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CFROG

CITIZENS FOR RESPONSIBLE OIL & GAS

October 8, 2015

To Chair Kathy Long and members of the Ventura County Board of Supervisors:

Citizens For Responsible Oil & Gas (CFROG) today submits a scientific report to you confirming issues raised in our appeal of CUP PL 13-0150. Much of the data in this report was previously prepared by the environmental consulting group Blue Tomorrow, LLC and presented to the Ventura County Planning Commission in our June 11th appeal of this project. However, that Blue Tomorrow document was rejected by the Ventura County Planning Department because it "did not have a geologist's stamp on it."

CFROG believes these facts should have been analyzed, as all evidence, including measurements, brought before a government fact finder by either experts or lay people is worthy of consideration. Nevertheless, now you have before you an even stronger document to consider, authored by Dr. Brad Newton and Blue Tomorrow staff (Alex Dragos and Eric Hopkins). Dr. Newton has a B.S. in geology, an M.S. in ground water hydrology, a Ph.D in surface water hydrology and is a licensed professional geologist with nearly 30 years of environmental consulting. Both Mr. Dragos and Mr. Hopkins have a Master's degree in environmental science and management, with a specialization in water resources management, and their area of expertise involves assessing water quality impacts.

Blue Tomorrow staff and Dr. Newton will attend the appeal hearing to explain this new information of substantial importance. This includes findings that Drill Site 7 in particular, where five of the wells are proposed, present risks that call for a complete Environmental Impact Report.

It is our view that not only should new wells not be allowed on that drill site but that the drill site be eliminated altogether as part of this project and the pad removed from the creek, as in its present condition it contributes a significantly heightened risk factor

CFROG Board of Directors: John Brooks, Helen Conly, Carol Holly, Rain Perry, Todd Shuman

Advisory Board: Steve Colome PhD, Leif Dautch, Kevin Hartigan, Theresa Hartigan, Richard Holly, Michael Netzer, Mary Ann O'Connor, Sarah Otterstrom, PhD, Vickie Peters, C. Michael Shapiro, Diane Underhill, Tom Williams, PhD

concerning flooding and environmental degradation.

This study by Dr. Newton and Blue Tomorrow demonstrates that Drill Site 7 is within the Santa Paula Creek channel and it violates setback requirements for both “Blue Line” and “Red Line” channels.

New information of substantial importance also documents that the creek is high quality habitat for the Steelhead Trout, now listed as an Endangered Species under the Endangered Species Act. No Steelhead analysis has ever been conducted by Ventura County, though a 2005 survey of Santa Paula Creek found more than 200 trout. Steelhead recovery may be threatened by runoff from Drill Site 7, as the drain from the pad empties directly into the creek.

CFROG believes that this new information justifies our request that consideration of the CUP PL 13-0150 proposal be delayed until after the Ventura County Board of Supervisors is able to collectively evaluate a completed, legally adequate, CEQA-compliant environmental impact report.

On October 20th, CFROG will also confirm the presence of the following trigger factors that your staff specified as mandatory for a subsequent EIR:

1. Due to the involvement of significant new environmental effects, there are substantial changes that call for major revisions of the previous EIR.

2. There is a substantial increase in the severity of previously identified significant effects.

In public testimony you will also hear from others who may discuss additional grounds of appeal, but CFROG will limit its own presentation to confirming the factors demanded by your staff.

We will respectfully urge you to uphold our appeal, direct staff to prepare a subsequent EIR and refund our fees.

Thank you.

Sincerely,

Citizens for Responsible Oil & Gas (CFROG)

Hydrologic Considerations of CUP PL13-0150
Drill Site No. 7 - Ferndale Lease, Ojai Oil Field

Prepared by:
Blue Tomorrow, LLC

&

NEWTON GEO-HYDROLOGY
CONSULTING SERVICES

Prepared for:
Citizens For Responsible Oil and Gas (CFROG)

October 1, 2015

The cover photo was taken on August 28, 2012, and shows the Santa Paula Creek that encompasses the study reach with Drill Site No. 7 and the avocado orchard on opposite sides of the channel (Source: Google Earth).

Hydrologic Considerations of CUP PL13-0150
Drill Site No. 7 - Ferndale Lease, Ojai Oil Field

October 1, 2015

Prepared by:

Alex Dragos
Project Manager

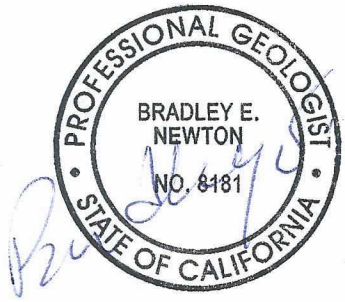
Eric Hopkins
Project Scientist

Blue Tomorrow, LLC

&

BRAD NEWTON, P.G., PH. D.

NEWTON GEO-HYDROLOGY CONSULTING SERVICES



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Acronyms

CEQA	California Environmental Quality Act
CUP	Conditional use Permit
CFROG	Citizens for Responsible Oil and Gas
DS7	Drill Site #7
NCZO	Non-Coastal Zoning Ordinance
NGH	NEWTON GEO-HYDROLOGY CONSULTING SERVICES
HEC-RAS	Hydrologic Engineering Centers River Analysis System
MND	Mitigated Negative Declaration
VCWPD	Ventura County Watershed Protection District
USGS	United States Geologic Services
VCFCD	Ventura County Flood Control District

Abbreviations

cfs	cubic feet per second
Q5 – Q500	Discharge for 5-year return interval – Discharge for 500 year return interval

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Executive Summary

This report evaluates the history of the Conditional Use Permit 3344 and environmental review of the newly proposed and related project, CUP PL13-0150, to include five additional oil wells on Drill Site 7 (DS7). The Santa Paula Creek watershed characteristics and morphology are evaluated and discussed. Measurements were taken from the "Top of Bank" of the Santa Paula Creek channel and compared with setback requirements of the Non-Coastal Zoning Ordinance (NCZO), and drainage characteristics of DS7 were observed and recorded.

CUP PL13-0150 involves the installation of five new wells on DS7 that were approved to be drilled under a previous project (CUP 3344). An Environmental Impact Report for CUP 3344 was certified by the Planning Commission on July 6, 1978 for the drilling of up to 36 wells on the Ferndale Ranch lease on six Drill Sites (1, 2, 3, 4, 5, and 6). An MND was prepared for the modification to CUP 3344 for the construction of DS7 and proposed 10 wells on the site and approved in 1983. The 1983 MND was the only environmental review that considered impacts from the drilling and operation of wells on DS7. A subsequent EIR was prepared in 1984 that focused only on environmental consequences of providing access to the Ferndale Ranch lease and did not evaluate potential impacts from drilling and oil production.

DS7 was built in the East Fork of the Santa Paula Creek upstream of the City of Santa Paula and the Thomas Aquinas College. The watershed above DS7 is prone to landslides, flashy discharge events, and debris flow. Based on discharge estimates and channel characteristics, stage-discharge estimates at DS7 were calculated using HEC-RAS and demonstrate that the upstream end of DS7 has the greatest risk of flooding, with a minimum of 0.2% probability in any given year.

The Non-Coastal Zoning Ordinance describes setback requirements for oil wells and production facilities, with a setback requirement of 100' from a "blue line" channel (found on USGS 2000' scale topography maps) and 300' from a "red line" channel as defined by the Ventra County Watershed Protection District (VCWPD). The East Fork of the Santa Paula Creek at Ds7 is designated as both a red line and blue line channel. Based on the "top of bank," from which setbacks are measured, about 50% of DS7 is within the 100' setback and 100% of DS7 is within the 300' setback.

DS7 is drained at the southwestern corner by a drain pipe and culvert that discharges directly into the Santa Paula Creek. The Santa Paula Creek was designated critical Steelhead habitat in 2005, and the Southern Steelhead were listed as an endangered species in 2006. CUP PL13-0150 has never had an adequate environmental review following CEQA guidelines to determine the impacts of this project to water quality, the endangered Steelhead, or habitat. The previous project (CUP 3344) was evaluated through CEQA and an MND was certified in 1983 by the Ventura County Board of Supervisors, but a greater understanding of environmental and water quality impacts has arisen since this time. The environmental review took place prior to Steelhead being listed as an endangered species and before both the NCZO and the VCWPD's WP-2 Ordinance existed, which prohibit such installations as DS7 for water quality and flood control reasons.

The following are the main findings from this report, the investigation of DS7, and the proposed project:

- DS7 is built within the Santa Paula Creek channel.
- Santa Paula Creek is designated as a “Blue Line” channel on USGS 2000’ scale topography maps.
- Santa Paula creek is designated as a “Red Line” channel on the Ventura County Watershed Protection District maps.
- Santa Paula creek is high quality steelhead habitat in jeopardy of degradation.
- 100 percent of DS7 is within 300’ from the “Red Line” flow boundary, and more than 50 percent of DS7 is within 100’ of the “Blue Line” and Q50+4’ (height of discharge for 50-year return interval plus 4 feet) flow boundary of the modified channel.
- Q500 (discharge for 500 year return interval floods) inundates DS7 at the north end.
- Runoff from DS7 is conveyed by 24” culvert pipe directly into the Santa Paula Creek.

1. Introduction

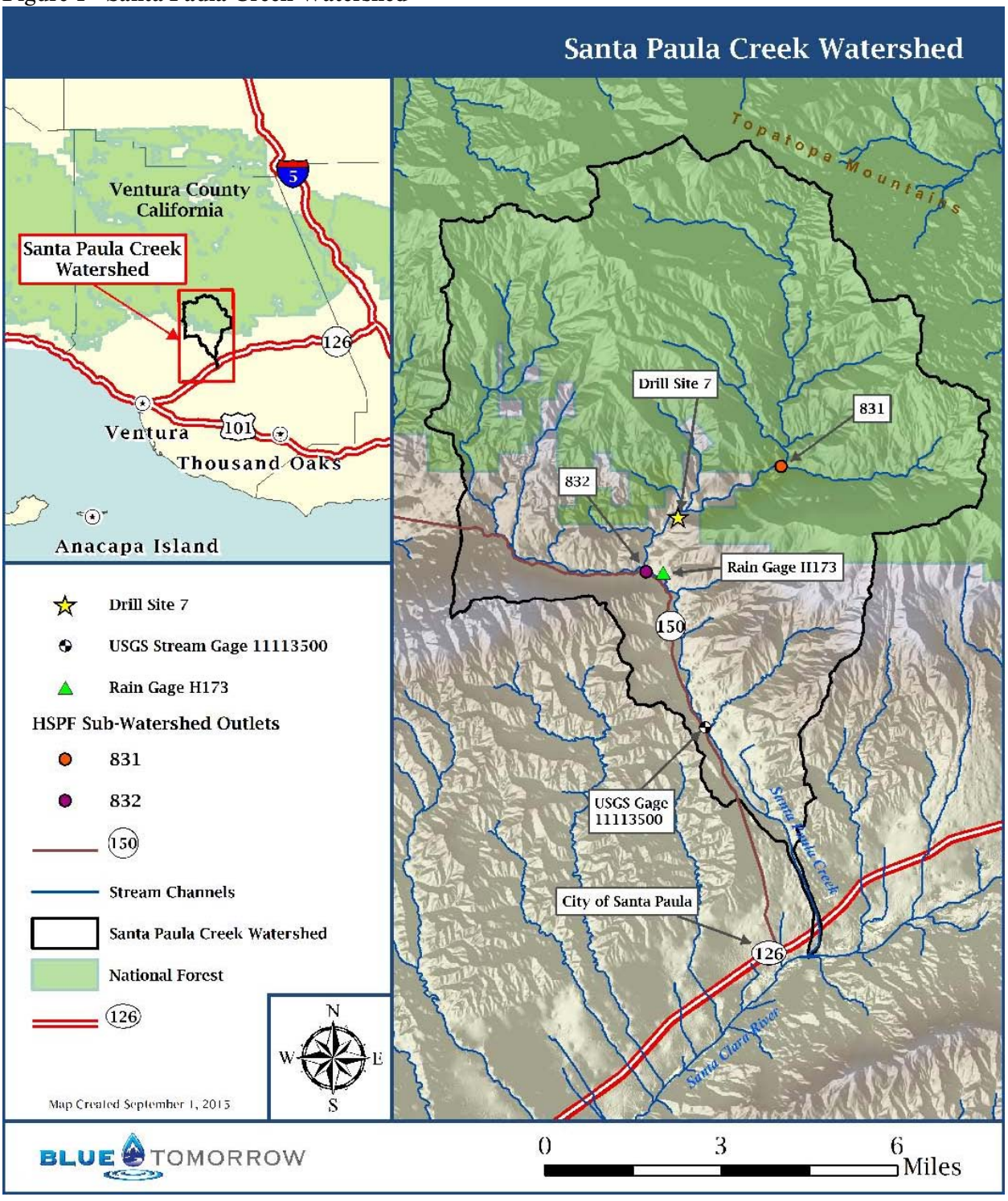
The County of Ventura initially granted CUP No. 3344 in 1971 for oil exploration and production. Subsequently, the County has granted twelve (12) modifications to CUP No. 3344 authorizing additional wells, transfer of well permits, and time extensions, with the most recent modification occurring in 1997 for the continued operation of 17 existing oil and gas wells, and the drilling of 19 additional new wells for a total of 36 wells and related production equipment. CUP No. 3344 expired in 2011. On February 17, 2015, the Planning Director granted the thirteenth (13) modification to Conditional Use Permit No. 3344 Case No PL13-0150 (CUP PL13-0150) following public comments at the January 8, 2015 Planning Director Hearing, which authorizes the continued operation of 17 existing oil and gas wells and associated production facilities, and the installation of 19 new oil and gas wells over a 30-year period.

The Citizens for Responsible Oil and Gas (CFROG) requested that the Planning Commission grant an appeal to overturn the Planning Director's decision. On June 11, 2015, the Planning Commission denied the CFROG's appeal. On June 22, 2015, CFROG appealed the Planning Commission's granting of CUP PL13-0150 to the Ventura County Board of Supervisors to reverse the Planning Commission's decision regarding CUP PL13-0150 and remand CUP PL13-0150 to the planning department, directing planning staff to prepare either a full environmental impact report in compliance with CEQA or a supplemental EIR that addresses the cumulative and specific potential impacts that are demonstrated in the appeal, and limit the term of any future CUP for this area to a maximum of five years and incorporate strict condition compliance.

