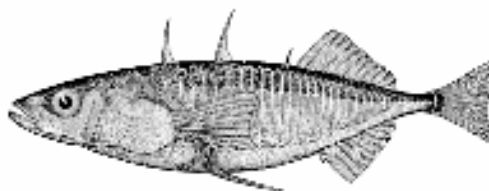




Summary of Conditions within the Orchard Reach of Franklin Creek



JOHN MUIR NATIONAL HISTORIC SITE

PORE-NR-WR-05/06

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BACKGROUND

John Muir National Historic Site (JOMU) is located in Martinez, approximately 20 miles northeast of San Francisco, within the Alhambra Valley of Contra-Costa County. The park was established in 1964 to preserve the 8.8 acre area including the John Muir house “as a public memorial to John Muir in recognition of his efforts as a conservationist and a crusader for national parks and reservations” (Public Law 88-547). In 1990, Mount Wanda (named after Muir’s eldest daughter) was added to the park. It includes 326 acres of undeveloped woodland and grassland with residential areas surrounding it. Most recently, the John Muir gravesite tract along Alhambra Creek (1.3 acres) was acquired.

Surface Hydrology & Water Resources

John Muir NHS is located within the 16.5 mi² Alhambra Creek watershed in northwestern Contra Costa County. Two sub-watersheds are located within the park: Franklin Creek and Strentzel Canyon (Sub-watershed No. 1167). Alhambra Creek itself flows past the Muir gravesite, but is not located within the park boundaries. Alhambra Creek flows north into the Carquinez Strait between Suisan Bay and San Pablo Bay north of San Francisco Bay. Annual rainfall within the Franklin Creek area is approximately 25 inches (see Map 1).

Franklin Creek is an intermittent stream that flows behind the Muir house (just west of the house) and meets Alhambra Creek in the town of Martinez. It originates in the hills west of Martinez and flows primarily eastward towards Alhambra Creek. The drainage area of Franklin Creek is approximately five square miles. In addition to the rural mixed land use, Highway 4 is a prominent feature along the entirety of the drainage. Most of the creek is located on private and city owned lands. Franklin Creek crosses under Highway 4 through a 200+ foot box culvert, and into the 90 meter park reach. The JOMU reach is defined at the upstream end by a culvert under Highway 4, and at the downstream end by a concrete weir and grouted channel. The downstream end of the reach is incised approximately two meters below the valley terrace (part of the active orchard).

Evaluation of historic and current salmonid use in the San Francisco Bay Estuary reports that historically, Alhambra Creek supported limited populations observations of steelhead (*Oncorhynchus mykiss*) and may currently support a resident rainbow population and some in-migrating steelhead (Leidy et. al. 2005). While Franklin Creek supports perennial water and may have historically supported steelhead, barriers in the lower watershed and highly degraded riparian conditions and water quality reduce the current potential of occurrence. Authors of the recently completed Cultural Landscape Report noted that there was no mention of fish in Franklin Creek in any of their research, including what fish were kept in the orchard “fish pond” (Jeff Killion personal communication). While it is unusual to consider that such information was not contained in John Muir’s notes, it is possible that the populations there were always rather modest in number.

METHODS

Beginning with the summer of 2002, SFAN fisheries staff has surveyed the JOMU reach of Franklin Creek to quantify aquatic habitat and determine presence/absence of fish species. Sampling was conducted over one day in August in 2002, June in 2003 and 2004, and May in 2005. Habitat typing surveys were conducted using methods and habitat unit classifications outlined in the Summer/Fall Stream Fish and Habitat Surveys Standard Operating Procedure 1 (Ketcham et al. 2005) developed for the San Francisco Area Network Inventory and Monitoring Program. Water quality conditions were also measured as part of the electrofishing activities in 2002, 2004 and 2005.

Fish sampling was conducted using a Smith-Root model 12-B or LR-24 backpack electrofisher (unpulsed direct current setting at 100 volts). Due to high conductivity in the creek, we were unable to find a setting which would effectively capture stickleback (the primary and possibly only fish species present in the reach) without overloading the electrofishing unit. Therefore, sampling was conducted only to establish

presence/absence and no attempt was made to estimate abundance. A single electrofishing pass was conducted along the entire reach, and any captured fish were placed in holding buckets and counted and processed immediately after sampling.

