RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS

UPDATED MEMORANDUM

February 23, 2023

To: Mr. Cuong Pham
Red Boat LLC
Sent via email (phamcuongt@gmail.com)

Job No. 747-NPA01

Re: Updated Napa County Tier 3 Water Availability Analysis (WAA)
Red Boat Vineyard Development Project
Napa County APN 039-380-037
1373 Soda Canyon Road
Napa County, California

Dear Mr. Pham:

Richard C. Slade & Associates LLC, Consulting Groundwater Geologists (RCS), is pleased to present this Updated Memorandum regarding a Tier 3 Water Availability Analysis for the Red Boat Vineyard property, which is located at 1373 Soda Canyon Road, north of the City of Napa in Napa County. The Red Boat property is referred to herein as the subject property. RCS prepared a document titled "Results of Napa County Tier 1 Water Availability Analysis, Red Boat Vineyard Development Project, 1373 Soda Canyon Road, Napa County, California" dated November 8, 2021 (RCS, 2021). That document was submitted to the County as part of the review process for the proposed vineyard development project. Following Napa County review of the application, Napa County Planning, Building & Environmental Services (PBES) issued an email dated August 9, 2022, subject titled "Red Boat P21-00307 – Project Status Update" (PBES, 2022). Therein, a Tier 3 WAA analysis was requested by the County. As quoted from the County's August 9, 2022, email for the project submission:

> *"Given the proximity to what has been identified as a "Stream of Concern"(Soda Creek) the WAA will need to discuss the applicability of a Tier III analysis for the proposed winery. I believe, given that the project wells are located within a separate watershed than the watershed which drains to Soda Creek it should be possible to demonstrate (with applicable discussion and evidence) that there would be no interference between the well and the creek. If this cannot be demonstrated then the project would require a full Tier III analysis."*

Therefore, the purpose of this document is to respond to the County PBES comment above, in accordance with the Napa County WAA guidelines (WAA, 2015). An original version of this document dated October 10, 2022 was reviewed by PBES. Subsequent to that review, RCS attended a meeting with PBES and PPI Engineering, Inc. (PPI, the project Engineer) on November 3, 2022. During that meeting, PBES expressed a general desire for more information

and data to support the assertion that pumping the project well (the Upper Well) on the Red Boat Vineyard property for the purposes of the project would not affect surface flows in Soda Creek. Therefore, this document was updated with additional data, information, and analyses.

Background

RCS prepared the document "Results of Revised Napa County Tier 1 Water Availability Analysis, Red Boat Vineyard Development Project, 1373 Soda Canyon Road, Napa, California" dated February 23, 2023 (RCS, 2023) for the project. That initial WAA document includes significant details regarding the subject property, including descriptions of the local geology and hydrogeology; well construction; precipitation; groundwater recharge; and other factors. This current Updated Memorandum is intended to compliment the Revised WAA (RCS, 2023), and should be reviewed in conjunction with the previously submitted WAA documentation.

Napa County has published information defining which Rivers, Streams, and Creeks within the County are considered "significant" for the purposes of Tier 3 Analysis. These "Significant Streams," as defined by Napa County, are shown on a published and undated map and GIS data set titled "Napa County Well Permit Standards: Significant Streams" (Napa County GIS Data, 2022). According to the County's WAA Guidelines (WAA, 2015), if a project well is within 1,500 ft of a Significant Stream, Creek, or River, a Tier 3 WAA is required. As noted in the "Project Status Update" email from Napa County PBES, Soda Creek falls within the 1,500 offset distance requiring Tier 3 analysis.

Figure 1, "Location Map" shows the subject property boundaries superimposed on a topographic map of the Yountville Quadrangle (USGS, 1951). As shown thereon, Soda Creek is shown on the USGS basemap. Soda Creek, at its closest location to the project well (the Upper Well), is located ~500 east of the Upper Well. An unnamed creek tributary to Soda Creek is located ~1,200 ft north of the property. The unnamed creek merges with Soda Creek north of the subject property boundary; any runoff in Soda Creek flows toward the south, towards the Napa River. Figure 2, "Aerial Photograph Map", shows an aerial photograph of the area and the same information that is shown on Figure 1.