Drill Site No. 7 (DS7) was constructed in 1989 in the Ferndale Lease of the Ojai Oil field and is one of the four drilling sites included in CUP PL13-0150. DS7 is located on the East Fork of the Santa Paula Creek within the Santa Clara River Watershed and upstream of the city of Santa Paula (Figure 1). There are three existing oil wells (712, 716, and 717) at DS7 and CUP PL13-0150 authorizes five of the 19 new oil and gas wells to be developed at DS7 (Figure 1). The VCWPD utilizes the 100-year storm event as a determination of the defined bed of waters flowing in a defined direction (personal communication with Deputy Director of Ventra County Watershed Protection District, April 15, 2015). In a memorandum dated February 12, 2015 from the Ventura County Public Works Agency, Development and Inspection Services Division, the "top of bank" adjacent to DS7 was defined as four vertical feet above the 50-year storm water mark[18]. This memorandum also specified that the five additional wells proposed to be drilled at DS7 are required to be setback a minimum of 100 feet from the "top of bank" [18].

Citizens for Responsible Oil and Gas (CFROG) engaged the services of Blue Tomorrow and Newton Geo-Hydrology Consulting Services (NGH) to evaluate the physiography of DS7. Specifically CFROG seeks to evaluate the setback distance between the existing and proposed wells and the channel, Santa Paula Creek discharge at DS7, and runoff from DS7 to the channel. The channel edge is defined by the height of water (stage height) in the channel which differs by discharge amounts. Discharge estimates, along with channel cross-sections, are necessary to calculate stage height in the channel at DS7. This technical memorandum is organized into nine sections that present: (1) Introduction, (2) Background of the requirements imposed by County Ordinances, Steelhead habitat, and Environmental evaluation (3) Watershed characteristics with a general description of the watershed, (4) DS7 characteristics describing DS7 infrastructure and hydrology including stage-discharge relationships and inundation, (5) HEC-RAS results defining setback distances and flooding potential, (6) Discussion of potential impacts, (7) Conclusion, and References and Appendices.

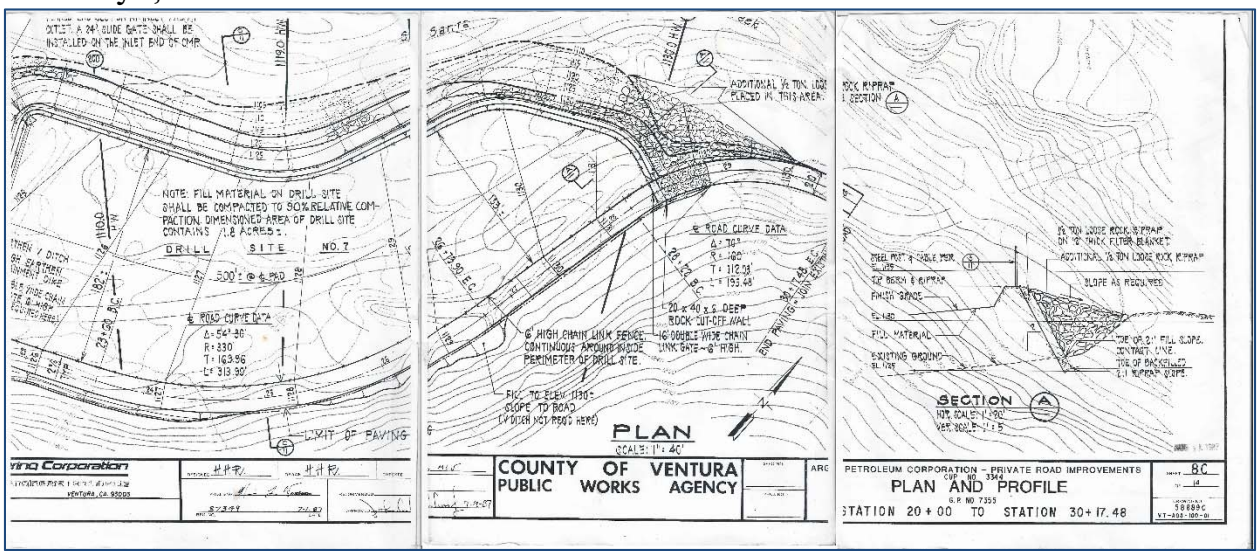
Figure 1 - Santa Paula Creek Watershed



2. Background

DS7 was constructed in the Santa Paula Creek by filling in the channel with rip-rap and fill dirt as depicted on the Plan and Profile for Private Road Improvements by ARGO Petroleum Corporation approved on July 9, 1987 (Figure 2). Plan contours overlay original channel topography contours and demonstrate 15 feet of fill in places which ultimately constricts flow and reduces flow conveyance to a smaller channel at DS7.

Figure 2 - Plan and Profile for Private Road Improvements by ARGO Petroleum Corporation dated July 1, 1987.



2.1. Ventura County Non-Coastal Zoning Ordinance

The Ventura County Non-Coastal Zoning Ordinance specifies setback distances for oil production operations from "Red Line" channels. According to Sec. 8107-5.6.1 of the ordinance, “No well shall be drilled and no equipment or facilities shall be permanently located within: d) 300 feet from the edge of existing banks of “Red Line” channels as established by the Ventura County Flood Control District (VCFCD), 100 feet from the existing banks of all other channels appearing on the most current United States Geologic Services (USGS) 2,000' scale topographic map as a blue line.”[15] In 2003, the VCFCD changed its name to the Ventura County Watershed Protection District (VCWPD).

Section 8107-5.6 of the ordinance is as follows:

Sec. 8107-5.6 - Oil Development Standards

The following are minimum standards and requirements which shall be applied pursuant to Sec. 8107-5.2. More restrictive requirements may be imposed on a project through the conditions of the permit. Measurements are taken from the outside perimeter of the noise receptors noted below: (AM. ORD. 3900 - 6/20/89)

Sec. 8107-5.6.1 - Setbacks

No well shall be drilled and no equipment or facilities shall be permanently located within:

a. 100 feet of any dedicated public street, highway or nearest rail of a railway being used as such, unless the new well is located on an existing drill site and the new well would not present a safety or right-of-way problem. If aesthetics is a problem, then the permit must be conditioned to mitigate the problem.

b. 500 feet of any building or dwelling not necessary to the operation of the well, unless a waiver is signed pursuant to Sec. 8107-5.6.25, allowing the setback to be reduced. In no case shall the well be located less than 100 feet from said structures. (AM. ORD. 3730 - 5/7/85);

c. 500 feet of any institution, school or other building used as a place of public assemblage, unless a waiver is signed pursuant to Sec. 8107-5.6.25, allowing the setback to be reduced. In no case shall any well be located less than 300 feet from said structures. (AM. ORD 3730 - 5/7/85);

d. 300 feet from the edge of the existing banks of "Red Line" channels as established by the Ventura County Flood Control District (VCFCD), 100 feet from the existing banks of all other channels appearing on the most current United States Geologic Services (USGS) 2,000' scale topographic map as a blue line. These setbacks shall prevail unless the permittee can demonstrate to the satisfaction of the Public Works Agency that the subject use can be safely located nearer the stream or channel in question without posing an undue risk of water pollution, and impairment of flood control interests. In no case shall setbacks from streams or channels be less than 50 feet. All drill sites located within the 100-year flood plain shall be protected from flooding in accordance with Flood Control District requirements.

e. The applicable setbacks for accessory structures for the zone in which the use is located.

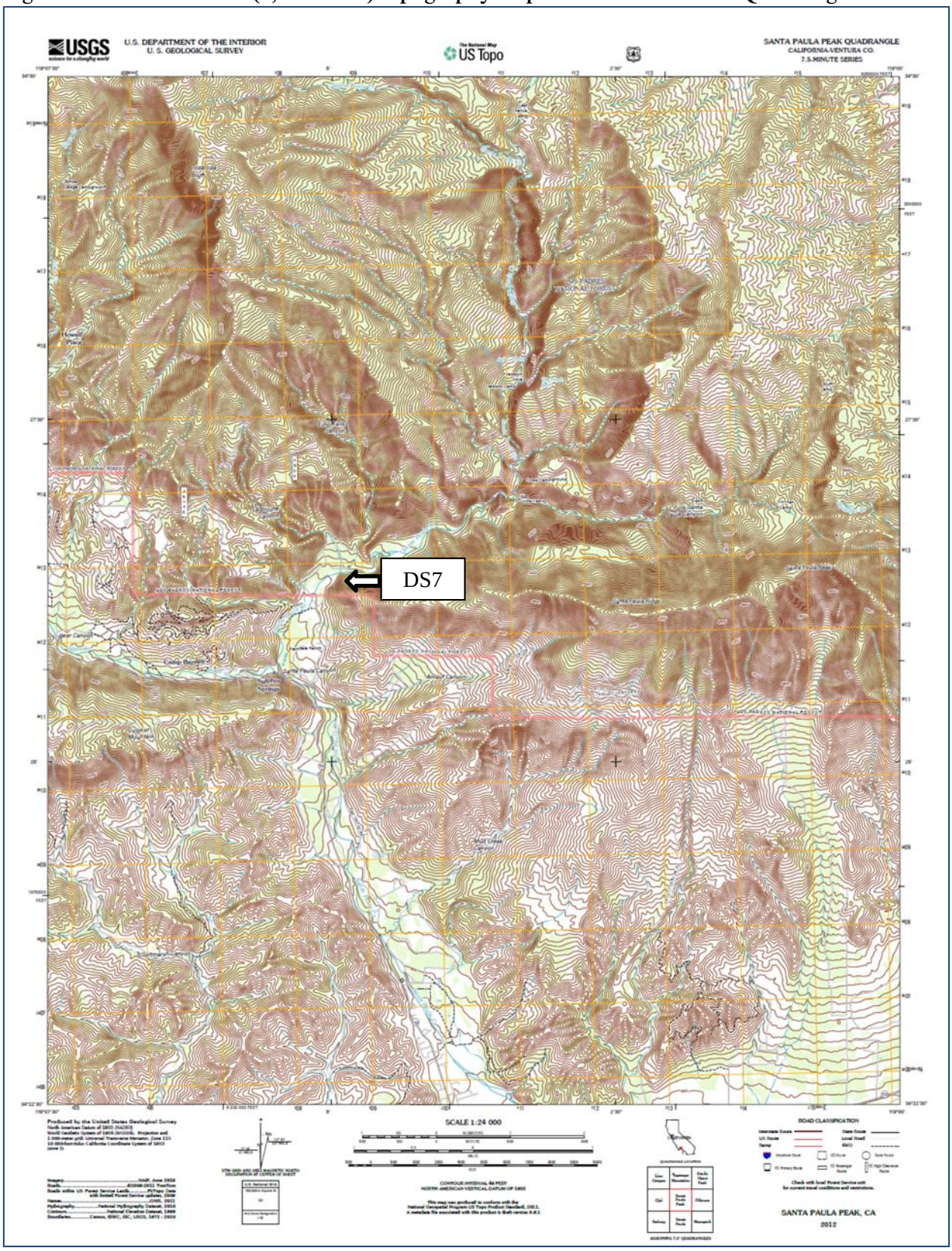
f. 100 feet from any marsh, small wash, intermittent lake, intermittent stream, spring or perennial stream appearing on the most current USGS 2000' scale topographic map, unless a qualified biologist, approved by the County, determines that there are no significant biological resources present or that this standard setback should be adjusted. (AM. ORD. 3900 - 6/20/89)

Sec. 8107-5.6.2 - Obstruction of Drainage Courses

Drill sites and access roads shall not obstruct natural drainage courses. Diverting or channeling such drainage courses may be permitted only with the authorization of the Public Works Agency.

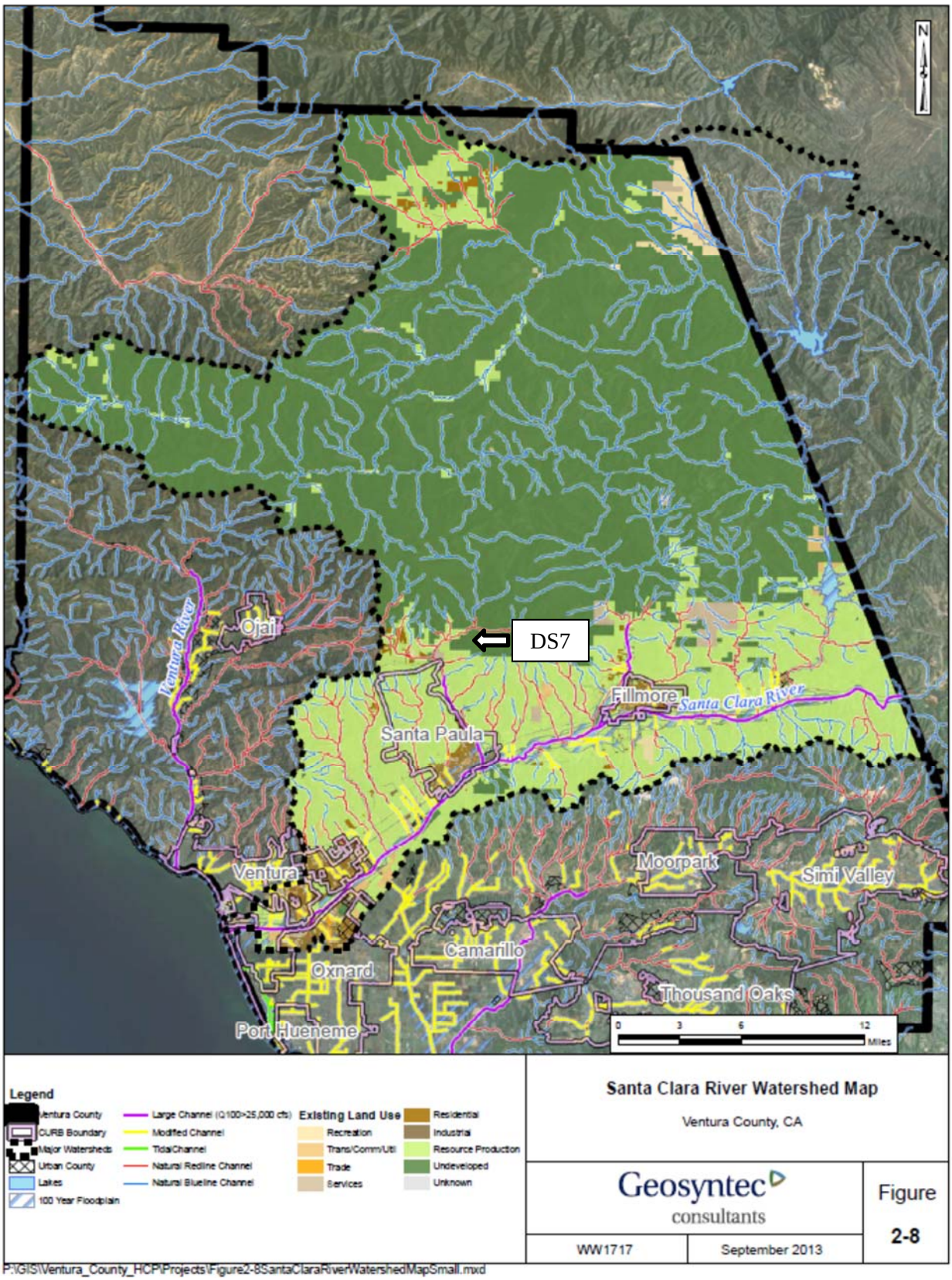
Santa Paula Creek is shown as a blue line on the USGS 2,000’ scale topography map at the location of DS7 (Figure 3).

