

# Public Report: PINE GULCH CREEK INSTREAM FLOW ENHANCEMENT PROJECT

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*Grant Agreement # P1130410*

*Prepared for*

*The California Department of Fish and Wildlife*



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*Prepared by  
Marin Resource Conservation District  
Point Reyes Station, California*

*December 20, 2015*

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*Front page photo credits from left to right go to  
Nancy Scolari, Casey Del Real and Elise Suronen.*

### Pine Gulch Creek



Elise Suronen, Marin RCD

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## Acknowledgements

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## Pine Gulch Creek Instream Flow Enhancement Project

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**Accomplishments:** Constructed four irrigation ponds for three organic farms eliminating their need to divert from Pine Gulch Creek for irrigation, thus increasing summer instream flows and improving salmonid habitat in Pine Gulch Creek.

**Start & End Dates:** June 1, 2012 – March 31, 2016

**Geographic Area:** Pine Gulch Creek Watershed, Tributary to Bolinas Lagoon

**Location of Work:** Pine Gulch Watershed Map – see Figure 1  
Fresh Run Farm (FRF): Latitude = 37.9336 Longitude = - 122.7069  
New Land Fund (NLF): Latitude = 37.9245 Longitude = - 122.7012  
Star Route Farms (SRF): Latitude = 37.9178 Longitude = - 122.6972

**Total Budget:** \$2,500,817.78

**Total Volunteer Hours:** 666 hours = \$15,364.62 match cost-share



## Pine Gulch Creek within the Bolinas Lagoon Watershed



**Figure 1. Map of the Bolinas watershed, in Marin County, California (courtesy of Marin County) showing the Pine Gulch Creek watershed. A portion of it flows within the Point Reyes National Seashore and the remainder run through private property. The orange dots show the locations of the irrigation ponds constructed in the Pine Gulch Creek Instream Flow Enhancement Project.**

## Project Benefits to Anadromous Salmonids

The goal of the Pine Gulch Creek Instream Enhancement Project is to enhance summer instream flows of Pine Gulch Creek by building off-stream ponds for three organic farms (Figure 1). Pine Gulch Creek runs 11.7 km with the lower 7.8 km used by coho salmon and the lower 10 km used by steelhead trout. Three organic farms are located along the lower three kilometers of Pine Gulch Creek, the section of habitat utilized by salmonids. (Top Right Photo: Fish survey conducted in Pine Gulch Creek)

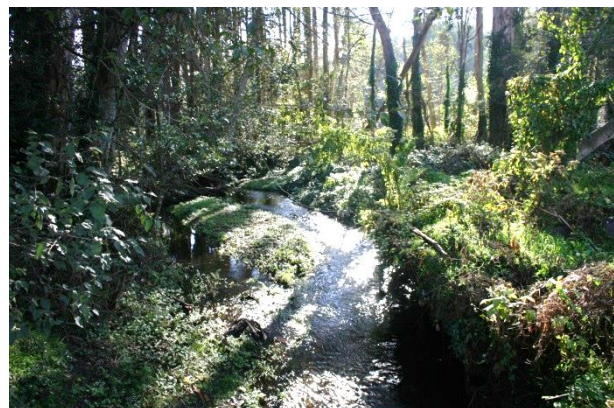


In 1997, the Point Reyes National Seashore (PRNS) estimated the average monthly summer agricultural demand on Pine Gulch Creek to be 0.15 cubic feet per second (cfs), about a third of the estimated 0.5 cfs summer flow of Pine Gulch Creek. A PRNS habitat assessment<sup>1</sup> revealed that water quality and quantity were being impacted by agricultural water use. PRNS concluded it was likely that instantaneous irrigation demands on the creek exceeded base flows for short periods, reducing rearing habitat for salmonids<sup>2</sup>. The National Park Service estimated that average commercial diversions by the farmers from 1995 - 2002 was about 56.91 acre-feet (AF) during the summer months of July – November. This information led PRNS to propose the farmers develop off-site water storage sites to reduce agricultural summer demands upon the creek (Bottom Right Photo: Pine Gulch Creek).

