



**California Department of Fish and Wildlife**  
*Fisheries Restoration Grant Program*  
Restoration Project Case Study



**P1450011 Fish Passage Improvement at Crossing 3, Quiota Creek**

**Project Objective(s)** – The objective of this project was to provide access to 3.38 miles of spawning and rearing habitat for southern steelhead trout (*Oncorhynchus mykiss*) by removing the passage barrier, a concrete low-flow Arizona crossing with a fully obstructed 16-inch diameter corrugated metal pipe culvert, at Crossing 3 and replacing it with a 53 foot-span concrete bottomless-arch culvert.

**Project Location(s)** – Quiota Creek; tributary to the Santa Ynez River; near the town of Santa Ynez; in Santa Barbara County.

**Project Description** – Crossing 3 is one of 11 crossings along Quiota Creek that were assessed as fish passage barriers (Crossings 0A, 0B, 1, 2, 3, 4, 5, 6, 7, 8, and 9). Prior to construction at this location, two of the crossings downstream and two further upstream had previously been remediated. Crossing 3 was classified as a partial barrier to three life stages of anadromous steelhead trout and resident rainbow trout, with hydraulic conditions allowing for fish passage during approximately four percent of the anticipated range of fish passage flows (1-148 cubic feet per second). Project construction took place between October 1, 2015, and November 18, 2015. The concrete crossing was demolished and then the channel was regraded and reconstructed with engineered streambed material. Concrete was poured for the new culvert footings and the prefabricated 53-foot bottomless arch culvert and wingwalls were installed. Rock slope protection (RSP) was installed on both banks along the abutments. Additional rock slope protection was placed along the upstream right bank to protect a large undercut oak tree as well as along the upstream left bank to stabilize a high flow erosional scarp.

**Project Monitoring**

Pre-Treatment

Date: 9/10/2015

Post-Treatment

Date: 9/25/2023



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Photo Credit: Cachuma Operations and Maintenance Board



**Figure 1.** View, facing upstream, of the concrete low-flow crossing and the undercutting and plunge below the downstream side. Pre-treatment photo date: 9/16/2015

Photo Credit: K Mayeda, Scientific Aid (California Department of Fish and Wildlife)



**Figure 2.** View, facing upstream, of the reconstructed channel and the upgraded bottomless arch culvert. Post-treatment photo date: 9/25/2023

### **Post-Treatment Project Rating and Summary**

The bottomless arch culvert, channel reconstruction, and rock slope protection treatments at the Quiota Crossing 3 project site were assessed for condition in September of 2023, approximately eight years after implementation. Components of the bottomless arch culvert and wingwalls appeared to be in good condition and were functioning as intended. The reconstructed channel retained the gradient and substrate composition as intended. The barrier to fish passage was successfully removed and no visible barriers were apparent throughout the reconstructed channel. The attempt to redirect the flow within the channel upstream of the crossing towards river right was unsuccessful, and channel shifting back towards river left and continued erosion of the left bank at this location was observed. Most of the large RSP was still in place and functioning as intended to protect crossing abutments from scour. Much of the smaller material installed as fill between the larger rocks and boulders that make up the rock slope protection appeared to have washed out, exposing the large rock that was intended to be buried. Some of the large RSP at the upstream ends of both banks had shifted out of its original placement and settled within the channel. The erosion and shifting of RSP and channel materials was likely caused by significant storm and flow events that occurred the winter before post-treatment monitoring was conducted.



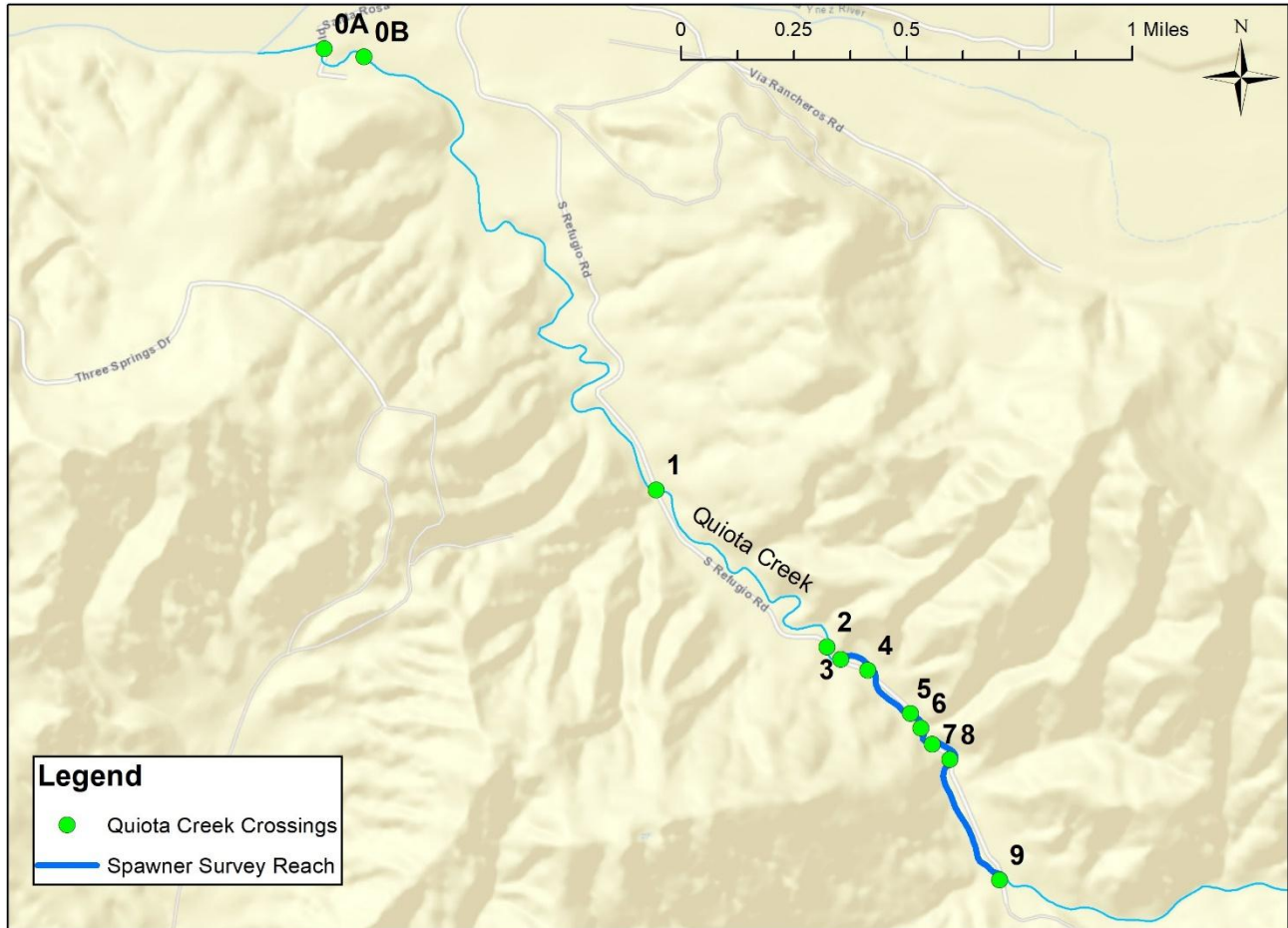
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Approximately 0.78 miles of Quiota Creek were surveyed during spawner survey validation monitoring (Figure 3). This survey reach encompasses the portion of the creek from Crossing 3 through Crossing 9, the last of the stream crossings located along the creek. Much of the potential spawning habitat and summer refugia is in the upper watershed. One spawner survey was conducted by the MESHR team on April 4, 2023. Additional spawner surveys were conducted by Cachuma Operations and Maintenance Board (COMB) during the 2022-2023 spawning season. No steelhead trout were observed during these surveys. Summer snorkel surveys were conducted by COMB in June and September 2023 along a slightly longer survey reach beginning from Crossing 2 through just upstream of Crossing 9. During the June snorkel survey, 12 juvenile *O. mykiss* were observed upstream of Crossing 3. During the September snorkel survey, a total of 15 juvenile and resident adult *O. mykiss* were observed throughout the survey reach, with 5 trout observed below Crossing 3 and 10 trout observed above Crossing 3. Spawner and snorkel surveys have been conducted annually along this portion of Quiota Creek by COMB staff since 2012. No anadromous adult steelhead trout were observed during any of these surveys. One barrier to fish passage, Crossing 0B, still remains along Quiota Creek, though efforts are underway to replace this remaining Arizona crossing with a bottomless arch culvert. Combined with multiple years of severe drought conditions, this remaining barrier, which is located downstream of nine of the remediated crossings and downstream of the validation survey reach, likely contributes to a lack of steelhead observations. With the removal of Crossing 3 and the other fish passage barriers along Quiota Creek, future repopulation by steelhead can be possible when stream flow and habitat conditions allow. Future surveys are recommended to monitor long-term adult steelhead passage and repopulation in Quiota Creek.