Figure 3 – USGS 1:24 000 (2,000‘ scale) topography map of Santa Paula Peak Quadrangle



Santa Paula Creek, the East Fork of Santa Paula Creek, Echo Falls Canyon, and La Broche Canyons are all watercourses under the jurisdiction of the VCWPD and classified as a "*Red Line"* channels per the Comprehensive Plan for Flood Control[16,17] (Figure 4).

Figure 4 – Santa Clara River Watershed with Santa Paula Creek shown as a Red Line Channel.



2.2. Ventura County Watershed Protection District Ordinance No. WP-2

The Ventura County Watershed Protection District (VCWPD) enacted a Watershed Protection Ordinance No. WP-2 titled "Ventura County Watershed Protection District Ordinance" on September 10, 2013. Ventura County Watershed Protection Ordinance No. WP-2 prohibits without a District permit, Section 202: (a) Impair, divert, impede or alter the characteristics of the flow of water running in a watercourse; (b) Deposit any material of any kind in a watercourse so as to obstruct it, or to impair, divert, impede or alter the characteristics of the flow of water therein; (c) Alter the surface of the land by construction, excavation, embankment or otherwise, so as to alter the capacity of the watercourse or the characteristics of the flow of water therein; (e) Construct or place any structure in, upon or across a watercourse. The District permit requires the Permittee to comply with the provisions of Section 1603 of the Fish and Game Code of the State of California.

Pertinent excerpts from Ordinance No. WP-2 are as follows:

Article 1. General Provisions

Section 102-14. **Watercourse** means any natural or artificial watercourse, including any stream, river, creek, ditch, channel, canal, conduit, drain, waterway, gully, ravine or arroyo or wash within the incorporated or unincorporated areas of the District in which waters flow in a definite direction or course whether continuously or intermittently, and which has a definite channel, bed and banks:

(a) To the extent described in or shown on the Comprehensive Plan or,

(b) To the extent owned, controlled, improved, operated or maintained by the District; or,

(c) To the extent shown on the Master Plan of Drainage for the area within the boundaries of any special zone, established pursuant to the provision of Sections 6.1 et seq. of the district Act.

For purposes of application and enforcement of the prohibitory provisions of the Ordinance, "watercourse" shall also include any area adjacent thereto designated by the Board as subject to a reasonable probability of substantial inundation or erosion by reason of overflow of flood or storm water, based on criteria established by the District, and which has been delineated on maps or plats approved and adopted by the Board pursuant to the procedure set forth in Section 104 of the Ordinance. ….

Article 2. Protection and Regulation of Watercourses.

Section 201. **Purpose:** The purpose of this Article is to protect life and property from flood and storm waters within or overflowing the banks of a Watercourse.

Section 202. **Acts prohibited unless District permit obtained.** No person shall do or commit or cause to be done or committed any of the following described acts without first obtaining a written permit from the District:

(a) Impair, divert, impede or alter the characteristics of the flow of water running in a watercourse;
(b) Deposit any material of any kind in a watercourse so as to obstruct it, or to impair, divert, impede or alter the characteristics of the flow of water therein;
(c) Alter the surface of the land by construction, excavation, embankment or otherwise, so as to alter the capacity of the watercourse or the characteristics of the flow of water therein;
(d) Construct, alter, or remove any flood control, storm water drainage or water conservation facility, structure or channel of or in a watercourse;
(e) Construct or place any structure in, upon or across a watercourse;
(f) Plant any vegetation (other than grasses or annual corps) within a watercourse or plant any vegetation on the banks thereof which impairs, impedes, diverts, or alters the characteristics of the flow of water in such watercourse;
(g) Commit any act on or in any easement dedicated, granted or reserved for flood control, storm water drainage or water conservation purposes that will impair the use of such easement for such purposes; or,
(h) Interfere with, impair the use of, or cause damage to any flood control, storm water drainage or water conservation facility, structure or right of way in a watercourse.

The Ventura County Watershed Protection District's WATERCOURSE / ENCROACHMENT PERMIT form or PERMIT MODIFICATION form contain the following Special Provision requiring the Permittee to comply with the provisions of Section 1603 of the Fish and Game Code of the State of California:

SPECIAL PROVISION (Section 1630: California Fish and Game Code)

Attention is directed to Standard Condition No. 5 regarding the Permittee's responsibility for obtaining other required permits. As one example, neither the issuance of a watercourse permit nor an encroachment permit precludes the need for the Permittee to comply with the provisions of Section 1603 of the Fish and Game Code of the State of California. In connection therewith, the Department of Fish and Wildlife may determine the project to be subject to the requirements of the California Environmental Quality Act (CEQA), notwithstanding that issuance of Watercourse or Encroachment permits by the Ventura County Watershed Protection District is a ministerial act and exempt from the provisions of the CEQA, as provided in Section 4.3.2(a) of the County of Ventura Administrative Supplement to the State CEQA Guidelines (which has been adopted for the Ventura County Watershed Protection District).

2.3. Santa Paula Creek Steelhead Habitat

Many southern California rivers and streams, including the East Fork of the Santa Paula Creek at DS7, were listed as critical habitat in the Federal Register on September 2, 2005. Southern Steelhead was officially listed as an endangered species, in the Federal Register under the Endangered Species Act (ESA), on January 5, 2006.[22]

The Santa Paula Creek watershed has some of the most productive and high quality steelhead habitat in the larger Santa Clara River watershed[5]. The many habitat quality indicators in this watershed

suggest the Santa Paula Creek is better habitat than the larger Sespe Creek watershed. These indicators include lower water temperatures, abundance of spawning gravel, low substrate embeddedness, and a high percentage of stream cover. The Santa Paula Creek watershed was recently documented to have the second greatest abundance of steelhead trout in the Santa Clara River watershed (after the Sespe Creek watershed), with Sisar Creek accounting for the majority of the population[5].

There are many factors that can impact steelhead populations such as barriers that are known to impede migration up the Santa Paula Creek[5]. Another limiting factor is increased fine sediment production, which can originate from roads or graded surfaces, and has been linked to declines in Coho and other salmonids in the Pacific Northwest[6,7]. Fine sediment can increase water turbidity causing stress, and fill in the interstitial pores in gravel, embedding it, and reducing the flow of oxygen through spawning gravels, which in turn reduces egg and larval survival and aquatic invertebrate production [7,8,9]. Santa Paula Creek has diverse geomorphology and habitat characteristics that make it highly productive steelhead habitat. Although, this area is one of the most productive steelhead habitats in the larger Santa Clara Watershed, it has suffered considerable declines in steelhead abundance over the last 100 years due to habitat destruction, fish migration barriers, water quality impacts, and other impacts resulting from urbanization.

2.4. CEQA Evaluations

Previous environmental impact evaluations were conducted prior to the enactment of the Ventura County Non-Coastal Zoning Ordinance Sec. 8107-5.6.1 and the Watershed Protection Ordinance No. WP-2, and prior to the designation of the Southern California Steelhead as an endangered species and the Santa Paula Hydrologic Sub-area as critical habitat in 2005 (70 FR 52488).

3. Watershed Characteristics

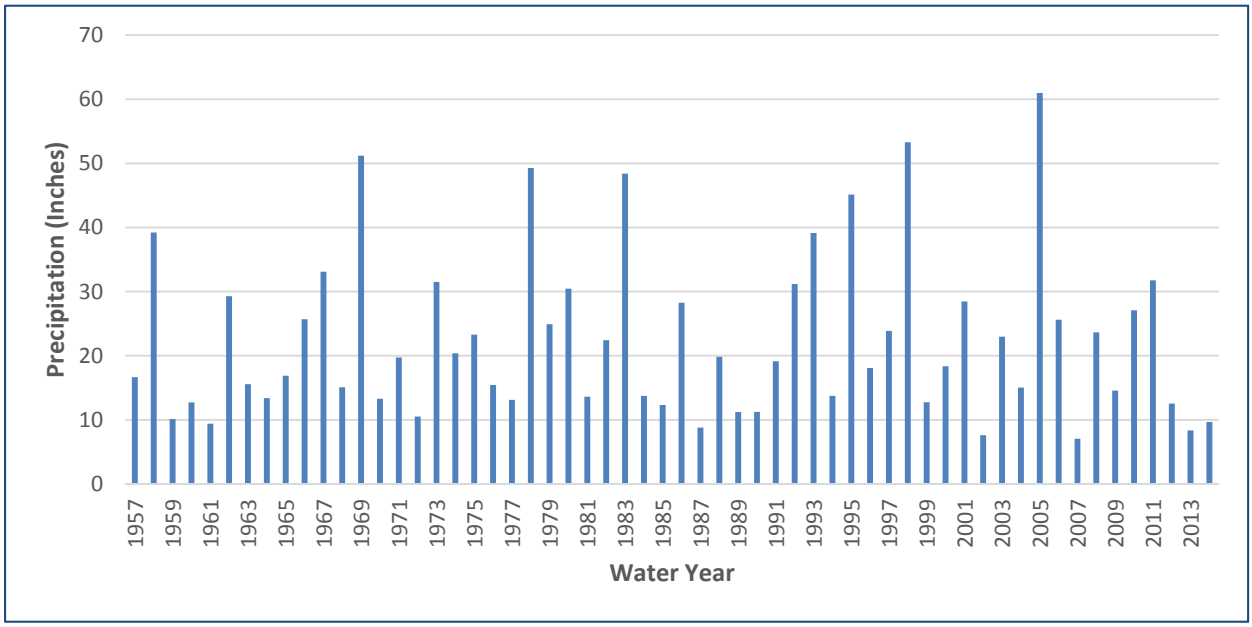
Santa Paula Creek watershed encompasses roughly 64 square miles, defined by the confluence of the Santa Paula Creek as a tributary to the Santa Clara River, and 65 percent of which is in National Forest[1] (Figure 1). The headwaters of Santa Paula Creek are within the steep south-facing slopes of the Topatopa Mountains, and the vegetation cover in the upper watershed is scrub-chaparral and mixed forest[1]. The main stem of Santa Paula Creek originates near Hines Peak (elevation of roughly 6,600 ft or 2,000 m) and water flows down a steep (>6% grade) bedrock-dominated canyon[1] before joining with the East Fork of the Santa Paula Creek (about 1.6 miles upstream of DS7). Two other intermittent tributaries (La Broche and Echo Falls Canyons) drain into the Santa Paula Creek just above DS7, which has an elevation of approximately 1,130 feet. DS7 lies directly downstream of La Broche Canyon and Echo Falls Canyon, upstream of Thomas Aquinas College, the Sisar Creek confluence, and the Highway 150 bridge-crossing.

3.1. Precipitation

Precipitation in the Santa Paula Creek watershed primarily occurs during winter months with little to no rainfall during late spring to early fall. Annual precipitation from the 1957 water year to the 2014 water year was measured at the Santa Paula Canyon – Ferndale Ranch rain gauge (H173), located approximately one mile south of DS7 (Figure 1). The long-term average annual rainfall is 21.82 inches (Figure 5). From November to April, 20.5 inches of rainfall occurs on average with an additional 1.32

inches of rainfall occurring on average during May through October. Inter-annual rainfall is highly variable with some years as dry as 6 to 7 inches of rainfall and some years as wet as 50 to 60 inches of rainfall. The area is known to experience multi-year droughts and periodic high-intensity storm events (correlated to the El Nino-Southern Oscillation phenomenon)[1].

Figure 5 – Annual Precipitation at Ferndale Ranch gage (H173). Data obtained from Ventura County Watershed Protection District (VCWPD) gages 173 and 173A. Gage 173 recorded precipitation from the 1957 through 1979 water years, and gage 173A recorded precipitation from 1980 through the 2014 water year[3].