Water quality samples were collected consistent with protocols documented in the San Francisco Area Network Water Quality I&M Protocols, specifically SOPs 5 (core parameters), 6 (pathogens), and 7(nutrients) (Coopridier 2005). Other monitoring activities, including streamflow monitoring and aquatic macroinvertebrate inventories have been conducted in this reach (see Map 2).

RESULTS

Because the Alhambra Creek watershed supports a small population of steelhead and Franklin Creek, while limited does have the potential to support steelhead, monitoring on the JOMU reach of Franklin Creek has been adapted to determine potential use by salmonids in this creek. Our first year of monitoring in August 2002 revealed limiting water quality conditions (high temperature, low dissolved oxygen) in the intermittent pools. Based on the water quality condition, surveys were moved up to June in 2003 and 2004, and May in 2005. The intent with sampling earlier in the spring was to determine if steelhead may actually use this habitat and then leave as flows decline in the summer. In both 2004 and 2005, measured water temperature and dissolved oxygen levels were in an acceptable range for the areas endemic fish species (Table 3).

Habitat composition

Habitat unit composition is summarized in Table 1 and detailed in Appendix A. The upper 50 meters consists of a riffle-flatwater complex with some small scour pockets. The lower 40 meters of the reach consists of long, narrow trench pools in an incised channel with vertical banks. The downstream boundary of the lower pool reach is the concrete weir/spillway structure at the north park boundary. Substrate throughout the entire survey reach consists primarily of cobble and concrete riprap embedded in fine silt and organic detritus.

Table 1. Summary of habitat composition in JOMU reach of Franklin Creek, Summer 2002-2005.

Year	Habitat Type	# of Units	Length (m)		Surface Area (m ²)	
			Sampled	% of total	Sampled	% of total
2002	Pool	3	38.2	44	84.8	70
	Riffle	2	39.3	45	22.7	19
	Flatwater	2	10.0	11	13.4	11
	TOTAL	7	87.5		120.9	
2003	Pool	2	41.0	47	110.9	61
	Riffle	3	32.0	36	34.3	19
	Flatwater	3	15.0	17	35.5	20
	TOTAL	8	88.0		180.7	
2004	Pool	2	39.3	44	100.7	65
	Riffle	3	33.4	38	27.8	18
	Flatwater	3	15.8	18	26.7	17
	TOTAL	8	88.5		155.2	
2005	Pool	3	48.3	58	124.6	64
	Riffle	3	25.6	30	48.9	25
	Flatwater	1	10.1	12	21.2	11
	TOTAL	7	84.0		194.7	

Aquatic Community Summary

Fish

Relatively high densities of three-spined stickleback (*Gasterosteus aculeatus*) were observed in the creek in years 2002 to 2004, particularly in the pool section, but capture efficiencies were fairly low (estimated <50% for adults and < 10% for juveniles) related to the high stream conductivity. Of the few that were captured, the proportion of juveniles (<35 mm) to adults (>35 mm) was high (Table 2). In 2005 low densities of three-spined stickleback were observed with higher proportions of adults (>35 mm) than juveniles (<35mm) captured (Table 2). The low capture of juveniles in 2005 may be attributed to the dip nets having a mesh size too large to capture the small juveniles present. The juvenile stickleback were most likely less developed because sampling was performed earlier in the season than in previous years. No other fish species have been captured through our monitoring efforts. In 2004 and 2005, however, non-native swamp crayfish (*Procambarus clarkii*) were captured while electrofishing.

Table 2. Electrofishing summary, JOMU reach of Franklin Creek, summer 2002-2005.

