EXECUTIVE SUMMARY

Watershed Analysis for Mendocino Redwood Company's Ownership in the Navarro River Watershed

This report presents the results of a watershed analysis performed by Mendocino Redwood Company (MRC) on their ownership[1] in the Navarro River watershed. The MRC ownership in the Navarro River watershed is considered the Navarro watershed analysis unit (WAU). This section presents a brief overview of the watershed and the watershed analysis process followed by MRC. More specific information is found in the individual modules of this report.

The Navarro River is on the 303(d) list as sediment and temperature impaired and a total maximum daily load (TMDL) has been developed for sediment and temperature reduction in the river (NCRWQCB, 2000). The Navarro River and its tributaries support populations of coho salmon and steelhead trout, two fisheries of concern in northern California. For this reason MRC conducted a watershed analysis to assist in their efforts to reduce non-point source pollution, evaluate current and past land management practices and establish a baseline for monitoring of watershed conditions over time. The watershed analysis will also be used to identify needs for site-specific management planning and restoration in the watershed to reduce impacts to aquatic resources and potentially to improve fish and aquatic habitat conditions.

MRC's approach to the Navarro River watershed analysis was to perform resource assessments of mass wasting, surface and point source erosion (roads/skid trails), hydrology, fish habitat, riparian condition and stream channel condition. Mass wasting, riparian condition and surface and point source erosion modules address the hillslope hazards. The fish habitat and stream channel condition modules address the vulnerability of aquatic resources. Prescriptions are developed to address the issues and processes identified in the watershed analysis. Finally, monitoring is suggested to determine the efficacy of the prescriptions to protect sensitive aquatic resources. The monitoring will provide the feedback for MRC's adaptive management approach to resource conservation.

The Navarro WAU is separated into two separate management units by MRC, Navarro West and Navarro East (see Navarro WAU Base Maps A and B). Much of the data was summarized and presented by these administrative units.

RESULTS

Mass Wasting

A total of 1220 shallow-seated landslides (debris slides, torrents, or flows) were identified and characterized in the Navarro WAU, 578 in Navarro West and 642 in Navarro East. A total of 270 deep-seated landslides (rockslides or earth flows) were mapped in the Navarro WAU, 187 in Navarro West and 83 in Navarro East. Of the 1220 shallow-seated landslides in the Navarro WAU, 759 are determined to be road-associated. This is approximately 62% of the total number of shallow-seated landslides.

[1] It must be emphasized that only the Mendocino Redwood Company ownership is analyzed in the watershed.

A total of 2,189,000 tons of mass wasting sediment delivery was estimated for the time period 1969-2000 in the Navarro WAU. This equates to 750 tons/sq. mi./yr. Of the total estimated amount, 258,500 tons (12% of total) occurred from 1969-1981, 441,600 tons (20% of total) occurred from 1982-1987, and 1,492,000 tons (68% of total) occurred in the 1988-2000 time period (Table A-5). A total of approximately 84,000 tons was delivered into Navarro West in 1995 by the Floodgate slide, which is 4% of the total delivery from 1969-2000 and 6% of the total amount delivered from 1988-2000 in the whole Navarro WMU. The sediment delivery was a result of a deep-seated rockslide that was not caused by forest management practices (Sownma-Bawcom, 1996).

Relatively large amounts of sediment delivered from 1988-2000 compared to earlier time periods results from several factors, including high rain fall events during this time frame, two sets of aerial photographs analyzed during this time, and field work done in the summer of 1999. Consequently more landslides where found in the 1988-2000 period than the other periods.

The landscape was partitioned into six Mass Wasting Map Units (MWMU) representing general areas of similar geomorphology, landslide processes, and sediment delivery potential for shallow-seated landslides (Map A-2). The total sediment delivered from non-road related slides in MWMU 1, 2, and 3 was 81%, while MWMU 4 delivered 19% of the total non-road related delivery.

Surface and Point Erosion (Roads/Skid Trails)

It was determined that there are 617 miles of truck roads in the Navarro WAU (skid trails not included). This represented a road density of 7.3 miles of road per square mile. In the Navarro WAU 276 controllable erosion sites have high treatment immediacy and 466 controllable erosion sites have moderate treatment immediacy. In addition to these controllable erosion sites 610 culverts or crossings in the Navarro WAU have a diversion potential. These diversion potential sites need to be considered a high priority for road improvement as they can represent a significant potential fluvial erosion hazard. The culvert size analysis has determined that 260 culverts are potentially too small to pass the 50 year flood and an additional 276 culverts potentially will not pass the 100 year flood.

Roads in the MRC ownership in the Navarro WAU are estimated to generate, on average, 490 tons/mi^2/yr of sediment from road-associated surface and point source erosion. This represented 520 tons/mi^2/yr and 450 tons/mi^2/yr of estimated sediment delivery from Navarro East and Navarro West respectively (Table ES1 a & b).

Table ES-1(a) Road Associated Surface and Point Source Erosion Estimates by Planning Watershed for the Navarro East, MRC ownership.

Planning Watershed	**MRC Owned Acres**	**Surface Erosion (tons/yr)**	**Point Source Erosion (tons/yr)**	**Total Road Assoc. Erosion (tons/yr)**	**Road Assoc. Erosion Rate (tons/sq mi/yr)**
Dutch Henry Creek	4625	709	1537	2246	311
North Fork Indian Creek	1729	187	535	721	267
John Smith Creek	2080	569	2108	2678	824
Lower South Branch Navarro River	3988	532	287	819	131
Middle South Branch Navarro	6095	1359	3576	4935	518
Little North Fork Navarro River	6423	1648	5905	7553	753
Upper South Branch Navarro River	4807	1090	700	1790	238
Navarro East Totals (rounded)	***30,000***	***6,000***	***14,500***	***21,000***	***450***

Table ES-1(b) Road Associated Surface and Point Source Erosion Estimates by Planning Watershed for the Navarro West, MRC ownership.

Planning Watershed	MRC Owned Acres	Surface Erosion (tons/yr)	Point Source Erosion (tons/yr)	Total Road Assoc. Erosion (tons/yr)	Road Assoc. Erosion Rate (tons/sq mi/yr)
Rancheria Creek	742	542	930	1472	1270
Flynn Creek	2874	397	75	472	105
Floodgate Creek	704	67	8	75	68
Hendy Woods	998	585	757	1341	860
Lower Navarro River	4583	1149	433	1582	221
Middle Navarro River	4641	1328	649	1978	273
North Fork Navarro River	3943	1310	637	1947	316
Ray Gulch	2982	896	5573	6470	1389
Upper Navarro River	2925	991	3547	4538	993
Mill Creek	429	96	27	123	184
Navarro West Totals (rounded)	***25000***	***7500***	***13000***	***20000***	***520***

The future potential for point source erosion was evaluated in the Navarro WAU. This potential erosion or controllable erosion was identified during the road inventory during 1998-2000. A total of 1,103,723 cubic yards of controllable erosion was identified in the Navarro WAU (Table ES-2).

Table ES-2. Controllable Erosion by Treatment Immediacy for the Navarro WAU.

	Controllable Erosion Treatment Immediacy (yd^3)				
Location	**High**	**Moderate**	**Low**	**None**	**Undetermined**
Navarro East	221958	80573	194689	21715	10
Navarro West	96836	378072	102429	1164	53
Navarro WAU Total	***318794***	***458645***	***297118***	***22879***	***63***
Percent of total	29%	42%	27%	2%	<1%

In the Navarro WAU the majority of the forested portion of what is now the MRC ownership was harvested using tractor based yarding during the 1940s, 1950s and 1960s. This high level of skid trail construction and use is estimated to contribute a high level of sediment delivery. In general, skid trail sediment delivery rates were higher in Navarro East during the 1940s and 1950s than Navarro West. Navarro East has a more consistent skid trail sediment delivery rate for the duration of that time period than Navarro West.

Hydrology

Using the peak flow record from 1952-1998, the flood of record for the Navarro River is 1955 (64,500 cfs) considered to be greater than a 50 year event for the Navarro River. Throughout the last 50 years in the Navarro WAU there have been numerous large flood events. There have been 4 events >20 year recurrence (1955, 1965, 1974, and 1993 water years) and an additional 4 events > 10 year recurrence (1970, 1982, 1986, and 1996 water years). In the last decade alone there have been 2 storms greater than a 10 year recurrence (1993 and 1995), 5 storms greater than a 5 year recurrence (1993, 1995(3 events) and 1998) and 8 storms greater than a 2 year recurrence. This indicates a high number of large storms occurring within the last decade. The high occurrence of these large storms in the last decade suggests that the Navarro WAU has been subjected to stressful hydrologic conditions, possibly creating a greater incidence of landslides, road failures or surface erosion than previous decades. These flood events have the capacity to re-shape river or stream channels and transport large sediment loads. The meteorological events that created these large floods also can be assumed to be a major contributor to the erosion and mass wasting delivered to the watercourses in the WAU.

Riparian Function

The riparian function assessment is divided into two groups: 1) the potential of the riparian stand to recruit large woody debris (LWD) to the stream channel along with the level of concern about current LWD conditions in the stream, and 2) a canopy closure and stream temperature assessment.
Our analysis showed a need for large woody debris in most of the channel segments of the Navarro WAU due to past stream clearing, historic harvest and low riparian recruitment potentials. Channel segments with LWD levels that are well below targets will need to be a priority for future recruitment and restoration work. Riparian LWD recruitment potential in the Navarro WAU is moderate to low. Currently, the majority of the streams have a deficient LWD quality rating, with the remainder being marginal. None of the major streams in the Navarro WAU received an on target LWD quality rating.

Stream temperatures for the tributary watercourses in the lower portion of the Navarro River, in Navarro West, are all “on target” (see module for description). Further, the small tributaries of the mainstem Navarro River in Navarro West are “on target” for stream temperatures. The mainstem of the Navarro River does not provide water temperatures compatible for salmonid summer rearing. The proximity and size of the mainstem of the Navarro River allows limited ability for streamside vegetation to affect stream temperatures for the Navarro River.

The North Fork of the Navarro River, both the South and North Branches exhibit stream temperatures that are either marginal or deficient to support salmonids. The North Fork of the Navarro River, a.k.a. Navarro East, is further inland and has higher air temperatures. Therefore, higher stream water temperatures should be expected. However, the stream shade quality is either marginal or deficient in the North Fork of the Navarro River (Navarro East). This suggests a need for improvement in stream shading to assist in maintaining more appropriate stream temperatures for aquatic organisms.

Stream Channel Condition

Baseline information on the stream channels of the Navarro WAU was collected and reported (see Stream Channel Condition module). Individual channel segments were categorized into geomorphic units using the baseline stream channel information, topography the channel segments are found in, position in the drainage network, and gradient/confinement classes. Seven stream geomorphic units were established to represent the range of channel conditions and sensitivities to input factors of coarse and fine sediment and LWD (Table ES-3).

Table ES-3. Stream Geomorphic Units and Sensitivities for the Navarro WAU.

Stream Geomorphic Unit	Channel Sensitivity		
	Coarse Sediment	Fine Sediment	LWD
Geomorphic Unit I. Estuarine Channels of the Navarro River.	Low	Moderate	Low
Geomorphic Unit II. Low Gradient, Confined Channels of the Navarro River.	Moderate	Moderate	Moderate
Geomorphic Unit III. Confined and Moderately Confined Low Gradient Channel Segments in the Navarro River Watershed.	Moderate	Moderate	High
Geomorphic Unit IV. Confined Low Gradient Channel Segments of Small Tributary Streams in the Navarro River Watershed.	High	Moderate	High
Geomorphic Unit V. Channel Migration/Avulsion Channel Segments in the Navarro River Watershed.	Moderate	Low	High
Geomorphic Unit VI. Moderate Gradient Confined Transport Segments.	Moderate	Low	Moderate
Geomorphic Unit VII. High Gradient Transport Segments.	Low	Low	Low

Fish Habitat Assessment

The anadromous fish species inhabiting the Navarro River WAU are steelhead trout (*Oncorhynchus mykiss*), coho salmon (*O. kisutch*) and Pacific lamprey (*Lampetra tridentata*). Non-anadromous species include sculpin (*Cottus spp.),* threespine stickleback (*Gasterosteus aculeatus*), California roach (*Lavinia symmetricus*), and Sacramento sucker (*Castomus occidentalis*). On MRC's property there are approximately 63 stream miles of habitat being utilized by coho and 95 stream miles of habitat being utilized by steelhead in the Navarro River watershed.

Habitat typing data indicated that spawning habitat was fair to good throughout most of the Navarro WAU. However, permeability data indicated areas with poor quality spawning gravel, especially in the North Branch North Fork Navarro River. Reduction of erosion rates should increase the quality of spawning gravel in the Navarro River WAU. Throughout most of the Navarro WAU, summer rearing and over-wintering habitat is limited by a lack of large woody debris and deep pools. Land management activities that promote woody debris recruitment and reduce pool filling (caused by erosion) should directly increase the quality of rearing habitat in the Navarro WAU.

Sediment Input Summary

The average estimated sediment input for the past thirty-two years for the Navarro WAU is 1300 tons/square mile/year. The Navarro WAU is broken down into two areas Navarro West and Navarro East for sediment inputs. Sediment inputs over the last thirty two years in Navarro West have come from hillslope mass wasting (25%), road mass wasting (23%), road surface and point source erosion (49%) and to a lesser extent skid trail erosion (3%). In Navarro East sediment inputs came from hillslope mass wasting (9%), road mass wasting (61%), road surface and point source erosion (27%), and to a lesser extent skid trail erosion (3%).

Road associated erosion is the dominant sediment contributing process in the Navarro WAU. The road associated mass wasting and surface and point source erosion combined accounts for 88% of the estimated sediment inputs in the Navarro East. In Navarro West road associated mass wasting and surface and point source erosion combined accounted for 72% of the sediment input. Mass wasting from roads accounts for 61% of the sediment inputs in the Navarro East. While in Navarro West mass wasting associated with roads accounted for 23% of the sediment input.

Land Management Prescriptions

The following prescriptions were specifically prepared for use in the Navarro WAU. These prescriptions are meant to help address issues to aid in the stewardship of aquatic resources of the Mendocino Redwood Company ownership in the Navarro WAU. The prescriptions are meant to be used in addition to the current California Forest Practice Rules and company policies. At the time of the publication of this watershed analysis MRC's forest management policies are governed by interim guidelines prior to the issuance of a Habitat Conservation Plan and Natural Community Conservation Plan (HCP/NCCP). Once the HCP/NCCP is approved, the conservation strategies set forth in these documents will become the company policies. A prescription is only presented if it deviates from or adds clarification to these policies.

Mass Wasting

Mass wasting map unit 1 – Inner gorge or steep streamside slopes adjacent to low gradient watercourses

MWMU 1 Road placement, construction, and management:

- New road construction in MWMU 1 will not occur unless it is the only access available. If new road construction must occur it will only be to gain entry in and out of MWMU 1 and construction developed with the approval of a California Registered Geologist. The exception is when the road is the best alternative.
- Seasonal roads (roads subjected to annual use) in MWMU 1, including newly constructed roads and re-opened existing roads, will have the surface armored with rock.
- Temporary roads (roads only used periodically, every few years or decades) in MWMU 1 will be storm-proofed (such as suggested in Weaver and Hagans, 1994) prior to the winter period and the surface stabilized with grass seed, mulch, or other cover product.
- Any road that is within MWMU 1 will not have winter period heavy truck or log hauling traffic unless armored with a rock surface.
- The slopes of the inner gorge or the first 50 feet, whichever is longer, will be an equipment exclusion zone (EEZ) except for designated crossings and existing truck roads.

MWMU 1 timber harvest:

- MWMU 1 will receive no harvest on inner gorge slopes unless approved by a California Registered Geologist. On other areas (non-inner gorge slopes) within MWMU 1 in addition to the riparian protections set as company policy timber harvest must retain a minimum of 50% overstory canopy dispersed evenly across the slopes.
- The MWMU 1 protections will extend from the edge of the watercourse transition line up to the break in slope of the inner gorge and 25 feet of additional slope distance after the break in slope of the inner gorge.
- For those areas that do not have well defined inner gorge topography in MWMU 1 timber harvest must retain 50% overstory canopy.
- The area directly adjacent to the break in slope of the inner gorge will retain those trees with a root mass that maintains the stability of that slope break.

- Trees within 10 feet of the bankfull channel will be retained, except for redwood clumps. At least 50% of a redwood clump must be retained with emphasis on leaving the trees most likely to deliver to the stream in this 10 foot zone.

Mass wasting map unit 2 – Inner gorge or steep streamside slopes adjacent to moderate to high gradient watercourses

Road construction, placement or management:

- Alternatives to road construction or road use, such as cable yarding, helicopter yarding or alternative road placement, will be pursued in MWMU 2.
- New road construction in MWMU 2 will not occur unless it is the only access available. If new road construction must occur it will only be to gain entry in and out of MWMU 2 and construction developed with the approval of a California Registered Geologist. The exception is when the road is the best alternative.
- The slopes of the inner gorge or the first 50 feet, whichever is longer, will be an equipment exclusion zone (EEZ) except for designated crossings and existing truck roads.

Timber Harvest:

- MWMU 2 will receive no harvest on inner gorge slopes unless approved by a California Registered Geologist. On other areas (non-inner gorge slopes) within MWMU 2 in addition to the riparian protections set as company policy timber harvest must retain a minimum of 50% overstory canopy dispersed evenly across the slopes.
- Trees within 10 feet of the bankfull channel will be retained, except for redwood clumps. At least 50% of a redwood clump must be retained with emphasis on leaving the trees most likely to deliver to the stream in this 10 foot zone.

Mass wasting map unit 3 – Steep dissected terrain

Forester will utilize available resources for identification of unstable areas or areas with predicted slope instability. These include Map A-1 of Mass Wasting Assessment for the Navarro WAU, Division of Mines and Geology landslide maps (if available), or past Timber Harvest Plans.

Forester will walk the ground of this unit prior to prescribing operations. If upon field review the unit is confirmed to meet the definition of MWMU 3 and a significant risk of sediment delivery is identified the following guidelines apply:

- No road or landing construction activity will occur in areas identified in the field as having a significant likelihood of sediment delivery to a watercourse from mass wasting unless a site-specific assessment is conducted and operations approved by a California Registered Geologist.
- Harvest operations must retain at least 50% of the overstory canopy unless a site-specific assessment is conducted and operations approved by a California Registered Geologist.

Rockslides

No harvest or new road construction will occur on active portions of rockslides with a risk for sediment delivery unless approved by a California Registered Geologist.

Roads

John Smith Creek, Ray Gulch, Upper Navarro, Little North Fork Navarro River, Rancheria Creek and Hendy Woods planning watersheds had the highest rates of road associated erosion. In all of these cases the roads in the planning watersheds had a high amount of point source erosion. This probably indicates older legacy roads that are having a high amount of culvert or landing failures or inappropriate drainage creating gully erosion. These planning watersheds with a high rate of erosion should be considered priorities for erosion control work when considering work in a watershed context (i.e. "buttoning-up the entire watershed").

High and Moderate Erosion Hazard Roads

The roads with a high erosion hazard rating should be given special attention for maintenance or erosion control. These roads should be considered high priority roads for rock surface, improved and increased road drainage relief, design upgrades or decommissioning.

The moderate erosion hazard roads should be given similar attention, but not as high a priority as the high erosion hazard roads.

Masonite Road (M Road)

A management plan has been developed for the Masonite road, across all watersheds (not just the Navarro WAU). The plan presents a prioritization of where road restoration work should occur and a timeline and process for that restoration.

High and moderate treatment immediacy sites for roads in the Navarro WAU

The high treatment immediacy controllable erosion sites will be the highest priority for erosion control, upgrade, or modifications to existing design. These sites will be scheduled for repair based on operational considerations of harvest scheduling, proximity and availability of equipment, magnitude of the problem, and accessibility to the site.

The moderate treatment immediacy controllable erosion sites will be the next highest priority (relative to the high treatment immediacy sites) for erosion control, upgrade, or modifications to existing design. The moderate treatment immediacy sites will typically be addressed when in close proximity to high treatment immediacy sites.

It is recommended that road site corrections attempt to follow the order of treatment immediacy as presented in Appendix B.

Diversion potential sites along roads in the Navarro WAU

These diversion potential sites will be a high priority for correction. These sites will be scheduled for repair based on operational considerations of harvest scheduling, proximity and availability of equipment, magnitude of the problem, and accessibility to the site. It is very likely that these sites will be addressed when in close proximity to high treatment immediacy sites.

It is recommended that road site corrections attempt to follow the order these diversion potential sites are presented in Appendix B.

Undersized culverts in the Navarro WAU

The 260 culverts that will not pass the 50 year flood will be visited in the field and a determination will be made if the culverts are indeed under-sized (identification of under-sized culverts was done by an office-based evaluation that could be inaccurate). If after field review the culverts are found to be under-sized it will be a high priority for replacement to a watercourse crossing structure that will pass the 100-year flood.

The 16 culverts that will not pass the 100 year flood will be visited in the field and a determination will be made if the culverts are indeed under-sized for this sized flood event (identification of under-sized culverts was done by an office-based evaluation that could be inaccurate). If after field review the culverts are found to be under-sized for the 100 year flood it will be a moderate priority for replacement to a watercourse crossing structure that will pass the 100-year flood. Typically the upgrade will occur once the culvert has reached the end of its operational life.

The field review will consist of determining the cross section area of the bankfull channel and comparing it the cross sectional area of the culvert in question. A rule of thumb is that to pass the 100 year flood the culvert opening area needs to be 3 times as large as the bankfull channel cross section area (Cafferata, Spittler, and Wopat, 2000).

Fish passage barriers from culverts in the Navarro WAU

There are 3 known culverts that are fish passage barriers Bridge Creek, Camp Creek and an unnamed tributary below John Smith Creek. In the case of Bridge Creek and Camp Creek a bridge should be built at the watercourse crossing. The unnamed tributary below John Smith Creek will be evaluated for appropriate watercourse crossing design for fish passage.

Other fish migration barriers likely exist and need to be investigated over time.

<u>Riparian</u>

Large woody debris recruitment

The company policies for streamside stand retention are considered to be appropriate at this time for LWD recruitment. Monitoring of LWD recruitment will be done to determine if this is correct.

In the interim MRC will promote attempts to place LWD in stream channels to provide habitat structure. The stream locations with high instream LWD demand should be considered the highest priority for LWD placement. The moderate instream LWD demand segments would be next.

When planning for instream LWD placement the following major streams in the Navarro WAU are recommended for a higher level of consideration, due to instream LWD demands and coho salmon habitat improvement:

- Little North Fork Navarro River
- John Smith Creek
- South Branch North Fork Navarro River
- Flynn Creek
- Marsh Gulch
- Murray Gulch

Stream Shade

The company policies for streamside canopy and riparian management are considered to be appropriate at this time.

The 2 river reaches with unnaturally low canopy, the North Branch North Fork Navarro from approximately John Smith Creek downstream to the crossing at highway 128, and the South Branch. North Fork Navarro from Malcom's bridge downstream to the confluence with the North Branch will have the following considerations for canopy improvement:

- Tree planting along the river for restoration of riparian vegetation should be emphasized.
- Restoration harvest within the AMZ will not remove trees providing effective shade.
- Stream temperatures will be monitored to determine if temperatures are lowering as canopy grows in over time.

Monitoring

Aquatic resources monitoring will be conducted in the Navarro WAU. This monitoring is to assist Mendocino Redwood Company to assess impacts to aquatic resources associated with past or future timber harvest and related forest management activities in the Navarro WAU. The monitoring suggested in this plan is monitoring that MRC across all its lands including the Navarro WAU. However, other monitoring efforts not mentioned here may be conducted by MRC in the Navarro WAU. Currently a comprehensive monitoring plan is being developed for the MRC lands. Once that plan is finalized it will supercede the monitoring presented here.

Monitoring Plan Goals:

- Test the efficacy of the Navarro WAU prescriptions to address impacts to aquatic resources from timber harvest and related forest management activities.
- To assess long term channel conditions. Are current and future forest management practices inhibiting, neutralizing or promoting stream channel conditions for aquatic habitat?

A monitoring report will be produced each year that monitoring is conducted in the Navarro WAU. The report will cover the monitoring and analysis that has occurred up to that year; if no monitoring is conducted in a given year than no report will be produced. The goal will be to have a report completed by February of the year following the monitoring. Table ES-4 summarizes some of the monitoring to be conducted in the Navarro WAU over time.

Table ES-4. Monitoring Matrix for Mendocino Redwood Company Lands Including the Navarro Watershed Analysis Unit.

Monitoring Objectives	**Reasoning, Comments**	**Technique**
1. Determine effectiveness of measures to reduce management created mass wasting.	Management created mass wasting is significant contributor of sediment delivery.	Evaluation of mass wasting following a large storm event or after approximately 20 years.
2. Determine effectiveness of erosion control practices on high and moderate surface erosion hazard roads and landings.	Roads provide sediment delivery in the Navarro WAU.	Evaluation of watercourse crossings, landings, and road lengths for erosion evaluation.
3. Determine in-stream large woody debris amounts over time.	Large woody debris is needed for stream channel and aquatic habitat improvement in the Navarro WAU.	Stream LWD inventories and mapping of LWD designation areas in select stream reaches and long term channel monitoring sites.
4. Determine if stream temperatures are staying within properly functioning range for salmonids.	Stream temperature can be a limiting factor for salmonid growth and survival.	Stream temperature probes and assessment conducted in strategic locations.
5. Determine if fine sediment in stream channels is creating effects deleterious to salmonid reproduction.	Many forest practices can produce high fine sediment amounts. Need to ensure fine sediments are not impacting salmonid reproduction.	Permeability measurements on select stream reaches (bulk gravel samples if necessary).
6. Determine long-term channel morphology changes from coarse sediments.	Channel morphology can be altered from sediment increases, possibly affecting aquatic habitat.	Thalweg profiles and cross section surveys on select stream reaches.
7. Determine presence and absence of fish species in Class I watercourses.	Management practices and resource protections can affect distribution of aquatic organisms.	Electro-fishing and snorkeling observations at select locations to determine species composition and presence.

INTRODUCTION

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INTRODUCTION

This report presents the results of a watershed analysis performed by Mendocino Redwood Company (MRC) on their ownership in the Navarro River watershed. The MRC ownership in the Navarro River watershed is considered the Navarro watershed analysis unit (WAU). This section presents a brief overview of the watershed and the watershed analysis process followed by MRC. More specific information is found in the individual modules of this report.

MENDOCINO REDWOOD COMPANY'S WATERSHED ANALYSIS APPROACH

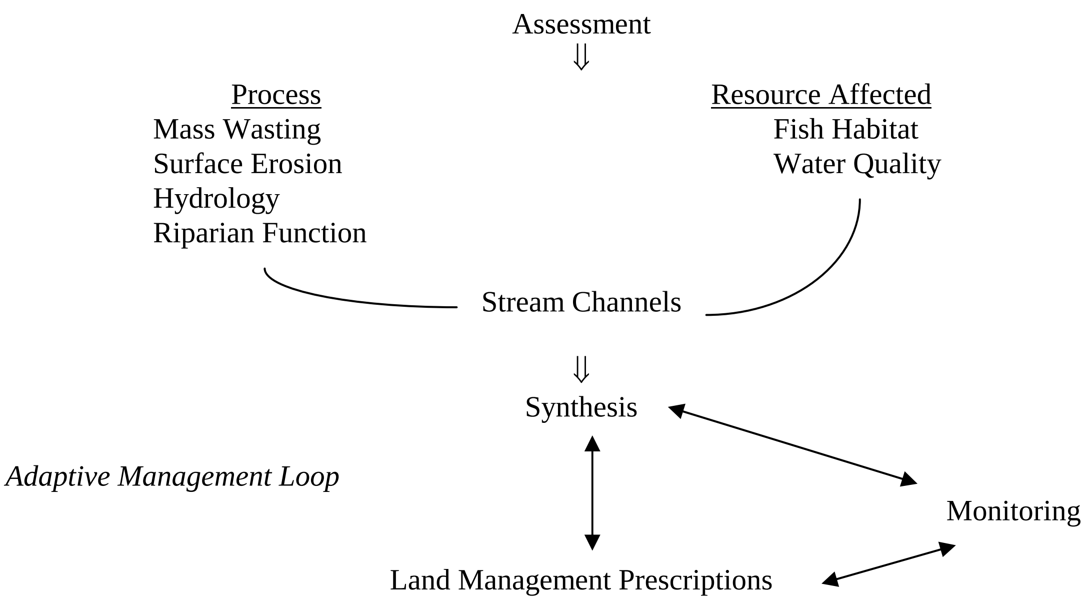
MRC is conducting watershed analysis on watersheds within its ownership in Northern California. The criteria for a watershed to be selected for analysis are: 1) impaired waterbodies pursuant to the Clean Water Act Section 303(d), 2) key fish populations, and 3) forestry operation-related concerns.

The Navarro River is on the 303(d) list as sediment and temperature impaired and a total maximum daily load (TMDL) has been developed for sediment and temperature reduction in the river (NCRWQCB, 2000). The Navarro River and its tributaries support populations of coho salmon and steelhead trout, two fisheries of concern in northern California. For this reason MRC conducted a watershed analysis to assist in their efforts to reduce non-point source pollution, evaluate current and past land management practices and establish a baseline for monitoring of watershed conditions over time. The watershed analysis will also be used to identify needs for site-specific management planning in the watershed to reduce impacts to aquatic resources and potentially to improve fish and aquatic habitat conditions.

The watershed analysis of the Navarro River WAU was conducted following modified guidelines from the Standard Methodology for Conducting Watershed Analysis (Version 4.0, Washington Forest Practices Board). Some variations of the methods in this manual were performed when it was determined that the methodology better served the purpose of this assessment. The watershed analysis process is not yet a regulatory requirement in the state of California. However, MRC is using this process to address cumulative effects from forest practices and provide baseline information of watershed conditions for aquatic habitat and water quality for their ownership.

MRC's approach to the Navarro River watershed analysis was to perform resource assessments of mass wasting, surface and point source erosion (roads/skid trails), hydrology, fish habitat, riparian condition and stream channel condition. Mass wasting, riparian condition and surface and point source erosion modules address the hillslope hazards. The physical processes and potential triggering mechanisms for each hillslope hazard are described in the module reports. The fish habitat and stream channel condition modules address the vulnerability of aquatic resources. The results of the resource assessments are synthesized and reported in a causal mechanism report (Figure 1). A causal mechanism report is produced for each hillslope hazard that has affected or has the potential to adversely affect aquatic resources. A prescription is developed to address the issues and processes identified in each causal mechanism report. Finally, monitoring is suggested to determine the efficacy of the prescriptions to protect sensitive aquatic resources. The monitoring will provide the feedback for MRC's adaptive management approach to resource conservation.

Figure 1. Watershed Analysis Overview



ASSESSMENT OVERVIEW

This watershed analysis was produced from a combination of field observations performed during the summer of 1999-2001, aerial photograph interpretation, and use of existing analysis on the Navarro WAU.

Existing data or analysis used in this watershed analysis included: Louisiana-Pacific's (L-P) Coastal Mendocino Sustained Yield Plan, Fish and Game Reports on large woody debris removal, monitoring data collected by L-P, and a fish habitat assessment report prepared by Alice Rich for L-P. These information sources are cited in each module as they are used.

Aerial photograph interpretation was performed using available aerial photographs for the recent time period. The delineation of time periods for analysis was based on the available aerial photographs. The aerial photographs used are described below.

Aerial Photo Year	Scale	Photo Source
1952	1:20000	Mendocino County
1963	1:20000	Mendocino County
1973	1:20000	Mendocino County
1978	1:15840	Mendocino Redwood Co.
1981	1:20000	Mendocino County
1988	1:12000	Mendocino Redwood Co.
1988	1:31680	Mendocino County
1996	1:12000	Mendocino Redwood Co.
2000	1:13000	Mendocino Redwood Co.

The synthesis of the field observations, aerial photo interpretation and existing analysis on the WAU constitutes the resource assessment modules in this report.

NAVARRO RIVER WATERSHED OVERVIEW

Physical Characteristics

General Location

The Navarro WAU is located in the California Coast Range and drains into the Pacific Ocean in western Mendocino County, California. The outlet of the Navarro River is approximately 17 miles south of the city of Fort Bragg.

The Navarro River watershed encompasses approximately a 315 mi^2 area. The MRC ownership is within 17 different planning watersheds in the Navarro watershed as delineated by the California Water Agency. MRC separates its ownerhsip within the Navarro River watershed into two administrative units Navarro East and Navarro West, this breakdown is defined in Table 1. MRC owns approximately 27 percent of the land in the Navarro River watershed (see Base Map, Navarro River Watershed Map and Table 1). The basin's elevations range from sea level to 3,411 feet. Rainfall is seasonal in this region, with most of the rain (approximately 40-60 inches/year, Table 1) occurring between October and May.

Table 1. Selected Physical Characteristics by Planning Watershed for the Navarro River WAU.

PLANNING WATERSHED	Planning Watershed Number	INVENTORY BLOCK	PLANNING WATERSHED ACRES	MRC OWNED ACRES
Little North Fork Navarro River	114.50060	Navarro East	7,085	6,423
John Smith Creek	114.50061	Navarro East	3,674	2,080
Dutch Henry Creek	114.50062	Navarro East	7,315	4,625
Mill Creek	114.50070	Navarro East	7,738	429
Upper South Branch Navarro River	114.50050	Navarro East	7,898	4,807
Middle South Branch Navarro	114.50051	Navarro East	6,464	6,095
Lower South Branch Navarro River	114.50052	Navarro East	4,448	3,988
North Fork Indian Creek	114.50041	Navarro East	8,902	1,729
Rancheria Creek	114.50020	Navarro East	6,259	742
Upper Navarro River	114.50071	Navarro West	3,757	2,925
Floodgate Creek	114.50072	Navarro West	3,834	704
Middle Navarro River	114.50073	Navarro West	5,728	4,641
North Fork Navarro River	114.50074	Navarro West	5,709	3,943
Flynn Creek	114.50075	Navarro West	4,864	2,874
Ray Gulch	114.50076	Navarro West	3,910	2,982
Lower Navarro River	114.50077	Navarro West	7,776	4,583
Hendy Woods	114.50043	Navarro West	7,770	998

Fisheries

The anadromous fish species inhabiting the Navarro River WAU are steelhead trout (*Oncorhynchus mykiss*), coho salmon (*O. kisutch*) and Pacific lamprey (*Lampetra tridentata*). Non-anadromous species include sculpin (*Cottus spp.),* threespine stickleback (*Gasterosteus aculeatus*), California roach (*Lavinia symmetricus*), and Sacramento sucker (*Castomus occidentalis*). On MRC's property there are approximately 45 stream miles of habitat being utilized by coho and 95 stream miles of habitat being utilized by steelhead in the Navarro River watershed.

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Section A
MASS WASTING

INTRODUCTION

This module summarizes the methods and results of a mass wasting assessment conducted on the Mendocino Redwood Company, LLC (MRC) ownership in the Navarro River watershed, the Navarro Watershed Analysis Unit (Navarro WAU). The Navarro WAU is separated into two separate administrative units Navarro West and Navarro East (Table A-1). This assessment is part of a watershed analysis initiated by MRC and utilizes modified methodology adapted from procedures outlined in the Standard Methodology for Conducting Watershed Analysis (Version 4.0, Washington Forest Practices Board).

Table A-1: Planning Watersheds of Mendocino Redwood Company's Navarro West and Navarro East Administrative Units.

Navarro West	**Navarro East**
Floodgate Creek	Dutch Henry Creek
Flynn Creek	John Smith Creek
Hendy Woods	Little North Fork Navarro River
Lower Navarro River	Lower South Branch Navarro River
Middle Navarro River	North Fork Indian Creek
Mill Creek	Middle South Branch Navarro River
North Fork Navarro River	Upper South Branch Navarro River
Rancheria Creek	
Ray Gulch	
Upper Navarro River	

The principle objectives of this assessment are to:
1) Identify the types of mass wasting processes active in the basin.
2) Identify the link between mass wasting and forest management related activities.
3) Identify where the mass wasting processes are concentrated.
4) Partition the ownership into zones of relative mass wasting potential (Mass Wasting Map Units) based on the likelihood of future mass wasting and sediment delivery to stream channels.

Additionally, the role of mass wasting sediment input to watercourses is examined. This information combined with the results of the Surface and Point Source Erosion module is used to construct a sediment input summary for the Navarro WAU, contained in the Sediment Input Summary section of this watershed analysis.

The products of this report are: a landslide inventory map (Map A-1), a mass wasting map unit (MWMU) map (Map A-2), and a mass wasting inventory database (Appendix A). The data for these products are the interpretation of five sets of aerial photographs, field observations during the summer of 1999, and interpretation of SHALSTAB (Dietrich and Montgomery, 1998) predictions. The 1978 aerial photograph set was used only for the Navarro East area and the 1981 aerial photograph set was used only for the Navarro West area due to lack of coverage in both aerial photographic sets for the entire Navarro WAU. The analysis was done without the use of older aerial photographs (pre-1970s). Therefore the analysis presented is, in general, representative for recent mass wasting conditions (last 32 years).

The assembled information will enable forestland managers to make better forest management decisions to reduce management-induced risk of mass wasting. The mass wasting inventory will provide the information necessary to understand the spatial distribution, causal mechanisms, relative size, and timing of mass wasting processes active in the basin with reasonable confidence.

LANDSLIDE TYPES AND PROCESSES IN THE NAVARRO WAU

The terminology used to describe landslides in this report closely follows the definitions of Cruden and Varnes (1996). This terminology is based on two nouns, the first describing the material that the landslide is composed of and the second describing the type of movement. Landslides identified in the Navarro WAU were described using the following names: debris slides, debris torrents, debris flows, rockslides, and earth flows. These names are described in Cruden and Varnes (1996) with the exception of our use of debris torrent.

Shallow-Seated Landslides

Debris slides, debris flows, and debris torrents are terms used through out Mendocino Redwood Company's ownership to identify shallow-seated landslide processes. The material composition of debris slides, flows, or torrents is considered to be soil with a significant proportion of coarse material; 20 to 80 percent of the particles larger than 2 mm as stated in Cruden and Varnes (1996). Shallow-seated slides generally move quickly downslope and commonly break apart during failure. Shallow-seated slides commonly occur in converging topography where colluvial materials accumulate and subsurface drainage concentrates. Susceptibility of a slope to fail by shallow-seated landslides is affected by slope steepness, saturation of soil, soil strength (friction angle and cohesion), and root strength. Due to the shallow depth and fact that debris slides, flows, or torrents involve the soil mantle, these are landslide types that can be significantly influenced by forest practices.

Debris slides are, by far, the most common landslide type observed in the WAU. The landslide mass typically fails along a surface of rupture or along relatively thin zones of intense shear strain located near the base of the soil profile. The landslide deposit commonly slides a distance beyond the toe of the surface of rupture and onto the ground surface below the failure; it generally does not slide more than the distance equal to the length of the failure scar. Landslides with deposits that traveled a longer distance below the failure scar would be defined as a debris flow or debris torrent. Debris slides commonly occur on steep planar slopes, convergent slopes, along forest roads, and on steep slopes adjacent to watercourses. They usually fail by translational movement along an undulating or planar surface of failure. By definition debris slides do not continue downstream upon reaching a watercourse.

A debris flow is similar to a debris slide with the exception that the landslide mass continues to "flow" down the slope below the failure a considerable distance on top of the ground surface. A debris flow is characterized as a mobile, potentially rapid, slurry of soil, rock, vegetation, and water. High water content is needed for this process to occur. Debris flows generally occur on both steep, planar hillslopes and confined, convergent hillslopes. Often a failure will initiate as a debris slide, but will change as its moves downslope to a debris flow. During this analysis no debris flows where observed.

Debris torrents have the greatest potential to destroy stream habitat and deliver large amounts of sediment. The main characteristic distinguishing a debris torrent is that the mass of failed soil and debris "torrents" downstream in a confined channel and erodes the channel. As the debris torrent moves downslope and scours the channel, the liquefied landslide material increases in mass. Highly saturated soil or run-off in a channel is required for this process to occur. Debris torrents move rapidly and can potentially run down a channel for great distances. They typically initiate in headwall swales and torrent down intermittent watercourses. Often a failure will initiate as a debris slide, but will develop into a debris torrent upon reaching a channel. While actually a combination of two processes, these features were considered debris torrents.

Sediment Input from Shallow-Seated Landslides

The overall time period used for mass wasting interpretation and sediment budget analysis is thirty-two years. Sediment input to stream channels by mass wasting is quantified for three time periods (1969-1980, 1981-1987, 1988-2000). The evaluation assumes that the last 10 years of mass wasting is observed in the aerial photograph. This is because landslide surfaces can re-vegetate quickly, making shallow-seated landslides older than about 10 years difficult to see. We acknowledge that we have likely missed some small mass wasting events during the aerial photograph interpretation. However, we assume we have captured the majority of the larger mass wasting events in this analysis. It is the large mass wasting events that provide the greatest sedimentation impacts. In the case of the landslides observed in the Navarro WAU, landslides greater than 300 cubic yards in size represented over 74% of the sediment delivery estimated. Landslides greater than 200 and 100 cubic yards in size represented approximately 87% and 97%, of the sediment delivery estimated, respectively.

Sediment delivery estimates from mapped shallow-seated landslides were used to produce the total mass wasting sediment input. Some of the sediment delivery from shallow-seated landslides is the result of conditions created by deep-seated landslides. For example, a deep-seated failure could result in a debris slide or torrent, which could deliver sediment. Furthermore, over-steepened scarps or toes of deep-seated landslides may have shallow failures associated with them. These types of sediment delivery from shallow-seated landslides associated with deep-seated landslides are accounted for in the delivery estimates.

Deep-Seated Landslides

The two deep-seated landslide processes identified in the Navarro WAU are rockslides and earth flows. The failure dates of the deep-seated landslides generally could not be estimated with confidence and the landslides are likely to be of varying age with some landslides potentially being over 10,000 years old. Many of the deep-seated landslides are considered "dormant", but the importance of identifying them lies in the fact that if reactivated, they have the potential to deliver large amounts of sediment and impair stream habitat. Accelerated or episodic movement in some landslides is likely to have occurred over time in response to seismic shaking or high rainfall events. Deep-seated landslides can be very large, exceeding tens to hundreds of acres.

Rockslides are deep-seated landslides with movement involving a relatively intact mass of rock and overlying earth materials. The failure plane is below the colluvial layer and involves the underlying bedrock. Mode of rock sliding generally is not strictly rotational or translational, but involves some component of each. Rotational slides typically fail along a concave surface, while translational slides typically fail on a planar or undulating surface of rupture. Rockslides commonly create a flat or back-tilted bench below the crown of the scarp. A prominent bench is usually preserved over time and can be indicative of a rockslide. Rockslides can fail in response to triggering mechanisms such as seismic shaking, adverse local structural geology, high rainfall, offloading or loading material on the slide, or channel incision. The stream itself can be the cause of chronic movement, if it periodically undercuts the toe of a rockslide.

Earth flows are deep-seated landslides composed of fine-grained materials and soils derived from clay-bearing rocks. Earth flow materials consist of 80% or more of the particles smaller than 2mm as stated in Cruden and Varnes (1996). Materials in an earth flow also commonly contain boulders, some very large, which move downslope in the clay matrix. Failure in earth flows is characterized by spatially differential rates of movement on discontinuous failure surfaces that are not preserved. The “flow” type of movement creates a landslide that can be very irregularly shaped. Some earth flow surfaces are dominantly grassland, while some are partially or completely forested. The areas of grassy vegetation are likely due to the inability of the unstable, clay-rich soils to support forest vegetation. The surface of an earth flow is characteristically hummocky with locally variable slope forms and relatively abundant gullies. The inherently weak materials within earth flows are not able to support steep slopes, therefore slope gradients are low to moderate. The rates of movement vary over time and can be accelerated by persistent high groundwater conditions. Timber harvesting can have the effect of increasing the amount of subsurface water, which can accelerate movement in an earth flow (Swanston et al 1988).

Sediment Delivery from Deep-Seated Landslides

A large, active deep-seated slide can deliver large volumes of sediment. Delivery generally occurs over long time periods compared to shallow-seated landslides, with movement delivering earth materials into the channel, resulting in an increased sediment load downstream of the failure. Actual delivery can occur by over-steepening of the toe of the slide and subsequent failure into the creek, or by the slide pushing out into the creek. It is very important not to confuse normal stream bank erosion at the toe of a slide as an indicator of movement of that slide. Before making such a connection, the slide surface should be carefully explored for evidence of significant movement, such as wide ground cracks. Sediment delivery could also occur in a catastrophic manner. In such a situation, large portions of the landslide essentially fail and move into the watercourse “instantaneously”. These types of deep-seated failures are relatively rare on MRC property and usually occur in response to unusual storm events or seismic ground shaking.

Movement of deep-seated landslides has definitely resulted in some sediment delivery in the Navarro WAU. Quantification of the sediment delivery from deep-seated landslides was not determined in this watershed analysis. Factors such as rate of movement, or depth of the deep-seated landslide are difficult to determine without in-depth geotechnical observations that were not conducted in the analysis. Sediment delivery to watercourses from deep-seated landslides (landslides typically $\geq$10 feet thick) can occur by several processes. Such processes can include surface erosion and shallow-or deep-seated movement of a portion or all of the deep-seated landslide deposit.

The ground surface of a deep-seated landslide, like any other hillside surface, is subject to surface erosion processes such as rain drop impact, sheet wash (overland flow), and gully/rill erosion. Under these conditions the sediment delivery from surficial processes is assumed to be the same as adjacent hillside slopes not underlain by landslide deposits. The materials within the landslide are disturbed and can be arguably somewhat weaker. However, once a soil has developed, the fact that the slope is underlain by a deep-seated landslide should make little difference regarding sediment delivery generated by erosional processes that act at the ground surface. Although, fresh unprotected surfaces that develop in response to recent or active movement could become a source of sediment until the bare surface becomes covered with leaf litter, re-vegetated, or soils develop.

Clearly, movement of a portion or all of a deep-seated landslide can result in delivery of sediment to a watercourse. To determine this the slide surface should be carefully explored for evidence of movement. However, movement would need to be on slopes immediately adjacent to or in close proximity to a watercourse and of sufficient magnitude to push the toe of the slide into the watercourse. A deep-seated slide that toes out on a slope far from a creek or moves only a short distance downslope will generally deliver little to a watercourse. It is also important to realize that often only a portion of a deep-seated slide may become active, though the portion could be quite variable in size. Ground cracking at the head of a large, deep-seated landslide does not necessarily equate to immediate sediment delivery at the toe of the landslide. Movement of large deep-seated landslides can create void spaces within the slide mass. Though movement can be clearly indicated by the ground cracks, many times the toe may not respond or show indications of movement until some of the void space is “closed up”. This would be particularly true in the case of very large deep-seated landslides that exhibit ground cracks that are only a few inches to a couple of feet wide. Compared to the entire length of the slide, the amount of movement implied by the ground crack could be very small. This combined with the closing up or “bulking up” of the slide, would not generate much movement, if any, at the toe of the slide. Significant movement, represented by large wide ground cracks, would need to occur to result in significant movement and sediment delivery at the toe of the slide.

Use of SHALSTAB by Mendocino Redwood Company for the Navarro WAU

SHALSTAB, a coupled steady state runoff and infinite-slope stability model, is used by MRC as one tool to demonstrate the relative potential for shallow-landslide hazard across the MRC ownership. A detailed description of the model is available in Dietrich and Montgomery (1998). In the watershed analysis, mass wasting hazard is expanded beyond SHALSTAB. Areas of mass wasting and sediment delivery hazards are mapped using field and aerial photograph interpretation techniques. However, SHALSTAB output was used to assist in this interpretation of the landscape and mass wasting map units.

METHODS

Landslide Inventory

The mass wasting assessment relies on an inventory of mass wasting features collected through the use of aerial photographs and field observations. The 2000 (color), 1996 (color), 1987 (B&W), and 1978 (color) photograph sets used to interpret landslides are owned by MRC. The 1981 (B&W) photograph set was borrowed from the Mendocino County Assessors office. The 2000 photographs are at a scale of 1:13000, the 1996 and 1987 photographs at a scale of 1:12000, the 1981 photographs at a scale of 1:20000 and the 1978 photograph are at a scale of 1:15840. MRC collected data regarding characteristics and dimensions of the identified landslides. Since mass wasting events were essentially “temporally sampled” based on available aerial photographs, we acknowledge that some landslides may have been missed, particularly small ones that may be obscured by vegetation. A description of select parameters inventoried for each landslide observed in the field and during aerial photograph interpretation is presented in Figure A-1.

Figure A-1. Description of Select Parameters used to Describe Mass Wasting in the Mass Wasting Inventory.

- Slide I.D. Number: Each landslide is assigned a two letter code (see below) that denotes which planning watershed the slide is located, followed by two numbers, the first number indicates the USGS designated map section number the slide is mapped in, and the second number indicates the consecutive amount of slides within the map section. For example WI-4-1, is landslide number 1 in Section 4 of the Mill Creek planning watershed.

  Planning Watershed Code

WI	= Mill Creek
WU	= Upper Navarro River
WG	= Floodgate Creek
WM	= Middle Navarro River
WN	= North Fork Navarro River
WF	= Flynn Creek
WR	= Ray Gulch
WL	= Lower Navarro River
WC	= Rancheria Creek
WH	= Hendy Woods
EN	= Little North Fork Navarro
EJ	= John Smith Creek
ED	= Dutch Henry Creek
EU	= Upper South Branch Navarro
EM	= Middle South Branch Navarro
EL	= Lower South Branch Navarro
EI	= North Fork Indian Creek

- MWMU # – Mass Wasting Map Unit in which landslide is located.
- Landslide Process:

DS	= debris slide
DT	= debris torrent
DF	= debris flow
RS	= rockslide
EF	= earth flow

- Certainty: The certainty of identification is recorded.
  D - Definite, P - Probable; Q - Questionable.
- Approximate Failure Date: Minimum failure date is typically the photo year that the slide first appears on or the year observed in the field.
- Physical Characteristics: Includes average length, width, depth, and volume of individual slides.
- Sediment delivery and routing: Includes sediment delivered to streams (N - no sediment delivered; Y - sediment delivered), estimate of the percent of landslide mass delivered, the type of stream that sediment was delivered to (perennial or ephemeral/intermittent).
- Land Use Association: Road, landing, or skid trail association.
- Deep seated landslides morphologic descriptions: toe, body, lateral scarps, and main scarp (see below for descriptions).

Landslides identified in the field and from aerial photograph observations are plotted on a landslide inventory map (Map A-1). All shallow-seated landslides are identified as a point plotted on the map at the interpreted head scarp of the failure. Deep-seated landslides are represented as a polygon representing the interpreted perimeter of the landslide feature.

Physical and geomorphic characteristics of shallow-seated landslides are categorized in a database including identification number, planning watershed, type of landslide, approximate failure date, slope gradient, length, width, depth, volume, sediment delivery, sediment routing, and associated land use (Appendix A). Landslide dimensions and depths can be quite variable, therefore length, width, and depth values that are recorded are considered to be the average dimension of that feature. When converting landslide volumes to mass (tons), we assume a soil bulk density of 100 lbs/cubic foot.

The certainty of landslide identification is assessed for each landslide. Three designations are used: definite, probable, and questionable. Definite means the landslide definitely exists. Probable means the landslide probably is there, but there is some doubt in the analyst's interpretation. Questionable means that the interpretation of the landslide identification may be inaccurate; the analyst has the least amount of confidence in the interpretation. Accuracy in identifying landslides on aerial photographs is dependent on the size of the slide, scale of the photographs, thickness of canopy, and logging history. Landslides mapped in areas recently logged or through a thin canopy are identified with the highest level of confidence. Characteristics of the particular aerial photographs used affects confidence in identifying landslides. For example, sun angle creates shadows which may obscure landslides, the print quality of some photo sets varies, and photographs taken at larger scale makes identifying small landslides difficult. The landslide inventory results are considered a minimum estimate of sediment production. This is because landslides that were too small to identify on aerial photographs may have been missed, landslide surfaces could have reactivated in subsequent years and not been quantified, and secondary erosion by rills and gullies on slide surfaces is difficult to assess. However, small landslides cumulatively may not deliver amounts of sediment that would significantly alter total sediment delivery.

Two techniques were employed in order to extrapolate a sediment volume delivery percentage to landslides not visited in the field. Landslides that were determined to be directly adjacent to a watercourse from topographic maps and aerial photograph interpretation were assigned 100% delivery. Landslides that were determined to deliver, but were not directly adjacent to a watercourse, were assigned the mean delivery percentage from landslides observed in the field.

Landslides were classified based on the likelihood that a road associated land use practice was associated with the landslide. In this analysis, the effects of silvicultural techniques were not observed. Because the Navarro WAU has been managed, recently and historically, for timber production, it was determined that the effect of silvicultural practices was too difficult to confidently assign to landslides. There have been too many different silvicultural activities over time for reasonable confidence in a landslide evaluation based on silviculture. The land use practices that were assigned to landslides were associations with roads, skid trails, or landings. It was assumed that a landslide adjacent to a road, landing, or skid trail was triggered either directly or indirectly by that land use practice. If a landslide appeared to be influenced by more than one land use practice, the more causative one was noted. If a cutslope failure did not cross the road prism, it was assumed that the failure would remain perched on the road, landing, or skid trail and would not deliver to a watercourse. Some surface erosion could result from a cutslope failure and is assumed to be addressed in the road surface erosion estimates (Surface and Fluvial Erosion module).