The neighboring farmers accepted the proposed project and after seventeen years of planning and permitting, the Pine Gulch Creek Instream Flow Enhancement Project was constructed, resulting in four irrigation ponds that collectively store

### Project Benefits to Salmonids<sup>2</sup>

- significantly enhance 2 acres of stream habitat
- increase depths & current velocities
- reduce instream temperatures
- increase instream oxygen levels
- improve rearing habitat quality
- improve macroinvertebrate habitat, a large component of juvenile salmonid habitat
- increase survival and abundance of steelhead and coho salmon
- promote the return of adult salmon



<sup>1</sup> Coho and Steelhead Restoration Project. 1997. National Park Service.

<sup>2</sup> Fisheries and other Ecological Benefits of the Pine Gulch Creek Watershed Enhancement Project. 2013. National Marine Fisheries Service Southwest Region. California.

69.2 AF of water. The ponds fill via direct rainfall, sheet flow and strict creek diversions limited to the winter months. From December 15 through the end of March, when Pine Gulch Creek is flowing above 25 cfs, appropriate water can be diverted at 2 cfs. Then from April – June, the farms can continue commercial diversions at reduced rates (Table 1).

**Table 1. Commercial withdrawal limitations from Pine Gulch Creek Points of Diversion (PODs) for the three farms participating in the Pine Gulch Creek Instream Flow Enhancement Project.**

<b>Withdrawal Limitations</b>	<i>Dec 15</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec 14</i>
Minimum cfs bypass required before diverting	25 cfs				3 cfs	2 cfs	1 cfs	N/A					
Maximum instantaneous rate of withdrawal for all PODs	Not exceed 2 cfs or 898 gallons per minute				0.3 cfs	0.2 cfs	0.1 cfs	N/A					

According to a PRNS hydrology report<sup>3</sup>, this project is expected to reduce the rate of diversion by ten-fold, thus increasing streamflow rates by 15 - 45%. Increased stream flows will improve summer rearing habitat value by increasing pool area and riffle connectivity, lowering water temperatures, and maintaining beneficial dissolved oxygen levels (see benefits table on page 1). The construction of storage ponds would enable the farmers to cede their summer commercial riparian water rights to instream flows for anadromous salmonids.

This project model is critical to the success of Threatened and Endangered species in heavily diverted watersheds where the endangered Coho salmon and threatened steelhead trout are struggling, as in Pine Gulch Creek. The National Marine Fisheries Service set a recovery target for coho salmon in Pine Gulch Creek at 394 spawning adult fish. Over the past sixteen years, only five observations were made of two to six adult coho salmonids in Pine Gulch Creek. For the past seven consecutive years, no juvenile coho salmon were observed during basin-wide surveys by the National Park Service. For steelhead, the National Marine Fisheries Service does not have a recovery target for spawning adults in Pine Gulch Creek. Steelhead are more consistently present with larger numbers in Pine Gulch Creek than coho with counts over the past seventeen years ranging from zero to fifty-four adults. By improving instream habitat quality, through a project like the Pine Gulch Creek Instream Enhancement Project, the goal is to increase coho salmon and steelhead trout numbers in Pine Gulch Creek.