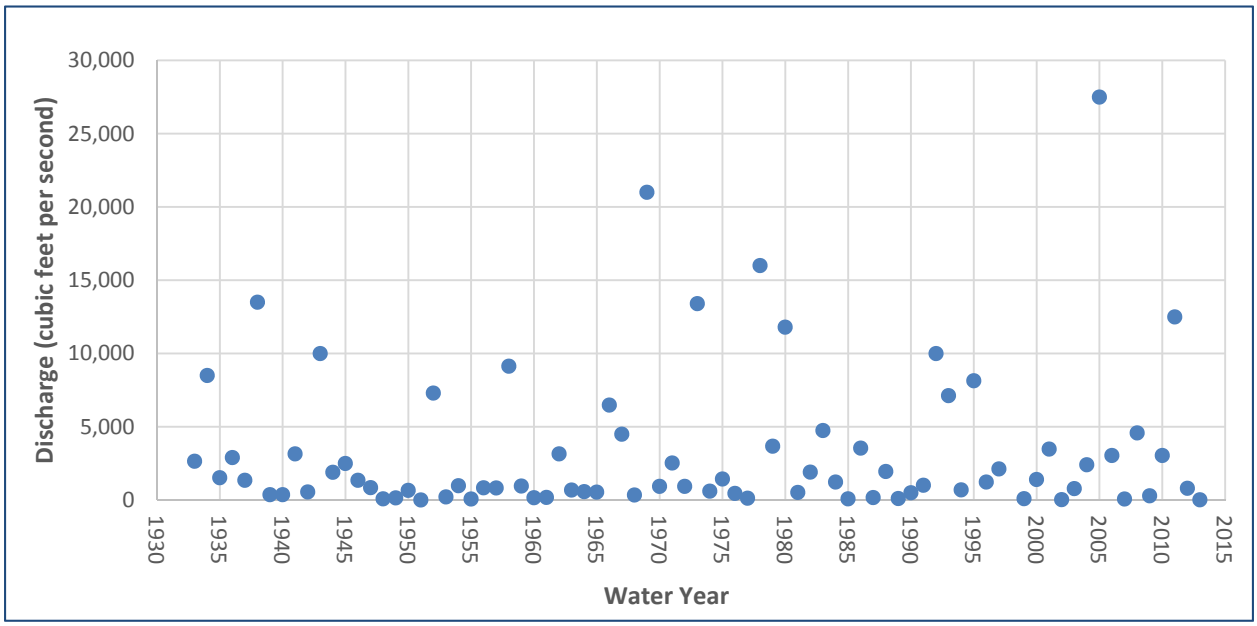


The 2005 water year had the highest recorded precipitation in the area with 60.69 inches recorded at gage H173. A total of 22.91 inches fell during a 96 hour period from January 7 through January 11, 2005. The total rainfall measured on January 10, 2005 was 7.16 inches, with a peak intensity of 2.05 inches for the hour between 7:00 – 8:00 am. The region periodically faces extreme storm events which are intensified by the orographic effect of the steep slopes in the upper watershed area.

3.2. Discharge Measurements

As a result of these high-intensity rainfalls, Santa Paula Creek is prone to flashy discharges. The peak discharge for each water year was measured by the USGS gauge 11113500 near Santa Paula (Figure 1). This gage has over 80 years of peak discharge records and is a good reference for estimating discharge at ungauged sites upstream (such as DS7). Discharge was measured above 10,000 cubic feet per second (cfs) 9 times from 1933 to 2013, and the highest discharge was estimated at 27,500 cfs and recorded on January 10, 2005[4] (Figure 5).

Figure 6– Santa Paula Creek Peak Discharge at US Geologic Survey gage 11113500 near Santa Paula[4].



In addition to discharge measurements at Santa Paula Creek downstream of DS7, estimates of the discharge and reoccurrence intervals have been made for the creek upstream and downstream of DS7 (AQUA TERRA 2009).

The next sections describe the method used to estimate the discharges for the 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, 200-year, and 500-year reoccurrence intervals (annual reoccurrence probability of 50%, 20%, 10%, 4%, 2%, 1%, 0.5%, and 0.2% respectively) for the Santa Paula Creek at DS7. Discharge estimates, along with channel cross-sections, are necessary to calculate stage height in the channel at DS7.

3.3. Discharge Estimates

AQUA Terra Consultants estimated discharge of the Santa Paula Creek watershed with the Hydrological Simulation Program FORTRAN (HSPF) for the Ventura County Watershed Protection District (VCWPD)[10] study of the Santa Clara River watershed. The HSPF model uses VCWPD data and design storm methodology, and the model was calibrated using long-term records from precipitation and stream gages throughout the Santa Clara River watershed.

The HSPF model of the Santa Paula Creek watershed was calibrated to the USGS gage 11113500 and precipitation gages throughout the watershed taking into account the physical hydrologic processes within the watershed as well as hydraulic routing through the drainage channels. The Santa Clara River watershed study created two sub-watersheds (831 and 832) in the Santa Paula Creek watershed. Sub-watershed 831 is slightly smaller and fully contained by the watershed above DS7, while sub-watershed 832 is slightly larger than the watershed above DS7 with the drainage outlet at the confluence of Sisar Creek just below Thomas Aquinas College [13](Figure 1).

The discharge estimates for the two sub-watersheds from the HSPF model were used to estimate the discharge at DS7 for the 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, 200-year, and 500-year events by assuming a watershed area-weighted discharge relationship (Table 1).

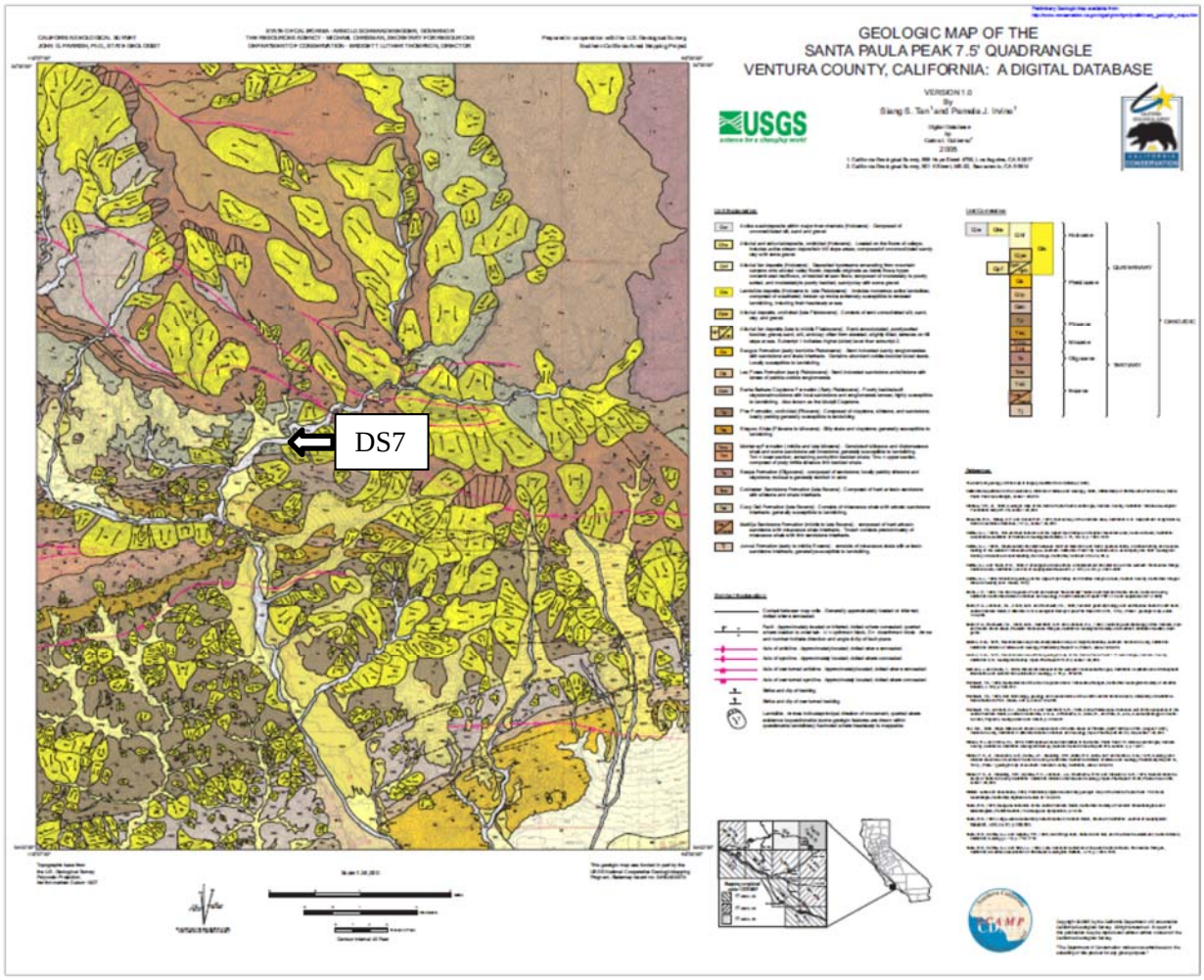
Table 1 - Ventura County HSPF model flood discharge estimates. Estimates are for sub-watersheds 831 and 832, along with the discharge estimate for the watershed above DS7[13].

Sub-watersheds	Area (mi^2)	Discharge (cubic feet per second)							
		Q2	Q5	Q10	Q25	Q50	Q100	Q200	Q500
831 – sub-watershed outlet above DS7	17.43	926	3,082	5,607	10,358	15,215	21,400	28,783	41,773
832 – sub-watershed outlet below DS7 at confluence with Sisar Creek	23.49	1,095	3,643	6,629	12,245	17,988	25,300	34,029	49,386
DS7 – Discharge estimated by assuming a watershed area-weighted discharge relationship to sub-basins 831 and 832	21.8	1,048	3,487	6,344	11,719	17,215	24,213	32,566	47,263

3.4. Channel Morphology

DS7 is located on the north side of the San Cayentano Fault trace depicted on the geologic map of the Santa Paula Peak 7.5' Quadrangle, Ventura County, California (Figure 7). The morphology of Santa Paula Creek results from the interactions of runoff from rainfall, sediment supply, vegetation and bedrock controls[1]. The upstream area of the Santa Paula Creek watershed from DS7 is dominated by landslides which deliver rock and sediment to channels increasing the likelihood of debris flows through the channel network. These mass movement events often clog channels damming flows and causing avulsions in which a stream rapidly abandons a developed channel and creates a new one. The Santa Paula Creek channel at DS7 is primarily armored with cobbles (6.4-25.6 cm) and boulders (>25.6 cm) with interspersed sand and gravel deposits. There is an abundance of alder trees in the riparian corridor, and the floodplain is littered with fallen trees, branches, boulders, and other debris.

Figure 7 – Geologic Map of the Santa Paula Peak 7.5' Quadrangle.

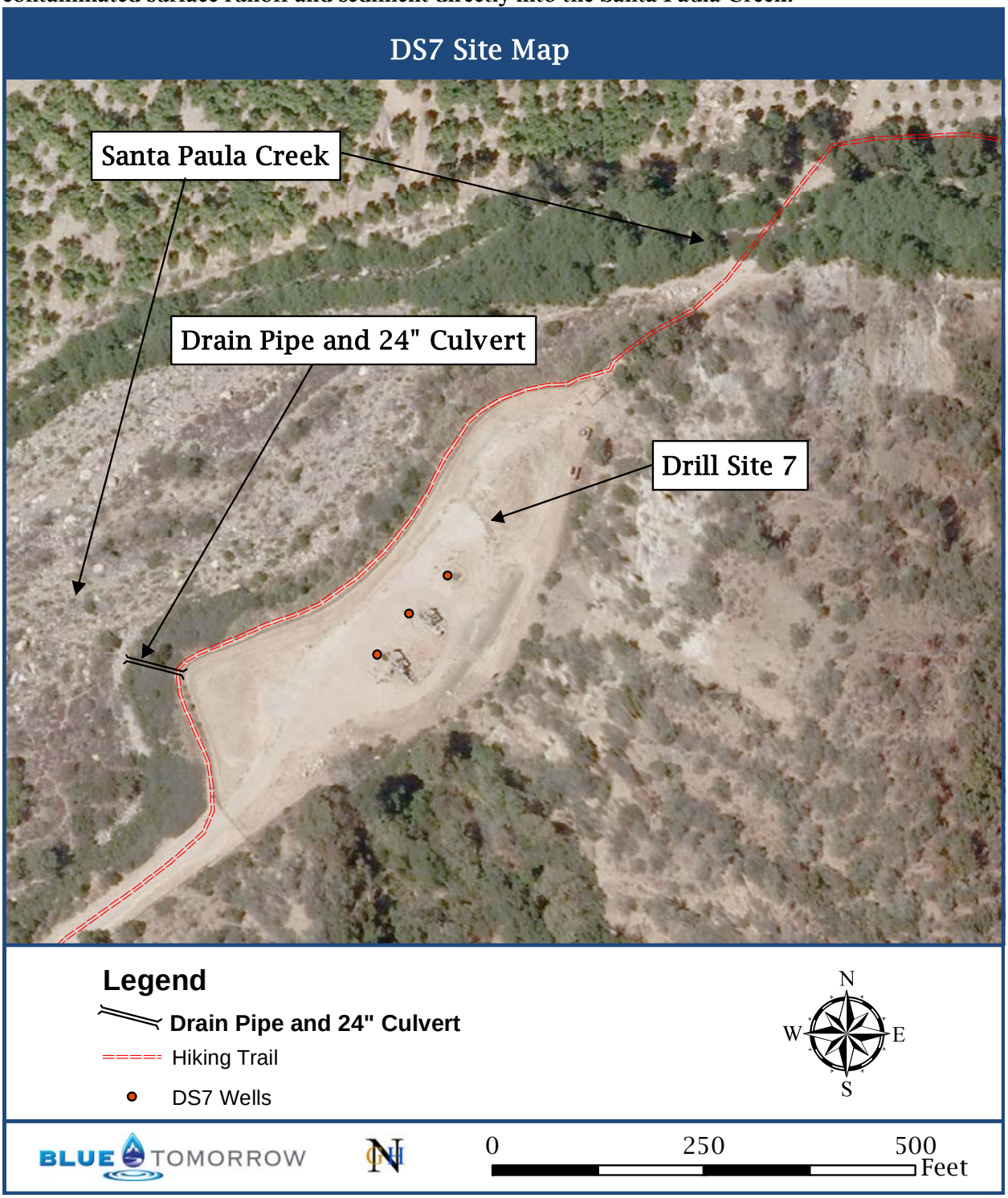


Following the 2005 storm event (the largest recorded discharge), the low flow channel shifted approximately 225 feet from the south bank to the north bank (away from DS7) where it is currently located. These shifts in the low flow channel location are common to this type of morphological regime, and there is a high expectation that the low flow channel will swing back to the south. The large peak discharges and plentiful headwater sediment production, combined with the bedrock outcrops and vegetation, create diverse channel and habitat characteristics throughout the watershed.