Mass wasting was separated into three time periods for analysis: 1969-1981, 1982-1987, and 1988-2000. The dates for each of the time periods are based on the date of aerial photographs used to interpret landslides (1978, 1981, 1987, 1996, and 2000) and field observations (1999). The available aerial photography did not correspond perfectly to ten year time periods for mass wasting assessment, however the time periods and the aerial photographs analyzed approximate decadal intervals. These time periods allow for a general evaluation of the relative magnitude of sediment delivery rate estimates across the Navarro WAU.

The characteristics of deep-seated landslides received less attention in the landslide inventory than shallow-seated landslides mainly due to the fact that complicated geotechnical analyses would have to be done to estimate attributes such as depth, failure date, activity, and sediment delivery. Few of the mapped deep-seated landslides were observed to have recent movement associated with them. Further assessment of deep-seated landslides will occur on a site-by-site basis in the Navarro WAU, likely during timber harvest plan preparation and review.

Systematic description of deep-seated landslide features

Deep-seated landslides were only interpreted by reconnaissance techniques (aerial photograph interpretation rather than field observations). Reconnaissance mapping criteria consist of observations of four morphologic features of deep seated landslides --toe, internal morphology, lateral flanks, main scarp--and vegetation (after McCalpin 1984 as presented by Keaton and DeGraff, 1996, p. 186, Table 9-1). The mapping and classification criteria for each feature are presented in detail below.

Aerial photo interpretation of deep seated landslide features in the Navarro WAU suggest that the first three morphologic features above are the most useful for inferring the presence of deep-seated landslides. The presence of tension cracks and/or sharply defined and topographically offset scarps are probably a more accurate indicator of recent or active landslide movement. These features, however, are rarely visible on aerial photos.

Sets of five descriptions have been developed to classify each deep-seated landslide morphologic feature or vegetation influence. The five descriptions are ranked in descending order from characteristics more typical of active landslides to characteristics more typical of dormant landslides, to characteristics more typical of relict landslides. One description should characterize the feature most accurately. Nevertheless, some overlap between classifications is neither unusual nor unexpected. We recognize that some deep-seated landslides may lack evidence with respect to one or more of the observable features, but show strong evidence of another feature. If there is no expression of a particular geomorphic feature (e.g. lateral flanks), the classification of that feature is considered “undetermined”. If a deep-seated landslide is associated with other deep-seated landslides, it may also be classified as a landslide complex.

In addition to the classification criteria specific to the deep-seated landslide features, more general classification of the strength of the interpretation of the deep-seated landslide is conducted. Some landslides are obscured by vegetation to varying degrees, with areas that are clearly visible and areas that are poorly visible. In addition, weathering and erosion processes may also obscure geomorphic features over time. The quality of different aerial photograph sets varies and can sometimes make interpretations difficult. Owing to these circumstances, each inferred deep-seated landslide feature is classified according to the strength of the evidence as either definite, probable or questionable as defined with respect to interpretation of shallow landslides.

At the project scale (THP development and planning), field observations of deep-seated landslide morphology and other indicators by qualified professionals are expected to be used to reduce uncertainty of interpretation inherent in reconnaissance mapping. Field criteria for mapping deep-seated landslides and assessment of activity are presented elsewhere.

Deep seated landslide morphologic classification criteria:

I. Toe Activity

1. Steep streamside slopes with extensive unvegetated to sparsely vegetated debris slide scars. Debris slides occur on both sides of stream channel, but more prominently on side containing the deep-seated landslide. Stream channel in toe region may contain coarser sediment than adjacent channel. Stream channel may be pushed out by toe. Toe may be eroding, exhibiting sharp topography/geomorphology.
2. Steep streamside slopes with few unvegetated to sparsely vegetated debris slide scars. Debris slides generally are distinguishable only on streamside slope containing the deep-seated landslide. Stream channel may be pushed out by toe. Sharp edges becoming subdued.
3. Steep streamside slopes that are predominantly vegetated with little to no debris slide activity. Topography/geomorphology subdued.
4. Gently sloping stream banks that are vegetated and lack debris slide activity. Topography/geomorphology very subdued.
5. Undetermined

II. Internal Morphology

1. Multiple, well defined scarps and associated angular benches. Some benches may be rotated against scarps so that their surfaces slope back into the hill causing ponded water, which can be identified by different vegetation than adjacent areas. Hummocky topography with ground cracks. Jack-strawed trees may be present. No drainage to chaotic drainage/disrupted drainage.
2. Hummocky topography with identifiable scarps and benches, but those features have been smoothed. Undrained to drained but somewhat subdued depressions may exist. Poorly established drainage.
3. Slight benches can be identified, but are subtle and not prominent. Undrained depressions have since been drained. Moderately developed drainage to established drainage but not strongly incised. Subdued depressions but are being filled.
4. Smooth topography. Body of slide typically appears to have failed as one large coherent mass, rather than broken and fragmented. Developed drainage well established, incised. Essentially only large undrained depressions preserved and would be very subdued. Could have standing water. May appear as amphitheater slope where slide deposit is mostly or all removed.
5. Undetermined

III. Lateral Flanks

1. Sharp, well defined. Debris slides on lateral scarps fail onto body of slide. Gullies/drainage may begin to form at boundary between lateral scarps and sides of slide deposit. Bare spots are common or partially unvegetated.

2. Sharp to somewhat subdued, rounded, essentially continuous, might have small breaks; gullies/drainage may be developing down lateral edges of slide body. May have debris slide activity, but less prominent. Few bare spots.
3. Smooth, subdued, but can be discontinuous and vegetated. Drainage may begin to develop along boundary between lateral scarp and slide body. Tributaries to drainage extend onto body of slide.
4. Subtle, well subdued to indistinguishable, discontinuous. Vegetation is identical to adjacent areas. Watercourses could be well incised, may have developed along boundary between lateral scarp and slide body. Tributaries to drainage developed on slide body.
5. Undetermined

IV. Main Scarp

1. Sharp, continuous geomorphic expression, usually arcuate break in slope with bare spots to unvegetated; often has debris slide activity.
2. Distinct, essentially continuous break in slope that may be smooth to slightly subdued in parts and sharp in others, apparent lack of debris slide activity. Bare spots may exist, but are few.
3. Smooth, subdued, less distinct break in slope with generally similar vegetation relative to adjacent areas. Bare spots are essentially non-existent.
4. Very subtle to subdued, well vegetated, can be discontinuous and deeply incised, dissected; feature may be indistinct.
5. Undetermined

V. Vegetation

1. Less dense vegetation than adjacent areas. Recent slide scarps and deposits leave many bare areas. Bare areas also due to lack of vegetative ability to root in unstable soils. Open canopy, may have jack-strawed trees; can have large openings.
2. Bare areas exist with some regrowth. Regrowth or successional patterns related to scarps and deposits. May have some openings in canopy or young broad-leaf vegetation with similar age.
3. Subtle differences from surrounding areas. Slightly less dense and different type vegetation. Essentially closed canopy; may have moderately aged to old trees.
4. Same size, type, and density as surrounding areas.
5. Undetermined

Mass Wasting Map Units

Mass Wasting Map Units (MWMUs) are delineated by partitioning the landscape into zones characterized by similar geomorphic attributes, shallow-seated landslide potential, and sediment delivery to stream channels. A combination of aerial photograph interpretation, field investigation, SHALSTAB output, and observed mass wasting were utilized to delineate MWMUs. The MWMU designations for the Navarro WAU are only meant to be general characterizations of similar geomorphic and terrain characteristics related to shallow seated landslides. Deep-seated landslides are also shown on the MWMU map (Map A-2). The deep-seated landslides have been included to provide land managers with supplemental information to guide evaluation of harvest planning and subsequent needs for geologic review. The landscape and geomorphic setting in the Navarro WAU is certainly more complex than generalized

MWMUs delineated for this evaluation. The MWMUs are only meant to be a starting point for gauging the need for site-specific field assessments.

The delineation of each MWMU described is based on landforms present, the mass wasting processes, sensitivity to forest practices, mass wasting hazard, delivery potential, and forest management related trigger mechanisms for shallow seated landslides. The landform section of the MWMU description defines the terrain found within the MWMU. The mass wasting process section is a summary of landslide types found in the MWMU. Sensitivity to forest practice and mass wasting hazard is, in part, a subjective call by the analyst based on the relative landslide hazard and influence of forest practices. Delivery potential is based on proximity of MWMU to watercourses and the likelihood of mass wasting in the unit to reach a watercourse. The hazard potential is based on a combination of the mass wasting hazard and delivery potential (Figure A-2.). The trigger mechanisms are a list of forest management practices that may have the potential to create mass wasting in the MWMU.

Figure A-2. Ratings for Potential Hazard of Delivery of Debris and Sediment to Streams by Mass Wasting (letters designate hazard: L= low, M= moderate, H = high)(Version 4.0, Washington Forest Practices Board, 1995).

		Mass Wasting Potential		
		Low	Moderate	High
Delivery Potential	Low	**L**	**L**	**M**
	Moderate	**L**	**M**	**H**
	High	**L**	**M**	**H**

RESULTS

Mass Wasting Inventory

A Landslide Inventory Data Sheet (Appendix A) was used to record attributes associated with each landslide. The spatial distribution and location of landslides is shown on Map A-1.

A total of 1220 shallow-seated landslides (debris slides, torrents, or flows) were identified and characterized in the Navarro WAU, 578 in Navarro West and 642 in Navarro East. A total of 270 deep-seated landslides (rockslides or earth flows) were mapped in the Navarro WAU, 187 in Navarro West and 83 in Navarro East. A considerable effort was made to field verify as many landslides as possible to insure greater confidence in the results. A total of 20% of the identified shallow-seated landslides were field verified. From this level of field observations, extrapolation of landslide depth and sediment delivery is assumed to be performed with a reasonable level of confidence.

To extrapolate depth to the shallow-seated landslides not visited in the field, an average was taken from the depths visited in the field. The mean depth of all shallow-landslides was 4 feet. Due to the relative lack of debris flows and torrents, no effort was made to differentiate landslide depths among different shallow landslide types. A mean depth of 4 feet was assumed for all landslides not field checked. The mean sediment delivery percentage assigned to shallow landslides determined to deliver sediment, but not visited in the field is 92%. Delivery statistics were not calculated for deep-seated landslides.

The temporal distribution of the 1220 shallow-seated landslides observed in the Navarro WAU is listed in Table A-2a for Navarro West and Table A-2b for Navarro East. The distribution by landslide type is shown in Table A-3a for Navarro West and Table A-3b for Navarro East.

Table A-2a. Shallow-Seated Landslide Summary for Navarro West by Time Periods.

Planning Watershed	1969 - 1981 Landslides	1982 - 1987 Landslides	1988 – 2000 Landslides
Rancheria Creek	1	7	10
Flynn Creek	3	6	18
Floodgate Creek	3	6	4
Hendy Woods	0	1	0
Mill Creek	0	0	8
Lower Navarro River	7	22	63
Middle Navarro River	42	54	108
North Fork Navarro River	23	24	37
Ray Gulch	2	4	47
Upper Navarro River	6	30	42
Total	***87***	***154***	***337***

Table A-2b. Shallow-Seated Landslide Summary for Navarro East by Time Periods

Planning Watershed	1969 - 1981 Landslides	1982 - 1987 Landslides	1988 – 2000 Landslides
Dutch Henry Creek	2	55	56
North Fork Indian Creek	5	10	30
John Smith Creek	0	6	2
Lower South Branch Navarro River	21	15	36
Little North Fork Navarro River	15	37	79
Middle South Branch Navarro River	35	49	84
Upper South Branch Navarro River	18	18	69
Total	***96***	***190***	***356***

Table A-3a. Landslide Summary by Type and Planning Watershed for MRC Ownership in Navarro West.

Planning Watershed	Debris Slides	Debris Torrents	Debris Flows	Rockslides	Earth Flows	Total	Road Assoc.
Rancheria Creek	17	0	1	6	0	24	9
Flynn Creek	25	1	1	12	0	39	8
Floodgate Creek	11	1	1	0	0	13	8
Hendy Woods	1	0	0	0	0	1	1
Mill Creek	7	0	1	0	0	8	5
Lower Navarro River	90	2	0	71	0	163	54
Middle Navarro River	192	7	5	33	0	237	94
North Fork Navarro River	81	1	2	17	0	101	50
Ray Gulch	53	0	0	10	0	63	19
Upper Navarro River	74	2	2	37	1	116	36

Table A-3b. Landslide Summary by Type and Planning Watershed for MRC Ownership in Navarro East.

Planning Watershed	Debris Slides	Debris Torrents	Debris Flows	Rockslides	Earth Flows	Total	Road Assoc.
Dutch Henry Creek	104	3	6	19	0	132	88
North Fork Indian Creek	37	0	8	10	0	55	27
John Smith Creek	8	0	0	1	1	10	6
Lower South Branch Navarro River	67	1	4	12	0	84	46
Little North Fork Navarro River	119	3	9	12	1	144	102
Middle South Branch Navarro River	147	9	12	8	0	176	124
Upper South Branch Navarro River	86	3	16	16	3	124	82

The majority of landslides observed in the Navarro WAU are debris slides and rockslides. Only a few of the rock slides are likely to be active in the Navarro WAU, the remaining are most likely dormant features. Of the 1220 shallow-seated landslides in the Navarro WAU, 759 are determined to be road-associated. This is approximately 62% of the total number of shallow-seated landslides.

There were 101 debris torrents and flows observed in the Navarro WAU. This is approximately 8% of the total shallow landslides observed in the Navarro WAU. Debris torrents or flows are common in the Navarro WAU.

A total of 91% of the shallow landslides inventoried were initiated on slopes of 60% gradient or greater. Twelve landslides occurred on slopes with gradients less than 60%. Of those 12, only 4 were not road associated. The majority of inventoried landslides originated in convergent topography where sub-surface water tends to concentrate or on steep, planar topography where sub-surface water can be concentrated at the base of slopes, in localized topographic depressions, or by subsoil geologic structures. Few landslides originated in divergent topography, where subsurface water is routed to the sides of ridges. Such observations were, in part, the basis for the delineation of the Navarro WAU into Mass Wasting Map Units.

Mass Wasting Map Units

The landscape was partitioned into six Mass Wasting Map Units (MWMU) representing general areas of similar geomorphology, landslide processes, and sediment delivery potential for shallow-seated landslides (Map A-2). The units are to be used by forest managers to assist in making decisions that will minimize future mass wasting sediment input to watercourses. The delineation for the MWMUs was based on qualitative observations and interpretations from aerial photographs, field evaluation, and SHALSTAB output. Deep-seated landslides are also shown on the MWMU map (Map A-2). The deep-seated landslides have been included to provide land managers with supplemental information to guide evaluation of harvest planning and subsequent needs for geologic review.

Shallow-seated landslide characteristics considered in determination of map units are size, frequency, delivery to watercourses, and spatial distribution. Hillslope characteristics considered are slope form (convergence, divergence, planar), slope gradient, magnitude of stream incision, and overall geomorphology. The range of slope gradients was determined from USGS 1:24000 topographic maps and field observations. Hillslope and landslide morphology vary within each individual Mass Wasting Map Unit and the boundaries are not exact. This evaluation is not intended to be a substitute for site-specific field assessments. Site-specific field assessments will still be required in MWMUs and at deep-seated landslides or specific areas of some MWMUs to assess the risk and likelihood of mass wasting impacts from a proposed management action. The Mass Wasting Map Units are compiled on the entitled Mass Wasting Map Unit Map (Map A-2).

MWMU Number: 1

Description: Inner Gorge or Steep Slopes adjacent to Low Gradient Watercourses

Materials: Shallow soils formed on weathered marine sedimentary rocks. May be composed of sediment from the toe of a deep-seated landslide deposit.

Landform: Characterized by steep slopes or steep inner gorge topography along low gradient watercourses (typically less than 6-7%). An inner gorge is considered a geomorphic feature created from down cutting of the stream in response to a change in base level (tectonic uplift or receding sea level). Inner gorge slopes extend from either one side or both sides of the stream channel to the first break in slope. Inner gorge slope gradients typically exceed 70%. Slopes with lower inclination are locally present. Heights of inner gorge slopes range from 25 to 300 feet in the Navarro WAU. Slopes commonly contain areas of multiple, coalescing shallow seated landslide scars of varying age. Steep slopes adjacent to low gradient streams are generally planar in form with slope gradients typically exceeding 70%. The difference from inner gorge topography is the lack of a distinct break in slope. The upper extent of the unit is variable. Where there is not a break in slope, the unit may exceed 150 feet upslope (based on the range of lengths of landslides observed being 16-500 feet, mean length of all landslides in the unit is 110 feet). Landslides in this unit generally deposit sediment directly into Class I and II streams. Small areas of incised terraces may be locally present.

Slope: 70 % to vertical, (mean slope of observed mass wasting events is 82%, range: 45 %-128%)

Total Area: 2416 acres; 4 % of the total WAU area.

MW Processes: *146 road-associated landslides*

- 137 Debris slides
- 5 Debris flow
- 4 Debris torrent

87 non-road associated landslides

- 82 Debris slides
- 1 Debris torrent
- 4 Debris flows

Non Road-related Landslide Density: 0.04 landslides per acre for the past 32 years.

Road-related Landslide Density: 3.5 landslides per mile of road for the past 32 years.

Forest Practices Sensitivity: High sensitivity to road construction due to proximity to watercourses, bedrock underlying inner gorge slopes may create increased stability, high sensitivity to harvesting and forest management practices due to steep slopes with localized colluvial or alluvial soil deposits next to watercourses.

Mass Wasting Potential: High localized potential for landslides in both unmanaged and managed conditions.

Delivery Potential: High

Delivery Criteria Used: Steep slopes adjacent to stream channels, all observed landslides delivered sediment into streams.

Hazard-Potential Rating: **High**

Forest Management Related Trigger Mechanisms:

- Sidecast fill material placed on steep slopes can initiate debris slides or flows in this unit.
- Concentrated drainage from roads onto unstable areas can initiate debris slides or flows in this unit.
- Poorly sized culvert or excessive debris at watercourse crossings can initiate failure of the fill material creating debris slides, torrents or flows in this unit.
- Cut-slope of roads can expose potential failure planes creating debris slides, torrents or flows in this unit.
- Sidecast fill material created from skid trail construction placed on steep slopes can initiate debris slides or flows in this unit.
- Concentrated drainage from skid trails onto unstable areas can initiate debris slides or flows in this unit.
- Cut-slope of skid trails can remove support of slope creating debris slides, torrents or flows in this unit.
- Root decay of hardwood or non-redwood conifer species can be a contributing factor in the initiation of debris slides, torrents or flows in this unit.
- Concentrated drainage from roads can increase groundwater, accelerating movement of rockslides or earth flows and over-steepening inner gorge slopes.
- Removal of vegetation above these slopes can result in loss of evapo-transpiration and thus increase pore water pressures that could create debris slides in this unit.

Confidence: High confidence for susceptibility of landslides and sediment delivery in this unit. Moderate confidence for placement of this unit. This unit is locally variable and exact boundaries are better determined from field observations.

MWMU Number: 2

Description: Steep slopes or inner gorge topography adjacent to high gradient intermittent or ephemeral watercourses.

Materials: Shallow soils formed from weathered marine sedimentary rocks with localized areas of thin to thick colluvial deposits.

Landforms: Characterized by steep slopes or inner gorge topography adjacent to high gradient intermittent or ephemeral watercourses. An inner gorge is considered a geomorphic feature created from down cutting of the stream in response to a change in base level (tectonic uplift or receding sea level). Inner gorge slopes extend from either one side or both sides of the stream channel to the first break in slope. Inner gorge slope gradients typically exceed 70%. Slopes with lower inclination are locally present. Steep slope form is largely concave or planar with gradients typically greater than 70%. The break in slope in this unit is typically about 100 feet from the watercourse (based on mean observed debris slide length of 109 feet; maximum observed landslide length is 500 feet). Landslides in this unit commonly are debris slides that deposit sediment directly into Class II and III watercourses. Occasionally the debris slides can form debris torrents that can transport material down the slope through and out of this unit. This unit typically extends upstream from MWMU 1.

Slope: >70% (mean slope of observed mass wasting events is 82%, range: 60%-98%).

Total Area: 3053 acres; 6% of total WAU area

MW Processes: *53 road-associated landslides*

- 51 Debris slides
- 1 Debris flow
- 1 Debris torrent

84 non-road associated landslides

- 82 Debris slides
- 1 Debris flow
- 1 Debris torrent

Non Road-related Landslide Density: 0.02 landslides per acre for the past 32 years.

Road-related Landslide Density: 1.8 landslides per mile of road for the past 32 years.

Forest Practices Sensitivity: High sensitivity to roads due to steep slopes adjacent to watercourses, high to moderate sensitivity to harvesting and forest management due to steep slopes next to watercourses. Localized areas of steeper and/or convergent slopes may have an even higher sensitivity to forest practices.

Mass Wasting Potential: High, due to the steep converging topography of the slope in both unmanaged and managed conditions.

Delivery Potential: High

Delivery Criteria Used: Steep slopes adjacent to stream channels, all observed landslides delivered sediment into streams.

Hazard-Potential Rating: **High**

Forest Management Related Trigger Mechanisms:

- Sidecast fill material placed on steep slopes can initiate debris slides, torrents or flows in this unit.
- Concentrated drainage from roads onto unstable areas can initiate debris slides, torrents or flows in this unit.
- Poorly sized culvert or excessive debris at watercourse crossings can initiate failure of the fill material creating debris slides, torrents or flows in this unit.
- Cut-slope of roads can over-steepen the slope creating debris slides, torrents or flows in this unit.
- Cut-slope of roads can remove support of the toe or expose potential failure planes of rockslides or earth flows.
- Sidecast fill material created from skid trail construction placed on steep slopes can initiate debris slides, torrents or flows.
- Concentrated drainage from skid trails onto unstable areas can initiate debris slides, torrents or flows.
- Cut-slope of skid trails can remove support of the toe or expose potential failure planes of rockslides or earth flows.
- Root decay of hardwood or non-redwood conifer species can be a contributing factor in the initiation of debris slides, torrents or flows in this unit.
- Loss of evapo-transpiration from forest harvest can increase groundwater levels initiating or accelerating movement in rockslides or earth flows or aid in the initiation of debris slides, torrents or flows.

Confidence: High confidence for susceptibility of unit to landslides and deliver sediment. Moderate confidence in the placement of this unit. This unit is highly localized and exact boundaries are better determined from field observations. Within this unit there are areas of low gradient slopes that are less susceptible to mass wasting.

MWMU Number: 3

Description: Dissected and convergent topography

Materials: Shallow soils formed from weathered marine sedimentary rocks with localized thin to thick colluvial deposits.

Landforms: These areas have steep slopes (typically greater than 60%) that have been sculpted over geologic time by repeated debris slide events. The area is characterized primarily by 1) steep convergent and dissected topography located within steep gradient collivial hollows or headwall swales and small high gradient watercourses, and 2) local very steep planar slopes, where there is strong evidence of past shallow landslide failures. MRC intends this unit to represent areas of potential high to moderate high risk for shallow landslides that does not constitute a continuous streamside unit (otherwise would classify as MWMU 1 or 2). The mapped unit may represent isolated individual "high risk" areas or areas where there is a concentration of "high risk" areas. Boundaries between higher hazard areas and other more stable areas (i.e. divergent and lower gradient slopes) within the unit should be keyed out as necessary based on field verification of diagnostic landslide form features.

Slope: >60%, (mean slope of observed mass wasting events is 79% range: 30%-125%)

Total Area: 9297 ac., 17% of the total WAU

MW Processes: *120 road associated landslides*

- 114 Debris slides
- 2 Debris flow
- 4 Debris Torrent

116 non-road associated landslides

- 107 Debris slides
- 6 Debris flow
- 3 debris torrent

Non Road-related Landslide Density: 0.01 landslides per acre for the past 32 years.

Road-related Landslide Density: 1.7 landslides per mile of road for the past 32 years.

Forest Practices Sensitivity: Moderate to high sensitivity to road building, moderate to high sensitivity to harvesting and forest management practices due to moderately steep slopes within this unit. Localized areas of steeper and/or convergent slopes have even higher sensitivity to forest practices.

Mass Wasting Potential: High

Delivery Potential: Moderate

Delivery Criteria Used: The converging topography directs mass wasting down slopes toward watercourses. Delivery potential may be high based on relatively high number of debris slides. Landslides in headwater swales often torrent or flow down watercourses. Approximately 74% of landslides in this unit delivered sediment.

Hazard-Potential Rating: **High**

Forest Management Related Trigger Mechanisms:

- Sidecast fill material placed on steep slopes can initiate debris slides, torrents or flows in this unit.
- Concentrated drainage from roads onto unstable areas can initiate debris slides, torrents or flows in this unit.
- Concentrated drainage from roads can increase groundwater, accelerating movement of rockslides or earth flows in this unit.
- Poorly sized culvert or excessive debris at watercourse crossings can initiate failure of the fill material creating debris slides, torrents or flows in this unit.
- Cut-slope of roads can over-steepen the slope creating debris slides, torrents or flows in this unit.
- Cut-slope of roads can remove support of the toe or expose potential failure planes of rockslides or earth flows.
- Sidecast fill material created from skid trail construction placed on steep slopes can initiate debris slides, torrents or flows.
- Concentrated drainage from skid trails onto unstable areas can initiate debris slides, torrents or flows.
- Cut-slope of skid trails can remove support of the toe or expose potential failure planes of rockslides or earth flows.
- Root decay of hardwood or non-redwood conifer species can be a contributing factor in the initiation of debris slides, torrents or flows in this unit.
- Loss of evapo-transpiration from forest harvest can increase groundwater levels initiating or accelerating movement in rockslides or earth flows or aid in the initiation of debris slides, torrents or flows.

Confidence: Moderate confidence in placement of unit. This unit is locally variable and exact boundaries are better determined from field observations. Some areas within this unit could have higher susceptibility to landslides and higher delivery rates due to localized areas of steep slopes with weak soils, and unusually adverse ground water conditions.

MWMU Number: 4

Description: Non-dissected topography

Materials: Shallow to moderately deep soils formed from weathered marine sedimentary rocks.

Landforms: Moderate to moderately steep hillslopes with planar, divergent, or broadly convergent slope forms with isolated areas of steep topography or strongly convergent slope forms. Unit is generally a midslope region of lesser slope gradient and more variable slope form than unit 3.

Slope: >40%, (mean slope of observed mass wasting events 83%, range: 36%-135%)

Total Area: 38372 acres, 69.9% of the total WAU

MW Processes: *432 road-associated landslides*

- 390 Debris slides
- 28 Debris flow
- 14 Debris torrent

159 non-road associated landslides

- 144 Debris slides
- 11 Debris flow
- 4 Debris Torrents

Non Road-related Landslide Density: 0.004 landslides per acre for the past 32 years.

Road-related Landslide Density: 1.0 landslides per mile of road for the past 32 years.

Forest Practices Sensitivity: Moderate sensitivity to road building, moderate to low sensitivity to harvesting and forest management practices due to moderate slope gradients and non-converging topography within this unit. Localized areas of steeper slopes have higher sensitivity to forest practices.

Mass Wasting Potential: Moderate

Delivery Potential: High

Delivery Criteria Used: This unit has the largest area, which accounts for it having the highest number of landslides. This unit has a low landslide density, and therefore has a moderate mass wasting hazard. Although the landslides in this unit are highly localized, when landslides occur, the landslide has a high potential to deliver. Approximately 84% of landslides in this unit delivered sediment. This unit has a moderate sensitivity to road building due to a relatively low road landslide density.

Hazard-Potential Rating: **Moderate**

Forest Management Related Trigger Mechanisms:

- Sidecast fill material placed on steep slopes can initiate debris slides, torrents or flows in this unit.
- Concentrated drainage from roads onto unstable areas can initiate debris slides, torrents or flows in this unit.
- Concentrated drainage from roads can increase groundwater, accelerating movement of rockslides or earth flows in this unit.
- Poorly sized culvert or excessive debris at watercourse crossings can initiate failure of the fill material creating debris slides, torrents or flows in this unit.
- Cut-slope of roads can over-steepen the slope creating debris slides, torrents or flows in this unit.
- Cut-slope of roads can remove support of the toe or expose potential failure planes of rockslides or earth flows.
- Sidecast fill material created from skid trail construction placed on steep slopes can initiate debris slides, torrents or flows.
- Concentrated drainage from skid trails onto unstable areas can initiate debris slides, torrents or flows.
- Cut-slope of skid trails can remove support of the toe or expose potential failure planes of rockslides or earth flows.
- Root decay of hardwood or non-redwood conifer species can be a contributing factor in the initiation of debris slides, torrents or flows in this unit.
- Loss of evapo-transpiration from forest harvest can increase groundwater levels initiating or accelerating movement in rockslides or earth flows or aid in the initiation of debris slides, torrents or flows.

Confidence: High confidence in placement of unit. Some areas within this unit could have higher susceptibility to landslides and higher delivery rates due to localized areas of steep slopes with weak soils, and adverse groundwater conditions.

MWMU Number:	5
Description:	Low relief topography
Material:	Moderately deep to deep soils, formed from weathered marine sedimentary rocks.
Landforms:	Characterized by low gradient slopes generally less than 40%, although in some places slopes can be steeper. This unit occurs on ridge crests, low gradient side slopes, and well-developed terraces. Shallow-seated landslides seldom occur and usually do not deliver sediment to stream channels.
Slope:	<55% (based on field observations)
Total Area:	1849 acres, 3% of WAU area
MW Processes:	*8 road associated landslides (debris slide)*
Non Road-related Landslide Density:	0 landslides per acre for past 32 years.
Road-related Landslide Density:	0.26 landslides per mile of road for the past 32 years.
Forest Practices Sensitivity:	Low sensitivity to road building and forest management practices due to low gradient slopes
Mass Wasting Potential:	Low
Delivery Potential:	Low
Delivery Criteria Used:	Sediment delivery in this unit is low.
Hazard-Potential Rating:	**Low**
Forest Management Related Trigger Mechanisms:	•Poorly sized culvert or excessive debris at watercourse crossings can initiate failure of the fill material creating debris slides, torrents or flows in this unit. •Concentrated drainage from roads and skid trails can initiate or accelerate gully erosion, which can increase the potential for mass wasting processes.
Confidence:	High confidence in placement of unit in areas of obviously stable topography. High confidence in mass wasting potential and sediment delivery potential ratings.

MWMU Number: 6

Description: Earth Flow Topography

Materials: Fine-grained soils and clays of highly weathered and sheared marine sedimentary and metamorphic rocks. Soils contain >80% particles less than 2mm in size with boulders, some very large, within the soil matrix.

Landforms: Boundaries of this unit correspond to the mapped, deep-seated earth flows from mass wasting inventory, regardless of state of activity. Characterized by hummocky slopes with localized areas of steep, and areas of flat topography. Slopes commonly contain areas of backtilted topography, creating ponded water. Ground surfaces in this unit commonly contain areas of grassy vegetation, which may be attributed to the inability of the clay-rich soil to support dense forests. Gullies are common in this unit. Rate of movement within earth flows typically is variable and likely fluctuates seasonally according to groundwater conditions. Most of unit 6 is earth flow complexes with many scarps and benches that create a step-like profile.

Slope: Unknown (no field observations)

Total Area: 5 acres; 0.01% of the total WAU.

MW Processes: no shallow landslides

Non Road-related Landslide Density: 0 landslides per acre for past 32 years.

Forest Practices Sensitivity: High sensitivity to roads, harvesting, and forest management practices on active earth flow surfaces. Potential forest practices in this unit should be assessed on at a site specific basis due to variable topography and differing rates of movement within an earth flow.

Mass Wasting Potential: High

Delivery Potential: High

Delivery Criteria Used: Many of the earth flows in the Navarro WAU have the toe or lateral edges along watercourses. If earth flow movement occurs the landslides will deliver sediment.

Hazard Potential Rating: **High**

Forest Management Related Trigger Mechanisms:

- Sidecast fill material placed on locally steep slopes can initiate debris slides, torrents or flows in this unit.
- Concentrated drainage from roads onto unstable areas can initiate debris slides, torrents or flows in this unit.
- Concentrated drainage from roads can increase groundwater, accelerating movement of earth flows of this unit.
- Poorly sized culvert or excessive debris at watercourse crossings can initiate failure of the fill material creating debris slides, torrents or flows in this unit.
- Cut-slope of roads can over-steepen the slope creating debris slides in this unit.
- Concentrated drainage from skid trails onto unstable areas can initiate debris slides, torrents or flows in this unit.
- Loss of evapo-transpiration from forest harvest can increase groundwater levels initiating or accelerating movement of earth flows of this unit or aid in initiation of debris slides, torrents or flows.
- Concentrated drainage from roads and skid trails can initiate or accelerate gully erosion, which can increase the potential for mass wasting processes.
- Cut-slope of skid trails can remove support of the toe or expose potential failure planes of earth flows.
- Sidecast fill material created from skid trail construction placed on locally steep slopes can initiate debris slides, torrents or flows.
- Root decay of hardwood or non-redwood conifer species can be a contributing factor in the initiation of debris slides, torrents or flows in this unit.

Confidence: Confidence in delineation of unit is consistent with confidence level in mass wasting inventory mapping of deep-seated earth flows. High confidence in hazard potential rating due to relatively low hazard for shallow-seated landslides

Sediment Input from Mass Wasting

Sediment delivery was estimated for shallow-seated landslides in the Navarro WAU. Landslides were determined to have either no sediment delivery or to deliver all or a percentage of their total volume. Of the shallow-seated landslides mapped by MRC in this watershed analysis, 86 percent of the landslides delivered some amount of sediment (Table A-4).

Table A-4a. Total Shallow-Seated Landslides Mapped for each Planning Watershed in Navarro West.

Planning Watershed	Total Landslides	Landslides with Sediment Delivery	Landslides with No Sediment Delivery
Rancheria Creek	18	18	0
Flynn Creek	27	22	5
Floodgate Creek	13	13	0
Hendy Woods	1	1	0
Mill Creek	8	7	1
Lower Navarro River	92	65	27
Middle Navarro River	204	167	37
North Fork Navarro River	84	75	9
Ray Gulch	53	39	14
Upper Navarro River	78	70	8
sum	***578***	***477***	***101***
Percentage	***100%***	***83%***	***17%***

Table A-4b. Total Shallow-Seated Landslides Mapped for each Planning Watershed in Navarro East.

Planning Watershed	Total Landslides	Landslides with Sediment Delivery	Landslides with No Sediment Delivery
Dutch Henry Creek	113	107	6
North Fork Indian Creek	45	42	3
John Smith Creek	8	7	1
Lower South Branch Navarro River	72	69	3
Little North Fork Navarro River	131	105	26
Middle South Branch Navarro River	168	145	23
Upper South Branch Navarro River	105	97	8
Sum	***642***	***572***	***70***
Percentage	***100%***	***89%***	***11%***

A total of 2,186,100 tons of mass wasting sediment delivery was estimated for the time period 1969-2000 in the Navarro WAU. This equates to 753 tons/sq. mi./yr. Of the total estimated amount, 258,500 tons (12% of total) occurred from 1969-1981, 441,700 tons (20% of total) occurred from 1982-1987,and 1,485,900 tons (68% of total) occurred in the 1988-2000 time period (Table A-5a and Table A-5b). A total of approximately 84,000 tons was delivered into Navarro West in 1995 by the Floodgate slide, which is 4% of the total delivery from 1969-2000 and 6% of the total amount delivered from 1988-2000 in the whole Navarro WMU. The floodgate slide consisted of a deep-seated rockslide and associated debris flow which delivered sediment into the Navarro River approximately 1/3 of a mile upstream of the confluence of the Navarro River with Floodgate Creek.

Relatively large amounts of sediment delivered from 1988-2000 compared to earlier time periods results from several factors, including high rain fall events during this time frame, two sets of aerial photographs analyzed during this time, and field work done in the summer of 1999. Unusually intense storms and/or high annual rainfall occurred in 1995, 1997 and 1998, and under wet conditions more landslides occurred. According to rainfall data taken from Casper Creek, just South of Fort Bragg, the most intense rainfall during the 1995 – 1998 period was January 8-9 1995 5.78 inches, March 13-14 1995 4.64 inches, December 30 1996 – January 1 1997 10.58 inches and March 21-23 1998 6.63 inches. During the 1988-2000 time period two sets of aerial photographs were analyzed, (1996 and 2000), both of which were photographed after a major storm event. Consequently more landslides where found in the 1988-2000 period than the other periods. Field surveys located additional landslides. The field assessment occurred in the summer of 1999 a year after the 1998 storm events. In Navarro West, 69% of the total amount of sediment delivered was from landslides found in the field and in Navarro East 76% of the total amount of the sediment delivered was from landslides found in the field. The high percent of landslides found in the field is due to field work being done before the 2000 aerial photographs could be assessed, therefore landslides where found in the field that would have been found in the 2000 photographs.

The highest overall sediment input from mass wasting occurred in the Dutch Henry planning watershed. The higher sediment delivery appears to be due to a large amount of landslides that occurred on roads adjacent to watercourses. In contrast, Hendy Woods planning watershed has the lowest mass wasting input. The low input for Hendy Woods on Mendocino Redwood Company property is attributable to relatively gentle terrain within this planning watershed.

Table A-5a. Sediment Volume Input by Time Period for Navarro West Planning Watersheds. Data Reported in Tons of Sediment Delivered.

Planning Watershed	1969 - 1981	1982 – 1987	1988 - 2000
Rancheria Creek	1600	16800	13900
Flynn Creek	3600	1700	25000
Floodgate Creek	6600	2500	5200
Hendy Woods	0	200	0
Mill Creek	0	0	12500
Lower Navarro River	6700	31600	64500
Middle Navarro River	47600	63000	168800
North Fork Navarro River	21400	21100	17300
Ray Gulch	1700	3800	13900
Upper Navarro River	15100	48000	124600
Total	***104,300***	***188,700***	***445,700***

Table A-5b. Sediment Volume Input by Time Period for Navarro East Planning Watersheds. Data Reported in Tons of Sediment Delivered.

Planning Watershed	1969 – 1981	1982 – 1987	1988 - 2000
Dutch Henry Creek	6000	116000	204000
North Fork Indian Creek	6000	20000	263000
John Smith Creek	0	4500	10000
Lower South Branch Navarro River	45000	12500	83000
Little North Fork Navarro River	28000	38000	142000
Middle South Branch Navarro River	42000	3000	238000
Upper South Branch Navarro River	28000	2800	100000
Total	***154,000***	***253,000***	***1,040,000***

Chart A-1a. Total Mass Wasting Sediment Input Rate (tons/yr/sq. mi.) from Landslides for MRC Ownership in Navarro West Shown by Watershed and Time Period.

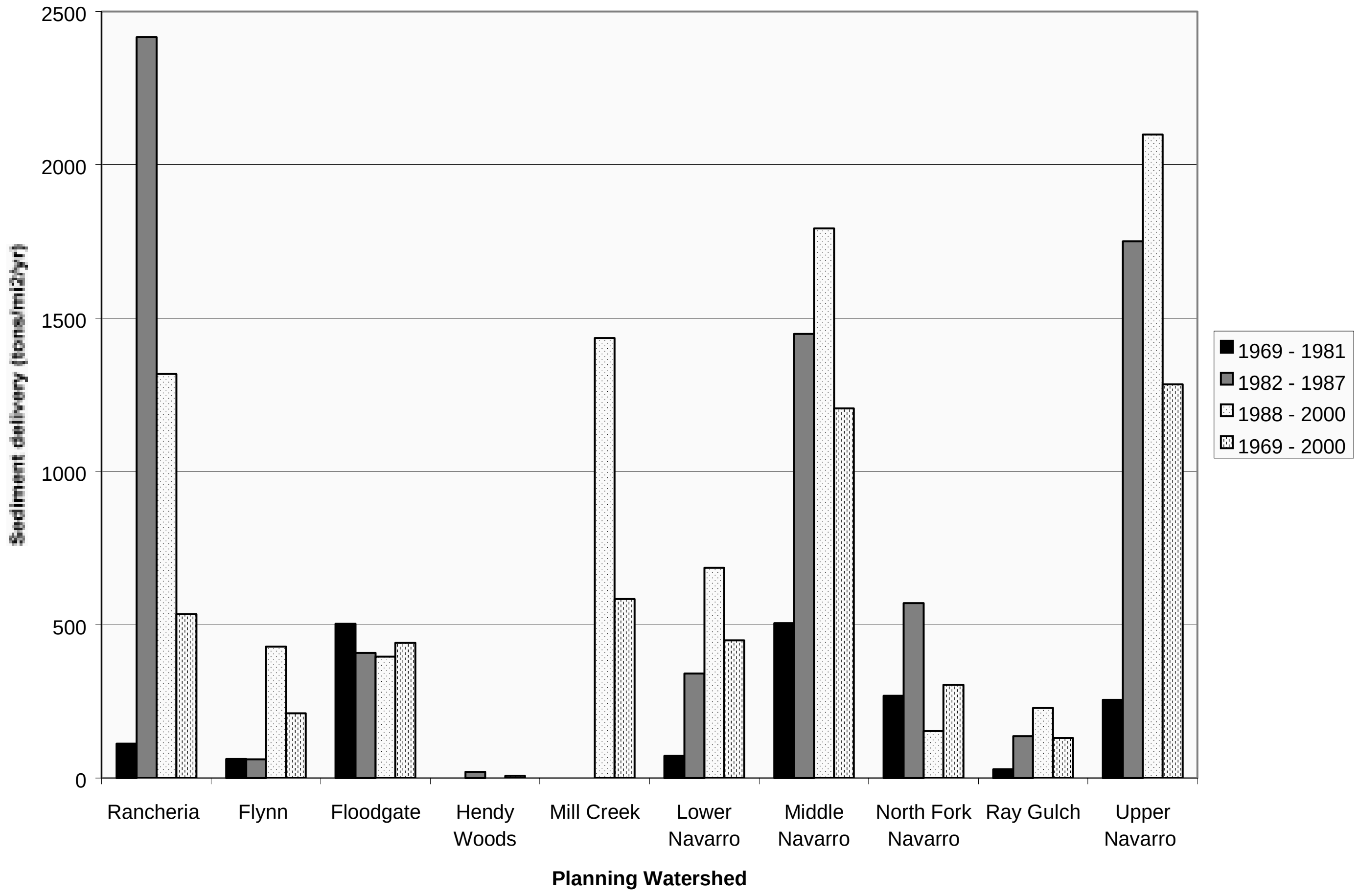
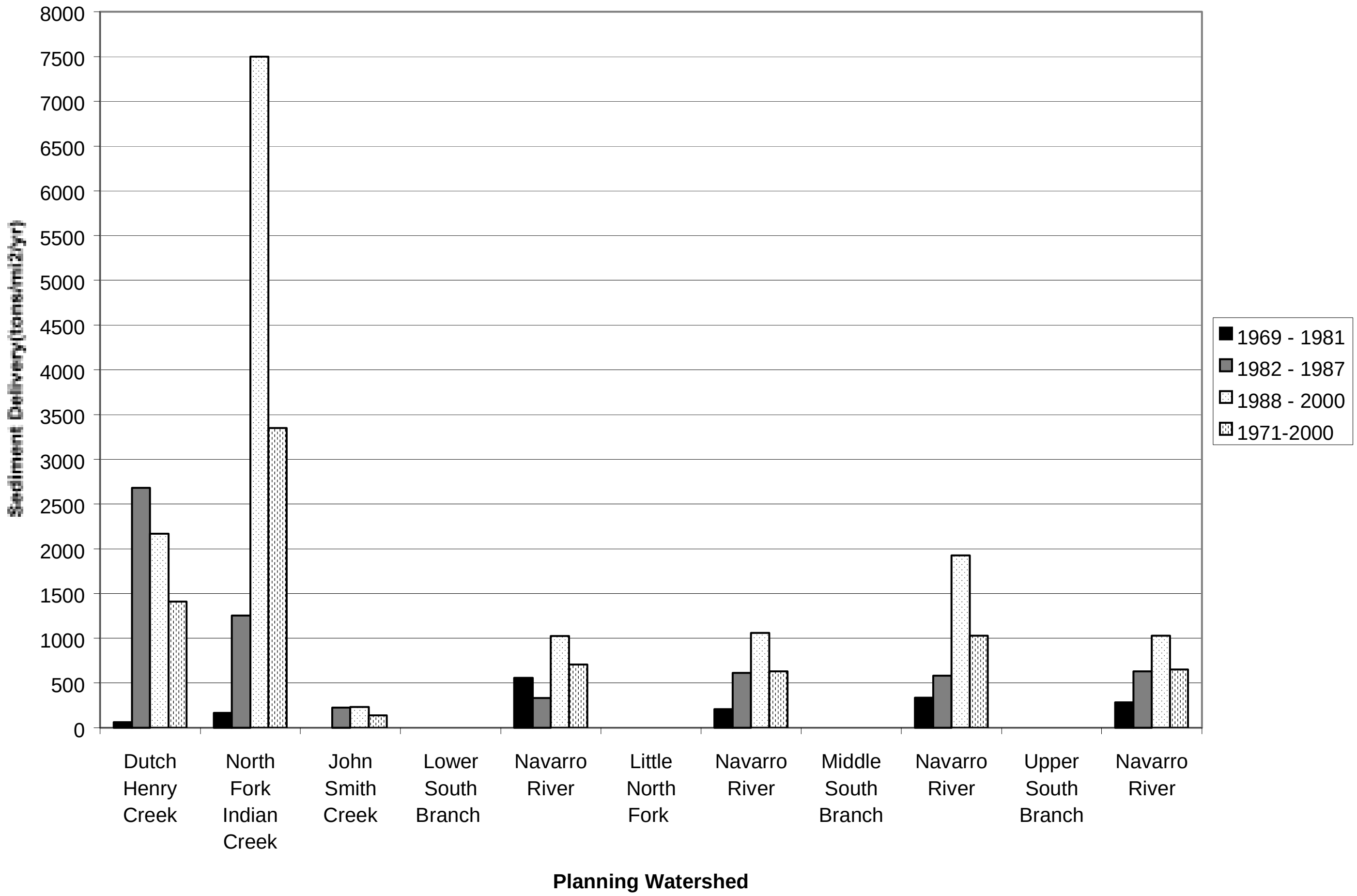


Chart A-1b. Total Mass Wasting Sediment Input Rate (tons/yr/sq. mi.) from Landslides for MRC Ownership in Navarro East Shown by Watershed and Time Period.



Road associated mass wasting was found to have contributed 1,548,000 tons (530 tons/sq. mi./yr) of sediment over the 32 years analyzed (1969-2000) in the Navarro WAU (Table A-6a and Table A-6b). This represents approximately 71% of the total mass wasting inputs for the Navarro WAU for 1969-2000. In the Dutch Henry Creek and North Fork Indian Creek planning watershed, road associated landslide sediment delivery was a major sediment source, contributing 87% of the sediment delivered into the Dutch Henry planning watershed and 93% of the sediment delivered into the North Fork Indian Creek planning watershed. In John Smith Creek planning watershed 98% of the sediment delivered was road associated, out of 7 shallow landslides that delivered, 6 where road related. However, the Upper Navarro River planning watershed had a low percentage of road associated mass wasting delivery, 25%, due to the large amount of sediment delivered from the Floodgate slide, which is attributed to non - road associated mass wasting.

One road in particular in the Navarro WAU, the Masonite Road, was constructed in the 1950's and is still in use today as a major haul road. This road has created many mass wasting events, causing the road to be a major source of sediment into the Navarro WAU. Between 1969-2000 the Masonite road is estimated to have delivered 300,000 tons of mass wasting sediment, 21% of the total mass wasting sediment delivered into Navarro East and 14% of the total sediment delivered into the Navarro WAU.

Table A-6a. Road Associated Sediment Delivery for Shallow-Seated Landslides for Navarro West by Planning Watershed, 1969-2000.

Planning Watershed	**Road Associated Mass Wasting Sediment Delivery (tons)**	**Percent of Total Sediment Delivery of Planning Watershed**
Rancheria Creek	18000	56%
Flynn Creek	17000	57%
Floodgate Creek	11500	80%
Hendy Woods	200	100%
Mill Creek	11000	89%
Lower Navarro River	54000	52%
Middle Navarro River	118000	38%
North Fork Navarro River	35000	59%
Ray Gulch	11000	56%
Upper Navarro River	39000	25%
Total	***315,000***	***43%***

Table A-6b. Road Associated Sediment Delivery for Shallow-Seated Landslides for Navarro East by Planning Watershed, 1969-2000.

Planning Watershed	**Road Associated Mass Wasting Sediment Delivery (tons)**	**Percent of Total Sediment Delivery of Planning Watershed**
Dutch Henry Creek	282400	87%
North Fork Indian Creek	268300	93%
John Smith Creek	13900	98%
Lower South Branch Navarro River	98700	70%
Little North Fork Navarro River	171300	82%
Middle South Branch Navarro River	254400	81%
Upper South Branch Navarro River	144900	93%
Total(rounded to 1000s)	***1,234,000***	***85%***

Sediment Input by Mass Wasting Map Unit

Total mass wasting sediment delivery for the Navarro WAU was separated into respective mass wasting map units. Sediment delivery statistics for each MWMU are summarized in Table A-7. It should be noted that not all planning watersheds contain all six MWMUs.

The mass wasting map unit with the highest sediment delivery is MWMU 4, which is estimated to deliver 51% of the total sediment input for the Navarro WAU. This is due to the high road density within this unit which makes the actual hazard of the unit appear artificially high; 86% of the total delivered sediment came from road related features in MWMU 4. MWMU 5 is estimated to have delivered 1% of the total sediment input. This is because the majority of the landslides are road associated in MWMU 5. Combining all streamside units (MWMU 1, 2, 3) would yield 48% of the total sediment input. The total sediment delivered from non-road related slides in MWMU 1, 2, and 3 was 77%, while MWMU 4 delivered 23% of the total non-road related delivery.

One measure of the intensity of mass wasting processes in a MWMU is the amount of sediment produced divided by the area in the MWMU. The last row in Table A-7 expresses landslide intensity as the ratio of the percentage of total sediment delivered by the percentage of watershed area in the MWMU. High values of this ratio indicate high landslide rates in a concentrated area. The MWMU with the highest ratio was unit 1 with a ratio of 5.8 while unit 5 and 4 had the lowest ratio with unit 5 having 0.3 and unit 4 having a ratio of 0.7.

Table A-7. Total Sediment Delivery by Mass Wasting Map Units in the Navarro WAU (1969-2000).

MWMU	1	2	3	4	5	6
Road Related Sediment Delivered (tons)	335700	84700	155400	961100	11200	n/a
Non-Road Related Sediment Delivered (tons)	175600	83300	227200	151900	0	n/a
Total Sediment Delivered (tons)	511300	168000	382600	1113000	11200	n/a
% road related delivery	22%	5%	10%	62%	1%	n/a
% non-road related delivery	28%	13%	36%	23%	0%	n/a
% of total delivered	23%	8%	17%	51%	1%	n/a
% of Watershed	4%	6%	17%	70%	3%	~0.01%
% ratio: delivery %/area %	5.8	1.3	1	0.7	0.3	n/a

CONCLUSIONS

In natural forest environments of the California Coast Range, mass wasting is a common occurrence. In the Navarro WAU this is due to steep slopes, the condition of weathered and fractured marine sedimentary rocks (interbedded sandstone and shale), tectonic activity, locally thick colluvial soils, a history of timber harvest practices, and the occurrence of high intensity rainfall events. Mass wasting events are episodic and many landslides may happen in a short time frame. Mass wasting features of variable age and stability are observed throughout the Navarro WAU. The vast majority of the landslides visited in the field during this assessment occurred on slopes greater than 60%, in main and side scarps. Seeps and springs were evident in the evacuated cavity at many sites. Particular caution should be exercised when conducting any type of forest management activity in areas with convergent or locally steep topography.

The steep streamside areas of MWMU 1, 2, and 3 contribute the highest amount of the sediment per unit area in the watershed. In the moderate and low hazard units of MWMU 4 and 5, a large amount of road associated landslides are occurring, suggesting the need to make improvements on roads within the Navarro WAU.

Almost 62% of the shallow-seated landslides in the Navarro WAU are road associated. Road associated mass wasting represented 70% of the sediment delivery. Roads are a significant factor in the cause of shallow-seated mass wasting events. Improved road construction practices combined with design upgrades of old roads should reduce sediment input rates and mass wasting hazards.

Navarro East has a higher amount of road delivered sediment then Navarro West. This is due to a higher road density directly adjacent to watercourses. One road in particular in the Navarro WAU; the Masonite Road, was constructed from 1948-1950 (Baldo and Brown, 2000) and is still in use today as a major haul road. This road has created many mass wasting events, causing the road to be a major source of sediment in the Navarro WAU. Between 1969-2000 the Masonite road is estimated to have delivered 300,200 tons of mass wasting sediment, 21% of the total mass wasting sediment delivered into Navarro East and 14% of the total sediment delivered into the Navarro WAU.