<sup>3</sup> Pine Gulch Creek Watershed: Water Availability and Cumulative Instream Impact Analysis. Prepared as part of the Pine Gulch Creek Watershed Enhancement Project. Version 5.2. November 2005. Ketcham, B., National Park Service

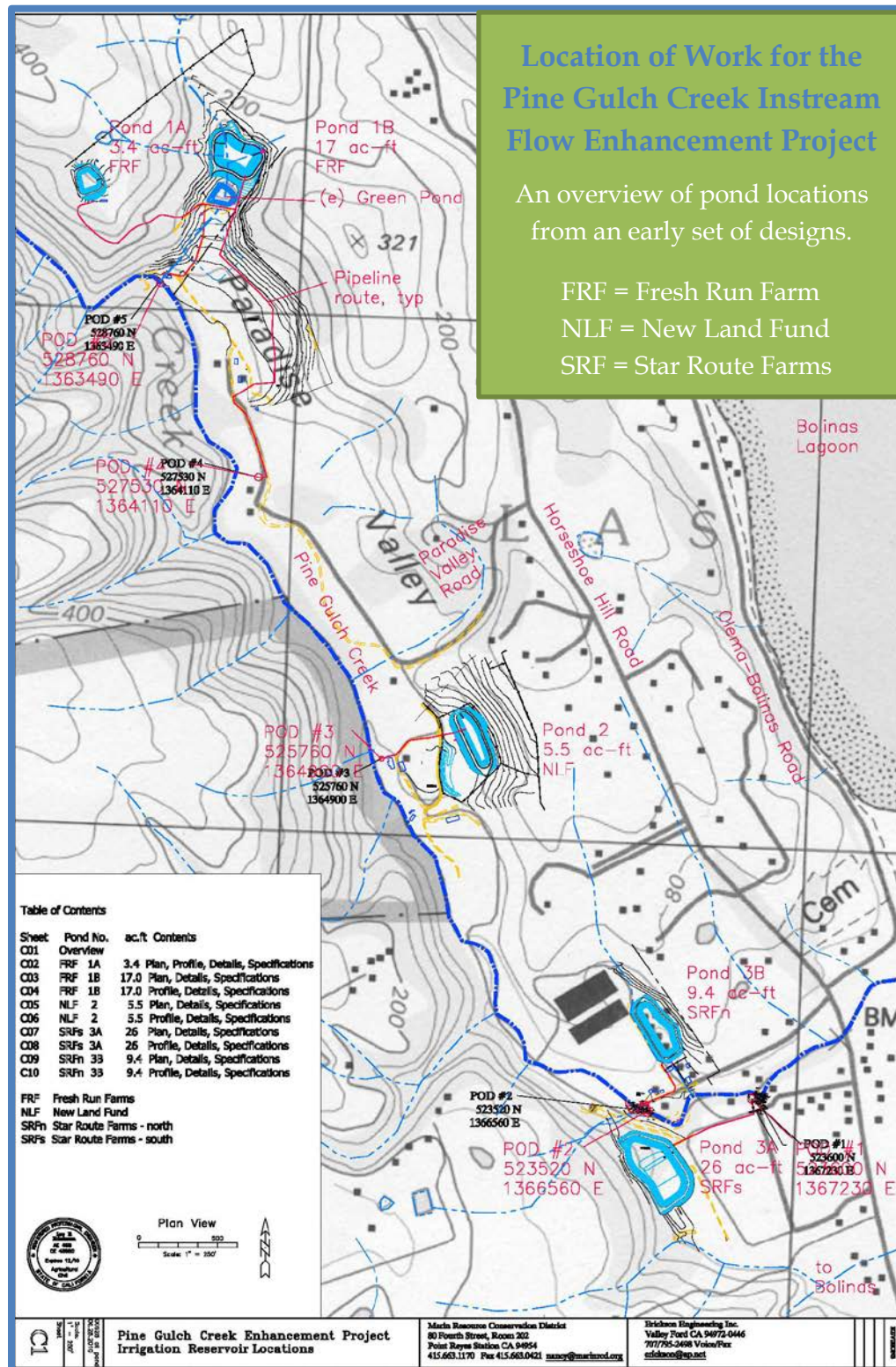


Figure 2. Map of pond locations for the Pine Gulch Creek Instream Enhancement Project from an early set of plans. This map also shows the relation of the ponds to roads within Bolinas, California.