4. DS7 Characteristics

DS7 was constructed in 1989 within the Santa Paula Creek channel at the base of a northwestern facing hillside (Figure 8). DS7 is roughly 80,000 square feet and has a perimeter berm designed to control runoff from the well pad[20]. There is a drain located on the southwestern corner of DS7 that consists of two parts: 1) a 6 inch diameter pipe with a valve that goes from inside the fenced area to outside of DS7; and 2) a 24 inch diameter culvert located outside of DS7 into which the 6 inch pipe discharges. The 24 inch culvert discharges directly into the Santa Paula Creek approximately 53 feet downslope.

Figure 8: DS7 site map showing the location of the drain pipe and 24" culvert that would convey contaminated surface runoff and sediment directly into the Santa Paula Creek.



4.1. DS7 Observations and Runoff Pathway to Santa Paula Creek

On April 7, 2015, a rainfall event occurred at DS7 from 1:00pm until 4:30pm, during which time approximately 0.4 inches of rainfall was measured at rain gauge H173. The rainfall intensity was high enough to cause ponding on the well pad area closest to the wells (Picture 1), and some overland flow started to occur in the surrounding area. However, there was not enough rainfall for runoff to reach the well pad drain pipe and culvert which drains to the Santa Paula Creek (Figure 8).

Clay and silt deposits are evident near the intake for the drain pipe from DS7 to the Santa Paula Creek (Picture 2). These clays and silts are presumably being transported from areas closer to the wells to the Santa Paula Creek during storm events when surface runoff is occurring (Picture 1). Organic pollutants generated on well pads are carcinogenic and can be bound to and carried with these fine sediments to the Santa Paula Creek when the well pad runoff is conveyed though the drain pipe and drain culvert.

Picture 1 - Edge of Drill Site No. 7 at XS-C, facing well #717. Ponding visible on the graveled area of the well pad, around the wells, and towards the gated entrance of the well pad. Picture taken on April 7, 2015 at 4:10 pm

Picture 2 - Western edge of Drill Site No. 7 facing the drain. No ponding near the drain. Silts and clays appear cracked from swelling and shrinking due to moisture accumulation and evaporation. Picture taken on April 7, 2015 at 4:12 pm

4.2. Stage-Discharge Estimates

Stage-discharge relations are developed for stream gages by physically measuring the flow of the creek with a mechanical current meter or ADCP at a wide range of stages; for each measurement of discharge there is a corresponding measurement of stage. The development of an accurate stage-discharge relation requires numerous discharge measurements at all ranges of stage and stream discharge. In addition, these relations must be continually checked against on-going discharge measurements because stream channels are constantly changing. Changes in stream channels are often caused by erosion or deposition of streambed materials, seasonal vegetation growth, and debris.

In this evaluation, discharge estimates at DS7 are compared to cross-sections from LiDAR to estimate stage height for the 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, 200-year, and 500-year events. The comparison requires an estimate of flow velocity to calculate stage. Flow velocities were estimated with HEC-RAS, based on field observations of channel characteristics presented in the following sections. Then for each magnitude of discharge, a corresponding stage height is determined

by the HEC-RAS software, which defines the edge of stream flow for each event. The distance from well heads to stream flow can then be evaluated.

4.2.1. LIDAR Contours and Cross-sections

The County of Ventura Watershed Protection District provided a Bare Earth LiDAR point tiles dataset of the flights made following the storm events in 2005. These point tiles were converted to 2-foot contours of topography with ESRI GIS software packages. The developed contours are overlaid onto the 2010 USGS ortho-imagery showing DS7 along with the measured cross-sections to verify the representation of the 2005 LiDAR as current conditions.

4.2.1.1. Cross-Sections

Three cross-sections of the Santa Paula Creek channel at DS7 were surveyed on March 19th and 20th 2015.

4.2.1.2. Locations

The cross-section locations were selected near the upstream end of DS7 as the stream channel is narrowest upstream and then quickly widens in the downstream direction. The objective was to document this narrow section of the channel where the highest stage for each discharge would occur.

4.2.1.3. Field Survey of Santa Paula Creek Channel at DS7

Three channel cross-sectional profiles and one longitudinal profile of the low-flow stream were surveyed on March 19 & 20, 2015 in the Santa Paula Creek at DS7 (Figure 9). Standard field survey techniques were followed (Harrelson et al. 1994[21]). The distance between A-A' and B-B' is approximately 200 to 240 feet, and the distance between B-B' and C-C' is approximately 135 to 150 feet apart. Because there is a slight curvature in the study reach, cross-sections are closer together on the inside of the curve, where they start at the DS7 fence line. Selecting cross-section locations also included safety, access, and capturing representative cross-sections to show the changes in the channel profile and cross-sectional area along this study reach.

A laser level was used to survey differences in elevation in the floodplain overbank areas. In places, very dense riparian vegetation inhibited the use of the laser and a level line was used to measure differences in elevation in the riparian corridor and stream channel. The level line was a lightweight string that was pulled tight between stakes on the stream banks and leveled with a bubble level. Care was taken to ensure no leaves, vegetation, or anything else was in contact with the string and the line was as level as possible during measurement. Tape measures and lines were placed along each segment of the cross-section and the directional bearing recorded and adjustments were made to ensure segments of the cross-section were in a straight line along the same bearing. Distance measurements for each cross-section are measured from south bank to north bank (or left-right facing downstream), and the furthest south bank point (zero feet distance) was at the fence line surrounding DS7. Relative elevation for each cross-section was matched to the LiDAR data and compared to LiDAR topography demonstrating good agreement between current field conditions and the 2005 LiDAR topography data (Figure 10). Therefore, LiDAR topography was used to establish 14 channel cross-sections for input to HEC-RAS (Figure 11).

Figure 9 - The locations of cross-sections of the Santa Paula Creek adjacent DS7 and LIDAR contours. Background image is 2010 USGS ortho-imagery; Active & Idle wells are provided by the California Department of Conservation, Department of Oil, Gas, and Geothermal Resources (DOGGR), downloaded March 2015.

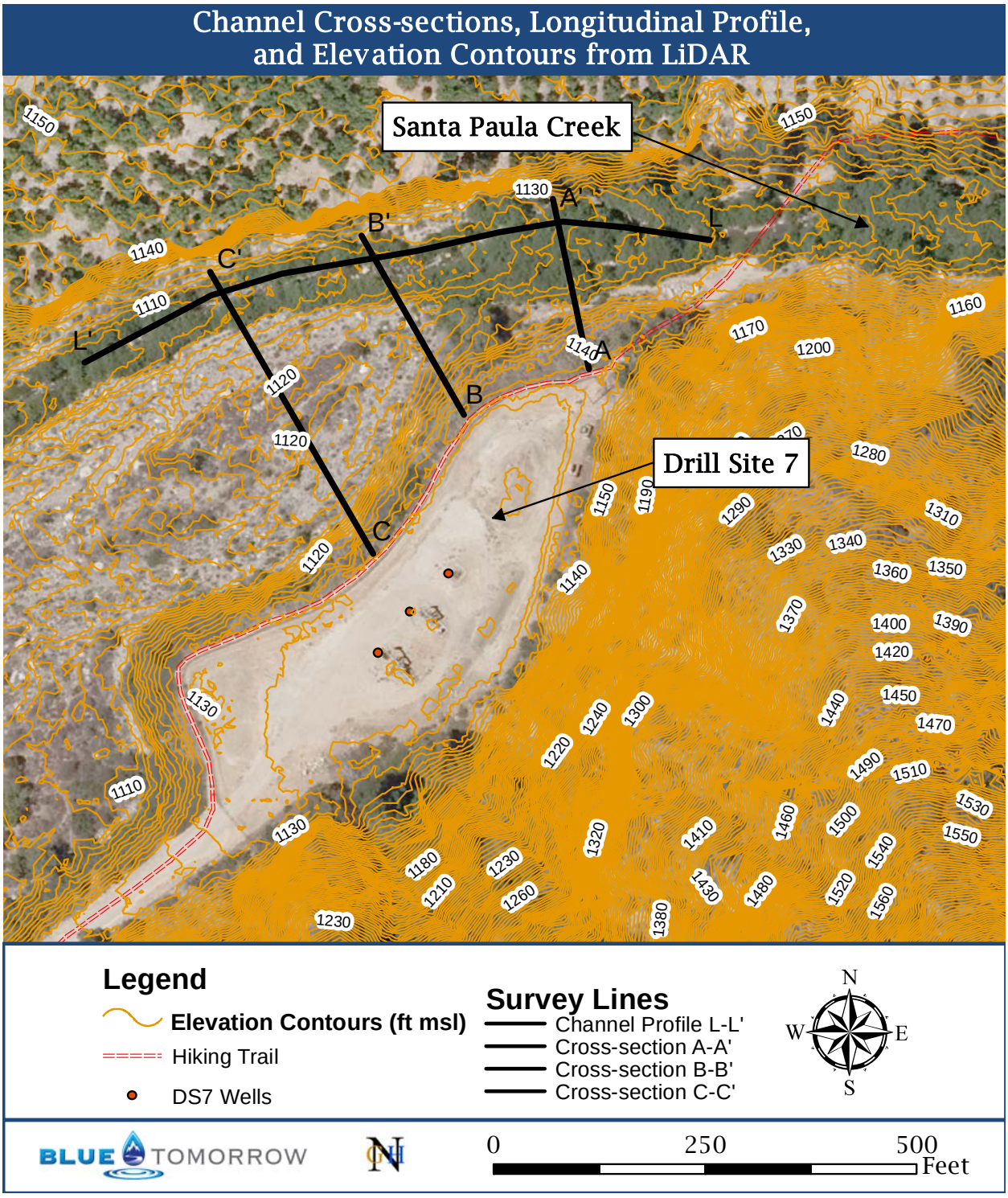


Figure 10 - Comparison of survey cross-section data to LiDAR elevation data at each location.

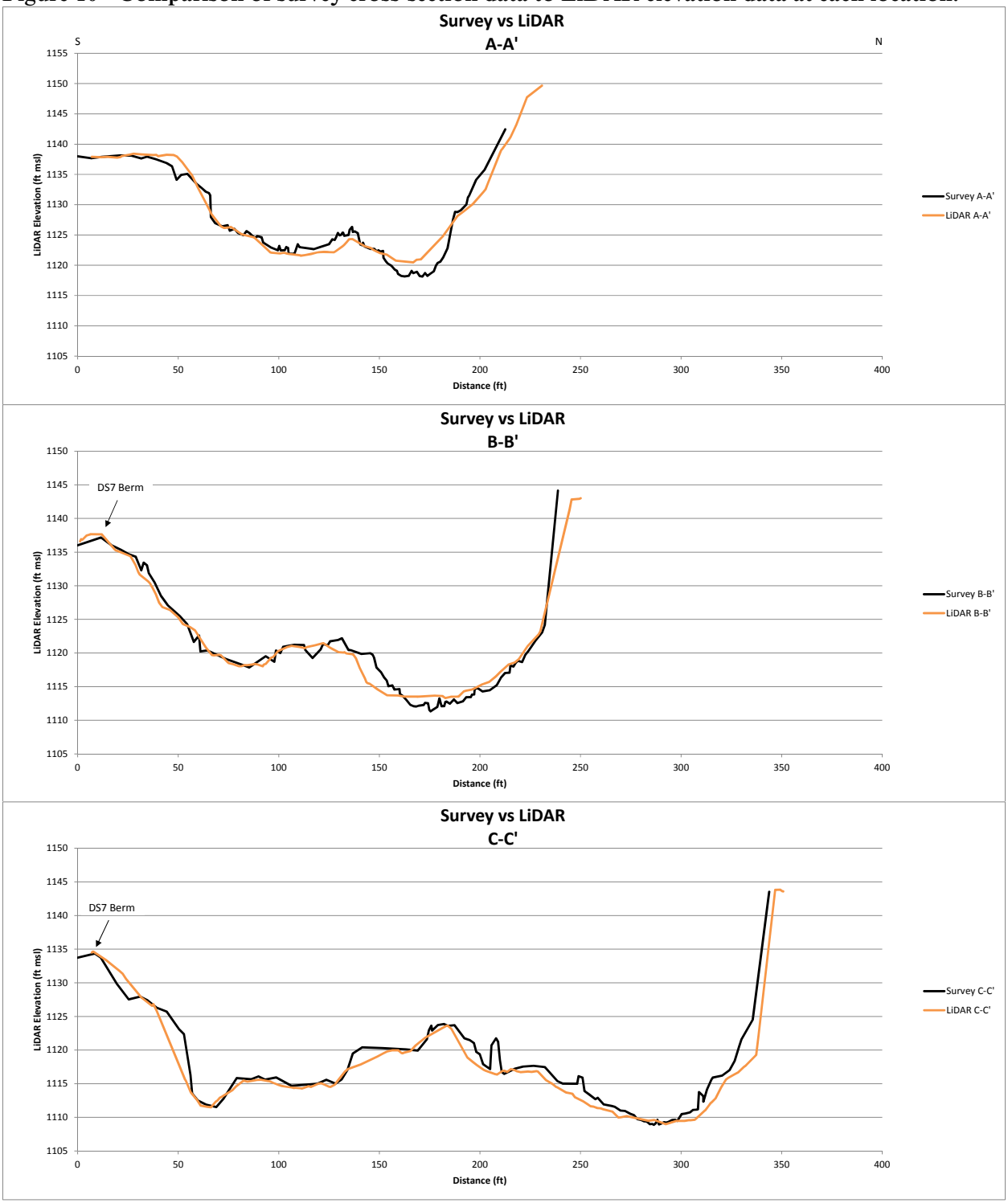
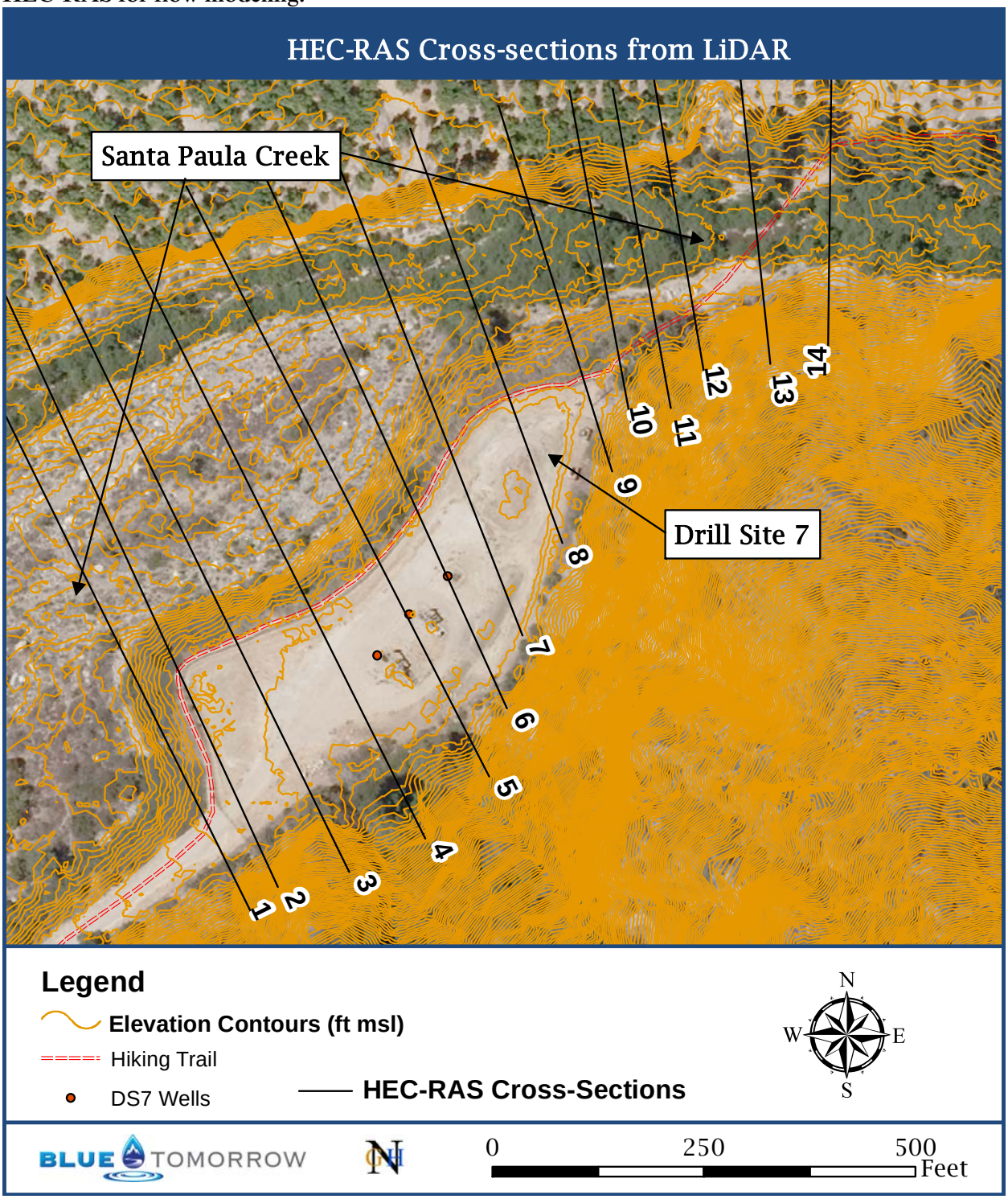


