Watershed-Wide Instream Flow Criteria for the Santa Margarita River

California Department of Fish and Wildlife
Instream Flow Program
Watershed Criteria Report No. 2026-01

California Department of Fish and Wildlife
Water Branch
Instream Flow Program
Watershed Criteria Report No. 2026–01

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Introduction

This *Watershed-Wide Instream Flow Criteria* report (Watershed Criteria Report) provides instream flow criteria for the Santa Margarita River watershed, based on the best available scientific information, existing and new datasets, analysis, and fieldwork. Its intended audience includes agencies, water managers, non-governmental organizations, and the public.

The Santa Margarita River was identified in the "California Salmon Strategy for a Hotter, Drier Future: Restoring Aquatic Ecosystems in the Age of Climate Change" as a priority stream for which the California Department of Fish and Wildlife (Department) must complete an instream flow analysis (Office of Governor Newsom 2024). This directive is consistent with the identification of the Santa Margarita River as a watercourse for which minimum flow levels need to be established in order to ensure continued viability of stream-related fish and wildlife resources, in accordance with Public Resources Code section 10001.

This report presents stream assessments for 25 reaches. An overview of the analyses used to create instream flow regime criteria contained in this document, as well as examples of potential criteria applications, are found in the Department's *Overview of Watershed-Wide Instream Flow Criteria Report Methodology* (Overview) document (CDFW 2021). Reviewing and understanding the information contained in the Overview document is essential to understanding flow criteria contained in this report. Complete background files for this report are maintained in the Department's Headquarters office. This document and the Overview may be found on the Watershed-Wide Instream Flow Criteria webpage (CDFW 2025).

The Department provides this document as a tool for consideration in water management planning. It presents an analytical approach that can be implemented, if appropriate, under the specific circumstances of a watershed, stream, or informational need. This report and the Overview, in and of themselves, should not be considered to provide binding guidelines.

Santa Margarita River
SANTA MARGARITA RIVER WATERSHED, SAN DIEGO AND RIVERSIDE COUNTY

Santa Margarita River Watershed

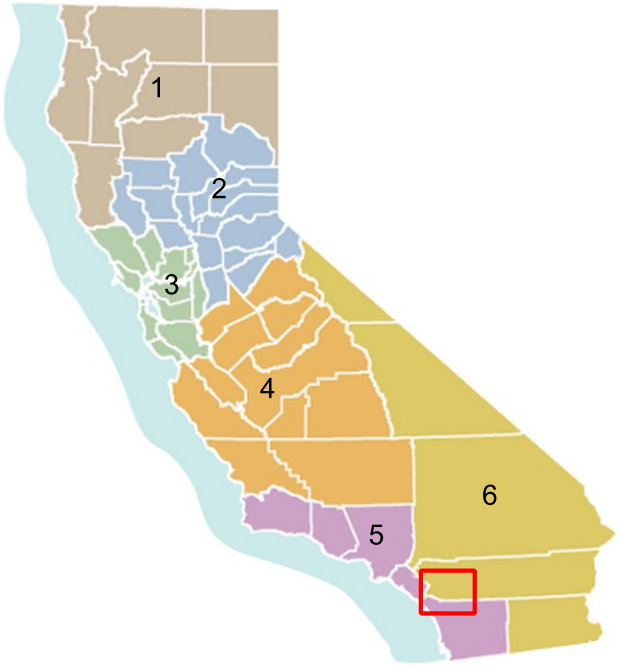

Figure 1. Map of the Department's Regions.

- Located in the Department's Region 5 and 6
- Spans San Diego and Riverside counties
- 740-square-mile (mi^2) drainage area
- Supports pacific lamprey, arroyo chub, and southern California steelhead trout

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This report presents streamflow analyses for 25 stream reaches within the Santa Margarita River watershed (Figure 2–Figure 4). Instream flow criteria have been developed for five priority reaches. The common identifiers (COMIDs) that correspond to the numbered reaches are listed in Appendix A.