Year	Pass time (seconds)	Stickleback		Other Spp.
		<35 mm	>35mm	
2002	997	47	15	
2003	874	27	7	
2004	862	20	2	1 swamp crayfish
2005	1998	0	12	4 swamp crayfish

Aquatic Macroinvertebrates (Summary from Lee and Coopridger 2005)

As a separate I&M inventory, aquatic bioassessment was conducted on this reach of Franklin Creek in June 18, 2003 (JOMU1; representing summer conditions) and March 30, 2004 (FRA1; representing spring conditions). Among a total of 25 sites sampled and analyzed as part of the investigation, the summer (JOMU1) and spring (FRA1) samples had results indicative of highly degraded water quality and habitat. The EPT taxa richness (total number of sensitive taxa present – representing the orders of Ephemeroptera [mayfly], Plecoptera [stonefly], and Trichoptera [caddisfly]) and % EPT taxa (percent of EPT taxa of total number of taxa in sample) were nearly the lowest of all sites samples (regardless of season). A high taxa richness score in the summer (JOMU1) included 13 non-insect taxa, all of which are considered tolerant - with the ability to take advantage of fine sediment accumulation, thereby creating a false richness value in the sample. The summer (JOMU1) samples also contained six tolerant beetle genera (one of which occurred in the spring sample) suggesting recruitment of these tolerant species as discharge decreases and conductivity and temperature increased (Table 3). Overall, the aquatic macroinvertebrate samples on Franklin Creek indicate a community that is tolerant of high temperature, conductivity, and fine sediment. Within the 25 monitoring sites, the Franklin Creek samples showed scores highly indicative of human disturbance and degradation.

Water Quality

As described in the fish and macroinvertebrate community results sections, water quality is considered generally poor, with low dissolved oxygen and high water temperature, salinity, and conductivity (Table 3). Most problematic of these from the perspective of aquatic health is the unusually high salinity and conductivities associated with the water. Salinity in this freshwater reach may actually be the primary water quality limiting factor in the watershed for salmonids. The single winter flow sample (2/25/04) was collected at the peak of runoff for that specific event. It indicates that rainwater is likely not the source of these conditions, indicating that anions in the water creating the more saline conditions are potentially leaching in from the surrounding soils under low flow conditions. Additional sampling will provide better insight into these elevated conductivity conditions.

In addition to the degraded core parameter results, the lab analytes assessed as part of the I&M water quality investigation (Table 4) showed elevated nitrate and ammonia levels. Fecal coliform levels, while greater than the recreational contact level (200 MPN/100ml), were far below the non-contact thresholds (2,000 MPN/100ml) except during the winter runoff event where the sample exceeded the analytical level of 1,600 MPN/100ml.

Table 3. Water quality monitoring results for JOMU reach of Franklin Creek, 2002-2005.

Date	Project Name	Air Temp. (°C)	pH	Water Temp. (°C)	Specific Conductance (uS/cm)	Conductivity (uS/cm)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Oxygen percent
8/22/2002	Fish sampling	M	M	19.2	1483	1290	0.7	2.73	37.1
6/18/2003	Aquatic bioassessment/ Fish sampling	21.0	8.30	16.0	1334	1105	0.7	9.11	92.4
1/15/2004	I&M water quality monitoring	17.5	8.25	11.4	1285	949	0.6	17.50	160.7
2/25/2004	I&M water quality monitoring	15.1	7.92	11.7	165.1	122.8	0.1	9.5	83.0
3/30/2004	Aquatic bioassessment	15.9	7.98	14.0	1157	913	0.6	8.44	83.2
4/22/2004	I&M water quality monitoring	16.0	8.20	12.8	1232	941	0.6	5.50	41.6
6/24/2004	Fish sampling	M	M	16.4	1490	1242	0.8	8.34	85.4
8/16/2004	I&M water quality monitoring	25.3	7.67	17.2	1492	1271	0.8	5.05	54.0
5/3/2005	Fish sampling	M	M	14.0	1055	833	0.5	9.87	95.8

Table 4. Laboratory analytical results for water quality samples from JOMU reach of Franklin Creek as part of pilot I&M water quality monitoring program.

Date	Project Name	Nitrate as NO3 (mg/L) [EPA 300.0]	Ammonia as NH3 (mg/L) [EPA 350.3]	Total Coliform (MPN/100mL) [SM9221B]	Fecal Coliform (MPN/100mL) [SM9221B]
1/15/2004	I&M WQ monitoring	5.5	ND	900	900
2/25/2004	I&M WQ monitoring	4.8	0.32	>1600	>1600
4/22/2004	I&M WQ monitoring	6.5	0.3	900	500
8/16/2004	I&M WQ monitoring	3.3	0.7	300	130

In addition to event based samples, a Hobo-brand temperature logger was deployed at the stream gage location near the downstream extent of the JOMU reach. A summary of temperature data spanning from August 2004 to July 2005 is presented as Figure 1. Temperature is critical for maintaining suitable habitat for aquatic organisms. Thermal tolerance ranges for steelhead trout range from 4-23 degrees centigrade (Moyle 2002), however, optimal growth conditions for juvenile steelhead range between 10-16 degrees centigrade. The levels of dissolved oxygen in water are strongly correlated to temperature. The higher the temperature, the lower the ability of the water to store dissolved oxygen. Monitored water temperatures could support salmonids, though summer temperatures likely would make salmonids susceptible to the presence of fish disease (McCollough 1999).