## Pond Construction

The completion of the Pine Gulch Creek Instream Flow Enhancement Project will improve anadromous salmonid habitat in the lower end of Pine Gulch Creek by increasing instream summer flows by eliminating summer commercial diversions of three organic farms on the creek. The farms relinquished their riparian summer diversions for appropriative water rights to store winter storm water. The participating farms include Fresh Run Farm, New Land Fund and Star Route Farms. The State Coastal Conservancy funded the design and permitting process for the Pine Gulch Instream Flow Enhancement Project<sup>4</sup>. Through this grant the following permit applications were created and ultimately received: a Marin County Coastal Permit, State Water Resources Control Board Water Right permits, California Department of Fish and Wildlife Streambed Alteration Agreement, a \$401 Regional Water Quality Control Board Water Quality Certification, and a \$404 Army Corps of Engineers Nationwide Permit 27. With 100% designs and permits in progress, the California Department of Fish and Wildlife's Fisheries Restoration Grant Program funded a proposal to construct the five irrigation ponds: 1A, 1B, 2, 3A and 3B. Pond 1A and Pond 1B were designed to provide Fresh Run Farm with 20.5 AF of water. Pond 2 was planned to provide New Land Fund with 5.5 AF of water. Pond 3A and Pond 3B were engineered provide Star Route Farms with 35.4 AF of water. The project would conserve 61.5 AF of water and improve summer salmonid habitat.

The Marin Resource Conservation District (MRCD) created and circulated a Request for Cost Proposals (RFCP) per farm, for public bid. MRCD held pre-bid site visits (see photo below of pre-bid walk) and received completed RFCPs and reviewed RFCPs to confirm that each bidder met the California Department of Fish and Wildlife and MRCD RFCP requirements (i.e. bonding, insurance licensing, etc.). The Project Civil Engineer reviewed the qualifying bids and recommended a contractor for each farm to the MRCD Board. Rege Construction was awarded all three project sites at a regularly scheduled monthly MRCD Board meeting.



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<sup>4</sup> Pine Gulch Watershed Enhancement: Instream Flow Enhancement Project. Grant Agreement #07-081. 2010-2011. State Coastal Conservancy

Construction began on June 1, 2015. A pre-construction meeting was held at Star Route Farm where the Project Biologist provided a biological training, the Project Archaeologist provided an archaeological training, and a tribal representative from the Federated Indians of Graton Rancheria presented a historical perspective of the project location. In addition, the Project Geotechnical Engineer and the Project Civil Engineer spoke about their duties during construction. The Project Biologist conducted pre-construction biological sweeps and observed the vegetation clearing of all pond sites. At Pond 3B and Pond 2, the Project Archeologist witnessed vegetation removal and excavation to depth. For all ponds, inspection points were made throughout construction by the Geotechnical Engineer and by the Civil Engineer to ensure the project was being completed according to plan.

### **Pond 1A/1B – Fresh Run Farm**

Construction of the ponds at Fresh Run Farm began with Pond 1B, since the site's Geotechnical Investigation Report (Miller Pacific Engineering Group, 2002) indicated the soils were highly saturated, yet buildable with reasonable soil profiles. The site for Pond 1B was slated to be built over a historically farmed site just above an old livestock pond, called Green Pond (see historical photo to the right. Green Pond is indicated above the farmed area, later to be the site for Pond 1B). On June 15, 2015, construction at Pond 1B was initiated. The contractor removed vegetation and installed drainage trenches, which revealed the underlying soil to be saturated, consolidated sand with substantial water present. Once disturbed, the sand lost all strength. The drains developed were somewhat effective: a meadow center drain 12 feet deep flowed at about 3 gallons per minute (gpm); and a 740-foot perimeter drain around the east and north of the meadow flowed at a steady 4 gpm. The sub-drains functioned as intended but were unable to significantly affect the bulk of the saturated material. Additional water percolated up maintaining the profile in a saturated condition (see photo below of the Pond 1B site with Green Pond to the right of the yellow water truck).