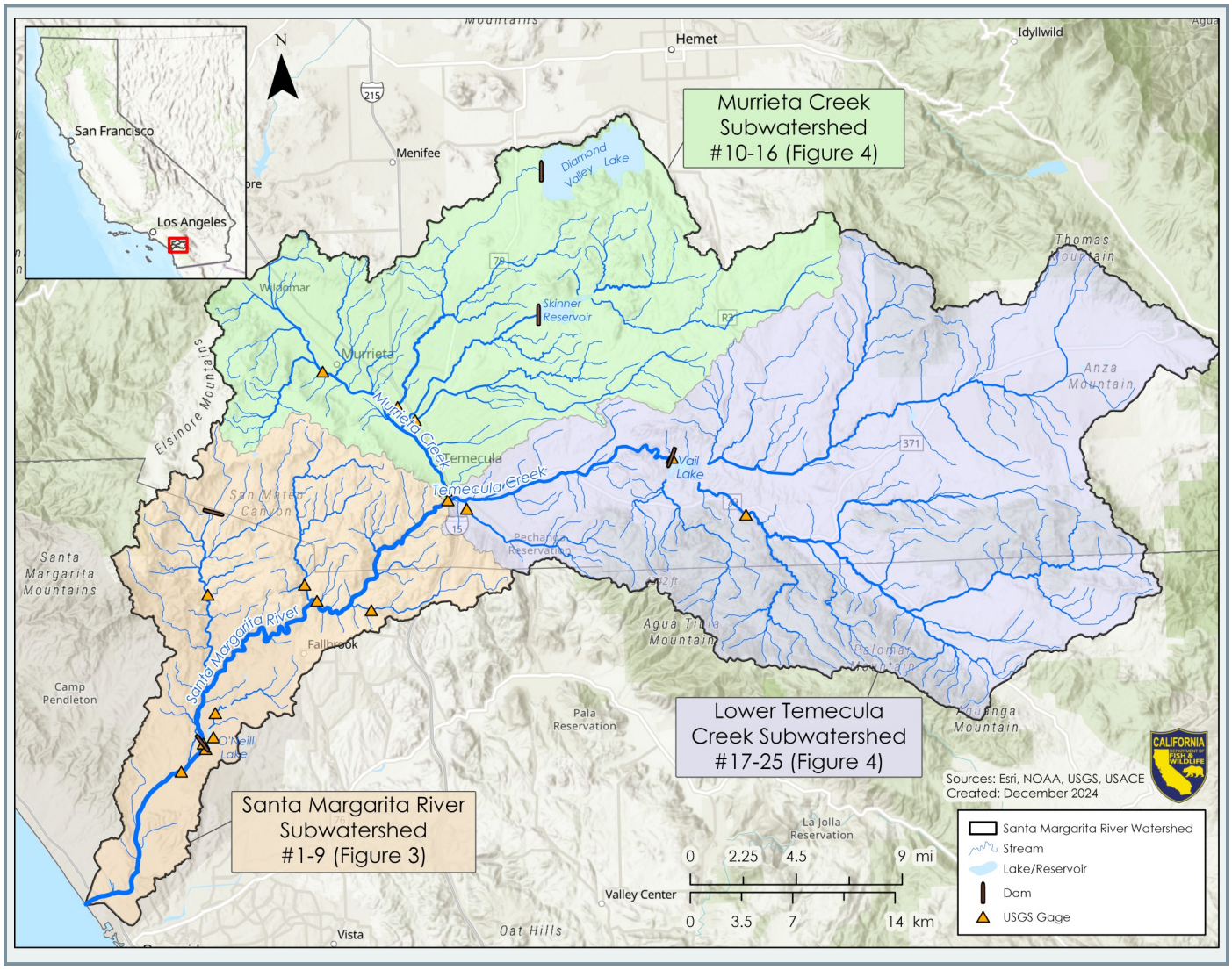
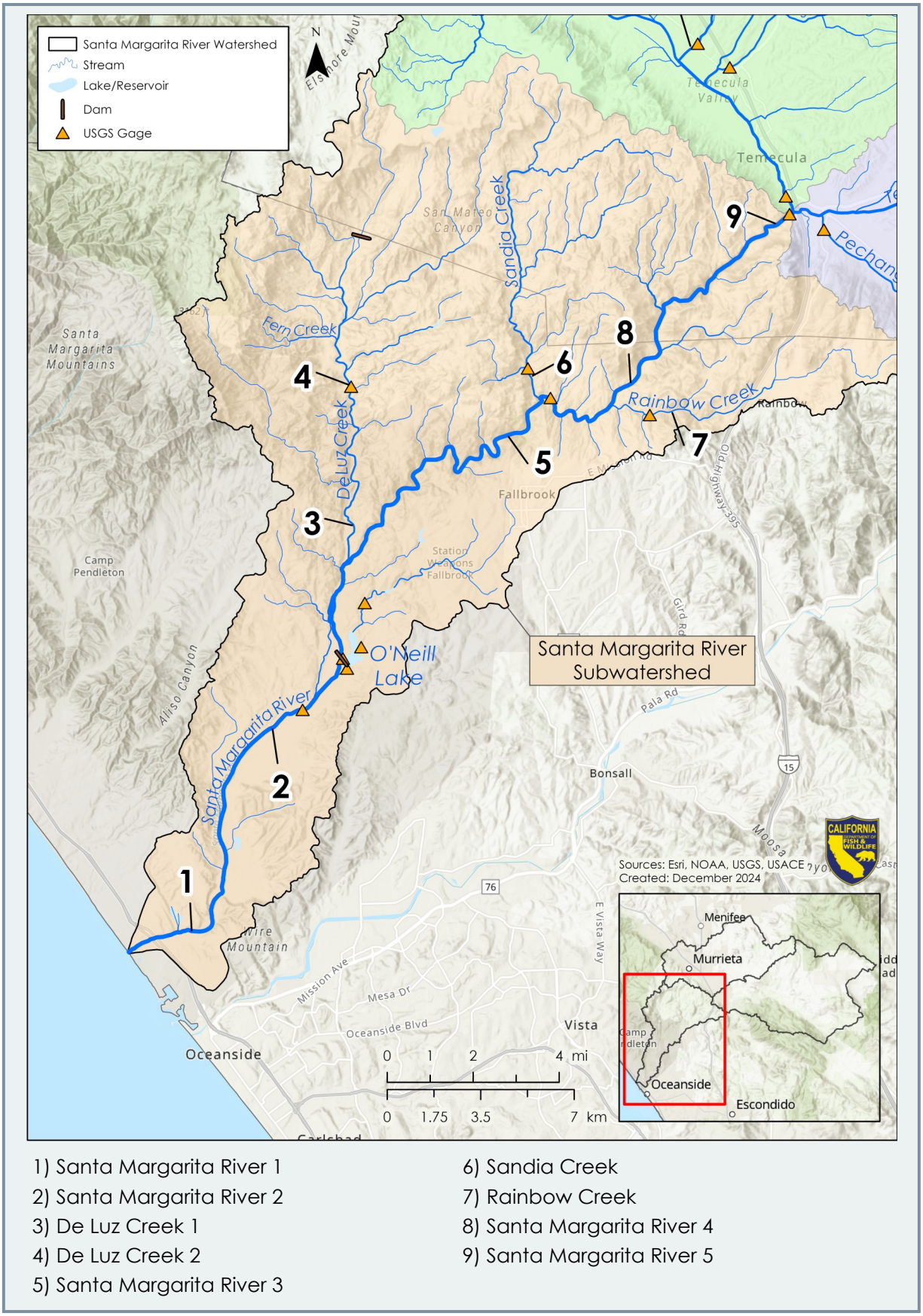
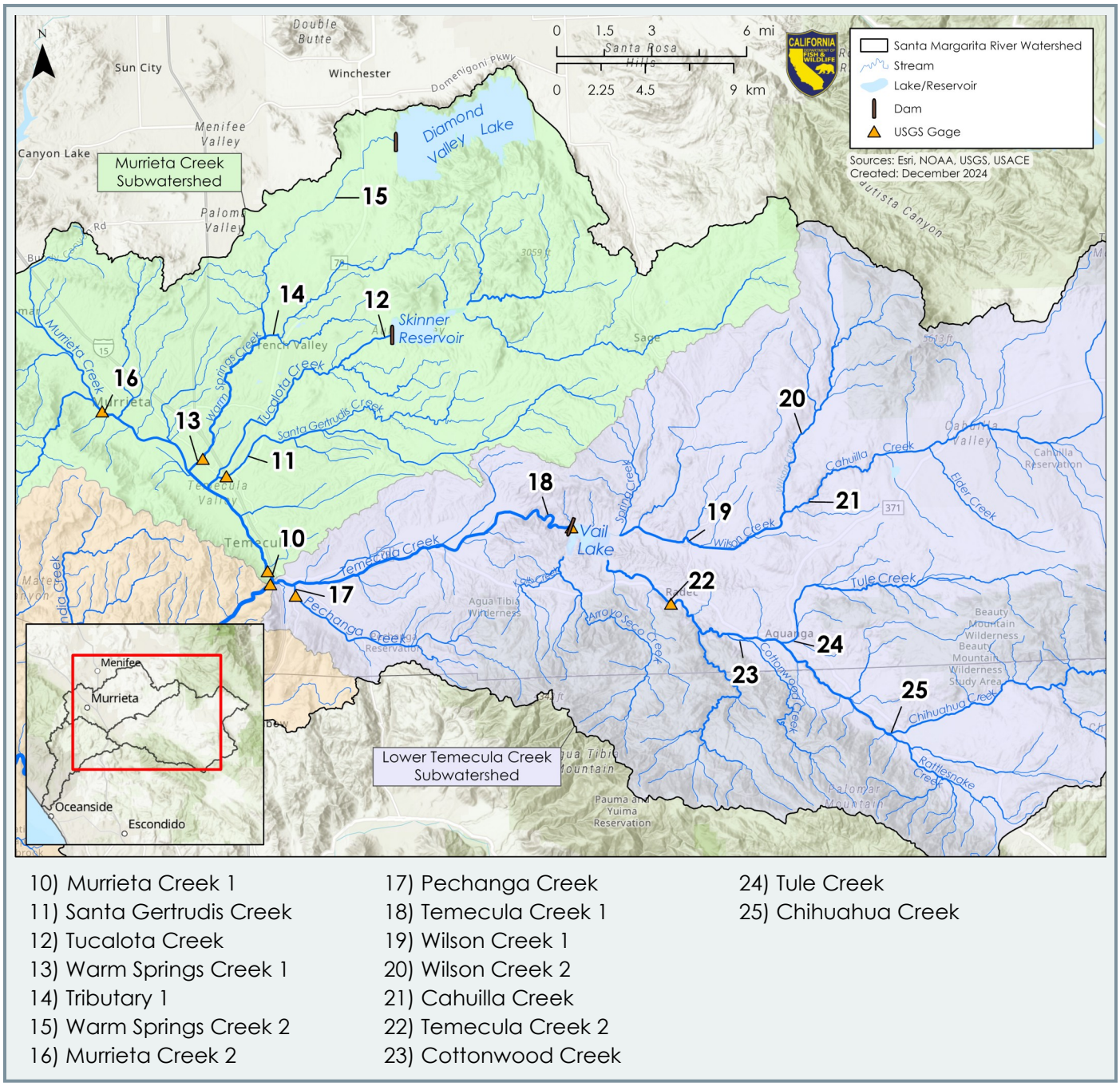


Figure 2. Santa Margarita River watershed map. The orange triangles are United States Geological Survey (USGS) gages.