Creek Flow Observations

RCS was able to recover only limited information related to historic surface water flows in Soda Creek. In a document titled "Central Napa River Watershed Project, Salmonid Habitat Form and Function" (NCRCD, 2005), a survey of Soda Creek was made in August of 2004. It is noted therein that Soda Creek was "dry below Loma Vista Avenue to the confluence with the Napa River". The subject property is located along Soda Creek, roughly 900 feet downstream of Loma Vista Avenue, where Soda Creek was observed to be dry at the time of the survey. Observations of flow (or lack thereof) were made by RCS geologists on two different dates, at two distinct locations along Soda Creek, near the subject property. The two observation locations are shown on Figure 2. One observation point was at the entrance bridge to the subject property, 510 ft east of the project well, and the second observation point was 1,420 ft northeast of the project well, where Soda Creek passes under a bridge at Loma Vista Drive. During a site visit to the property in May 2021, an RCS geologist noted that Soda Creek was flowing at both of these observation

locations. During a later site visit to the property in September 2022, an RCS geologist noted that Soda Creek was dry at the same two observation locations. The Creek was again noted to be flowing at both locations during a January 26, 2023, site visit by RCS. Although the available Soda Creek flow data are sparse, these data suggest that flows in Soda Creek in the vicinity of the subject property are intermittent, and that flow generally does not occur during summer months.

Photographs of Soda Creek are available from the Google Maps website, using the "street view" function. Because Soda Creek is sufficiently close to the road, it can be viewed in the "street view" photos at a location just north of the driveway of the subject property; GPS coordinates of the observation location as reported on the website are (38.372666°N, 122.282560°W). Only a limited number of photographs of that particular roadside stream location are available for review. Table 1, "Summary of 'Street View' Soda Creek Photo Review," presents a summary of the qualitative creek conditions determined by RCS via review of the available "street view" photographs. As shown in the table below, the Creek was shown to be dry in the summer months of June 2013 and October 2007.

Table 1 – Summary of 'Street View' Soda Creek Photo Review

Date of "Street View" Photo	Flow Visible? (Y/N)	Qualitative Flow Volume Assessment
March 2021	Y	Low Flow
March 2019	Y	Significant Flow
April 2016	Y	Low Flow
June 2013	N	Dry
October 2007	N	Dry

Table 2, "Summary of 'Satellite View' Soda Creek Photo Review" presents the results of a similar exercise as was conducted for Table 1, but the Table 2 results were based on review of "satellite view" photos from the Google Earth Pro software package. Not all historic air photos available from Google Earth Pro are included in Table 2. Photos that were excluded either did not have an indication as to the date of the photo, or the resolution was too poor to reasonably discern flow in Soda Creek. Review of Table 2 yields the same conclusion as was determined from Table 1; Soda Creek is generally dry (not flowing) in the summer months of the year.

Table 2 – Summary of "Satellite View" Stream Photo Review

Date of "Street View" Photo	Flow Visible? (Y/N)	Qualitative Flow Volume Assessment
February 2022	Y	Significant Flow
October 2020	N	Dry
August 2020	N	Dry
July 2019	N	Dry
May 2019	Y	Low Flow
Sept 2018	Y?	Low Flow?
Feb 2018	Y	Significant Flow
May 2017	Y	Low Flow
September 2016	N	Dry

Napa Valley Subbasin Groundwater Sustainability Plan Review

In Section 6, "Groundwater and Surface Water Conditions", of the Napa Valley Subbasin Groundwater Sustainability Plan (LSCE, 2022), a discussion of the hydraulic connection of groundwater and creeks within the County, as simulated by computer modeling, is presented. Figure 6-123b shows the "average annual hydraulic connection" of creeks, including Soda Creek (LSCE, 2022). On that Figure, the nearest portion of Soda Creek that is shown to have any hydraulic connection to groundwater is located roughly 1,500 ft south of the Upper Well (the project well). That portion of Soda Creek is shown as having "> 2 weeks – 13 weeks" of annual hydraulic connectivity (LSCE, 2022). Downstream of the subject property, connectivity between Soda Creek and the underlying groundwater is limited to approximately 13 weeks per year (according to the GSP); therefore, any connection to groundwater (in the unlikely scenario that they are connected) likely does not extend beyond the wet season (LSCE, 2022).

Northeast Napa Area: Special Groundwater Study Review

In a report on the Northeast Napa Area (LSCE, 2017), the connection between groundwater and surface area in the area of Soda Creek is discussed. The subject property and project well are within the study area for the report, and just outside of (northeast of) the model area boundary for the report. In general, the Northeast Napa Area study showed that for the portion of Soda Creek within the model area, groundwater pumpage has a small effect on surface water flows. As stated in the report:

> *"Tributaries on the east side of the Napa River consistently show net losing[6] stream conditions over time, despite seasonal fluctuations where gaining stream*

> *conditions occur briefly. As an example, Soda Creek consistently exhibits net losing stream conditions on an annual basis (even during wet winter conditions and also during the scenario when no pumping was simulated); the Creek is more affected by precipitation, and therefore climate, than groundwater pumping in determining the rate of stream flow and leakage to groundwater." (LSCE, 2017).*

Footnote 6 in the passage above defines "net losing" as "Water is flowing into the ground from a stream when there is no direct connection between the stream and groundwater." (LSCE 2017). The report also states on page 41 that "Streamflow depletion occurs when pumping causes less groundwater to be discharged to surface water by capturing groundwater that would have discharged to the stream, or by inducing infiltration and reducing streamflow." (LSCE, 2017). As stated above, Soda Creek "consistently exhibits net losing stream conditions*"* (LSCE, 2017) and therefore streamflow depletion is not occurring based on the discussion presented in LSCE (2017).