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**Figure 3.** Map of the eleven stream crossing locations along Quiota Creek. The spawner survey reach is highlighted in dark blue.

**Project Funding & Cost**

- California Department of Fish and Wildlife Fisheries Restoration Grant Program ..... \$705,205
- Cachuma Operations and Maintenance Board ..... \$219,863
- **Total Project Cost** ..... **\$925,068**

Report prepared by Tanielle Redman, Fishery Biologist, 12/13/2023. For permission to use with proper citation, contact CDFW Monitoring and Evaluation of Salmonid Habitat Restoration (MESHR)-1-(707) 834-4358  
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## **P1550010 Fish Passage Improvement at Crossing 4, Quiota Creek**

**Project Objective(s)** – The objective of this project was to provide access to 3.27 miles of spawning and rearing habitat for southern steelhead trout (*Oncorhynchus mykiss*) by removing the passage barrier, a concrete low-flow Arizona crossing with a fully obstructed 12-inch diameter corrugated metal pipe culvert, at Crossing 4 and replacing with a concrete bottomless-arch culvert. An additional objective included restoring stream habitat by reconstructing the channel through the crossing with engineered streambed material.

**Project Location(s)** – Quiota Creek; tributary to the Santa Ynez River; near the town of Santa Ynez; in Santa Barbara County.

**Project Description** – Crossing 4 is one of 11 crossings along Quiota Creek that were assessed as fish passage barriers (Crossings 0A, 0B, 1, 2, 3, 4, 5, 6, 7, 8, and 9). Prior to construction at this location, four of the crossings downstream and two further upstream had previously been remediated. Crossing 4 was classified as a partial barrier to anadromous steelhead trout and resident rainbow trout due to the lack of pool depth downstream of the crossing required for leaping, lack of depth over the concrete crossing, and high velocities over the crossing during storm events. Project construction took place between October 3, 2016, and November 18, 2016. The concrete crossing was demolished and removed and then the channel was regraded and reconstructed with engineered streambed material. The prefabricated 54-foot bottomless arch culvert and wingwalls were installed. Rock slope protection (RSP) was installed on both banks along the abutments and additional RSP was installed along the downstream right bank to prevent continued erosion. In order to reconfigure the channel upstream of the crossing from a split channel into a single channel, a root wad was installed on the left bank in addition to the channel grading and reconstruction.

### **Project Monitoring**

Pre-Treatment

Date: 10/2/2016

Post-Treatment

Date: 9/25/2023



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Photo Credit: Cachuma Operations and Maintenance Board



**Figure 1.** View, facing upstream, of the concrete low-flow crossing. Pre-treatment photo date: 9/28/2016

Photo Credit: K Mayeda, Scientific Aid (California Department of Fish and Wildlife)



**Figure 2.** View, facing upstream, of the reconstructed channel and the upgraded bottomless arch culvert. Post-treatment photo date: 9/25/2023