1) Santa Margarita River 1
2) Santa Margarita River 2
3) De Luz Creek 1
4) De Luz Creek 2
5) Santa Margarita River 3
6) Sandia Creek
7) Rainbow Creek
8) Santa Margarita River 4
9) Santa Margarita River 5

Figure 3. Lower Santa Margarita River subwatershed map. The orange triangles are United States Geological Survey (USGS) gages.



10) Murrieta Creek 1
11) Santa Gertrudis Creek
12) Tucalota Creek
13) Warm Springs Creek 1
14) Tributary 1
15) Warm Springs Creek 2
16) Murrieta Creek 2
17) Pechanga Creek
18) Temecula Creek 1
19) Wilson Creek 1
20) Wilson Creek 2
21) Cahuilla Creek
22) Temecula Creek 2
23) Cottonwood Creek
24) Tule Creek
25) Chihuahua Creek

Figure 4. Upper Santa Margarita River subwatersheds map. The orange triangles are United States Geological Survey (USGS) gages.

This watershed criteria report includes five distinct analyses (Figure 5). For more details on each analysis see the Overview, which can be found through the Watershed-Wide Instream Flow Criteria webpage (CDFW 2026).

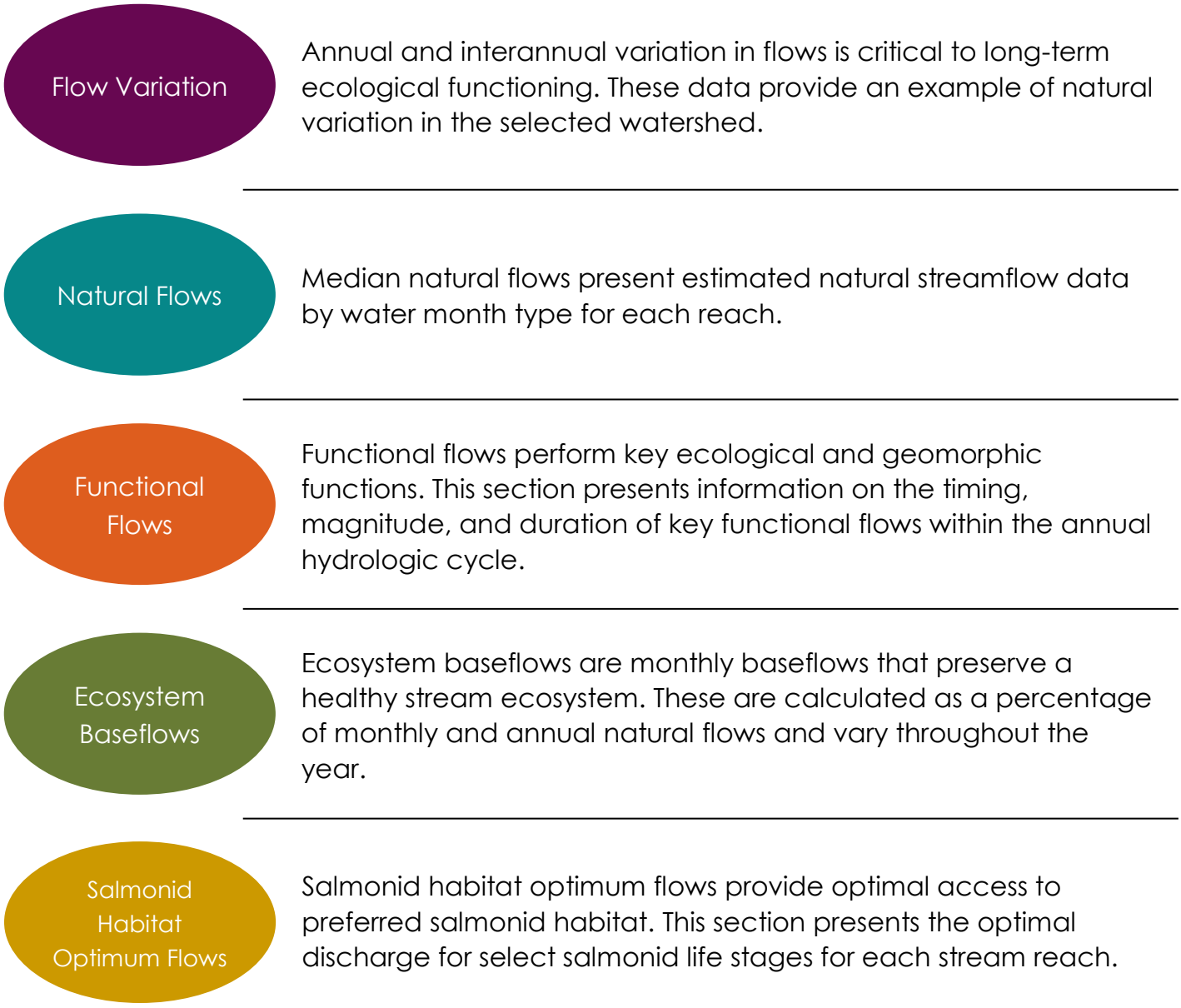


Figure 5. Watershed criteria analyses key.

Flow Variation

Flows in the Santa Margarita River watershed are variable throughout the year and from year to year. The USGS gage located at Ysidora was used to visualize flow variation because it is relatively unimpaired and is representative of the overall hydrologic patterns in the Santa Margarita River watershed (Figure 6). It is important to note, however, that the Santa Margarita River watershed has experienced decades of anthropogenic impacts, including land use changes and water diversions, which have resulted in changes in hydrologic patterns (Tetra Tech 2018). Note that the y-axis in Figure 6 has been truncated for clarity; maximum daily flows exceeded 6,000 cfs for a total of six days in 1993.

Precipitation variability is predicted to increase as climate change impacts intensify. In the Santa Margarita River watershed, the wet season is predicted to become shorter and more intense, while the dry season is predicted to become longer, more frequent and severe (Kalansky et al. 2018). These shifts, combined with ongoing surface and groundwater extractions, may result in higher stress to ecosystems and reduced water availability. Understanding natural variability and projected future changes to flow patterns can help water users and managers create a flow regime and plan for changes in water availability.