Timing of Groundwater Use

Irrigation of the proposed new vineyards using the project well (the Upper Well) is projected to occur during a typical 20-week irrigation season each year (RCS, 2023). This 20-week irrigation season usually occurs between May and October. As discussed above, based on the data reviewed for this Updated Tier 3 WAA Memorandum, Soda Creek is typically dry in the summer months each year. The total annual irrigation demand of the proposed vineyards is 3.5 AF (RCS, 2023), and that irrigation water would be extracted only during the irrigation season (typically between May and October). Therefore, the vast majority of the groundwater needed for the project will be pumped from the project well when Soda Creek has historically been dry. Hence, even if there were a hydrogeologic or hydraulic connection between the intermittent flows in Soda Creek and the Upper Well (all evidence reviewed herein suggests no connection), the vineyard irrigation pumping would occur when Soda Creek is already dry.

Well Construction and Hydrogeology

As stated in the WAA report (RCS, 2023), the Upper Well is the project well proposed to supply groundwater to the proposed vineyard development. A driller's log could not be located for the Upper Well from the various online sources reviewed by RCS. Limited information was available for the Upper Well on the County permit, which was obtained by the drilling contractor prior to construction of the well. Figure 3, "Geology Map," is the same geology map shown in the RCS-prepared WAA (RCS, 2023), and it shows that the ground surface beneath the subject property and surrounding areas is comprised solely by the Sonoma Volcanics. The Upper Well was drilled into a ground surface exposure of rocks of the Sonoma Volcanics. Based on subsurface data reviewed in the RCS WAA (2023), the maps patterns shown on Figure 3, and known thicknesses of the Sonoma Volcanics rocks in the region, the perforated intervals in the Upper Well also exist solely within rocks of the Sonoma Volcanics.

Figure 3 also shows the alignment of a geologic cross section created by RCS for the purposes of this Tier 3 analysis. The alignment of the cross section was chosen such that it intersected both the project well and the channel of Soda Creek, along the shortest straight-line distance between Soda Creek and the project well. The geologic cross section is shown on Figure 4,

"Cross Section A-A'". The cross section is a scaled schematic illustration that shows the interpreted geologic conditions beneath the property and the construction of the project well (the Upper Well), along with the projected location and well construction details for the and the Lower Well. Figure 4 is notated with the surface features that the cross section intercepts, including Soda Creek and the subject property boundaries. Also shown on the cross section are the water level depth measurements described above, as measured by RCS geologists during the May 2021, September 2022, and January 2023 site visits.

The lack of connection between groundwater accessible to the project well and surface water in the vicinity of the subject property is also demonstrated on Figure 4. Thereon, the elevation of the water levels measured in in the Upper Well (the project well) in relation to the approximate elevation of the bottom of Soda Creek. In May 2021, the water level in the Upper Well was measured to be at an elevation 29 ft below the bed of Soda Creek. Soda Creek was observed (at the observation locations shown on Figure 2) to be flowing at that time. In September 2022, the water level in the Upper Well was recorded at an elevation that is 47 feet lower than the elevation of the bed of Soda Creek (see Figure 4). At the time of the September 2022 water level measurement, Soda Creek was noted to be dry at the observation locations shown on Figure 2. In January 2023, Soda Creek was observed to be flowing, and the water level in the well was 31 ft below the bottom of the creek. The 2021, 2022, and 2023 water level elevation measurements were therefore at elevations significantly lower (>25 ft) than the bed of Soda Creek. Based on these observations, the presence of surface water in Soda Creek appears to be unconnected and independent of water levels in the Upper Well. Further, groundwater available to wells at the subject property is stored in a fractured rock aquifer system. Fracture systems in volcanic rock aquifers are highly variable in the area; no information reviewed suggests that fractures in the volcanics rocks are in direct contact with Soda Creek in the area for the subject property, nor has any information been reviewed that suggests these fractures otherwise provide a significant conduit that would need to extend at least hundreds of feet to facilitate connection between the project well and Soda Creek.