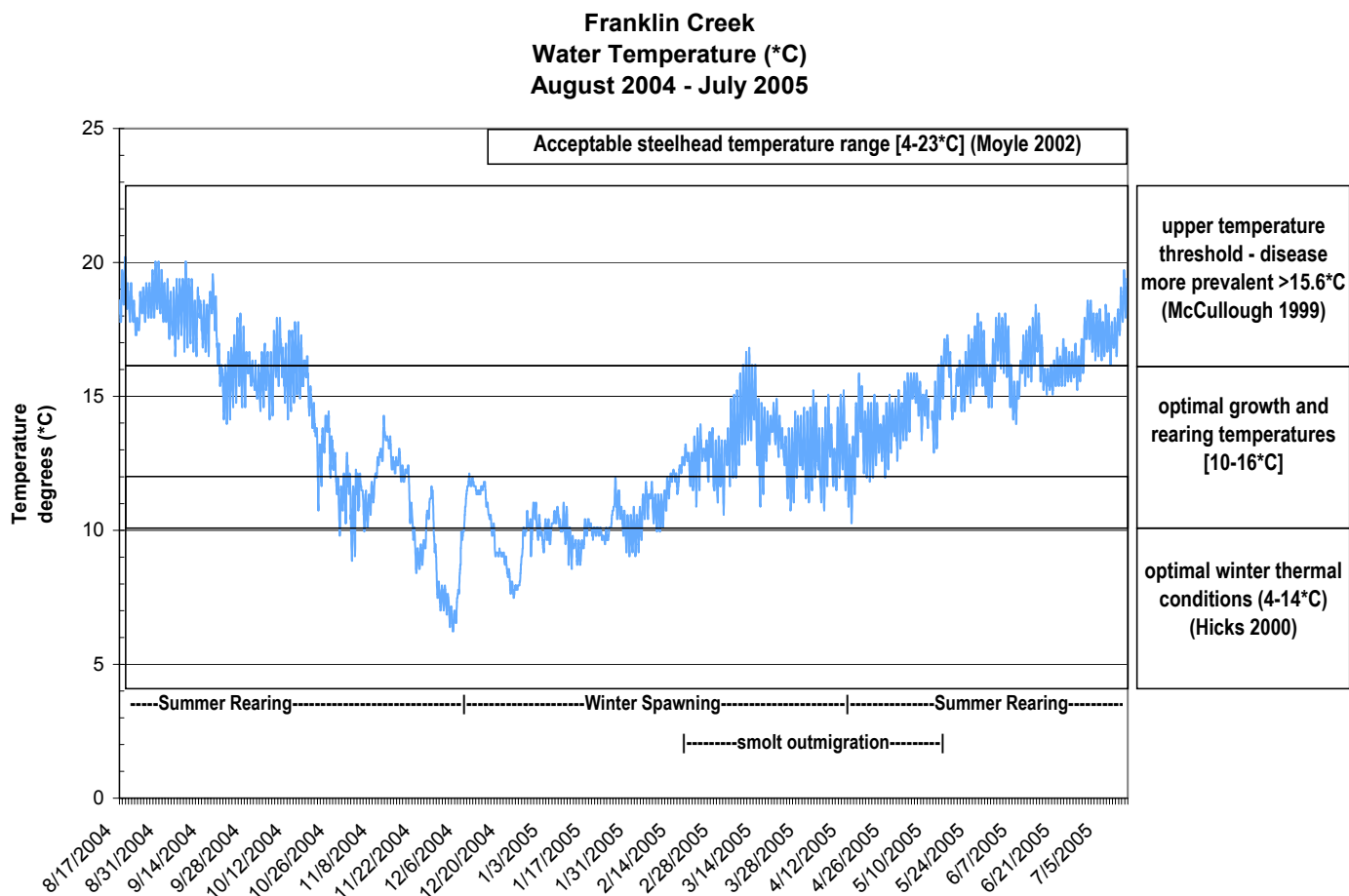


Figure 1. Water temperature by date and time collected on Franklin Creek from August 2004 to July 2005.