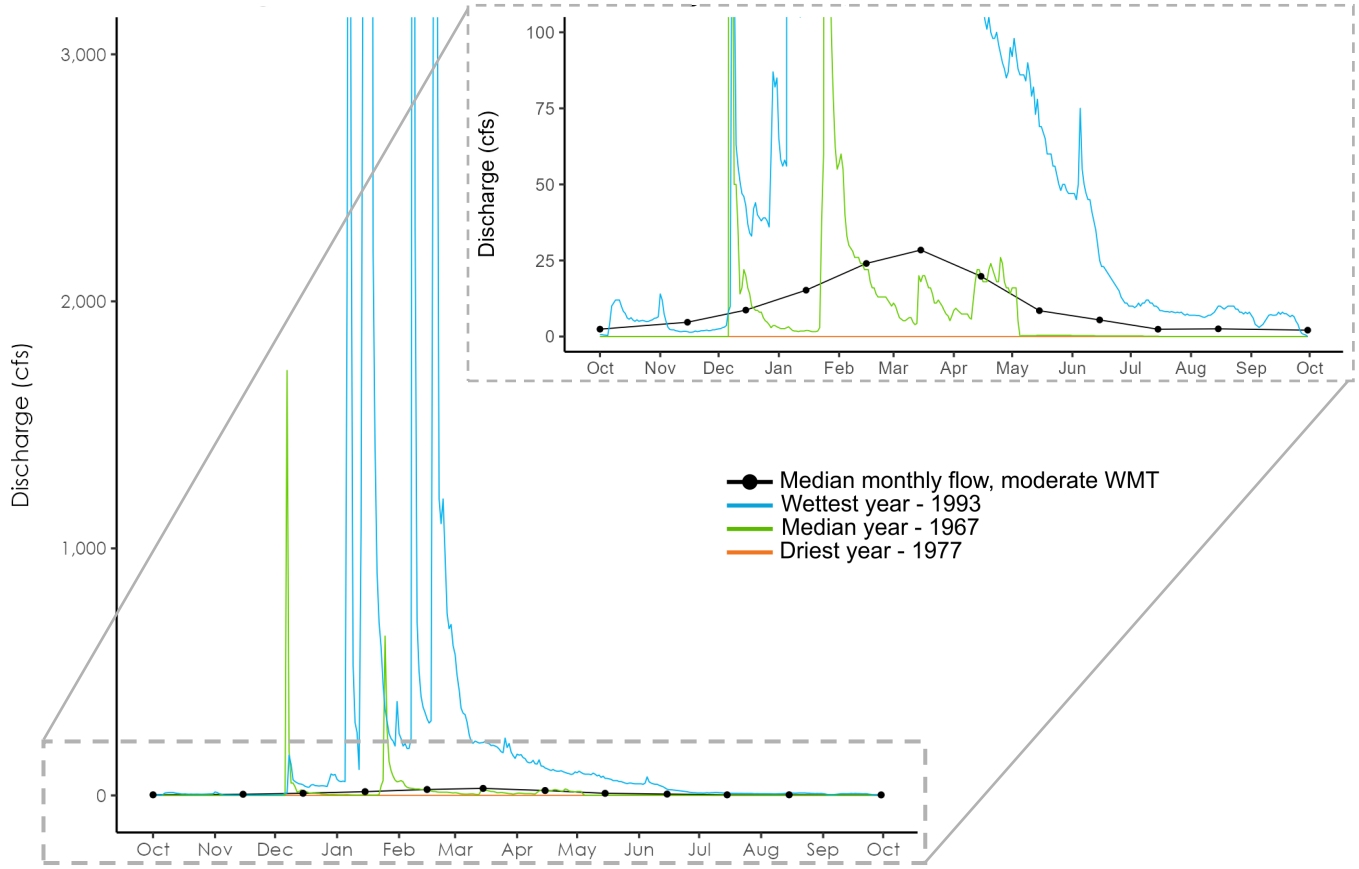


Figure 6. Variation in the Santa Margarita River hydrograph. Mean daily Santa Margarita River flows at USGS gage 11046000, located in the lower Santa Margarita River watershed, in the driest, median, and wettest water years on record between water years 1923 and 2024 (USGS 2025). Median monthly flow for a moderate water month type is also included.

Natural Flows

Natural flows are the stream flows (in cfs) that would be expected with no human influence (data from Zimmerman et al. 2023). This section presents median monthly natural flows for wet, moderate, and dry water month types for each Santa Margarita River tributary and mainstem reach analyzed in this report (Table 1). The numbers next to each stream name correspond to the numbers found on the Santa Margarita River watershed maps (Figure 3 and Figure 4).

Table 1. Median natural flows (cfs) by water month type (month type).

1) Santa Margarita River 1 738 mi^2

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	60	137	357	218	86	27	9	9	3	3	8	20
Moderate	16	25	29	20	11	7	4	7	2	2	5	7
Dry	8	10	14	10	7	6	4	6	2	2	4	5

2) Santa Margarita River 2 722 mi^2

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	59	135	352	223	85	27	6	4	4	4	7	18
Moderate	15	24	28	20	8	5	2	3	2	2	5	9
Dry	8	10	15	10	5	4	2	2	2	2	4	6

3) De Luz Creek 1 48 mi^2

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	5	11	23	12	5	2	1	<1	<1	<1	1	1
Moderate	1	2	2	1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1

4) De Luz Creek 2 33 mi^2

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	3	8	16	8	3	1	<1	<1	<1	<1	<1	1
Moderate	1	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1

5) Santa Margarita River 3 643 mi^2

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	58	119	343	196	79	23	4	3	3	3	7	17
Moderate	14	21	27	18	7	3	2	2	2	2	4	8
Dry	8	9	14	9	3	2	1	2	2	2	4	6

6) Sandia Creek 19.7 mi^2

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	3	5	6	3	1	<1	<1	<1	<1	<1	<1	<1
Moderate	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 1. Median natural flows (continued).

7) Rainbow Creek 10.3 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	1	3	5	3	1	<1	<1	<1	<1	<1	<1	<1
Moderate	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

8) Santa Margarita River 4 603 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	56	111	353	192	73	22	4	3	3	3	6	17
Moderate	13	20	27	17	6	3	2	2	2	2	4	7
Dry	7	8	14	9	3	2	1	2	2	2	3	6

9) Santa Margarita River 5 588 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	56	108	356	186	72	22	4	3	3	4	6	17
Moderate	13	20	23	16	6	3	1	2	2	2	4	7
Dry	7	8	12	8	3	2	1	1	1	2	3	5

10) Murrieta Creek 1 221 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	11	32	69	40	13	5	1	1	1	1	2	4
Moderate	4	5	6	4	1	<1	<1	1	<1	1	1	3
Dry	3	3	3	2	1	<1	<1	<1	<1	<1	1	2

11) Santa Gertrudis Creek 27.1 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	2	4	10	5	2	1	<1	1	1	<1	<1	<1
Moderate	<1	1	1	<1	<1	1	<1	1	1	<1	<1	<1
Dry	<1	<1	<1	<1	<1	1	<1	<1	1	<1	<1	<1

12) Tucalota Creek 50.9 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	4	7	30	12	4	1	<1	<1	<1	<1	1	1
Moderate	1	1	2	1	<1	<1	<1	<1	<1	<1	<1	1
Dry	1	1	1	1	<1	<1	<1	<1	<1	<1	<1	1

13) Warm Spring Creek 1 57.7 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	2	6	15	9	2	1	<1	<1	<1	<1	<1	1
Moderate	1	1	1	1	<1	<1	<1	<1	<1	<1	<1	1
Dry	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1	1

Table 1. Median natural flows (continued).

14) Tributary 1 36.1 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	1	3	10	5	1	1	<1	<1	<1	<1	<1	1
Moderate	1	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

15) Warm Springs Creek 2 8.48 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	<1	1	2	1	<1	<1	<1	<1	<1	<1	<1	<1
Moderate	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

16) Murrieta Creek 2 30.8 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	3	7	13	6	3	1	<1	<1	<1	<1	<1	1
Moderate	1	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

17) Pechanga Creek 13.7 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	2	4	7	4	1	1	<1	<1	<1	<1	<1	<1
Moderate	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

18) Temecula Creek 1 320 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	43	72	177	130	42	19	4	2	2	3	5	12
Moderate	7	13	15	11	5	4	1	1	1	2	3	3
Dry	3	4	5	5	3	2	1	1	1	1	2	2

19) Wilson Creek 1 124 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	12	19	73	39	14	6	2	2	1	1	2	4
Moderate	2	4	5	4	2	1	1	1	1	1	1	1
Dry	1	1	2	2	1	1	<1	<1	1	1	1	1

20) Wilson Creek 2 25 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	3	4	17	9	3	1	<1	<1	<1	<1	<1	1
Moderate	<1	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 1. Median natural flows (continued).