The unexpected saturated conditions prevented effective operation with standard earthmoving equipment. The deep profile of saturated soil prevented the development an adequate foundation to support the levee embankment. It was the consensus of Project Geotechnical Engineer and Project Civil Engineer that timely and cost-effective construction was not possible at this site. MRCD notified all permitting agencies of the issue and proposed a project modification that would achieve the desired environmental goals consistent with the permit provisions and would provide the Fresh Run Farm with its irrigation water needs. MRCD proposed and ultimately received agency approval for the following solution: abandon Pond 1B, capture water from the existing drains at the Pond 1B site to supplement the farm's water supply, and expand Pond 1A to partially mitigate for storage loss due to not constructing Pond 1B. The drains at 1B were estimated to collect about 1 AF of water a month (if flows stay constant over time) from the impacted area. By capturing this water over the irrigation season, the farm can potentially secure about 7AF of water to irrigate. The combination of seasonal drainage flows collected from 1B along with expansion of 1A to 11.7 AF would help the farm meet its irrigation demands.

In late August 2015, the soils at Pond 1B were regraded back into place. A portion of the disturbed area at Pond 1B was return to its' historical farmland use and another portion at the bottom of the work area was left to return to wetland. Plumbing and a sump pump were installed to route sub-drain discharge to tank storage.

Construction at Pond 1A began June 22, 2015. Soil conditions were good and the small pond, 3.5 AF, was practically finished by July 2, 2015 when construction at Pond 1A was halted due to the issues at Pond 1B. Once the project modification was accepted, the storage capacity of Pond 1A was increased from 3.5 AF to 11.7 AF starting on August 28, 2015. The altered configuration expanded the pond footprint into highly used farmland and avoided a man-made duck pond. The expanded pond version of Pond 1A, Pond 1A.2, would collect about 11.7 AF/year of rainfall and non-jurisdictional upland sheet flow based on its location in the watershed. The new pond design would eliminate the need to withdrawal from Pine Gulch Creek. The modified Pond 1A also included a shallow section to create California red-legged frog (CRLF), *Rana draytonii*, breeding habitat (see photo below of shallow shelf in Pond 1A).



### **Pond 2 – New Land Fund**

Construction of Pond 2 began on July 27, 2015 and wet soil conditions slowed construction. Wet soils lead to unexpected soil shrinkage problems that resulted in the elimination of the pond's backside pathway in order to secure enough material to finish the pond (see photo to the right of Pond 2 and no pathway on the right side of the pond). The increased level of excavation created a larger reservoir from 5.5 AF to 8.2 AF. Without a complete pathway, New Land Fund may have difficulties managing the vegetation on the backside of the pond. The MRCD will continue to work with the landowner to resolve the issue.



### **Pond 3A & 3B – Star Route Farm**

Pond 3B was the first site of the Pine Gulch Creek Instream Flow Enhancement Project opened for construction. Work immediately slowed due to water draining into the construction site. A curtain drain was installed to capture the water in order to dry the site (see photo to the right of the draining process of the Pond 3B site). The contractor also continually worked the dirt, mixing soils to keep soil moisture content levels low and to expedite the drying process. Due to wet soil conditions, the contractor had to wait a couple of weeks to let the bottom of the pond dry out before the final compaction. The completed pond holds 10.6 AF.



On July 20, 2015, construction began at Pond 3A. Constructing Pond 3A included the demolition of an existing irrigation pond (see bottom right photo of existing pond). The Project Biologist conducted several surveys of the existing pond before construction began and relocated many species from the pond into Pine Gulch Creek including but not limited to: four





CRLF adults, 61 CRLF juveniles, and 350 CRLF tadpoles. The Project Biologist also captured four American bullfrogs, *Lithobates catesbeianus*, which were removed from the site. The soils below the existing pond site were saturated and slow to work with and, in addition other locations within the footprint of Pond 3A, also had high soil moisture content prolonging construction. Pond 3A also experience unexpected soil shrinkage problems, which lead to the expansion of the pond size. The completed pond holds 31AF of water.