Data presented above, and as illustrated on the cross sections, strongly support the assertion that the Upper Well (the project well) and the other onsite wells on the Red Boat property are not hydraulically connected to Soda Creek. As shown on the Figure F-2 "Decision Tree" in the County's WAA Guidance Document (WAA, 2015), and described in the Guidance Document text, because the project well is not hydraulically connected to surface water(s), the "Groundwater/Surface Water Evaluation is complete."

Conclusions

- The Upper Well (the project well) is not hydraulicly connected with Soda Creek, the location for which is shown on Figures 1, 2, and 3. This lack of connection is demonstrated by the following:
    - The elevations of the water levels measured in the project well in May 2021, September 2022, and January 2023 are significantly lower that the bed elevation of Soda Creek (see Figure 4). Even when flow was present in Soda Creek, as observed in May 2021 and January 2023, the water level measured in the project well was nearly 30 ft lower than the bed elevation of Soda Creek. The significant

differences in elevation between water levels in the project well and the bed elevation of Soda Creek suggest that, in the vicinity of the subject property, a hydraulic connection between the onsite water wells and Soda Creek does not exist.

- Creek flow observations and other data presented herein support the assertion that Soda Creek does not typically flow during the summer months. Sources that support this assertion are: direct observation by RCS geologists; Google Maps "street view" photos; Google Earth Pro "satellite view" photos; and data from an NCRCD (2005) report. These sources all suggest that Soda Creek is typically dry during a portion of the year in the vicinity of the subject property.

- Modeling work described in Section 6 of the Napa Valley Subbasin Groundwater Sustainability Plan suggests that connectivity of Soda Creek to underlying groundwater (if such connectivity did exist) likely does not extend beyond the wet season.

- Surficial flow in the portion of Soda Creek near the subject property and within 1,500 ft of the project well is dependent upon rainfall events, and not derived from groundwater in the vicinity of the subject property. Information provided in the Northeast Napa Area report (LSCE, 2017) shows that a connection between groundwater and surface area in the area of Soda Creek does not exist. Further, Soda Creek is described as a "net losing" stream, meaning that the vast majority of the year, the Creek is not gaining flow from groundwater (LSCE, 2017). The results of that report showed that Soda Creek "is more affected by precipitation, and therefore climate, than groundwater pumping in determining the rate of stream flow and leakage to groundwater." (LSCE, 2017). Therefore, streamflow depletion by virtue of pumping is not occurring in Soda Creek.

- The vast majority of groundwater pumped for the vineyard irrigation project will be pumped during a time of year when the creek is noted to historically be dry. Hence, pumping groundwater from the Upper Well (the project well) for the purposes of the proposed vineyards will not affect creek flows, because the creek is naturally not flowing during the anticipated periods of vineyard irrigation for the proposed vineyard development project.

- According to the WAA Guidance document (WAA, 2015), the Tier 3 analysis has been satisfied because a lack of hydraulic connection between the project well and Soda Creek has been demonstrated.

Closure/Disclaimer

This Updated Memorandum regarding a Tier 3 WAA analysis for the Red Boat Vineyard Development Project at 1373 Soda Canyon Road in Napa County, CA has been prepared for Red Boat LLC and applies only to the evaluation of the subject property for the requirements discussed herein. This Updated Memorandum has been prepared in accordance with the care

and skill generally exercised by reputable professionals, under similar circumstances, and in this or similar localities. No other warranty, either express or implied, is made to the calculations, conclusions, or professional advice presented herein. No project details or RCS WAA calculations are changed as part of this document. For all other project details, please refer to the referenced 2023 RCS WAA.

References:

Luhdorff & Scalmanini, Consulting Engineers (LSCE), 2022. Napa Valley Subbasin Groundwater Sustainability Plan, Section 6 - "Groundwater and Surface Water Conditions". January 2022

----------, 2017 "Northeast Napa Area: Special Groundwater Study." Prepared for Napa County, September 2017.

Napa County Board of Supervisors, 2015. "Water Availability Analysis (WAA) – Guidance Document." Adopted May 12, 2015

Napa County GIS Data, "Significant_Streams_1500ft_Buffer" data layer, ARC GIS Online Data Catalog (https://www.arcgis.com/home/item.html?id=8f3927797b6f490c89a8b07778dfed6f), July 6, 2022.

Napa County GIS Data, "Significant_Streams" data layer, ARC GIS Online Data Catalog (https://www.arcgis.com/home/item.html?id=3e3a0f5a59f147e1ae99723f8420f096), July 27, 2022.