### **Post-Treatment Project Rating and Summary**

The bottomless arch culvert, channel reconstruction, RSP, and root wad treatments at the Quiota Crossing 4 project site were monitored for effectiveness in September of 2023, 7 years after implementation. Components of the bottomless arch culvert and wingwalls appeared to be in good condition and were functioning as intended. The reconstructed channel retained the gradient and substrate composition as intended. The project's main objective of providing fish passage to all life stages of *O. mykiss* was met as the barrier to fish passage was successfully removed and no visible barriers were apparent throughout the reconstructed channel. The attempt to fill in the river left side channel and direct the flow towards the river right main channel upstream of the crossing was unsuccessful. At the time of the monitoring survey, the channel upstream of the crossing was braided and flowing in both the intended channel and the previously filled in side channel, which had caused some side cutting and erosion on the left bank. Most of the large RSP was still in place and functioning as intended to protect crossing abutments from scour. Much of the smaller material installed as fill between the larger rocks and boulders that make up the RSP appeared to have washed out, exposing the large rock that was intended to be buried. Some of the large RSP at the upstream ends of the left bank had shifted out of its original placement and settled within the channel. Likely as a result of the erosion of the small fill on the banks, these features were measured to have slightly higher bank angles than the targeted 2:1 slope. The root wad feature that was installed at the



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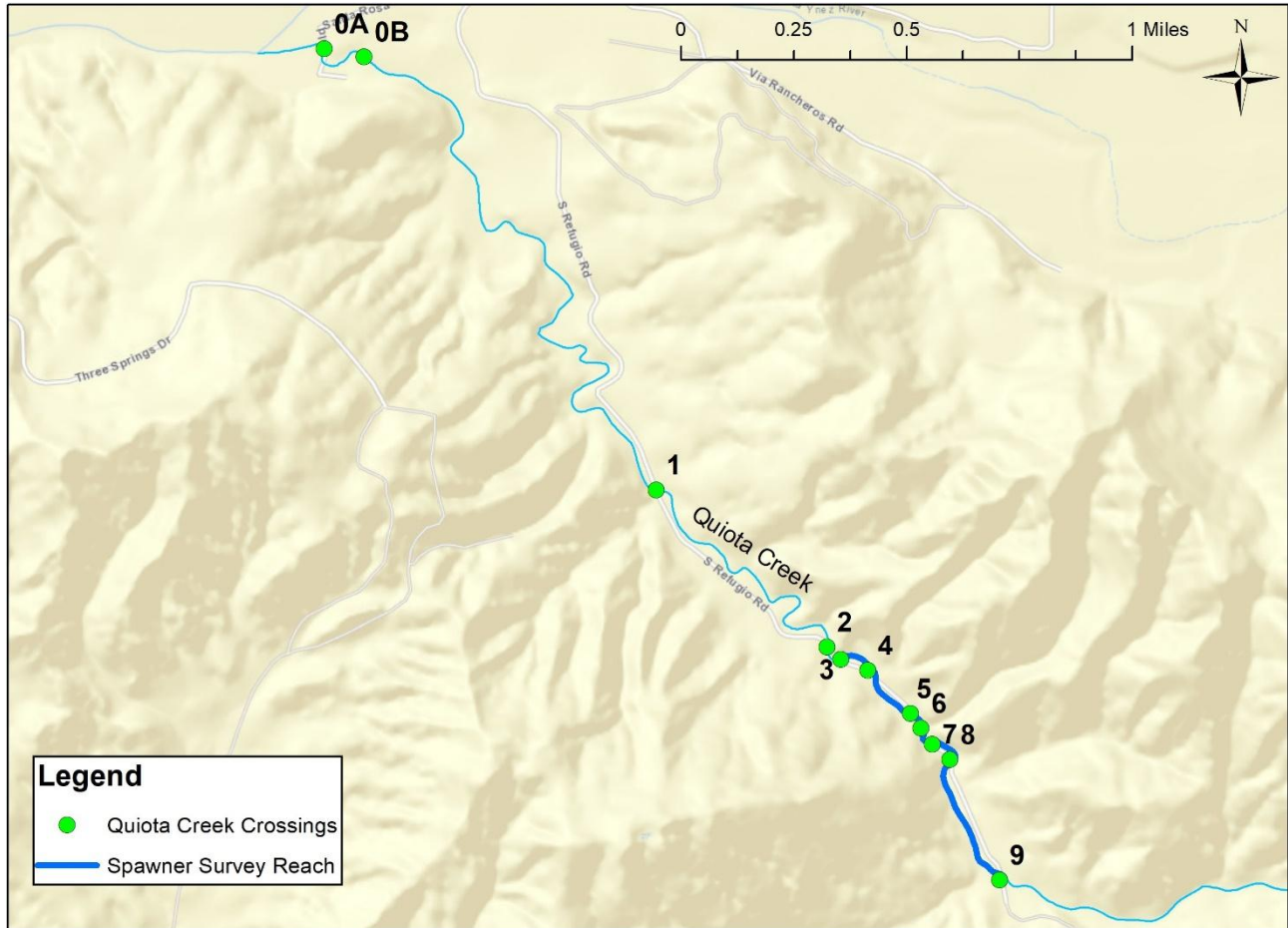


upstream limit of the channel reconstruction had been installed with the intent to form a scour pool and help direct flow into the main river right channel. The entire feature had washed out and the root was could not be located anywhere within the project boundaries.

Approximately 0.78 miles of Quiota Creek were surveyed during spawner survey validation monitoring (Figure 3). This survey reach encompasses the portion of the creek from Crossing 3 through Crossing 9, the last of the stream crossings located along the creek (Figure 3). Much of the potential spawning habitat and summer refugia is located in the upper watershed. One spawner survey was conducted by the MESH team on April 4, 2023. Additional spawner surveys were conducted by Cachuma Operations and Maintenance Board (COMB) during the 2022-2023 spawning season. No steelhead trout were observed during these surveys. Summer snorkel surveys were conducted by COMB in June and September 2023 along a slightly longer survey reach beginning from Crossing 2 through just upstream of Crossing 9. During the June snorkel survey, 12 juvenile *O. mykiss* were observed upstream of Crossing 4. During the September snorkel survey, a total of 15 juvenile and resident adult *O. mykiss* were observed throughout the survey reach, with 5 trout observed below Crossing 4 and 10 trout observed above Crossing 4. Spawner and snorkel surveys have been conducted annually along this portion of Quiota Creek by COMB staff since 2012. No anadromous adult steelhead trout were observed during any of these surveys. One barrier to fish passage, Crossing 0B, still remains along Quiota Creek, though efforts are underway to replace this remaining Arizona crossing with a bottomless arch culvert. Combined with multiple years of severe drought conditions, this remaining barrier, which is located downstream of nine of the remediated crossings and downstream of the validation survey reach, likely contributes to a lack of steelhead observations. With the removal of Crossing 4 and the other fish passage barriers along Quiota Creek, future repopulation by steelhead can be possible when stream flow and habitat conditions allow. Future surveys are recommended to monitor long-term adult steelhead passage and repopulation in Quiota Creek.