DISCUSSION AND RECOMMENDATIONS

Aquatic Habitat

Based on the length and lack of complexity of the survey reach, annual surveys may be conducted in conjunction with additional aquatic surveys and can be completed in a single day. Sampling requires a single trained person, with one or two additional people to assist with the electrofishing. The habitat portion of the survey can document changes in habitat composition and channel morphology from year to year. The fish sampling can provide presence/absence information for fish and other aquatic vertebrates and larger invertebrates. This would be useful to detect occurrences of non-native species or species of concern such as steelhead (*Oncorhynchus mykiss*), which have been documented in the mainstem of Alhambra Creek. Surveys along this reach of Franklin Creek may also incorporate methods for other sampling protocols, including amphibian and reptile, and non-native plant sampling during the sample day.

Because of the high conductivity levels in Franklin Creek, electrofishing has not been effective for quantifying abundance of stickleback. Seining or minnow traps may be a better option for developing abundance indices, particularly for stickleback which do not seem to respond well to electrofishing under the stream conditions typically encountered.

Although the observed temperature ranges (6°C-20°C) for Franklin Creek are well within acceptable ranges (4°C-23°C) for steelhead trout (Moyle 2002), no steelhead were observed in the 84.0 meters surveyed. A benthic macroinvertebrate analysis conducted during the spring of 2004 suggested a high disturbance level for Franklin Creek (Lee and Coopridier 2005). The high disturbance levels found by Lee and Coopridier is further supported by the high observed specific conductance, which indicates poor water quality in lotic systems. The low observed water temperatures are probably due to the water source (predominantly spring fed) and the Highway 4 underground culvert just upstream of the sampling location (Alhambra Creek Watershed Planning Group 2001).

Water Quality

While temperatures are concerning, the primary limiting factor to salmonids in this reach may actually be conductivity and salinity. The salinity and conductivity levels documented through multiple water quality monitoring events are consistently above levels that should support a freshwater aquatic community. Annual rainfall in the watershed is 24-26 inches. It is likely that these high levels of salinity and conductivity are a result of either concentrating effects associated with heavy human disturbance (e.g. land use, highway 4) in the watershed or salts leaching out of the groundwater under low flow conditions. Evaluation of monitoring results from other watersheds in the area should be conducted to determine if these salinity levels are only high in Franklin Creek, or throughout the Alhambra Creek watershed.

In 2005, Leidy et. al. documented all recorded steelhead observations in Alhambra Creek including a two mile visual survey in 1946 where no steelhead were observed, and a CDFG memo concluded there was no salmon run in the watershed (Crocker 1946). If high salinity is the condition throughout the Alhambra Creek watershed, that could be another reason for very low numbers of salmonids dating back as early as the 1940s and potentially earlier.

Other Recommendations

Strentzel Canyon Creek in the Mt Wanda subwatershed may be assessed to establish baseline fish/aquatic species assemblage use (if any) in this ephemeral watershed. Approximately 44% of this subwatershed to Alhambra Creek lies within NPS lands (Alhambra Creek Watershed Planning Group 2001). Efforts could include bank observations, general systematic sampling or index reach monitoring as described in the Summer/Fall Stream Fish and Habitat Surveys Standard Operating Procedure 1 (Ketcham et al. 2005) or amphibian survey methods developed for the San Francisco Area Network Inventory and Monitoring Program.

The Olmstead Center for Landscape Preservation recently completed a Cultural Landscape Report for John Muir National Historic Site (Killion 2005). The report recommends two general actions with respect to the Orchard Reach of Franklin Creek.

1. Retain and reestablish historic character of Franklin Creek through the restoration of native riparian complex and management of the riparian corridor height (to maintain desired viewshed).
2. notch or remove cement weir at north end of Orchard Reach.