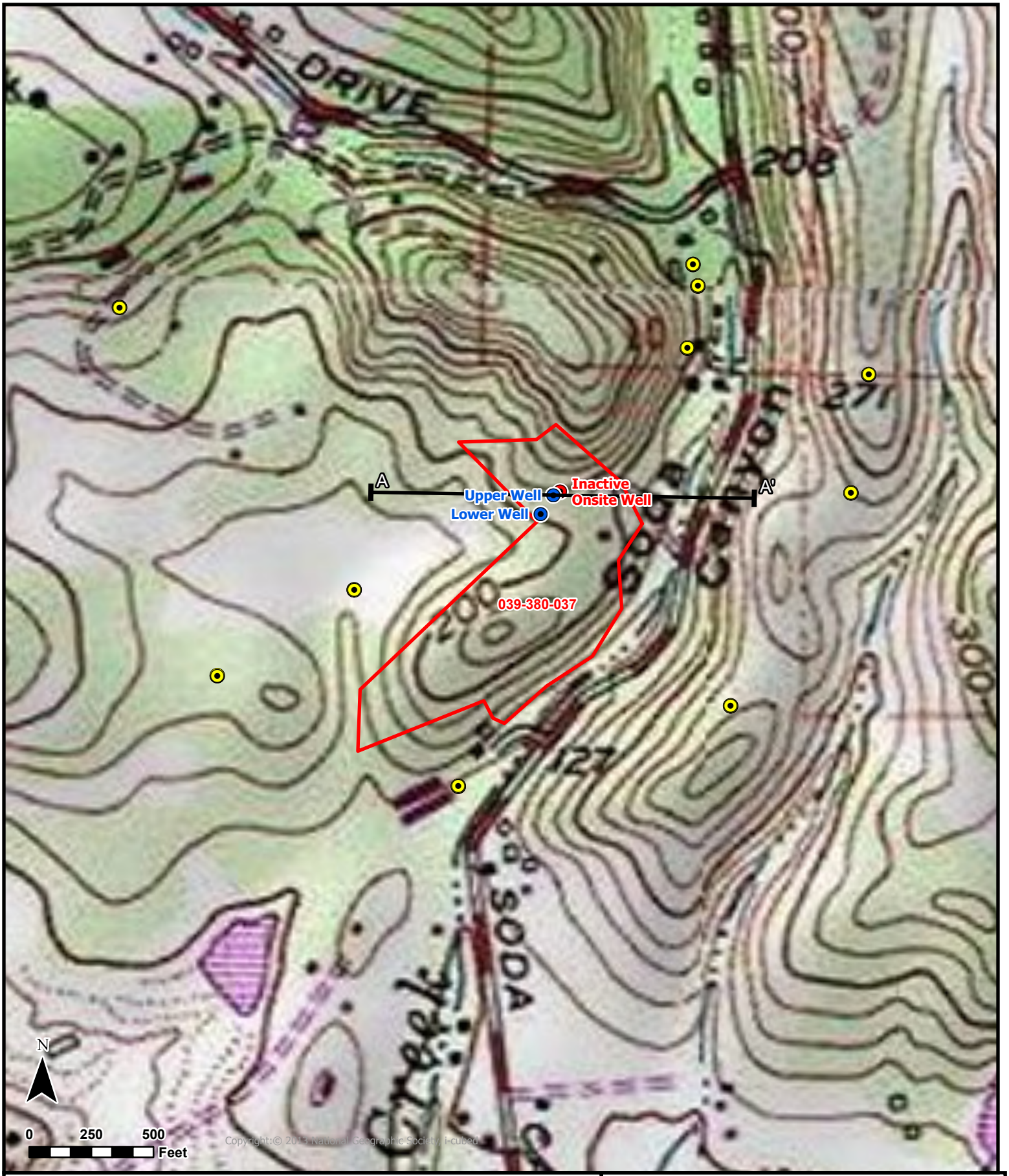
Napa County Groundwater Sustainability Website (https://www.countyofnapa.org/3074/Groundwater-Sustainability), "Figure 1, Napa County Well Permit Standards: Significant Streams", undated. (https://www.countyofnapa.org/DocumentCenter/View/25902/Figure-1-Significant-Streams-for-Tier-3)

Napa County Planning, Building & Environmental Services (PBES), 2022. Email titled "Red Boat P21-00307 - Project Status Update". August 9, 2022.

Napa County Resource Conservation District (NCRCD), 2005. "Central Napa River Watershed Project", Prepared for the U.S. Department of Fish and Game. October 5, 2005.

Richard C. Slade & Associates LLC (RCS), 2023. "Results of Revised Napa County Tier 1 Water Availability Analysis, Red Boat Vineyard Development Project, 1373 Soda Canyon Road, Napa, California". February 23, 2023.