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**Figure 3.** Map of the eleven stream crossing locations along Quiota Creek. The spawner survey reach is highlighted in dark blue.

**Project Funding & Cost**

- California Department of Fish and Wildlife Fisheries Restoration Grant Program ..... \$937,838
- Cachuma Operations and Maintenance Board ..... \$181,035
- **Total Project Cost** ..... **\$1,118,873**

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**P1650902 Fish Passage Improvement at Crossing 5, Quiota Creek**

**Project Objective(s)** – The objective of this project was to provide access to 3.17 miles of spawning and rearing habitat for southern steelhead trout (*Oncorhynchus mykiss*) by removing the passage barrier, a concrete low-flow Arizona crossing with a fully obstructed 16-inch diameter corrugated metal pipe culvert, at Crossing 5 and replacing with a 59 foot-span concrete bottomless-arch culvert. An additional objective included restoring stream habitat by reconstructing the channel through the crossing with engineered streambed material and adding a rock riffle feature.

**Project Location(s)** – Quiota Creek; tributary to the Santa Ynez River; near the town of Santa Ynez; in Santa Barbara County.

**Project Description** – Crossing 5 is one of 11 crossings along Quiota Creek that were assessed as fish passage barriers (Crossings 0A, 0B, 1, 2, 3, 4, 5, 6, 7, 8, and 9). Prior to construction at this location, four of the crossings downstream and two further upstream had previously been remediated. Crossing 5 was classified as a partial barrier to anadromous steelhead trout and resident rainbow trout due to the lack of pool depth downstream of the crossing required for leaping, lack of depth over the concrete crossing, and high velocities over the crossing during storm events. Project construction took place between July 23, 2018, and December 21, 2018. The concrete crossing was demolished and removed. Concrete was poured for the new culvert footings and the prefabricated bottomless arch culvert and wingwalls were installed. Rock slope protection (RSP) was installed on both banks along the abutments. The channel was regraded and reconstructed with engineered streambed material and a rock riffle feature was installed upstream of the crossing.

**Project Monitoring**

Pre-Treatment

None

Post-Treatment

Date: 9/25/2023



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*Photo Credit: Cachuma Operations and Maintenance Board*



**Figure 1.** View, facing upstream, of the concrete low-flow crossing and the undercutting and plunge below the downstream side. Pre-treatment photo date: 7/23/2018

*Photo Credit: K Mayeda, Scientific Aid (California Department of Fish and Wildlife [CDFW])*



**Figure 2.** View, facing upstream, of the reconstructed channel and the upgraded bottomless arch culvert. Post-treatment photo date: 9/25/2023

### **Post-Treatment Project Rating and Summary**

The bottomless arch culvert, channel reconstruction, rock riffle, and RSP treatments at the Quiota Crossing 5 project site were monitored for effectiveness in September of 2023, five years after implementation. The bottomless arch culvert was in good condition and functioning as intended. Channel conditions appeared ideal for passage for all steelhead life stages during passable flow conditions as the crossing replacement successfully removed the barrier to fish passage. The channel regrading and reconstruction with engineered stream material retained the intended gradient and good substrate, even after significant flow events following implementation. There was some shifting of materials in the channel, resulting in the unintended effect of aggradation of boulders and cobble within the channel upstream of and under the culvert. This has led to a reduced freeboard within the culvert. Overall, the channel feature still is passable and provides good habitat for fish. The large RSP was still in place and functioning as intended to protect crossing abutments from scour. Some of the smaller material installed as fill between the larger rocks and boulders that make up the RSP appeared to have washed out, exposing the large rock that was intended to be buried. The rock riffle that was installed at the upstream limit of the channel reconstruction was still riffle habitat and the large boulders installed appear to still be in place, but the channel had shifted to the river left side of this feature rather



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than mid-channel as intended. This resulted in some scour on the river left side and deposition of large sediment on the river right side (Figure 4). No obvious barrier has formed within this riffle feature, and it appears passable to all life stages of steelhead trout. Planning and efforts to remove the aggraded material beneath the crossing are in progress.

Photo Credit: Cachuma Operations and Maintenance Board



**Figure 3.** View, facing downstream, of the new bottomless arch culvert and upstream channel as they appeared immediately following implementation. Photo date: 1/8/2019

Photo Credit: K Mayeda, Scientific Aid (CDFW)



**Figure 4.** View, facing downstream, of the bottomless arch culvert and upstream channel, showing the shifting of the wetted channel towards river left and aggradation of substrate upstream of and beneath the crossing. Post-treatment photo date: 9/25/2023