Figure 11 – Location of 14 channel cross-sections prepared from LiDAR topography and input to HEC-RAS for flow modeling.



4.2.2. Channel Characteristics

Channel characteristics, slope and roughness, are input parameters to HEC-RAS along with channel cross-sections and discharge to estimate flow velocity resulting in an estimate of stage height.

4.2.2.1. Channel Slope

The longitudinal profile of the low-flow stream channel was surveyed from 40 meters upstream of cross-section A-A' to 40 meters below the most downstream cross-section C-C', extending a total of 631.5 feet (see Appendix). This profile shows the channel has a slope of 0.033. Slope calculations from LiDAR data and Google Earth data over a longer distance up and down stream verified this slope as a reasonable estimate for the stream channel in this area.

4.2.2.2. Channel Roughness

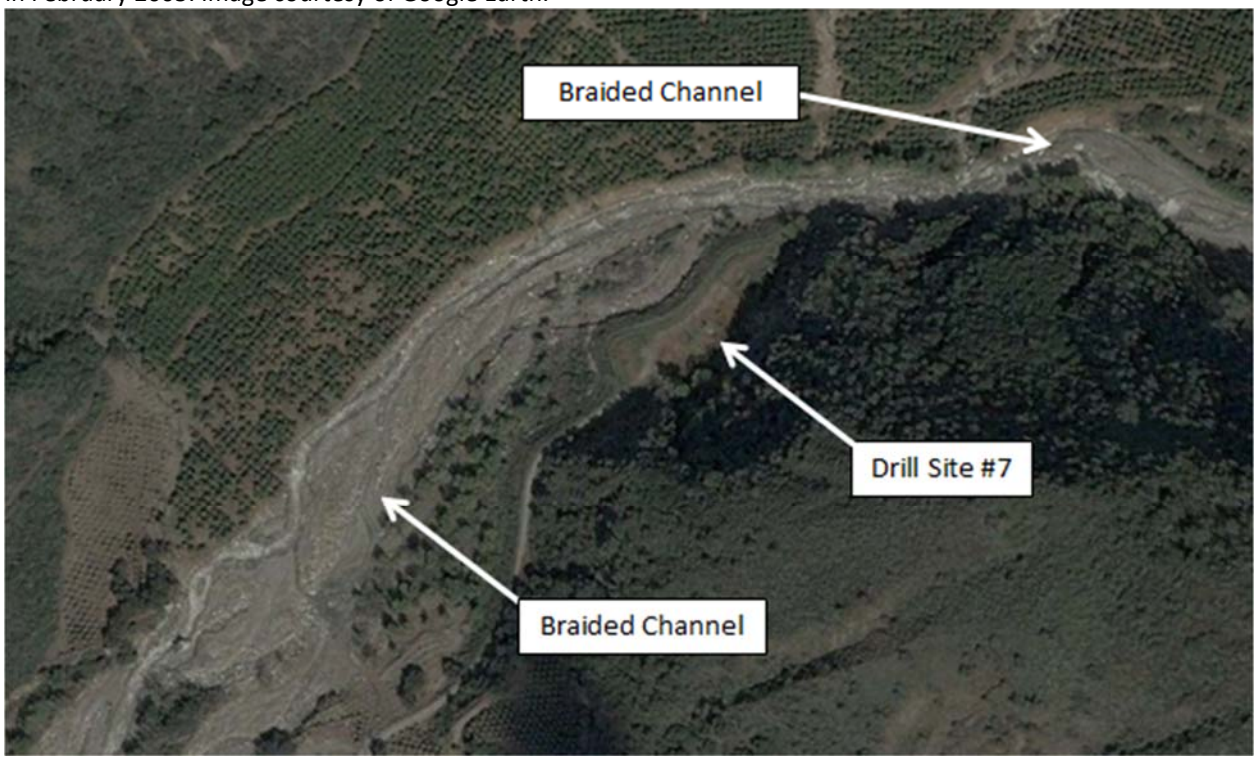
Roughness coefficients (Manning's n) were estimated from field observations and compared to literature references. A Geomorphic Assessment of the Santa Paula Creek conducted by Stillwater Sciences assumed a Manning's n of 0.05 for cross-sections located further downstream below the confluence with Sisar Creek and the Highway 150 bridge. The channel upstream near DS7 is steeper and rougher with larger substrate, and therefore a value of 0.05 was assumed as a minimum roughness.

Higher roughness coefficients are justified for the stream channel at DS7. In this area, the bed load is cobble-boulder-gravel with many boulders being up to or greater than 5 feet in diameter, as noted in the C-C' cross-section at distance 210 feet, where one of these large boulders is shown in the cross-section (Figure 10). The riparian vegetation along the DS7 study reach is dense and would provide considerable roughness until flows become strong enough to rip out the trees and vegetation. Roughness coefficients for dense riparian vegetation and scrub on the floodplain and overbank areas can be 0.1 or higher. Another factor that would affect roughness in this reach is the large amount of sediment that is mobilized during large discharge events. This sediment and debris can have a "bulking" effect on the flow, which can cause an increase in the roughness coefficient.

During the 2005 flood event, aerial imagery shows that riparian vegetation was scoured out, leaving little to no vegetation between the high water marks from this event (Picture 3). It can be assumed that this is likely to happen again during flow event of similar magnitude (50-year event) or greater, depending on the status of the vegetation present at the time of a flood.

Based on these observations, stream flow stage was estimated for each discharge event using two roughness coefficient scenarios: 1) assuming vegetation is scoured out during a large event and roughness is approximately uniform across the channel with a low roughness of 0.05; 2) vegetation is scoured and roughness is uniform across the channel with a high roughness of 0.07.

Picture 3 - Aerial image of the reach of Santa Paula Creek near Drill Site No. 7 after the January 2005 flood. The photo shows that riparian vegetation in the floodplain and stream channel has been scoured and removed. The photo also shows the narrow bedrock constrained section of the Santa Paula Creek directly upstream of DS7, and the widening of the channel causing deposition of sediment adjacent DS7. Photo was taken in February 2005. Image courtesy of Google Earth.



4.3. Modeled Flow Conditions

The 14 LiDAR cross-section data, channel characteristics, and Q2 – Q500 estimated discharges were input to the US Army Corps of Engineers Hydrologic Engineering Centers River Analysis System (HEC-RAS) to model the flow velocity for each discharge event in the Santa Paula Creek at DS7. HEC-RAS determines stage height for each discharge at each cross-sectional profile. The edge of the stream flow for each event can be determined by comparing the stage height at each cross-section to the LiDAR topography. Flow was modeled as a mixed subcritical and supercritical flow, however supercritical flow was dominant at all cross-sections (except for lessor discharge scenarios at C-C') due to the relatively steep channel in this reach and the flow velocities estimated by HEC-RAS.

5. HEC-RAS Results

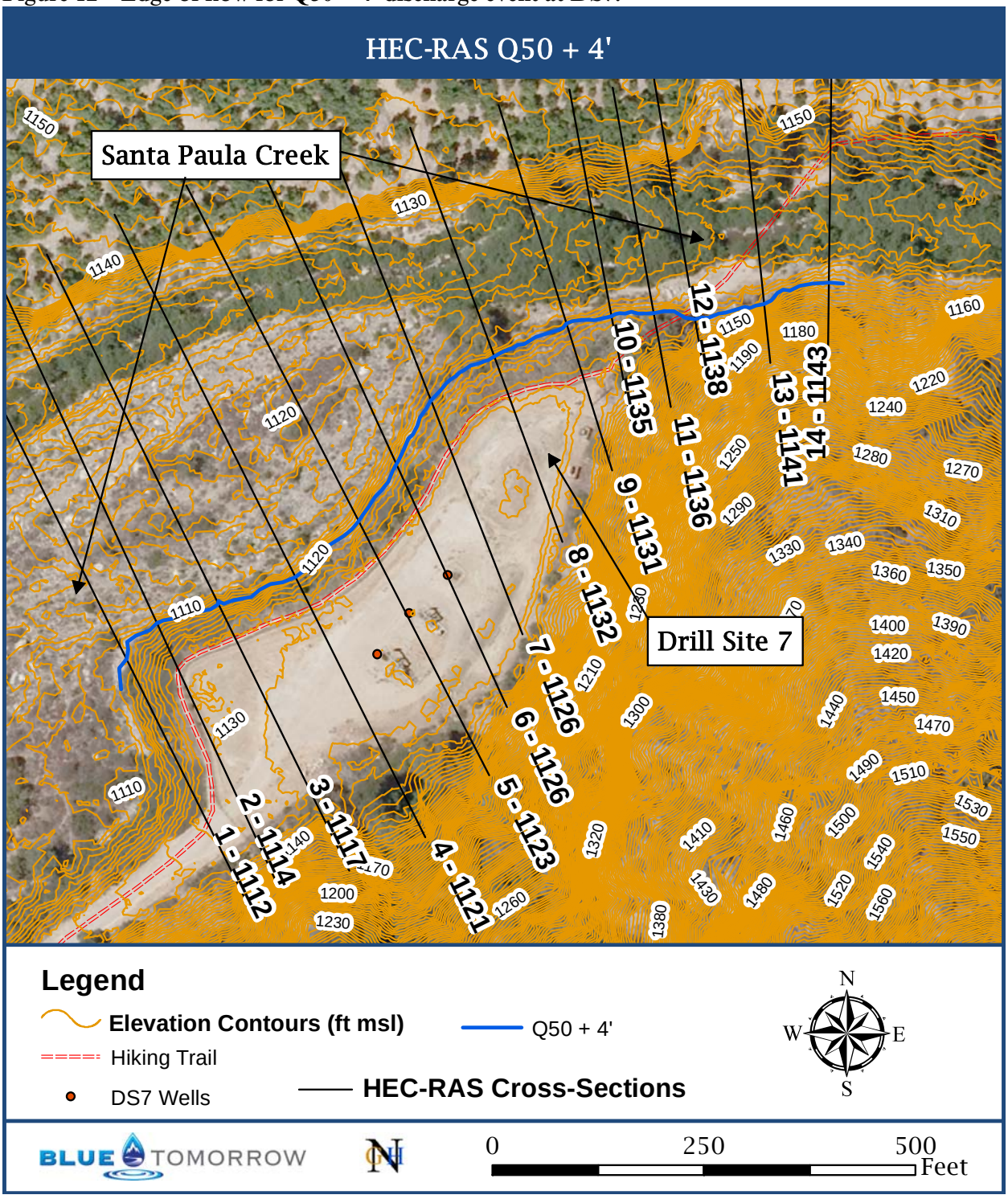
Stage height at each cross-section was calculated for each discharge event, using both roughness coefficients of n=0.05 and n=0.07 (Table 2). Stage height may only exceed the DS7 elevation at cross-section #12 under the extreme flow events of discharge greater than Q200, n=0.05. However, in the case of bulking or a debris flow, a lessor magnitude event may overtop DS7 as can be surmised from the fact that the Q25 discharge is only 6 feet below DS7. A more detailed modeling exercise may provide insights to conditions where bulking and debris flows influence stage height.

