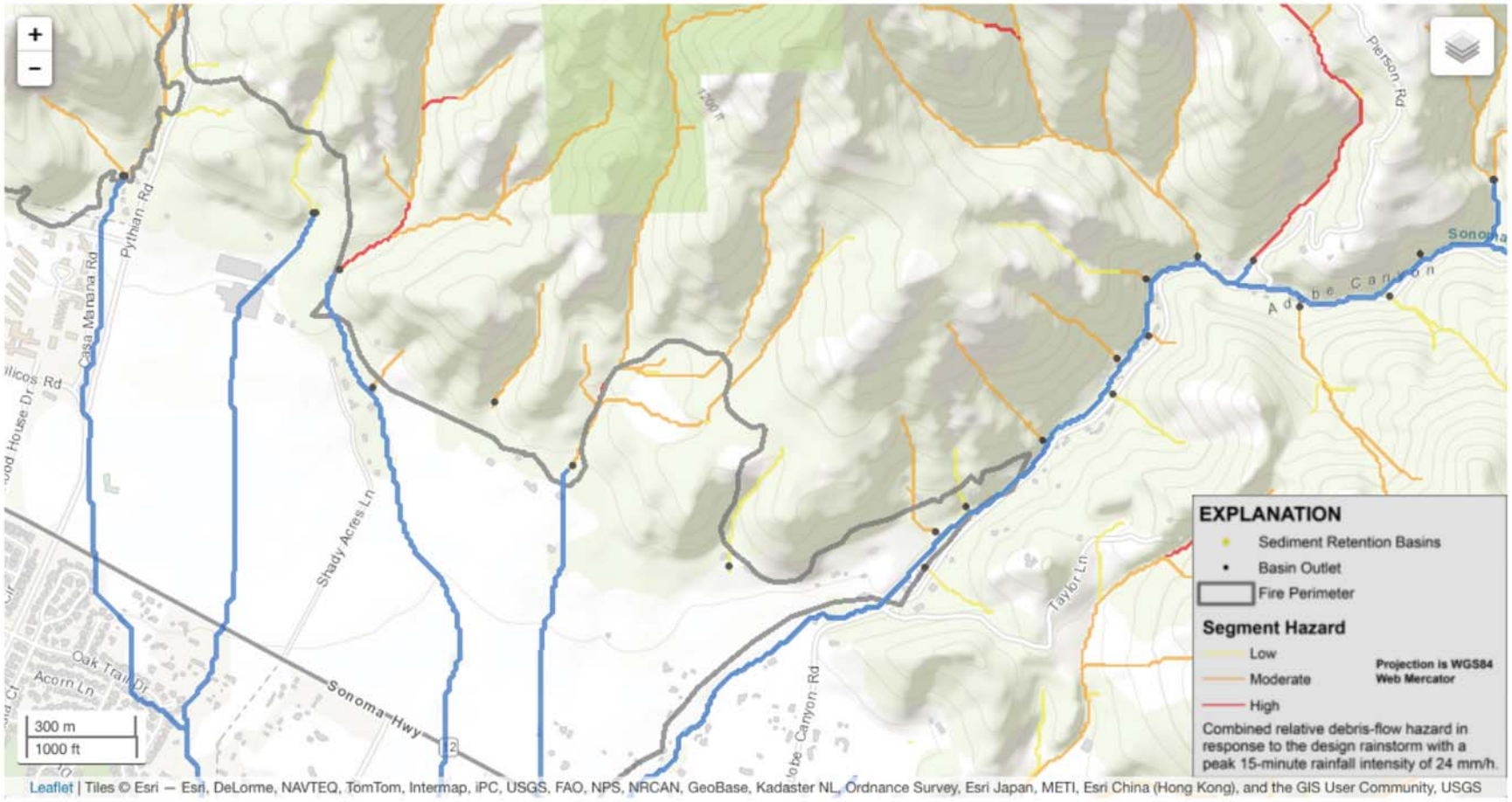
Reference North

Reference: https://landslides.usgs.gov/hazards/postfire_debrisflow/detail.php?objectid=162
Note: The locations of all features are approximate and may vary. Scale as shown

BAUER ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	Job No: 3245.3 Date: 1/18 By: GDS	**DEBRIS FLOW CHANNEL PROPABILITY** LOT S13, SONOMA COUNTRY INN Kenwood, California	PLATE **6**

Preliminary Hazard Assessment



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Reference North

Reference: https://landslides.usgs.gov/hazards/postfire_debrisflow/detail.php?objectid=162
Note: The locations of all features are approximate and may vary. Scale as shown

BAUER ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	Job No: 3245.3 Date: 1/18 By: GDS	**DEBRIS FLOW CHANNEL HAZARD RATING** LOT S13, SONOMA COUNTRY INN Kenwood, California	PLATE **7**

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https://landslides.usgs.gov/hazards/postfire_debrisflow/detail.php?objectid=162