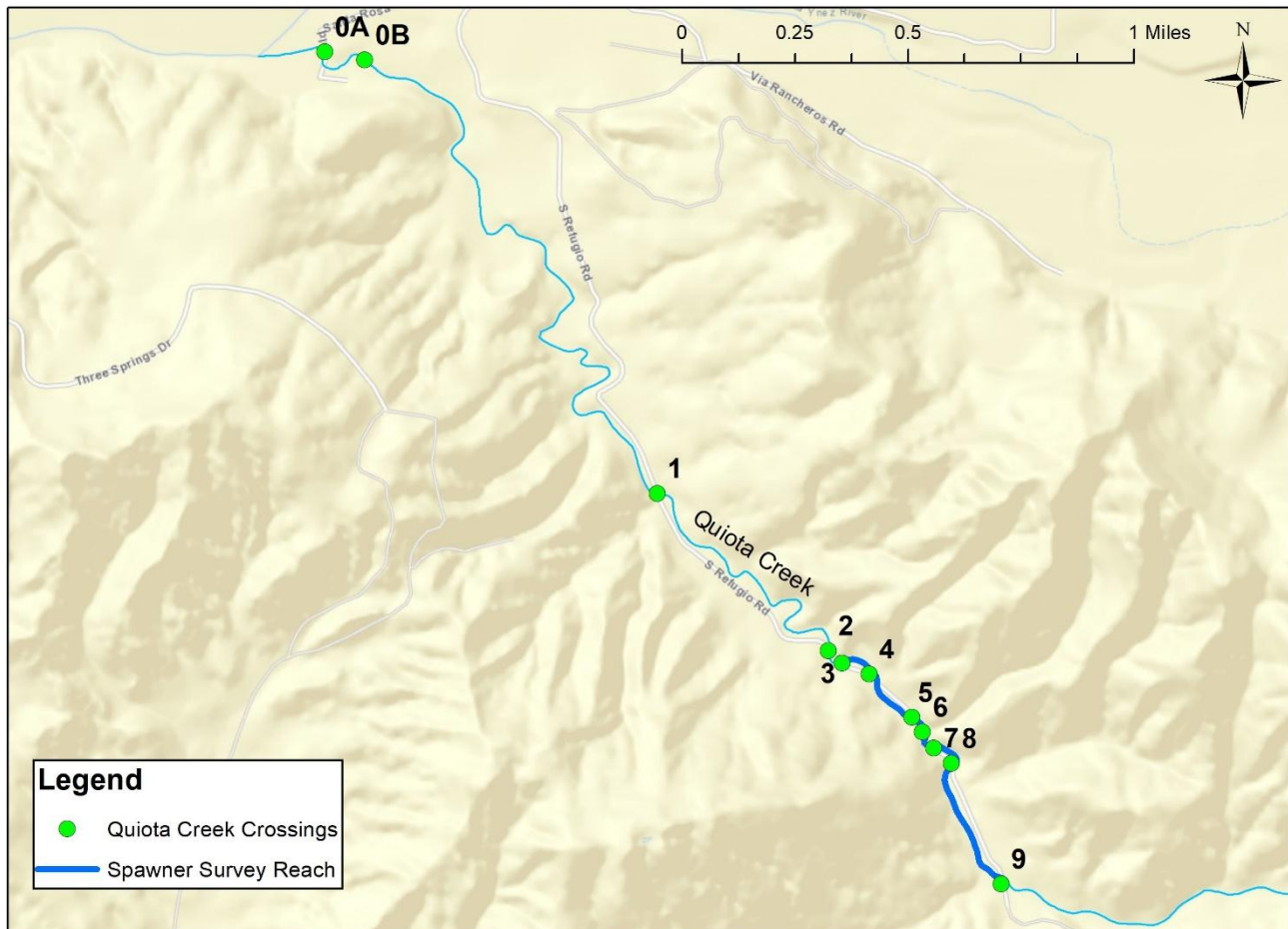
Approximately 0.78 miles of Quiota Creek were surveyed during spawner survey validation monitoring (Figure 5). This survey reach encompasses the portion of the creek from Crossing 3 through Crossing 9, the last of the stream crossings located along the creek. Much of the potential spawning habitat and summer refugia is in the upper watershed. One spawner survey was conducted by the MESHR team on April 4, 2023. Additional spawner surveys were conducted by Cachuma Operations and Maintenance Board (COMB) during the 2022-2023 spawning season. No steelhead trout were observed during these surveys. Summer snorkel surveys were conducted by COMB in June and September 2023 along a slightly longer survey reach beginning from Crossing 2 through just upstream of Crossing 9. During the June snorkel survey, 12 juvenile *O. mykiss* were observed upstream of Crossing 5. During the September snorkel survey, a total of 15 juvenile and resident adult *O. mykiss* were observed throughout the survey reach, with five trout observed below Crossing 5 and 10 trout observed above Crossing 5. Spawner and



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snorkel surveys have been conducted annually along this portion of Quiota Creek by COMB staff since 2012. No anadromous adult steelhead trout were observed during any of these surveys. One barrier to fish passage, Crossing 0B, still remains along Quiota Creek, though efforts are underway to replace this remaining Arizona crossing with a bottomless arch culvert. Combined with multiple years of severe drought conditions, this remaining barrier, which is located downstream of nine of the remediated crossings and downstream of the validation survey reach, likely contributes to the lack of steelhead observations. With the removal of Crossing 5 and the other fish passage barriers along Quiota Creek, future repopulation by steelhead can be possible when stream flow and habitat conditions allow. Future surveys are recommended to monitor long-term adult steelhead passage and repopulation in Quiota Creek.



**Figure 5.** Map of the eleven stream crossing locations along Quiota Creek. The spawner survey reach is highlighted in dark blue.



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**Project Funding & Cost**

- California Department of Fish and Wildlife Fisheries Restoration Grant Program ..... \$893,287
- Cachuma Operations and Maintenance Board ..... \$234,450
- **Total Project Cost** ..... **\$1,127,737**

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**P1850902 Fish Passage Improvement at Crossing 8, Quiota Creek Project**

**Objective(s)** – The objective of this project was to provide access to 3.03 miles of spawning and rearing habitat for southern steelhead trout (*Oncorhynchus mykiss*) by removing the passage barrier, a temporary bridge over a damaged concrete low-flow crossing, at Crossing 8 and replacing it with a 54-foot concrete bottomless-arch culvert. An additional objective included restoring stream habitat by reconstructing the channel through the crossing with engineered streambed material, two rock weirs, and a rootwad.

**Project Location(s)** – Quiota Creek; tributary to the Santa Ynez River; near the town of Santa Ynez; in Santa Barbara County.

**Project Description** – Crossing 8 is one of 11 crossings along Quiota Creek that were assessed as fish passage barriers (Crossings 0A, 0B, 1, 2, 3, 4, 5, 6, 7, 8, and 9). Prior to construction at this location, eight of the crossings downstream and the one crossing further upstream had previously been remediated. Crossing 8 was classified as a partial barrier to three life stages of steelhead trout and resident rainbow trout due to narrowing of the channel caused by concrete bags lining the bridge footings, turbulence and high velocities during passage flows, and boulder/cobble deposited upstream of the bridge. Project construction took place between September 30, 2019, and November 11, 2019. The concrete and temporary bridge were demolished. Concrete was poured for the new culvert footings and the prefabricated 54-foot bottomless arch culvert and wingwalls were installed. Rock slope protection (RSP) was installed on both banks along the abutments and for a short distance upstream and downstream of the crossing. The channel was regraded and reconstructed with engineered streambed material (ESM). Additionally, two rock weirs were installed within the ESM under the culvert to help maintain pool habitat and vertical profile. A rootwad, salvaged from tree removal during construction, was installed at the downstream limits of the project to maintain a scour pool and provide fish habitat.