#### Riparian Enhancement Area

The Pine Gulch Creek Instream Flow Enhancement Project included a 0.67-acre Riparian Enhancement Area improving the riparian corridor along a degraded section of Pine Gulch Creek. This section of creek is situated on Star Route Farm next to Pond 3A and lacks robust riparian vegetation. MRCD hired the Conservation Corps North Bay to remove invasive non-native species by hand, weed wrench, weed-eat, and chainsaw from the area. No heavy equipment was used in the riparian zone and only minimal soil disturbance occurred. Invasive species including broom (*Cytisus scoparius*), Himalayan blackberry (*Rubus armeniacus*), ivy (*Hedera helix*), and others were disposed of in an approved location. Care was taken that removal of native understory species was minimized. Once Conservation Corps North Bay removed the non-natives, Point Blue Conservation Sciences'



Students and Teachers Restoring a Watershed Program then came out with 111 volunteers, students and teachers (see photo below), who worked for six hours to plant 80 native trees: box elders (*Acer negundo*), red alders (*Alnus rubra*), coast live oaks (*Quercus agrifolia*) and California bay (*Umbellularia californica*). The area will be maintained and monitored for five years.

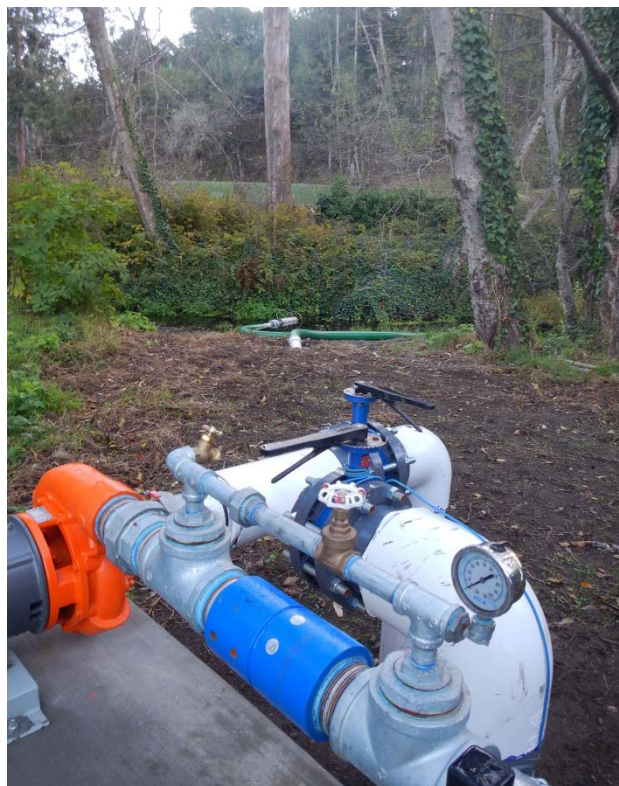


Photo by Point Blue Conservation Science STRAW staff

### Points of Diversion

The Points of Diversion (POD) were installed once the majority of the earthwork was completed for the pond sites. The project originally included five PODs, one for each pond. However, the project modifications at Fresh Run Farm (the elimination of Pond 1B and the development of a spring) are expected to eliminate the farm's need to divert from Pine Gulch Creek altogether for irrigation purposes, thus POD 4 for Pond 1B and POD 5 for Pond 1A were not installed. Instead, Fresh Run Farm received a pump to move the collected spring water from the tank system into Pond 1A.