Mass wasting sediment input is estimated to be at least 750-tons/sq. mi./yr. over the 1969-2000 time period for the entire Navarro WAU. Overall in the Navarro WAU, sediment delivery from mass wasting was highest in the Dutch Henry planning watershed. The large amount of road landslides adjacent to watercourses is the reason for the high sediment delivery.

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Navarro Mass Wasting
Appendix A

Road slide following construction along the Masonite Road, circa 1950.

Id	MWMU	Landslides Type	Landslides Certainty	Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet) Length	Width	Depth	Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	Comments
ED-29-1		RS	Q			2150	800	0		Y				Ephem./Int.		3	2	3	3	4	N	
ED-3-1	4	DS	D	1987	0	50	30	4	222	N	0	0	0		ROAD							
ED-3-2	4	DS	D	1987	0	160	65	4	1541	Y	92	1417	1871	Ephem./Int.								
ED-32-1	1	DS	D	96;87	65	60	30	4	267	Y	100	267	3600	Perennial	ROAD							inner gorge
ED-32-10	1	DS	D	1987	0	65	30	4	289	Y	100	289	381	Perennial	ROAD							
ED-32-11	1	DS	D	1987	0	200	100	4	2963	Y	92	2726	3598	Perennial	ROAD							starts above road and goes to stream
ED-32-12	1	DS	D	1987	0	80	50	4	593	Y	100	593	782	Perennial	ROAD							
ED-32-13	1	DS	D	1987	0	50	65	4	481	Y	100	481	636	Perennial	ROAD							
ED-32-14	1	DS	D	1987	0	80	480	4	5689	Y	92	5234	6909	Perennial	ROAD							
ED-32-15	1	DS	D	1987	0	30	50	4	222	Y	92	204	270	Perennial	ROAD							
ED-32-16	2	DS	P	2000	0	180	20	4	533	Y	92	491	662	Ephem./Int.								
ED-32-17		RS	Q			860	400	0		Y				Ephem./Int.		3	3	3	3	4	N	
ED-32-18		RS	P			820	2190	0		Y				Ephem./Int.		3	3	3	4	4	Y	
ED-32-19		RS	Q			960	690	0		Y				Ephem./Int.		3	3	3	3	4	N	
ED-32-2	1	DS	D	96	80	60	180	2	800	Y	100	800	1080	Perennial	ROAD							
ED-32-20		RS	Q			1540	980	0		Y				Perennial		3	2	3	5	4	N	
ED-32-3	1	DS	D	96	75	60	100	3	667	Y	100	667	900	Perennial	ROAD							inner gorge
ED-32-4	1	DS	D	96;87	70	60	20	7	311	Y	100	311	420	Perennial	ROAD							
ED-32-5	1	DS	D	96	0	94	64	4	891	Y	92	820	1107	Perennial								
ED-32-6	1	DS	Q	96	0	80	80	4	948	Y	92	872	1178	Ephem./Int.								
ED-32-7	1	DS	D	96	88	70	100	4	1037	Y	100	1037	1400	Ephem./Int.	ROAD							
ED-32-8	1	DS	D	1987	0	65	80	4	770	Y	100	770	1017	Perennial	ROAD							
ED-32-9	1	DS	D	1987	0	80	20	4	237	Y	100	237	313	Perennial	ROAD							
ED-3-3	1	DS	P	1987	0	30	15	4	67	Y	92	61	81	Ephem./Int.								
ED-33-1	1	DS	D	96	82	110	80	3	978	Y	100	978	1320	Perennial	ROAD							inner gorge
ED-33-10	1	DS	D	1987	0	80	30	4	356	Y	100	356	469	Perennial	ROAD							
ED-33-11	1	DS	D	1987	0	130	50	4	963	Y	92	886	1169	Perennial	ROAD							
ED-33-12	1	DS	D	1987	0	115	80	4	1363	Y	100	1363	1799	Perennial	ROAD							
ED-33-13	1	DS	D	1987	0	210	115	4	3578	Y	92	3292	4345	Perennial	ROAD							
ED-33-14	1	DS	D	1987	0	65	30	4	289	Y	100	289	381	Perennial	ROAD							
ED-33-15	1	DS	D	1987	0	50	35	4	259	Y	92	239	315	Perennial	ROAD							
ED-33-16	4	DS	D	1987	0	100	50	4	741	Y	92	681	900	Perennial	ROAD							
ED-33-17	4	DS	D	1987	0	200	30	4	889	Y	92	818	1079	Perennial	SKID							
ED-33-18		RS	P			1800	1120	0		Y				Perennial		3	2	3	3	4	N	
ED-33-19	3	DS	D	2000	0	100	30	4	444	Y	92	409	552	Ephem./Int.								
ED-33-2	4	DS	D	96	96	80	50	5	741	Y	100	741	1000	Perennial	ROAD							inner gorge
ED-33-20		RS	Q			700	960	0		Y				Perennial		3	3	3	4	4	N	
ED-33-21		RS	Q			460	750	0		Y				Ephem./Int.		3	3	3	3	4	N	
ED-33-3	4	DS	D	96	84	75	184	4	2044	Y	90	1840	2484	Perennial	ROAD							
ED-33-4	4	DS	D	96	66	50	75	2	278	Y	80	22	300	Perennial	SKID							
ED-33-5	4	DS	D	96	0	80	32	4	379	Y	92	349	471	Perennial								
ED-33-6	4	DS	D	96	90	60	40	2	178	Y	80	142	192	Perennial	ROAD							skid
ED-33-8	4	DS	D	96	0	200	100	12	8889	Y	100	8889	12000	Ephem./Int.	ROAD							
ED-33-9	4	DS	D	1987	0	100	30	4	444	Y	92	409	540	Ephem./Int.	LAND							
ED-3-4	2	DS	P	2000	0	220	70	4	2281	Y	92	2099	2834	Ephem./Int.								
ED-34-1		RS	Q			1390	1180	0		Y				Ephem./Int.		3	3	3	4	4	N	
ED-3-5		RS	Q			860	530	0		Y				Ephem./Int.		4	3	3	4	4	N	
ED-4-1	4	DS	D	96	0	240	80	4	2844	Y	92	2617	2553	Ephem./Int.								
ED-4-2	1	DF	P	96	0	64	16	4	152	Y	92	140	188	Ephem./Int.								
ED-4-3	4	DS	D	1987	0	230	115	4	3919	Y	92	3605	4759	Ephem./Int.								HW Swale
ED-4-4	1	DT	P	1987	0	50	20	4	148	Y	92	136	180	Perennial	ROAD							inner gorge
ED-4-5	4	DS	D	1987	0	130	30	4	578	Y	92	532	702	Perennial	ROAD							

Id	MWMU	Landslides Type	Landslides Certainty	Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet) Length	Width	Depth	Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	Comments
ED-4-6	1	DT	D	1978	0	110	20	4	326	Y	92	300	405	Perennial	ROAD							
ED-4-7	1	DS	P	1978	0	260	110	4	4237	Y	92	3898	5262	Perennial	ROAD							
ED-5-1	1	DS	Q	96	0	48	80	4	569	Y	92	523	707	Perennial								
ED-5-10	4	DS	D	1987	0	130	50	4	963	Y	92	886	1169	Perennial	ROAD							
ED-5-11	1	DS	Q	1987	0	80	30	4	356	Y	92	327	432	Perennial	ROAD							
ED-5-12	1	DS	D	1987	0	160	200	4	4741	Y	92	4361	5757	Perennial	LAND							
ED-5-13	1	DS	D	1987	0	130	180	4	3467	Y	92	3189	4210	Perennial	ROAD							
ED-5-14	1	DS	D	1987	0	80	100	4	1185	Y	92	1090	1439	Perennial	ROAD							
ED-5-15	4	DS	D	1987	0	400	210	4	12444	Y	92	11449	15113	Perennial	ROAD							road top and middle skid as well
ED-5-16	4	DS	P	1987	0	560	130	4	10785	Y	92	9922	13098	Perennial	ROAD							
ED-5-17	2	DS	D	2000	0	160	50	4	1185	Y	92	1090	1472	Ephem./Int.	ROAD							
ED-5-18		RS	Q			780	450	0		Y				Perennial		3	2	3	3	4	N	
ED-5-19		RS	Q			780	400	0		Y				Perennial		3	3	3	3	4	N	
ED-5-2	1	DS	P	96	0	240	64	4	2276	N	0	0	0		ROAD							
ED-5-3	1	DS	D	96	0	80	32	4	379	N	0	0	0									
ED-5-4	1	DS	Q	96	0	160	240	4	5689	Y	92	5234	7066	Ephem./Int.								
ED-5-5	1	DS	D	96	100	300	130	4	5778	Y	100	5778	7800	Perennial								inner gorge
ED-5-6	1	DS	D	96	100	330	60	4	2933	Y	100	2933	3960	Perennial								inner gorge
ED-5-7	1	DS	D	96	98	300	100	4	4444	Y	100	4444	6000	Perennial	ROAD							
ED-5-8	1	DS	D	96	99	200	250	10	18519	Y	100	18519	25000	Perennial	ROAD							culvert
ED-5-9	4	DS	P	1987	0	160	50	4	1185	Y	92	1090	1439	Perennial								
ED-6-1	1	DS	D	96	0	80	128	4	1517	Y	92	1396	1884	Perennial	ROAD							inner gorge
ED-6-10	1	DS	D	>96	70	500	230	8	34074	Y	98	33393	45080	Perennial	ROAD							older slide
ED-6-11	1	DS	D	>98	73	120	100	10	4444	Y	100	4444	6000	Perennial	ROAD							
ED-6-12	1	DS	D	96	65	60	30	4	267	Y	100	267	360	Perennial	ROAD							inner gorge
ED-6-13	1	DF	P	96	0	64	16	4	152	N	0	0	0		ROAD							fill failure
ED-6-14	4	DS	Q	1996	0	96	32	4	455	Y	92	419	545	Perennial								
ED-6-15	1	DS	D	96	89	300	70	4	3111	Y	90	2800	3780	Perennial	ROAD							
ED-6-16	1	DS	D	96	91	300	50	8	4444	Y	100	4444	6000	Perennial	ROAD							culvert
ED-6-17	1	DF	D	97	0	230	20	4	681	Y	100	681	920	Perennial								
ED-6-18	1	DT	D	1987	0	65	20	4	193	Y	100	193	254	Perennial	ROAD							
ED-6-19	1	DS	D	1987	0	80	50	4	593	Y	92	545	720	Perennial	ROAD							
ED-6-2	1	DS	Q	96	0	48	16	4	114	N	0	0	0		SKID							
ED-6-20	1	DS	D	1987	0	50	10	4	74	Y	100	74	98	Perennial	ROAD							
ED-6-21	1	DS	D	1987	0	100	20	4	296	Y	100	296	391	Perennial	ROAD							
ED-6-22	1	DS	D	1987	0	320	100	4	4741	Y	92	4361	5757	Perennial	ROAD							
ED-6-23	1	DS	D	1987	0	50	30	4	222	Y	100	222	293	Perennial								stream failure
ED-6-24	1	DS	D	1987	0	100	270	4	4000	Y	92	3680	4858	Perennial	ROAD							
ED-6-25	1	DS	D	1987	0	100	320	4	4741	Y	100	4741	6258	Perennial	ROAD							
ED-6-26	1	DS	D	1987	0	80	50	4	593	Y	100	593	782	Perennial	ROAD							
ED-6-27		RS	P			3100	2880	0		Y				Perennial		2	3	4	4	4	Y	
ED-6-28		RS	P			1090	450	0		Y				Perennial		3	2	3	3	4	N	
ED-6-29		RS	Q			1460	700	0		Y				Perennial		3	3	3	4	4	N	
ED-6-3	1	DS	P	96	0	64	32	4	303	N	0	0	0		SKID							
ED-6-4	1	DS	D	96	0	80	64	4	759	Y	92	698	942	Perennial	ROAD							
ED-6-5	1	DS	D	96	72	150	240	4	5333	Y	90	4800	6480	Perennial	ROAD							SKID at top of slide
ED-6-6	1	DS	D	96	52	120	50	6	1333	Y	100	1333	1800	Perennial	ROAD							culvert blowout, inner gorge
ED-6-7	1	DF	D	96	0	224	32	4	1062	Y	92	977	1319	Perennial	ROAD							
ED-6-8	1	DS	Q	96	0	160	80	4	1896	Y	92	1745	2355	Perennial	ROAD							
ED-6-9	1	DS	D	96	0	80	160	4	1896	Y	92	1745	2355	Perennial	ROAD							inner gorge
ED-7-1	1	DF	P	96	0	80	32	4	379	Y	92	349	471	Perennial								inner gorge
ED-7-10	1	DS	D	96	0	400	320	4	18963	Y	92	17446	23552	Perennial	ROAD							

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%)	Average Landslide Dimensions (feet)			Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty		Field	Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	
ED-7-11	1	DS	P	96	0	80	64	4	759	Y	92	698	942	Perennial	ROAD							inner gorge
ED-7-12	1	DS	P	96	0	80	64	4	759	Y	92	698	942	Perennial								inner gorge
ED-7-13	1	DS	D	1987	0	50	65	4	481	Y	92	443	585	Perennial	ROAD							
ED-7-14	1	DS	D	1987	0	50	65	4	481	Y	92	443	585	Perennial	ROAD							
ED-7-15	1	DS	D	1987	0	100	80	4	1185	Y	92	1090	1439	Perennial	ROAD							
ED-7-16	1	DS	D	1987	0	50	50	4	370	Y	92	341	450	Perennial	ROAD							
ED-7-17	1	DS	D	1987	0	65	50	4	481	Y	100	481	636	Perennial	ROAD							
ED-7-18	1	DS	D	1987	0	130	80	4	1541	Y	92	1417	1871	Perennial	ROAD							
ED-7-19	1	DS	D	1987	0	100	65	4	963	Y	100	963	1271	Perennial	ROAD							
ED-7-2	1	DS	P	96	0	80	32	4	379	Y	92	349	471	Perennial	ROAD							inner gorge
ED-7-20	1	DS	D	1987	0	200	100	4	2963	Y	92	2726	3598	Perennial	ROAD							
ED-7-21	1	DS	D	1987	0	100	50	4	741	Y	92	681	900	Perennial	ROAD							
ED-7-22	1	DS	D	1987	0	80	130	4	1541	Y	92	1417	1871	Perennial	ROAD							
ED-7-23	4	DS	D	1987	0	240	65	4	2311	Y	92	2126	2807	Perennial	ROAD							
ED-7-24	3	DS	D	2000	0	140	40	4	830	Y	92	763	1030	Ephem./Int.								
ED-7-25		RS	Q			1210	930	0		Y				Perennial		3	3	3	4	4	N	
ED-7-26		RS	Q			2540	1760	0		Y				Perennial		2	3	3	3	4	N	
ED-7-27		RS	Q			1035	450	0		Y				Perennial		3	3	3	3	4	N	
ED-7-3	1	DS	Q	96	0	64	32	4	303	Y	92	279	377	Perennial	ROAD							inner gorge
ED-7-4	1	DF	P	96	0	64	32	4	303	Y	92	279	377	Perennial								inner gorge
ED-7-5	1	DS	D	>96	68	400	50	6	4444	Y	95	4222	5700	Perennial	ROAD							still active, inner gorge
ED-7-6	1	DS	D	96	100	150	100	2	1111	Y	100	1111	1500	Perennial	ROAD							inner gorge
ED-7-7	4	DS	D	96	0	160	48	4	1138	Y	92	1047	1413	Perennial								HW SWALE, older slide
ED-7-8	1	DS	D	96	0	240	64	4	2276	Y	92	2094	2826	Perennial	ROAD							inner gorge
ED-7-9	1	DS	D	96	0	112	80	4	1327	Y	92	1221	1649	Perennial	ROAD							inner gorge
ED-8-1	1	DS	P	96	0	64	112	4	1062	Y	92	977	1319	Perennial	ROAD							inner gorge
ED-8-2	1	DS	D	1987	0	210	20	4	622	Y	92	572	756	Perennial	ROAD							
ED-8-3		RS	Q			2730	960	0		Y				Perennial		3	3	3	3	4	N	
EI-2-1	4	DF	D	96	0	96	32	4	455	Y	92	419	565	Perennial								
EI-2-10		RS	Q			1560	640	0		Y				Perennial		2	3	3	3	4	N	
EI-2-11		RS	Q			1120	680	0		Y				Perennial		3	3	3	3	4	N	
EI-2-12		RS	Q			2250	880	0		Y				Ephem./Int.		4	3	3	3	4	N	
EI-2-2	4	DF	D	96	0	112	16	4	265	Y	92	244	330	Perennial								
EI-2-3	4	DS	P	96	0	48	16	4	114	Y	100	114	154	Perennial								
EI-2-4	4	DS	Q	96	0	48	48	4	341	Y	100	341	461	Perennial	ROAD							
EI-2-5	1	DS	P	1987	0	110	50	4	815	Y	92	750	975	Perennial	SKID							
EI-2-6	4	DS	D	1978	0	45	70	4	467	Y	92	429	580	Perennial								stream failure
EI-2-7	1	DS	D	1978	0	90	70	4	933	Y	92	859	1159	Perennial								stream failure
EI-2-8	1	DS	D	2000	0	60	30	4	267	Y	92	245	331	Perennial								
EI-28-1	4	DS	Q	96	0	48	16	4	114	Y	92	105	141	Ephem./Int.	ROAD							
EI-28-2	4	DS	P	96	0	96	16	4	228	N	0	0	0		ROAD							
EI-28-3	4	DS	D	1987	0	65	50	4	481	Y	92	443	585	Perennial	ROAD							
EI-2-9	4	DS	P	2000	0	60	30	4	267	Y	92	245	331	Perennial	Road							
EI-3-3	4	DS	D	1987	0	80	160	4	1896	Y	92	1745	2303	Ephem./Int.								
EI-3-4	4	DS	P	1978	0	130	50	4	963	Y	92	886	1196	Perennial								stream failure
EI-34-1	4	DF	D	96	0	48	32	4	228	Y	92	209	283	Perennial	Landing							
EI-34-10	4	DS	P	1978	0	50	20	4	148	Y	92	136	184	Perennial	ROAD							
EI-34-12		RS	P			1560	580	0		Y				Perennial		2	3	3	3	4	Y	
EI-34-2	4	DF	D	96	0	35	16	4	83	Y	92	76	103	Perennial	Landing							
EI-34-3	4	DF	D	96	0	64	16	4	152	Y	92	140	188	Perennial	Landing							
EI-34-4	4	DF	P	96	0	80	16	4	190	N	0	0	0		ROAD							
EI-34-5	4	DF	D	96	0	64	16	4	152	N	0	0	0									

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EI-34-6	4	DS	D	96	90	150	100	2	1111	Y	100	1111	1500	Perennial	ROAD							
EI-34-7		RS	Q			1540	1040	0		Y				Perennial		3	3	3	3	4	N	
EI-34-8	4	DS	D	1987	0	50	240	4	1778	Y	92	1636	2159	Perennial								
EI-34-9	4	DS	D	1987	0	65	100	4	963	Y	92	886	1169	Perennial								
EI-3-5	4	DS	P	1987	0	100	50	4	741	Y	92	681	900	Perennial	SKID							inner gorge
EI-35-1	4	DF	P	96	0	160	16	4	379	Y	92	349	471	Perennial								
EI-35-10	4	DS	D	96	56	100	40	3	444	Y	100	444	600	Perennial	ROAD							
EI-35-11	4	DS	D	96	85	100	150	4	2222	Y	80	1778	2400	Perennial	ROAD							
EI-35-12	4	DS	D	96	75	100	70	3	778	Y	100	778	1050	Perennial								
EI-35-13	4	DS	D	96	100	30	70	4	311	Y	100	311	420	Perennial	ROAD							
EI-35-14	4	DS	D	96	85	150	130	3	2167	Y	100	2167	2925	Perennial	ROAD							
EI-35-15	4	DS	D	96	65	60	50	3	333	Y	100	333	450	Perennial	ROAD							
EI-35-16	4	DS	D	96	60	50	100	2	370	Y	100	370	500	Perennial								
EI-35-17	4	DS	D	1987	65	240	80	4	2844	Y	92	2617	3454	Perennial	ROAD/Landing							
EI-35-18	4	DS	D	1987	0	80	130	4	1541	Y	92	1417	1871	Perennial								stream side
EI-35-19	4	DS	D	1987	0	80	240	4	2844	Y	92	2617	3454	Perennial								
EI-35-2	4	DS	D	96	65	120	30	2	267	Y	100	267	360	Perennial								
EI-35-20	4	DS	D	1978	0	290	50	4	2148	Y	92	1976	2668	Perennial	ROAD							takes out a couple roads
EI-35-21	4	DS	D	1987	0	240	80	4	2844	Y	92	2616	3401	Perennial								
EI-35-22		RS	Q			2420	1010	0		Y				Perennial		3	3	3	3	4	Y	
EI-35-23		RS	D			2930	2960	0		Y				Perennial		3	3	3	3	4	Y	
EI-35-24		RS	P			2280	1440	0		Y				Perennial		3	3	3	3	4	N	
EI-35-25		RS	P			1950	800	0		Y				Perennial		3	3	3	3	4	Y	
EI-35-26		RS	D			3380	1540	0		Y				Perennial		3	2	3	3	4	Y	
EI-35-3	4	DS	D	96	70	1000	600	8	177778	Y	100	177778	240000	Perennial	ROAD							SKID across slide, recent activity
EI-35-4	4	DS	D	96	80	170	100	2	1259	Y	100	1259	1700	Perennial	ROAD							
EI-35-5	4	DS	D	96	0	64	80	4	759	Y	92	698	942	Perennial	ROAD							
EI-35-6	4	DS	D	96	90	150	100	2	1111	Y	100	1111	1500	Perennial	ROAD							
EI-35-7	4	DS	D	96	90	200	80	2	2044	Y	100	2044	2760	Perennial	ROAD							
EI-35-8	4	DS	D	96	90	200	80	2	1185	Y	100	1185	1600	Perennial	ROAD							
EI-35-9	4	DS	D	96	0	250	200	5	9259	Y	100	9259	1250	Perennial	ROAD							
EJ-17-1	4	DS	D	99	42	350	100	8	10370	Y	70	7259	9800	Ephem./Int.	ROAD							ROAD at top of slide
EJ-21-1	4	DS	Q	96	0	64	16	4	152	N	0	0	0									
EJ-27-1		EF	Q			2240	1120	0		Y				Ephem./Int.		4	3	3	3	4	N	
EJ-28-1	4	DS	P	1987	0	50	30	4	222	Y	92	204	270	Ephem./Int.								
EJ-28-2	4	DS	D	1987	0	65	50	4	481	Y	92	443	585	Ephem./Int.	ROAD							
EJ-28-3	4	DS	D	1987	0	150	80	4	1778	Y	92	1636	2159	Ephem./Int.	SKID							older skid
EJ-28-4	4	DS	P	1987	0	80	50	4	593	Y	92	545	720	Ephem./Int.	ROAD							
EJ-28-5		RS	Q			1580	860	0		Y				Perennial		3	3	3	3	4	N	
EJ-33-1	4	DS	D	1987	0	65	30	4	289	Y	92	266	351	Perennial	ROAD							
EJ-33-2	4	DS	D	1987	0	30	50	4	222	Y	92	204	270	Perennial	ROAD							
EL-10-1	4	DS	Q	96	0	80	40	4	474	N	0	0	0									
EL-10-10	4	DS	P	2000	0	140	80	4	1659	Y	92	1527	2061	Ephem./Int.	SKID							
EL-10-11	4	DS	D	2000	0	120	70	4	1244	Y	92	1145	1546	Ephem./Int.								
EL-10-12	2	DS	P	2000	0	140	110	4	2281	Y	92	2099	2834	Ephem./Int.								
EL-10-2	4	DS	D	96	0	96	80	4	1138	Y	92	1047	1413	Ephem./Int.	ROAD							
EL-10-3	4	DF	D	96	0	160	48	4	1138	Y	92	1047	1413	Perennial								
EL-10-4	4	DS	P	96	0	80	32	4	379	Y	92	349	471	Ephem./Int.								
EL-10-5	4	DS	P	1978	0	110	70	4	1141	Y	92	1049	1417	Ephem./Int.	SKID							
EL-10-6	4	DS	D	1978	0	130	180	4	3467	Y	92	3189	4306	Ephem./Int.	ROAD							
EL-10-7	4	DS	D	1978	0	260	130	4	5007	Y	92	4607	6219	Perennial	ROAD							
EL-10-9	3	DS	D	2000	0	160	80	4	1896	Y	92	1745	2355	Ephem./Int.								HW SWALE

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EL-13-1	3	DS	P	1981	0	220	90	4	2933	Y	92	2698	3507	Ephem./Int.	SKID							
EL-14-1	4	DF	D	96	0	112	48	4	796	Y	92	733	989	Ephem./Int.	ROAD							
EL-14-10	4	DS	D	78;81;87	0	50	80	4	593	Y	92	546	710	Perennial	ROAD							
EL-14-11	1	DS	D	1978	0	220	110	4	3585	Y	92	3298	4453	Perennial	ROAD							
EL-14-12	4	DS	D	1978	0	110	90	4	1467	Y	92	1349	1822	Ephem./Int.	SKID							
EL-14-13	4	DS	D	1978	0	110	50	4	815	Y	92	750	1012	Perennial	ROAD							
EL-14-14	4	DS	D	1978	0	50	50	4	370	Y	92	341	460	Perennial	ROAD							
EL-14-15	1	DS	D	1978	0	70	240	4	2489	Y	92	2290	3091	Perennial	ROAD							
EL-14-16	4	DS	D	1978	0	70	70	4	726	Y	92	668	902	Perennial	ROAD							
EL-14-17	4	DS	D	1978	0	110	90	4	1467	Y	92	1349	1822	Perennial	ROAD							
EL-14-18	4	DS	D	1978	0	110	130	4	2119	Y	92	1949	2631	Perennial	ROAD							
EL-14-19	4	DS	P	1978	0	150	20	4	444	Y	92	409	552	Perennial	ROAD							
EL-14-2	4	DS	D	96	0	80	112	4	1327	Y	92	1221	1649	Perennial	ROAD							inner gorge
EL-14-20		RS	Q			2260	1630	0		Y				Perennial		3	3	3	3	4	Y	
EL-14-21	3	DS	D	2000	0	490	130	4	9437	Y	92	8682	11721	Ephem./Int.	ROAD							
EL-14-22		RS	Q			2240	3890	0		Y				Perennial		3	3	3	3	4	Y	
EL-14-3	4	DS	D	98	73	150	300	4	6667	Y	80	5333	7200	Perennial	ROAD							
EL-14-4	4	DS	P	1987	0	80	20	4	237	Y	92	218	283	Perennial	ROAD							
EL-14-5	4	DS	D	1987	0	130	160	4	3081	Y	100	3081	4005	Perennial	ROAD							
EL-14-6	4	DS	D	1987	0	80	15	4	178	Y	100	178	231	Perennial	ROAD							
EL-14-7	4	DS	D	1987	0	80	30	4	356	Y	100	356	463	Perennial	ROAD							
EL-14-8	4	DS	D	1987	0	50	30	4	222	Y	92	204	265	Ephem./Int.	ROAD							
EL-14-9	4	DS	D	1987	0	50	20	4	148	Y	92	136	177	Ephem./Int.	ROAD							
EL-15-1	4	DS	P	96	0	80	96	4	1138	Y	92	1047	1413	Perennial								inner gorge
EL-15-2	4	DS	D	96	0	80	80	4	948	Y	92	872	1178	Perennial	ROAD							inner gorge
EL-15-4	4	DS	D	1987	0	30	15	4	67	Y	92	62	81	Perennial								stream bank failure
EL-15-5	4	DS	Q	1987	0	80	65	4	770	Y	92	708	920	Ephem./Int.	ROAD							
EL-15-6	4	DS	P	1987	0	50	15	4	111	Y	92	102	133	Perennial	LANDING							stream failure
EL-15-7	4	DT	D	1978	0	240	20	4	711	Y	92	654	883	Perennial	ROAD							
EL-15-8	3	DS	D	2000	0	220	120	4	3911	Y	92	3598	4858	Ephem./Int.	ROAD							
EL-15-9		RS	P			1580	450	0		Y				Perennial		3	3	3	3	4	N	
EL-16-1	4	DF	Q	96	0	80	48	4	569	Y	92	523	707	Ephem./Int.								
EL-16-10	4	DS	D	1978	0	90	90	4	1200	Y	92	1104	1490	Perennial	ROAD							
EL-16-11	4	DS	D	1978	0	110	70	4	1141	Y	92	1049	1417	Perennial	ROAD							older
EL-16-12		RS	Q			1560	530	0		Y				Ephem./Int.		4	3	3	3	4	N	
EL-16-2	4	DS	P	96	0	80	16	4	190	Y	92	174	236	Ephem./Int.								
EL-16-3	4	DS	P	1987	0	100	30	4	444	Y	92	408	530	Ephem./Int.								stream failure
EL-16-4	4	DS	P	1987	0	50	65	4	481	Y	92	443	576	Perennial	ROAD							
EL-16-5	4	DS	P	1987	0	50	50	4	370	Y	92	340	442	Ephem./Int.	ROAD							
EL-16-6	4	DS	P	1987	0	80	65	4	770	Y	92	708	920	Ephem./Int.								
EL-16-7	4	DS	D	1978	0	130	70	4	1348	Y	92	1240	1674	Perennial	ROAD							
EL-16-8	4	DS	P	1978	0	330	70	4	3422	Y	92	3148	4250	Perennial	SKID							
EL-16-9	4	DS	P	1978	0	130	70	4	1348	Y	92	1240	1674	Perennial	SKID							
EL-17-1	4	DS	P	96	0	32	96	4	455	Y	92	419	565	Perennial								inner gorge
EL-17-2	4	DF	D	96	0	176	48	4	1252	Y	92	1151	1554	Ephem./Int.	ROAD							
EL-17-3	4	DS	D	96	0	96	32	4	455	Y	92	419	565	Ephem./Int.	Landing							
EL-17-4	4	DS	D	1987	0	210	80	4	2489	Y	92	2290	2977	Ephem./Int.	ROAD							skid/road on top of slide
EL-17-5		RS	Q			780	580	0		Y				Perennial		3	3	3	3	4	N	
EL-18-1	4	DS	P	96	0	48	64	4	455	Y	92	419	565	Perennial								inner gorge
EL-18-2	4	DS	P	96	0	32	96	4	455	Y	92	419	565	Perennial								inner gorge
EL-18-3		RS	Q			720	260	0		Y				Perennial		3	2	3	3	4	N	
EL-18-6		RS	Q			2250	4480	0		Y				Perennial		3	3	3	3	4	Y	

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EL-7-1	4	DS	P	96	63	60	63	4	560	Y	100	560	756	Perennial	ROAD							
EL-8-1	4	DS	D	96	0	200	110	4	3259	Y	80	2607	3520	Perennial	ROAD							
EL-8-11	4	DS	P	1978	0	90	50	4	667	Y	92	613	828	Ephem./Int.	SKID							
EL-8-12		RS	Q			550	400	0		Y				Perennial		3	3	3	3	4	N	
EL-8-13		RS	Q			590	430	0		Y				Perennial		3	3	3	3	4	N	
EL-8-14		RS	Q			1560	1920	0		Y				Perennial		3	3	3	3	4	Y	
EL-8-2	4	DS	P	96	0	48	64	4	455	Y	92	419	565	Perennial								inner gorge
EL-8-3	4	DS	P	96	0	32	48	4	228	Y	92	209	283	Perennial								inner gorge
EL-8-4	4	DS	P	96	0	48	48	4	341	Y	92	314	424	Perennial								inner gorge
EL-8-5	4	DS	Q	96	0	48	48	4	341	Y	92	314	424	Perennial								inner gorge
EL-8-6	4	DS	D	96	0	160	48	4	1138	N	0	0	0									
EL-8-7	4	DS	D	96	95	200	70	8	4148	Y	100	4148	5600	Perennial	ROAD							culvert
EL-8-9	4	DS	D	98	76	150	70	3	1167	Y	70	817	1103	Perennial								
EL-9-1	4	DS	Q	96	0	80	400	4	4741	N	0	0	0		Landing							5-10 years old, reveg.
EL-9-2	4	DS	Q	1987	0	80	30	4	356	Y	92	328	426	Ephem./Int.								
EL-9-4	2	DS	D	2000	0	250	50	4	1852	Y	92	1704	2300	Ephem./Int.								
EL-9-5	4	DS	D	2000	0	510	100	4	7556	Y	92	6951	9384	Ephem./Int.								
EL-9-6	2	DS	D	2000	0	390	80	4	4622	Y	92	4252	5741	Ephem./Int.								
EL-9-7		RS	Q			800	320	0		Y				Ephem./Int.		3	2	3	3	4	N	
EL-9-8	2	DS	D	2000	0	210	180	4	5600	Y	92	5152	6955	Ephem./Int.								
EL-9-9		RS	Q			1410	700	0		Y				Perennial		2	2	3	3	4	N	
EM-1-1	4	DS	D	96	0	160	96	4	2276	Y	92	2094	2826	Ephem./Int.								
EM-11-1	4	DS	D	96	78	50	100	2	370	Y	20	74	100	Perennial	ROAD							recent activity
EM-11-2	4	DS	Q	96	0	64	16	4	152	N	0	0	0									
EM-11-3	4	DS	P	96	0	48	16	4	114	N	0	0	0									
EM-11-4	4	DS	Q	96	0	128	48	4	910	Y	92	837	1130	Perennial								
EM-11-5	4	DS	D	98	45	70	110	3	856	N	0	0	0		ROAD							
EM-11-6	4	DS	D	1978	0	180	90	4	2400	Y	92	2208	2981	Ephem./Int.	SKID							skid lower on slide as well
EM-11-7		RS	Q			1290	700	0		Y				Perennial		3	3	3	5	4	N	
EM-1-2	4	DS	P	96	0	64	32	4	303	Y	92	279	377	Ephem./Int.								
EM-12-1	4	DS	D	96	0	176	80	4	2086	Y	92	1919	2591	Ephem./Int.								
EM-12-2	2	DS	D	1987	0	160	50	4	1185	Y	92	1090	1439	Perennial	ROAD							
EM-12-3	4	DS	D	96	0	80	16	4	190	Y	92	174	236	Ephem./Int.	ROAD							
EM-12-4	4	DS	D	1978	0	130	90	4	1733	Y	92	1595	2153	Ephem./Int.	SKID							
EM-12-5	3	DS	P	2000	0	220	70	4	2281	Y	92	2099	2834	Ephem./Int.								
EM-12-6		RS	Q			870	1280	0		Y				Ephem./Int.		3	3	3	4	4	N	
EM-12-7	3	DS	P	2000	0	140	30	4	622	Y	92	572	773	Ephem./Int.								
EM-12-8	3	DS	Q	2000	0	250	100	4	3704	Y	92	3407	4600	Ephem./Int.								
EM-1-3	4	DS	D	1987	0	200	50	4	1481	Y	92	1363	1799	Ephem./Int.	SKID							
EM-13-1	4	DS	P	96	0	160	80	4	1896	Y	92	1745	2355	Perennial								
EM-13-10	4	DS	Q	1987	0	100	30	4	444	Y	92	409	540	Ephem./Int.								
EM-13-11	4	DS	D	1987	0	100	50	4	741	Y	92	682	887	Perennial	ROAD							
EM-13-12	4	DS	P	1987	0	160	20	4	474	Y	92	436	567	Perennial	ROAD							
EM-13-13	4	DS	P	1987	0	100	20	4	296	Y	92	272	354	Perennial								
EM-13-14	4	DS	P	1987	0	80	50	4	593	Y	92	545	720	Perennial	ROAD							
EM-13-15	4	DS	D	1978	0	50	50	4	370	Y	92	341	460	Perennial	ROAD							
EM-13-16	4	DS	D	1978	0	110	40	4	652	Y	92	600	810	Ephem./Int.	SKID							
EM-13-17	4	DS	P	1978	0	70	50	4	519	Y	92	477	644	Ephem./Int.	SKID							
EM-13-18	4	DS	D	1978	0	260	50	4	1926	Y	92	1772	2392	Ephem./Int.	SKID							inner gorge
EM-13-19	4	DT	D	1987	0	80	20	4	237	Y	92	218	288	Perennial	SKID							
EM-13-2	4	DS	D	96, 87	80	100	200	3	2222	Y	100	2222	3000	Perennial								
EM-13-20	2	DS	P	2000	0	160	70	4	1659	Y	92	1527	2061	Ephem./Int.								

Id	MWMU	Landslides Type	Landslides Certainty	Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet) Length	Width	Depth	Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	Comments
EM-13-21	2	DS	Q	2000	0	80	60	4	711	Y	92	654	883	Ephem./Int.								
EM-13-22		RS	Q			1190	1380	0		Y				Perennial		3	3	3	3	4	N	
EM-13-3	4	DS	P	96	0	272	80	4	3224	N	0	0	0									
EM-13-4	4	DS	D	96	0	96	64	4	910	Y	92	837	1130	Perennial	ROAD							inner gorge
EM-13-5	4	DF	P	96	0	160	16	4	379	Y	92	349	471	Ephem./Int.	ROAD							
EM-13-6	4	DS	P	96	0	64	32	4	303	Y	92	279	377	Ephem./Int.	ROAD							
EM-13-7	4	DS	D	96	0	80	80	4	948	Y	92	872	1178	Ephem./Int.								
EM-13-8	4	DS	P	1987	0	50	10	4	74	N	0	0	0		LAND							
EM-13-9	4	DS	D	1987	0	80	64	4	759	Y	92	698	921	Perennial	ROAD							
EM-1-4	4	DS	D	1987	0	160	80	4	1896	Y	92	1745	2303	Ephem./Int.	SKID							
EM-14-1	4	DS	Q	96	0	48	32	4	228	Y	92	209	283	Perennial								
EM-14-2	4	DS	P	1978	0	70	20	4	207	Y	92	191	258	Perennial	SKID							
EM-17-1	4	DF	P	96	0	320	32	4	1517	Y	92	1396	1884	Ephem./Int.								
EM-17-10	4	DS	P	96	0	64	64	4	607	N	0	0	0									
EM-17-11	4	DS	D	96	92	150	100	8	4444	Y	100	4444	6000	Perennial	ROAD							inner gorge, culvert
EM-17-12	4	DS	P	96	0	80	32	4	379	Y	92	349	471	Perennial								inner gorge
EM-17-13	4	DS	D	97	78	80	250	2	1481	Y	60	889	1200	Perennial	ROAD							
EM-17-14	4	DS	D	97	78	300	210	5	11667	Y	100	11667	15750	Perennial	ROAD							both road on top and middle of slide
EM-17-15	4	DS	D	96	73	100	40	5	741	Y	100	741	1000	Perennial	ROAD							
EM-17-16	4	DS	D	96	75	250	200	3	5556	Y	80	4444	6000	Perennial	ROAD/Landing							
EM-17-17	4	DS	D	96	80	100	100	4	1481	Y	100	1481	2000	Perennial	ROAD							
EM-17-18	4	DF	D	96	80	200	50	2	741	Y	100	741	1000	Perennial								
EM-17-19	4	DS	D	96	66	80	100	3	889	Y	40	356	480	Perennial	ROAD							
EM-17-2	4	DF	P	96	0	240	16	4	569	Y	92	523	707	Ephem./Int.	ROAD							
EM-17-20	4	DS	P	1987	0	160	20	4	474	Y	92	436	576	Perennial	ROAD							
EM-17-21	4	DS	P	1987	0	80	30	4	356	Y	92	327	432	Perennial	ROAD							
EM-17-22	4	DS	D	1987	0	160	30	4	711	Y	92	654	864	Perennial	ROAD							
EM-17-23	4	DS	D	1978	0	50	110	4	815	Y	92	750	1012	Perennial	ROAD							skid on top
EM-17-24	4	DS	D	1978	0	70	130	4	1348	Y	92	1240	1674	Perennial	ROAD							
EM-17-25	4	DS	P	1978	0	70	25	4	259	Y	92	239	322	Perennial	ROAD							
EM-17-26		RS	P			1560	1120	0		Y				Ephem./Int.		2	3	3	4	4	N	
EM-17-3	4	DS	P	96	0	64	32	4	303	Y	92	279	377	Perennial								
EM-17-4	4	DS	Q	96	0	32	64	4	303	N	0	0	0									
EM-17-5	4	DS	Q	96	0	32	48	4	228	N	0	0	0									
EM-17-6	4	DS	P	96	0	48	16	4	114	Y	92	105	141	Ephem./Int.	ROAD							
EM-17-7	4	DF	P	96	0	192	16	4	455	Y	92	419	565	Perennial								
EM-17-8	4	DS	D	96	72	150	100	4	2222	Y	100	2222	3000	Perennial	ROAD							inner gorge
EM-17-9	4	DF	D	96	0	272	16	4	645	Y	92	593	801	Perennial	ROAD							washed out two roads
EM-18-1	4	DS	D	96	78	400	330	5	24444	Y	90	22000	29700	Perennial	ROAD							inner gorge, recent activity, slide over road
EM-18-10	4	DS	D	97	68	80	130	2	770	Y	70	539	728	Perennial	ROAD							
EM-18-11	4	DS	D	97<	70	300	250	7	19444	Y	80	15556	21000	Perennial	ROAD							old road on top of slide
EM-18-12	4	DS	D	97	80	150	100	7	3889	Y	90	3500	4725	Ephem./Int.	ROAD							road on top of slide
EM-18-13	4	DS	D	97	78	80	250	2	1481	Y	60	889	1200	Perennial	ROAD							
EM-18-14	4	DF	D	98	73	150	300	4	6667	Y	80	5333	7200	Perennial								
EM-18-15	4	DS	D	97<	80	300	150	8	13333	Y	90	12000	16200	Perennial	ROAD/Landing							
EM-18-16	4	DS	D	1987	0	80	20	4	237	Y	92	218	288	Perennial	ROAD							inner gorge
EM-18-17	4	DS	P	1987	0	50	30	4	222	Y	92	204	270	Ephem./Int.	SKID							
EM-18-18	4	DS	Q	1987	0	80	50	4	593	Y	92	545	720	Ephem./Int.	ROAD							inner gorge
EM-18-19	4	DS	P	1987	0	50	20	4	148	Y	92	136	180	Perennial	ROAD							
EM-18-2	4	DS	D	96	78	110	80	3	15880	Y	100	15880	21438	Perennial	ROAD							inner gorge
EM-18-20	4	DS	D	1987	0	80	30	4	356	Y	92	327	432	Ephem./Int.	SKID							
EM-18-21	4	DS	D	1978	0	90	40	4	533	Y	92	491	662	Perennial	ROAD							

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%)	Average Landslide Dimensions (feet)			Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty		Field	Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	
EM-18-22	4	DS	D	1978	0	150	110	4	2444	Y	92	2249	3036	Perennial	ROAD							
EM-18-23	4	DS	D	1978	0	220	180	4	5867	Y	92	5397	7286	Perennial	ROAD							inner gorge
EM-18-24	4	DS	D	1978	0	90	70	4	933	Y	92	859	1159	Perennial	ROAD							inner gorge
EM-18-25	4	DS	P	1978	0	70	70	4	726	Y	92	668	902	Ephem./Int.	SKID							
EM-18-26	4	DS	D	1987	0	240	35	4	1244	Y	92	1145	1511	Perennial								
EM-18-27	4	DS	D	1978	0	90	30	4	400	Y	92	368	497	Perennial	SKID							
EM-18-28	4	DS	D	1978	0	60	20	4	178	Y	92	164	221	Perennial	SKID							
EM-18-29	4	DS	P	1978	0	150	40	4	889	Y	92	818	1104	Ephem./Int.								
EM-18-3	4	DS	D	96	78	350	350	4	15880	Y	100	15880	21438	Perennial	ROAD							inner gorge, over road
EM-18-30		RS	Q			1070	700	0		Y				Perennial		3	3	3	3	4	N	
EM-18-4	4	DS	D	96	86	200	150	2	2222	Y	90	2000	2700	Perennial	ROAD							
EM-18-5	4	DS	P	96	0	48	32	4	228	Y	92	209	283	Ephem./Int.								
EM-18-6	4	DF	Q	96	0	32	10	4	47	N	0	0	0		Landing							
EM-18-7	4	DS	P	96	0	32	16	4	76	N	0	0	0		Landing							
EM-18-8	4	DS	P	96	0	32	16	4	76	Y	92	70	94	Ephem./Int.								
EM-18-9	4	DS	P	96	0	48	16	4	114	Y	92	105	141	Ephem./Int.	ROAD							inner gorge
EM-19-1		RS	P			1230	1120	0		Y				Perennial		3	3	3	3	4	N	
EM-20-1	4	DS	P	96	0	32	16	4	76	Y	92	70	94	Perennial	ROAD							
EM-20-10	4	DS	P	1978	0	90	50	4	667	Y	92	613	828	Perennial	ROAD							
EM-20-11	4	DS	P	1978	0	110	40	4	652	Y	92	600	810	Ephem./Int.	ROAD							
EM-20-12	4	DS	D	1978	0	130	50	4	963	Y	92	886	1196	Ephem./Int.	SKID							
EM-20-13	4	DS	D	1978	0	110	20	4	326	Y	92	300	405	Perennial	ROAD							
EM-20-14	4	DS	P	1978	0	110	50	4	815	Y	92	750	1012	Perennial	ROAD/SKID							
EM-20-15		RS	Q			1680	770	0		Y				Perennial		3	3	3	3	4	N	
EM-20-16		RS	P			3120	5680	0		Y				Perennial		3	3	4	4	4	Y	
EM-20-2	4	DS	D	96	0	80	32	4	379	N	0	0	0		ROAD							
EM-20-3	4	DS	P	96	0	80	192	4	2276	N	0	0	0		ROAD							
EM-20-4	4	DT	P	1987	0	160	20	4	474	Y	92	436	576	Perennial	ROAD							inner gorge
EM-20-5	4	DF	Q	96	0	80	16	4	190	Y	92	174	236	Ephem./Int.								
EM-20-6	1	DT	P	78;81;87	0	160	20	4	474	Y	92	436	567	Perennial	ROAD							
EM-20-8	4	DS	P	1978	0	70	20	4	207	Y	92	191	258	Perennial	ROAD/SKID							
EM-20-9	4	DS	D	1978	0	90	70	4	933	Y	92	859	1159	Perennial	SKID							
EM-21-1	4	DS	P	96	0	32	160	4	759	N	0	0	0									
EM-21-2	4	DS	P	1987	0	80	10	4	119	Y	92	109	144	Perennial	LAND							
EM-21-3	4	DS	D	1978	0	70	20	4	207	Y	92	191	258	Perennial	ROAD							
EM-24-1	3	DS	P	2000	0	220	50	4	1630	Y	92	1499	2024	Ephem./Int.	ROAD							
EM-24-2	3	DT	P	2000	0	670	80	4	7941	Y	92	7305	9862	Ephem./Int.								HW SWALE
EM-28-1	4	DS	P	96	0	96	48	4	683	N	0	0	0									
EM-28-2	4	DS	Q	96	0	96	32	4	455	N	0	0	0									
EM-28-3	4	DT	P	1987	0	80	10	4	119	Y	92	109	144	Perennial	ROAD							
EM-28-4	4	DS	D	1987	0	160	20	4	474	N	0	0	0		ROAD							
EM-28-5	4	DS	P	1987	0	80	10	4	119	Y	92	109	144	Perennial	ROAD							
EM-29-1	4	DS	D	96	0	48	16	4	114	N	0	0	0		Landing							
EM-29-2	4	DS	P	96	0	32	32	4	152	N	0	0	0		ROAD							
EM-29-3	4	DS	Q	96	0	16	32	4	76	N	0	0	0		ROAD							
EM-29-4	4	DF	P	96	0	160	32	4	759	Y	92	698	942	Ephem./Int.								
EM-29-5	4	DS	P	1987	0	65	10	4	96	Y	92	89	117	Perennial	LAND							
EM-5-1	4	DS	D	96	78	180	80	4	2133	Y	80	1707	2304	Perennial	Landing							
EM-6-1	4	DS	D	96	0	64	16	4	152	Y	92	140	188	Perennial	ROAD							
EM-7-1	4	DS	P	96	0	160	32	4	759	Y	92	698	942	Perennial	ROAD							
EM-7-10	4	DT	P	1987	0	80	60	4	711	Y	92	654	864	Perennial	SKID							
EM-7-11	4	DS	D	1987	0	80	30	4	356	Y	92	327	432	Ephem./Int.	SKID							

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%)	Average Landslide Dimensions (feet)			Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty		Field	Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	
EM-7-12	4	DS	P	1987	0	50	50	4	370	Y	92	341	450	Ephem./Int.	SKID							
EM-7-13	4	DF	Q	1987	0	50	10	4	74	Y	92	68	90	Ephem./Int.	SKID							
EM-7-14	4	DS	P	1987	0	80	50	4	593	Y	92	545	720	Ephem./Int.	SKID							
EM-7-15	4	DS	P	1987	0	80	30	4	356	Y	92	327	432	Ephem./Int.								
EM-7-16	4	DS	P	1987	0	50	15	4	111	Y	92	102	135	Ephem./Int.	SKID							
EM-7-17	4	DS	Q	1978	0	90	20	4	267	Y	92	245	331	Ephem./Int.								
EM-7-2	4	DS	D	96	0	160	32	4	759	N	0	0	0		Landing							
EM-7-3	4	DS	Q	96	0	48	16	4	114	Y	92	105	141	Ephem./Int.								
EM-7-4	4	DF	P	96	0	128	16	4	303	Y	92	279	377	Ephem./Int.	ROAD							
EM-7-5	4	DS	P	96	0	240	112	4	3982	Y	92	3664	4946	Perennial								
EM-7-6	4	DS	P	1987	0	80	30	4	356	Y	92	327	432	Perennial	ROAD							
EM-7-7	4	DS	P	1987	0	200	50	4	1481	Y	92	1363	1799	Ephem./Int.	LAND							
EM-7-8	4	DS	P	1987	0	80	30	4	356	Y	92	327	432	Perennial	SKID							
EM-7-9	4	DT	P	1987	0	115	50	4	852	Y	92	784	1034	Perennial	SKID							
EM-8-1	4	DS	D	96	0	160	80	4	1896	N	0	0	0		ROAD							
EM-8-10	4	DS	D	97	86	70	200	4	2074	Y	65	1348	1820	Perennial	ROAD							
EM-8-11	4	DS	D	1987	0	80	65	4	770	Y	100	770	1017	Perennial	ROAD							inner gorge
EM-8-12	4	DS	D	1980	0	80	65	4	770	Y	92	709	936	Perennial	ROAD							older slide
EM-8-13	4	DS	P	1987	0	80	20	4	237	Y	92	218	288	Perennial								
EM-8-14	4	DS	P	1987	0	80	20	4	237	Y	92	218	288	Ephem./Int.	ROAD							
EM-8-15	4	DS	P	1987	0	80	80	4	948	Y	92	872	1151	Perennial	ROAD							
EM-8-16	4	DT	P	1987	0	80	20	4	237	Y	92	218	288	Ephem./Int.	SKID							
EM-8-17	4	DS	D	1987	0	50	30	4	222	Y	92	204	270	Ephem./Int.								
EM-8-18	4	DS	D	1987	0	130	50	4	963	Y	92	886	1169	Ephem./Int.								
EM-8-19	4	DS	P	1978	0	20	40	4	119	Y	92	109	147	Perennial	ROAD							
EM-8-2	4	DS	P	96	0	160	80	4	1896	Y	92	1745	2355	Perennial	ROAD							
EM-8-20	4	DS	P	1978	0	150	90	4	2000	Y	92	1840	2484	Ephem./Int.	ROAD							
EM-8-21	4	DS	D	1978	0	70	220	4	2281	Y	92	2099	2834	Perennial	ROAD							
EM-8-22	4	DS	P	1978	0	110	50	4	815	N	0	0	0		ROAD							
EM-8-23	4	DS	D	1978	0	40	110	4	652	Y	92	600	810	Perennial	ROAD							
EM-8-24	4	DS	D	1978	0	40	20	4	119	Y	92	109	147	Perennial	ROAD							
EM-8-3	4	DS	P	96	0	80	16	4	190	Y	92	174	236	Ephem./Int.	ROAD							
EM-8-4	4	DS	D	96	82	200	370	4	10963	Y	85	9319	12580	Perennial	ROAD							
EM-8-5	4	DS	D	96	84	80	100	2	593	Y	20	119	160	Perennial	ROAD							
EM-8-6	4	DS	D	96	90	200	150	4	4444	Y	100	4444	6000	Perennial	ROAD							inner gorge
EM-8-7	4	DS	D	1987	78	100	20	4	296	Y	92	273	360	Perennial	ROAD							seen in field 1999
EM-8-8	4	DS	D	1987	78	130	35	4	674	Y	92	620	819	Perennial	ROAD							seen in field 1999
EM-8-9	4	DS	P	96	0	80	16	4	190	N	0	0	0		Landing/ROAD							
EM-9-1	4	DS	D	96	80	50	80	3	444	Y	100	444	600	Ephem./Int.	ROAD							
EM-9-2	4	DT	P	1987	0	120	50	4	889	Y	92	818	1079	Ephem./Int.	SKID							
EM-9-3	4	DS	Q	1987	0	100	30	4	444	Y	92	409	540	Ephem./Int.	SKID							could be skid
EN-1-1	4	DS	D	96	0	48	16	4	114	Y	92	105	141	Ephem./Int.	Landing							
EN-1-10	1	DS	D	1987	0	65	20	4	193	Y	92	177	234	Perennial	ROAD							
EN-1-11	1	DS	D	1978	0	200	70	4	2074	Y	92	1908	2576	Ephem./Int.	SKID							
EN-1-12	1	DS	D	1978	0	110	70	4	1141	Y	92	1049	1417	Ephem./Int.	SKID							
EN-1-13	4	DS	D	1987	0	160	100	4	2370	Y	92	2181	2879	Ephem./Int.	ROAD							
EN-1-14		RS	P			2340	1630	0		Y				Ephem./Int.		2	3	3	5	4	Y	
EN-1-2	4	DS	P	96	0	48	16	4	114	Y	92	105	141	Ephem./Int.	Landing							
EN-1-3	1	DS	D	1987	0	50	15	4	111	Y	92	102	135	Perennial	LAND							
EN-1-4	1	DS	Q	1987	0	100	30	4	444	N	0	0	0		SKID							
EN-1-5	1	DS	D	1987	0	80	30	4	356	Y	92	327	432	Ephem./Int.	SKID							
EN-1-6	1	DS	P	1987	0	100	50	4	741	Y	92	681	900	Ephem./Int.	ROAD							