**Project Monitoring**

Pre-Treatment

None

Post-Treatment

Date: 9/26/2023



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Photo Credit: Cachuma Operations and Maintenance Board



**Figure 1.** View, facing upstream, of the dilapidated bridge and concrete abutment lining. Pre-treatment photo date: 1/8/2019

Photo Credit: I Parson, Scientific Aid (California Department of Fish and Wildlife)



**Figure 2.** View, facing upstream, of the reconstructed channel and the upgraded bottomless arch culvert. Post-treatment photo date: 9/26/2023

### **Post-Treatment Project Rating and Summary**

The bottomless arch culvert, RSP, channel reconstruction, rock weirs, and rootwad treatments at the Quiota Crossing 8 project site were monitored for effectiveness in September of 2023, four years after implementation. The bottomless arch culvert was in good condition and functioning as intended. Channel conditions appeared good for passage for all steelhead life stages during passable flow conditions as the crossing replacement successfully removed the barrier to fish passage. The RSP features installed along both banks were functioning as intended to protect the crossing abutments from scour. Along the right bank, all the large RSP was still in place and, while only small amounts of the smaller material installed as fill between the larger rocks and boulders that make up the RSP appears to have washed out. On the left bank, some of the larger RSP at the upstream end of this feature had shifted into the channel and much of the small fill had washed out. Some sidecutting into the left bank at the upper end of the RSP and upstream of it was observed. The channel reconstructed with ESM retained the intended gradient and substrate composition, even after significant flow events following implementation. Some shifting of the smaller materials had occurred, but the larger boulders remained in place where they were installed in the channel. Overall, the channel feature still was passable and provided good habitat for fish. A pair of rock weirs installed within the channel reconstruction beneath the culvert consisted of large boulders with the intended purpose to maintain pool habitat. Following strong winter storms, the upstream weir appeared to have washed out or



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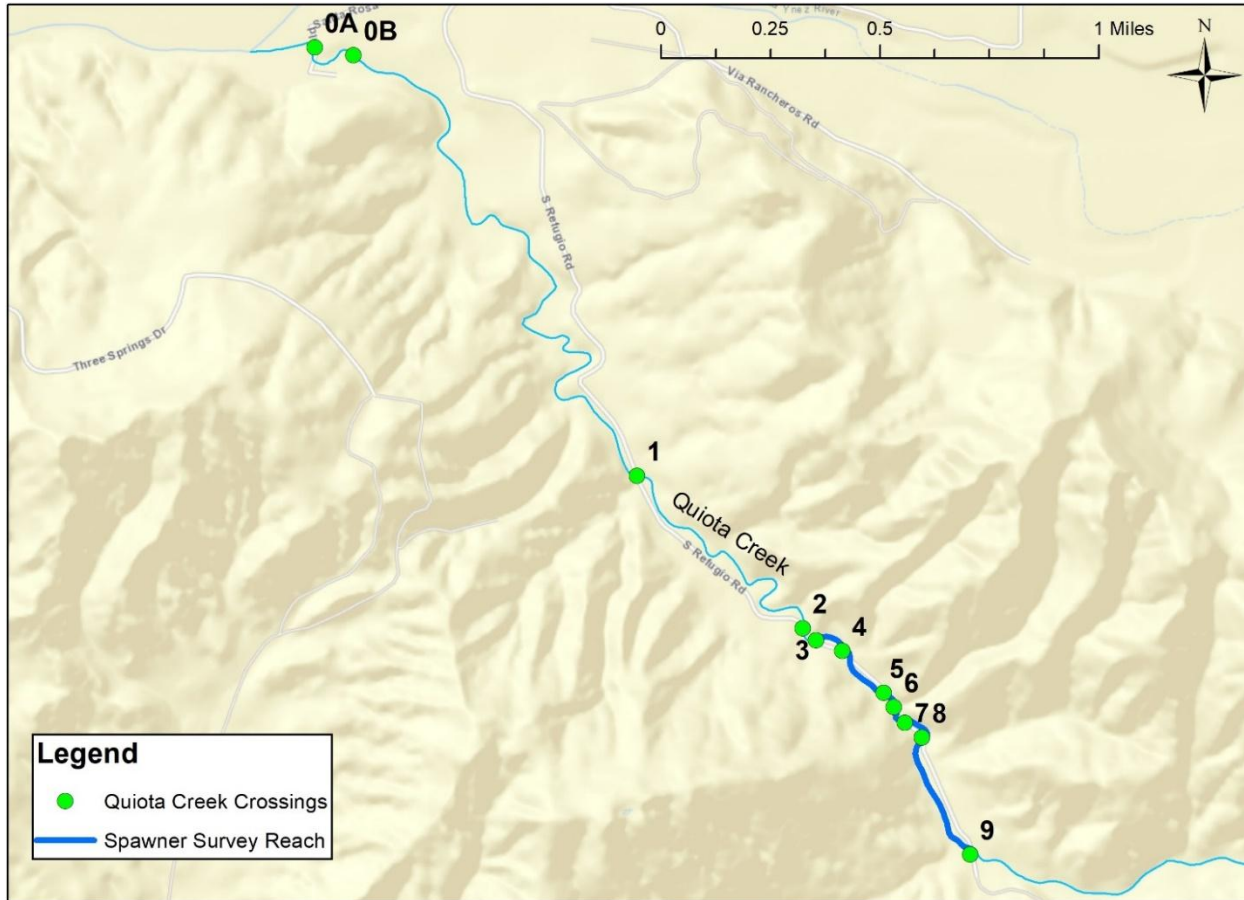


potentially became partially buried under sediment. The downstream weir was still functioning, and pool habitat maintained above it as intended. The feature appeared passable to steelhead trout and the intended channel grade appeared to have been maintained. A rootwad installed at the downstream limit of the channel reconstruction was intended to form a scour pool and provide cover for fish. Although some erosion had occurred on the bank upstream of the rootwad, the feature remained in place, formed a scour, and was providing instream cover.