21) Cahuilla Creek 85 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	8	12	43	24	13	5	2	2	2	1	1	2
Moderate	1	2	4	3	2	1	1	1	1	1	1	1
Dry	1	1	1	1	1	1	<1	1	1	1	<1	<1

22) Temecula Creek 2 133 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	24	39	83	77	20	10	3	2	1	2	2	6
Moderate	5	9	9	8	3	2	<1	<1	<1	<1	1	2
Dry	2	3	3	2	1	1	<1	<1	<1	<1	<1	1

23) Cottonwood Creek 111 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	3	5	7	7	3	1	<1	<1	<1	<1	<1	1
Moderate	1	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

24) Tule Creek 23 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	3	5	16	9	3	1	<1	<1	<1	<1	<1	1
Moderate	1	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1
Dry	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

25) Chihuahua Creek 36.1 mi²

Month Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6	12	23	21	6	3	1	1	<1	1	1	2
Moderate	1	3	2	2	1	1	<1	<1	<1	<1	<1	1
Dry	1	1	1	1	1	<1	<1	<1	<1	<1	<1	<1

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Functional Flows

This section presents examples illustrating functional flows in the Santa Margarita River watershed (data from Qiu et al. 2021 and CEFWG 2024). The functional flow metric data are representative of the mainstem Santa Margarita River watershed as well as its tributaries (Table 2–Table 4). Functional flow timing throughout the watershed is likely consistent, but flow magnitudes differ across selected reaches (Rodríguez-Iturbe and Valdés 1979).

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Table 2. Santa Margarita River 2 (reach 2) functional flow metric median values, 10th–90th percentile in parentheses. Metrics are provided by water year type (i.e., wet, moderate, and dry) and are based on modeled functional flow metrics for the Santa Margarita River.

Metric	Wet Years	Moderate Years	Dry Years
Fall pulse flow magnitude (cfs)	121 (18–800)	64 (9–525)	57 (8–437)
Fall pulse flow duration (total days per year, when present)	4 (2–9)*	4 (2–9)*	4 (2–9)*
Fall pulse flow start timing	Nov 14 (Oct 12–Dec 03)	Nov 05 (Oct 04–Dec 02)	Oct 25 (Oct 03–Nov 29)
Wet-season baseflow magnitude (cfs)	17 (1–61)	7 (<1–24)	5 (<1–17)
Median wet-season flow magnitude (cfs)	122 (31–345)	18 (2–65)	8 (1–29)
Wet-season duration (days)	82 (33–154)	126 (36–203)	142 (39–212)
Wet-season start timing	Jan 02 (Nov 24–Jan 29)	Dec 12 (Oct 27–Feb 08)	Nov 14 (Oct 15–Jan 14)
2-year peak flow magnitude (cfs)	919 (219–4,150)	919 (219–4,150)	919 (219–4,150)
2-year peak flow duration (total days per year, when present)	3 (1–16)*	3 (1–16)*	3 (1–16)*
2-year peak flow frequency (events per year, when present)	2 (1–5)*	2 (1–5)*	2 (1–5)*
5-year peak flow magnitude (cfs)	6,780 (570–17,400)	6,780 (570–17,400)	6,780 (570–17,400)
5-year peak flow duration (total days per year, when present)	1 (1–5)*	1 (1–5)*	1 (1–5)*
5-year peak flow frequency (events per year, when present)	1 (1–3)*	1 (1–3)*	1 (1–3)*
Spring recession flow magnitude (cfs)	1,160 (171–8,140)	223 (17–1,770)	156 (10–1,070)
Spring recession flow duration (days)	67 (24–136)	64 (23–146)	68 (23–160)
Spring recession flow start timing	Mar 27 (Mar 03–May 11)	Apr 01 (Feb 22–May 30)	Apr 09 (Feb 09–Jun 05)
Spring recession flow rate of change (%)	7 (4–17)*	7 (4–17)*	7 (4–17)*
Dry-season baseflow magnitude (cfs)	4 (<1–19)	2 (<1–15)	2 (<1–14)
Dry-season duration (days)	177 (84–283)	171 (71–275)	155 (55–268)
Dry-season start timing	Jun 05 (Apr 10–Aug 06)	Jun 16 (Apr 16–Aug 18)	Jun 22 (Apr 23–Aug 25)

* indicates a metric with inferred ranges that was not modeled by water year type

Table 3. Murrieta Creek 1 (reach 10) functional flow metric median values, 10th–90th percentile in parentheses. Metrics are provided by water year type (i.e., wet, moderate, and dry) and are based on modeled functional flow metrics for Murrieta Creek.

Metric	Wet Years	Moderate Years	Dry Years
Fall pulse flow magnitude (cfs)	77 (13–357)	55 (7–346)	64 (10–351)
Fall pulse flow duration (total days per year, when present)	4 (2–9)*	4 (2–9)*	4 (2–9)*
Fall pulse flow start timing	Nov 11 (Oct 11–Dec 04)	Nov 03 (Oct 04–Dec 01)	Oct 24 (Oct 03–Nov 30)
Wet-season baseflow magnitude (cfs)	4 (<1–12)	2 (<1–8)	2 (<1–6)
Median wet-season flow magnitude (cfs)	22 (5–101)	5 (1–20)	4 (<1–14)
Wet-season duration (days)	88 (37–163)	117 (36–200)	140 (38–211)
Wet-season start timing	Jan 01 (Nov 18–Jan 29)	Dec 24 (Oct 25–Feb 09)	Nov 17 (Oct 22–Feb 05)
2-year peak flow magnitude (cfs)	316 (192–1,420)	316 (192–1,420)	316 (192–1,420)
2-year peak flow duration (total days per year, when present)	3 (1–16)*	3 (1–16)*	3 (1–16)*
2-year peak flow frequency (events per year, when present)	2 (1–5)*	2 (1–5)*	2 (1–5)*
5-year peak flow magnitude (cfs)	2,110 (611–4,630)	2,110 (611–4,630)	2,110 (611–4,630)
5-year peak flow duration (total days per year, when present)	1 (1–5)*	1 (1–5)*	1 (1–5)*
5-year peak flow frequency (events per year, when present)	1 (1–3)*	1 (1–3)*	1 (1–3)*
Spring recession flow magnitude (cfs)	710 (88–2,830)	149 (10–845)	114 (11–775)
Spring recession flow duration (days)	66 (20–137)	62 (22–145)	60 (21–156)
Spring recession flow start timing	Mar 29 (Mar 05–May 17)	Apr 01 (Feb 23–May 31)	Apr 11 (Jan 24–Jun 04)
Spring recession flow rate of change (%)	7 (4–17)*	7 (4–17)*	7 (4–17)*
Dry-season baseflow magnitude (cfs)	1 (<1–5)	1 (<1–4)	1 (<1–4)
Dry-season duration (days)	206 (118–288)	189 (96–272)	189 (96–277)
Dry-season start timing	May 15 (Apr 03–Jul 27)	May 31 (Apr 08–Aug 09)	Jun 01 (Mar 29–Aug 12)

* indicates a metric with inferred ranges that was not modeled by water year type

Table 4. Temecula Creek 1 (reach 18) functional flow metric median values, 10th–90th percentile in parentheses. Metrics are provided by water year type (i.e., wet, moderate, and dry) and are based on modeled functional flow metrics for Temecula Creek.