Table 2 – HEC-RAS Output at each cross-section.

Roughness n = 0.05							Roughness n = 0.07						
HEC-RAS Cross-secti	Discharge	Discharge	Stage (ft n	Drill Pad Elevation (ft msl)			HEC-RAS C	Discharge	Discharge	Stage (ft n	Drill Pad Elevatio		
14	Q2	1048	1131.56				14	Q2	1048	1131.97			
14	Q5	3487	1133.44				14	Q5	3487	1134.44			
14	Q10	6344	1134.99				14	Q10	6344	1136.36			
14	Q25	11719	1137.18				14	Q25	11719	1138.92			
14	Q50	17215	1138.91				14	Q50	17215	1140.44			
14	Q100	24213	1140.78				14	Q100	24213	1142.87			
14	Q200	32566	1142.62				14	Q200	32566	1145.05			
14	Q500	47263	1145.33				14	Q500	47263	1148.23			
13	Q2	1048	1129.72				13	Q2	1048	1130.23			
13	Q5	3487	1131.93				13	Q5	3487	1132.33			
13	Q10	6344	1133.27				13	Q10	6344	1133.8			
13	Q25	11719	1134.99				13	Q25	11719	1136.03			
13	Q50	17215	1136.68				13	Q50	17215	1138.37			
13	Q100	24213	1138.27				13	Q100	24213	1139.87			
13	Q200	32566	1139.97				13	Q200	32566	1141.85			
13	Q500	47263	1142.46				13	Q500	47263	1144.39			
12	Q2	1048	1127.22	1138			12	Q2	1048	1127.41	1138		
12	Q5	3487	1128.84	1138			12	Q5	3487	1129.62	1138		
12	Q10	6344	1130.38	1138			12	Q10	6344	1131.34	1138		
12	Q25	11719	1132.2	1138			12	Q25	11719	1133.4	1138		
12	Q50	17215	1133.68	1138			12	Q50	17215	1134.99	1138		
12	Q100	24213	1135.37	1138			12	Q100	24213	1137.18	1138		
12	Q200	32566	1137.14	1138			12	Q200	32566	1139.03	1138		
12	Q500	47263	1139.63	1138			12	Q500	47263	1144.12	1138		
11	Q2	1048	1125.41	1138.02			11	Q2	1048	1126.13	1138.02		
11	Q5	3487	1127.34	1138.02			11	Q5	3487	1128.15	1138.02		
11	Q10	6344	1128.69	1138.02			11	Q10	6344	1129.42	1138.02		
11	Q25	11719	1130.45	1138.02			11	Q25	11719	1131.52	1138.02		
11	Q50	17215	1131.9	1138.02			11	Q50	17215	1133.23	1138.02		
11	Q100	24213	1133.53	1138.02			11	Q100	24213	1135.18	1138.02		
11	Q200	32566	1135.28	1138.02			11	Q200	32566	1137.42	1138.02		
11	Q500	47263	1138.38	1138.02			11	Q500	47263	1144.25	1138.02		
10	Q2	1048	1124.45	1139.37			10	Q2	1048	1124.48	1139.37		
10	Q5	3487	1125.78	1139.37			10	Q5	3487	1126.37	1139.37		
10	Q10	6344	1127.12	1139.37			10	Q10	6344	1128.08	1139.37		
10	Q25	11719	1129	1139.37			10	Q25	11719	1130.43	1139.37		
10	Q50	17215	1130.51	1139.37			10	Q50	17215	1132.37	1139.37		
10	Q100	24213	1132.14	1139.37			10	Q100	24213	1134.5	1139.37		
10	Q200	32566	1133.9	1139.37			10	Q200	32566	1136.86	1139.37		
10	Q500	47263	1136.76	1139.37			10	Q500	47263	1138.97	1139.37		
9	Q2	1048	1120.53	1140.12			9	Q2	1048	1121.68	1140.12		
9	Q5	3487	1122.17	1140.12			9	Q5	3487	1124.7	1140.12		
9	Q10	6344	1123.47	1140.12			9	Q10	6344	1126.69	1140.12		
9	Q25	11719	1125.44	1140.12			9	Q25	11719	1129.12	1140.12		
9	Q50	17215	1127.07	1140.12			9	Q50	17215	1131.25	1140.12		
9	Q100	24213	1128.6	1140.12			9	Q100	24213	1133.65	1140.12		
9	Q200	32566	1130.24	1140.12			9	Q200	32566	1136.35	1140.12		
9	Q500	47263	1132.88	1140.12			9	Q500	47263	1134.62	1140.12		
8	Q2	1048	1118.79	1138.68			8	Q2	1048	1118.79	1138.68		
8	Q5	3487	1121.06	1138.68			8	Q5	3487	1121.06	1138.68		
8	Q10	6344	1123.55	1138.68			8	Q10	6344	1123.55	1138.68		
8	Q25	11719	1126.19	1138.68			8	Q25	11719	1126.19	1138.68		
8	Q50	17215	1127.81	1138.68			8	Q50	17215	1128.04	1138.68		
8	Q100	24213	1129.31	1138.68			8	Q100	24213	1130.07	1138.68		
8	Q200	32566	1130.97	1138.68			8	Q200	32566	1132.09	1138.68		
8	Q500	47263	1133.4	1138.68			8	Q500	47263	1137	1138.68		
7	Q2	1048	1115.74	1136.67			7	Q2	1048	1116.91	1136.67		
7	Q5	3487	1117.94	1136.67			7	Q5	3487	1119.71	1136.67		
7	Q10	6344	1119.25	1136.67			7	Q10	6344	1121.67	1136.67		
7	Q25	11719	1121.16	1136.67			7	Q25	11719	1121.73	1136.67		
7	Q50	17215	1122.29	1136.67			7	Q50	17215	1122.86	1136.67		
7	Q100	24213	1123.46	1136.67			7	Q100	24213	1124.04	1136.67		
7	Q200	32566	1124.63	1136.67			7	Q200	32566	1125.25	1136.67		
7	Q500	47263	1126.41	1136.67			7	Q500	47263	1127.41	1136.67		
6	Q2	1048	1114.54	1136.2			6	Q2	1048	1114.67	1136.2		
6	Q5	3487	1117.3	1136.2			6	Q5	3487	1117.37	1136.2		
6	Q10	6344	1118.91	1136.2			6	Q10	6344	1119.27	1136.2		
6	Q25	11719	1120.6	1136.2			6	Q25	11719	1121.83	1136.2		
6	Q50	17215	1121.58	1136.2			6	Q50	17215	1123.18	1136.2		
6	Q100	24213	1122.58	1136.2			6	Q100	24213	1124.64	1136.2		
6	Q200	32566	1123.56	1136.2			6	Q200	32566	1126.11	1136.2		
6	Q500	47263	1125.06	1136.2			6	Q500	47263	1127.59	1136.2		
5	Q2	1048	1112.24	1134.38			5	Q2	1048	1113.05	1134.38		
5	Q5	3487	1113.82	1134.38			5	Q5	3487	1115.52	1134.38		
5	Q10	6344	1115.2	1134.38			5	Q10	6344	1115.76	1134.38		
5	Q25	11719	1116.7	1134.38			5	Q25	11719	1117.18	1134.38		
5	Q50	17215	1117.93	1134.38			5	Q50	17215	1118.51	1134.38		
5	Q100	24213	1118.95	1134.38			5	Q100	24213	1119.7	1134.38		
5	Q200	32566	1119.93	1134.38			5	Q200	32566	1120.89	1134.38		
5	Q500	47263	1121.26	1134.38			5	Q500	47263	1122.5	1134.38		
4	Q2	1048	1110.07	1133.49			4	Q2	1048	1110.21	1133.49		
4	Q5	3487	1112.83	1133.49			4	Q5	3487	1113.01	1133.49		
4	Q10	6344	1114.2	1133.49			4	Q10	6344	1114.83	1133.49		
4	Q25	11719	1116.08	1133.49			4	Q25	11719	1116.92	1133.49		
4	Q50	17215	1117.4	1133.49			4	Q50	17215	1118.95	1133.49		
4	Q100	24213	1118.71	1133.49			4	Q100	24213	1119.99	1133.49		
4	Q200	32566	1119.43	1133.49			4	Q200	32566	1121.24	1133.49		
4	Q500	47263	1120.51	1133.49			4	Q500	47263	1123.06	1133.49		
3	Q2	1048	1107.34	1132.35			3	Q2	1048	1108.09	1132.35		
3	Q5	3487	1108.76	1132.35			3	Q5	3487	1109.34	1132.35		
3	Q10	6344	1110	1132.35			3	Q10	6344	1110.47	1132.35		
3	Q25	11719	1111.44	1132.35			3	Q25	11719	1111.95	1132.35		
3	Q50	17215	1112.57	1132.35			3	Q50	17215	1113	1132.35		
3	Q100	24213	1113.78	1132.35			3	Q100	24213	1114.32	1132.35		
3	Q200	32566	1114.7	1132.35			3	Q200	32566	1115.42	1132.35		
3	Q500	47263	1116.05	1132.35			3	Q500	47263	1117.18	1132.35		
2	Q2	1048	1105.95	1131.02			2	Q2	1048	1106.01	1131.02		
2	Q5	3487	1107.15	1131.02			2	Q5	3487	1107.51	1131.02		
2	Q10	6344	1107.96	1131.02			2	Q10	6344	1108.69	1131.02		
2	Q25	11719	1109.31	1131.02			2	Q25	11719	1110.69	1131.02		
2	Q50	17215	1110.46	1131.02			2	Q50	17215	1111.85	1131.02		
2	Q100	24213	1111.46	1131.02			2	Q100	24213	1113.21	1131.02		
2	Q200	32566	1112.66	1131.02			2	Q200	32566	1114.61	1131.02		
2	Q500	47263	1114.4	1131.02			2	Q500	47263	1116.65	1131.02		
1	Q2	1048	1103.77				1	Q2	1048	1104.28			
1	Q5	3487	1105.46				1	Q5	3487	1106.03			
1	Q10	6344	1106.33				1	Q10	6344	1107.28			
1	Q25	11719	1107.47				1	Q25	11719	1107.95			
1	Q50	17215	1108.25				1	Q50	17215	1108.92			
1	Q100	24213	1109.15				1	Q100	24213	1109.88			
1	Q200	32566	1110.09				1	Q200	32566	1110.88			
1	Q500	47263	1111.55				1	Q500	47263	1112.44			

The boundary of flow can be easily mapped from the HEC-RAS output. The County of Ventura has used the Q50 + 4' to determine the edge of water at DS7 from which setback distances are determined. The Q50 stage elevation plus 4' was calculated at each of the HEC-RAS cross-sections and plotted on the LiDAR contour map. The elevation of water between cross-sections was estimated and hand digitized (Figure 12). The edge of water follows the contour of the rip-rap emplaced within the Santa Paula Creek channel. The 100' setback is determined from this boundary.

Figure 12 – Edge of flow for Q50 + 4' discharge event at DS7.

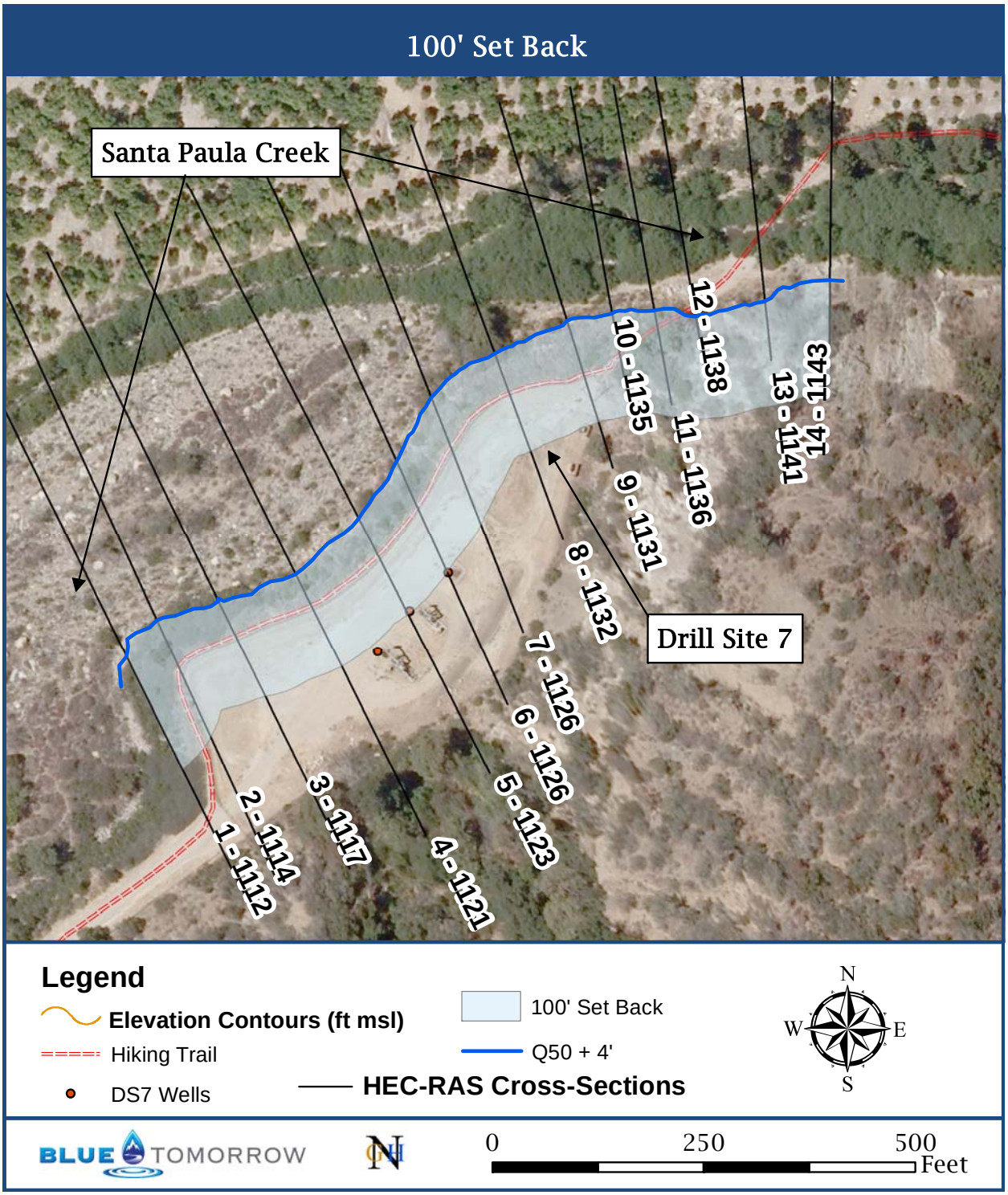


The 100' setback is determined from the edge of flow for the Q50 + 4' stage height by measuring the horizontal distance from the blue line (Figure 13). The Ventura County Non-Coastal Zoning Ordinance specifies setback distances for oil production operations from "Red Line" channels. According to Sec. 8107-5.6.1 of the ordinance, "No well shall be drilled and no equipment or facility shall

be permanently located within: d) 300 feet from the edge of existing banks of “Red Line” channels as established by the Ventura County Flood Control District (VCFCD), 100 feet from the existing banks of all other channels appearing on the most current United States Geological Service (USGS) 2,000' scale topographic map as a blue line.”