Approximately 0.78 miles of Quiota Creek were surveyed during spawner survey validation monitoring (Figure 3). This survey reach encompasses the part of the creek from Crossing 3 through Crossing 9, the last of the stream crossings located along the creek. Much of the potential spawning habitat and summer refugia is in the upper watershed. One spawner survey was conducted by the MESHR team on April 4, 2023. Additional spawner surveys were conducted by Cachuma Operations and Maintenance Board (COMB) during the 2022-2023 spawning season. No steelhead trout were observed during these surveys. Summer snorkel surveys were conducted by COMB in June and September 2023 along a slightly longer survey reach beginning from Crossing 2 through just upstream of Crossing 9. During the June snorkel survey, 12 juvenile *O. mykiss* were observed upstream of Crossing 8. During the September snorkel survey, a total of 15 juvenile and resident adult *O. mykiss* were observed throughout the survey reach, with 5 trout observed below Crossing 8 and 10 trout observed above Crossing 8. Spawner and snorkel surveys have been conducted annually along this portion of Quiota Creek by COMB staff since 2012. No adult steelhead trout were observed during any of these surveys. One barrier to fish passage, Crossing 0B, still remains along Quiota Creek, though efforts are underway to replace this remaining Arizona crossing with a bottomless arch culvert. Combined with multiple years of severe drought conditions, this remaining barrier, which is located downstream of nine of the remediated crossings and downstream of the validation survey reach, likely contributes to a lack of steelhead observations. With the removal of Crossing 8 and the other fish passage barriers along Quiota Creek, future repopulation by steelhead can be possible when stream flow and habitat conditions allow. Future surveys are recommended to monitor long-term adult steelhead passage and repopulation in Quiota Creek.



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**Figure 3.** Map of the eleven stream crossing locations along Quiota Creek. The spawner survey reach is highlighted in dark blue.

**Project Funding & Cost**

- California Department of Fish and Wildlife Fisheries Restoration Grant Program ..... \$1,010,700
- Cachuma Operations and Maintenance Board ..... \$296,487
- **Total Project Cost** ..... **\$1,304,187**

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**P1750902 Fish Passage Improvement at Crossing 9, Quiota Creek**

**Project Objective(s)** – The objective of this project was to provide access to 2.73 miles of spawning and rearing habitat for southern steelhead trout (*Oncorhynchus mykiss*) by removing the passage barrier, a concrete low-flow Arizona crossing with a partially obstructed 16-inch diameter corrugated metal pipe (CMP) culvert and a concrete apron, at Crossing 9 and replacing it with a 55 foot-span concrete bottomless-arch culvert. An additional objective included restoring stream habitat by reconstructing the channel through the crossing with engineered streambed material and adding buried rock weirs for grade control.

**Project Location(s)** – Quiota Creek; tributary to the Santa Ynez River; near the town of Santa Ynez; in Santa Barbara County.

**Project Description** – Crossing 9 is the upstream-most of 11 crossings along Quiota Creek that were assessed as fish passage barriers (Crossings 0A, 0B, 1, 2, 3, 4, 5, 6, 7, 8, and 9). Prior to construction at this location, eight of the crossings downstream had previously been remediated. Crossing 9 was classified as a partial barrier to steelhead trout and resident rainbow trout due to the lack of pool depth downstream of the crossing required for leaping, lack of depth over the concrete crossing, presence of the concrete apron, and lack of flow and depth and high velocities at the culvert outfall. Project construction took place between September 5, 2018, and December 21, 2018. The concrete crossing and associated CMP culvert were demolished and removed. Concrete was poured for the new culvert footings and the prefabricated 60-foot bottomless arch culvert and wingwalls were installed. Rock slope protection (RSP) was installed on both banks along the abutments. The channel was regraded and reconstructed with engineered streambed material (ESM). Two buried rock weirs were installed downstream of the upgraded crossing for grade control.

**Project Monitoring**

Pre-Treatment

Date: none

Post-Treatment

Date: 9/26/2023



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Photo Credit: Cachuma Operations and Maintenance Board



**Figure 1.** View, facing downstream, of the concrete low-flow crossing. Pre-treatment photo date: 9/5/2018

Photo Credit: I Parson, Scientific Aid (California Department of Fish and Wildlife)



**Figure 2.** View, facing downstream, of the reconstructed channel and the upgraded bottomless arch culvert. Post-treatment photo date: 9/26/2023

### **Post-Treatment Project Rating and Summary**

The bottomless arch culvert, channel reconstruction and grade control rock weirs, and RSP treatments at the Quiota Crossing 9 project site were monitored for effectiveness in September of 2023, 5 years after implementation. Components of the bottomless arch culvert and wingwalls appeared to be in good condition and were functioning as intended. The RSP on both banks was functioning as intended to protect crossing abutments from scour. All of the large RSP was still in place, though small amounts of the smaller material installed as fill between the larger rocks and boulders that make up the RSP appeared to have washed out in some areas.

Quiota Creek experienced several severe storm and flow events during the winter prior to post-treatment monitoring which had significant effects on parts of the stream channel within this project area. The channel regrading and reconstruction with engineered stream material located upstream of and beneath the new crossing retained the intended gradient and installed ESM. Some shifting of the smaller materials might have occurred, but the larger boulders remained in place where they were installed in the channel under the culvert. Fish passage conditions through the new crossing and this section of reconstructed channel appear good. Downstream of the crossing and ESM channel section, two rock weirs consisting of large boulders that were buried under channel material were installed with the intended purpose to remain buried and maintain grade control (Figure 3). During



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post-treatment monitoring, significant channel incision and scouring was observed between and downstream of the rock weirs (Figure 4). As a result, the previously buried rock weirs were fully exposed, and flow was travelling behind and through gaps in the large boulders. The condition of the boulder weirs observed during post treatment likely poses a threat to upstream fish passage. Efforts to repair these damaged and exposed grade control weirs are in progress.