At the other farms, POD 3 for Pond 2, POD 2 for Pond 3B and POD 1 for Pond 3A began installation on September 29, 2015 and were completed on December 15, 2015. The PODs include fish screens at the intake valves, in-take flow meters to quantify diversion rate and meters to quantify amount of water diverted. Downstream of Star Route Farm's POD 2 and New Land Fund's POD 3, stream gauges were installed within Pine Gulch Creek. The meters will enable farmers to read stream flow levels and determine time sequence for appropriate diversion. Consequently, Fresh Run Farm did not receive a stream gauge because the farm does not expect to need to pump from Pine Gulch Creek for commercial irrigation.



### Maintenance and Monitoring

The Pine Gulch Creek Instream Enhancement Project includes pond and pump maintenance protocols as well as habitat monitoring procedures and reports. The Project Civil Engineer, Project Biologist and MRCD staff created a Compliance and Effectiveness Monitoring Plan as required by the State Water Quality Control Board (SWRCB) and California Department of Fish and Wildlife (DFW). The plan outlines the methods for the recording bypass flows and pond storage levels. Farmers will submit annual reports to SWRCB for ten years of their monthly recordings of instantaneous rate of withdrawals, cumulative amount of water diverted, days of actual diversion and the end of the month reservoir reading/s. For three years, a pond maintenance report will be submitted to the County of Marin and Army Corps of Engineers documenting maintenance, repairs and pond conditions including: any vandalism, trash, vegetation management activities, and any altered hydrology patterns. The Marin County Department of Agriculture, Weights and Measures will work with the farmers to submit annual Safe Harbor Agreement reports to United States Fish and Wildlife Service for the next 30 years. This report requires specific updates on ponds 1A and 3A: the farmer will describe and photographically document the habitat conditions of the ponds, and track their maintenance activities. Annually for five years, the farmers must submit a report to

the Army Corps of Engineers and the Regional Water Quality Board (RWQCB) reporting on the vegetative goals of the ponds, specifically the percentage of pond occupied by hydrophytic vegetation, the condition of those plants and general observations of pond functioning. Ponds will be surveyed on an annual basis for invasive species and reports will be submitted to SWRCB (indefinitely) and DFW (until 2018). At year three and year five post-construction, 2019 and 2021, MRCD will conduct a California Rapid Assessment of the pond sites and will submit the findings to the Army Corps of Engineers and the RWQCB. Five years post-construction, 2021, a biologist will conduct wetland delineation survey of the pond sites and a report will be submitted to the RWQCB and Army Corps of Engineers. MRCD staff will report on the functional goals of the Riparian Enhancement Area, tree survival and canopy and invasive species cover, which will be submitted annually to Marin County for three years and for five years to Army Corps of Engineers and DFW.

Finally, the Safe Harbor Agreement states that a post-construction report will be provided to the United States Department of Fish including pre and post-project photos and discussion on the implementation of avoidance and minimization measures. In February 2016, the Project Biologist was establishing photo points and sighted the following: two sub-adult red-legged frogs at Star Route Farm's Pond 3B, a Western Pond Turtle and a CRLF eggs mass at Star Route Farm's Pond 3A.



### Conclusion

The Pine Gulch Creek Instream Enhancement Project resulted in the construction of four irrigation ponds capturing 62.2 AF of storm water. Pond 1A can hold 11.7 AF and developed springs at site 1B provide Fresh Run Farm with 1AF per irrigation month for a total of 18.7 AF. Pond 2 provides New Land Fund with 8.2 AF. Pond 3A and Pond 3B provide Star Route Farms with 42.3 AF of water (Pond 1B shown below). The Project Civil Engineer prepared as-built drawings provided in Exhibit C. The project provides 62.2 AF of water storage; therefore, conserving instream summer flows, thus improving summer salmonid habitat.