Metric	Wet Years	Moderate Years	Dry Years
Fall pulse flow magnitude (cfs)	57 (10–402)	21 (4–160)	14 (3–104)
Fall pulse flow duration (total days per year, when present)	4 (2–9)*	4 (2–9)*	4 (2–9)*
Fall pulse flow start timing	Nov 15 (Oct 12–Dec 03)	Nov 09 (Oct 05–Dec 03)	Oct 21 (Oct 02–Nov 29)
Wet-season baseflow magnitude (cfs)	12 (<1–53)	3 (<1–12)	2 (<1–6)
Median wet-season flow magnitude (cfs)	66 (10–234)	11 (2–44)	4 (1–12)
Wet-season duration (days)	82 (33–155)	102 (28–202)	143 (28–217)
Wet-season start timing	Jan 01 (Nov 25–Jan 31)	Dec 10 (Oct 23–Feb 06)	Nov 11 (Oct 12–Jan 11)
2-year peak flow magnitude (cfs)	540 (88–1,980)	540 (88–1,980)	540 (88–1,980)
2-year peak flow duration (total days per year, when present)	3 (1–16)*	3 (1–16)*	3 (1–16)*
2-year peak flow frequency (events per year, when present)	2 (1–5)*	2 (1–5)*	2 (1–5)*
5-year peak flow magnitude (cfs)	1,290 (233–7,550)	1,290 (233–7,550)	1,290 (233–7,550)
5-year peak flow duration (total days per year, when present)	1 (1–5)*	1 (1–5)*	1 (1–5)*
5-year peak flow frequency (events per year, when present)	1 (1–3)*	1 (1–3)*	1 (1–3)*
Spring recession flow magnitude (cfs)	423 (59–2,420)	70 (6–358)	28 (4–230)
Spring recession flow duration (days)	84 (31–161)	95 (30–174)	93 (27–186)
Spring recession flow start timing	Mar 27 (Mar 04–May 13)	Apr 02 (Feb 17–Jun 01)	Apr 09 (Feb 05–Jun 09)
Spring recession flow rate of change (%)	7 (4–17)*	7 (4–17)*	7 (4–17)*
Dry-season baseflow magnitude (cfs)	3 (<1–11)	1 (<1–7)	1 (<1–6)
Dry-season duration (days)	175 (88–274)	164 (74–266)	141 (56–246)
Dry-season start timing	Jun 19 (Apr 21–Aug 18)	Jun 29 (Apr 26–Aug 29)	Jul 06 (May 03–Sep 01)

* indicates a metric with inferred ranges that was not modeled by water year type

Ecosystem Baseflows

Ecosystem baseflows are the monthly instream flows needed to preserve a healthy stream ecosystem. In wet water month types, median monthly discharge (MMD), derived using natural flows (data from Zimmerman et al. 2023), meets or exceeds ecosystem baseflows (Tessmann 1980) for approximately six months of the water year for most reaches in the Santa Margarita River watershed.

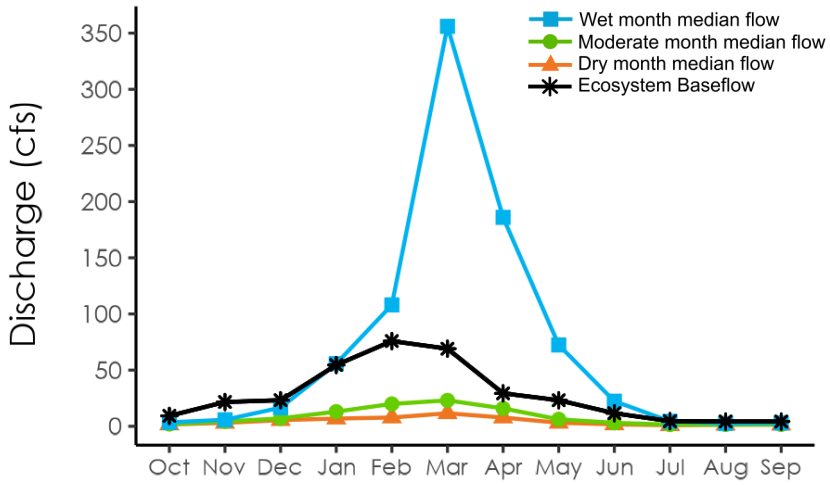

Figure 7. Ecosystem baseflows and median natural flows for wet, moderate, and dry water month types for the Santa Margarita River 5 (reach 9).

For the Santa Margarita River 5 (reach 9) in moderate and dry water month types , median natural flows may exceed ecosystem baseflows for approximately one or fewer months of the water year (Figure 7). This pattern is similar for most reaches in the Santa Margarita River watershed.

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Ecosystem baseflows are monthly flows unique to each Santa Margarita River tributary and mainstem reach analyzed in this report (Table 5). The numbers next to each stream name correspond to the numbers found on the Santa Margarita River watershed maps (Figure 3 and Figure 4).

Table 5. Ecosystem baseflows (cfs).

Stream	Drainage Area (mi^2)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1) Santa Margarita River 1	738	57	92	81	34	27	15	8	9	5	17	24	27
2) Santa Margarita River 2	722	59	93	83	33	27	15	6	6	5	12	24	27
3) De Luz Creek 1	48	5	9	7	2	2	1	<1	<1	<1	1	1	2
4) De Luz Creek 2	33	4	7	5	2	1	<1	<1	<1	<1	<1	1	2
5) Santa Margarita River 3	643	55	80	74	32	25	13	5	5	5	10	23	25
6) Sandia Creek	19.7	2	4	2	1	<1	<1	<1	<1	<1	<1	<1	1
7) Rainbow Creek	10.3	1	2	2	1	<1	<1	<1	<1	<1	<1	<1	1
8) Santa Margarita River 4	603	55	76	71	31	24	12	5	5	4	10	23	24
9) Santa Margarita River 5	588	55	76	69	29	23	12	5	4	4	9	22	23
10) Murrieta Creek 1	221	22	29	22	8	6	2	2	1	2	3	8	8
11) Santa Gertrudis Creek	27.1	3	4	3	1	1	1	1	1	1	<1	1	1
12) Tucalota Creek	50.9	5	7	6	2	2	1	<1	<1	1	1	2	2
13) Warm Springs Creek 1	57.7	5	7	5	2	1	1	<1	<1	<1	1	2	2
14) Tributary 1	36.1	3	4	3	1	1	<1	<1	<1	<1	<1	1	1
15) Warm Springs Creek 2	8.5	1	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
16) Murrieta Creek 2	30.8	3	6	4	1	1	<1	<1	<1	<1	<1	1	1
17) Pechanga Creek	13.7	2	2	2	1	<1	<1	<1	<1	<1	<1	<1	1
18) Temecula Creek 1	320	28	39	40	20	13	10	4	3	2	5	13	13
19) Wilson Creek 1	124	8	12	13	6	4	4	2	1	1	2	4	4

Table 5. Ecosystem baseflows (continued).