Half of DS7 is within 100’, and all of DS7 is within 300’ of the existing banks of Santa Paula Creek.

Figure 13 – The 100' setback per the Ventura County Non-Coastal Zoning Ordinance Sec. 8107-5.6.1.



6. Potential Impacts of CUP PL13-0150

The VCWPD utilizes the 100-year storm event as a determination of the defined bed of waters flowing in a defined direction (personal communication with Deputy Director of VCWPD, April 15, 2015). In a memorandum dated February 12, 2015 from the Ventura County Public Works Agency, Development and Inspection Services Division, the "top of bank" adjacent to DS7 was defined as four vertical feet above the 50-year storm water mark[18]. This memorandum also specified that the five additional wells proposed to be drilled at DS7 are required to be setback a minimum of 100 feet from the "top of bank" [18].

The installation of the proposed 5 wells would result in the creation of approximately 2,000 square feet of new impervious surface[20]. Increasing the number of wells and operations on the pad will increase the potential for spills, and the additional impervious surface will lead to increased surface runoff and discharge through the drain pipe and culvert, where well pad generated pollutants are released into the creek.

The outer edge of DS7 is located within 50 feet of the "top of bank" (defined as four vertical feet above the 50-year flood mark in previous County documentation), and the oil wells currently located on DS7 are within 300 feet of the "top of bank". The drain pipe at the northwest corner of DS7 drains directly into the Santa Paula Creek. The Ventura County Non-Coastal Zoning Ordinance states that wells and permanent oil field infrastructure should abide by a 300 foot setback "… unless the permittee can demonstrate to the satisfaction of the Public Works Agency that the subject use can be safely located nearer the stream or channel in question without posing an undue risk of water pollution..." Given the drainage of DS7 and its location near the creek, increasing the amount of oil wells and impervious area poses an increased risk to water quality.

7. Conclusion

DS7 was constructed in the Santa Paula Creek channel, and is drained by a 24" culvert that discharges directly into the creek. It is likely that pollutants that accumulate on DS7 from spills and pollutants deposited from the operation of machinery are currently being released into the creek. The 1983 MND for CUP 3344 was the only environmental review that considered impacts from the drilling and operation of wells on DS7. A subsequent EIR was prepared in 1984 that focused only on environmental consequences of providing access to the Ferndale Ranch lease. CUP 3344 expired in 2011. Since the certification of the previous MND in 1983, new determinations have been made regarding biological and water resources that were not available at the time the MND was certified by the County Board of Supervisors. In 2006, Steelhead Trout was listed as an endangered species and Santa Paula Creek is designated as critical habitat for this protected species. Since the MND there have been advances in water quality science and assessment of impacts to water quality. Additionally, when the MND was certified the Ventura County NCZO and the VCWPD WP-2 Ordinance did not exist.

The Non-Coastal Zoning Ordinance (NCZO) specifies setback requirements for oil wells, permanent equipment, or facilities, from Santa Paula Creek (classified as both a "red" and "blue-line" stream). The setback distance is measured from the "top of bank" that was determined by the County as four feet above the 50-year flood stage. Based on flood discharge estimates, 100% of DS7 is within the 300-foot setback requirement, and approximately 50% of DS7 is within the 100-foot setback that the

County has determined in the NCZO. The addition of 5 new wells (currently 3 wells exist at DS7) will increase the impervious area, compaction and creation of fine-grain sediment, and increase the potential of spills and contaminated soils on DS7. These factors will impact the water quality of Santa Paula Creek, thus impacting the endangered Steelhead Trout, and their habitat.

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Appendix

Cross-sectional data for the three cross-sections surveyed for this study. Station data (distance from drill site fence on left-bank) was collected using a meter tape and converted to feet, elevation was collected as decimal feet using a surveying rod (stadia rod).

A-A'			B-B'			C-C'		
Station (ft)	Elev. (ft)	notes	Station (ft)	Elev. (ft)	notes	Station (ft)	Elev. (ft)	notes
0	-0.13		0	-2.57		0	-4.76	
6.56	-0.45		11.65	-1.41		8.53	-4.14	
12.14	-0.22		16.73	-2.52		11.48	-4.73	
21.16	0		21.65	-3.25		19.52	-8.61	
26.9	-0.03		25.43	-3.87		25.43	-10.95	
31.66	-0.5		28.87	-4.26		31	-10.53	
34.45	-0.21		31.66	-6.28		34.61	-11.05	
39.04	-0.64		32.81	-5.13		39.21	-12.16	
44.29	-1.27		34.45	-5.54		44.29	-12.76	
46.92	-1.78		35.43	-6.72		50.52	-15.42	
49.21	-4.02		38.22	-8.08		52.82	-16.11	
51.51	-3.21		41.5	-10.12		56.1	-22.19	
54.56	-3.05		44.78	-11.47		56.92	-24.94	
59.19	-4.71		50.85	-13.1		59.71	-25.97	
61.68	-5.38		54.46	-14.3		63.65	-26.56	
63.65	-5.98		57.74	-16.92		68.9	-26.96	
65.29	-6.21		60.37	-15.97		72.51	-25.72	
65.94	-6.61		61.02	-18.34		79.07	-22.64	
66.27	-10.17		64.47	-18.19		86.29	-22.81	
68.41	-11.18		73.82	-19.46		89.9	-22.39	
71.85	-11.69		83.01	-20.45		93.18	-22.86	
74.57	-11.5		85.3	-20.72		98.75	-22.55	
75.62	-12.42		93.5	-19.04		106.3	-23.79	
77.89	-12.12		97.77	-19.88		119.09	-23.48	
79.72	-12.8		98.59	-18.21		123.69	-22.88	
82.45	-13.18		100.72	-18.57		128.28	-23.46	
83.92	-12.48		102.2	-17.64		131.23	-22.85	
85.4	-12.8		104.82	-17.49		134.19	-21.4	
87.14	-13.36		107.78	-17.34		136.81	-18.99	
88.39	-13.61		112.53	-17.38		141.4	-18.08	
89.21	-13.33		113.19	-18.12		151.74	-18.19	
91.47	-13.51		116.8	-19.31		163.22	-18.38	
92.26	-14.39		120.73	-18.06		169.13	-18.55	

96.29	-15.23		122.05	-17.24		173.65	-16.87	
99.57	-15.67		124.34	-17.42		174.61	-15.58	
100.26	-14.92		125.49	-16.83		175.85	-14.85	
100.92	-15.68		129.59	-16.62		176.18	-15.58	
103.02	-15.63		131.4	-16.38		179.13	-14.75	
103.67	-15.12		134.68	-18.13		182.09	-14.6	
104.66	-15.28		135.83	-18.14		184.06	-14.89	
104.92	-16.23		141.08	-18.71		187.34	-14.78	
107.78	-16.22		145.51	-18.6		192.26	-16.72	
109.42	-14.66		146.72	-18.82		194.88	-17	
110.3	-15.13		147.38	-19.28		197.01	-17.45	
117.45	-15.48		148.59	-20.71		198.16	-18.75	
120.57	-15.11		150.75	-21.41		199.97	-19.09	
125	-14.65		152.4	-22.23		201.61	-20.58	
126.61	-13.84		153.67	-22.67		205.05	-21.31	
127.79	-13.95		154.53	-23.51		205.71	-17.78	
128.44	-13.54		156.43	-23.38		208.01	-16.72	
129.4	-12.8		157.45	-24		208.99	-17.22	
130.25	-13.2		159.97	-23.93		209.97	-19.97	
130.87	-13.14		160.2	-24.65		210.86	-21.73	
131.69	-12.74		161.58	-24.97	BF	212.11	-22.03	
132.05	-12.77		163.25	-25.49		217.52	-21.23	
132.55	-13.27		165.35	-26.24	WE	221.46	-20.93	
134.68	-13.13		165.85	-26.34		226.71	-20.82	
135.24	-12.29		167.06	-26.49		232.28	-21.01	
136.45	-11.81		168.34	-26.52	TW	238.52	-23.1	
136.81	-12.63		169.52	-26.41		241.14	-23.46	
137.73	-12.54		172.05	-26.3		248.36	-23.48	
139.27	-12.83		172.74	-25.98		249.02	-22.36	
140.52	-14.71		174.18	-26.03		250.98	-22.56	
141.54	-14.82		174.8	-27.04		251.97	-24.58	
141.83	-14.41		175.46	-27.26		254.27	-25.07	
142.68	-15.03		176.61	-27		257.38	-25.77	
145.47	-15.43		178.77	-26.6	WE	258.53	-25.58	
147.54	-15.42		179.89	-25.32		261.48	-26.55	
148.72	-15.83		180.94	-26.49		265.58	-26.8	
149.57	-15.66		182.25	-26.47		267.06	-26.92	
150.36	-15.88		182.74	-25.87		269.85	-27.47	
151.84	-15.77		183.4	-25.78		272.15	-27.53	
152.07	-16.9		185.07	-26.11		274.77	-27.95	BF
153.28	-17.51		187.01	-25.47		276.57	-28.16	
154.13	-17.83	BF	188.81	-26.02		278.22	-28.75	

156	-18.23		191.57	-25.75		280.02	-28.86	
157.64	-18.85		193.14	-25.15	BF	281.56	-29.06	WE
158.73	-19.03		195.47	-25.13		282.81	-29.08	
159.28	-19.56	WE	196.06	-24.75		284.45	-29.49	
160.89	-19.9		197.15	-24.74		285.7	-29.45	
162.53	-19.98		197.44	-23.9		286.42	-29.58	
164.63	-19.88		198.98	-23.82		287.34	-29.38	
166.01	-19.07		201.28	-24.28		288.22	-28.83	
166.86	-19.43		204.89	-24.1		288.98	-29.54	
168.64	-19.21		208.4	-23.34		290.32	-29.38	
170.05	-19.91		210.5	-22.21		291.5	-29.2	
171.42	-19.99	TW	212.47	-21.55		292.65	-29.27	
172.7	-19.41		214.73	-21.49		293.8	-29.13	WE
173.88	-19.9		215.16	-20.43		295.54	-28.88	
175.52	-19.48		216.7	-20.58		297.05	-28.83	
177.07	-19.13	WE	217.68	-20.09		298.13	-29	
178.15	-18.17		218.8	-19.73		300.3	-27.99	
178.97	-17.74	BF	220.96	-19.91		302	-27.92	BF
180.35	-17.54		222.6	-18.83		304.46	-27.73	
181.76	-16.82		224.02	-18.29		305.91	-27.37	
183.89	-15.32		227.62	-16.73		307.74	-27.34	
185.27	-12.92		230.91	-15.52		308.4	-27.28	
186.61	-10.58		232.22	-14.43		308.89	-24.73	
187.7	-9.3		238.78	5.57	EE	311.02	-25.3	
188.78	-9.37					311.12	-26.16	
190.52	-9.04					312.89	-24.33	
193.27	-8.1					315.12	-22.87	
194.03	-6.95					315.78	-22.56	
194.69	-6.58					320.47	-22.27	
198.13	-4.01					324.15	-21.46	
202.4	-2.34					326.64	-20.08	
212.57	4.32					328.9	-17.93	
						330.05	-16.87	
						335.63	-13.95	
						343.83	5.05	EE

Notes Key:
BF – Bank Full, estimated from geomorphic marks in the field this is the height of the estimated 2-year discharge event.
WE – Waters edge at the time of survey, March 19, 2015.
TW – Thalweg, the deepest point in the channel.
EE – estimated elevation and distance, at cross-section B and C the last point on the right bank was estimated using the measurement rod because it was a sheer cliff of approximately 20 of more feet that drops from the avocado orchard.

Presents the longitudinal low-flow stream profile (L-L') data surveyed for this study. Station data (distance downstream) was collected using a meter tape and converted to feet, elevation was collected as decimal feet using a surveying rod (stadia rod). This profile begins approximately on the downstream edge of the public hiking trail stream crossing, 131 feet (40 meters) upstream of cross-section A. The profile follows the centerline between water's edge and the banks of the main channel.

L-L'		
Station (ft)	Elev. (ft)	notes
0.00	-14.21	
28.54	-15.18	
47.24	-16.48	
82.02	-17.19	
116.80	-19.08	
131.56	-19.37	A-A'
159.45	-22.39	
201.12	-22.35	
232.94	-23.62	
259.84	-23.8	
288.06	-24.73	
311.68	-25.34	
334.97	-25.67	
344.16	-26.06	B-B'
366.14	-27	
402.23	-27.35	
428.81	-28.14	
455.05	-28.8	
471.78	-28.93	
484.81	-29.45	C-C'
494.42	-29.73	
511.81	-30.87	
531.82	-32.14	
570.87	-31.87	
586.29	-32.04	
631.56	-35.35	

Notes Key:
A-A' – Intersect with A-A' at 168.1 feet distance from left bank extent (chain-link fence).
B-B' – Intersect with B-B' at 153.8 feet distance from left bank extent.
C-C' – Intersect with C-C' at 263.2 feet distance from left bank extent.