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%)	Average Landslide Dimensions (feet)			Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty		Field	Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	
EN-1-7	4	DS	P	1987	0	115	30	4	511	N	0	0	0		SKID							
EN-1-8	4	DS	D	1987	0	260	160	4	6163	Y	92	5670	7484	Ephem./Int.	SKID							
EN-1-9	1	DS	D	1987	0	65	80	4	770	Y	92	709	936	Perennial	LAND							
EN-2-1	1	DF	D	96	100	110	10	2	81	N	0	0	0		ROAD							
EN-2-10	1	DS	D	2000	0	80	30	4	356	Y	92	327	442	Perennial								
EN-2-11	3	DS	D	2000	0	240	70	4	2489	Y	92	2290	3091	Ephem./Int.	ROAD							
EN-2-2	1	DS	D	96	98	170	60	10	3778	Y	50	1889	2550	Perennial	ROAD							
EN-2-3	1	DS	P	96	0	16	64	4	152	Y	92	140	188	Perennial	ROAD							
EN-2-4	4	DF	P	96	0	64	16	4	152	N	0	0	0		ROAD							
EN-2-5	4	DS	D	96	0	80	80	4	948	N	0	0	0									HW SWALE
EN-25-1	4	DS	D	96	0	80	48	4	569	Y	92	523	707	Ephem./Int.								
EN-25-2	4	DS	P	96	0	80	32	4	379	N	0	0	0		ROAD							
EN-25-4	4	DT	D	1987	0	240	30	4	1067	Y	92	981	1295	Perennial	LAND							road top and lower down slide
EN-25-5	4	DS	D	1987	0	160	30	4	711	Y	92	654	864	Ephem./Int.								HW Swale
EN-25-6	4	DS	D	1987	0	200	50	4	1481	Y	92	1363	1799	Perennial	LAND							
EN-25-7	4	DS	P	1987	0	80	50	4	593	Y	92	545	720	Ephem./Int.								
EN-25-8		RS	Q			1560	890	0		Y				Perennial		3	3	3	3	4	N	
EN-25-9		RS	Q			1190	1380	0		Y				Perennial		3	3	3	3	4	N	
EN-2-6	1	DS	P	96	0	48	16	4	114	Y	92	105	141	Ephem./Int.	Landing							
EN-26-1	4	DS	D	1987	0	80	50	4	593	N	0	0	0		LAND							
EN-2-7	1	DS	P	96	0	80	32	4	379	Y	92	349	471	Ephem./Int.								
EN-27-1		RS	Q			1760	850	0		Y				Ephem./Int.		3	2	3	3	4	N	
EN-2-8	4	DS	P	96	0	48	16	4	114	N	0	0	0									
EN-2-9	1	DS	D	87,96	0	100	70	4	1037	N	0	0	0									
EN-30-1	4	DF	D	96	0	560	16	4	1327	Y	92	1221	1649	Ephem./Int.	ROAD							
EN-30-10	4	DS	D	1978	0	130	50	4	963	Y	92	886	1196	Ephem./Int.	SKID							
EN-30-2	4	DS	P	96	0	128	80	4	1517	Y	92	1396	1884	Ephem./Int.								
EN-30-3	4	DS	D	96	0	64	32	4	303	Y	92	279	377	Ephem./Int.	ROAD							
EN-30-4	4	DS	D	96	0	112	48	4	796	N	0	0	0		ROAD							
EN-30-5	4	DF	D	96	0	192	64	4	1820	Y	92	1675	2261	Ephem./Int.	ROAD							washed out road
EN-30-6	4	DS	P	96	0	80	32	4	379	Y	92	349	471	Perennial	ROAD							
EN-30-7	4	DS	P	96	0	160	192	4	4551	Y	92	4187	5652	Ephem./Int.	ROAD/SKID							
EN-30-9	4	DS	D	1978	0	110	70	4	1141	Y	92	1049	1417	Perennial								
EN-3-1	1	DS	D	96	0	80	80	4	948	Y	92	872	1178	Perennial	ROAD							
EN-31-1	4	DS	P	96	0	80	16	4	190	N	0	0	0									
EN-31-10	4	DS	P	1987	0	50	30	4	222	Y	92	204	270	Ephem./Int.	SKID							
EN-31-11	4	DT	D	1987	0	100	10	4	148	Y	92	136	180	Perennial	ROAD							inner gorge
EN-31-12	1	DS	P	1987	0	80	20	4	237	Y	92	218	288	Perennial	ROAD							
EN-31-13	4	DS	P	1987	0	50	10	4	74	Y	92	68	90	Perennial	ROAD							
EN-31-14	4	DS	P	1987	0	50	10	4	74	Y	92	68	90	Perennial	ROAD							inner gorge
EN-31-15	4	DS	P	1987	0	30	30	4	133	Y	92	123	162	Perennial	ROAD							
EN-31-16	4	DS	D	1978	0	70	70	4	726	Y	92	668	902	Perennial	SKID							
EN-31-17	4	DS	D	1978	0	90	90	4	1200	Y	92	1104	1490	Perennial	ROAD							
EN-31-18	4	DS	P	1978	0	50	50	4	370	Y	92	341	460	Perennial	ROAD							
EN-31-19	4	DS	D	1978	0	90	20	4	267	Y	92	245	331	Perennial	ROAD							
EN-31-2	4	DS	D	96	135	40	100	4	593	Y	100	593	800	Perennial	ROAD							inner gorge
EN-31-20	1	DS	P	1978	0	110	70	4	1141	Y	92	1049	1417	Perennial	ROAD							
EN-31-21	4	DS	D	1978	0	150	70	4	1556	Y	92	1431	1932	Perennial								stream failure
EN-31-22		RS	Q			1110	1120	0		Y				Ephem./Int.		3	3	3	4	4	N	
EN-31-23	4	DS	P	2000	0	60	30	4	267	N	0	0	0		ROAD							
EN-31-24	3	DS	Q	2000	0	60	30	4	267	Y	92	245	331	Ephem./Int.								
EN-31-25	4	DS	D	78;81	0	260	90	4	3467	Y	92	3190	4147	Perennial	SKID							

Id	MWMU	Landslides Type	Landslides Certainty	Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet) Length	Width	Depth	Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	Comments
EN-31-26		RS	Q			2770	990	0		Y				Perennial		2	3	3	4	4	Y	
EN-31-3	4	DF	P	96	0	80	16	4	190	Y	92	174	236	Perennial	ROAD							
EN-31-4	4	DS	Q	96	0	64	48	4	455	N	0	0	0		ROAD							
EN-31-5	4	DS	D	96	0	160	16	4	379	N	0	0	0		ROAD							
EN-31-6	4	DS	D	96	0	112	32	4	531	Y	92	488	659	Perennial	ROAD							inner gorge
EN-31-9	4	DS	P	1987	0	80	20	4	237	Y	92	218	288	Ephem./Int.								
EN-3-2	1	DS	P	96	0	48	32	4	228	N	0	0	0		ROAD							
EN-3-3	1	DS	D	98	73	100	300	4	4444	Y	80	3556	4800	Perennial	ROAD							
EN-3-4	1	DS	P	1987	0	100	30	4	444	Y	92	409	540	Perennial	ROAD							inner gorge
EN-34-1	4	DS	D	96	96	50	100	5	926	Y	100	926	1250	Perennial	ROAD							inner gorge
EN-34-10	4	DS	P	96	0	64	16	4	152	N	0	0	0									
EN-34-11	4	DS	D	96	108	30	80	2	178	N	0	0	0		ROAD							
EN-34-12	4	DS	D	96	60	60	100	3	667	Y	100	667	900	Perennial	ROAD							inner gorge
EN-34-13	4	DS	D	96	116	80	198	3	1760	Y	80	1408	1901	Perennial	ROAD							
EN-34-14	4	DS	D	1987	0	50	35	4	259	Y	100	259	342	Perennial	ROAD							
EN-34-15	4	DS	D	1987	0	35	50	4	259	Y	92	239	315	Perennial	ROAD							
EN-34-16	3	DS	D	2000	0	140	100	4	2074	Y	92	1908	2576	Ephem./Int.	ROAD							
EN-34-17		RS	P			1780	600	0		Y				Perennial		3	3	3	3	4	N	
EN-34-18	2	DS	P	2000	0	60	30	4	267	Y	92	245	331	Ephem./Int.								
EN-34-19		RS	Q			1950	1010	0		Y				Perennial		3	3	4	4	4	Y	
EN-34-2	4	DS	D	96	78	150	50	2	556	Y	100	556	750	Perennial	ROAD							
EN-34-3	4	DS	D	96	78	100	150	6	3333	Y	100	3333	4500	Perennial	ROAD							inner gorge
EN-34-4	4	DS	D	96	0	48	16	4	114	Y	92	105	141	Perennial	ROAD							inner gorge
EN-34-5	4	DS	D	96	98	120	80	3	1067	Y	95	1013	1363	Perennial	ROAD							
EN-34-6	4	DS	D	96	80	120	50	4	889	Y	100	889	1200	Perennial	ROAD							inner gorge
EN-34-7	4	DS	D	96	94	200	220	3	4889	Y	80	3911	5280	Perennial	ROAD							
EN-34-8	4	DS	Q	96	0	80	16	4	190	Y	92	174	236	Perennial								
EN-34-9	4	DS	P	96	0	96	48	4	683	N	0	0	0									older?
EN-35-1	1	DS	D	96	0	240	96	4	3413	Y	92	3140	4239	Perennial	ROAD							
EN-35-10	1	DS	D	1987	0	320	80	4	3793	Y	92	3489	4606	Perennial	ROAD							
EN-35-11	4	DS	P	1987	0	180	80	4	2133	Y	92	1963	2591	Ephem./Int.	SKID							multiple skids trails
EN-35-12	1	DS	D	1987	0	80	80	4	948	Y	92	872	1151	Perennial	ROAD							cut bank
EN-35-13	1	DS	D	1987	0	50	30	4	222	Y	100	222	293	Perennial	ROAD							inner gorge
EN-35-14	4	DS	D	1987	0	200	130	4	3852	Y	100	3852	5084	Perennial	ROAD							
EN-35-15	4	DS	D	1987	0	115	50	4	852	Y	92	784	1034	Ephem./Int.	SKID							HW Swale
EN-35-16	4	DS	P	1987	0	80	35	4	415	Y	100	415	548	Perennial	SKID							
EN-35-17	1	DS	D	1978	0	130	90	4	1733	Y	92	1595	2153	Perennial	ROAD							
EN-35-18	1	DS	D	1978	0	260	130	4	5007	Y	92	4607	6219	Perennial	ROAD							
EN-35-19	3	DS	D	2000	0	80	65	4	770	N	0	0	0		ROAD							
EN-35-2	1	DS	D	96	80	110	80	3	978	Y	100	978	1320	Perennial								inner gorge, recent activity
EN-35-20	4	DS	P	2000	0	270	100	4	4000	Y	92	3680	4968	Ephem./Int.	ROAD							
EN-35-21	3	DS	D	2000	0	200	50	4	1481	Y	92	1363	1840	Ephem./Int.								
EN-35-22	1	DS	D	2000	0	180	30	4	800	Y	92	736	994	Ephem./Int.	ROAD							
EN-35-23		RS	Q			1780	910	0		Y				Perennial		3	3	3	3	4	N	
EN-35-24		RS	Q			390	240	0		Y				Perennial		3	3	3	3	4	N	
EN-35-25	2	DS	D	2000	0	120	50	4	889	Y	92	818	1104	Ephem./Int.	ROAD							
EN-35-3	1	DS	P	96	0	128	80	4	1517	Y	92	1396	1884	Perennial	ROAD							older?
EN-35-4	1	DS	D	96	0	80	32	4	379	Y	92	349	471	Perennial	ROAD							
EN-35-5	1	DS	P	96	0	48	60	4	427	Y	92	393	530	Perennial	ROAD							inner gorge
EN-35-6	1	DS	D	98	80	210	130	4	4044	Y	100	4044	5460	Perennial	Landing							
EN-35-7	1	DS	D	98	80	180	120	4	3200	Y	100	3200	4320	Perennial	Landing							
EN-35-8	1	DS	D	96	80	230	80	3	2044	Y	100	2044	2760	Perennial	ROAD							

Id	MWMU	Landslides Type	Landslides Certainty	Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet) Length	Width	Depth	Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	Comments
EN-35-9	4	DS	Q	1987	0	80	30	4	356	N	0	0	0		SKID							
EN-36-1	1	DS	D	96	70	180	150	6	6000	Y	95	5700	7695	Perennial								inner gorge, recent activity
EN-36-10	1	DS	P	1987	0	130	50	4	963	Y	92	886	1169	Perennial								
EN-36-11	1	DS	D	1978	0	200	50	4	1481	Y	92	1363	1840	Perennial	ROAD							
EN-36-12	4	DS	P	2000	0	160	30	4	711	Y	92	654	883	Ephem./Int.								
EN-36-15		EF	P			1760	1150	0		Y				Ephem./Int.		4	2	3	4	4	N	
EN-36-16		RS	P			1680	2960	0		Y				Perennial		3	3	3	5	4	Y	
EN-36-2	1	DS	D	96	0	80	40	4	474	Y	92	436	589	Perennial	ROAD							
EN-36-3	4	DS	D	96	0	32	64	4	303	N	0	0	0		ROAD							
EN-36-4	4	DF	D	96	36	150	50	4	1111	N	0	0	0		ROAD							
EN-36-5	4	DS	D	96	82	400	300	5	22222	Y	95	21111	28500	Perennial	ROAD							recent activity
EN-36-6	4	DS	P	96	0	92	20	4	273	N	0	0	0									
EN-5-1	4	DS	D	96	96	120	85	3	1133	Y	100	1133	1530	Perennial	ROAD							
EN-5-12	3	DS	P	2000	0	220	70	4	2281	Y	92	2099	2834	Ephem./Int.								
EN-5-2	4	DS	D	96	78	200	100	2	1481	Y	100	1481	2000	Perennial	ROAD							inner gorge
EN-5-3	4	DS	D	1978	0	130	20	4	385	Y	92	354	478	Ephem./Int.	ROAD							
EN-6-1	1	DF	Q	96	0	48	10	4	71	N	0	0	0		Landing							
EN-6-10	1	DS	Q	1987	0	80	50	4	593	Y	92	545	720	Ephem./Int.								stream failure
EN-6-11	1	DS	P	2000	0	320	140	4	6637	Y	92	6106	8243	Ephem./Int.								
EN-6-12	3	DT	P	2000	0	290	30	4	1289	Y	92	1186	1601	Ephem./Int.								HW SWALE
EN-6-14		RS	Q			2010	850	0		Y				Ephem./Int.		3	3	3	3	4	N	
EN-6-2	4	DF	P	96	0	160	16	4	379	N	0	0	0		ROAD							
EN-6-3	4	DF	D	96	0	160	48	4	1138	N	0	0	0		ROAD							
EN-6-4	4	DS	D	96	78	70	100	2	519	Y	95	493	665	Perennial								
EN-6-5	1	DS	D	96	0	80	32	4	379	Y	92	349	471	Perennial	ROAD							inner gorge
EN-6-6	1	DS	D	96	0	112	32	4	531	Y	92	488	659	Perennial	ROAD							inner gorge
EN-6-7	1	DS	D	96	105	150	130	8	5778	Y	100	5778	7800	Perennial	ROAD							inner gorge
EN-6-8	1	DS	P	1987	0	80	15	4	178	Y	92	164	216	Ephem./Int.	ROAD							
EN-6-9	4	DS	P	1987	0	80	20	4	237	Y	92	218	288	Ephem./Int.	ROAD							
EU-15-1	4	DF	P	96	0	176	16	4	417	N	0	0	0		Landing							
EU-15-2	4	DS	D	96	0	48	16	4	114	Y	100	144	154	Ephem./Int.								
EU-15-3	4	DS	Q	96	0	160	16	4	379	Y	100	379	512	Ephem./Int.								
EU-15-4		RS	P			2480	1600	0		Y				Ephem./Int.		4	3	2	3	4	N	
EU-16-1	4	DF	P	96	0	80	16	4	190	Y	92	174	236	Perennial								
EU-16-10	3	DS	D	2000	0	630	130	4	12133	Y	92	11163	15070	Perennial	ROAD							
EU-16-11		RS	P			980	300	0		Y				Ephem./Int.		4	3	3	3	4	N	
EU-16-12		EF	P			1560	590	0		Y				Ephem./Int.		3	3	3	4	4	N	
EU-16-13		EF	P			1270	480	0		Y				Ephem./Int.		4	3	3	3	4	N	
EU-16-2	4	DS	D	96	95	220	100	4	3259	Y	100	3259	4400	Perennial	ROAD							inner gorge, above road
EU-16-3	1	DS	P	1987	80	100	30	4	444	Y	92	409	540	Ephem./Int.	ROAD							stream failure
EU-16-4	4	DS	P	1987	0	50	65	4	481	Y	92	443	585	Perennial	ROAD							
EU-16-5	4	DS	D	98	92	100	30	2	222	Y	100	222	300	Perennial	ROAD							inner gorge
EU-16-6	4	DS	P	1987	0	100	35	4	519	Y	92	477	630	Ephem./Int.	SKID							
EU-16-7	4	DS	P	1987	0	100	20	4	296	Y	92	273	360	Ephem./Int.								
EU-16-8	4	DS	D	1978	0	70	20	4	207	Y	92	191	258	Perennial	ROAD							
EU-16-9		RS	Q			2190	670	0		Y				Perennial		3	3	3	4	4	N	
EU-21-1	4	DS	D	96	0	96	128	4	1820	Y	92	1675	2261	Perennial	ROAD							inner gorge
EU-21-10	4	DS	D	1978	0	150	90	4	2000	Y	92	1840	2484	Perennial	ROAD							
EU-21-12		RS	Q			3220	2790	0		Y				Perennial		3	3	3	3	4	Y	
EU-21-13		RS	P			1870	900	0		Y				Perennial		3	3	3	3	4	Y	
EU-21-14		RS	P			2360	1660	0		Y				Perennial		3	3	3	3	4	N	
EU-21-2	4	DS	D	96	0	80	32	4	379	Y	92	349	471	Perennial	SKID							inner gorge

Id	MWMU	Landslides Type	Landslides Certainty	Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet) Length	Width	Depth	Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	Comments
EU-21-3	4	DS	D	96	0	48	64	4	455	Y	92	419	565	Perennial	ROAD							
EU-21-4	4	DS	D	96	0	32	16	4	76	Y	92	70	94	Perennial	ROAD							inner gorge
EU-21-5	4	DS	P	1978	0	50	50	4	370	N	0	0	0		ROAD							
EU-21-6	4	DS	P	1978	0	70	20	4	207	N	0	0	0		ROAD							
EU-21-7	4	DS	P	1978	0	110	20	4	326	Y	92	300	405	Perennial	LAND							
EU-21-8	4	DS	D	1978	0	440	90	4	5867	Y	92	5397	7286	Perennial	ROAD							starts above road
EU-21-9	4	DS	D	1978	0	130	50	4	963	Y	92	886	1196	Perennial	ROAD							
EU-22-1	4	DS	D	96	65	310	110	3	3789	Y	80	3031	4092	Perennial	ROAD							
EU-22-10	4	DF	D	96	88	120	50	2	444	Y	100	444	600	Perennial	ROAD							
EU-22-11	4	DF	D	96	62	200	25	1	185	Y	100	185	250	Perennial	ROAD							
EU-22-12	4	DS	P	96	0	80	80	4	948	Y	100	948	1280	Ephem./Int.	ROAD							
EU-22-13	4	DS	Q	96	0	48	32	4	228	Y	100	228	307	Ephem./Int.								
EU-22-14	4	DF	D	96	77	80	25	2	148	Y	100	1480	200	Ephem./Int.								
EU-22-15	4	DF	D	96	85	100	20	2	148	Y	100	148	200	Perennial								
EU-22-16	4	DS	D	96	110	50	130	3	722	Y	100	722	975	Perennial	ROAD							inner gorge
EU-22-17	4	DS	D	96	85	200	80	4	2370	Y	100	2370	3200	Perennial								
EU-22-18	4	DF	D	96	0	256	16	4	607	N	0	0	0									
EU-22-19	4	DF	D	96	0	96	16	4	228	N	0	0	0									
EU-22-2	4	DS	D	96	78	130	70	5	1685	Y	100	1685	2275	Perennial	ROAD							inner gorge
EU-22-20	4	DS	D	96	90	40	40	4	237	Y	100	237	320	Perennial								
EU-22-21	4	DS	D	96	100	100	70	2	519	Y	100	519	700	Perennial								
EU-22-22	4	DS	D	96	99	150	40	3	667	Y	100	667	900	Perennial	ROAD							inner gorge
EU-22-23	4	DS	D	96	96	100	50	4	741	Y	100	741	1000	Perennial	ROAD							inner gorge
EU-22-24	4	DS	D	96	80	100	130	8	2852	Y	100	2852	5200	Perennial	ROAD							
EU-22-25	4	DS	D	96	114	30	50	2	111	Y	100	111	150	Perennial	ROAD							
EU-22-26	4	DS	D	96	84	150	90	4	2000	Y	70	1400	1890	Perennial	ROAD							
EU-22-27	4	DS	D	96	110	200	50	4	1481	Y	75	1111	1500	Perennial	ROAD							
EU-22-28	4	DS	D	96	65	150	120	8	5333	Y	85	4533	6120	Perennial	ROAD							
EU-22-29	4	DS	D	97	75	150	50	5	1389	Y	75	1042	1406	Perennial								
EU-22-3	4	DS	D	96	100	100	100	4	1481	Y	100	1481	2000	Perennial	ROAD							inner gorge
EU-22-30	4	DS	D	1987	0	160	35	4	830	Y	92	763	1008	Perennial	ROAD							
EU-22-31	4	DS	D	1987	0	80	20	4	237	Y	92	218	288	Perennial	ROAD							
EU-22-32	4	DS	P	1987	0	170	30	4	756	Y	92	696	905	Perennial	ROAD							washout??
EU-22-33	4	DS	D	1978	0	70	20	4	207	Y	92	191	258	Perennial	ROAD/SKID							
EU-22-34	4	DS	P	1978	0	110	70	4	1141	Y	92	1049	1417	Perennial	LAND							
EU-22-35	4	DS	D	1978	0	90	50	4	667	Y	92	613	828	Perennial	ROAD							
EU-22-36	4	DT	D	1978	0	180	40	4	1067	Y	92	981	1325	Ephem./Int.	SKID							
EU-22-37	4	DT	P	1978	0	130	20	4	385	Y	92	354	478	Ephem./Int.	SKID							
EU-22-38	4	DS	D	1978	0	110	60	4	978	Y	92	900	1214	Perennial	ROAD							
EU-22-4	4	DS	D	96	100	100	150	4	2222	Y	100	2222	3000	Perennial	ROAD							inner gorge
EU-22-40	4	DT	D	2000	0	220	30	4	978	N	0	0	0									
EU-22-41	4	DS	D	78;81;87	0	80	50	4	593	Y	92	546	710	Perennial	ROAD							
EU-22-42		RS	Q			3710	2590	0		Y				Perennial		2	3	3	3	4	N	
EU-22-5	4	DS	D	96	110	150	130	3	2167	Y	100	2167	2925	Perennial	Landing							inner gorge
EU-22-6	4	DS	P	96	0	48	80	4	569	Y	100	569	768	Perennial	ROAD							inner gorge
EU-22-7	4	DS	D	96	94	150	80	4	1778	Y	100	1778	2400	Perennial	ROAD							inner gorge
EU-22-8	1	DS	D	1987	90	320	160	4	7585	Y	100	7585	10012	Perennial	ROAD							inner gorge,,, seen
EU-22-9	4	DS	Q	96	0	48	64	4	445	Y	100	445	614	Perennial								inner gorge
EU-23-1	4	DF	P	96	0	176	16	4	417	N	0	0	0		ROAD							
EU-23-10	4	DS	D	96	88	80	40	8	948	Y	100	948	1280	Perennial	ROAD							inner gorge
EU-23-11	4	DF	D	96	88	180	30	6	1200	Y	100	1200	1620	Perennial	ROAD							
EU-23-13	4	DS	D	1987	0	65	130	4	1252	Y	92	1152	1520	Ephem./Int.	ROAD							

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%)	Average Landslide Dimensions (feet)			Volume (cub.-yrds.)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty		Field	Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg.	Complex	
EU-23-14	4	DS	D	1987	0	50	30	4	222	Y	92	204	270	Perennial	ROAD							
EU-23-15	4	DS	P	1978	0	130	40	4	770	Y	92	709	957	Ephem./Int.	ROAD							
EU-23-16	4	DS	P	1978	0	220	50	4	1630	Y	92	1499	2024	Perennial	SKID							
EU-23-18		RS	P			2810	2350	0		Y				Ephem./Int.		3	3	3	4	4	Y	
EU-23-2	4	DS	D	96	95	80	50	5	741	Y	100	741	1000	Ephem./Int.	ROAD							
EU-23-3	4	DS	D	1996	0	32	32	4	152	Y	92	140	182	Ephem./Int.								
EU-23-4	4	DS	D	96	65	170	150	4	3778	Y	100	3778	5100	Perennial	ROAD							
EU-23-5	4	DS	P	96	0	48	16	4	114	Y	100	114	154	Perennial	ROAD							inner gorge
EU-23-6	4	DF	P	96	0	112	16	4	265	Y	92	244	330	Perennial								
EU-23-7	4	DS	P	96	0	96	16	4	228	Y	100	228	307	Perennial	ROAD							
EU-23-8	4	DS	D	96	90	200	80	3	1778	Y	100	1778	2400	Perennial	ROAD							
EU-23-9	4	DS	D	96	112	40	130	4	770	Y	100	770	1040	Perennial	ROAD							inner gorge
EU-24-1	4	DS	D	96	0	48	48	4	341	Y	92	314	424	Perennial	ROAD							
EU-24-2	4	DS	D	96	0	48	80	4	569	Y	92	523	707	Perennial	ROAD							
EU-24-3	4	DS	D	96	0	48	16	4	114	Y	100	114	154	Perennial								
EU-24-4	4	DS	D	96	65	170	150	4	3778	Y	100	3778	5100	Perennial	ROAD							
EU-24-5		RS	P			2730	1150	0		Y				Perennial		3	3	3	3	5	Y	
EU-24-6		RS	P			1870	750	0		Y				Perennial		3	3	3	3	5	Y	
EU-24-7		RS	Q			2320	400	0		Y				Perennial		3	3	3	3	4	N	
EU-24-8		RS	Q			1450	2000	0		Y				Perennial		3	3	3	3	4	Y	
EU-25-1	4	DS	D	96	0	112	32	4	531	Y	92	488	659	Ephem./Int.	ROAD							
EU-25-2	4	DS	D	1987	0	240	80	4	2844	Y	92	2617	3454	Ephem./Int.	ROAD							
EU-25-3	4	DS	D	1987	0	130	50	4	963	Y	92	886	1169	Ephem./Int.	ROAD							
EU-25-4	4	DS	D	1987	0	115	50	4	852	Y	92	784	1019	Perennial	LANDING							
EU-26-1	4	DS	Q	96	0	16	48	4	114	N	0	0	0									
EU-26-10	4	DS	D	1987	0	160	65	4	1541	Y	92	1417	1871	Ephem./Int.	ROAD							
EU-26-11	4	DS	D	1987	0	65	30	4	289	Y	92	266	351	Ephem./Int.	LAND							
EU-26-12	4	DS	D	1987	0	150	50	4	1111	Y	92	1022	1349	Ephem./Int.	LAND							
EU-26-13	4	DS	D	1987	0	240	65	4	2311	Y	92	2126	2807	Ephem./Int.	ROAD							
EU-26-15		RS	P			2360	1170	0		N						4	2	3	3	4	N	
EU-26-16		RS	Q			2440	1150	0		Y				Perennial		3	3	3	3	4	N	
EU-26-2	4	DF	D	96	0	80	16	4	190	Y	92	174	236	Ephem./Int.	ROAD							
EU-26-3	4	DF	D	96	0	320	16	4	759	Y	92	698	942	Ephem./Int.	ROAD/Landing							
EU-26-4	4	DS	D	96	106	150	40	4	889	Y	75	667	900	Ephem./Int.	Landing							
EU-26-5	4	DS	D	96	73	100	130	2	963	Y	95	915	1235	Perennial	ROAD							
EU-26-6	4	DF	P	96	0	112	16	4	265	Y	92	244	330	Perennial								
EU-26-7	4	DS	D	96	0	64	48	4	445	Y	92	419	565	Perennial	Landing							
EU-26-8	4	DF	D	98	78	150	30	4	667	Y	80	533	720	Ephem./Int.	ROAD							
EU-26-9	4	DS	D	97	119	70	100	4	1037	Y	100	1037	1400	Perennial								
EU-27-1	4	DS	D	96	93	80	150	5	2222	Y	100	2222	3000	Perennial	Landing							
EU-27-2	4	DF	D	96	0	200	50	3	1111	Y	80	889	1200	Perennial	ROAD							
EU-27-3	4	DS	P	1987	0	80	15	4	178	Y	92	164	216	Ephem./Int.	LANDING							
EU-27-4	4	DS	P	1978	0	440	80	4	5215	Y	92	4798	6477	Perennial	SKID							
EU-27-5	4	DS	D	1978	0	130	20	4	385	Y	92	354	478	Ephem./Int.	ROAD							
EU-27-6		RS	Q			3830	3760	0		Y				Ephem./Int.		2	3	4	4	4	Y	
EU-27-7	2	DS	P	2000	0	60	30	4	267	Y	92	245	331	Ephem./Int.								
EU-27-8	2	DS	D	2000	0	120	30	4	533	Y	92	491	662	Ephem./Int.								
EU-34-6		RS	D			1210	1150	0		Y				Perennial		3	3	3	3	4	N	
EU-9-1		EF	P			1270	560	0		Y				Ephem./Int.		4	3	3	4	4	N	

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		Type	Certainty		Field	Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	
WC-15-1	1	DS	P	1981	0	80	110	4	1304	Y	92	1199	1559	Perennial	ROAD							
WC-22-2	4	DS	D	>90	0	330	100	4	4889	Y	92	4498	6072	Ephem./Int.								
WC-22-3	1	DS	D	96,87	0	75	60	4	667	Y	100	667	900	Ephem./Int.								inner gorge
WC-22-4	2	DS	D	1987	0	200	50	4	1481	Y	92	1363	1840	Ephem./Int.	ROAD							road top and bottom
WC-22-5	4	DS	D	87	0	200	50	4	1481	Y	92	1363	1772	Ephem./Int.	ROAD							road top and bottom
WC-22-6		RS	Q			550	320	0		Y				Ephem./Int.		3	3	3	3	4	N	
WC-27-1	3	DS	Q	96	0	60	40	4	356	Y	92	327	442	Ephem./Int.								
WC-27-10	2	DS	D	1987	0	290	160	4	6874	Y	92	6324	8538	Ephem./Int.	SKID							
WC-27-11	4	DS	D	2000	0	230	50	4	1704	Y	92	1567	2116	Ephem./Int.								
WC-27-12	2	DS	D	2000	0	100	50	4	741	Y	92	681	920	Ephem./Int.								
WC-27-13		RS	P			1380	460	0		Y				Ephem./Int.		3	3	3	4	4	N	
WC-27-14		RS	Q			390	260	0		Y				Ephem./Int.		4	3	3	3	4	N	
WC-27-15		RS	Q			390	260	0		Y				Ephem./Int.		3	3	5	4	4	N	
WC-27-16		RS	Q			1750	610	0						Ephem./Int.		4	3	3	3	4	N	
WC-27-2	4	DS	D	96	0	60	25	4	222	Y	92	204	276	Ephem./Int.	Landing							
WC-27-3	3	DF	D	96	0	350	35	4	1815	Y	92	1670	2254	Ephem./Int.								
WC-27-4	1	DS	P	96	0	30	60	4	267	Y	100	267	360	Perennial								streamside adjacent to log dam
WC-27-5	3	DS	P	96	0	40	40	4	237	Y	100	237	320	Perennial								streamside adjacent to log dam
WC-27-6	4	DS	D	96,87	0	110	40	4	652	Y	92	600	442	Ephem./Int.	ROAD							
WC-27-7	3	DS	P	96	0	70	30	4	311	Y	92	286	650	Ephem./Int.								
WC-27-8	2	DS	D	90,87	0	170	85	4	2141	Y	92	1969	2659	Ephem./Int.	ROAD							
WC-27-9	2	DS	D	96,87	64	50	130	2	481	Y	100	481	650	Ephem./Int.	ROAD							
WC-28-1	4	DS	D	96	0	60	40	4	356	Y	92	327	442	Ephem./Int.	ROAD							
WC-28-2		RS	Q			445	320	0		Y				Ephem./Int.		3	3	3	4	4	N	
WF-10-1	3	DS	P	1987	0	80	20	4	237	Y	92	218	283	Ephem./Int.								
WF-10-10		RS	P			620	340	0		Y				Ephem./Int.		3	2	3	4	4	N	
WF-10-9		RS	P			1190	640	0		Y				Ephem./Int.		3	3	3	3	4	Y	
WF-11-1	2	DS	P	96	0	80	35	4	415	Y	92	382	515	Ephem./Int.								
WF-11-2	2	DS	D	96	74	500	100	4	7407	Y	100	7407	10000	Ephem./Int.	ROAD							
WF-11-3	3	DF	D	96	73	200	80	3	1778	Y	90	1600	2160	Perennial	ROAD							
WF-11-4		RS	P			1780	1630	0		Y				Perennial		3	3	3	5	4	N	
WF-11-5	4	DS	Q	2000	0	220	110	4	3585	Y	92	3298	4453	Ephem./Int.								
WF-11-6		RS	P			660	700	0		Y				Ephem./Int.		3	3	3	3	4	N	
WF-11-8		RS	D			1660	1250	0		Y				Perennial		3	2	3	3	4	Y	
WF-13-1		RS	P			2400	4270	0		Y				Perennial		3	3	4	5	4	Y	
WF-2-1		RS	Q			335	210	0		Y				Ephem./Int.		4	3	5	4	4	N	
WF-26-1	4	DS	D	96	0	150	100	4	2222	Y	92	2044	2760	Ephem./Int.								
WF-26-2	4	DS	D	96	0	80	100	4	1185	Y	92	1090	1472	Ephem./Int.								
WF-26-3	3	DS	D	96	0	70	100	4	1037	Y	92	954	1288	Ephem./Int.								
WF-26-4	2	DS	P	96	0	60	15	4	133	Y	92	123	166	Ephem./Int.	ROAD							
WF-26-5	2	DS	P	96	0	40	40	4	237	Y	92	218	294	Ephem./Int.								
WF-26-6	2	DS	P	96	0	40	30	4	178	Y	92	164	221	Ephem./Int.								
WF-26-7		RS	Q			1000	560	0		N						3	3	3	3	4	N	toe bounded by Flynn Creek Road
WF-27-1	3	DS	P	1981	0	250	60	4	2222	Y	92	2044	2760	Ephem./Int.	ROAD							
WF-3-1	4	DS	P	1987	0	50	10	4	74	N	0	0	0									
WF-3-2	4	DS	D	2000	0	120	30	4	533	N	0	0	0									
WF-3-3		RS	Q			330	210	0		Y				Ephem./Int.		3	3	3	4	4	N	
WF-3-4		RS	P			1390	1380	0		Y				Ephem./Int.		2	2	5	4	5	Y	
WF-34-1	3	DS	P	96	0	40	40	4	237	N	0	0	0									
WF-34-2	2	DS	P	96,87	0	40	20	4	119	Y	92	109	147	Ephem./Int.								
WF-34-3	3	DS	P	1987	0	80	50	4	593	Y	92	545	736	Ephem./Int.								older
WF-34-4	4	DS	P	1981	0	90	60	4	800	N	0	0	0									

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WF-34-7	3	DS	Q	2000	0	60	20	4	178	N	0	0	0									
WF-34-8	4	DS	Q	2000	0	40	20	4	119	Y	92	109	147	Ephem./Int.								
WF-35-1	3	DS	Q	96	0	40	30	4	178	Y	92	164	221	Ephem./Int.	ROAD							
WF-35-2	3	DS	P	96	0	65	30	4	289	Y	92	266	359	Ephem./Int.								
WF-35-3	3	DS	P	1987	0	80	10	4	119	Y	92	109	142	Ephem./Int.								
WF-35-4	3	DS	P	1987	0	65	30	4	289	Y	92	266	346	Ephem./Int.								
WF-35-5	2	DT	D	1981	0	240	40	4	1422	Y	92	1308	883	Perennial	ROAD							
WF-35-6	3	DS	D	2000	0	120	30	4	533	Y	92	491	662	Ephem./Int.	ROAD							
WF-35-7	3	DS	P	2000	0	60	30	4	267	Y	92	245	331	Ephem./Int.	ROAD							
WF-35-8		RS	Q			1070	600	0		Y				Perennial		2	3	3	3	4	N	
WF-35-9		RS	Q			590	400	0		Y				Ephem./Int.		3	3	3	3	4	N	
WG-24-1	3	DF	Q	96,87	0	200	25	4	741	Y	92	681	920	Ephem./Int.								
WG-24-2	4	DS	P	1981	0	140	60	4	1244	Y	92	1145	1546	Ephem./Int.	SKID							
WG-24-3	3	DS	D	1981	0	110	30	4	489	Y	92	450	607	Ephem./Int.								
WG-24-4	3	DT	D	2000	0	430	50	4	3185	Y	92	2930	3956	Ephem./Int.	ROAD							
WG-24-5	3	DS	D	2000	0	80	30	4	356	Y	92	327	442	Ephem./Int.	ROAD							
WG-25-1	3	DS	D	96	0	50	50	4	370	Y	92	341	460	Ephem./Int.	ROAD							
WG-25-2	4	DS	D	1987	0	80	50	4	593	Y	92	545	736	Ephem./Int.								
WG-25-3	3	DS	P	1987	0	50	15	4	111	Y	92	102	138	Ephem./Int.	SKID							older skid
WG-30-1	4	DS	P	96	0	60	30	4	267	Y	92	245	331	Ephem./Int.								
WG-30-2	2	DS	Q	1987	0	50	30	4	222	Y	92	204	266	Ephem./Int.	SKID							
WG-30-3	2	DS	P	1987	0	50	15	4	111	Y	92	102	138	Ephem./Int.								
WG-31-1	4	DS	P	1987	0	50	30	4	222	Y	92	204	276	Ephem./Int.	SKID							
WG-31-2	2	DS	D	1981	0	220	110	4	3585	Y	92	3298	4453	Ephem./Int.	SKID							
WH-10-1	2	DS	D	1987	0	50	20	4	148	Y	92	136	184	Perennial	ROAD							
WI-19-1	2	DS	D	96	0	100	100	4	1481	Y	92	1363	1840	Ephem./Int.	ROAD							
WI-30-1	1	DS	P	96	0	60	40	4	356	Y	100	356	480	Perennial								inner gorge
WI-30-2	4	DS	D	96	0	230	50	4	1704	Y	92	1567	2116	Ephem./Int.	ROAD							
WI-30-3	4	DS	D	96	0	40	30	4	178	Y	92	164	221	Ephem./Int.								
WI-30-4	3	DF	P	96	0	200	20	4	593	Y	92	545	736	Ephem./Int.								
WI-30-5	3	DS	D	96	0	220	130	4	4237	Y	92	3898	5262	Perennial	ROAD							
WI-30-6	3	DS	D	96	0	50	30	4	222	N	0	0	0		ROAD							
WI-30-7	3	DS	D	96	0	125	80	4	1481	Y	92	1363	1840	Ephem./Int.	SKID							
WL-11-1	2	DS	Q	96	0	30	40	4	178	Y	92	164	221	Ephem./Int.								
WL-11-10	4	DS	D	1981	0	90	60	4	800	Y	92	736	957	Perennial	LANDING							
WL-11-13		RS	Q			1270	640	0		Y				Ephem./Int.		4	3	3	4	3	N	
WL-11-15		RS	D			680	250	0		Y				Perennial		3	4	3	3	3	N	
WL-11-16		RS	P			1270	640	0		Y				Perennial		4	3	3	3	3	N	
WL-11-2	4	DS	D	96	90	60	20	6	267	Y	100	267	360	Perennial	ROAD							inner gorge
WL-11-3	4	DS	D	96	63	150	40	3	667	Y	100	667	900	Perennial	ROAD							inner gorge
WL-11-4	3	DS	D	89<	92	100	50	3	556	N	0	0	0		ROAD							
WL-11-5	4	DS	D	1987	94	65	30	4	289	Y	92	266	359	Ephem./Int.	LANDING							
WL-11-6	4	DS	D	1987	70	80	30	4	356	Y	92	327	442	Ephem./Int.	LANDING							inner gorge
WL-11-9	4	DS	D	1981	0	110	60	4	978	Y	92	900	1169	Perennial	ROAD							
WL-12-1	3	DS	D	96	0	40	30	4	178	N	0	0	0		ROAD							
WL-12-10		RS	D			2540	2430	0		Y				Perennial		3	2	3	3	3	Y	
WL-12-11	4	DS	P	1987	0	100	20	4	296	N	0	0	0		ROAD							
WL-12-12	4	DS	P	1987	0	130	30	4	578	Y	92	532	691	Ephem./Int.								
WL-12-13		RS	D			780	320	0		N						4	2	3	2	3	N	
WL-12-14		RS	P			1460	400	0		Y				Ephem./Int.		3	3	3	3	3	N	
WL-12-15		RS	P			1460	400	0		Y				Ephem./Int.		3	3	3	3	3	N	
WL-12-19		RS	D			1250	800	0		Y				Perennial		3	3	3	3	3	N	

Id	MWMU	Landslides Type	Landslides Certainty	Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet) Length	Width	Depth	Volume (cubic-yards)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	Comments
WL-12-2	3	DS	D	96	0	80	100	4	1185	N	0	0	0		ROAD							
WL-12-20		RS	P			1560	640	0		Y				Perennial		3	3	3	3	3	N	
WL-12-3	3	DS	P	96	0	70	30	4	311	N	0	0	0		Landing							
WL-12-4	1	DS	Q	96	0	40	20	4	119	Y	92	109	147	Perennial								
WL-12-5	4	DS	D	96	109	150	50	4	1111	Y	100	1111	1500	Perennial	ROAD							meander bend
WL-12-6	4	DS	D	96	98	50	70	5	648	Y	100	648	875	Perennial	ROAD							inner gorge
WL-12-7	5	DS	D	96	92	130	70	3	1011	Y	100	1011	1365	Perennial	ROAD							inner gorge
WL-12-8	4	DS	D	96	135	70	30	5	389	N	0	0	0		ROAD							
WL-12-9		RS	D			1660	720	0		Y				Perennial		3	3	3	3	3	N	
WL-13-1	3	DS	D	96	0	70	50	4	519	Y	92	477	644	Perennial	ROAD							
WL-13-10	4	DS	P	1987	0	100	30	4	444	Y	92	409	532	Ephem./Int.	ROAD							
WL-13-11	4	DS	D	1987	0	130	30	4	578	Y	92	532	691	Ephem./Int.	LANDING							
WL-13-12	4	DS	P	1981	0	250	30	4	1111	Y	92	1022	1380	Perennial	ROAD							
WL-13-13		RS	P			900	240	0		Y				Perennial		3	2	3	3	3	N	
WL-13-14		RS	P			1110	200	0		Y				Perennial		3	2	3	3	3	N	
WL-13-15		RS	P			920	240	0		Y				Perennial		3	4	3	2	3	N	
WL-13-16	2	DS	D	2000	0	200	80	4	2370	Y	92	2181	2944	Ephem./Int.								
WL-13-17		RS	P			980	480	0		Y				Perennial		3	3	3	3	3	N	
WL-13-18		RS	P			1670	910	0		Y				Ephem./Int.		3	4	3	3	3	Y	
WL-13-19		RS	D			1900	2680	0		Y				Ephem./Int.		3	3	3	3	3	Y	
WL-13-2	3	DS	D	96	0	280	30	4	1244	Y	92	1145	1546	Perennial	ROAD							
WL-13-20		RS	P			1660	1040	0		Y				Ephem./Int.		3	3	3	4	3	Y	
WL-13-21		RS	P			1660	1040	0		Y				Ephem./Int.		3	3	3	4	3	Y	
WL-13-22	3	DS	D	2000	0	170	50	4	1259	Y	92	1159	1564	Ephem./Int.								
WL-13-3	4	DS	Q	96	0	70	15	4	156	N	0	0	0		ROAD							
WL-13-4	1	DS	P	96	0	60	30	4	267	Y	92	245	331	Perennial								
WL-13-5	1	DS	P	96	0	70	30	4	311	Y	92	286	386	Perennial	ROAD							
WL-13-6	3	DS	P	1987	0	70	30	4	311	Y	92	286	386	Ephem./Int.	ROAD							
WL-13-7	3	DS	P	1987	0	80	15	4	178	Y	92	164	221	Ephem./Int.	ROAD							
WL-13-8	4	DS	P	1987	0	50	15	4	111	Y	92	102	138	Ephem./Int.	ROAD							
WL-13-9	2	DS	D	1987	0	65	30	4	289	Y	92	266	359	Perennial	SKID							
WL-14-1	3	DS	P	94-89	0	50	50	4	370	N	0	0	0									re-veg.
WL-14-2	3	DS	Q	96	0	20	20	4	59	N	0	0	0									
WL-14-3	3	DS	P	96	0	20	30	4	89	N	0	0	0		ROAD							
WL-14-4	3	DS	D	2000	0	160	50	4	1185	N	0	0	0									
WL-14-5		RS	P			740	450	0		Y				Perennial		3	2	3	3	2	N	
WL-14-7		RS	P			1660	430	0		Y				Ephem./Int.		4	4	4	3	3	Y	
WL-17-1	2	DS	D	96	98	300	80	4	3556	Y	100	3556	4800	Ephem./Int.								
WL-17-10	3	DS	D	1987	0	240	80	4	2844	Y	92	2617	3533	Ephem./Int.	ROAD							
WL-17-11	3	DS	P	87	0	80	30	4	356	Y	92	327	425	Ephem./Int.	ROAD							
WL-17-12	1	DS	P	1987	0	60	50	4	444	Y	92	409	552	Perennial								stream failure
WL-17-13	5	DS	D	1987	0	50	20	4	148	Y	92	136	184	Perennial	ROAD							stream bank failure
WL-17-14	2	DS	P	1981	0	110	50	4	815	Y	92	750	1012	Ephem./Int.	LANDING							
WL-17-15	4	DS	Q	1981	0	90	60	4	800	Y	92	736	994	Ephem./Int.	LANDING							
WL-17-16		RS	D			1540	690	0		Y				Perennial		3	2	3	3	3	N	
WL-17-17		RS	D			700	320	0		Y				Perennial		3	3	3	2	2	N	
WL-17-18		RS	P			550	320	0		Y				Ephem./Int.		3	2	3	3	3	N	
WL-17-19		RS	D			1270	350	0		Y				Ephem./Int.		3	3	3	3	3	N	
WL-17-2	3	DS	D	96,87	95	350	100	3	3889	Y	100	3889	5250	Perennial								
WL-17-20	4	DS	P	2000	0	140	30	4	622	Y	92	572	744	Ephem./Int.								
WL-17-21	3	DS	P	2000	0	160	60	4	1422	N	0	0	0		ROAD							
WL-17-22		RS	D			1540	690	0		Y				Perennial		3	2	3	3	3	Y	

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		Type	Certainty		Field	Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	
WL-17-23		RS	P			1950	880	0		Y				Perennial		3	3	3	3	3	N	
WL-17-3	4	DS	D	96	110	100	30	2	222	N	0	0	0									
WL-17-4	3	DS	D	96	0	40	40	4	237	Y	92	218	294	Ephem./Int.	ROAD							Failing off old legacy road
WL-17-5	3	DS	P	96	0	60	40	4	356	N	92	328	426		ROAD							Failing off old legacy road
WL-17-6	4	DS	D	96	60	130	50	4	963	N	0	0	0									
WL-17-8		RS	D			1130	960	0		Y				Perennial		4	3	3	3	3	N	
WL-18-12	4	DS	Q	1987	0	160	80	4	1896	Y	92	1745	2355	Ephem./Int.	ROAD							
WL-18-13	4	DS	D	1987	0	400	120	4	7111	Y	92	6542	8832	Perennial	ROAD							
WL-18-14	4	DT	D	1987	0	400	50	4	2963	Y	92	2726	3680	Perennial	ROAD							Run off WL-18-14
WL-18-15	2	DT	D	1987	0	160	20	4	474	Y	92	436	589	Ephem./Int.	LANDING							
WL-18-16	4	DS	P	1987	0	80	20	4	237	Y	92	218	294	Ephem./Int.								
WL-18-17		RS	D			1760	720	0		Y				Ephem./Int.		3	2	3	2	3	N	
WL-18-18	2	DS	Q	2000	0	40	20	4	119	N	0	0	0									
WL-18-19		RS	P			1190	1200	0		Y				Ephem./Int.		4	3	3	4	3	N	
WL-18-2	4	DS	D	96	0	70	20	4	207	N	0	0	0		Landing							
WL-18-20		RS	Q			960	530	0		Y				Ephem./Int.		3	4	4	3	3	N	
WL-18-21	1	DS	D	2000	0	215	65	4	2070	Y	92	1905	2571	Ephem./Int.								
WL-18-22	1	DS	D	2000	0	100	50	4	741	Y	92	681	920	Ephem./Int.								
WL-18-23		RS	P			1660	830	0		Y				Ephem./Int.		3	2	2	3	3	Y	
WL-18-24	3	DS	D	2000	0	100	20	4	296	N	0	0	0									
WL-18-25	3	DS	D	2000	0	120	30	4	533	N	0	0	0									
WL-18-26	3	DS	D	2000	0	200	65	4	1926	N	0	0	0									
WL-18-27	4	DS	D	2000	0	370	50	4	2741	N	0	0	0									
WL-18-28		RS	P			600	270	0		Y				Ephem./Int.		2	2	3	3	2	N	
WL-18-29		RS	P			600	530	0		Y				Ephem./Int.		2	2	3	3	3	N	
WL-18-3	3	DS	D	96	0	70	30	4	311	N	0	0	0		ROAD							
WL-18-30		RS	P			1030	530	0		Y				Ephem./Int.		3	3	3	3	2	N	
WL-18-31	4	DS	P	2000	0	60	30	4	267	N	0	0	0		SKID							
WL-18-32		RS	P			720	320	0		Y				Ephem./Int.		3	2	3	3	2	N	
WL-18-33		RS	D			1190	1140	0		Y				Ephem./Int.		3	2	3	3	3	Y	
WL-18-34		RS	P			600	210	0		Y				Ephem./Int.		3	2	3	3	2	N	
WL-18-35		RS	D			1370	590	0		Y				Ephem./Int.		2	2	3	3	2	Y	
WL-18-36		RS	P			600	220	0		Y				Ephem./Int.		2	2	3	3	2	N	
WL-18-37		RS	P			1460	1200	0		Y				Ephem./Int.		3	3	3	3	3	Y	
WL-18-38		RS	Q			720	340	0		Y				Ephem./Int.		3	3	3	4	3	N	
WL-18-39		RS	P			780	480	0		Y				Ephem./Int.		3	3	3	3	3	N	
WL-18-4	3	DS	P	96	0	20	30	4	89	Y	92	92	110	Ephem./Int.								
WL-18-40		RS	P			1270	4480	0		Y				Perennial		0	0	0	0	0	Y	large complex
WL-18-41		RS	P			11701	220	0		Y				Ephem./Int.		3	2	3	3	3	N	
WL-18-5	1	DS	D	96	0	80	30	4	356	Y	92	327	442	Perennial								
WL-18-6	2	DS	Q	96	0	30	60	4	267	Y	92	245	331	Ephem./Int.								
WL-18-7	2	DS	D	96	0	100	30	4	444	Y	92	409	552	Ephem./Int.								
WL-18-8	4	DS	D	96	0	80	25	4	296	N	0	0	0									
WL-18-9	1	DS	D	96	0	300	100	6	6667	Y	90	6000	8100	Perennial								
WL-19-1	3	DS	D	96	0	100	40	4	593	Y	92	545	736	Ephem./Int.	ROAD							
WL-19-2	3	DS	D	96	65	140	70	3	1089	Y	20	218	294	Ephem./Int.	ROAD							
WL-19-3	3	DS	D	96	60	60	150	5	1667	Y	100	1667	2550	Ephem./Int.	ROAD							
WL-19-4		RS	P			1500	1920	0		Y				Ephem./Int.		3	3	3	3	3	N	
WL-19-6		RS	P			780	1150	0		Y				Ephem./Int.		3	2	3	3	3	N	
WL-19-7		RS	Q			510	390	0		Y				Ephem./Int.		3	3	3	3	3	N	
WL-19-8		RS	P			1190	400	0		Y				Ephem./Int.		2	2	3	3	2	N	
WL-20-1	4	DS	Q	96	0	70	30	4	311	N	0	0	0									