Stream	Drainage Area (mi^2)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
20) Wilson Creek 2	25	2	3	3	1	1	1	<1	<1	<1	<1	1	1
21) Cahuilla Creek	85	6	8	9	4	3	3	1	2	2	2	3	3
22) Temecula Creek 2	133	16	24	21	12	8	6	2	2	1	3	7	8
23) Cottonwood Creek	111	2	2	2	1	1	<1	<1	<1	<1	<1	1	1
24) Tule Creek	23	2	3	3	1	1	1	<1	<1	<1	<1	1	1
25) Chihuahua Creek	36.1	4	7	6	3	2	2	1	1	1	1	2	2

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Salmonid Habitat Optimum Flows

Salmonid habitat optimum flows (optimum flows) provide optimal access to usable habitat for juvenile steelhead (Hatfield and Bruce 2000). Santa Margarita River 3 (reach 5) was analyzed to determine an optimum flow value, and while these values may vary between streams, the overall patterns in the watershed are the same. Natural flows often meet or exceed optimum flows during the winter months in wet conditions, while natural flows typically remain below optimum flows during the summer and fall months across dry and moderate water month types (Figure 8). In drainages with altered flow, the period of flow below the juvenile steelhead optimum flows may have a longer or shorter duration than shown here.

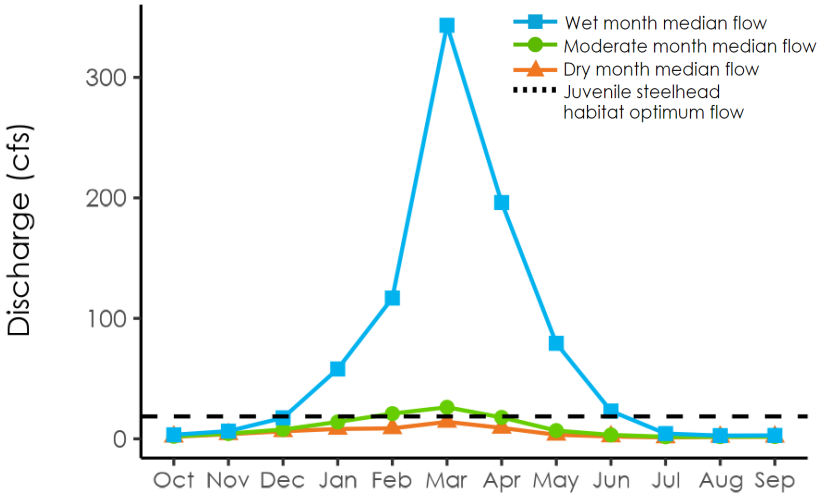

Figure 8. Juvenile steelhead optimum flows and median natural flows for wet, moderate, and dry water month types for the Santa Margarita River 3 (reach 5).

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Generally, the surface flow required to meet the juvenile steelhead optimum flows increases as the drainage area increases. This section groups juvenile steelhead optimum flows by drainage size category (i.e., small, mid-sized, and large streams, and the Santa Margarita River) (Table 6). The numbers next to each stream name correspond to the numbers found on the Santa Margarita River watershed maps (Figure 3 and 4).

Table 6. Juvenile steelhead optimum flows (by drainage area).

Small Streams

Stream	Drainage Area (mi^2)	Juvenile Steelhead Optimum Flows (cfs)
6) Sandia Creek	19.7	3
7) Rainbow Creek	10.3	2
15) Warm Springs Creek 2	8.5	1
17) Pechanga Creek	13.7	2

Mid-Sized Streams

Stream	Drainage Area (mi^2)	Juvenile Steelhead Optimum Flows (cfs)
3) De Luz Creek 1	48	4
4) De Luz Creek 2	33	4
11) Santa Gertrudis Creek	27.1	3
12) Tucalota Creek	50.9	4
13) Warm Springs Creek 1	57.7	4
14) Tributary 1	36.1	3
16) Murrieta Creek 2	30.8	3
20) Wilson Creek 2	25	3
24) Tule Creek	23	3
25) Chihuahua Creek	36.1	4

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Table 6. Juvenile steelhead optimum flows (by drainage area) (continued).

Large Streams

Stream	Drainage Area (mi²)	Juvenile Steelhead Optimum Flows (cfs)
10) Murrieta Creek 1	221	10
18) Temecula Creek 1	320	13
19) Wilson Creek 1	124	7
21) Cahuilla Creek	85	5
22) Temecula Creek 2	133	9
23) Cottonwood Creek	111	2

Mainstem Santa Margarita River

Stream	Drainage Area (mi²)	Juvenile Steelhead Optimum Flows (cfs)
1) Santa Margarita River 1	738	19
2) Santa Margarita River 2	722	20
5) Santa Margarita River 3	643	19
8) Santa Margarita River 4	603	18
9) Santa Margarita River 5	588	18

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Flow Criteria

Flow criteria provide a set of flow values that may be used to develop a flow regime for a location within a watershed. Using results from the Functional Flows section of this Watershed Criteria Report, flow criteria have been developed for several reaches of the Santa Margarita River, and also for Murrieta Creek and Temecula Creek (Table 7–Table 11). While the flow criteria presented in this section were developed for specific locations within the Santa Margarita River watershed, patterns and timings of flows throughout the watershed are consistent, and a similar process to the one outlined below could be followed to develop criteria for other locations within the watershed. Flow criteria presented below are provided as a tool for consideration in water management planning. While criteria are not formal flow recommendations, they may be used to develop flow recommendations. These criteria should not be relied upon for legal compliance and do not ensure project success. The Department may revise instream flow criteria for the Santa Margarita River and its tributaries based upon any new scientific information that may become available.

Flow criteria were developed for five locations within the Santa Margarita River watershed for three water year types (i.e., wet, moderate, and dry) using functional flow results from Table 2–Table 4. These locations were selected based on the Department's Region 5 and Region 6 priorities. In each case, criteria represent median functional flow metric values by water year type. Median values are commonly used to represent water availability in other instream flow methods, such as habitat duration time series analysis. Median flows would be met or exceeded in 50% of years under natural conditions, and represent a useful potential long-term management target. While medians were used to establish criteria, in the driest years flows may be closer to 10th percentile functional flow values, and in the wettest years may be closer to the 90th percentile values. Criteria are presented for each season corresponding to functional flow metrics, with additional detail provided during the spring to more specifically capture changes in flows during the transition period between the wet season and dry season. Note, the length of the spring recession varies by water year type.

Table 7. Flow criteria (in cfs) for the Santa Margarita River 2 (reach 2). Criteria are stratified by water year type (i.e., wet, moderate, and dry) and are provided for each functional flow season.

Water Year Type	**Wet Season** Dec-Mar	**Spring Recession** Week 1	**Spring Recession** Week 2	**Spring Recession** Week 3	**Spring Recession** Week 4	**Spring Recession** Week 5	**Spring Recession** Week 6	**Spring Recession** Week 7	**Dry Season** Jun-Nov
Wet	17†	99	59	35	21	12	7	5	4‡
Moderate	7†	15	9	5	3	2	-	-	2‡
Dry	5†	6	4	2	-	-	-	-	2‡

† Approximately every two years, protect at least two peak flow events of 919 cfs as they occur. Approximately every five years, protect at least one peak flow event of 6,780 cfs as it occurs.

‡ Beginning in October through November, allow a fall pulse event of at least 67 cfs .

- The length of the recession varies by water year type. In wet years, the recession lasts for seven weeks, in moderate years, the recession lasts for five weeks, and in dry years, the recession lasts for three weeks. The rate of change for wet, moderate, and dry years is 7% per day.

Table 8. Flow criteria (in cfs) for the Santa Margarita River 3 (reach 5). Criteria are stratified by water year type (i.e., wet, moderate, and dry) and are provided for each functional flow season.