United States Geological Survey (USGS), 1:24000-scale Quadrangle for Yountville, CA. 1951:



LEGEND

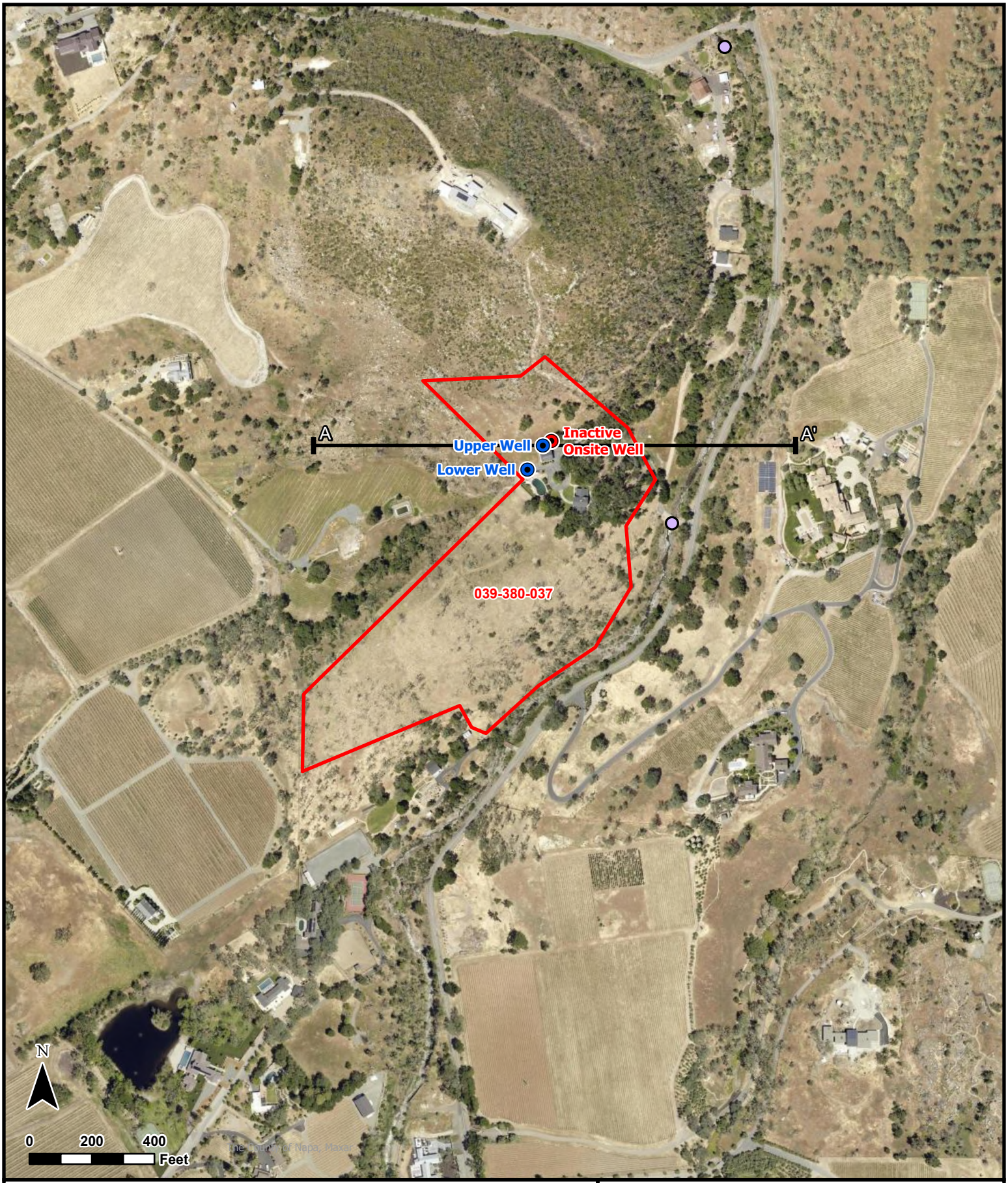
- Subject Property (Showing County APN)
- Onsite Well Location (approx.)
- Inactive Onsite Well Location (approx.)
- Known Offsite Well Location (approx.)
- Significant Streams (Napa County, 2022)
- A — A' Cross Section