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WL-20-10		RS	P			590	1150	0		Y				Ephem./Int.		3	3	3	3	3	N	
WL-20-11		RS	D			880	500	0		Y				Perennial		3	3	3	3	3	N	
WL-20-12		RS	D			1210	670	0		Y				Ephem./Int.		3	3	4	3	2	N	
WL-20-13		RS	P			1190	270	0		Y				Perennial		2	3	3	3	3	N	
WL-20-2	3	DS	D	96	108	200	70	2	1037	Y	100	1037	1400	Ephem./Int.								
WL-20-3		RS	D			1210	350	0		Y				Ephem./Int.		4	2	3	2	2	N	
WL-20-4		RS	D			740	300	0		Y				Ephem./Int.		3	2	3	3	2	N	
WL-20-5	3	DS	D	1981	0	90	60	4	800	Y	92	736	957	Ephem./Int.	ROAD							
WL-20-6	1	DS	D	2000	0	140	65	4	1348	Y	92	1240	1674	Perennial								
WL-20-7		RS	P			410	270	0		Y				Ephem./Int.		3	3	3	3	3	N	
WL-20-8		RS	P			390	900	0		Y				Ephem./Int.		3	3	3	3	2	N	
WL-20-9	3	DS	D	2000	0	660	65	4	6356	Y	92	5847	7894	Ephem./Int.								
WL-2-1	5	DS	D	96	90	100	70	6	1556	Y	100	1556	2100	Perennial	ROAD							inner gorge (starts above road)
WL-2-2	5	DS	D	96	78	50	50	2	185	Y	100	185	250	Perennial	ROAD							inner gorge
WL-24-1	4	DS	D	96	0	140	55	4	1141	Y	92	1049	1417	Perennial	Landing							
WL-24-17		RS	D			2770	3840	0		Y				Perennial		3	3	3	3	2	Y	
WL-24-2		RS	Q			490	720	0		Y				Ephem./Int.		3	3	3	3	5	N	
WL-3-1	4	DS	D	96	0	80	120	4	1422	Y	92	1308	1766	Ephem./Int.	ROAD							above road and cut slope
WL-32-1		RS	D			900	450	0		Y				Perennial		2	1	1	2	1	Y	Flood Gate Slide
WL-7-1	4	DS	Q	96	0	80	20	4	237	N	0	0	0									
WL-7-10		RS	D			780	1220	0		Y				Ephem./Int.		3	3	3	3	3	Y	
WL-7-11		RS	D			980	960	0		Y				Perennial		3	3	3	3	3	N	
WL-7-12		RS	D			1370	1220	0		Y				Perennial		3	3	3	3	3	Y	
WL-7-13		RS	P			860	510	0		Y				Perennial		3	3	3	3	3	N	
WL-7-14		RS	Q			680	540	0		Y				Perennial		4	3	3	3	3	N	
WL-7-15		RS	Q			1030	740	0		Y				Perennial		4	3	3	3	3	N	
WL-7-16		RS	Q			1270	530	0		Y				Perennial		3	3	3	3	3	N	
WL-7-2	4	DS	D	96	0	100	30	4	444	Y	92	409	552	Perennial								
WL-7-3	3	DS	Q	96	0	50	60	4	444	N	0	0	0									
WL-7-4	5	DS	D	96	65	100	200	6	4444	Y	80	3556	4800	Perennial	ROAD							
WL-7-5		RS	P			840	430	0		Y				Perennial		4	3	5	3	3	N	
WL-7-6	5	DS	P	1987	0	100	65	4	963	Y	92	886	1196	Perennial	ROAD							stream bank failure
WL-7-7	3	DS	D	1981	0	30	50	4	222	Y	92	204	276	Perennial	ROAD							Stream bank failure
WL-7-9		RS	P			1560	640	0		Y				Perennial		3	3	3	3	3	N	
WL-8-15		RS	P			850	290	0		Y				Ephem./Int.		4	3	3	3	4	N	
WL-8-17		RS	D			1130	960	0		Y				Perennial		4	3	3	3	3	N	
WM-16-1	3	DS	D	96	0	100	20	4	296	N	0	0	0									
WM-16-2	2	DF	Q	96	0	64	16	4	152	Y	92	140	188	Ephem./Int.	SKID							
WM-16-3		RS	P			1500	1010	0		Y				Perennial		3	3	3	4	4	N	
WM-16-4		RS	D			1460	690	0		Y				Perennial		3	3	3	3	3	N	
WM-17-1	3	DS	D	96	125	400	60	3	2667	Y	100	2667	3600	Perennial	Landing							
WM-21-1	2	DS	D	96	0	70	40	4	415	Y	92	382	515	Perennial	Landing							
WM-21-10	2	DS	P	96	0	70	25	4	259	N	0	0	0									
WM-21-11	3	DS	P	1987	0	50	20	4	148	Y	92	136	184	Ephem./Int.	ROAD							
WM-21-12	2	DS	P	1987	0	80	50	4	593	Y	92	545	736	Ephem./Int.	ROAD							
WM-21-13	3	DT	D	1987	0	400	30	4	1778	Y	92	1636	2208	Perennial	LANDING							
WM-21-14	1	DS	D	1987	0	160	60	4	1422	Y	92	1308	1766	Perennial	ROAD							
WM-21-2	3	DS	D	96	0	75	80	4	889	Y	92	818	1104	Perennial	Landing							
WM-21-3	3	DS	P	96	0	100	50	4	741	Y	92	681	920	Perennial	Landing							
WM-21-32		RS	Q			1560	1040	0		Y				Perennial		3	3	3	4	4	N	
WM-21-4	2	DS	D	96	0	80	30	4	356	Y	92	327	442	Ephem./Int.								
WM-21-5	4	DS	Q	96	0	50	40	4	296	N	0	0	0									

Id	MWMU	Landslides Type	Landslides Certainty	Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet) Length	Width	Depth	Volume (cubic-yards)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	Comments
WM-21-6	4	DS	Q	96	0	180	30	4	800	N	0	0	0									
WM-21-7	3	DS	P	96	0	50	30	4	222	Y	92	204	276	Ephem./Int.								
WM-21-8	3	DS	P	96	0	50	70	4	519	N	0	0	0									
WM-21-9	3	DS	P	96	0	50	40	4	296	N	0	0	0		ROAD							
WM-22-1	3	DS	P	96	0	80	30	4	356	N	0	0	0		ROAD							
WM-22-10	3	DF	D	85-90	70	150	30	2	333	Y	80	267	360	Ephem./Int.	ROAD							
WM-22-11	3	DS	P	96	0	80	200	4	2370	Y	92	2181	2944	Ephem./Int.								
WM-22-12	3	DS	P	96	0	80	50	4	593	Y	92	545	736	Ephem./Int.								
WM-22-14	3	DS	D	98	68	550	100	6	12222	Y	80	9778	13200	Perennial								
WM-22-15	3	DS	D	98	70	40	80	3	356	Y	70	249	336	Perennial								
WM-22-16	3	DS	P	1987	0	80	50	4	593	Y	92	545	736	Perennial	ROAD							
WM-22-17	3	DS	D	1987	0	115	60	4	1022	Y	92	940	1270	Perennial								
WM-22-19	4	DS	D	1987	0	160	30	4	711	Y	92	654	883	Perennial	LANDING							
WM-22-2	3	DS	D	96	0	250	35	4	1296	Y	92	1193	1610	Ephem./Int.								
WM-22-20	4	DS	P	1987	0	80	60	4	711	Y	92	654	883	Perennial	ROAD							
WM-22-21	4	DS	D	1987	0	320	200	4	9481	Y	92	8723	11776	Perennial	ROAD							
WM-22-22	3	DS	P	1987	0	240	30	4	1067	Y	92	981	1325	Perennial	ROAD							
WM-22-23	3	DS	D	1987	0	80	50	4	593	N	0	0	0		ROAD							
WM-22-24	4	DS	D	1987	0	30	50	4	222	N	0	0	0		LANDING							
WM-22-25	3	DS	P	1981	0	90	30	4	400	Y	92	368	497	Perennial	ROAD							Stream bank failure
WM-22-26	3	DS	P	1981	0	110	60	4	978	Y	92	900	1214	Perennial	ROAD							Skid at top of slide
WM-22-27	3	DS	P	1981	0	140	30	4	622	Y	92	572	773	Ephem./Int.								
WM-22-28	4	DS	D	1981	0	90	30	4	400	Y	92	368	497	Ephem./Int.	ROAD							
WM-22-29	3	DS	D	1981	0	30	20	4	89	N	0	0	0		ROAD							
WM-22-3	3	DS	P	96	0	100	50	4	741	Y	92	681	920	Perennial	Landing							
WM-22-30	3	DS	P	1981	0	140	30	4	622	Y	92	572	773	Perennial	SKID							
WM-22-32		RS	P			1460	2350	0		Y				Perennial		3	3	3	3	4	Y	
WM-22-4	4	DS	P	1981	75	60	30	4	267	Y	92	245	331	Ephem./Int.	ROAD							
WM-22-5	4	DS	D	96	65	100	130	3	1444	Y	85	1228	1658	Perennial	ROAD							
WM-22-6	1	DS	D	96	75	200	80	3	1778	Y	80	1422	1920	Perennial								meander bend, inner gorge
WM-22-7	3	DS	D	90,87	0	100	70	4	1037	Y	92	954	1288	Perennial								
WM-22-8	3	DS	D	96	0	200	20	4	593	N	0	0	0		ROAD							
WM-22-9	3	DS	D	96	58	100	20	4	296	Y	92	273	368	Ephem./Int.								
WM-23-1	2	DS	P	96	0	80	30	4	356	Y	92	327	442	Ephem./Int.								
WM-23-10	3	DS	P	1981	0	60	30	4	267	Y	92	245	331	Perennial	ROAD							
WM-23-11	3	DS	P	1987	0	160	20	4	474	Y	92	436	589	Perennial								
WM-23-12	4	DT	Q	81	0	110	60	4	978	Y	92	900	1169	Perennial	ROAD							
WM-23-13	3	DS	D	1981	0	200	60	4	1778	Y	92	1636	2208	Ephem./Int.								
WM-23-14	3	DS	Q	2000	0	100	30	4	444	N	0	0	0									
WM-23-2	3	DS	P	96	0	30	80	4	356	N	0	0	0									
WM-23-3	1	DS	P	96	0	50	50	4	370	Y	92	341	460	Perennial								
WM-23-4	1	DS	P	96	0	100	30	4	444	Y	92	409	552	Perennial								
WM-23-5	1	DS	P	96	0	80	30	4	356	Y	92	327	442	Perennial								
WM-23-6	3	DS	D	96	45	80	70	2	415	Y	100	415	560	Perennial								
WM-23-7	1	DS	P	96	0	75	150	4	1667	Y	92	1533	2070	Perennial								
WM-23-8	3	DS	P	90,87	0	80	35	4	415	N	0	0	0		ROAD							
WM-23-9		RS	P			740	430	0		Y				Ephem./Int.		4	3	3	4	4	N	
WM-25-1	4	DS	P	85-91	0	80	80	4	948	Y	92	872	1178	Perennial								run out 100 by 4 ft.
WM-25-10	2	DS	P	1981	0	65	30	4	289	Y	92	266	346	Ephem./Int.								
WM-25-11	4	DS	P	1987	0	65	115	4	1107	Y	92	1019	1324	Perennial	ROAD							older road?
WM-25-12	3	DS	P	1987	0	50	30	4	222	Y	92	204	266	Perennial	ROAD							
WM-25-13	3	DS	D	1987	0	100	50	4	741	Y	92	681	886	Perennial								stream failure

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WM-25-14	1	DS	P	1981	0	170	80	4	2015	Y	92	1854	2502	Perennial	ROAD							
WM-25-15	2	DS	P	1981	0	80	60	4	711	Y	92	654	883	Ephem./Int.	ROAD							
WM-25-16	2	DS	P	1981	0	110	30	4	489	Y	92	450	607	Ephem./Int.	ROAD							
WM-25-17	3	DS	D	1981	0	80	30	4	356	Y	92	327	442	Perennial	ROAD							Stream bank failure
WM-25-19		RS	Q			6190	4080	0		Y				Perennial		3	3	3	3	4	Y	
WM-25-2	3	DS	P	96	0	50	50	4	370	N	0	0	0									
WM-25-20	3	DS	P	2000	0	300	160	4	7111	Y	92	6542	8832	Perennial	ROAD							
WM-25-21		RS	Q			1680	1220	0		Y				Perennial		3	3	3	2	4	N	
WM-25-22	3	DS	D	2000	0	180	20	4	533	Y	92	491	662	Ephem./Int.	ROAD							
WM-25-3	3	DS	P	96	0	40	40	4	237	N	0	0	0									
WM-25-4	3	DS	D	96	86	30	100	3	333	Y	70	233	315	Perennial	ROAD							
WM-25-5	3	DS	D	96	104	250	100	10	9259	Y	100	9256	12500	Perennial								HW SWALE
WM-26-1	4	DS	D	96	85	300	80	3	2667	Y	100	2667	3600	Ephem./Int.	ROAD							
WM-26-10	2	DS	P	96	0	30	30	4	133	Y	92	123	166	Ephem./Int.								
WM-26-11	2	DS	P	96	0	60	50	4	444	Y	92	409	552	Perennial								inner gorge
WM-26-12	2	DS	P	96	0	30	20	4	89	Y	92	82	110	Perennial								inner gorge
WM-26-13	3	DS	P	96	0	100	70	4	1037	Y	92	954	1288	Ephem./Int.								
WM-26-14	2	DS	P	96	0	50	25	4	185	Y	92	170	230	Ephem./Int.								
WM-26-15	2	DS	Q	96	0	20	20	4	59	Y	92	55	74	Perennial								inner gorge
WM-26-16	2	DS	P	96	0	50	45	4	333	Y	92	307	414	Perennial								inner gorge
WM-26-17	2	DS	P	1987	0	80	30	4	356	Y	92	327	425	Ephem./Int.	ROAD							
WM-26-18	2	DS	P	1987	0	80	65	4	770	Y	92	709	921	Ephem./Int.								
WM-26-19	2	DS	D	87,81	0	65	20	4	193	Y	92	177	230	Ephem./Int.								
WM-26-2	2	DS	D	96	92	220	80	3	1956	Y	100	1956	2640	Ephem./Int.	ROAD							
WM-26-20	2	DS	P	1987	0	40	30	4	178	Y	92	164	213	Perennial	ROAD							
WM-26-21	4	DS	D	1987	0	230	80	4	2726	Y	92	2508	3386	Ephem./Int.	ROAD							
WM-26-22	2	DS	D	1981	0	140	80	4	1659	Y	92	1527	2061	Perennial	ROAD							
WM-26-23	4	DS	D	1981	0	110	30	4	489	Y	92	450	607	Ephem./Int.	LANDING							
WM-26-24	3	DS	D	1981	0	140	100	4	2074	Y	92	1908	2576	Ephem./Int.	LANDING							
WM-26-25	2	DS	P	1981	0	200	110	4	3259	Y	92	2999	4048	Ephem./Int.	ROAD							
WM-26-3	2	DS	D	96	80	60	30	3	200	Y	100	200	270	Ephem./Int.								inner gorge
WM-26-4	2	DS	D	96	93	100	150	3	1667	Y	100	1667	2550	Ephem./Int.								inner gorge
WM-26-5	2	DS	P	96	0	50	40	4	296	Y	92	273	368	Ephem./Int.								
WM-26-6	3	DS	P	96	0	40	40	4	237	Y	92	218	294	Ephem./Int.								
WM-26-7	3	DS	D	96,87	75	150	200	6	6667	Y	30	2000	2700	Ephem./Int.	Landing							
WM-26-8	4	DS	D	96,87	0	40	50	4	296	N	0	0	0									
WM-26-9	2	DS	P	96	0	100	20	4	296	Y	92	273	368	Perennial								inner gorge
WM-27-1	3	DS	D	96,87,81	80	100	100	3	1111	Y	100	1111	1500	Perennial								inner gorge
WM-27-10	3	DS	P	96,87	0	100	70	4	1037	N	0	0	0									
WM-27-11	3	DS	D	96	0	150	50	3	833	Y	50	417	563	Perennial	ROAD							
WM-27-12	3	DS	D	98,87	0	200	100	3	2222	Y	100	2222	3000	Ephem./Int.	ROAD							
WM-27-13	3	DS	D	1996<	0	50	100	3	556	Y	100	556	722	Ephem./Int.	ROAD							
WM-27-14	2	DS	D	96	0	150	100	3	1667	Y	100	1667	2250	Ephem./Int.								
WM-27-15	2	DS	D	96	0	150	130	3	2167	Y	100	2167	2925	Ephem./Int.	ROAD							
WM-27-16	4	DT	D	1987	0	480	20	4	1422	Y	92	1308	1766	Ephem./Int.								
WM-27-17	1	DS	P	1987	0	80	50	4	593	Y	92	545	736	Ephem./Int.								
WM-27-18	1	DS	D	1987	0	80	110	4	1304	Y	92	1199	1619	Ephem./Int.								
WM-27-19	1	DS	P	1987	0	50	110	4	815	Y	92	750	1012	Ephem./Int.	ROAD							
WM-27-2	1	DS	D	96	93	100	50	3	556	Y	100	556	750	Perennial								inner gorge
WM-27-20	2	DS	D	1987	0	30	80	4	356	Y	92	327	442	Ephem./Int.	ROAD							stream failure
WM-27-21	1	DS	P	1987	0	50	50	4	370	Y	92	341	460	Ephem./Int.	ROAD							
WM-27-22	1	DS	P	1987	0	50	20	4	148	Y	92	136	184	Ephem./Int.								

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WM-27-23	4	DS	P	1987	0	240	30	4	1067	Y	92	981	1325	Ephem./Int.	LANDING							
WM-27-24	2	DS	P	1987	0	80	30	4	356	Y	92	327	442	Ephem./Int.								
WM-27-25	4	DT	D	87	0	100	15	4	222	Y	92	204	266	Ephem./Int.								
WM-27-26	2	DS	D	1987	0	80	30	4	356	Y	92	327	442	Perennial	ROAD							
WM-27-27	2	DS	P	1981	0	60	80	4	711	Y	92	654	883	Ephem./Int.								
WM-27-28	2	DS	P	1981	0	90	90	4	1200	Y	92	1104	1490	Ephem./Int.								
WM-27-29	2	DS	D	81	0	110	80	4	1304	Y	92	1199	1559	Perennial								
WM-27-3	1	DS	D	96	93	100	70	3	778	Y	100	778	1050	Perennial								inner gorge
WM-27-30	2	DS	D	1981	0	80	100	4	1185	Y	92	1090	1472	Ephem./Int.	SKID							
WM-27-31	3	DS	D	1981	0	60	110	4	978	Y	92	900	1214	Ephem./Int.								
WM-27-32	1	DS	D	1981	0	110	60	4	978	Y	92	900	1214	Ephem./Int.								
WM-27-33	1	DS	D	1981	0	100	60	4	889	Y	92	818	1104	Ephem./Int.								
WM-27-34	1	DS	D	1981	0	60	30	4	267	Y	92	245	331	Ephem./Int.								
WM-27-35	1	DS	P	1981	0	60	30	4	267	Y	92	245	331	Ephem./Int.								Wasteland inner gorge
WM-27-36	1	DS	D	1981	0	90	60	4	800	Y	92	736	994	Ephem./Int.								
WM-27-37		RS	P			3200	3200	0		Y				Perennial		3	3	3	4	4	Y	
WM-27-38		RS	P			1950	960	0		Y				Perennial		3	3	3	3	3	N	
WM-27-39		RS	Q			1130	800	0		Y				Perennial		2	3	3	2	4	N	
WM-27-4	1	DS	D	96	95	100	100	3	1111	Y	100	1111	1500	Perennial								inner gorge
WM-27-40	3	DS	D	2000	0	80	50	4	593	N	0	0	0									
WM-27-41	1	DS	D	2000	0	120	65	4	1156	Y	92	1063	1435	Perennial								
WM-27-42		RS	Q			1230	500	0		Y				Perennial		3	3	3	3	4	N	part of WM-27-37
WM-27-43		RS	P			2890	960	0		Y				Perennial		3	3	3	2	4	N	
WM-27-5	1	DS	D	96	94	50	100	3	556	Y	100	556	750	Perennial								inner gorge
WM-27-6	1	DS	D	96,87	0	100	30	2	222	Y	100	222	300	Perennial								inner gorge
WM-27-7	3	DS	D	96	75	70	70	4	726	Y	92	668	902	Ephem./Int.	Landing							5-10 years old,
WM-27-8	1	DS	D	96,87	47	100	60	3	667	Y	100	667	900	Perennial	ROAD							
WM-27-9	1	DS	D	96	58	130	70	1	337	Y	100	337	455	Perennial	ROAD							
WM-30-1	3	DS	P	96,87	0	75	40	4	444	Y	92	409	552	Ephem./Int.								
WM-30-2	3	DS	D	96	0	125	50	4	926	N	0	0	0									
WM-30-3	2	DS	P	96	0	80	60	4	711	Y	92	654	883	Ephem./Int.								
WM-30-4	1	DT	P	1987	0	320	20	4	948	Y	92	872	1178	Ephem./Int.								
WM-30-5	3	DT	P	1987	0	240	20	4	711	Y	92	654	883	Ephem./Int.								
WM-31-1	3	DS	P	96	0	100	30	4	444	N	0	0	0									
WM-31-10	1	DS	D	96	0	300	600	7	46667	Y	100	46667	63000	Perennial								toe of WM-6-9 sliding into river, meander bend
WM-31-11	2	DS	P	96	0	40	30	4	178	Y	92	164	221	Ephem./Int.								
WM-31-12	3	DS	P	96	0	40	30	4	178	N	0	0	0									
WM-31-13	1	DS	D	96<	72	100	30	5	556	Y	100	556	750	Perennial	ROAD							inner gorge
WM-31-14	1	DS	D	96	128	30	65	4	289	Y	100	289	290	Perennial	ROAD							inner gorge
WM-31-15	1	DS	D	96	88	45	70	2	233	Y	100	233	315	Perennial	ROAD							inner gorge
WM-31-16	1	DS	D	96	100	40	20	4	119	Y	100	119	160	Perennial	ROAD							inner gorge
WM-31-17	1	DS	D	96	98	60	150	3	1000	Y	100	1000	1350	Perennial	ROAD							inner gorge
WM-31-18	3	DS	D	1987	0	150	80	4	1778	Y	92	1636	2208	Perennial	ROAD							road on top as well
WM-31-19	1	DS	P	1987	0	50	15	4	111	Y	92	102	133	Perennial	ROAD							
WM-31-2	3	DS	P	96	0	50	50	4	370	N	0	0	0									
WM-31-20	3	DS	D	1987	0	200	100	4	2963	Y	92	2726	3680	Perennial	ROAD							
WM-31-21	2	DS	P	1987	0	80	30	4	356	Y	92	327	442	Ephem./Int.								
WM-31-22	4	DS	P	1981	0	80	60	4	711	Y	92	654	850	Perennial	ROAD							
WM-31-23		RS	P			2200	540	0		Y				Perennial		2	2	3	3	4	N	
WM-31-24	1	DS	P	2000	0	100	30	4	444	Y	92	409	552	Perennial								
WM-31-25	2	DS	D	2000	0	60	60	4	533	Y	92	491	662	Perennial								
WM-31-28	4	DS	P	2000	0	120	80	4	1422	N	0	0	0		LANDING							

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%)	Average Landslide Dimensions (feet)			Volume (cubic-yards)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty		Field	Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	
WM-31-29		RS	P			1870	300	0		Y				Perennial		2	2	3	3	4	N	
WM-31-3	3	DS	D	>96	65	120	40	3	533	Y	100	533	720	Ephem./Int.	ROAD							
WM-31-30		RS	P			1580	860	0		Y				Perennial		2	3	3	3	4	N	
WM-31-31	3	DS	P	2000	0	80	20	4	237	N	0	0	0									
WM-31-34		RS	Q			200	1180	0		Y				Ephem./Int.		4	3	3	3	4	N	
WM-31-36		RS	Q			1020	860	0		Y				Perennial		3	3	3	3	4	N	
WM-31-37	4	DS	D	2000	0	140	100	4	2074	Y	92	1908	2576	Ephem./Int.								
WM-31-38	4	DS	P	2000	0	60	15	4	133	N	0	0	0									
WM-31-39		RS	P			660	300	0		Y				Ephem./Int.		3	2	3	2	4	N	
WM-31-4	4	DS	D	96	0	150	100	4	2222	N	0	0	0									
WM-31-40		RS	Q			640	320	0		N						4	3	3	3	5	N	
WM-31-41		RS	Q			450	270	0		Y				Perennial		3	3	3	3	4	N	
WM-31-42		RS	Q			630	270	0		Y				Perennial		3	3	3	3	4	N	
WM-31-42		RS	Q			630	270	0		Y				Perennial		3	3	3	3	4	N	
WM-31-43		RS	P			760	820	0		Y				Perennial		3	3	3	2	4	N	
WM-31-44		RS	Q			550	510	0		Y				Perennial		3	3	3	3	4	N	
WM-31-45	2	DT	D	2000	0	220	50	4	1630	N	0	0	0									
WM-31-46	1	DS	Q	2000	0	20	50	4	148	Y	92	136	184	Perennial								
WM-31-47	3	DS	P	2000	0	100	50	4	741	Y	92	681	920	Ephem./Int.	ROAD							
WM-31-5	2	DS	P	96	0	60	40	4	356	Y	92	327	442	Ephem./Int.								
WM-31-6	3	DS	P	96	0	70	30	4	311	N	0	0	0		ROAD							
WM-31-7	3	DS	P	96	0	125	220	4	4074	N	0	0	0									
WM-31-8	3	DS	P	96	0	60	50	4	444	Y	92	409	552	Ephem./Int.	ROAD							
WM-31-9	3	DS	D	96,87	0	100	100	4	1481	N	0	0	0		SKID							
WM-34-1	2	DS	D	1981	0	90	30	4	400	Y	92	368	497	Ephem./Int.	SKID							
WM-35-1	2	DS	D	1981	0	140	60	4	1244	Y	92	1145	1488	Ephem./Int.								
WM-36-1	4	DS	P	96	0	100	25	4	370	N	0	0	0									
WM-36-10	4	DS	D	1987	0	100	80	4	1185	N	0	0	0		LANDING							
WM-36-11	4	DS	D	1987	0	65	20	4	193	Y	92	177	230	Ephem./Int.								
WM-36-12	3	DS	D	1987	0	50	100	4	741	Y	92	681	886	Ephem./Int.	ROAD							
WM-36-13	3	DS	D	1987	0	80	30	4	356	Y	100	356	462	Perennial								stream failure
WM-36-15	2	DS	P	1981	0	80	30	4	356	Y	92	327	442	Ephem./Int.	SKID							
WM-36-16	3	DS	Q	1981	0	140	60	4	1244	N	0	0	0		SKID							
WM-36-17	3	DS	P	1981	0	170	60	4	1511	Y	92	1390	1877	Ephem./Int.	SKID							
WM-36-18	3	DS	P	1981	0	170	80	4	2015	Y	92	1854	2502	Ephem./Int.	ROAD							
WM-36-19	4	DS	D	1981	0	140	30	4	622	Y	92	572	773	Ephem./Int.								
WM-36-2	3	DF	D	96,87	0	200	90	4	2667	Y	92	2453	3312	Ephem./Int.								runout 500 by 10 ft.
WM-36-20	2	DS	P	1981	0	140	140	4	2904	Y	92	2671	3606	Ephem./Int.	SKID							
WM-36-21		RS	Q			1760	930	0		Y				Perennial		3	3	3	4	4	N	
WM-36-22		RS	Q			2030	640	0		Y				Ephem./Int.		4	2	3	2	4	N	
WM-36-23		RS	Q			1210	1344	0		Y				Ephem./Int.		3	3	3	3	3	N	
WM-36-24		RS	Q			780	130	0		N						3	2	3	3	4	N	
WM-36-26		RS	Q			635	400	0		Y				Perennial		3	3	2	3	4	Y	
WM-36-3	2	DS	P	96	0	60	40	4	356	Y	92	327	442	Ephem./Int.								
WM-36-4	3	DS	D	96	0	50	50	4	370	N	0	0	0									
WM-36-5	3	DF	D	96	0	150	60	8	2667	Y	100	2667	3600	Ephem./Int.	ROAD							
WM-36-7	1	DS	D	96	104	60	110	2	189	Y	100	489	660	Perennial	ROAD							inner gorge
WM-36-8	3	DS	D	1987	0	210	50	4	1556	Y	92	1431	1932	Ephem./Int.	ROAD							
WM-36-9	3	DS	P	1987	0	50	50	4	370	Y	92	341	460	Ephem./Int.	ROAD							
WM-39-25		RS	Q			3490	3680	0		Y				Perennial		3	3	3	3	4	Y	
WM-6-1	1	DS	D	96	0	70	40	4	415	Y	92	382	515	Perennial								inner gorge
WM-6-10	2	DF	D	96	0	260	20	4	770	Y	92	709	957	Ephem./Int.								

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%)	Average Landslide Dimensions (feet)			Volume (cubic-yards)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty		Field	Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	
WM-6-11	3	DS	D	1981	0	90	30	4	400	Y	92	368	478	Perennial	SKID							
WM-6-12	2	DS	P	1981	0	80	60	4	711	Y	92	654	850	Ephem./Int.	SKID							
WM-6-13	3	DS	D	2000	0	160	160	4	3793	N	0	0	0		ROAD							
WM-6-14		RS	P			2030	1070	0		Y				Ephem./Int.		3	2	3	4	4	N	
WM-6-15		RS	P			410	210	0		Y				Ephem./Int.		3	3	5	3	4	N	
WM-6-2	1	DS	P	96	0	50	100	4	741	Y	92	681	920	Perennial								inner gorge
WM-6-3	1	DS	P	96	0	160	25	4	593	Y	92	545	736	Perennial	ROAD							
WM-6-4	1	DS	P	96	0	50	80	4	593	Y	92	545	736	Perennial								inner gorge
WM-6-5	1	DS	P	96	0	40	30	4	178	Y	92	164	221	Perennial								inner gorge
WM-6-6	2	DS	Q	96	0	40	75	4	444	Y	92	409	552	Perennial								inner gorge
WM-6-7	2	DS	P	96	0	80	40	4	474	Y	92	436	589	Perennial								inner gorge
WM-6-8	3	DS	P	96	0	75	80	4	889	N	0	0	0									
WM-6-9		RS	D			3420	900	0		Y				Perennial		2	1	2	3	2	Y	Bare spots
WN-10-1	4	DS	P	1987	80	80	20	4	237	Y	92	218	294	Ephem./Int.	ROAD							run out caused by slide
WN-10-10	2	DS	D	1987	0	200	80	4	2370	Y	92	2181	2944	Ephem./Int.								
WN-10-11	2	DS	D	1987	0	240	70	4	2489	Y	92	2290	3091	Ephem./Int.								
WN-10-12		RS	D			1370	1040	0		Y				Perennial		3	2	3	2	4	N	
WN-10-13		RS	Q			820	270	0		Y				Perennial		3	3	3	3	4	N	
WN-10-14		RS	P			1150	560	0		Y				Perennial		3	2	2	3	4	N	
WN-10-15		RS	P			550	290	0		Y				Ephem./Int.		3	2	3	3	4	N	
WN-10-2	2	DS	D	96	0	80	80	4	948	Y	92	872	1178	Ephem./Int.								
WN-10-3	2	DS	D	96	0	150	50	4	1111	Y	92	1022	1380	Ephem./Int.								
WN-10-4	4	DS	D	96	85	90	110	3	1100	Y	100	1100	1485	Ephem./Int.								
WN-10-5	2	DS	P	96	96	130	100	4	1926	Y	100	1926	2600	Ephem./Int.								
WN-10-6	2	DS	P	96	0	50	30	4	222	Y	92	204	276	Ephem./Int.								
WN-10-7	4	DS	P	96	0	120	60	4	1067	N	0	0	0		Landing							above road
WN-10-8	3	DS	D	96	0	100	30	4	444	N	0	0	0									Headwall Failure
WN-10-9	3	DS	D	96	0	60	20	4	178	Y	92	164	221	Ephem./Int.								
WN-11-1	3	DS	P	96	0	90	40	4	533	Y	92	491	662	Ephem./Int.								
WN-13-1	4	DS	P	96	0	110	35	4	570	N	0	0	0									
WN-13-10	3	DS	D	1981	0	60	80	4	711	Y	92	654	883	Perennial	ROAD							
WN-13-11	3	DS	P	1981	0	90	30	4	400	Y	92	368	497	Ephem./Int.	SKID							
WN-13-12	3	DS	P	1981	0	90	30	4	400	Y	92	368	497	Ephem./Int.	SKID							
WN-13-14		RS	P			1370	480	0		Y				Perennial		3	3	3	3	4	N	
WN-13-15		RS	P			650	370	0		N						4	3	3	3	4	N	
WN-13-16		RS	Q			390	210	0		N						4	3	3	4	4	N	
WN-13-18		RS	Q			610	360	0		Y				Ephem./Int.		3	3	3	3	4	N	
WN-13-2	3	DS	P	96	0	40	20	4	119	Y	92	109	147	Ephem./Int.								
WN-13-3	3	DS	D	96	0	65	40	4	385	Y	92	254	478	Perennial	ROAD							initiates above road
WN-13-4	5	DS	D	96	110	110	70	1	285	Y	100	285	385	Perennial	ROAD							
WN-13-5	4	DS	D	1987	0	80	30	4	356	Y	92	327	442	Perennial								
WN-13-6	4	DS	D	1987	0	80	15	4	178	Y	92	164	221	Ephem./Int.								
WN-13-7	4	DT	P	1987	0	240	50	4	1778	Y	92	1636	2208	Ephem./Int.								
WN-13-8	4	DS	P	1981	0	80	60	4	711	Y	92	654	883	Ephem./Int.	ROAD							
WN-13-9	4	DS	P	1981	0	80	30	4	356	Y	92	327	442	Ephem./Int.	SKID							
WN-14-1	4	DS	D	96,87	0	180	50	4	1333	Y	92	1227	1656	Ephem./Int.								
WN-14-10	4	DS	D	1981	0	50	30	4	222	Y	92	204	276	Perennial	ROAD							
WN-14-11	4	DS	P	1981	0	140	110	4	2281	Y	92	2099	2834	Ephem./Int.	SKID							
WN-14-13	3	DS	Q	2000	0	100	20	4	256	N	0	0	0									
WN-14-17		RS	P			760	540	0		Y				Perennial		3	3	3	3	4	N	
WN-14-18		RS	Q			980	1120	0		Y				Perennial		3	3	3	3	4	Y	
WN-14-2	3	DS	P	96,87	0	40	40	4	237	N	0	0	0		SKID							

Id	MWMU	Landslides Type	Landslides Certainty	Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet) Length	Width	Depth	Volume (cubic-yards)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	Comments
WN-14-3	4	DS	P	96	0	50	25	4	185	N	0	0	0		SKID							
WN-14-4	1	DS	D	96,87	0	60	60	4	533	Y	92	491	662	Perennial	ROAD							
WN-14-5	1	DS	D	96	48	70	50	3	389	N	0	0	0		ROAD							
WN-14-6	3	DS	D	96	83	20	30	3	67	Y	100	67	90	Perennial	ROAD							
WN-14-8	3	DS	D	1987	0	50	80	4	593	Y	92	545	736	Perennial	ROAD							
WN-14-9	4	DS	P	1981	0	110	30	4	489	Y	92	450	585	Perennial	ROAD							
WN-15-1	3	DF	P	96	0	110	30	4	489	Y	92	450	607	Ephem./Int.								
WN-15-10	4	DS	P	1981	0	110	30	4	489	Y	92	450	607	Ephem./Int.	ROAD							Ground zero
WN-15-12		RS	Q			660	240	0		Y				Perennial		3	3	3	3	4	N	
WN-15-13		RS	Q			640	290	0		Y				Perennial		3	3	3	3	4	N	
WN-15-14	3	DS	D	2000	0	130	60	4	1156	Y	92	1063	1435	Ephem./Int.	ROAD							
WN-15-2	2	DS	D	96	0	140	60	4	1244	Y	92	1145	1546	Perennial	Landing							a 120 by 20 ft. run out formed due to this slide
WN-15-3	3	DS	D	96	30	30	10	2	22	Y	100	22	30	Ephem./Int.								
WN-15-4	3	DS	D	96	94	130	50	3	722	Y	95	686	926	Ephem./Int.	ROAD							
WN-15-5	4	DS	D	1987	0	160	30	4	711	Y	92	654	883	Ephem./Int.	ROAD							
WN-15-6	4	DS	D	1987	0	160	30	4	711	Y	92	654	883	Ephem./Int.	SKID							
WN-15-7	3	DS	P	1987	0	160	30	4	711	Y	92	654	883	Ephem./Int.	SKID							
WN-15-8	4	DS	P	1987	0	30	65	4	289	Y	92	266	359	Ephem./Int.	ROAD							
WN-15-9	1	DS	D	1981	0	110	90	4	1467	Y	92	1349	1754	Ephem./Int.	SKID							
WN-16-1	2	DS	D	1987	0	100	30	4	444	Y	92	409	552	Ephem./Int.	ROAD							
WN-17-1	4	DS	P	96	0	80	15	4	178	Y	92	164	221	Ephem./Int.	ROAD							culvert outlet?
WN-17-2	4	DS	P	96	0	100	20	4	296	Y	92	273	368	Ephem./Int.								
WN-18-1	2	DS	Q	1985	0	200	40	4	1185	Y	92	1090	1417	Ephem./Int.								> 5-10 years old
WN-18-2	2	DS	P	96	0	30	20	4	89	Y	92	82	110	Ephem./Int.								
WN-18-3	2	DS	P	1987	0	100	30	4	444	Y	92	409	552	Ephem./Int.								older
WN-18-4	3	DS	D	1981	0	230	60	4	2044	Y	92	1881	2539	Ephem./Int.	LANDING							
WN-18-5	4	DS	D	1981	0	100	30	4	444	Y	92	409	552	Ephem./Int.	SKID							
WN-18-6	4	DS	P	1987	0	65	30	4	289	Y	92	266	359	Ephem./Int.								HW Swale
WN-21-1	2	DS	D	96	0	60	40	4	356	Y	92	327	442	Ephem./Int.								
WN-22-1	2	DS	P	96,87	0	70	20	4	207	N	0	0	0									
WN-22-12	4	DS	Q	2000	0	40	20	4	119	Y	92	109	147	Ephem./Int.	ROAD							
WN-22-13	4	DS	Q	2000	0	80	30	4	356	Y	92	327	442	Ephem./Int.	ROAD							
WN-22-2	3	DS	P	96	0	30	50	4	222	Y	92	204	276	Ephem./Int.								
WN-22-3	3	DS	D	96	0	30	50	4	222	Y	92	204	276	Ephem./Int.	Landing							
WN-22-4	2	DS	P	1981	0	60	30	4	267	Y	92	245	319	Ephem./Int.	ROAD							
WN-22-5	2	DS	D	1981	0	60	60	4	533	Y	92	491	662	Ephem./Int.	SKID							
WN-22-6	2	DS	P	1981	0	90	60	4	800	Y	92	736	994	Ephem./Int.	ROAD							Skid at bottom of slide
WN-22-7		RS	Q			820	340	0		Y				Ephem./Int.		4	3	3	3	4	N	
WN-23-1	4	DS	P	96,87	0	80	30	4	356	Y	92	327	442	Ephem./Int.								
WN-23-10	1	DS	P	1981	0	60	30	4	267	Y	92	245	319	Perennial	ROAD							
WN-23-11	1	DS	P	1981	0	85	20	4	252	Y	92	232	301	Perennial								
WN-23-12	4	DS	Q	2000	0	40	20	4	119	Y	92	109	147	Ephem./Int.	ROAD							
WN-23-13		RS	P			1350	1890	0		Y				Perennial		3	3	3	4	4	N	
WN-23-14		RS	Q			1030	820	0		Y				Perennial		3	2	3	3	4	N	bare soil
WN-23-15		RS	Q			390	290	0		Y				Ephem./Int.		3	3	3	3	3	N	
WN-23-16		RS	Q			410	230	0		Y				Ephem./Int.		3	3	3	3	4	N	
WN-23-17	3	DS	Q	2000	0	60	30	4	267	Y	92	245	331	Ephem./Int.								
WN-23-2	1	DS	Q	96	0	30	20	4	89	Y	92	82	110	Perennial								
WN-23-3	1	DF	D	98	50	350	20	2	519	Y	90	467	630	Perennial	ROAD							old sink
WN-23-4	1	DS	D	96	70	20	50	3	111	N	0	0	0		ROAD							
WN-23-5	3	DS	D	1987	0	50	65	4	481	Y	92	443	598	Ephem./Int.								
WN-23-6	4	DS	P	1987	0	80	65	4	770	Y	92	709	957	Ephem./Int.	ROAD							

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet)			Volume (cubic-yards)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty			Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	
WN-23-7	5	DS	P	1987	0	80	60	4	711	Y	92	654	883	Ephem./Int.	SKID							
WN-23-8	4	DS	D	1987	0	50	10	4	74	Y	92	68	92	Ephem./Int.	SKID							
WN-23-9	3	DS	D	81	0	80	30	4	356	Y	92	327	425	Ephem./Int.	ROAD							
WN-24-1	2	DS	P	96	0	40	30	4	178	Y	92	164	221	Ephem./Int.								
WN-24-2	3	DS	P	96	0	30	20	4	89	Y	92	82	110	Ephem./Int.								
WN-24-3	2	DS	D	1981	0	140	80	4	1659	Y	92	1527	2061	Ephem./Int.	SKID							
WN-24-4	3	DS	P	1981	0	80	80	4	948	Y	92	872	1178	Ephem./Int.	ROAD							
WN-24-5	2	DS	P	1981	0	60	30	4	267	Y	92	245	319	Ephem./Int.	ROAD							
WN-24-6	2	DS	Q	1981	0	100	80	4	1185	Y	92	1090	1472	Ephem./Int.	SKID							
WN-24-7	2	DS	P	1981	0	140	40	4	830	Y	92	763	1030	Ephem./Int.	SKID							
WR-10-1	2	DS	P	96	0	110	20	4	326	Y	92	300	405	Ephem./Int.								
WR-10-2		RS	D			590	210	0		Y				Perennial		3	1	5	3	4	N	
WR-10-3	3	DS	Q	1987	0	80	65	4	770	Y	92	709	957	Ephem./Int.	SKID							
WR-10-4	2	DS	P	1981	0	110	40	4	652	Y	92	600	810	Ephem./Int.	SKID							Older
WR-10-5	2	DS	D	2000	0	120	50	4	889	Y	92	818	1104	Perennial	ROAD							
WR-10-7		RS	Q			760	320	0		Y				Ephem./Int.		3	3	2	3	4	N	
WR-3-1	1	DS	P	96	0	60	40	4	356	Y	92	327	442	Perennial								
WR-4-1	4	DS	D	96	78	200	30	2	444	Y	60	267	360	Ephem./Int.	ROAD							
WR-4-10	1	DS	P	1981	0	100	50	4	741	Y	92	681	886	Perennial	ROAD							
WR-4-11		RS	D			570	400	0		Y				Perennial		3	2	2	3	4	N	
WR-4-12		RS	Q			980	590	0		Y				Ephem./Int.		3	3	3	3	5	N	
WR-4-13		RS	P			1540	480	0		Y				Ephem./Int.		4	3	3	3	4	N	
WR-4-14	3	DS	D	2000	0	100	20	4	178	Y	92	164	213	Ephem./Int.								
WR-4-15	3	DS	P	2000	0	80	30	4	356	Y	92	327	442	Ephem./Int.								
WR-4-2	4	DS	D	96	78	60	30	3	200	N	0	0	0		ROAD							
WR-4-3	3	DS	P	96	0	40	25	4	148	N	0	0	0									Headwall
WR-4-4	3	DS	Q	96	0	30	80	4	359	Y	92	327	442	Ephem./Int.								
WR-4-5	2	DS	D	96	0	150	10	4	222	Y	92	204	276	Ephem./Int.								
WR-4-6	2	DS	P	96	0	50	30	4	222	Y	92	204	276	Ephem./Int.								
WR-4-7	3	DS	Q	96	0	30	25	4	111	Y	92	102	138	Ephem./Int.								
WR-4-8	2	DS	P	96	0	75	40	4	444	Y	92	409	552	Ephem./Int.								
WR-4-9	1	DS	P	1987	0	50	10	4	74	Y	92	68	92	Ephem./Int.								
WR-5-1	4	DS	D	96	0	200	15	1	111	Y	20	22	30	Ephem./Int.								
WR-5-18	3	DS	D	2000	0	80	35	4	415	Y	92	382	515	Ephem./Int.	ROAD							
WR-5-19		RS	P			410	180	0		Y				Ephem./Int.		3	3	3	3	4	N	
WR-5-2	3	DS	D	96	0	50	30	2	111	N	0	0	0									
WR-5-20		RS	Q			708	336	0		Y				Ephem./Int.		3	3	3	3	4	N	
WR-5-3	2	DS	Q	96	0	40	20	4	119	Y	92	109	147	Ephem./Int.								
WR-5-4	2	DS	Q	96	0	20	20	4	59	Y	92	55	74	Ephem./Int.								
WR-5-5	4	DS	Q	96	0	50	20	4	148	Y	92	136	184	Ephem./Int.								
WR-6-1	3	DS	P	96	0	30	30	4	133	N	0	0	0									
WR-6-2	3	DS	Q	96	0	30	70	4	311	Y	92	286	386	Ephem./Int.								
WR-6-3	4	DS	D	96	0	50	10	2	37	N	0	0	0									
WR-6-4	4	DS	D	96	98	60	150	3	1000	N	0	0	0		ROAD							
WR-6-5		RS	P			580	270	0		Y				Ephem./Int.		3	3	3	3	1	N	
WR-7-1	4	DS	P	96	0	80	60	4	711	N	0	0	0		ROAD							
WR-7-3		RS	Q			430	270	0		Y				Ephem./Int.		3	3	3	3	3	N	
WR-8-1	3	DS	P	96	0	200	100	4	2963	N	0	0	0									
WR-8-13	3	DS	D	2000	0	180	30	4	800	Y	92	736	994	Ephem./Int.								
WR-8-14	3	DS	Q	2000	0	60	30	4	267	N	0	0	0									
WR-8-2	2	DS	Q	96	0	50	80	4	593	Y	92	545	736	Ephem./Int.								
WR-8-3	2	DS	Q	96	0	50	60	4	444	Y	92	409	552	Ephem./Int.								