Water Year Type	**Wet Season** Dec-Mar	**Spring Recession** Week 1	**Spring Recession** Week 2	**Spring Recession** Week 3	**Spring Recession** Week 4	**Spring Recession** Week 5	**Spring Recession** Week 6	**Spring Recession** Week 7	**Dry Season** Jun-Nov
Wet	17†	90	54	32	19	11	7	4	4‡
Moderate	6†	12	7	4	3	2	-	-	2‡
Dry	5†	6	3	2	1	-	-	-	1‡

† Approximately every two years, protect at least two peak flow events of 765 cfs as they occur. Approximately every five years, protect at least one peak flow event of 6,030 cfs as it occurs.

‡ Beginning in October through November, allow a fall pulse event of at least 60 cfs .

- The length of the recession varies by water year type. In wet years, the recession lasts for seven weeks, in moderate years, the recession lasts for five weeks, and in dry years, the recession lasts for four weeks. The rate of change for wet, moderate, and dry years is 7% per day.

Table 9. Flow criteria (in cfs) for the Santa Margarita River 5 (reach 9). Criteria are stratified by water year type (i.e., wet, moderate, and dry) and are provided for each functional flow season.

Water Year Type	**Wet Season** Dec-Mar	**Spring Recession** Week 1	**Spring Recession** Week 2	**Spring Recession** Week 3	**Spring Recession** Week 4	**Spring Recession** Week 5	**Spring Recession** Week 6	**Spring Recession** Week 7	**Dry Season** Jun-Nov
Wet	16†	84	50	30	18	11	6	4	3‡
Moderate	6†	11	7	4	2	1	-	-	1‡
Dry	4†	5	3	2	1	-	-	-	1‡

† Approximately every two years, protect at least two peak flow events of 698 cfs as they occur. Approximately every five years, protect at least one peak flow event of 5,500 cfs as it occurs.

‡ Beginning in October through November, allow a fall pulse event of at least 60 cfs .

- The length of the recession varies by water year type. In wet years, the recession lasts for seven weeks, in moderate years, the recession lasts for five weeks, and in dry years, the recession lasts for four weeks. The rate of change for wet, moderate, and dry years is 7% per day.

Table 10. Flow criteria (in cfs) for Murrieta Creek 1 (reach 10). Criteria are stratified by water year type (i.e., wet, moderate, and dry) and are provided for each functional flow season.

Water Year Type	**Wet Season** Dec-Mar	**Spring Recession** Week 1	**Spring Recession** Week 2	**Spring Recession** Week 3	**Spring Recession** Week 4	**Spring Recession** Week 5	**Spring Recession** Week 6	**Dry Season** Jun-Nov
Wet	4†	18	11	6	4	2	1	1‡
Moderate	2†	4	2	1	-	-	-	1‡
Dry	2†	3	2	1	-	-	-	1‡

† Approximately every two years, protect at least two peak flow events of 316 cfs as they occur. Approximately every five years, protect at least one peak flow event of 2,110 cfs as it occurs.

‡ Beginning in October through November, allow a fall pulse event of at least 65 cfs.

- The length of the recession varies by water year type. In wet years, the recession lasts for six weeks, in moderate years, the recession lasts for three weeks, and in dry years, the recession lasts for three weeks. The rate of change for wet, moderate, and dry years is 7% per day.

Table 11. Flow criteria (in cfs) for Temecula Creek 1 (reach 18). Criteria are stratified by water year type (i.e., wet, moderate, and dry) and are provided for each functional flow season.

Water Year Type	**Wet Season** Dec-Mar	**Spring Recession** Week 1	**Spring Recession** Week 2	**Spring Recession** Week 3	**Spring Recession** Week 4	**Spring Recession** Week 5	**Spring Recession** Week 6	**Spring Recession** Week 7	**Dry Season** Jun-Nov
Wet	12†	53	32	19	11	7	4	3	3‡
Moderate	3†	9	5	3	2	1	-	-	1‡
Dry	2†	3	2	1	-	-	-	-	1‡

† Approximately every two years, protect at least two peak flow events of 540 cfs as they occur. Approximately every five years, protect at least one peak flow event of 1,290 cfs as it occurs.

‡ Beginning in October through November, allow a fall pulse event of at least 25 cfs.

- The length of the recession varies by water year type. In wet years, the recession lasts for seven weeks, in moderate years, the recession lasts for five weeks, and in dry years, the recession lasts for three weeks. The rate of change for wet, moderate, and dry years is 7% per day.

The timing of the wet season was approximated using the median start dates for each water year type (i.e., wet, moderate, dry) using functional flow results from Table 2–Table 4. The wet-season baseflow magnitudes represent flows between storm events; however, following peak flow events (e.g., winter storms), flows should be much higher than the criteria presented in Table 7–Table 11. Additionally, 2- and 5-year peak flow events, respectively, should be allowed to pass through the watershed. Refer to Table 2–Table 4 for specific recommended frequencies and durations of these peak events for each water year type. The end of the wet season for each water year type was determined by the median start date of the spring recession.

The median wet-season flow magnitude was used to represent spring high flows that immediately precede the recession period. This metric represents an elevated flow relative to baseflows occurring early in the wet season, as storm events saturate the system by the spring. The median spring recession rate for each water year type was used to calculate a daily decrease in flows, which were then averaged by week for the duration of the recession. The duration of the recession was determined by applying a daily rate of change in flows until the median dry-season baseflow magnitude was reached. The length of the recession varies across water year types due to differences in start magnitudes, rates of change, and the magnitude of dry-season baseflows.

The dry-season baseflow magnitude was used to establish flow criteria for the dry season. Baseflows will likely be higher at the beginning of the dry season than at the end of the dry season, but the median flow over the entire dry season should match the listed criteria. Additionally, fall pulse events should occur annually in October through November. Specific magnitudes and durations by water year type for the fall pulse flows can be found in Table 2–Table 4. The end of the dry season for each water year type was determined by the median start date of the wet season.

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All photos in this document were taken by Department Staff. Cover photo is of the Santa Margarita River watershed in San Diego/Riverside Counties.

Appendix A

Table A-1 presents each reach analyzed in this report with the associated NHDPlus COMIDs. The stream reaches were delineated using NHDPlus Version 2 medium-resolution mapping.[1] The COMIDs were used to identify and download natural flow estimates for each selected reach.

Table A-1. Reach delineation.

Stream	COMID
1) Santa Margarita River 1	22549121
2) Santa Margarita River 2	22548559
3) De Luz Creek 1	22549113
4) De Luz Creek 2	22548441
5) Santa Margarita River 3	22549107
6) Sandia Creek	22548429
7) Rainbow Creek	22548475
8) Santa Margarita River 4	22548449
9) Santa Margarita River 5	22549075
10) Murrieta Creek 1	22549073
11) Santa Gertrudis Creek	948070502
12) Tucalota Creek	22547129
13) Warm Springs Creek 1	22547091
14) Tributary 1	22545275
15) Warm Springs Creek 2	22547059
16) Murrieta Creek 2	22545337
17) Pechanga Creek	22549093
18) Temecula Creek 1	22549393
19) Wilson Creek 1	22549409
20) Wilson Creek 2	22547551
21) Cahuilla Creek	22547531
22) Temecula Creek 2	22549471
23) Cottonwood Creek	22549551
24) Tule Creek	22549509
25) Chihuahua Creek	22549627

[1] USEPA and USGS (2012). National Hydrography Dataset Plus (NHDPlus) medium resolution version 2. U.S. Environmental Protection Agency (USEPA) and the U.S. Geological Survey (USGS). Accessed: December 2024.