Our summary of stream conditions notes high water temperatures throughout much of the summer which is directly affected by the density of the riparian corridor. Management of riparian vegetation or its height would reduce the effectiveness of this corridor to provide thermal protection to the stream. It is noted that the specific management needs related to the riparian area should be addressed as part of the Orchard Management Plan. As discussed, this is a highly degraded watershed, and the JOMU reach, while not directly affected by park operations, shows the results of the watershed degradation. The riparian corridor does provide shade and is likely the reason temperatures are held to around 20 degrees C in the summer. Evaluation of this recommendation and how it might be implemented in a manner that does not make the stream reach susceptible to higher temperatures would be appropriate.

The CLR report notes that the cement weir is not a cultural feature and recommends notching or removal. A first step to determining the response, whether to remove or maintain the weir, is to understand the fish passage conditions leading up to the weir from the confluence with Franklin Creek. The channel is highly developed and culverted, and is not likely a good fish passage restoration candidate. The second evaluation would be how removal or lowering of the weir may effect the existing channel and habitat condition within the Orchard Reach. Complete removal would eliminate the existing grade control. This would likely need to be replaced with more appropriate structures that would generally maintain the grade but provide for better aquatic species movement through the control section. Removal without additional treatment would likely result in deeper incision of the channel through the orchard reach, further limiting habitat condition. Notching of the weir could be an effective means of focusing low flow, accommodating better aquatic species movement and maintaining the existing grade control. This would be a lower-cost solution to reduce general impact on stream process by this facility.

Future discussions regarding the restoration of process or function to the JOMU reach of Franklin Creek should only be undertaken after a more thorough assessment of Franklin Creek's capacity to support a steelhead fishery, the hydrologic connectivity downstream and upstream (primarily fish passage), and watershed impacts upstream.