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet)			Volume (cubic-yards)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty			Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	
WR-8-4	3	DS	D	96	0	300	5	4	222	Y	92	204	276	Ephem./Int.								run out of a 20 leg. x 10 wth. ft debris slide
WR-8-5	3	DS	P	96	0	30	20	4	89	N	0	0	0									
WR-8-6	2	DS	D	96	60	100	30	3	333	Y	10	33	45	Ephem./Int.	ROAD							HW SWALE (DF run out delivers sed.)
WR-8-7	3	DS	D	96	85	30	30	5	167	Y	100	167	225	Ephem./Int.	ROAD							
WR-8-9	4	DS	P	1987	0	210	65	4	2022	Y	92	1860	2512	Perennial	SKID							
WR-9-1	3	DS	P	96	0	60	30	4	267	N	0	0	0									
WR-9-10	3	DS	P	96	0	30	30	4	133	N	0	0	0									
WR-9-11	3	DS	P	96	0	30	40	4	178	N	0	0	0		SKID							
WR-9-12	4	DS	D	96<	66	50	30	3	167	Y	15	25	34	Ephem./Int.	ROAD							run out of
WR-9-13	4	DS	D	96<	70	200	30	3	667	Y	90	600	810	Ephem./Int.	ROAD							
WR-9-14	4	DS	D	96	65	130	100	4	1926	Y	50	963	1300	Ephem./Int.	ROAD							
WR-9-15	2	DS	P	1987	0	65	20	4	193	Y	92	177	239	Ephem./Int.	ROAD							
WR-9-16		RS	P			1090	1760	0		Y				Ephem./Int.		3	3	3	3	4	Y	
WR-9-2	3	DS	P	96	0	60	40	4	356	N	0	0	0									
WR-9-3	2	DS	P	96	0	60	40	4	356	Y	92	327	442	Perennial								
WR-9-4	3	DS	P	96	0	60	50	4	444	Y	92	409	552	Ephem./Int.								
WR-9-5	2	DS	P	96	0	70	40	4	415	Y	92	382	515	Ephem./Int.								
WR-9-6	4	DS	D	96	0	80	50	4	593	Y	92	545	736	Ephem./Int.	SKID							inner gorge
WR-9-7	3	DS	P	96	0	110	20	4	326	Y	92	300	405	Ephem./Int.	SKID							
WR-9-8	3	DS	P	96	0	50	20	4	148	Y	92	136	184	Ephem./Int.								
WR-9-9	3	DS	P	96	0	40	10	4	59	Y	92	55	74	Ephem./Int.								
WU-10-1	3	DT	D	1981	0	170	30	4	756	Y	92	695	938	Perennial	SKID							Inner gorge
WU-10-2	4	DS	Q	2000	0	40	30	4	178	N	0	0	0									
WU-10-3	4	DS	P	2000	0	60	20	4	178	Y	92	164	221	Ephem./Int.								
WU-10-5		RS	Q			470	380	0		Y				Ephem./Int.		3	3	3	3	4	N	
WU-10-6	3	DS	P	2000	0	200	30	4	889	Y	92	818	1104	Ephem./Int.	ROAD							
WU-32-10		RS	Q			940	240	0		Y				Perennial		3	3	3	3	4	N	
WU-32-11		RS	Q			840	370	0		Y				Perennial		3	3	3	4	4	N	
WU-32-13		RS	Q			600	300	0		Y				Perennial		3	3	3	4	4	N	
WU-32-16	3	DS	P	2000	0	60	20	4	178	Y	92	164	221	Ephem./Int.	ROAD							
WU-32-17		RS	Q			560	240	0		Y				Ephem./Int.		3	3	3	3	4	N	
WU-32-18		RS	Q			550	300	0		Y				Perennial		3	3	3	4	4	N	
WU-32-19		RS	Q			310	160	0		Y				Perennial		3	3	3	4	4	N	
WU-32-2	3	DF	D	95	56	700	100	24	62222	Y	100	62222	84000	Perennial								debris flow off Floodgate slide
WU-32-3	1	DS	D	96	88	100	30	2	222	Y	100	222	300	Perennial	ROAD							
WU-32-4	1	DS	D	96	82	70	100	3	778	Y	100	778	1050	Perennial	ROAD							
WU-32-6	3	DS	D	1987	0	160	20	4	474	Y	92	436	567	Ephem./Int.								HW SWALE
WU-32-7	4	DS	D	1987	0	65	30	4	289	Y	92	266	359	Ephem./Int.	ROAD							
WU-32-8		RS	P			2930	2110	0		Y				Perennial		3	3	3	4	4	Y	
WU-4-1	4	DF	D	96,87	0	100	80	4	1185	Y	92	1092	1472	Perennial	Landing							runout of 250 by 20 ft.
WU-4-10	4	DS	D	2000	0	120	30	4	533	Y	92	491	662	Perennial								
WU-4-11		RS	P			700	540	0		Y				Perennial		3	3	3	4	4	Y	
WU-4-12		RS	Q			2190	1310	0		Y				Perennial		3	3	3	4	4	Y	
WU-4-14		RS	P			1620	960	0		Y				Perennial		3	3	5	4	4	N	
WU-4-15		RS	P			980	630	0		Y				Perennial		3	3	3	4	4	N	
WU-4-2	1	DS	P	96,87	0	70	60	4	622	Y	100	622	840	Perennial								inner gorge
WU-4-3	1	DS	P	96,87	0	40	50	4	296	Y	100	296	400	Perennial								inner gorge
WU-4-4	1	DS	P	96,87	0	70	70	4	726	Y	100	726	980	Perennial								inner gorge
WU-4-5	1	DS	P	96,87	0	30	50	4	222	Y	100	222	300	Perennial								inner gorge
WU-4-6	1	DS	P	96	0	20	30	4	89	Y	100	89	120	Perennial								
WU-4-7	1	DS	D	96	102	80	10	2	59	Y	100	59	80	Perennial	ROAD							inner gorge
WU-4-8		RS	P			2090	1250	0		Y				Perennial		3	3	4	3	4	N	

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet)			Volume (cubic-yards)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty			Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	
WU-4-9		RS	P			1480	1120	0		Y				Perennial		2	3	3	3	4	N	
WU-5-1	4	DS	P	96	0	180	70	4	1867	Y	92	1717	2318	Ephem./Int.								
WU-5-10	2	DS	P	96	0	100	60	4	889	Y	92	818	1063	Perennial								
WU-5-11	4	DS	D	96	0	100	120	3	1333	Y	75	1000	1300	Perennial	Landing							
WU-5-12	4	DS	D	96	75	100	40	1	148	Y	100	148	200	Perennial	ROAD							
WU-5-13	4	DS	D	96	70	150	40	4	889	Y	100	889	1200	Perennial	ROAD							inner gorge
WU-5-14	2	DS	D	96	95	200	30	1	222	Y	100	222	300	Perennial	ROAD							inner gorge
WU-5-15	4	DS	D	96	86	100	30	3	333	Y	100	333	450	Perennial	Landing							inner gorge
WU-5-16	3	DS	D	96	85	80	50	6	889	Y	100	889	1200	Ephem./Int.	ROAD							
WU-5-17	3	DS	D	96	95	150	200	5	5556	Y	100	5556	7223	Perennial								inner gorge
WU-5-18	2	DS	D	1987	0	130	80	4	1541	Y	92	1417	1914	Perennial	ROAD							inner gorge
WU-5-19	1	DS	P	1996	0	50	50	4	370	Y	100	370	481	Ephem./Int.								
WU-5-2	4	DS	Q	>90	0	100	60	4	889	N	0	0	0									
WU-5-20	4	DS	D	1987	0	200	50	4	1481	Y	92	1363	1840	Ephem./Int.	ROAD							
WU-5-21	3	DS	D	1987	0	210	50	4	1556	Y	92	1431	1932	Perennial	ROAD							stream failure
WU-5-22	4	DS	P	1987	0	160	15	4	356	Y	92	327	425	Ephem./Int.	ROAD							
WU-5-23		RS	P			3360	2430	0		Y				Perennial		3	3	4	4	4	Y	
WU-5-24		RS	Q			800	460	0		Y				Ephem./Int.		3	3	3	3	4	N	
WU-5-25		RS	P			4680	2560	0		Y				Perennial		3	3	4	4	4	Y	
WU-5-26	1	DS	D	2000	0	80	50	4	593	Y	92	545	736	Ephem./Int.								
WU-5-27		RS	Q			430	220	0		Y				Ephem./Int.		3	3	3	4	4	N	
WU-5-29		RS	P			1700	1660	0		Y				Perennial		3	3	4	3	4	Y	
WU-5-3	4	DS	D	96	0	150	80	4	1778	N	0	0	0									
WU-5-30		RS	Q			2580	400	0		Y				Ephem./Int.		3	3	3	3	4	Y	
WU-5-31		RS	Q			570	380	0		Y				Ephem./Int.		3	3	3	3	4	N	
WU-5-32		RS	Q			880	1230	0		Y				Perennial		3	3	3	3	4	Y	
WU-5-33		RS	D			470	190	0		Y				Perennial		2	1	2	2	1	N	
WU-5-34		RS	Q			780	500	0		Y				Ephem./Int.		3	3	3	3	4	N	
WU-5-36	4	DS	D	2000	0	120	50	4	889	Y	92	818	1104	Ephem./Int.	ROAD							
WU-5-4	1	DS	Q	96	0	100	40	4	593	Y	92	545	736	Perennial								
WU-5-5	1	DS	P	96,87	0	150	100	4	2222	Y	92	2044	2760	Perennial								
WU-5-6	3	DS	P	96	0	40	30	4	178	N	0	0	0									
WU-5-7	3	DS	P	96	0	120	25	4	444	N	0	0	0		SKID							
WU-5-8	1	DS	D	96	95	150	200	5	5556	Y	100	5556	7500	Perennial								inner gorge
WU-5-9	3	DS	D	96	0	125	50	4	926	N	0	0	0		Landing							
WU-6-1	1	DS	D	96	96	30	50	5	278	Y	100	278	375	Ephem./Int.	ROAD							
WU-6-13		RS	P			1210	500	0		Y				Ephem./Int.		3	3	3	3	4	N	
WU-6-14		RS	Q			1630	880	0		Y				Ephem./Int.		4	3	3	3	4	N	
WU-7-1	2	DS	D	96	0	70	30	4	311	Y	92	286	372	Ephem./Int.								inner gorge
WU-8-1	3	DS	P	>90,87,81	0	330	100	4	4889	Y	92	4498	5847	Ephem./Int.								
WU-8-10	2	DS	D	1987	0	240	80	4	2844	Y	92	2617	3533	Ephem./Int.	ROAD							HW Swale
WU-8-11	3	DT	P	1987	0	210	30	4	933	Y	92	859	1159	Ephem./Int.	ROAD							HW Swale
WU-8-12	3	DS	P	1987	0	80	80	4		Y	92			Ephem./Int.	ROAD							
WU-8-13	3	DS	P	1987	0	65	50	4	481	Y	92	443	576	Ephem./Int.	ROAD							
WU-8-14	2	DS	D	1981	0	200	110	4	3259	Y	92	2999	4048	Perennial								
WU-8-15		RS	Q			1600	880	0		Y				Ephem./Int.		4	3	3	3	4	N	
WU-8-16		RS	Q			680	480	0		Y				Ephem./Int.		3	3	3	3	3	N	
WU-8-17		RS	Q			2715	660	0		Y				Ephem./Int.		4	3	4	4	4	N	
WU-8-18		RS	Q			390	990	0		Y				Ephem./Int.		3	3	5	4	4	N	
WU-8-19		RS	Q			1810	500	0		Y				Ephem./Int.		4	3	3	3	4	N	
WU-8-2	1	DS	Q	96,87	0	40	100	4	593	Y	92	546	709	Perennial								inner gorge
WU-8-3	1	DS	Q	96,87	0	70	40	4	415	Y	92	382	496	Perennial								inner gorge

Id	MWMU	Landslides		Approx. Failure Date	Slope Gradient (%) Field	Average Landslide Dimensions (feet)			Volume (cubic-yards)	Sediment Delivery	Delivery (%)	Delivery Volume (cub.-Yrds.)	Delivery Mass (tons)	Sediment Routing	Land Use Assoc.	Deep Seated Landslide Morphological Descriptions						Comments
		Type	Certainty			Length	Width	Depth								Toe	Body	Lat. Scarps	Main Scarps	Veg	Complex	
WU-8-4	3	DS	P	96	0	220	40	4	1304	Y	92	1200	1560	Ephem./Int.								
WU-8-5	3	DS	P	85-90	0	130	80	4	1541	Y	92	1418	1843	Ephem./Int.								
WU-8-6	2	DS	P	96	0	50	25	4	185	Y	92	170	230	Ephem./Int.								
WU-8-7	2	DS	P	96	0	50	25	4	185	Y	92	170	230	Ephem./Int.								
WU-8-8	4	DS	P	96	0	100	60	4	889	N	0	0	0		LANDING							
WU-8-9	1	DS	D	96,87	0	32	32	3	114	Y	100	114	154	Ephem./Int.								
WU-9-1	1	DS	P	96	0	60	40	4	356	Y	92	327	442	Perennial								
WU-9-10	3	DS	D	96,87	80	250	50	2	926	Y	100	926	1250	Perennial	ROAD							inner gorge
WU-9-11	3	DS	D	96	77	280	70	3	2178	Y	100	2178	2940	Perennial	ROAD							starts above road and goes over
WU-9-12	3	DS	D	96,87	80	50	30	3	167	Y	100	167	225	Perennial	ROAD							
WU-9-13	1	DS	D	96,87	81	40	70	4	415	Y	100	415	560	Perennial	ROAD							
WU-9-14	4	DS	P	1987	0	80	15	4	178	N	0	0	0		LANDING							
WU-9-15	4	DS	D	1987	0	80	30	4	356	Y	92	327	425	Ephem./Int.	ROAD							
WU-9-16	2	DS	Q	1987	0	240	160	4	5689	Y	92	5234	7066	Ephem./Int.	SKID							
WU-9-17	4	DS	D	1987	0	65	115	4	1107	Y	92	1019	1375	Ephem./Int.								
WU-9-18	3	DS	D	1981	0	110	50	4	815	Y	92	750	1012	Ephem./Int.	ROAD							
WU-9-19	1	DS	D	1981	0	60	110	4	978	Y	92	900	1214	Ephem./Int.								
WU-9-2	3	DS	D	96,87	0	200	100	4	2963	Y	100	2963	4000	Perennial								
WU-9-20	1	DS	D	1981	0	140	80	4	1659	Y	92	1527	2061	Ephem./Int.	SKID							
WU-9-21		RS	P			860	240	0		Y				Ephem./Int.		4	3	3	3	4	N	
WU-9-22		EF	P			2050	450	0		Y				Ephem./Int.		3	3	3	4	4	N	
WU-9-23		RS	P			2230	2240	0		Y				Perennial		3	3	3	4	4	Y	
WU-9-24		RS	P			1170	580	0		Y				Perennial		3	3	3	3	4	N	part of WU 9-22
WU-9-25		RS	Q			760	290	0		Y				Ephem./Int.		3	3	3	3	3	N	
WU-9-26		RS	P			900	540	0		Y				Ephem./Int.		3	3	3	3	4	N	
WU-9-27		RS	Q			780	880	0		Y				Ephem./Int.		3	3	4	3	4	N	
WU-9-3	2	DS	D	96,87	0	60	80	4	711	Y	100	711	960	Perennial								inner gorge
WU-9-4	3	DS	D	96,87	0	250	180	4	6667	Y	92	6133	8280	Ephem./Int.								
WU-9-5	1	DS	D	96,87	96	150	230	2	2556	Y	100	2556	3450	Perennial								
WU-9-6	1	DS	D	96	0	70	150	2	778	Y	100	778	1050	Ephem./Int.								inner gorge
WU-9-7	1	DS	P	96	0	50	100	4	741	Y	100	741	1000	Ephem./Int.								inner gorge
WU-9-8	1	DS	D	96	0	70	30	3	233	Y	100	233	315	Ephem./Int.								inner gorge
WU-9-9	2	DS	P	96	0	60	60	4	533	Y	100	533	720	Perennial								

Section B
SURFACE AND POINT SOURCE EROSION
(ROADS/SKID TRAILS)

INTRODUCTION

The surface and point source erosion module examines the past and present soil erosion from roads and skid trails of the Mendocino Redwood Company (MRC) ownership in the Navarro River watershed, the Navarro watershed analysis unit (WAU). This module also provides a hazard assessment of the potential for future surface and point source erosion from roads in the Navarro WAU. The potential erosion assessment is to assist in development of mitigation measures and actions to minimize future soil erosion from the road network. The road data that is the basis for most of this analysis was collected by MRC during a 100% road inventory of the Navarro WAU. The erosion estimates utilize a combination of field observations and the use of the surface erosion model presented in the Standard Methodology for Conducting Watershed Analysis (Version 4.0, Washington Forest Practices).

Surface erosion is defined as the removal of soil particles from the surface of the soil. Processes such as rill erosion, sheetwash, biogenic transport (animal burrows, treefall, etc.) and ravel are considered surface erosion. Gullies, road crossing wash-outs, and large erosion features created by erosion from overland flow of water are considered point source erosion. In contrast, the largest discrete erosion events, landslides, are considered mass wasting.

This report examines road and skid trail associated surface and point source erosion delivering sediment into watercourses. Excessive levels of fine sediments from surface and point source erosion can get trapped in porous streambed gravels; and can increase water turbidity and suspended sediment concentrations. Excessive coarse sediments from point source erosion can adversely affect stream channel morphology. These can reduce the survival of salmonid in their redds or affect habitat needs and physiological characteristics of rearing salmonids. Excessive surface and point source erosion when delivered to a watercourse can also affect other downstream uses such as water supplies, agricultural diversions and recreation users. It is important that best management practices be utilized in forest management operations to minimize the impacts of surface and point source erosion.

SURFACE AND POINT SOURCE EROSION FROM ROADS

Methods

A 100% road inventory of the roads with the Navarro WAU was conducted. The road inventory consisted of traveling all roads with a Global Positioning System (GPS) unit and identifying, mapping and inventorying all major features of the road network. Some of the features that are inventoried include watercourse-crossings and crossing structures (culverts, bridges, etc.), landings, erosion features and controllable erosion amounts (as defined below). Information relating to erosion and sediment delivery from the road inventory is analyzed in this report. Dimensions of the road network such as length, width and sediment contributing road lengths are also summarized. The road inventory collects information on the entire road infrastructure. This road infrastructure information allows for better management and tracking of the road network.

All road features (watercourse crossings, landings, road fill, etc.), during the road inventory, have the past deliverable point source erosion volume estimated for that feature. Deliverable point source erosion from a road is defined as major rills or gully erosion which is observed in close proximity to a watercourse or which showed evidence of eroding directly into a watercourse. These measurements were used to calculate the volume of point source erosion delivered from the road. The volume of erosion was converted to a weight (in tons) assuming a soil bulk density of 100 lbs./cubic foot. All observed sediment delivery from surface or point source erosion is assumed to have occurred within the past 5 years, unless there is information otherwise.

Future or potential point source erosion (gully or road fill wash-outs, not sheetwash) observations were collected during the road inventory. This potential future erosion is called controllable erosion, a term developed by the North Coast Regional Water Quality Control Board for Total Maximum Daily Load (TMDL) purposes. Controllable erosion is defined as soil that could potentially deliver to a watercourse in the next 40 years (the duration of a TMDL), is human created, and can be reasonably controlled by human actions. Typically, controllable erosion is a measure of the fill material from a road that could erode if a road feature is left un-maintained or fails in the next 40 years. The controllable erosion amount is the volume of soil that can be controlled with high design standards for a road feature (i.e. watercourse crossing, side-cast fill, etc.).

The controllable erosion sites are further designated by the potential for sediment delivery and the immediacy of treatment for the site. Both the sediment delivery potential and the treatment immediacy are ranked low, moderate, or high. The ranking of each controllable erosion site by these variables provides a hazard or risk assessment of the controllable erosion. This allows prioritization of road improvements and erosion control work based on potential point source erosion hazard.

Another important variable of potential future point source erosion from a road is the likelihood of diversion of water down the road prism. This diversion potential, as it is called, was evaluated for every watercourse crossing of every road in the Navarro WAU. A site has a diversion potential if when the watercourse crossing plugged, dammed or failed water could be diverted out of the “natural” watercourse channel and down the road prism. Water diverted out of its “natural” channel would erode the road prism creating potentially high sediment delivery. Sites with a diversion potential can be engineered such that the diversion of water down a road prism does not occur if the watercourse crossing plugged, dammed, or failed.

A prioritization of potential point source erosion sites for the Navarro WAU is presented (Appendix B). This prioritization is based on amount of controllable erosion of the site, the treatment immediacy, and a high diversion potential.

Proper culvert sizing is another important characteristic for consideration of road erosion potential. Culverts that do not have the capacity to pass debris, water and sediment in high flow events can plug creating road prism failures with high sediment inputs. MRC currently designs all new culvert installations to pass the 100 year flood to ensure enough capacity in the pipe to pass water, debris and sediment in high flows. To determine if culvert sizing is appropriate for existing culverts the area behind each culvert inventoried was determined from topography data in the MRC Geographic Information System (GIS). The regression equation for the North Coast region (Waananen and Crippen, 1977) is used to predict the 50 and 100 year peak flow. A culvert sizing nomograph is used to determine the appropriate size for 50 and 100 year peak flow magnitudes and the predicted size are compared to the existing culvert sizing to determine if the culvert is large enough.

The culvert sizing analysis must be interpreted carefully as it was often difficult to tell what area of watershed drained to a culvert from a map based analysis. This culvert sizing analysis is only meant to be “first cut” at determining if a culvert is properly sized. From this analysis a field visit to the site will determine if indeed the appropriate watershed drainage area was used and the culvert is indeed under-sized. The results from the culvert sizing analysis are presented in Appendix B.

Surface erosion (or sheetwash) from roads was not directly estimated in the field. The contributing length or extent of road that delivers erosion to a watercourse is measured in the field then used for surface erosion calculations. The contributing length of a road is the length of road prism that drains water and associated eroded soil into a watercourse. Thus it defines the length of surface erosion of any particular site on the road. The model used to calculate surface erosion from roads is from the Standard Methodology for Conducting Watershed Analysis (Version 4.0, Washington Forest Practices Board) and is described below.

Surface erosion from the road surface is influenced by the amount of road traffic (high use mainline, moderate use active secondary, etc.), the type of road surface material, precipitation, width and size of road (the more surface area to erode, the more erosion), and vegetative cover (Reid, 1981). The Standard Methodology for Conducting Watershed Analysis (Version 4.0, Washington Forest Practices Board) provides relationships based on these factors to estimate the amount of surface erosion from different road types and conditions.

Field observations from the road inventory determined the length of the road delivering sediment to a watercourse (contributing length) from individual features of the road (culverts and crossings), the road width, the road surface material and the type of road (seasonal or temporary) to aid in the surface erosion calculations.

The road inventory lacked contributing road length for road segments adjacent to a watercourse but not associated with a culvert or crossing. Using an analysis from GIS the amount of road within 50 feet, 50-100 feet and 100-200 feet of a watercourse was determined. It was assumed that within 50 feet, 100 percent of erosion from the road delivers sediment to a watercourse. At 50-100 feet 35 percent and at 100-200 feet 10 percent of erosion from the road was assumed to deliver sediment to a watercourse. These assumptions were based on sediment delivery ratios used in a road erosion model called SEDMOD.

The following model parameters were used to calculate surface erosion from roads in the Navarro WAU. All of the observed roads were assumed to be older than 2 years, a base erosion rate of 60 tons/acre/year was used. This initial value was altered (multiplied) by the factors of traffic on the road, cut- and fill-slope vegetation cover, road surface type, annual precipitation, and road type in an attempt to model the actual sediment volume contributed by a given road segment. The road tread width was determined in the field during the road inventory and is assumed to be 40% of the road prism. The cut- and fill-slopes are assumed to 60% of the road prism; their dimensions for the surface erosion model were determined by multiplying the tread width by 1.5.

Road cut- and fill-slopes usually had approximately 50% vegetative cover, giving a cover factor of 0.37. The majority of hauling on roads occurs during drier times of the year (i.e. late spring, summer and early fall). Therefore the lowest annual precipitation category is used (<47 in. precipitation annually). In this annual precipitation category a road with at least a 6 inch rock surface is given a factor of 0.2, while a native surface road has a factor of 1.

There were 4 traffic factors used in surface erosion modeling:

1) *Mainline roads with heavy traffic* have a factor of 20; these roads are actively used and maintained for log haul traffic.
2) *Mainline roads with moderate traffic* have a factor of 2; these roads are used for log haul traffic 2-3 times each decade.
3) *Seasonal roads* have a traffic factor of 1.2; these are tributary roads which receive moderate log haul traffic 1-2 years each decade and light traffic the remainder of the time.
4) *Temporary roads* receive a traffic factor of 0.61; these roads receive moderate log haul traffic 1-2 times per every 1-2 decades with little to no use in between.

The result of the surface erosion modeling is added to the total past point source erosion observed during the road inventory from a given road and presented as tons/year of sediment delivery (see Appendix B for erosion estimates of each road in the Navarro WAU). For relative sediment contributions from each planning watershed for roads for sediment input evaluation the tons/year calculations for all roads was totaled by planning watershed and normalized by dividing by the MRC ownership, in square miles, for the planning watershed. The result is a tons/square mile of MRC ownership/year estimate of road surface and point source erosion.

Finally, with this information each road in the Navarro WAU is assigned an erosion hazard class. The erosion hazard class is used to classify the roads in the Navarro WAU by their current and potential erosion hazard. The erosion hazard class was determined by the amount of erosion a road produced and the likelihood for that erosion to be delivered to a watercourse. High levels of traffic, road surface, proximity to the stream, high past point source erosion, and high modeled surface erosion all were considered when ranking roads for their erosion hazard. The roads with the highest risk of sediment delivery and soil erosion were given a high erosion hazard classification. The roads with medium risk of sediment delivery and soil erosion were given a moderate erosion hazard classification. The roads with the lowest risk of sediment delivery and soil erosion were given a low erosion hazard classification. A description of what each erosion hazard classification means can be found in the results and discussion sub-section of this report.

The data generated from the road inventory is separated into two areas, Navarro East and Navarro West:

Navarro West consists of MRC's ownership in the following Calwater planning watersheds: Floodgate Creek, Flynn Creek, Hendy Woods, Lower Navarro River, Middle Navarro River, Mill Creek, North Fork Navarro River, Rancheria Creek, Ray Gulch, and Upper Navarro River.

Navarro East consists of MRC's ownership in these Calwater planning watersheds: Dutch Henry Creek, John Smith Creek, Little North Fork Navarro River, Lower South Branch Navarro River, North Fork Indian Creek, Middle South Branch Navarro River, and Upper South Branch Navarro River.

Results and Discussion - Roads

The road erosion hazard rating for each road in the Navarro WAU is presented on Map B-1(a) and B-1(b) and for each individual road in Appendix B of this report. The categorizing of roads into hazard classes is intended to identify current problem areas, consider reconstruction and prioritize maintenance. The following are the definitions for each road erosion hazard class.

<u>High Road Erosion Hazard Class</u> - These roads have the highest amount of recent deliverable surface erosion to watercourses and a high potential for future deliverable erosion. These roads can be active, abandoned or closed. Often roads in this class are close to watercourses creating a high sediment delivery potential. Erosion is typically due to long contributing road lengths or road with native surfaces near watercourses: a result of too few waterbars and/or rolling dips or lack of rock surface. Erosion may also be a product of problem areas such as watercourse crossing wash-outs, poor road drainage, plugged road watercourse crossings, water diverted down the road surface, culverts not fitted with downspouts, etc. Active roads in this class should get the highest priority for maintenance or improvements. Closed roads in this class will need improvements before opening again. Opening abandoned roads in this class should be avoided.

<u>Moderate Road Erosion Hazard Class</u> - These roads have moderate amounts of recent deliverable surface erosion to watercourses and potential for future deliverable erosion. These roads can be active, abandoned or closed. Erosion problems on roads in this class can usually be handled with good road maintenance. Erosion is typically from problem areas such as poor road drainage, water diverted down the road surface, culverts not fitted with downspouts, and an occasional plugged culvert or watercourse crossing wash-out. Active roads in this class should be a priority for maintenance. Closed or abandoned roads in this class will need some improvements before opening again.

<u>Low Road Erosion Hazard Class</u> - These roads have low amounts of recent deliverable surface erosion to watercourses and low potential for future deliverable erosion. These roads can be active, abandoned or closed. Active roads in this class do not need to be a priority for maintenance. Closed or abandoned roads in this class will need only some improvements before opening again.

The mapped roads and road features (culverts, crossings, and landings) are presented in maps B-2(a) and B-2(b) for the Navarro WAU. The associated treatment immediacy of the road feature is also shown on these maps. Potential controllable (point source) erosion sites were identified and prioritized in the Navarro WAU. In the Navarro WAU 276 controllable erosion sites have high treatment immediacy and 466 controllable erosion sites have moderate treatment immediacy. In addition to these controllable erosion sites 610 culverts or crossings in the Navarro WAU have a diversion potential. These diversion potential sites need to be considered a high priority for road improvement as they can represent a significant potential point source erosion hazard. The site identification, treatment immediacy and amount of controllable erosion estimated are found in Appendix B of this report.

The culvert size analysis has determined that 260 culverts are potentially too small to pass the 50 year flood and an additional 276 culverts will not pass the 100 year flood. The analysis of culvert sizing is only an estimate based on culvert location from the MRC road inventory and area behind the culvert based on MRC GIS topographic data. A field review will be required at each site to determine if the culvert is indeed under-sized, as our confidence in the analysis is low. However, the identification of these culverts as under-sized is a good hypothesis to work from and provides information to address potential road problems in Navarro WAU. These culverts identified as potentially too small need to be a high priority for upgrade if after field review the culverts are determined to be under-sized. The culvert sizing results are found in Appendix B of this report.

It was determined that there are 617 miles of truck roads in the Navarro WAU (skid trails not included). This represented an average road density of 7.3 miles of road per square mile. Table B-1(a) and B-1(b) breaks down the road lengths and densities by planning watershed for Navarro East and Navarro West.

Table B-1(a). Road Lengths and Density by Planning Watershed for the Navarro East Tract.

Planning Watershed	**Road Length (miles)**	**Road Density (mi/sq mi)**
Dutch Henry Creek	56.7	7.9
North Fork Indian Creek	15.8	5.8
John Smith Creek	27.0	8.3
Lower South Branch Navarro River	45.1	7.2
Middle South Branch Navarro	67.2	7.1
Little North Fork Navarro River	76.9	7.7
Upper South Branch Navarro River	51.4	6.8
Navarro East Total	***340.0***	***7.3***

Table B-1(b). Road Lengths and Density by Planning Watershed for the Navarro West Tract.

Planning Watershed	**Road Length (miles)**	**Road Density (mi/sq mi)**
Rancheria Creek	11.1	9.5
Flynn Creek	23.2	5.2
Floodgate Creek	7.7	7.0
Hendy Woods	13.7	8.8
Lower Navarro River	55.3	7.7
Middle Navarro River	50.1	6.9
North Fork Navarro River	39.1	6.3
Ray Gulch	34.4	7.4
Upper Navarro River	37.5	8.2
Mill Creek	4.9	7.3
Navarro West Total	***277***	***7.3***

The road densities range from approximately 6-9 miles per square mile of MRC ownership. These are road densities typical of timberland. The highest road densities occur in watersheds where MRC owns the least amount of land. This is often due to the access constraint the smaller parcel creates. Road densities are something that should be managed for in the Navarro WAU. Not all roads can be abandoned, but by converting many of these roads to a temporary status or putting them to bed after use, the amount of road that can contribute erosion at any given time is reduced.

The surface and point source erosion estimates by planning watershed are presented in Table B-2(a) and B-2(b). The breakdown of estimated erosion, road lengths and hazard rating by individual roads is in Appendix B of this report. Roads in the MRC ownership in the Navarro WAU are estimated to generate, on average, 490 tons/mi^2/yr of sediment from road-associated surface and point source erosion. This represented 520 tons/mi^2/yr and 450 tons/mi^2/yr of estimated sediment delivery from Navarro East and Navarro West respectively.

Table B-2(a) Road Associated Surface and Point Source Erosion Estimates by Planning Watershed for the Navarro East Tract, Navarro WAU.

Planning Watershed	**MRC Owned Acres**	**Surface Erosion (tons/yr)**	**Point Source Erosion (tons/yr)**	**Total Road Assoc. Erosion (tons/yr)**	**Road Assoc. Erosion Rate (tons/sq mi/yr)**
Dutch Henry Creek	4625	709	1537	2246	311
North Fork Indian Creek	1729	187	535	721	267
John Smith Creek	2080	569	2108	2678	824
Lower South Branch Navarro River	3988	532	287	819	131
Middle South Branch Navarro	6095	1359	3576	4935	518
Little North Fork Navarro River	6423	1648	5905	7553	753
Upper South Branch Navarro River	4807	1090	700	1790	238
Navarro East Totals (rounded)	***30,000***	***6,000***	***14,500***	***21,000***	***450***

Table B-2(b) Road Associated Surface and Point Source Erosion Estimates by Planning Watershed for the Navarro West Tract, Navarro WAU.

Planning Watershed	**MRC Owned Acres**	**Surface Erosion (tons/yr)**	**Point Source Erosion (tons/yr)**	**Total Road Assoc. Erosion (tons/yr)**	**Road Assoc. Erosion Rate (tons/sq mi/yr)**
Rancheria Creek	742	542	930	1472	1270
Flynn Creek	2874	397	75	472	105
Floodgate Creek	704	67	8	75	68
Hendy Woods	998	585	757	1341	860
Lower Navarro River	4583	1149	433	1582	221
Middle Navarro River	4641	1328	649	1978	273
North Fork Navarro River	3943	1310	637	1947	316
Ray Gulch	2982	896	5573	6470	1389
Upper Navarro River	2925	991	3547	4538	993
Mill Creek	429	96	27	123	184
Navarro West Totals (rounded)	***25,000***	***7,500***	***13,000***	***20,000***	***520***

John Smith Creek, Ray Gulch, Upper Navarro, Little North Fork Navarro River, Rancheria Creek and Hendy Woods planning watersheds had the highest rates of road associated erosion. In all of these cases the roads in the planning watersheds had a high amount of point source erosion. This probably indicates older legacy roads that are having a high amount of culvert or landing failures or inappropriate drainage creating gully erosion. These planning watersheds with a high rate of erosion should be considered priorities for erosion control work when considering work in a watershed context (i.e. “buttoning-up the entire watershed”).

The future potential for point source erosion was evaluated in the Navarro WAU. This potential erosion or controllable erosion was identified during the road inventory during 1998-2000. A total of 1,103,723 cubic yards of controllable erosion was identified in the Navarro WAU (Table B-3).

Table B-3. Controllable Erosion Estimates by Calwater Planning Watershed and Road Feature for the Navarro WAU.

Planning Watershed	**Culverts (yd^3)**	**Crossings (yd^3)**	**Landings (yd^3)**	**Road Slides (yd^3)**	**Erosion Features (yd^3)**	***Total* (yd^3)**
Rancheria Creek	0	305,233	9,195	10,380	1,335	***326,143***
North Fork Indian Creek	18,294	3,740	11,530	19,877	29	***53,470***
Hendy Woods	2,755	1,957	3,992	200	70	***8,974***
Upper South Branch Navarro	17,179	6,936	4,933	7,043	1,111	***37,202***
Middle South Branch Navarro	129,687	5,242	3,616	6,499	481	***145,525***
Lower South Branch Navarro	10,418	3,114	2,036	5,194	310	***21,072***
Little North Fork Navarro	72,074	6,858	4,981	22,156	621	***106,690***
John Smith Creek	5,188	2,034	808	1,142	67	***9,239***
Dutch Henry Creek	92,290	6,100	7,388	39,291	678	***145,747***
Mill Creek	3,080	573	1,600	50	0	***5,303***
Upper Navarro River	14,389	12,921	11,752	7,352	2,514	***48,928***
Middle Navarro River	10,921	3,237	6,955	9,702	140	***30,955***
Lower Navarro River	30,726	2,347	8,338	14,535	2,582	***58,528***
Floodgate Creek	295	115	530	580	0	***1,520***
North Fork Navarro River	5,827	6,891	12,616	2,300	3,735	***31,369***
Flynn Creek	16,232	205	250	555	20	***17,262***
Ray Gulch	6,296	2,776	41,394	4,964	366	***55,796***
Totals	***435,651***	***370,279***	***131,914***	***151,820***	***14,059***	***1,103,723***

The majority of controllable erosion sites are at culverts and watercourse crossings. However, a large amount of controllable erosion is associated with road slides. The Middle South Branch Navarro and Dutch Henry Planning watersheds show the highest amounts of controllable erosion primarily due to several large controllable sites associated with the Masonite road in these planning watersheds. The importance or immediacy of treatment for this controllable erosion was evaluated. The high treatment immediacy sites should be addressed first (Table B-4).

Table B-4. Controllable Erosion by Treatment Immediacy for the Navarro WAU.

	Controllable Erosion Treatment Immediacy (yd^3)				
Location	**High**	**Moderate**	**Low**	**None**	**Undetermined**
Navarro East	221958	80573	194689	21715	10
Navarro West	96836	378072	102429	1164	53
Navarro WAU Total	***318794***	***458645***	***297118***	***22879***	***63***
Percent of total	29%	42%	27%	2%	<1%

Fish passage barriers from culverts in the Navarro WAU

There are 3 known culverts that are fish passage barriers Bridge Creek, Camp Creek and an unnamed tributary below John Smith Creek. However, other barriers likely exist and need to be investigated over time.

Masonite Road

The main haul road through the Navarro East tract is the Masonite Road (M road). This road, built about 1950, has a cut and fill construction. Many of the watercourse crossings along the Masonite Road have very large fill volumes with culverts that are reaching their life expectancy. The high fill volumes and high cut banks of the Masonite road have triggered numerous landslides and are a source of sediment for the North and South Branch of the North Fork Navarro River. Of the estimated past sediment delivery from surface and point source erosion of roads, the Masonite road is estimated to have represented 30% of the sediment delivery of the Navarro WAU. A considerable amount of the controllable erosion, or future point source erosion, estimated for the Navarro WAU is associated with the Masonite road, approximately 25%. Table B-5 outlines the controllable erosion amounts associated with the Masonite road.

Table B-5. Controllable Erosion Amounts for the Masonite Road within the Navarro WAU.

Planning Watershed	**Culverts (yd^3)**	**Landings (yd^3)**	**Road Slides (yd^3)**	***Total (yd^3)***
Middle South Branch Navarro	125,229	0	3,185	***128,414***
Little North Fork Navarro	52,666	50	3,340	***56,006***
John Smith Creek	3,050	0	0	***3,050***
Dutch Henry Creek	84,114	0	6,435	***90,549***
North Fork Navarro River	3,613	0	0	***3,613***
Totals	***268,672***	***50***	***12,960***	***281,682***

Approximately 55% of these controllable erosion amounts for the Masonite road are of high treatment immediacy. Sediment control along the Masonite road needs to be a high priority. Although, it will be costly work to do sediment control repairs along the Masonite road the good news is that by addressing the controllable erosion on the Masonite road about 2/3 of the high treatment immediacy controllable volume can be addressed for the Navarro WAU.

Masonite Road under construction, circa 1950.

SURFACE AND POINT SOURCE EROSION FROM SKID TRAILS

Methods

Sediment delivery from surface and point source erosion from skid trails was determined from aerial photograph interpretation and sediment delivery estimates developed in previous MRC watershed analyses (MRC, 1998 and MRC, 2000). Aerial photographs were analyzed from 1952, 1963, 1972, 1981, 1988 and 2000 with scales of 1:20,000, 1:20,000, 1:20,000, 1:20,000, 1:12,000 and 1:13,000, respectively. The aerial photographs were used to identify skid trail activity. The 1952 and 1963 aerial photographs were checked out at the Mendocino County Museum in Willits. The 1972 and '81 aerial photographs were checked out at the Mendocino County Assessor's Office in Ukiah. The 1988 and 2000 aerial photographs were used from Mendocino Redwood Company's collection.

The aerial photograph interpretation for skid trail activity consisted of determining the area harvested by ground based yarding by skid trail density (high, moderate, low) for each photo year. High-density skid trail activity is defined as having greater than 100 watercourse crossings per square mile. Moderate-density skid trail activity is defined as having between 50-100 watercourse crossings per square mile. Light skid trail density has less than 50 watercourse crossings per square mile or trails with significant re-vegetation observed in the aerial photograph.

The amount of sediment delivery from the various densities of skid trail activity was estimated from sediment delivery rates estimated during previous watershed analyses by MRC (MRC, 1998 and MRC, 2000). A combination of surface erosion modeling and field observations of point source erosion from skid trails was used to develop the skid trail estimates. High skid trail density is estimated to contribute 300 tons/square mile/year of sediment. Moderate skid trail density is estimated to contribute 200 tons/square mile/year of sediment, while low skid trail density contributes 50 tons/square mile/year.

For each photo year the area in each skid trail density category was multiplied by the sediment delivery rate for that density. The estimated rate was then assumed to represent the decade previous to the photo year observed (i.e. 1952 photo represent activity in the 1940s). In the situation where aerial photographs were missing from a collection, we extrapolated the calculated delivery rates within the same planning watershed to that area. For the Navarro watershed, this occurred with the 1963 aerial photographs. The 1963 aerial photograph collection was missing approximately 408 acres from a 54,568-acre total area.

Results and Discussion - Skid Trail Erosion

The results by time period for the skid trail sediment delivery estimates are summarized in Table B-3, Figure B-1 and Figure B-2. The estimates should be considered a minimum sediment delivery for skid trails constructed and used in the decade. Undoubtedly, some if not many, sediment delivering skid trails were vegetated enough to be overlooked during the inventory. In particular are those trails constructed or used greater than five years prior to aerial photograph reconnaissance.

Table B-3. Skid Trail Use and Sediment Delivery Estimates for Navarro WAU by Decade.

Planning Watershed	1940s Skid Trail Use Area (acres)	1940s Sediment Delivery (tons/mi^2/yr)	1950s Skid Trail Use Area (acres)	1950s Sediment Delivery (tons/mi^2/yr)	1960s Skid Trail Use Area (acres)	1960s Sediment Delivery (tons/mi^2/yr)	1970s Skid Trail Use Area (acres)	1970s Sediment Delivery (tons/mi^2/yr)	1980s Skid Trail Use Area (acres)	1980s Sediment Delivery (tons/mi^2/yr)	1990s Skid Trail Use Area (acres)	1990s Sediment Delivery (tons/mi^2/yr)
Lower Navarro R.	361	12	190	6	220	4	193	9	816	30	386	4
Middle Navarro R.	221	2	2122	76	1038	40	2052	79	1036	42	606	7
N.Fork Navarro	151	8	1069	56	2108	99	1914	62	1099	47	424	5
Ray Gulch	79	5	132	2	542	36	371	12	515	35	402	22
Upper Navarro R.	602	47	1920	138	919	84	866	41	934	33	850	15
Hendy Woods	911	248	0	0	302	69	232	12	113	6	0	0
Rancheria	227	87	611	227	469	117	502	125	231	35	155	26
Mill Creek	0	0	0	0	105	12	0	0	318	148	0	0
Floodgate Creek	0	0	264	19	0	0	118	8	0	0	0	0
Flynn Creek	44	5	0	0	409	28	0	0	409	28	96	2
John Smith Crk.	744	93	765	29	601	58	1050	59	545	45	505	12
Dutch Henry Crk.	1635	104	2799	111	0	0	2170	39	1551	36	991	11
Little N.Fk.Nav. R.	1023	42	3815	114	1141	13	3953	120	2729	73	2084	21
Lower S.B. Nav.R.	0	0	2075	137	2159	150	1255	28	471	11	741	9
Mid S.B. Nav.R.	777	32	1680	52	3748	99	4409	93	4652	124	2938	38
Upper S.B. Nav.R.	93	6	2700	169	1880	79	3100	106	3360	72	1593	17
N.Fk.Indian Crk.	945	152	1086	188	309	9	27	1	0	0	0	0

Figure B-1. Estimated Skid Trail Sediment Delivery Rate by Calwater Planning Watershed and Decade for Navarro West, Navarro WAU.

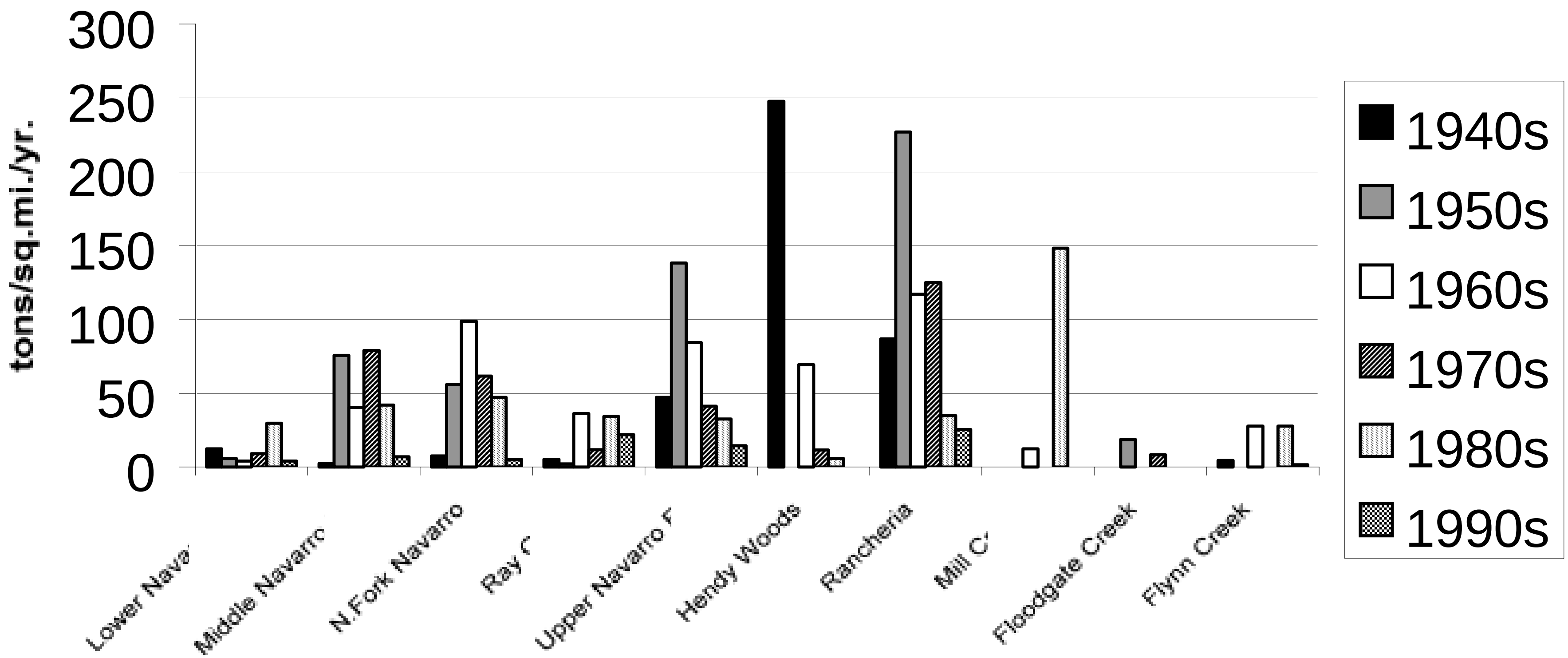
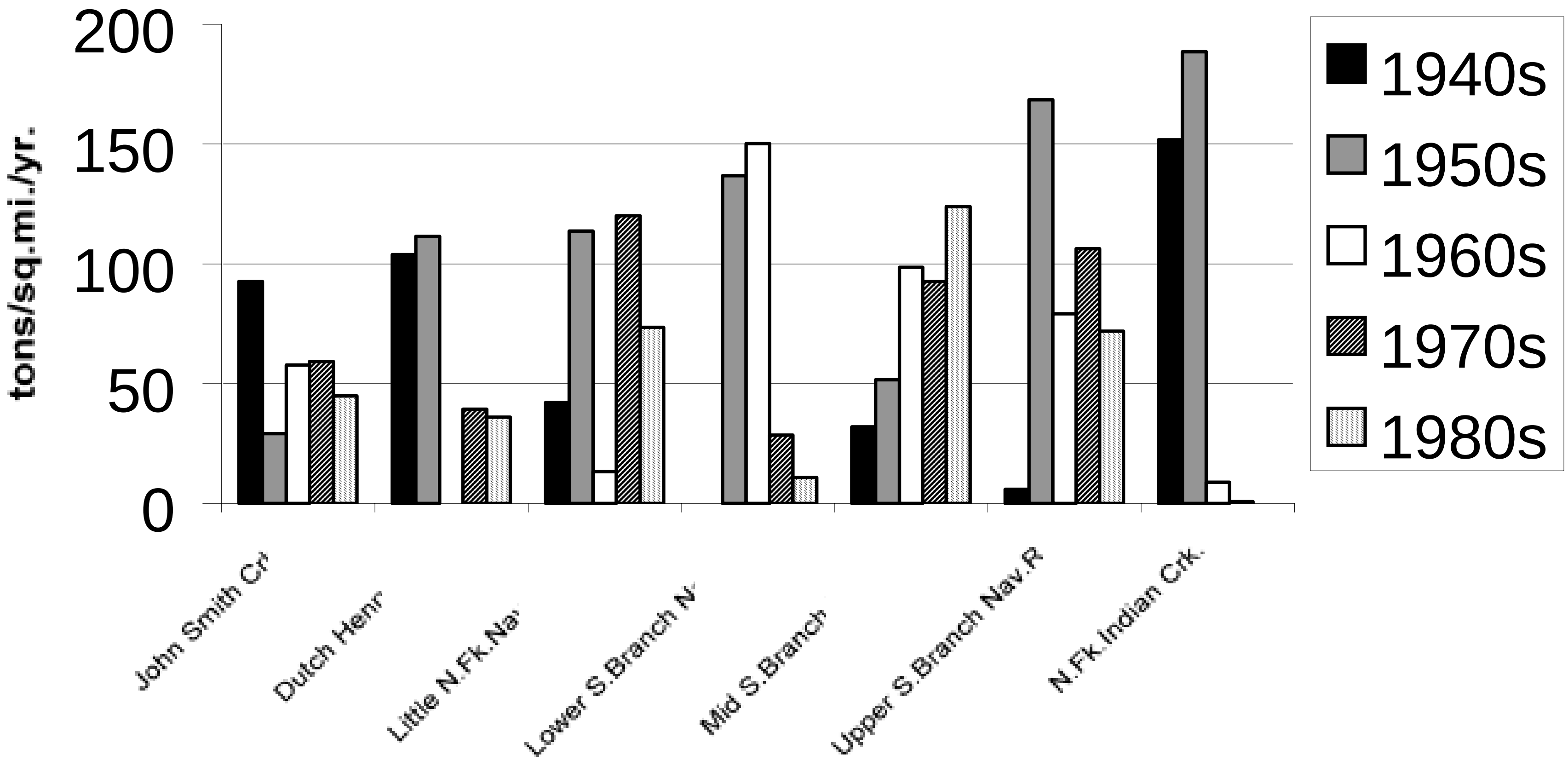


Figure B-2. Estimated Skid Trail Sediment Delivery Rate by Calwater Planning Watershed and Decade for Navarro East, Navarro WAU.



In the Navarro WAU the entire forested portion of what is now the MRC ownership was harvested using tractor based yarding during the 1940s, 1950s and 1960s. This high level of skid trail construction and use is estimated to contribute a high level of sediment delivery. In general, sediment delivery rates were higher in Navarro East during the 1940s and 1950s than Navarro West. (See Figures B-1, B-2). In Navarro West, six of the ten planning watersheds had their skid trail use area and sediment delivery peaks during the 1950s or 1960s (See Table B-1). Navarro East has a more consistent sediment delivery rate for the duration of the time period than Navarro West (See Figure B-1). Hendy Woods, Rancheria, Mill Creek and Floodgate Creek planning watersheds all had Mendocino Redwood Company-owned acreage at less than 1,000 acres.

In the late 1970s and 1980s a change in skid trail design likewise changed sediment delivery rates. A "Herringbone" type layout abandoned the low-slope trail designs of earlier times and placed the trails along ridges and branched out down the slopes. This produced a significant drop in skid trail watercourse crossings. The Herringbone pattern affected the designation of low, moderate and high skid trail usage.

In the 1990s skid trail sediment delivery rates diminished in all watersheds. This is a result of a combination of less harvest activity and stricter regulations on tractor based yarding use. Future skid trail sediment delivery rates will be lower than past rates because California Forest Practice Rules and MRC policy mandate better managed tractor yarding activities. Better erosion control measures are used on skid trails such as increased water bar spacing and a practice by MRC of packing the trails with logging debris (slash), when available, after operations to prevent surface erosion. Furthermore, skid trail operation is limited next to watercourses and prohibited directly in watercourses.