RCS

FIGURE 1
LOCATION MAP

RCS Job No. 747-NPA01

February 2023



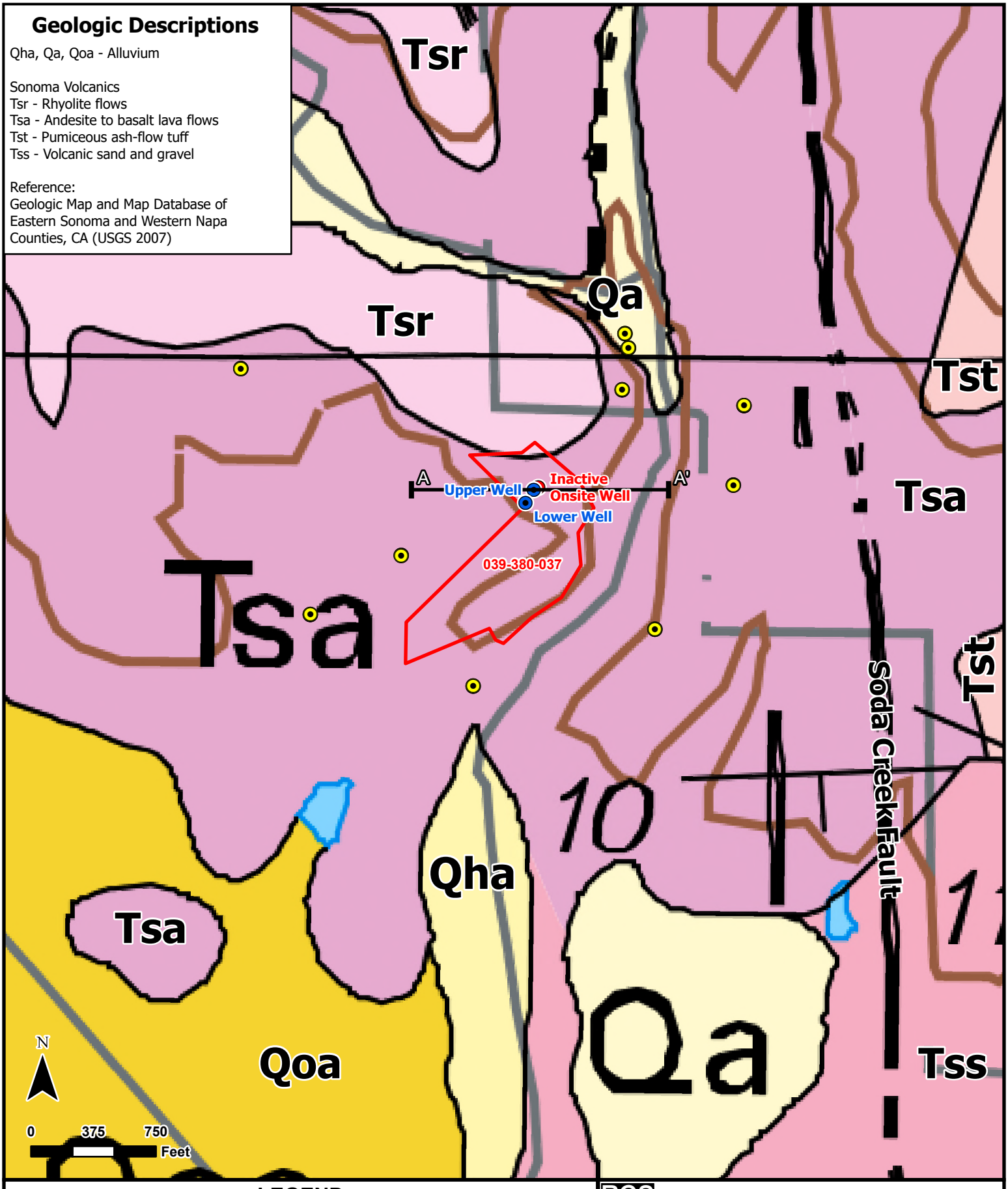
LEGEND

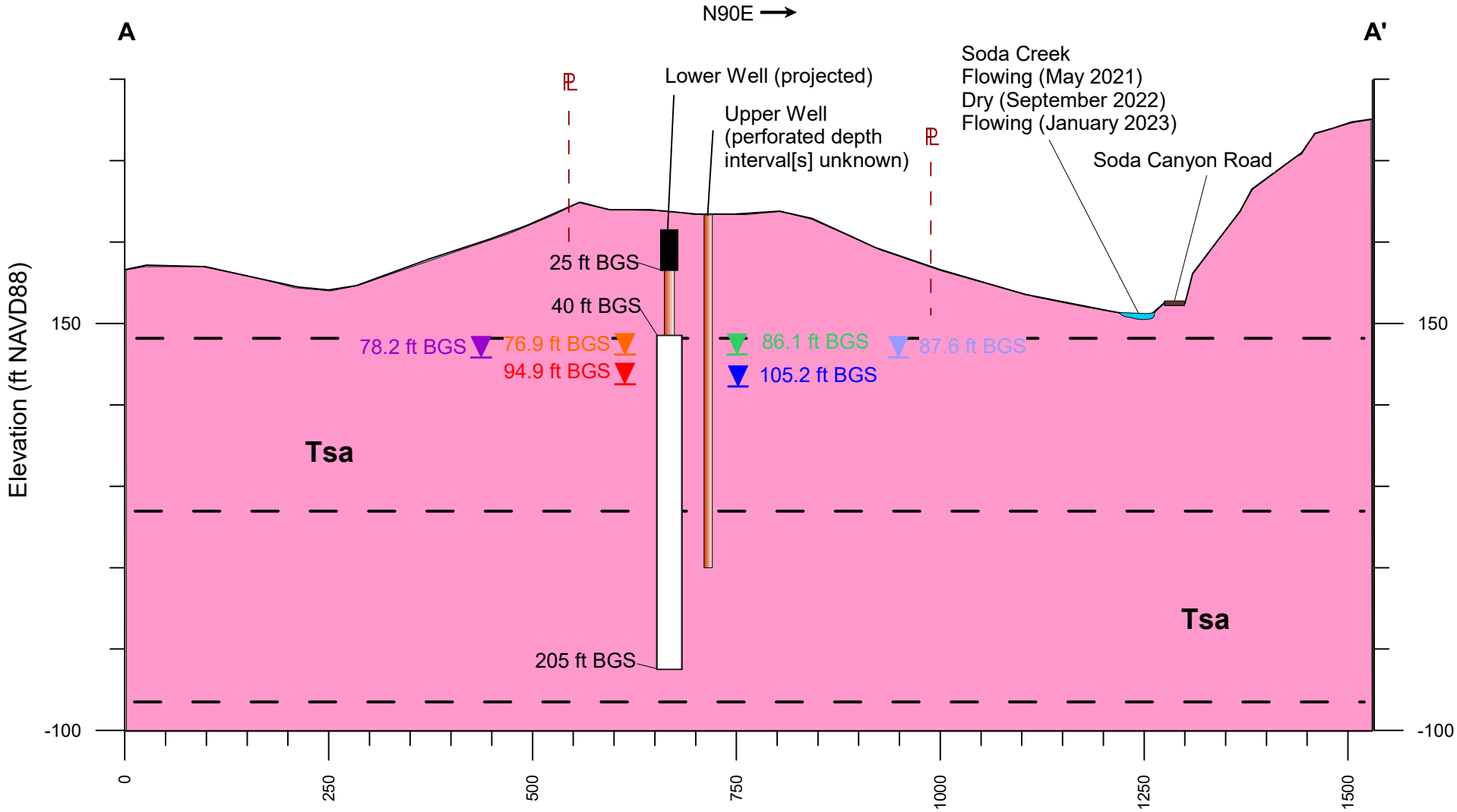
- Subject Property (Showing County APN)
- Onsite Well Location (approx.)
- Inactive Onsite Well Location (approx.)
- Significant Streams (Napa County, 2022)
- A A' Cross Section
- Observation Field Points by RCS
- parcels_public

RCS

FIGURE 2
AERIAL PHOTOGRAPH MAP

RCS Job No. 747-NPA01 February 2023


Geologic Descriptions
Qha, Qa, Qoa - Alluvium
Sonoma Volcanics
Tsr - Rhyolite flows
Tsa - Andesite to basalt lava flows
Tst - Pumiceous ash-flow tuff
Tss - Volcanic sand and gravel
Reference:
Geologic Map and Map Database of Eastern Sonoma and Western Napa Counties, CA (USGS 2007)
Tsr
Qa
Tsr
Tst
A
A'
Upper Well
Inactive Onsite Well
Lower Well
039-380-037
Tsa
Tsa
Tst
Soda Creek Fault
10
Qha
Tsa
Qa
Qoa
Tss
N
0
375
750
Feet
LEGEND
Subject Property (Showing County APN)
Onsite Well Location (approx.)
Inactive Onsite Well Location (approx.)
Known Offsite Well Location (approx.)
Significant Streams (Napa County, 2022)
A
A'
Cross Scection
Fault - dashed where inferred
RCS
FIGURE 3
GEOLOGIC MAP
RCS Job No. 747-NPA01
February 2023



Vertical Exaggeration = 2x

See location of section line on Figures 1, 2, & 3

ft BGS = Feet Below Ground Surface

ft NAVD88 = Feet North American Vertical Datum of 1988

LEGEND

- Cement Seal
- Blank Casing
- Perforated Interval
- Approximate Dip of Rock
- Tsa — Andesite to basalt lava flows, Sonoma Volcanics
- Lower Well Static Water Level (May 2021)
- Lower Well Static Water Level (September 2022)
- Lower Well Static Water Level (January 2023)
- Upper Well Static Water Level (May 2021)
- Upper Well Static Water Level (September 2022)
- Upper Well Static Water Level (January 2023)

RCS

FIGURE 4
CROSS SECTION A-A'

RCS Job No. 747-NPA01

February 2023