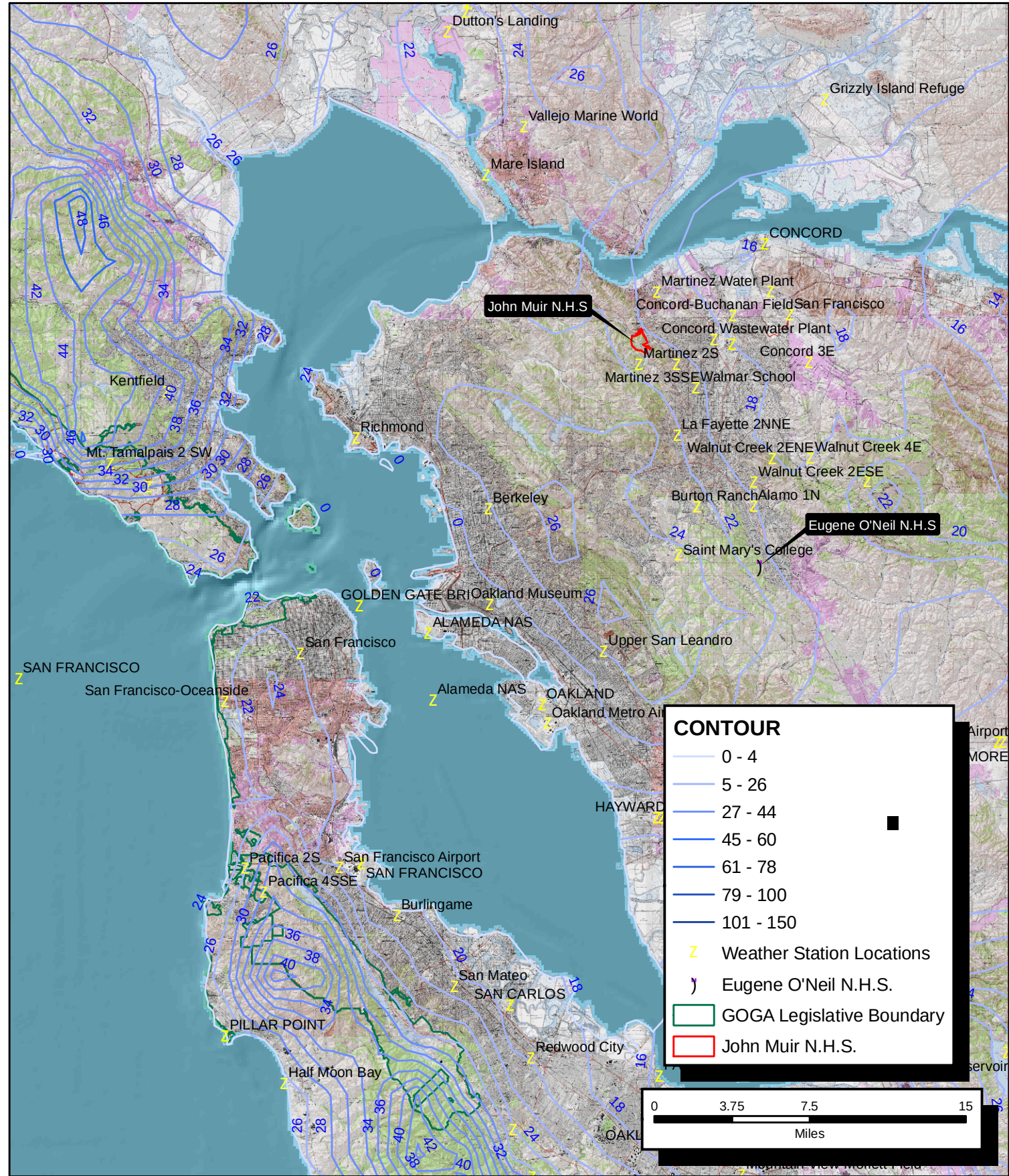
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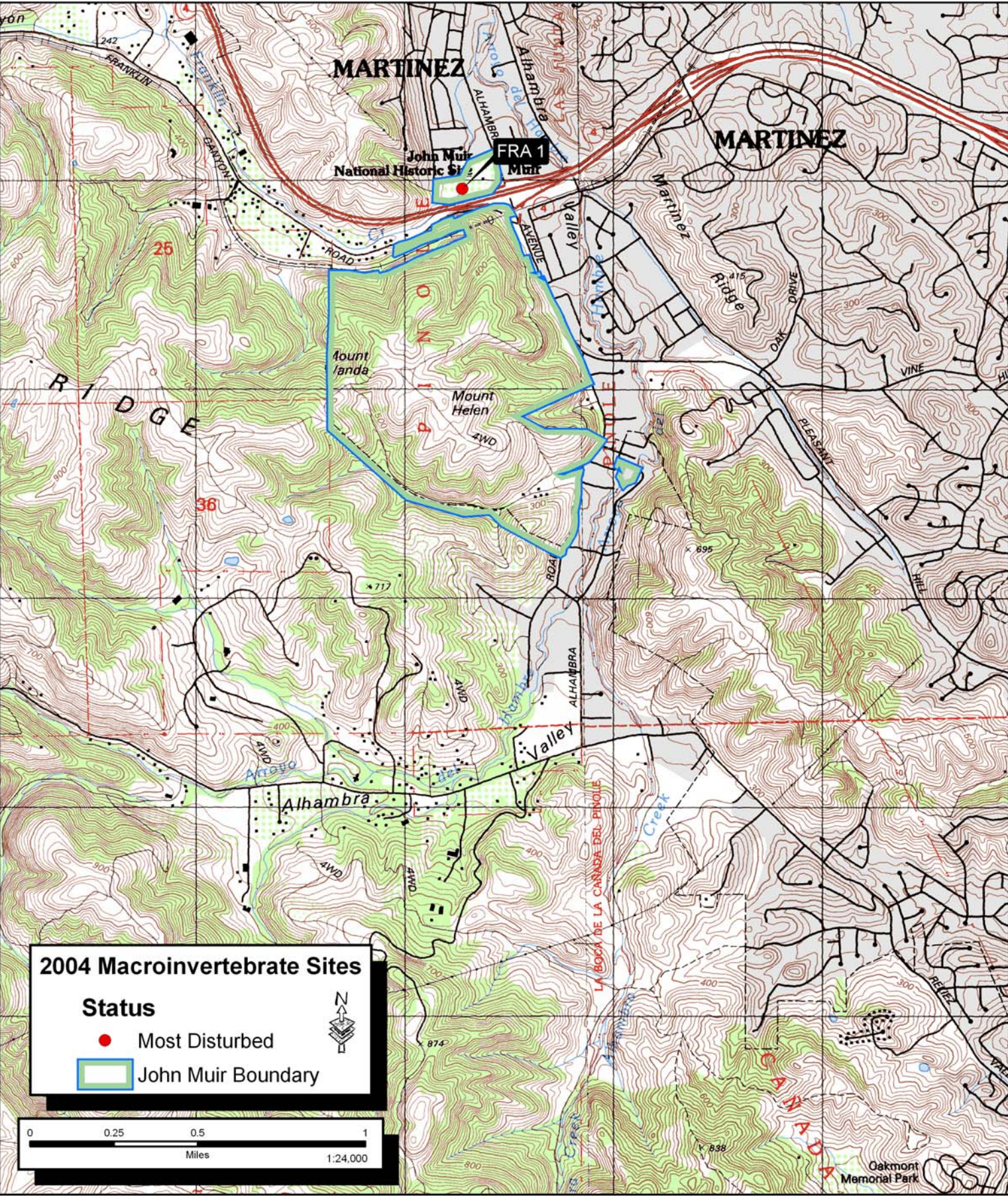
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San Francisco Area Network