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APPENDIX B
Surface and Point Source Erosion Module

Navarro East Culverts

Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-M	192	19.22	watercourse	high	41050	yes, ditch
81-M	200	20.00	watercourse	high	33250	yes, ditch
81-M	318	31.72	watercourse	high	12310	yes, ditch
81-M	229	22.95	watercourse	high	10230	no div. potential
81-M	246	24.57	watercourse	high	9000	yes, road
81-M	235	23.48	watercourse	high	7300	no div. potential
81-M	287	28.69	watercourse	high	6000	no div. potential
81-M	304	30.36	watercourse	high	4000	no div. potential
81-M	201	20.06	ditch relief	high	3500	yes, ditch
81-M	287	28.69	watercourse	high	3210	no div. potential
81-AR-043-29	1	0.01	watercourse	high	2600	no div. potential
81-M	216	21.61	watercourse	high	2500	yes, ditch
81-M	263	26.26	watercourse	high	2200	yes, ditch
81-M	310	31.05	ditch relief	high	2000	yes, ditch
81-M	226	22.56	watercourse	high	2000	yes, ditch
81-M	265	26.43	ditch relief	high	1800	yes, ditch
81-M	298	29.01	watercourse	high	1600	yes, ditch
81-M	269	26.73	ditch relief	high	1500	yes, ditch
81-M	317	31.60	watercourse	high	1500	no div. potential
81-M	190	18.94	ditch relief	high	1400	yes, ditch
81-M	275	27.42	ditch relief	high	1200	yes, ditch
81-M	264	26.35	ditch relief	high	1000	yes, ditch
81-M	300	29.97	watercourse	high	930	yes, ditch
81-AR-043-05	18	1.78	watercourse	high	800	yes, road
81-M	337	33.70	ditch relief	high	760	yes, ditch
81-M	323	32.19	watercourse	high	745	yes, ditch
81-M	330	32.80	ditch relief	high	740	yes, ditch
81-M	234	23.41	watercourse	high	740	yes, ditch
81-M	250	25.03	watercourse	high	740	yes, ditch
81-M	252	25.16	watercourse	high	740	no div. potential
81-M	282	28.09	watercourse	high	600	yes, ditch
81-M	328	32.60	ditch relief	high	565	yes, ditch
81-M	238	23.80	watercourse	high	550	yes, ditch
81-M	259	25.92	watercourse	high	500	yes, ditch
81-M	271	26.92	ditch relief	high	500	yes, ditch
81-M	253	25.31	watercourse	high	500	yes, ditch
81-RW-017	17	1.73	watercourse	high	474	no div. potential
81-M-250	5	0.51	watercourse	high	473	no div. potential
81-M	320	31.98	ditch relief	high	400	yes, ditch
81-M	204	20.35	watercourse	high	370	yes, ditch
81-M	206	20.57	watercourse	high	370	already diverted
81-M	248	24.82	watercourse	high	370	yes, road
81-M	273	27.15	ditch relief	high	350	yes, ditch
81-AR-043-29	2	0.13	watercourse	high	325	no div. potential
81-M	222	22.21	watercourse	high	310	yes, ditch
81-M	332	33.09	ditch relief	high	305	yes, ditch
81-M	322	32.19	ditch relief	high	270	no div. potential
81-M	293	29.31	watercourse	high	250	yes, ditch
81-M	193	19.30	ditch relief	high	250	yes, road
81-M	236	23.61	ditch relief	high	250	yes, road
81-CC-025	16	1.47	watercourse	high	237	no div. potential
81-M	203	20.25	ditch relief	high	230	yes, ditch
81-M	267	26.60	ditch relief	high	200	yes, ditch
81-M	289	28.93	ditch relief	high	200	yes, ditch
81-M	255	25.45	watercourse	high	200	yes, ditch
81-M	331	32.95	ditch relief	high	185	yes, ditch
81-M	244	24.36	ditch relief	high	170	yes, road
81-CC-025	2	0.24	watercourse	high	148	no div. potential
81-M	239	23.90	ditch relief	high	130	yes, ditch
81-M	225	22.47	ditch relief	high	120	yes, ditch
81-M	280	27.94	watercourse	high	110	yes, ditch
81-M	271	26.92	watercourse	high	100	yes, ditch
81-M	294	29.40	watercourse	high	100	yes, ditch
81-M	313	31.27	ditch relief	high	95	yes, ditch
81-RW-021	25	2.45	watercourse	high	92	no div. potential
81-M	231	23.10	watercourse	high	90	yes, ditch
81-M	241	24.06	ditch relief	high	90	yes, road
81-DH	8	0.81	watercourse	high	75	yes, ditch
81-M	299	29.84	ditch relief	high	75	yes, ditch
81-MD	29	2.65	ditch relief	high	74	no div. potential
81-M	263	26.27	watercourse	high	60	yes, ditch
81-M-260	5	0.50	watercourse	high	59	no div. potential
81-LG-016	7	0.74	watercourse	high	55	no div. potential
81-M	233	23.25	ditch relief	high	55	yes, ditch
81-M	316	31.50	ditch relief	high	50	yes, ditch
81-M	194	19.34	watercourse	high	50	yes, ditch
81-CC-019	5	0.47	watercourse	high	47	no div. potential
81-CC-025	15	1.46	ditch relief	high	46	no div. potential
81-AR-043	19	1.79	watercourse	high	45	no div. potential
81-M	326	32.46	ditch relief	high	40	yes, ditch
81-M	264	26.35	ditch relief	high	30	yes, ditch
81-M	265	26.43	ditch relief	high	30	yes, ditch
81-M	266	26.51	ditch relief	high	30	yes, ditch
81-M	267	26.60	ditch relief	high	30	yes, ditch
81-M	268	26.64	watercourse	high	30	yes, ditch

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
81-AR	34288	26.6	1.1	27.6	Moderate
81-AR-002	1441	16.0	33.8	49.8	High
81-AR-003	5380	22.0	37.8	59.8	Moderate
81-AR-012	2608	8.5	0.0	8.5	Moderate
81-AR-014	348	0.0	0.0	0.0	Low
81-AR-017	4715	21.3	81.0	102.3	Moderate
81-AR-018	2017	2.1	3.8	5.9	Moderate
81-AR-019	9187	21.3	5.1	26.4	Moderate
81-AR-019-05	660	0.0	0.0	0.0	Low
81-AR-019-16	570	1.0	1.4	2.4	Moderate
81-AR-039	1674	1.4	3.2	4.6	Moderate
81-AR-041	248	0.0	0.0	0.0	Low
81-AR-042	18290	30.8	88.3	119.1	Moderate
81-AR-042-05	3759	4.8	297.0	301.8	Moderate
81-AR-043	13981	37.2	11.1	48.2	Moderate
81-AR-043-03	2086	0.0	0.0	0.0	Low
81-AR-043-03-01	465	0.0	0.0	0.0	Low
81-AR-043-05	2012	0.0	0.0	0.0	Low
81-AR-043-13	269	0.0	0.0	0.0	Low
81-AR-054	3142	0.0	0.0	0.0	Low
81-AR-064	882	0.3	0.0	0.3	Moderate
81-AR-065	2360	4.1	0.0	4.1	Moderate
81-B	12102	184.7	51.8	236.5	High
81-B-002	8052	0.0	0.0	0.0	Low
81-B-005	23216	52.6	5.7	58.3	Low/Moderate
81-B-005-01	1558	1.2	0.0	1.2	Moderate
81-B-005-02	2476	2.5	6.2	8.8	Moderate
81-B-005-02-01	639	0.0	0.0	0.0	Low
81-B-005-14	840	0.0	0.0	0.0	Low
81-B-005-15	1742	0.0	0.0	0.0	Low
81-B-005-17	576	0.0	0.0	0.0	Low
81-B-005-18	3311	0.0	0.0	0.0	Low
81-B-005-20	3179	0.0	0.0	0.0	Low
81-B-005-21	586	0.0	0.0	0.0	Low
81-B-005-22	3348	0.0	0.0	0.0	Low
81-B-005-23	259	0.0	0.0	0.0	Low
81-B-005-25	438	0.0	0.0	0.0	Low
81-B-005-29	2482	0.0	0.0	0.0	Low
81-B-005-29-01	259	0.0	0.0	0.0	Low
81-B-005-29-02	195	0.0	0.0	0.0	Low
81-B-005-29-03	116	0.0	0.0	0.0	Low
81-B-005-29-04	84	0.0	0.0	0.0	Low
81-B-005-29-05	433	0.0	0.0	0.0	Low
81-B-005-29-06	106	0.0	0.0	0.0	Low
81-B-005-35	2028	1.0	0.0	1.0	Moderate
81-B-016	3448	33.9	43.5	77.3	High
81-B-016-04	201	2.7	0.0	2.7	Moderate
81-B-017	1742	7.1	0.0	7.1	Moderate
81-BC	18126	61.3	10.5	71.8	Low/Moderate
81-BC-001	14224	59.9	4.3	64.2	Moderate
81-BC-001-07	1705	2.4	0.0	2.4	Moderate
81-BC-001-11	2825	0.0	0.0	0.0	Low
81-BC-001-11-01	259	0.0	0.0	0.0	Low
81-BC-001-11-02	560	0.0	0.0	0.0	Low
81-BC-001-13	2043	6.6	0.0	6.6	Moderate
81-BC-001-18	354	0.0	0.0	0.0	Low
81-BC-002	570	12.4	0.0	12.4	Moderate
81-BC-004	3237	4.2	23.0	27.1	Moderate
81-BC-004-04	5539	1.1	0.0	1.1	Moderate
81-BC-004-04-01	1019	12.9	0.0	12.9	Moderate
81-BC-004-04-02	1230	0.0	0.0	0.0	Low
81-BC-004-04-03	903	0.0	0.0	0.0	Low
81-BC-011	7904	14.4	0.8	15.2	Moderate
81-BC-011-01	2313	0.4	0.0	0.4	Moderate
81-BC-012	1473	6.5	4.9	11.4	Moderate
81-BC-013	3316	11.8	6.8	18.6	Moderate
81-BC-018	1362	0.0	0.0	0.0	Low
81-BC-020	9425	2.7	0.0	2.7	Moderate
81-BC-020-05	6637	18.6	5.4	24.0	Moderate
81-BC-020-05-01	1077	15.8	18.4	34.1	Low
81-BC-023	9140	0.0	0.0	0.0	Low
81-BC-023-05	2941	21.1	2.7	23.8	Moderate
81-BC-023-11	2101	4.4	7.6	12.0	Moderate
81-BC-023-14	993	2.1	0.8	2.9	Moderate
81-BC-025	354	0.0	0.0	0.0	Low
81-BC-029	908	0.5	0.0	0.5	Moderate
81-BH	13649	15.1	3.5	18.6	Moderate
81-BH-007	3685	3.1	9.7	12.8	Moderate
81-BH-014	1024	0.0	0.0	0.0	Low
81-BH-015	4625	0.0	0.0	0.0	Low
81-BH-018	5613	8.4	1.4	9.8	Moderate
81-BH-018-02	1901	0.0	0.0	0.0	Low
81-BH-018-05	195	0.0	0.0	0.0	Low

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
81-BH-018-07	697	0.0	0.0	0.0	Low
81-BR	21099	0.0	0.0	0.0	Low
81-BR-008	4240	5.9	0.0	5.9	Moderate
81-BR-009	9008	7.7	18.4	26.0	Moderate
81-BR-009-04	972	0.0	0.0	0.0	Low
81-BR-016	407	0.0	0.0	0.0	Low
81-BR-018	9472	0.0	0.0	0.0	Low
81-BR-018-07	2677	0.0	0.0	0.0	Low
81-BR-018-11	3691	0.5	0.0	0.5	Moderate
81-BR-018-17	1389	0.0	0.0	0.0	Low
81-BR-024	2147	0.0	0.0	0.0	Low
81-BR-026	2698	0.0	0.0	0.0	Low
81-BR-028	4340	0.0	0.0	0.0	Low
81-BR-028-05	1452	1.1	75.3	76.4	High
81-BR-029	5512	1.2	0.3	1.5	Moderate
81-BR-029-05	507	0.0	0.0	0.0	Low
81-BR-032	692	0.0	0.0	0.0	Low
81-BR-036	3907	0.0	0.0	0.0	Low
81-BR-036-01	148	0.0	0.0	0.0	Low
81-BR-036-02	2381	0.0	0.0	0.0	Low
81-BR-036-04	454	0.0	0.0	0.0	Low
81-BR-038	201	0.0	0.0	0.0	Low
81-BR-040	180	0.0	0.0	0.0	Low
81-BV-001	2165	0.0	0.0	0.0	Low
81-BV-001-02	2368	0.7	0.0	0.7	Moderate
81-BV-003	591	0.0	0.0	0.0	Low
81-BV-005	3237	0.0	0.0	0.0	Low
81-BV-007	10813	11.8	0.0	11.8	Low/Moderate
81-BV-007-05	1927	0.0	0.0	0.0	Low
81-BV-007-07	523	0.0	0.0	0.0	Low
81-BV-007-09	908	0.0	0.0	0.0	Low
81-BV-007-11	2165	0.0	0.0	0.0	Low
81-BV-007-15	3258	3.1	0.0	3.1	Moderate
81-BV-007-22	528	0.0	0.0	0.0	Low
81-BV-009	1341	0.0	0.0	0.0	Low
81-BV-009-02	2656	22.3	0.0	22.3	Moderate
81-CC	12450	62.2	26.7	89.0	Moderate/High
81-CC-001	253	0.0	0.0	0.0	Low
81-CC-004	401	0.0	0.0	0.0	Low
81-CC-005	908	0.0	0.0	0.0	Low
81-CC-005-01	597	0.0	0.0	0.0	Low
81-CC-008	2566	9.7	48.1	57.7	Moderate
81-CC-011	6727	6.2	5.4	11.6	Moderate
81-CC-011-01	977	2.9	21.3	24.2	Moderate
81-CC-011-03	544	8.8	0.0	8.8	High
81-CC-012	3184	0.6	0.0	0.6	Low
81-CC-016	1890	1.0	1.6	2.6	Moderate
81-CC-016-01	977	0.6	4.3	4.9	Moderate
81-CC-019	10676	15.6	37.0	52.6	Moderate
81-CC-019-03	1014	23.9	79.9	103.8	High
81-CC-019-05	2117	1.7	2.7	4.4	Moderate
81-CC-019-06	7049	10.0	0.0	10.0	Moderate
81-CC-019-06-01	364	0.0	0.0	0.0	Low
81-CC-024	11004	7.5	31.3	38.8	Moderate
81-CC-025	9493	35.3	169.3	204.6	High
81-CC-025-01	348	1.4	6.2	7.6	Moderate
81-CC-025-02	734	8.2	0.0	8.2	High
81-CC-025-04	317	0.3	0.0	0.3	Moderate
81-CU-001	496	0.0	0.0	0.0	Low
81-CU-001-02	306	0.0	0.0	0.0	Low
81-DC	23332	46.1	112.6	158.7	Moderate
81-DC-002	3015	0.0	0.0	0.0	Low
81-DC-009	1257	8.7	0.0	8.7	Moderate
81-DC-018	15037	0.0	0.0	0.0	Low
81-DC-019	164	0.0	0.0	0.0	Low
81-DC-021	1700	1.6	6.2	7.8	Moderate
81-DC-022	1003	0.0	0.0	0.0	Low
81-DC-044	6500	4.7	51.0	55.8	Moderate
81-DC-044-06	3696	0.0	0.0	0.0	Low
81-DC-045	2239	5.8	0.0	5.8	Moderate
81-DH	16980	149.2	12.2	161.3	High
81-FH	7624	0.0	0.0	0.0	Low
81-FH-003	6094	8.9	0.0	8.9	Low/Moderate
81-FH-003-07	1647	0.0	0.0	0.0	Low
81-FH-003-07-01	1019	0.0	0.0	0.0	Low
81-FH-003-12	3728	0.0	0.0	0.0	Low
81-FH-003-13	1162	0.0	0.0	0.0	Low
81-FH-003-15	338	2.3	0.0	2.3	Moderate
81-FH-005	7334	10.5	62.6	73.2	Moderate
81-FH-005-06	3078	7.8	47.8	55.6	Moderate
81-FH-012	5993	3.1	0.0	3.1	Moderate
81-FH-012-02	1373	0.0	0.0	0.0	Low
81-FH-013	11209	7.3	2.7	10.0	Moderate

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
81-FH-013-09	507	0.0	0.0	0.0	Low
81-FH-013-14	1911	0.0	0.0	0.0	Low
81-FH-014	10280	0.0	0.0	0.0	Low
81-FH-015	3738	0.0	0.0	0.0	Low
81-FH-015-02	253	0.0	0.0	0.0	Low
81-FH-015-04	259	0.0	0.0	0.0	Low
81-FH-015-06	502	0.0	0.0	0.0	Low
81-IC	15888	107.7	88.0	195.7	Low/High
81-IC-003	14362	38.9	0.3	39.1	Moderate
81-IC-003-04	871	0.0	0.0	0.0	Low
81-IC-014	4066	24.7	51.3	76.0	Moderate
81-IC-018	623	0.0	0.0	0.0	Low
81-IC-022	3717	17.2	11.3	28.6	Moderate
81-IC-022-02	401	0.4	0.5	1.0	Moderate
81-IC-022-03	444	0.0	0.0	0.0	Low
81-JS	17308	205.8	0.0	205.8	High
81-JS-001	2460	0.0	0.0	0.0	Low
81-JS-006	882	0.0	0.0	0.0	Moderate
81-JS-007	1547	5.3	0.0	5.3	Moderate
81-JS-008	908	2.6	4.1	6.6	Moderate
81-JS-012	5908	3.7	2.7	6.4	Moderate
81-JS-012-01	2846	1.1	5.1	6.2	Moderate
81-JS-012-01-01	972	0.0	0.0	0.0	Low
81-JS-012-03	861	4.2	4.1	8.2	Moderate
81-JS-013	533	2.8	0.0	2.8	Moderate
81-JS-015	3680	2.4	0.0	2.4	Moderate
81-JS-015-01	3036	0.0	0.0	0.0	Low
81-JS-015-02	2107	0.0	0.0	0.0	Moderate
81-JS-021	317	0.8	0.0	0.8	Moderate
81-JS-016	982	5.9	0.0	5.9	Moderate
81-JS-016-02	1531	3.3	12.7	15.9	Moderate
81-JS-023	10122	71.6	2.2	73.7	Moderate/High
81-JS-023-05	2777	31.8	0.0	31.8	High
81-JS-023-05-01	1304	10.9	0.0	10.9	High
81-JS-023-05-02	1357	4.8	0.0	4.8	Moderate
81-JS-023-08	3844	2.1	0.0	2.1	Moderate
81-JS-023-08-01	222	0.0	0.0	0.0	Low
81-JS-023-08-02	2001	0.0	0.0	0.0	Low
81-JS-023-08-03	185	0.0	0.0	0.0	Low
81-JS-023-13	760	0.0	0.0	0.0	Low
81-JS-023-15	1130	0.0	0.0	0.0	Low
81-JS-026	9171	52.3	27.8	80.1	Moderate/High
81-JS-026-01	3305	41.2	2.7	43.9	High
81-JS-026-02	2059	12.1	0.0	12.1	Moderate
81-JS-026-03	7286	9.3	27.3	36.6	Low/Moderate
81-JS-026-03-01	1383	0.0	0.0	0.0	Low
81-JS-026-15	385	0.0	0.0	0.0	Low
81-JS-028	5808	8.4	72.6	81.1	Moderate
81-JS-028-05	164	0.0	0.0	0.0	Low
81-JS-028-09	4599	0.0	0.0	0.0	Low
81-LG-004	2323	5.5	0.0	5.5	Moderate
81-LG-006	3891	4.0	0.0	4.0	Moderate
81-LG-006-04-01	121	0.0	0.0	0.0	Low
81-LG-006-02	639	0.0	0.0	0.0	Low
81-LG-006-04	612	0.0	0.0	0.0	Low
81-LG-006-05	945	0.0	0.0	0.0	Low
81-LG-008	5665	0.0	0.0	0.0	Low
81-LG-008-06	581	0.0	0.0	0.0	Low
81-LG-008-08	1980	2.7	0.0	2.7	Moderate
81-LG-012	2751	0.0	0.0	0.0	Low
81-LG-012-01	2107	0.0	0.0	0.0	Low
81-LG-012-03	1959	0.4	0.0	0.4	Moderate
81-LG-016	14800	9.4	1085.9	1095.3	High
81-LG-016-01	69	0.0	0.0	0.0	Low
81-LG-016-06	3934	7.9	6.8	14.7	Moderate
81-LG-016-18	475	0.0	0.0	0.0	Low
81-LG-016-24	396	0.0	0.0	0.0	Low
81-LG-030	3902	0.0	0.0	0.0	Low
81-LG-030-03-01	1505	0.0	0.0	0.0	Low
81-LG-030-02	132	0.0	0.0	0.0	Low
81-LG-030-03	3379	0.2	0.5	0.7	Moderate
81-LG-030-04	1368	0.0	0.0	0.0	Low
81-LG-030-05	9187	4.7	4.1	8.8	Moderate
81-LG-030-05-02	1278	0.6	0.0	0.6	Moderate
81-LG-030-07	4145	0.0	0.0	0.0	Low
81-LG-030-08	671	0.0	0.0	0.0	Low
81-LG-030-05-01	1542	0.0	0.0	0.0	Low
81-LG-030-05-03	480	0.0	0.0	0.0	Low
81-LG-036	834	0.0	0.0	0.0	Low
81-LG-036-02	127	0.0	0.0	0.0	Low
81-LG-038	2387	0.0	0.0	0.0	Low
81-LG-042	243	0.0	0.0	0.0	Low
81-LG-044	9546	97.5	32.4	129.9	Moderate/High

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
81-LG-044-09-01	1357	1.0	0.0	1.0	Moderate
81-LG-044-09-02	750	0.6	0.0	0.6	Moderate
81-LG-044-09	8654	7.2	1.4	8.5	Moderate
81-LG-044-12	227	2.0	0.0	2.0	Moderate
81-LG-044-14	940	0.6	0.0	0.6	Moderate
81-LG-044-19	354	0.3	0.0	0.3	Moderate
81-LG-046	79	0.0	0.0	0.0	Low
81-LG-048	127	0.0	0.0	0.0	Low
81-LG-050	829	0.0	0.0	0.0	Low
81-LG-054	180	0.0	0.0	0.0	Low
81-LG-056	502	0.0	0.0	0.0	Low
81-LG-070	9694	0.0	0.0	0.0	Low
81-LG-070-05	993	0.0	0.0	0.0	Low
81-LG-070-09	1088	0.0	0.0	0.0	Low
81-LG-080	10945	0.0	0.0	0.0	Low
81-LG-080-13	2629	0.7	0.0	0.7	Moderate
81-LG-080-15	628	0.0	0.0	0.0	Low
81-LR	10798	0.0	0.0	0.0	Low
81-LR-002	106	0.0	0.0	0.0	Low
81-LR-007	12403	21.3	58.3	79.6	Moderate
81-LR-007-17	1109	0.0	0.0	0.0	Low
81-LR-009	285	0.0	0.0	0.0	Low
81-LR-011	1014	0.0	0.0	0.0	Low
81-LR-013	2001	0.7	3.2	3.9	Low
81-LR-014	549	0.0	0.0	0.0	Low
81-LR-015	5417	1.5	7.0	8.5	Moderate
81-LR-015-08	1199	1.7	1.9	3.6	Moderate
81-LR-021	4081	0.0	0.0	0.0	Low
81-LR-021-04	1183	0.0	0.0	0.0	Low
81-LR-022	1109	12.6	0.5	13.1	Low
81-M	86143	867.6	12996.5	13864.1	High
81-M-192	1214	0.0	0.0	0.0	Low
81-M-193	2925	17.4	6.5	23.9	Moderate
81-M-194	8068	4.8	2.2	6.9	Moderate
81-M-194-05	428	0.0	0.0	0.0	Low
81-M-194-08	597	0.0	0.0	0.0	Low
81-M-202	12107	3.7	2.2	5.8	Moderate
81-M-202-08	338	0.0	0.0	0.0	Low
81-M-202-16	449	0.0	0.0	0.0	Low
81-M-210	1526	21.2	0.0	21.2	High
81-M-211	554	0.8	0.0	0.8	Moderate
81-M-219	338	1.3	0.0	1.3	Moderate
81-M-220	945	1.6	0.0	1.6	Moderate
81-M-222	180	2.6	0.0	2.6	Low
81-M-224	3390	25.3	0.0	25.3	Moderate
81-M-232	1732	15.6	0.0	15.6	Moderate
81-M-233	2339	22.3	3.5	25.8	Moderate
81-M-233-05	301	2.3	0.0	2.3	Moderate
81-M-236	454	0.1	0.0	0.1	Moderate
81-M-240	3268	5.3	0.0	5.3	Moderate
81-M-243	2988	49.6	97.2	146.8	High
81-M-243-01	1848	10.6	0.0	10.6	Moderate
81-M-246-09	8115	38.5	0.0	38.5	Moderate
81-M-246	2962	0.0	0.0	0.0	Low
81-M-247	1283	11.5	16.2	27.7	High
81-M-248	169	2.4	0.0	2.4	Moderate
81-M-250	2735	43.0	84.8	127.8	High
81-M-251	496	1.1	0.0	1.1	Moderate
81-M-252	5644	14.1	0.0	14.1	Moderate
81-M-252-02	940	0.7	0.5	1.2	Moderate
81-M-253	776	9.4	0.0	9.4	Moderate
81-M-260	5523	15.3	1.6	17.0	Moderate
81-M-260-06	924	9.6	0.0	9.6	High
81-M-262	354	0.0	0.0	0.0	Low
81-M-278	4198	50.4	14.3	64.7	High
81-M-278-06	1167	3.1	35.9	39.0	Moderate
81-M-279	327	1.3	0.0	1.3	Moderate
81-M-280	211	0.1	0.0	0.1	Low
81-M-284	6479	9.6	5.7	15.3	Moderate
81-M-284-03	127	0.0	0.0	0.0	Low
81-M-289	4182	23.2	0.0	23.2	Moderate
81-M-294	11801	45.3	26.7	72.1	Low/Moderate/High
81-M-294-07-01	206	0.0	0.0	0.0	Low
81-M-294-15-01	1045	0.0	0.0	0.0	Low
81-M-294-05	2460	0.0	0.0	0.0	Low
81-M-294-07	1800	1.0	1.9	2.9	Moderate
81-M-294-08	6484	3.9	11.3	15.3	Moderate
81-M-294-15	1684	0.0	0.0	0.0	Low
81-M-296	940	1.7	0.0	1.7	Moderate
81-M-296-02	79	0.0	0.0	0.0	Low
81-M-304	6352	133.3	21.1	154.4	High
81-M-304-02	1938	2.0	0.0	2.0	Moderate
81-M-304-07	111	0.1	0.0	0.1	Moderate

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
81-M-310	7582	6.5	1.1	7.6	Low/Moderate
81-M-310-11	354	0.0	0.0	0.0	Low
81-M-317	491	0.5	0.0	0.5	Moderate
81-M-327	1024	11.0	0.0	11.0	Moderate
81-M-338	238	0.0	0.0	0.0	Low
81-M-342	2012	0.0	0.0	0.0	Low
81-M-348	4472	1.0	0.0	1.0	Moderate
81-MD	15111	45.1	800.8	846.0	High
81-MD-005	12836	19.5	80.5	100.0	Moderate
81-MD-007	4372	2.5	1.6	4.1	Moderate
81-MD-007-06	4794	0.6	9.5	10.1	Moderate
81-MD-016	248	0.0	0.0	0.0	Low
81-MD-029	12651	0.0	0.0	0.0	Low
81-MD-029-22	2888	0.0	0.0	0.0	Low
81-PM	7915	43.6	0.0	43.6	Moderate/High
81-PM-004	1378	0.4	0.0	0.4	Moderate
81-PM-006	8738	8.6	2.4	11.0	Low/Moderate
81-PM-009	7915	0.8	0.5	1.3	Low
81-PM-013	1008	0.4	0.0	0.4	Moderate
81-PM-014	370	6.7	0.0	6.7	High
81-RC	32092	308.1	46.2	354.2	Moderate/High
81-RC-003	5243	21.2	12.4	33.6	Moderate
81-RC-007	1837	1.3	5.4	6.7	Moderate
81-RC-008	4198	21.3	0.0	21.3	Moderate
81-RC-008-03	2175	6.4	1.9	8.3	Moderate
81-RC-008-06	818	9.2	0.0	9.2	Moderate
81-RC-013	7846	39.3	6.8	46.0	High
81-RC-013-01	1922	9.0	0.0	9.0	Moderate
81-RC-013-03	1859	27.8	0.0	27.8	High
81-RC-013-05	1721	24.3	0.0	24.3	High
81-RC-013-08	2207	2.4	3.8	6.1	Moderate
81-RC-013-08-01	253	0.4	23.8	24.1	Moderate
81-RC-013-10	1188	9.0	4.6	13.6	High
81-RC-015	11188	0.8	0.0	0.8	Moderate
81-RC-015-19	845	0.0	0.0	0.0	Low
81-RC-019	3390	0.7	0.0	0.7	Moderate
81-RC-029	11442	28.0	3.2	31.2	Moderate
81-RC-029-05	407	0.9	0.8	1.7	Moderate
81-RC-029-07	1225	0.0	0.0	0.0	Low
81-RC-029-09	4784	4.2	0.3	4.4	Moderate
81-RC-029-09-01	1003	0.0	0.0	0.0	Low
81-RC-029-09-02	4467	4.6	0.5	5.1	Moderate
81-RC-029-16	3078	13.2	8.6	21.8	Moderate
81-RC-038	1663	23.5	0.0	23.5	High
81-RC-041	3094	41.2	0.0	41.2	High
81-RC-042	275	0.5	0.0	0.5	Moderate
81-RC-043	5628	41.1	18.1	59.2	High
81-RC-043-04	95	0.2	0.0	0.2	Moderate
81-RC-043-06	14863	65.5	125.3	190.8	Moderate
81-RC-043-06-01	9013	28.7	0.3	29.0	Moderate
81-RC-043-06-02	744	4.2	0.0	4.2	Moderate
81-RC-043-06-03	2788	55.3	51.3	106.6	High
81-RC-043-06-04	744	0.0	0.0	0.0	Low
81-RC-043-06-05	612	0.0	0.0	0.0	Low
81-RC-043-06-06	2957	13.9	7.6	21.5	Moderate
81-RC-043-06-07	1859	0.0	0.0	0.0	Low
81-RC-043-06-08	1521	0.0	0.0	0.0	Low
81-RC-043-06-09	364	0.0	0.0	0.0	Low
81-RC-043-06-10	644	0.0	0.0	0.0	Low
81-RC-044	11949	92.8	21.3	114.1	Low/Moderate/High
81-RC-044-09	7693	43.5	11.9	55.4	Moderate
81-RC-044-16	2592	0.0	0.0	0.0	Low
81-RC-044-18	1700	0.0	0.0	0.0	Low
81-RC-057	1352	0.3	0.0	0.3	Moderate
81-RC-058	4784	12.9	189.8	202.7	High
81-RC-058-08	407	0.0	0.0	0.0	Low
81-RW	17767	8.1	0.8	8.9	Low/Moderate
81-RW-002	4398	62.2	4.9	67.1	High
81-RW-004	10116	27.6	44.0	71.7	Moderate
81-RW-004-12	4134	6.9	40.0	46.9	Moderate
81-RW-007	259	0.0	0.0	0.0	Low
81-RW-017	13348	9.5	276.2	285.7	Moderate
81-RW-021	16447	22.3	45.9	68.2	Moderate
81-RW-021-14	887	0.0	0.0	0.0	Low
81-RW-022	1378	0.0	0.0	0.0	Low
81-RW-032	3897	1.3	0.0	1.3	Moderate
81-RW-033	565	0.0	0.0	0.0	Low
81-SB	20650	63.6	54.8	118.4	Moderate
81-SB-002	813	6.1	0.0	6.1	Moderate
81-SB-004	607	3.1	0.0	3.1	Moderate
81-SB-022	4282	11.5	9.2	20.7	Moderate
81-SB-032	1975	0.0	0.0	0.0	Low
81-SB-039	7276	5.9	2.7	8.6	Low/Moderate

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
81-SB-039-04	3802	2.4	3.2	5.6	Moderate
81-SB-039-07	1742	0.0	0.0	0.0	Low
81-SB-039-09	1563	3.7	0.0	3.7	Moderate
81-SB-041	3025	0.0	0.0	0.0	Low
81-SC	25376	295.0	29.4	324.4	Moderate/High
81-SC-009	5454	19.5	24.3	43.8	Moderate
81-SC-009-04-01	137	0.0	0.0	0.0	Low
81-SC-009-02	4377	4.7	5.4	10.1	Moderate
81-SC-009-04	2038	2.7	0.0	2.7	Moderate
81-SC-018	11099	46.8	21.6	68.4	Moderate/High
81-SC-018-01	5708	5.3	0.0	5.3	Moderate
81-SC-018-04-01	116	1.0	0.0	1.0	Moderate
81-SC-018-04-02	2075	13.2	51.8	65.0	High
81-SC-018-04	8511	150.5	104.2	254.8	High
81-SC-018-05	1257	22.9	0.0	22.9	High
81-SC-018-04-03	1674	3.8	0.5	4.3	Moderate
81-SC-021	1209	2.2	0.0	2.2	Moderate
81-SC-022-14	7413	111.0	2.4	113.4	High
81-SC-022-06-01	935	2.7	0.0	2.7	Moderate
81-SC-022-17	898	3.4	0.0	3.4	Moderate
81-SC-022-06	2983	14.7	0.0	14.7	High
81-SC-026	908	12.3	0.0	12.3	High
81-SC-026-02-01	227	0.9	0.0	0.9	Moderate
81-SC-026-02	10623	39.5	7.6	47.1	Moderate
81-SC-026-02-02	216	0.0	0.0	0.0	Low
81-SC-027	3015	7.3	0.0	7.3	Moderate
81-SC-027-03	533	2.7	0.0	2.7	Moderate
81-SC-037	4520	5.1	0.0	5.1	Moderate
81-SC-038	370	0.0	0.0	0.0	Low
81-SC-039	2181	3.7	0.0	3.7	Moderate
81-SC-042	5840	14.4	3.0	17.3	Moderate
81-SC-043	528	0.0	0.0	0.0	Low
81-SC-044	3263	12.6	3.2	15.8	Moderate
81-WE	23712	113.0	0.0	113.0	Moderate
81-WE-009	216	0.0	0.0	0.0	Low
81-WE-018	143	0.0	0.0	0.0	Low
81-WE-028	5021	4.2	0.8	5.0	Low
81-WE-028-05	232	0.0	0.0	0.0	Low
81-WE-028-08	560	0.0	0.0	0.0	Low
81-WE-035	2740	22.3	0.0	22.3	Moderate
81-WE-035-05	4377	49.0	8.1	57.1	High
81-WE-035-05-01	628	0.0	0.0	0.0	Low
81-WE-045	866	0.0	0.0	0.0	Low
81-WE-046	2545	0.0	0.0	0.0	Low
81-WG	17239	86.2	0.0	86.2	Moderate
81-WG-006	7751	0.0	0.0	0.0	Low/Moderate
81-WG-006-01	333	0.0	0.0	0.0	Moderate
81-WG-008	23332	74.3	78.3	152.6	Moderate
81-WG-008-05	17957	199.5	18.9	218.4	High
81-WG-008-05-0	253	0.6	0.0	0.6	Moderate
81-WG-008-05-0	1563	2.7	0.0	2.7	Moderate
81-WG-008-05-0	370	1.2	0.0	1.2	Moderate
81-WG-008-23	1172	0.3	0.0	0.3	Moderate
81-WG-009	10196	47.9	0.0	47.9	Moderate
81-WG-009-04	259	0.0	0.0	0.0	Low
81-WG-009-07	5322	30.9	30.5	61.4	Moderate/High
81-WG-009-07-0	333	0.3	0.0	0.3	Moderate
81-WG-009-11	180	0.0	0.0	0.0	Low
81-WG-009-12	1468	0.0	0.0	0.0	Low
81-WG-009-13	1003	1.6	0.0	1.6	Moderate
81-WG-009-16	169	0.0	0.0	0.0	Low
81-WG-009-18	1795	0.0	0.0	0.0	Low
81-WG-009-18-0	3379	0.0	0.0	0.0	Low
81-WG-011	354	0.1	0.0	0.1	Low
81-WG-012	1896	2.9	0.0	2.9	Moderate
81-WG-015	3590	1.7	2.7	4.4	Moderate
81-WG-015-04	153	0.0	0.0	0.0	Low
81-WG-018	649	0.0	0.0	0.0	Low
81-WG-021	1917	0.0	0.0	0.0	Low
81-WG-033	8279	10.2	0.8	11.0	Moderate
81-WG-033-04	6721	15.2	0.0	15.2	Moderate
81-WG-033-04-0	1800	0.0	0.0	0.0	Low
81-WG-033-04-0	153	0.0	0.0	0.0	Low
81-WR-002	3189	0.0	0.0	0.0	Low
81-WR-002-03	422	0.0	0.0	0.0	Low
82-BC	14268	60.8	108.4	120.6	Moderate
82-BC-006	2151	0.0	0.0	0.0	Low
82-BC-008	5013	13.5	1.7	4.4	Moderate
82-BC-008-03	1766	0.0	0.0	0.0	Moderate
82-BC-008-04	1439	0.0	0.0	0.0	Moderate
82-BC-008-05	975	0.0	0.0	0.0	Low
82-BC-016	235	0.0	0.0	0.0	Moderate
82-BC-017	2367	0.0	0.0	0.0	Moderate

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
82-BC-022	163	0.0	0.0	0.0	Moderate
82-BC-026	419	0.0	4.0	4.0	Moderate
82-BC-027	1290	0.0	6.2	6.2	Moderate
82-BC-028	2874	0.0	25.1	25.1	Moderate
82-BC-028-01	1408	33.8	5.0	11.8	Moderate
82-BC-028-02	440	27.0	4.5	9.9	Moderate
82-BC-028-03	79	0.0	1.0	1.0	Moderate
82-BC-028-01-01	511	0.0	0.0	0.0	Moderate
82-BC-028-05	193	0.0	0.0	0.0	Moderate
82-BC-030	383	0.0	3.1	3.1	Moderate
82-BG	8942	0.0	23.2	23.2	Moderate/Low
82-BG-005	623	0.0	0.0	0.0	Moderate
82-BG-011	6694	63.5	16.9	29.6	Moderate
82-BG-013	7158	17.6	45.6	49.1	Moderate
82-BG-013-02	191	0.0	0.0	0.0	Moderate
82-BG-014	2098	0.0	0.0	0.0	Low
82-BG-014-03	323	0.0	0.0	0.0	Low
82-BG-017	1171	0.0	0.0	0.0	Moderate
82-BP	17375	16.2	28.1	31.4	Moderate
82-BP-021	2489	0.0	10.5	10.5	Moderate
82-BP-021-01	1290	0.0	0.0	0.0	Moderate
82-BP-024	6125	163.4	7.6	40.3	Moderate
82-BP-024-08	534	0.0	0.0	0.0	Moderate
82-BP-024-09	87	0.0	0.0	0.0	Moderate
82-BP-027	11913	371.3	11.2	85.5	Moderate
82-BP-027-22	809	0.0	0.0	0.0	Low
82-BP-031	1685	0.0	0.0	0.0	Moderate
82-BP-033	4658	202.5	2.1	42.6	Moderate/Low
82-BP-034	6342	0.0	5.7	5.7	Moderate/Low
82-BP-034-01	5558	0.0	0.0	0.0	Low
82-BP-034-01-01	678	0.0	0.0	0.0	Low
82-BP-034-01-02	215	0.0	0.0	0.0	Low
82-BP-034-09	640	0.0	0.0	0.0	Low
82-BR	22075	1528.2	190.0	495.7	High/Moderate/Low
82-BR-001	1122	0.0	0.0	0.0	Moderate
82-BR-004	1344	101.3	8.0	28.2	Moderate
82-BR-008	8627	152.6	12.5	43.0	Moderate
82-BR-008-01	2105	0.0	0.0	0.0	Moderate
82-BR-008-07	1561	0.0	0.0	0.0	Moderate
82-BR-008-08	517	0.0	0.0	0.0	Moderate
82-BR-008-09	234	0.0	0.0	0.0	Moderate
82-BR-009	462	0.0	0.0	0.0	Moderate
82-BR-016	2505	122.9	5.0	29.6	Moderate
82-BR-019	2519	55.4	12.7	23.7	Moderate
82-BR-019-01	676	0.0	0.0	0.0	Low
82-BR-019-01-01	104	0.0	0.0	0.0	Low
82-BR-021	17973	3531.6	95.3	801.6	High
82-BR-021-18-01	433	0.0	5.7	5.7	Moderate
82-BR-021-02	392	0.0	0.0	0.0	Moderate
82-BR-021-28-01	389	0.0	0.0	0.0	Moderate
82-BR-021-28-02	654	0.0	1.7	1.7	Moderate
82-BR-021-17	2159	2.7	4.0	4.5	Moderate
82-BR-021-18	2868	0.0	29.9	29.9	Moderate
82-BR-021-21	2262	0.0	0.0	0.0	Low
82-BR-021-28	2553	357.8	25.4	96.9	Moderate
82-BR-021-32	508	0.0	0.0	0.0	Moderate
82-BR-028	229	0.0	2.6	2.6	Moderate
82-BR-032	7346	464.4	20.0	112.9	Moderate
82-BR-032-02-01	553	13.5	8.0	10.7	Moderate
82-BR-032-02	5227	0.0	6.8	6.8	Moderate
82-BR-032-02-02	817	0.0	0.0	0.0	Moderate
82-BR-032-04	786	0.0	0.0	0.0	Moderate
82-BR-032-02-03	2780	0.0	0.0	0.0	Moderate/Low
82-BR-035	75	0.0	0.0	0.0	Moderate
82-BR-038	129	0.0	0.0	0.0	Moderate
82-BV-043	4823	0.0	12.9	12.9	Moderate
82-BV-043-03	2505	0.0	44.1	44.1	High
82-BV-043-05	463	0.0	0.0	0.0	Moderate
82-BV-043-06	428	0.0	0.0	0.0	Moderate
82-BV-075	2023	0.0	38.6	38.6	High
82-BV-079	5089	6.8	7.8	9.1	Moderate
82-BV-085	3855	9.5	11.8	13.7	Moderate
82-BV-128	6889	0.0	51.4	51.4	Moderate
82-BV-128-11-01	543	0.0	40.2	40.2	Moderate
82-BV-128-02	1553	0.0	1.1	1.1	Moderate
82-BV-128-06	748	0.0	0.0	0.0	Moderate
82-BV-128-09	98	0.0	0.0	0.0	Moderate
82-BV-128-11	811	0.0	0.0	0.0	Moderate
82-BV-128-13	826	0.0	0.0	0.0	Moderate
82-BV-128-15	213	0.0	0.0	0.0	Moderate
82-BV-140	2969	110.7	20.1	42.2	Moderate
82-CC	16801	364.5	90.6	163.5	Moderate
82-CC-002	5342	40.5	14.2	22.3	Moderate

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
82-CC-004	5726	40.5	19.4	27.5	Moderate
82-CC-006	5287	1362.2	70.6	343.0	High
82-CC-018	1897	0.0	0.0	0.0	Low
82-CC-022	869	0.0	0.0	0.0	Low
82-CC-028	1814	0.0	0.0	0.0	Moderate
82-CC-031	1622	0.0	0.0	0.0	Low
82-CR-012	408	0.0	0.0	0.0	Moderate
82-CR-013	2546	5.4	9.5	10.6	Moderate
82-CR-014	599	0.0	0.0	0.0	Moderate
82-CR-017	1350	0.0	0.0	0.0	Moderate
82-CR-017-01	131	0.0	0.0	0.0	Moderate
82-CR-022	139	0.0	0.0	0.0	Moderate
82-CR-026	2065	0.0	0.0	0.0	Moderate
82-CR-027	2065	0.0	13.5	13.5	Moderate
82-CR-028	3452	0.0	0.0	0.0	Moderate
82-CR-036	5727	0.0	9.1	9.1	Moderate
82-CR-036-08-01	633	0.0	0.0	0.0	Moderate
82-CR-036-08-02	168	0.0	0.0	0.0	Moderate
82-CR-036-08	4162	40.5	4.2	12.3	Moderate
82-CR-036-09	568	0.0	3.1	3.1	Moderate
82-CS	9218	2029.1	126.9	532.7	High
82-CS-003	1148	0.0	0.0	0.0	Moderate
82-CS-016	2310	0.0	3.8	3.8	Moderate
82-CS-018	1385	64.8	13.6	26.6	Moderate
82-DC	3894	240.3	159.9	207.9	High
82-DC-002	2660	168.8	21.1	54.8	Moderate
82-DC-002-02	1726	0.0	0.0	0.0	Moderate
82-DC-002-04	2715	0.0	0.0	0.0	Moderate
82-DC-003	2524	207.9	24.5	66.1	High
82-DC-003-04	909	0.0	13.5	13.5	Moderate
82-DC-005	318	33.8	6.9	13.6	Moderate
82-DC-007	902	209.3	10.7	52.5	Moderate
82-DC-008	545	37.8	17.7	25.3	High
82-DH	16489	4.1	98.2	99.0	High/Low
82-DH-005	5923	31.1	28.7	34.9	Moderate
82-DH-005-03-01	439	0.0	0.0	0.0	Low
82-DH-005-02	153	0.0	2.8	2.8	Moderate
82-DH-005-03	3120	1.4	9.6	9.9	Moderate/Low
82-DH-005-03-02	281	0.0	0.0	0.0	Low
82-DH-016	3134	0.0	0.0	0.0	Moderate/Low
82-DH-016-01	163	0.0	0.0	0.0	Moderate
82-DH-018	2702	0.0	3.1	3.1	Moderate/High
82-DH-028	691	0.0	0.0	0.0	Low
82-DH-029	190	0.0	0.0	0.0	Low
82-DH-030	3371	0.0	0.0	0.0	Moderate/Low
82-DH-030-01	611	0.0	0.0	0.0	Moderate
82-DH-030-02	525	0.0	0.0	0.0	Low
82-DH-030-04-01	314	0.0	0.0	0.0	Low
82-DH-030-04	667	0.0	0.0	0.0	Low
82-DH-030-06	1178	0.0	0.0	0.0	Low
82-DH-032	1126	0.0	0.0	0.0	Moderate
82-DH-032-02	144	0.0	0.0	0.0	Moderate
82-EN	33877	0.0	134.8	134.8	Moderate
82-EN-006	284	0.0	0.0	0.0	Low
82-EN-009	6368	0.0	4.6	4.6	Moderate
82-EN-009-05	963	0.0	0.0	0.0	Moderate
82-EN-016	2161	0.0	15.5	15.5	Moderate
82-EN-026	2717	0.0	10.1	10.1	Moderate
82-EN-035	4068	0.0	3.3	3.3	Moderate/Low
82-EN-035-01	322	0.0	0.0	0.0	Low
82-EN-035-02	617	0.0	0.0	0.0	Low
82-EN-035-05-01	972	0.0	0.0	0.0	Low
82-EN-035-05	2285	0.0	0.0	0.0	Moderate/Low
82-EN-036	1254	0.0	0.0	0.0	Low
82-EN-038	1525	0.0	2.0	2.0	Moderate
82-EN-038-03	169	0.0	0.0	0.0	Moderate
82-EN-044	4386	0.0	0.0	0.0	Moderate/Low
82-EN-044-05	525	0.0	0.0	0.0	Low
82-EN-044-08	563	0.0	0.0	0.0	Moderate
82-EN-044-10	75	0.0	0.0	0.0	Moderate
82-EN-044-12	238	0.0	0.0	0.0	Moderate
82-EN-046	881	0.0	5.9	5.9	Low
82-EN-054	1723	0.0	0.0	0.0	Low
82-EN-054-01	241	0.0	0.0	0.0	Low
82-EN-054-02	1239	0.0	0.0	0.0	Low
82-EN-054-02-01	250	0.0	0.0	0.0	Low
82-EN-056	1653	0.0	0.0	0.0	Low
82-EN-057	114	0.0	0.0	0.0	Low
82-EN-058	187	0.0	0.0	0.0	Low
82-EN-064	1562	0.0	0.0	0.0	Low
82-EN-064-01	635	0.0	0.0	0.0	Low
82-EN-066	1316	0.0	20.1	20.1	Moderate
82-FG	16308	29.7	125.3	131.2	High/Moderate

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
82-FG-004	11401	6.8	6.0	7.4	Moderate
82-FG-004-02	7139	12.2	6.8	9.2	Moderate
82-FG-013	761	0.0	10.8	10.8	Moderate
82-FG-016	1372	0.0	0.0	0.0	Moderate
82-FG-017	487	0.0	2.2	2.2	Moderate
82-FG-021	672	0.0	3.3	3.3	Moderate
82-FG-027	1941	2.7	2.6	3.1	Moderate
82-FG-027-01	312	0.0	0.0	0.0	Moderate
82-FG-031	5157	0.0	5.9	5.9	Moderate
82-FG-031-05	2982	0.0	0.0	0.0	Moderate
82-FG-031-07	762	0.0	0.0	0.0	Moderate
82-GP-027	1727	0.0	0.0	0.0	Moderate/Low
82-GP-069	1466	0.0	0.0	0.0	Low
82-GP-073	2075	0.0	0.0	0.0	Low
82-GP-075	2180	0.0	15.9	15.9	Moderate
82-GP-089	2239	2.7	13.5	14.0	Moderate
82-GP-123	6729	661.5	37.2	169.5	Moderate
82-GP-123-08-01	663	297.0	10.4	69.8	Moderate
82-GP-123-08	3141	3402.0	46.9	727.3	High
82-GP-126	663	0.0	0.0	0.0	Moderate
82-GP-126-01	142	0.0	0.0	0.0	Moderate
82-GP-127	1886	0.0	0.0	0.0	Moderate
82-GP-127-03	225	0.0	0.0	0.0	Moderate
82-GP-130	1470	0.0	0.0	0.0	Moderate
82-GP-130-01	316	0.0	0.0	0.0	Moderate
82-GP-147	3807	0.0	0.0	0.0	Moderate
82-GP-152	3054	0.0	0.0	0.0	Moderate
82-GP-165	521	0.0	0.0	0.0	Moderate
82-GP-172	1376	243.0	51.6	100.2	High
82-GP-172-01	143	0.0	1.0	1.0	Moderate
82-HR	12198	1475.6	192.6	487.7	High/Low
82-HR-003	1326	0.0	9.8	9.8	Moderate
82-HR-007	1058	0.0	0.0	0.0	Low
82-HR-007-02	88	0.0	0.0	0.0	Moderate
82-HR-009	2706	16.2	23.5	26.8	Moderate
82-HR-009-05	182	0.0	1.2	1.2	Moderate
82-HR-013	90	0.0	0.0	0.0	Moderate
82-HR-015	1569	0.0	0.0	0.0	Moderate
82-HR-015-04	95	0.0	0.0	0.0	Moderate
82-HR-015-06	88	0.0	0.0	0.0	Moderate
82-HR-017	1057	205.2	3.4	44.4	Moderate
82-HR-019	1371	202.5	4.4	44.9	Moderate
82-HR-019-01	50	0.0	0.0	0.0	Moderate
82-HT	7427	0.0	0.0	0.0	Moderate/Low
82-HT-001	345	0.0	0.0	0.0	Low
82-HT-004	4150	0.0	0.0	0.0	Low
82-HT-004-09	1039	0.0	6.8	6.8	Low
82-HT-005	222	0.0	0.0	0.0	Low
82-HT-008	405	0.0	0.0	0.0	Low
82-HT-011	101	0.0	0.0	0.0	Low
82-HT-012	1711	0.0	0.0	0.0	Low
82-HT-013	74	0.0	0.0	0.0	Moderate
82-HT-014	105	0.0	0.0	0.0	Low
82-HT-015	42	0.0	0.0	0.0	Moderate
82-HT-016	231	0.0	0.0	0.0	Low
82-HT-017	521	0.0	0.0	0.0	Low
82-HT-018	5272	0.0	0.0	0.0	Low
82-HT-018-05-01	185	0.0	0.0	0.0	Low
82-HT-018-03	353	0.0	0.0	0.0	Low
82-HT-018-05	389	0.0	0.0	0.0	Low
82-HT-018-07	618	0.0	0.0	0.0	Low
82-HT-018-09	99	0.0	0.0	0.0	Moderate
82-HW	8965	2.7	83.6	84.2	Moderate/Low
82-HW-002	951	6.8	4.5	5.9	Moderate
82-HW-003	841	0.0	0.1	0.1	Moderate
82-HW-004	197	0.0	0.0	0.0	Moderate
82-HW-007	1599	0.0	0.0	0.0	Moderate
82-HW-007-02	199	0.0	0.0	0.0	Moderate
82-HW-008	2901	52.7	32.9	43.5	Moderate
82-HW-008-02	557	0.0	4.7	4.7	Moderate
82-HW-009	1751	591.3	31.8	150.0	High
82-HW-012	1751	6.8	2.4	3.7	Moderate
82-HW-014	1647	0.0	4.3	4.3	Moderate
82-HW-015	421	0.0	0.0	0.0	Low
82-HW-016	2965	0.0	0.0	0.0	Moderate/Low
82-HW-016-03	1617	0.0	0.0	0.0	Moderate
82-HW-017	540	0.0	0.0	0.0	Low
82-K-013	5424	0.0	0.0	0.0	Moderate/Low
82-K-013-04	1835	0.0	0.0	0.0	Low
82-LB	8946	0.0	0.0	0.0	Moderate/Low
82-LB-004	2245	0.0	0.0	0.0	Moderate
82-LB-004-02	319	0.0	0.0	0.0	Moderate
82-LB-009	2289	0.0	0.0	0.0	Low

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
82-LB-009-02	777	0.0	0.0	0.0	Low
82-LB-009-03	890	0.0	0.0	0.0	Low
82-LB-009-05	211	0.0	0.0	0.0	Low
82-LB-017	11953	0.0	47.9	47.9	Moderate/Low
82-LB-017-11	717	0.0	0.0	0.0	Moderate
82-LB-018	3786	0.0	3.4	3.4	Moderate/Low
82-LB-018-01	2789	0.0	0.0	0.0	Moderate
82-MG	19831	121.5	127.0	151.3	High/Moderate/Low
82-MG-002	2704	17.6	17.3	20.8	Moderate
82-MG-003	6127	40.5	65.2	73.3	Moderate
82-MG-013	1678	0.0	0.0	0.0	Moderate/Low
82-MG-015	9256	0.0	5.2	5.2	Moderate/Low
82-MG-015-08-0	797	0.0	0.0	0.0	Low
82-MG-015-02	2206	0.0	14.5	14.5	Moderate
82-MG-015-08	2249	0.0	0.0	0.0	Moderate/Low
82-MG-015-13	804	0.0	0.0	0.0	Moderate
82-MG-015-18	62	0.0	0.0	0.0	Moderate
82-MG-017	296	0.0	0.0	0.0	Moderate
82-MG-026	3708	0.0	0.0	0.0	Moderate/Low
82-MG-026-04	420	0.0	0.0	0.0	Low
82-MG-026-07	492	0.0	0.0	0.0	Low
82-MG-033	10841	0.0	0.0	0.0	Low
82-MG-033-12-0	519	0.0	0.0	0.0	Low
82-MG-033-06	180	0.0	0.0	0.0	Moderate
82-MG-033-08	2803	13.5	15.9	18.6	Moderate
82-MG-033-11	418	0.0	0.0	0.0	Moderate
82-MG-033-12	2210	0.0	0.0	0.0	Low
82-MG-033-18	275	0.0	0.0	0.0	Low
82-MG-033-20	483	0.0	0.0	0.0	Low
82-MG-033-22	353	0.0	0.0	0.0	Low
82-MS	14507	230.9	39.4	85.5	Moderate/Low
82-MS-003	4930	152.6	17.7	48.2	Moderate
82-MS-003-08	3355	20.3	22.9	26.9	Moderate
82-MS-003-09	1840	0.0	4.7	4.7	Moderate
82-MS-018	720	0.0	0.0	0.0	Moderate
82-MS-020	9117	365.9	100.6	173.8	Moderate
82-MS-020-13-01	645	0.0	0.0	0.0	Moderate
82-MS-020-05	1225	0.0	17.7	17.7	Moderate
82-MS-020-12	420	0.0	0.0	0.0	Moderate
82-MS-020-13	1533	0.0	0.0	0.0	Moderate
82-MS-020-15	803	16.2	5.7	8.9	Moderate
82-MS-023	1081	0.0	0.0	0.0	Moderate
82-MS-025	6775	33.8	20.0	26.8	Moderate
82-MS-025-06	2067	0.0	6.8	6.8	Moderate
82-MS-026	935	28.4	5.7	11.4	Moderate
82-NF	14967	278.1	202.3	257.9	High
82-NF-004	238	0.0	0.4	0.4	Moderate
82-NF-005	3296	108.0	9.3	30.9	Moderate
82-NF-016	950	0.0	8.7	8.7	Moderate
82-NF-017	416	0.0	0.0	0.0	Moderate
82-NF-019	4376	67.5	34.0	47.5	Moderate
82-NF-019-01	4568	2.7	19.9	20.5	Moderate
82-NF-019-01-01	1675	0.0	30.4	30.4	High
82-NF-019-03	1047	0.0	0.0	0.0	Moderate
82-NF-019-01-02	1632	0.0	0.0	0.0	Moderate
82-NF-019-01-03	952	0.0	2.3	2.3	Moderate
82-NF-019-09-01	648	0.0	0.0	0.0	Moderate
82-NF-019-01-04	511	0.0	0.0	0.0	Moderate
82-NF-019-09	990	0.0	0.8	0.8	Moderate
82-NF-028	134	0.0	1.9	1.9	Moderate
82-NF-029	16292	0.0	279.4	279.4	High
82-NF-029-09-01	1762	29.7	30.7	36.6	High
82-NF-029-09-02	1603	48.6	3.1	12.8	Moderate
82-NF-029-09-03	192	0.0	0.0	0.0	Moderate
82-NF-029-13-01	284	0.0	0.0	0.0	Moderate
82-NF-029-05	1205	0.0	15.5	15.5	Moderate
82-NF-029-13-02	1336	0.0	0.0	0.0	Low
82-NF-029-07	1364	0.0	22.6	22.6	High
82-NF-029-13-03	110	0.0	0.0	0.0	Moderate
82-NF-029-09	5808	0.0	18.3	18.3	Moderate
82-NF-029-13-04	481	0.0	0.0	0.0	Low
82-NF-029-11	874	0.0	11.5	11.5	Moderate
82-NF-029-27-01	2158	0.0	0.0	0.0	Low
82-NF-029-13	11143	226.8	52.3	97.6	Moderate
82-NF-029-27-02	384	0.0	0.0	0.0	Low
82-NF-029-15	166	0.0	2.9	2.9	Moderate
82-NF-029-13-05	167	0.0	0.0	0.0	Moderate
82-NF-029-17	2455	421.2	39.8	124.0	High/Moderate
82-NF-029-27-03	905	0.0	0.0	0.0	Low
82-NF-029-27-04	132	0.0	0.0	0.0	Moderate
82-NF-029-27	6774	0.0	0.4	0.4	Low
82-NR-044	844	0.0	0.0	0.0	Moderate
82-NR-044-02	219	0.0	0.0	0.0	Moderate