*Photo Credit: Cachuma Operations and Maintenance Board*



**Figure 3.** View, facing upstream, of the reconstructed portion of channel below the crossing with buried boulder weirs as it appeared immediately following implementation. Photo date: 10/23/2018

*Photo Credit: I Parson, Scientific Aid (California Department of Fish and Wildlife)*



**Figure 4.** View, facing upstream, of the channel incision and now exposed boulder weirs in this same section of channel. Post-treatment photo date: 9/26/2023

Approximately 0.78 miles of Quiota Creek were surveyed during spawner survey validation monitoring (Figure 5). This survey reach encompasses the portion of the creek from Crossing 3 through Crossing 9, the last of the stream crossings located along the creek. Much of the potential spawning habitat and summer refugia is located in the upper watershed. One spawner survey was conducted by the MESHR team on April 4, 2023. Additional spawner surveys were conducted by Cachuma Operations and Maintenance Board (COMB) during the 2022-2023 spawning season. No steelhead trout were observed during these surveys. Summer snorkel surveys were conducted by COMB in June and September 2023 along a slightly longer survey reach beginning from Crossing 2 through just upstream of Crossing 9. During the June snorkel survey, 12 juvenile *O. mykiss* were observed, with seven below and five above Crossing 9. During the September snorkel survey, a total of 15 juvenile and resident adult *O. mykiss* were observed throughout the survey reach, with 13 observed below Crossing 9 and two observed above



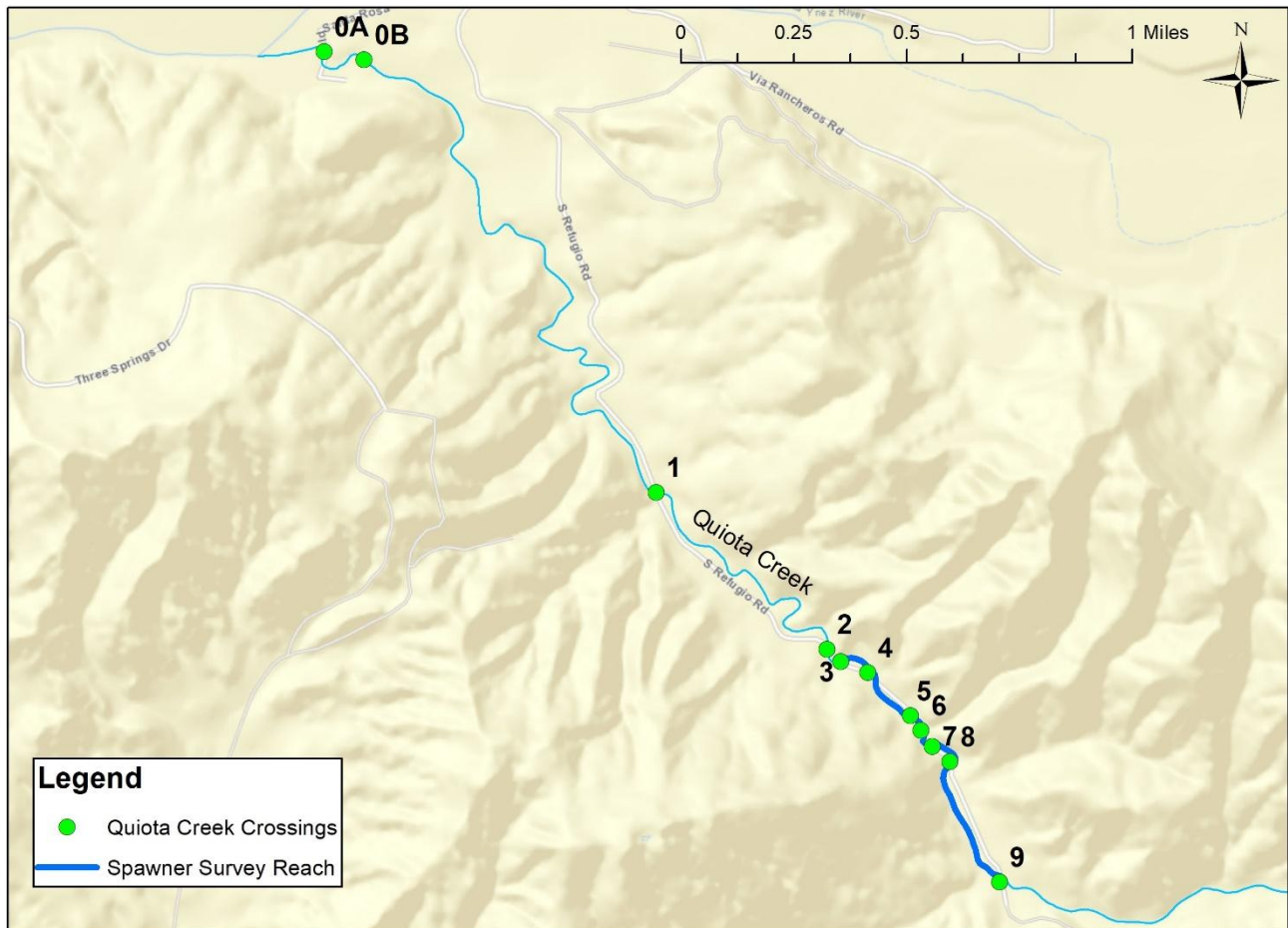
# California Department of Fish and Wildlife

## Fisheries Restoration Grant Program

### Restoration Project Case Study



Crossing 9. Spawner and snorkel surveys have been conducted annually along this portion of Quiota Creek by COMB staff since 2012. No adult steelhead trout were observed during any of these surveys. One barrier to fish passage, Crossing 0B, still remains along Quiota Creek, though efforts are underway to remove this remaining barrier. Combined with multiple years of severe drought conditions, this remaining barrier, which is located downstream of nine of the remediated crossings and downstream of the validation survey reach, likely contributes to of lack of steelhead observations. With the removal of Crossing 3 and the other fish passage barriers along Quiota Creek, future repopulation by steelhead can be possible when stream flow and habitat conditions allow. Future surveys are recommended to monitor long-term adult steelhead passage and repopulation in Quiota Creek.



**Figure 5.** Map of the eleven stream crossing locations along Quiota Creek. The spawner survey reach is highlighted in dark blue.



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**Project Funding & Cost**

- California Department of Fish and Wildlife Fisheries Restoration Grant Program ..... \$993,121
- Cachuma Operations and Maintenance Board ..... \$217,852
- **Total Project Cost** ..... **\$1,210,973**

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