Weather Station Locations and Average Annual Precipitation Amounts (in) 1961-1990 NRCS

National Park Service
U.S. Department of the Interior





Appendix A. Habitat typing results from JOMU reach of Franklin Creek, summer 2002-2005.

Unit #	Length (m)	Unit type	subtype	max depth (m)	mean width (m)	surface area (sq m)	habitat comments
Aug-02							
1	3.4	pool	DPL			2.0	6.8 starts at concrete dam at north Park boundary
2	25.8	pool	MCP	0.41		2.4	60.6 bridge at downstream end
3	9	pool	MCP	0.41		1.9	17.4 small rock barrier btn unit 2 & unit 3
4	6	riffle	LGR			1.0	6.0
5	5.3	flatwater	FW/MCP			1.0	5.3
6	33.3	riffle	LGR			0.5	16.7 dense thicket overgrown btn unit 5 & unit 6
7	4.7	flatwater	FW/SC	0.25		1.7	8.1 Hwy 4 culvert at upstream end
				87.5		1.5	120.9
Jun-03							
1	30.8	pool	MCP	0.5		2.7	84.2 trench pool, vertical banks, weir at downstream end
2	10.2	pool	MCP	0.5		2.6	26.7
3	4	riffle	LGR			1.2	4.9 dense willow overgrowth
4	2.5	flatwater	GLD	0.15		1.8	4.4
5	13	riffle	LGR			1.1	14.9
6	6	flatwater	GLD	0.24		1.8	11.0
7	15	riffle	LGR			1.0	14.5 dense willow overgrowth
8	6.5	flatwater	GLD	0.18		3.1	20.1 at outlet of Hwy 4 culvert
				88.0		1.9	180.6
Jun-04							
1	6	pool	DPL	0.41		2.9	17.4 concrete weir at downstream end
2	33.3	pool	MCP	0.55		2.5	83.3 bridge at downstream end
3	2.7	riffle	LGR			0.7	1.9
4	7.9	flatwater	FW/MCP	0.35		1.1	8.7 dense willow overgrowth in middle
5	13.2	riffle	LGR			0.9	11.9
6	5.2	flatwater	GLD	0.21		1.7	8.8
7	17.5	riffle	LGR			0.8	14.0 redwoods on right bank
8	2.7	flatwater	GLD			3.4	9.2 at outlet of Hwy 4 culvert
				88.5		1.8	155.1

Unit #	Length (m)	Unit type	subtype	max depth (m)	mean width (m)	surface area (sq m)	habitat comments
May-05							
1	33.0	pool	DPL/MC	1.80	2.7	89.1	concrete weir at downstream end
2	8.0	pool	MC	1.64	2.7	21.6	
3	3.9	riffle	HGR	0.67	2.0	7.8	
4	7.3	pool	SC	1.60	1.9	13.9	
5	9.1	riffle	LGR	0.6	2.3	20.9	
6	10.1	flatwater	FW	0.78	2.1	21.2	redwoods on right bank
7	12.6	riffle	LGR/HGR	0.78	1.6	20.2	at outlet of Hwy 4
	84.0				2.2	194.7	