### Measureable Metrics for Project Sites

#### *Habitat Protection and Restoration Projects – Reporting Metrics*

<b><i>Reporting Metric</i></b>	<b><i>Project Total</i></b>
Miles of stream protected for adequate flow	6.14 miles
Flow rate in cfs of water conserved	<i>The required pump flow rates for recharge based on a particular set of dry year worst case assumptions total 4 cfs, occurring during the wet winter storage period. The average equivalent irrigation withdrawal rates the creek during the “no take” summer season and assuming 100% water consumption in that period total 1 cfs.</i>
Start date of return flow to the stream	July 1
End date of return flow to the stream	December 15
Number of days that flow was returned to the stream	167 days
Acre-feet of water conserved	61.5 AF

Please note that the Pine Gulch Creek Instream Flow Enhancement Project did not include a monitoring component.



## Exhibit A: Before and After Photographs

*Fresh Run Farm Pond 1A: Pond 1A is 11. Exhibit C 7 AF and will irrigate 22.5 acres of organic produce. The pond coupled with a spring development will eliminate the diversion of 29.1 AF from Pine Gulch Creek every year.*

*Pond 1A – Start of Construction*



*Pond 1A – Mid-Construction (original size of Pond 1A before the project was modified to expand the size of Pond 1A)*



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DFW Final Report  
Exhibit B: Before and After Photographs

*Pond 1A – After Construction*



***Fresh Run Farm Site 1B Spring Development:*** Pond 1B was planned to provide Fresh Run Farm with 17AF of water storage, but wet soil conditions rendered the pond unbuildable. The perimeter drains installed to dry out the construction site ended up tapping into a spring that provides a reliable source of water for the farm providing the farm with about 1AF each month.

*Pond 1B Before Construction*



*Pond 1B After Construction (pond abandoned & sump pump)*



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Exhibit B: Before and After Photographs

***New Land Fund Pond 2:*** Pond 2 is 8.2 AF and will irrigate up to 10 acres of organic farmland. This pond will eliminate the annual diversion of 7.54 AF from Pine Gulch Creek.

*Pond 2- Before Construction*



*Pond 2- After Construction*



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***Star Route Farm Pond 3A and 3B:*** Pond 3A is 31 AF and Pond 3B is 10.6 AF. These two irrigation ponds will support 29 acres of organic row crops. These ponds will eliminate the annual diversion of 53.5 AF from Pine Gulch Creek.

*Pond 3A Before Construction*



*Pond 3A - After Construction*



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*Pond 3A – Before Construction (from the north looking southeast)*



*Pond 3A – After Construction (from the north looking southeast)*



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*Pond 3A – Before Construction (photo from the south looking northeast)*



*Pond 3A – After Construction (photo from the south looking northeast)*



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*Pond 3B – Construction Start (photo from the southeast looking northwest)*



*Pond 3B – After Construction (photo from the southeast looking northwest)*



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*Pond 3B – Before Construction (photo from the southwest looking north)*



*Pond 3B – After Construction (photo from the southwest looking north)*



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Exhibit B: Before and After Photographs

*Points of Diversion (POD) at Star Route Farm (SRF) and New Land Fund (NLF)*

*POD 1 for Pond 3A at SRF before Installation*



*POD 1 for Pond 3A at SRF after Installation*



*POD 2 for Pond 3B at SRF before Installation*



*POD 2 for Pond 3B at SRF after Installation*



*POD 3 for Pond 2 at NLF before Installation*



*POD 3 for Pond 2 at NLF after Installation*



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Exhibit B: Before and After Photographs

*Other Techniques Implemented*

*Concrete inlets*



*Pond spillway*



*Pond staff gauges*



*Diversion Flow Meter*



*Stream staff gauges*



*Fish Screen*



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Exhibit B: Before and After Photographs

***Riparian Enhancement Area at Star Route Farm** – A 0.67-acre stretch of Pine Gulch Creek, the Riparian Enhancement Area, was improved by removing invasive species and installing 80 native trees. This segment of enhanced riparian corridor is located adjacent to Pond 3A.*

*Before Planting the Riparian Enhancement Area at Star Route Farm*



*After Planting the Riparian Enhancement Area at SRF*