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
82-NR-047	254	0.0	0.0	0.0	Moderate
82-NR-048	3807	1.4	5.1	5.3	Moderate/Low
82-NR-090	464	0.0	0.0	0.0	Low
82-NR-095	634	0.0	0.0	0.0	Moderate/Low
82-NR-096	2438	0.0	0.0	0.0	Moderate/Low
82-NR-096-01	1293	0.0	0.0	0.0	Moderate/Low
82-NR-096-02	596	0.0	0.0	0.0	Low
82-NR-097	270	0.0	0.0	0.0	Low
82-NR-098	702	0.0	0.0	0.0	Moderate/Low
82-NR-099	530	0.0	1.9	1.9	Low
82-NR-100	898	0.0	0.0	0.0	Low
82-NR-100-01	141	0.0	0.0	0.0	Low
82-NR-102	1584	0.0	0.0	0.0	Moderate/Low
82-NR-102-01	548	0.0	0.0	0.0	Low
82-NR-104	90	0.0	0.0	0.0	Low
82-NR-105	1805	0.0	0.0	0.0	Moderate/Low
82-NR-106	8739	27445.5	76.1	5565.2	High/Moderate
82-NR-106-01	978	0.0	0.0	0.0	Low
82-NR-106-01-01	200	0.0	0.0	0.0	Low
82-NR-106-07	1010	0.0	0.0	0.0	Moderate
82-NR-106-11	1100	0.0	0.0	0.0	Low
82-NR-107	95	0.0	0.0	0.0	Low
82-NR-110	1218	20.3	7.9	11.9	Moderate/Low
82-NR-110-01	717	0.0	0.0	0.0	Low
82-NR-111	226	0.0	0.0	0.0	Low
82-NR-112	233	0.0	0.0	0.0	Low
82-NR-123	1135	0.0	0.0	0.0	Moderate
82-NR-130	682	0.0	0.0	0.0	Moderate
82-PG	25562	125.6	304.3	329.5	High/Moderate
82-PG-011	293	0.0	4.4	4.4	Moderate
82-PG-015	1884	0.0	0.0	0.0	Moderate
82-PG-041	2078	67.5	4.4	17.9	Moderate
82-PG-049	6920	24.3	15.3	20.2	Moderate
82-PG-049-04	1585	337.5	7.5	75.0	Moderate
82-PG-049-08	3307	56.7	2.5	13.8	Moderate
82-PG-051	1208	0.0	10.3	10.3	Moderate
82-RC	18406	20.3	62.4	66.5	Moderate
82-RC-003	5017	0.0	0.8	0.8	Moderate
82-RC-003-09	801	0.0	1.4	1.4	Moderate
82-RC-009	909	0.0	0.0	0.0	Moderate
82-RC-012	214	0.0	0.0	0.0	Moderate
82-RC-022	5641	0.0	13.5	13.5	Moderate
82-RC-022-04-01	1019	0.0	3.0	3.0	Moderate
82-RC-022-04	1565	0.0	0.0	0.0	Moderate
82-RC-024	475	0.0	0.0	0.0	Moderate
82-RC-026	1963	0.0	3.7	3.7	Moderate
82-RC-028	649	0.0	0.0	0.0	Moderate
82-RC-031	5559	135.0	24.0	51.0	Moderate
82-RG	18572	147.2	29.3	58.8	Moderate/Low
82-RG-002	15342	268.7	253.9	307.6	High/Moderate
82-RG-002-04	397	0.0	2.3	2.3	Moderate
82-RG-002-06	11519	109.4	159.6	181.5	High
82-RG-002-07	373	0.0	4.2	4.2	Moderate
82-RG-002-19	1885	0.0	32.0	32.0	High
82-RG-002-21	2238	0.0	9.4	9.4	Low
82-RG-002-23	984	18.9	17.0	20.8	High
82-RG-006	988	0.0	0.0	0.0	Moderate
82-RG-006-02	363	0.0	0.0	0.0	Moderate
82-RG-009	6165	2.7	4.4	5.0	Low
82-RG-009-01	1025	0.0	2.5	2.5	Moderate/Low
82-RG-009-08-01	541	0.0	0.0	0.0	Low
82-RG-009-03	143	0.0	0.0	0.0	Low
82-RG-009-05	413	0.0	0.0	0.0	Low
82-RG-009-07	203	0.0	0.0	0.0	Low
82-RG-009-08	2096	0.0	2.5	2.5	Moderate/Low
82-RG-009-11	126	0.0	0.0	0.0	Low
82-RG-012	1278	0.0	2.5	2.5	Moderate
82-RG-012-01	434	0.0	0.0	0.0	Moderate
82-RG-014	230	0.0	0.0	0.0	Low
82-RG-015	2225	0.0	0.0	0.0	Low
82-RG-015-02	1443	0.0	0.0	0.0	Low
82-RG-015-05	228	0.0	0.0	0.0	Low
82-RG-024	3133	0.0	0.0	0.0	Low
82-RG-024-03-01	1272	0.0	0.0	0.0	Moderate
82-RG-024-03	3292	0.0	0.0	0.0	Moderate/Low
82-RG-024-04	547	0.0	0.0	0.0	Low
82-RG-024-06	1106	0.0	0.0	0.0	Low
82-RG-027	866	0.0	0.0	0.0	Low
82-RG-031	316	0.0	0.0	0.0	Low
82-RG-032	2274	0.0	0.0	0.0	Low
82-RG-033	773	0.0	0.0	0.0	Low
82-RG-033-02	220	0.0	0.0	0.0	Low
82-RG-034	822	0.0	0.0	0.0	Low

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
82-RG-035	1363	0.0	0.0	0.0	Low
82-RN	9509	0.0	0.0	0.0	Moderate/Low
82-RN-005	7762	850.5	91.1	261.2	High/Moderate
82-RN-005-09	277	0.0	0.0	0.0	Moderate
82-RN-018	5164	783.0	21.2	177.8	Moderate
82-RN-018-09	374	0.0	1.9	1.9	Moderate
82-RN-019	1739	27.0	28.8	34.2	Moderate
82-SC	25675	266.0	393.2	446.4	High
82-SC-003	7784	0.0	0.0	0.0	Moderate/Low
82-SC-003-03	1805	4.1	0.5	1.4	Moderate
82-SC-003-06	256	0.0	0.0	0.0	Low
82-SC-003-07	1665	0.0	0.0	0.0	Moderate
82-SC-003-08	450	0.0	0.0	0.0	Low
82-SC-003-10	481	0.0	0.0	0.0	Moderate
82-SC-003-12	213	0.0	0.0	0.0	Moderate
82-SC-022	102	0.0	0.0	0.0	Moderate
82-SC-039	5875	0.0	0.0	0.0	Moderate
82-SC-043	1048	0.0	23.3	23.3	High
82-SC-048	5135	66.2	61.9	75.1	High
82-SC-049	10073	81.0	39.4	55.6	Moderate
82-SC-049-01	521	0.0	0.0	0.0	Moderate
82-SC-049-05	1650	0.0	0.0	0.0	Moderate
82-SC-049-09	695	0.0	0.0	0.0	Moderate
82-SM	26567	476.6	302.3	397.6	High/Moderate
82-SM-002	4717	1.4	0.6	0.9	Moderate
82-SM-002-03-01	554	810.0	3.1	165.1	Moderate
82-SM-002-03	1106	0.0	0.0	0.0	Moderate
82-SM-002-04	1180	5.4	5.2	6.3	Moderate
82-SM-004	1443	0.0	0.0	0.0	Low
82-SM-006	2059	4.1	22.7	23.5	Moderate
82-SM-014	1333	0.0	0.0	0.0	Moderate/Low
82-SM-015	1831	0.0	0.0	0.0	Moderate
82-SM-017	3230	0.0	0.0	0.0	Low
82-SM-018	250	0.0	0.0	0.0	Moderate
82-SM-020	1009	0.0	3.5	3.5	Moderate
82-SM-025	12501	8217.5	64.4	1707.9	High/Moderate
82-SM-025-07	4236	0.0	0.0	0.0	Low
82-SM-025-12	176	0.0	0.0	0.0	Moderate
82-SM-028	1109	0.0	0.0	0.0	Low
82-SM-029	266	0.0	0.0	0.0	Low
82-SM-031	1116	0.0	0.0	0.0	Low
82-SM-033	2589	24.3	2.3	7.1	Moderate
82-SM-038	9518	2.7	22.6	23.2	Moderate/Low
82-SM-038-04	842	2.7	0.7	1.3	Moderate
82-SM-038-08	776	0.0	0.0	0.0	Low
82-SM-038-15	397	0.0	0.0	0.0	Low
82-SM-038-17	183	0.0	0.0	0.0	Low
82-SM-044	3180	85.1	12.5	29.6	Moderate
82-SM-044-06	711	0.0	0.0	0.0	Moderate
82-SM-052	8354	20.3	9.3	13.4	Moderate/Low
82-SM-052-02	1917	54.0	2.5	13.3	Moderate
82-SM-052-05	3753	70.2	4.1	18.1	Moderate
82-SM-052-12	840	0.0	0.0	0.0	Low
82-SR	41799	86.4	495.4	512.6	High/Moderate
82-SR-001	174	0.0	0.0	0.0	Moderate
82-SR-004	642	0.0	0.0	0.0	Moderate
82-SR-006	13493	0.0	0.0	0.0	Moderate/Low
82-SR-006-02	114	0.0	0.0	0.0	Moderate
82-SR-006-05	876	0.0	0.0	0.0	Low
82-SR-006-08	551	0.0	0.0	0.0	Low
82-SR-006-10	637	0.0	0.0	0.0	Low
82-SR-006-11	1433	1.4	1.8	2.1	Moderate
82-SR-006-12	1481	0.0	0.0	0.0	Low
82-SR-006-15	1015	0.0	0.0	0.0	Moderate
82-SR-006-16	175	0.0	0.0	0.0	Low
82-SR-006-18	502	0.0	0.0	0.0	Moderate
82-SR-011	2207	8.1	26.1	27.8	Moderate
82-SR-013	1212	0.0	29.3	29.3	High
82-SR-015	141	0.0	0.0	0.0	Low
82-SR-016	3648	0.0	0.0	0.0	Moderate
82-SR-016-07	261	0.0	0.0	0.0	Moderate
82-SR-018	9198	0.0	6.3	6.3	Moderate/Low
82-SR-018-03-01	130	0.0	0.0	0.0	Low
82-SR-018-08-01	678	0.0	0.0	0.0	Low
82-SR-018-03	1521	0.0	0.0	0.0	Low
82-SR-018-08-02	1426	0.0	0.0	0.0	Moderate/Low
82-SR-018-11-01	561	0.0	0.0	0.0	Low
82-SR-018-06	417	0.0	0.0	0.0	Moderate/Low
82-SR-018-08	3971	0.0	0.0	0.0	Low
82-SR-018-11	2372	68.9	1.2	14.9	Moderate
82-SR-018-13	1365	4.1	2.4	3.2	Moderate
82-SR-019	8415	0.0	0.0	0.0	Moderate/Low
82-SR-019-07-01	164	0.0	0.0	0.0	Low

Road Number	Road Length (ft)	Fluvial Erosion (tons/yr)	Surface Erosion (tons/yr)	Total erosion (tons/yr)	Erosion Hazard Rating
82-SR-019-07-02	1338	0.0	0.0	0.0	Low
82-SR-019-07-03	572	0.0	0.0	0.0	Low
82-SR-019-07-04	246	0.0	0.0	0.0	Low
82-SR-019-07	5155	0.0	0.0	0.0	Moderate/Low
82-SR-019-09	441	0.0	0.0	0.0	Low
82-SR-019-16	147	0.0	0.0	0.0	Low
82-SR-036	2312	0.0	15.9	15.9	Moderate
82-SR-041	7412	94.5	15.1	34.0	Moderate/Low
82-SR-041-12-01	92	0.0	0.0	0.0	Moderate
82-SR-041-11	375	0.0	0.0	0.0	Low
82-SR-041-12	1087	0.0	0.0	0.0	Low
82-SR-041-14	784	0.0	0.0	0.0	Moderate/Low
82-SR-042	1156	0.0	7.9	7.9	Moderate
82-SR-044	887	0.0	5.8	5.8	Moderate
82-SR-045	3635	0.0	62.2	62.2	High
82-SR-052	5154	47.3	41.5	50.9	Moderate
82-SR-052-04	1519	0.0	0.0	0.0	Moderate
82-SR-052-09	249	60.8	2.0	14.2	Moderate
82-SR-059	13574	0.0	32.9	32.9	Moderate/Low
82-SR-059-12-01	891	0.0	1.0	1.0	Moderate
82-SR-059-12-02	1631	0.0	0.0	0.0	Low
82-SR-059-18-01	478	0.0	0.0	0.0	Low
82-SR-059-18-02	860	0.0	0.0	0.0	Low
82-SR-059-12	5280	5.4	18.0	19.0	Moderate/Low
82-SR-059-15	226	0.0	0.0	0.0	Moderate
82-SR-059-17	481	0.0	0.0	0.0	Low
82-SR-059-18	1582	0.0	0.0	0.0	Low
82-SR-059-23	497	0.0	0.0	0.0	Low
82-SR-061	10609	8.1	23.3	24.9	Moderate/Low
82-SR-061-01	451	0.0	6.5	6.5	Moderate
82-SR-061-17-01	210	0.0	0.0	0.0	Low
82-SR-061-07	1962	0.0	0.0	0.0	Moderate/Low
82-SR-061-09	770	0.0	0.0	0.0	Low
82-SR-061-17	473	0.0	0.0	0.0	Low
82-SR-068	807	0.0	12.5	12.5	Moderate
82-SR-078	540	0.0	3.9	3.9	Moderate
82-SR-079	2963	0.0	32.0	32.0	Moderate
82-SR-079-03-01	3427	0.0	0.0	0.0	Moderate
82-SR-079-03-02	323	0.0	0.0	0.0	Moderate
82-SR-079-03	5143	232.2	38.0	84.4	High
82-SR-079-05-01	211	0.0	0.0	0.0	Moderate
82-SR-079-05	1997	0.0	0.0	0.0	Moderate
82-SR-080	645	0.0	16.4	16.4	Moderate
82-T4	8271	0.0	133.9	133.9	High
82-T4-016	4102	21.6	20.2	24.5	Moderate
82-T4-017	3953	67.5	38.6	52.1	Moderate
82-T4-017-06	1184	0.0	0.0	0.0	Moderate
82-XX	322	0.0	0.0	0.0	Moderate

Navarro East Culverts

Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-M	269	26.72	ditch relief	high	30	yes, ditch
81-M	270	26.89	ditch relief	high	30	yes, ditch
81-M	324	32.28	watercourse	high	30	yes, ditch
81-M	329	32.72	ditch relief	high	30	yes, ditch
81-M	228	22.78	ditch relief	high	30	yes, ditch
81-M	276	27.55	watercourse	high	25	yes, ditch
81-M	288	28.77	ditch relief	high	25	yes, ditch
81-IC-010	1	0.11	ditch relief	high	25	no div. potential
81-SC-018	8	0.81	watercourse	high	21	no div. potential
81-M	283	28.18	ditch relief	high	20	yes, ditch
81-M	296	29.59	ditch relief	high	20	yes, ditch
81-DH	1	0.01	ditch relief	high	10	yes, ditch
81-M	303	29.77	ditch relief	high	10	yes, road
81-MD-007	2	0.23	watercourse	high	10	already diverted
81-PM	21	1.65	ditch relief	high	10	yes, road
81-PM	20	1.45	ditch relief	high	8	no div. potential
81-M	306	30.57	watercourse	high	7	yes, ditch
81-M	266	26.51	ditch relief	high	0	yes, ditch
81-PM	21	1.65	ditch relief	high	0	no div. potential
81-M	227	22.73	watercourse	high	0	already diverted
81-M	325	32.39	watercourse	moderate	3700	no div. potential
81-M	339	33.81	watercourse	moderate	3000	yes, road
81-M	221	22.07	watercourse	moderate	2200	no div. potential
81-M	218	21.83	ditch relief	moderate	1800	yes, ditch
81-M	202	20.21	ditch relief	moderate	1500	yes, ditch
81-AR-017	5	0.32	watercourse	moderate	1200	yes, ditch
81-IC-022	7	0.66	watercourse	moderate	1200	already diverted
81-AR-003	6	0.50	ditch relief	moderate	800	yes, ditch
81-M	262	26.16	ditch relief	moderate	670	yes, ditch
81-AR-043-05-01	4	0.36	watercourse	moderate	590	no div. potential
81-RC-013	1	0.05	watercourse	moderate	577	no div. potential
81-M	285	28.49	watercourse	moderate	500	yes, ditch
81-DH	13	1.32	watercourse	moderate	497	no div. potential
81-SB-039	10	1.02	watercourse	moderate	420	no div. potential
81-M	334	33.43	watercourse	moderate	388	yes, ditch
81-SC	15	1.44	watercourse	moderate	333	no div. potential
81-SC-009	6	0.52	watercourse	moderate	333	no div. potential
81-DH	26	2.52	watercourse	moderate	330	yes, road
81-M	281	27.05	ditch relief	moderate	310	yes, ditch
81-M	341	34.12	watercourse	moderate	200	no div. potential
81-M	237	23.74	ditch relief	moderate	200	yes, ditch
81-DH	23	2.33	watercourse	moderate	177	no div. potential
81-LR-007	20	1.97	watercourse	moderate	177	no div. potential
81-LR-007	21	1.99	watercourse	moderate	177	no div. potential
81-JS-026	13	1.30	watercourse	moderate	175	yes, road
81-SC	18	1.85	watercourse	moderate	148	no div. potential
81-AR-043	29	2.88	watercourse	moderate	140	no div. potential
81-LR-007	6	0.61	watercourse	moderate	135	yes, road
81-LG-016	4	0.36	watercourse	moderate	125	yes, road
81-M	336	33.58	ditch relief	moderate	125	yes, ditch
81-IC	11	1.14	watercourse	moderate	106	yes, road
81-SC-009	3	0.27	watercourse	moderate	99	no div. potential
81-RW-004-12	4	0.34	watercourse	moderate	98	no div. potential
81-BH	23	2.29	watercourse	moderate	93	yes, road
81-M	242	24.22	ditch relief	moderate	90	yes, ditch
81-M	257	25.70	ditch relief	moderate	75	yes, ditch
81-BC-004	3	0.26	watercourse	moderate	75	yes, road
81-M	305	30.38	watercourse	moderate	74	yes, ditch
81-RW-004	18	1.84	watercourse	moderate	74	no div. potential
81-BC-023	13	1.27	watercourse	moderate	70	no div. potential
81-JS-023-05	1	0.14	watercourse	moderate	65	no div. potential
81-BR-009	3	0.28	watercourse	moderate	59	no div. potential
81-M-278-06	1	0.02	watercourse	moderate	59	no div. potential
81-BC-001	28	2.27	ditch relief	moderate	59	no div. potential
81-LG-016	14	1.34	watercourse	moderate	55	no div. potential
81-LG-016	5	0.41	ditch relief	moderate	50	yes, road
81-M	272	27.04	ditch relief	moderate	50	yes, ditch
81-IC-022	3	0.33	ditch relief	moderate	50	yes, road
81-CC-025	18	1.75	ditch relief	moderate	49	no div. potential
81-M	307	30.69	watercourse	moderate	42	yes, ditch
81-M-233	1	0.13	watercourse	moderate	38	no div. potential
81-M	211	21.12	watercourse	moderate	35	yes, ditch
81-MD-007	1	0.09	ditch relief	moderate	32	yes, road
81-M	262	26.16	ditch relief	moderate	30	yes, ditch
81-M	333	33.29	ditch relief	moderate	27	yes, ditch
81-SB-002	1	0.00	ditch relief	moderate	25	yes, road
81-SB	13	1.06	ditch relief	moderate	24	no div. potential
81-BR-009	16	1.59	watercourse	moderate	23	no div. potential
81-SC-018	12	1.17	watercourse	moderate	21	no div. potential
81-CC	14	1.44	ditch relief	moderate	20	yes, ditch
81-CC-019	3	0.26	ditch relief	moderate	20	no div. potential
81-CC-019	4	0.38	ditch relief	moderate	20	no div. potential
81-M	215	21.44	ditch relief	moderate	20	yes, ditch
81-CC	11	0.89	ditch relief	moderate	18	yes, ditch
81-CC	10	0.89	ditch relief	moderate	16	yes, ditch

Navarro East Culverts

Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-WG-008-05	21	2.04	watercourse	moderate	10	no div. potential
81-M	308	30.80	watercourse	low	30850	no div. potential
81-M	314	31.32	watercourse	low	16800	undetermined
81-M	279	27.75	watercourse	low	10300	no div. potential
81-M	287	28.69	watercourse	low	6000	no div. potential
81-M	287	28.69	watercourse	low	3210	no div. potential
81-M	338	33.75	watercourse	low	3111	no div. potential
81-M	401	29.67	watercourse	low	3000	no div. potential
81-IC	7	0.63	watercourse	low	2370	yes, road
81-IC	6	0.56	ditch relief	low	2222	yes, road
81-M	263	26.26	watercourse	low	2200	yes, ditch
81-IC	5	0.52	watercourse	low	2074	already diverted
81-IC-022	6	0.61	watercourse	low	1800	yes, road
81-IC	8	0.68	watercourse	low	1777	yes, road
81-M	269	26.73	ditch relief	low	1500	yes, ditch
81-M	230	22.96	watercourse	low	1500	no div. potential
81-IC	10	0.81	watercourse	low	1211	yes, road
81-M	264	26.35	ditch relief	low	1000	yes, ditch
81-IC-022	4	0.40	watercourse	low	960	already diverted
81-M-260	10	1.03	watercourse	low	911	no div. potential
81-RC-056	17	1.68	watercourse	low	900	no div. potential
81-AR-043-05-01	5	0.43	watercourse	low	890	no div. potential
81-LG-016	10	1.01	watercourse	low	763	no div. potential
81-SC	40	3.94	watercourse	low	700	no div. potential
81-IC	17	1.63	watercourse	low	694	no div. potential
81-IC-014	3	0.26	watercourse	low	694	no div. potential
81-M	262	26.16	ditch relief	low	670	yes, ditch
81-WG-009-13	1	0.10	watercourse	low	660	no div. potential
81-DC	17	1.69	watercourse	low	625	yes, road
81-M	284	28.43	watercourse	low	600	yes, ditch
81-IC	9	0.72	watercourse	low	558	yes, road
81-MD	27	2.38	watercourse	low	555	no div. potential
81-SC-042	9	0.91	watercourse	low	555	no div. potential
81-M	207	20.72	watercourse	low	550	yes, ditch
81-IC	21	2.07	watercourse	low	550	yes, road
81-RW-004-12	7	0.62	watercourse	low	533	no div. potential
81-RC	33	3.34	watercourse	low	533	no div. potential
81-WE	37	3.71	watercourse	low	530	no div. potential
81-WE	38	3.72	watercourse	low	530	no div. potential
81-WE	41	4.08	watercourse	low	520	no div. potential
81-WE	42	4.09	watercourse	low	520	no div. potential
81-IC	16	1.63	watercourse	low	520	yes, road
81-M	271	26.92	ditch relief	low	500	yes, ditch
81-LG-080-13	1	0.04	watercourse	low	474	no div. potential
81-MD	30	2.67	watercourse	low	462	no div. potential
81-WG-033	8	0.85	watercourse	low	460	yes, road
81-WG-009	18	1.85	watercourse	low	450	no div. potential
81-IC	13	1.30	watercourse	low	444	no div. potential
81-M-294-07	2	0.19	watercourse	low	400	yes, road
81-SC-027	5	0.46	watercourse	low	370	no div. potential
81-AR-019	14	1.44	watercourse	low	370	yes, road
81-M	274	27.27	ditch relief	low	350	yes, ditch
81-WG-008-05-02	2	0.19	watercourse	low	350	no div. potential
81-WG	29	2.77	watercourse	low	330	no div. potential
81-MD-005	8	0.81	watercourse	low	320	no div. potential
81-AR-043-05-01	8	0.71	watercourse	low	320	no div. potential
81-M	281	27.05	ditch relief	low	310	yes, ditch
81-SB	39	3.53	watercourse	low	310	yes, ditch
81-DC	30	2.97	watercourse	low	300	no div. potential
81-M	315	31.41	watercourse	low	300	yes, ditch
81-SB-022	2	0.21	watercourse	low	300	no div. potential
81-CC	12	0.98	watercourse	low	296	no div. potential
81-SC-018	1	0.12	watercourse	low	296	no div. potential
81-AR-019	1	0.13	watercourse	low	290	yes, road
81-SC-026-02	10	0.99	watercourse	low	280	no div. potential
81-SC-042	6	0.58	watercourse	low	280	no div. potential
81-SC-042	8	0.80	watercourse	low	280	no div. potential
81-SC-018	4	0.38	watercourse	low	276	no div. potential
81-LG-006	5	0.55	watercourse	low	275	no div. potential
81-CC	7	0.73	watercourse	low	273	yes, road
81-JS-026	1	0.14	watercourse	low	260	no div. potential
81-AR-019	4	0.36	watercourse	low	260	yes, road
81-BC	24	2.35	watercourse	low	250	no div. potential
81-WG-009	19	1.87	watercourse	low	250	no div. potential
81-WG-009	20	1.90	watercourse	low	250	no div. potential
81-DC	31	3.13	watercourse	low	247	no div. potential
81-M	277	27.57	ditch relief	low	240	yes, ditch
81-M-294	2	0.20	watercourse	low	240	yes, road
81-SC	39	3.87	watercourse	low	230	yes, road
81-AR-043-05-01	13	1.26	watercourse	low	230	no div. potential
81-SC-026-02	8	0.75	watercourse	low	222	no div. potential
81-SC-026-02	9	0.87	watercourse	low	220	no div. potential
81-SB-039-09	2	0.21	watercourse	low	220	no div. potential
81-WG	31	3.02	watercourse	low	220	no div. potential
81-AR-043-05-01	7	0.60	watercourse	low	216	no div. potential

Navarro East Culverts

Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-LG-016	6	0.64	watercourse	low	205	no div. potential
81-M	267	26.60	ditch relief	low	200	yes, ditch
81-M	341	34.12	watercourse	low	200	no div. potential
81-AR-043-05-01	1	0.06	watercourse	low	198	no div. potential
81-RW-021	16	1.62	watercourse	low	197	no div. potential
81-M	327	32.56	ditch relief	low	185	yes, ditch
81-SC-044	6	0.57	watercourse	low	180	no div. potential
81-AR-043-29	3	0.30	watercourse	low	180	no div. potential
81-M	254	25.41	ditch relief	low	180	yes, ditch
81-WG-033-04	5	0.39	watercourse	low	180	no div. potential
81-DC	40	3.97	watercourse	low	177	no div. potential
81-SC	14	1.37	ditch relief	low	177	no div. potential
81-SC-009	7	0.62	watercourse	low	177	no div. potential
81-IC	4	0.39	watercourse	low	177	already diverted
81-IC	12	1.16	watercourse	low	177	yes, road
81-RW-004	8	0.78	watercourse	low	172	no div. potential
81-WG	32	3.09	watercourse	low	170	no div. potential
81-WG-033-04	6	0.54	watercourse	low	170	no div. potential
81-SC	38	3.74	watercourse	low	165	yes, road
81-SB	42	3.83	watercourse	low	165	no div. potential
81-MD	13	1.15	watercourse	low	161	yes, road
81-CC-025	13	1.35	watercourse	low	160	yes, road
81-DC	34	3.43	watercourse	low	160	no div. potential
81-WG-008	19	1.89	watercourse	low	160	no div. potential
81-WG-033-04	2	0.22	watercourse	low	160	no div. potential
81-AR-042-05	4	0.41	watercourse	low	160	no div. potential
81-DH	25	2.49	watercourse	low	159	yes, road
81-JS-023	6	0.65	watercourse	low	155	yes, road
81-SC-042	10	0.99	watercourse	low	155	no div. potential
81-SC	31	3.08	watercourse	low	150	yes, road
81-SC	34	3.41	watercourse	low	150	yes, road
81-SC-037	5	0.52	watercourse	low	150	no div. potential
81-SC-044	5	0.51	watercourse	low	150	no div. potential
81-WE	43	4.11	watercourse	low	150	no div. potential
81-WG	16	1.63	watercourse	low	150	no div. potential
81-WG	25	2.33	watercourse	low	150	no div. potential
81-WG	28	2.51	watercourse	low	150	no div. potential
81-WG-033-04	4	0.35	watercourse	low	150	no div. potential
81-CC-025	10	1.04	watercourse	low	148	no div. potential
81-LG-012-03	1	0.14	watercourse	low	148	no div. potential
81-RW-004-12	2	0.17	watercourse	low	148	no div. potential
81-AR-043	23	2.34	watercourse	low	148	no div. potential
81-DC	36	3.57	watercourse	low	146	yes, road
81-JS	7	0.65	watercourse	low	140	no div. potential
81-SC	36	3.58	watercourse	low	140	yes, road
81-SC-026-02	16	1.60	watercourse	low	140	no div. potential
81-SB	25	2.29	watercourse	low	140	yes, road
81-SC-018	5	0.51	watercourse	low	138	no div. potential
81-BR-009	10	1.00	watercourse	low	135	no div. potential
81-CC-025	1	0.01	watercourse	low	133	no div. potential
81-LG-016	16	1.43	watercourse	low	130	no div. potential
81-M-284	4	0.36	watercourse	low	130	no div. potential
81-M	249	24.89	watercourse	low	130	yes, road
81-SB	33	3.07	watercourse	low	130	yes, road
81-LR-007	11	1.05	watercourse	low	125	no div. potential
81-SC-026-02	1	0.03	watercourse	low	125	yes, road
81-BR-009	12	1.19	watercourse	low	123	no div. potential
81-RW-004	11	1.07	watercourse	low	123	no div. potential
81-BC-001	31	2.64	watercourse	low	122	yes, road
81-JS	6	0.57	watercourse	low	120	yes, ditch
81-SB	36	3.23	watercourse	low	120	no div. potential
81-SC	35	3.54	watercourse	low	120	yes, road
81-SC-009	1	0.07	watercourse	low	120	yes, road
81-SB	26	2.44	watercourse	low	120	no div. potential
81-SB	30	2.77	watercourse	low	120	no div. potential
81-WG-008	20	2.04	watercourse	low	120	no div. potential
81-SC-044	3	0.25	watercourse	low	119	no div. potential
81-DC	12	1.17	watercourse	low	118	no div. potential
81-DH	10	0.97	watercourse	low	118	no div. potential
81-RW-004	5	0.48	watercourse	low	118	no div. potential
81-SC	45	4.47	ditch relief	low	118	yes, ditch
81-SC-018	6	0.62	watercourse	low	118	no div. potential
81-WG	11	1.13	watercourse	low	115	no div. potential
81-DH	5	0.51	watercourse	low	111	no div. potential
81-MD	26	2.30	watercourse	low	111	yes, road
81-SC-037	3	0.33	watercourse	low	111	no div. potential
81-LG-016	15	1.39	watercourse	low	110	no div. potential
81-BC	29	2.91	watercourse	low	110	no div. potential
81-SB	29	2.55	watercourse	low	110	no div. potential
81-SC-026-02-01	1	0.00	watercourse	low	105	no div. potential
81-AR-042	6	0.60	watercourse	low	105	no div. potential
81-AR-042	7	0.63	watercourse	low	105	no div. potential
81-CC-019	6	0.50	watercourse	low	104	yes, road
81-LG-008-08	2	0.18	watercourse	low	103	no div. potential
81-SC-039	3	0.25	watercourse	low	101	no div. potential

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Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-M	271	26.92	watercourse	low	100	yes, ditch
81-SB	27	2.49	watercourse	low	100	no div. potential
81-AR-017	3	0.27	watercourse	low	100	yes, road
81-WG	17	1.65	watercourse	low	100	no div. potential
81-JS-023-08	5	0.53	watercourse	low	99	no div. potential
81-MD	7	0.69	watercourse	low	99	no div. potential
81-SC	23	2.27	watercourse	low	99	no div. potential
81-DC	16	1.64	watercourse	low	95	yes, road
81-SB	1	0.13	ditch relief	low	95	no div. potential
81-SC	41	4.05	ditch relief	low	95	yes, road
81-WE	26	2.45	watercourse	low	95	no div. potential
81-SC	26	2.53	watercourse	low	93	no div. potential
81-SB	20	1.81	watercourse	low	93	no div. potential
81-SC-039	2	0.17	watercourse	low	92	no div. potential
81-AR-017	8	0.83	watercourse	low	90	no div. potential
81-AR-019	7	0.70	watercourse	low	90	yes, road
81-SB	28	2.53	watercourse	low	90	no div. potential
81-SB	41	3.57	watercourse	low	90	no div. potential
81-SB-039-04	3	0.28	watercourse	low	90	no div. potential
81-WG	12	1.17	watercourse	low	90	no div. potential
81-WG	23	2.18	watercourse	low	90	no div. potential
81-LG-016	9	0.89	ditch relief	low	89	no div. potential
81-M-294	5	0.47	ditch relief	low	89	yes, road
81-BC-001-07	1	0.09	watercourse	low	89	no div. potential
81-AR-043-05-01	6	0.47	watercourse	low	88	no div. potential
81-B-005	3	0.27	watercourse	low	88	yes, road
81-LG-016-06	7	0.74	watercourse	low	86	no div. potential
81-B-005	27	2.73	watercourse	low	85	no div. potential
81-B-005	28	2.83	watercourse	low	85	no div. potential
81-M-252-02	1	0.12	watercourse	low	85	no div. potential
81-WE	32	3.12	watercourse	low	85	yes, road
81-SC	25	2.48	ditch relief	low	80	yes, road
81-M	188	18.78	watercourse	low	80	yes, ditch
81-SB	34	3.15	watercourse	low	80	yes, road
81-LR-007	4	0.43	watercourse	low	79	no div. potential
81-RW-004-12	1	0.09	watercourse	low	79	no div. potential
81-SC-018	13	1.33	watercourse	low	77	no div. potential
81-JS-023	5	0.46	watercourse	low	75	yes, road
81-LR-007	13	1.27	watercourse	low	75	no div. potential
81-SC-027-03	1	0.09	watercourse	low	75	no div. potential
81-BC	12	1.18	watercourse	low	75	yes, road
81-SB	38	3.39	watercourse	low	75	no div. potential
81-WG-008-05	6	0.63	watercourse	low	75	no div. potential
81-WG-033	9	0.95	watercourse	low	75	yes, road
81-MD	20	1.84	watercourse	low	74	no div. potential
81-SC	20	2.02	watercourse	low	74	no div. potential
81-SC	22	2.20	watercourse	low	74	no div. potential
81-SC-018	16	1.55	watercourse	low	74	no div. potential
81-AR-043	5	0.45	watercourse	low	74	no div. potential
81-SB	16	1.33	watercourse	low	74	no div. potential
81-SC	42	4.13	ditch relief	low	71	no div. potential
81-B-005	1	0.04	watercourse	low	71	yes, road
81-CC	9	0.86	watercourse	low	70	yes, ditch
81-SC-026-02	17	1.68	watercourse	low	70	no div. potential
81-M	213	21.27	ditch relief	low	70	yes, ditch
81-RC-008	3	0.26	watercourse	low	70	yes, road
81-WG	26	2.36	watercourse	low	70	no div. potential
81-WG	27	2.39	watercourse	low	70	no div. potential
81-M-224	1	0.08	watercourse	low	68	no div. potential
81-BC-001	18	1.72	watercourse	low	67	no div. potential
81-BH	12	0.97	watercourse	low	66	yes, road
81-SC	8	0.76	ditch relief	low	66	yes, ditch
81-SC-044	2	0.17	watercourse	low	65	no div. potential
81-M-224	4	0.38	watercourse	low	65	no div. potential
81-WG	13	1.24	watercourse	low	65	yes, road
81-IC-003	22	2.00	watercourse	low	65	no div. potential
81-JS	23	2.28	watercourse	low	62	no div. potential
81-AR-043	12	1.20	watercourse	low	62	no div. potential
81-SB	22	1.98	watercourse	low	62	no div. potential
81-RW-017	8	0.80	watercourse	low	61	no div. potential
81-M	263	26.27	watercourse	low	60	yes, ditch
81-AR-043	15	1.47	watercourse	low	60	no div. potential
81-AR-043	21	2.14	watercourse	low	60	no div. potential
81-BC-020	1	0.13	watercourse	low	60	no div. potential
81-M	223	22.32	ditch relief	low	60	yes, ditch
81-WE	15	1.46	watercourse	low	60	no div. potential
81-WE	23	2.28	watercourse	low	60	no div. potential
81-WG	24	2.19	watercourse	low	60	no div. potential
81-SC-009	5	0.45	watercourse	low	59	no div. potential
81-AR-012	1	0.10	watercourse	low	59	no div. potential
81-RC-008-03	2	0.16	watercourse	low	59	no div. potential
81-M-224	6	0.61	watercourse	low	58	no div. potential
81-DC	9	0.87	watercourse	low	56	no div. potential
81-BC-001	17	1.67	watercourse	low	56	no div. potential
81-MD	8	0.75	watercourse	low	55	no div. potential

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Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-SC	27	2.57	watercourse	low	55	yes, ditch
81-AR-043-05	12	1.17	watercourse	low	55	no div. potential
81-SB	40	3.54	ditch relief	low	55	no div. potential
81-WE	22	2.18	watercourse	low	55	no div. potential
81-WE	24	2.32	watercourse	low	55	no div. potential
81-WE	29	2.85	watercourse	low	55	no div. potential
81-WG-008	10	1.02	watercourse	low	55	yes, road
81-MD	14	1.19	watercourse	low	54	yes, ditch
81-AR-043	18	1.76	watercourse	low	54	yes, road
81-SB	31	2.85	ditch relief	low	54	no div. potential
81-DH	15	1.54	watercourse	low	53	no div. potential
81-DH	21	2.14	watercourse	low	53	no div. potential
81-SC	30	2.94	ditch relief	low	53	no div. potential
81-AR-043	16	1.62	watercourse	low	52	no div. potential
81-SB	14	1.10	watercourse	low	52	yes, road
81-M	261	26.08	ditch relief	low	50	yes, ditch
81-M	272	27.04	ditch relief	low	50	yes, ditch
81-SC-018	19	1.88	watercourse	low	50	no div. potential
81-AR-017	4	0.30	ditch relief	low	50	yes, road
81-AR-019	9	0.94	watercourse	low	50	yes, road
81-AR-043	31	3.13	watercourse	low	50	yes, road
81-BC	4	0.40	watercourse	low	50	yes, road
81-M	197	19.65	ditch relief	low	50	yes, ditch
81-SB	11	0.84	watercourse	low	50	no div. potential
81-SB-022	3	0.26	watercourse	low	50	no div. potential
81-WG	30	2.96	watercourse	low	50	no div. potential
81-WG-033	5	0.50	watercourse	low	50	no div. potential
81-RC	3	0.27	watercourse	low	48	no div. potential
81-SB	19	1.73	watercourse	low	48	no div. potential
81-DC	15	1.45	watercourse	low	47	yes, road
81-MD	16	1.31	watercourse	low	47	no div. potential
81-SC	9	0.88	ditch relief	low	46	yes, ditch
81-BC-001	22	1.95	watercourse	low	46	no div. potential
81-MD	5	0.49	ditch relief	low	45	yes, road
81-AR	16	1.62	watercourse	low	45	no div. potential
81-AR-043-29	4	0.33	watercourse	low	45	no div. potential
81-BC-001	4	0.36	watercourse	low	45	yes, road
81-BC-023-05	4	0.40	watercourse	low	45	no div. potential
81-M-224	3	0.34	watercourse	low	45	no div. potential
81-WE	30	2.98	watercourse	low	45	no div. potential
81-WG-033	12	1.19	watercourse	low	45	no div. potential
81-IC-003	20	1.78	watercourse	low	45	no div. potential
81-IC-003	23	2.21	watercourse	low	45	no div. potential
81-AR-043	13	1.25	watercourse	low	44	no div. potential
81-BC-001	19	1.78	ditch relief	low	44	no div. potential
81-WG-008	31	3.12	watercourse	low	44	no div. potential
81-LG-016	17	1.56	ditch relief	low	41	no div. potential
81-SC	10	0.99	ditch relief	low	40	no div. potential
81-AR-003	1	0.13	ditch relief	low	40	yes, road
81-AR-043	28	2.83	watercourse	low	40	yes, road
81-BC-001	14	1.43	watercourse	low	40	no div. potential
81-BC-001	20	1.86	ditch relief	low	40	yes, road
81-BC-001-13	3	0.34	ditch relief	low	40	yes, road
81-SB	15	1.16	ditch relief	low	40	no div. potential
81-SB-022	4	0.26	watercourse	low	40	no div. potential
81-WE	31	3.09	ditch relief	low	40	yes, road
81-WG-033	11	1.10	watercourse	low	40	no div. potential
81-IC	2	0.38	watercourse	low	40	yes, ditch
81-BH	8	0.63	watercourse	low	39	yes, road
81-RW-004-12	3	0.20	watercourse	low	39	no div. potential
81-BH	11	0.89	watercourse	low	38	yes, road
81-RW-004	3	0.30	watercourse	low	37	no div. potential
81-RW-017	16	1.58	ditch relief	low	37	no div. potential
81-SB	3	0.29	watercourse	low	37	no div. potential
81-SC	4	0.37	ditch relief	low	37	yes, ditch
81-SC	29	2.85	ditch relief	low	37	no div. potential
81-BC	10	0.98	watercourse	low	37	no div. potential
81-BC-001	15	1.44	watercourse	low	37	no div. potential
81-BC-001	21	1.90	watercourse	low	37	no div. potential
81-BC-001	23	2.04	watercourse	low	37	no div. potential
81-JS	30	2.93	ditch relief	low	35	no div. potential
81-AR-039	2	0.17	watercourse	low	35	no div. potential
81-BC-001	25	2.16	watercourse	low	35	no div. potential
81-BC-001	26	2.18	watercourse	low	35	no div. potential
81-BC-001	27	2.20	ditch relief	low	35	yes, road
81-BC-001	29	2.29	watercourse	low	35	yes, road
81-BC-001	30	2.47	ditch relief	low	35	yes, road
81-SB	6	0.55	ditch relief	low	35	no div. potential
81-SB	21	1.88	ditch relief	low	35	no div. potential
81-WE	25	2.40	watercourse	low	35	no div. potential
81-M-289	7	0.73	ditch relief	low	34	no div. potential
81-SB	18	1.56	ditch relief	low	34	yes, road
81-BH	6	0.57	ditch relief	low	33	yes, ditch
81-DH	7	0.69	watercourse	low	33	no div. potential
81-BH	7	0.62	watercourse	low	31	no div. potential

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Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-M	262	26.16	ditch relief	low	30	yes, ditch
81-M	264	26.35	ditch relief	low	30	yes, ditch
81-M	266	26.51	ditch relief	low	30	yes, ditch
81-M	267	26.60	ditch relief	low	30	yes, ditch
81-M	269	26.72	ditch relief	low	30	yes, ditch
81-MD-005	9	0.84	ditch relief	low	30	yes, road
81-SC	11	1.10	ditch relief	low	30	yes, ditch
81-SC	21	2.12	watercourse	low	30	no div. potential
81-SC-009-04	3	0.30	ditch relief	low	30	yes, road
81-AR-019	10	0.99	ditch relief	low	30	no div. potential
81-M	189	18.89	ditch relief	low	30	yes, ditch
81-M	195	19.47	watercourse	low	30	yes, ditch
81-M	198	19.77	ditch relief	low	30	yes, ditch
81-M	210	21.00	ditch relief	low	30	yes, ditch
81-SB	24	2.15	ditch relief	low	30	yes, road
81-WE	10	1.03	watercourse	low	30	no div. potential
81-WG-008-05	20	1.89	watercourse	low	30	no div. potential
81-JS	10	0.96	ditch relief	low	29	yes, ditch
81-JS	14	1.35	ditch relief	low	29	no div. potential
81-JS	27	2.74	ditch relief	low	29	no div. potential
81-JS	29	2.86	ditch relief	low	29	no div. potential
81-LR-007	5	0.50	watercourse	low	29	no div. potential
81-M-289	5	0.50	watercourse	low	29	no div. potential
81-RW-004-12	6	0.57	watercourse	low	29	no div. potential
81-AR-043-05-01	9	0.88	watercourse	low	28	no div. potential
81-SC	28	2.68	ditch relief	low	27	no div. potential
81-AR-001-10	2	0.25	ditch relief	low	27	no div. potential
81-CC	13	1.16	ditch relief	low	26	yes, ditch
81-JS	16	1.56	ditch relief	low	26	no div. potential
81-M-284	3	0.25	ditch relief	low	26	yes, road
81-MD	4	0.38	ditch relief	low	25	yes, road
81-SB	35	3.21	ditch relief	low	25	no div. potential
81-AR	8	0.81	watercourse	low	25	no div. potential
81-M	214	21.33	ditch relief	low	25	yes, ditch
81-RC	24	2.35	watercourse	low	25	no div. potential
81-SB	5	0.48	watercourse	low	25	no div. potential
81-SB	9	0.74	watercourse	low	25	no div. potential
81-SB	37	3.32	ditch relief	low	25	no div. potential
81-WG	22	2.16	watercourse	low	25	no div. potential
81-IC-003	21	1.85	watercourse	low	25	no div. potential
81-BH-007	5	0.48	watercourse	low	24	no div. potential
81-AR-001	3	0.25	watercourse	low	24	no div. potential
81-SB	12	0.97	ditch relief	low	24	no div. potential
81-BH	5	0.50	ditch relief	low	22	yes, ditch
81-DH	3	0.25	ditch relief	low	22	no div. potential
81-DH	17	1.69	ditch relief	low	22	no div. potential
81-DH	27	2.72	ditch relief	low	22	no div. potential
81-DH	29	2.87	ditch relief	low	22	no div. potential
81-JS	2	0.18	watercourse	low	22	no div. potential
81-JS	24	2.42	ditch relief	low	22	no div. potential
81-JS	31	3.12	ditch relief	low	22	no div. potential
81-MD-005	14	1.43	ditch relief	low	22	no div. potential
81-SC	12	1.19	ditch relief	low	22	no div. potential
81-SC-022-14	7	0.66	ditch relief	low	22	no div. potential
81-SB	17	1.46	ditch relief	low	22	no div. potential
81-IC-003	24	2.31	watercourse	low	22	no div. potential
79-DC	1	0.01	ditch relief	low	20	no div. potential
81-M	297	29.68	ditch relief	low	20	yes, ditch
81-MD-005	12	1.21	ditch relief	low	20	yes, ditch
81-MD-005	13	1.29	ditch relief	low	20	no div. potential
81-MD-005	15	1.50	ditch relief	low	20	no div. potential
81-RW-002	1	0.01	ditch relief	low	20	no div. potential
81-SC	37	3.64	ditch relief	low	20	yes, road
81-AR-001	1	0.05	ditch relief	low	20	no div. potential
81-AR-001	10	1.04	ditch relief	low	20	yes, road
81-RC-056	21	2.08	watercourse	low	20	no div. potential
81-WG-008-05	10	0.96	watercourse	low	20	no div. potential
81-IC-003	25	2.34	watercourse	low	20	no div. potential
81-SC-009	8	0.78	ditch relief	low	19	no div. potential
81-BR-009	1	0.12	watercourse	low	18	no div. potential
81-LR-007	18	1.77	ditch relief	low	18	no div. potential
81-MD-005	3	0.27	ditch relief	low	18	no div. potential
81-PM	27	2.02	ditch relief	low	18	no div. potential
81-RW	1	0.09	ditch relief	low	18	no div. potential
81-RW-004	2	0.16	ditch relief	low	18	no div. potential
81-RW-021	23	2.32	watercourse	low	18	no div. potential
81-SC	2	0.24	ditch relief	low	18	no div. potential
81-IC-003	5	0.49	watercourse	low	18	no div. potential
81-RC	28	2.67	watercourse	low	18	no div. potential
81-SB	23	2.03	ditch relief	low	18	no div. potential
81-JS	9	0.80	ditch relief	low	17	no div. potential
81-JS	17	1.73	ditch relief	low	17	no div. potential
81-JS	21	2.09	ditch relief	low	17	no div. potential
81-MD	1	0.05	ditch relief	low	17	yes, ditch
81-SC-018	10	0.99	ditch relief	low	17	no div. potential

Navarro East Culverts

Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-BH	1	0.00	ditch relief	low	16	yes, ditch
81-AR-001	6	0.59	ditch relief	low	16	no div. potential
81-IC-003	6	0.50	watercourse	low	16	no div. potential
81-IC-003	8	0.63	watercourse	low	16	no div. potential
81-RC	4	0.31	watercourse	low	16	no div. potential
81-WE	36	3.56	ditch relief	low	16	yes, ditch
81-M	278	27.68	ditch relief	low	15	yes, ditch
81-PM	28	2.18	ditch relief	low	15	yes, ditch
81-AR	11	1.10	watercourse	low	15	no div. potential
81-AR-001	24	2.40	ditch relief	low	15	no div. potential
81-BC-001	24	2.09	ditch relief	low	15	no div. potential
81-SB	10	0.80	ditch relief	low	15	no div. potential
81-SB	32	2.85	ditch relief	low	15	no div. potential
81-IC-003	13	1.10	watercourse	low	15	no div. potential
81-IC-003	19	1.60	watercourse	low	15	no div. potential
81-SB	7	0.66	ditch relief	low	14	yes, ditch
81-SB	8	0.71	ditch relief	low	14	no div. potential
81-PM	26	1.84	ditch relief	low	13	no div. potential
81-PM	29	2.28	ditch relief	low	13	no div. potential
81-PM	30	2.48	ditch relief	low	13	no div. potential
81-PM	31	2.59	ditch relief	low	13	no div. potential
81-PM	32	2.65	ditch relief	low	13	no div. potential
81-RC	52	5.21	ditch relief	low	13	no div. potential
81-BH-018	3	0.22	watercourse	low	12	yes, road
81-RW-021	30	3.03	ditch relief	low	12	no div. potential
81-IC-003	10	0.80	watercourse	low	12	no div. potential
81-LR-007	14	1.36	ditch relief	low	11	no div. potential
81-M	290	27.98	ditch relief	low	11	yes, ditch
81-MD	15	1.25	ditch relief	low	11	no div. potential
81-AR-001	22	2.19	ditch relief	low	11	no div. potential
81-IC	15	1.53	ditch relief	low	11	no div. potential
81-PM	21	1.65	ditch relief	low	10	yes, road
81-PM	25	1.77	ditch relief	low	10	yes, ditch
81-RW-021	26	2.53	ditch relief	low	10	no div. potential
81-SB	4	0.39	watercourse	low	10	yes, ditch
81-PM	18	1.27	ditch relief	low	9	no div. potential
81-PM	20	1.45	ditch relief	low	8	no div. potential
81-RW	7	0.68	ditch relief	low	8	no div. potential
81-RW-021	21	2.15	watercourse	low	8	no div. potential
81-RW-021	27	2.57	ditch relief	low	8	no div. potential
81-RW	5	0.48	ditch relief	low	6	no div. potential
81-WG-008-05	19	1.85	watercourse	low	5	no div. potential
81-MD	12	1.11	ditch relief	low	4	yes, ditch
81-BH-018	11	1.05	ditch relief	low	3	yes, ditch
81-M-338	1	0.00	ditch relief	low	1	yes, road
81-BH	10	0.81	ditch relief	low	0	yes, road
81-BH	13	1.01	ditch relief	low	0	yes, road
81-BH	15	1.55	ditch relief	low	0	yes, road
81-BH-018	2	0.17	watercourse	low	0	yes, road
81-BH-018	5	0.51	ditch relief	low	0	yes, road
81-DH	2	0.14	ditch relief	low	0	yes, ditch
81-DH	19	1.91	watercourse	low	0	yes, ditch
81-JS	4	0.40	ditch relief	low	0	yes, ditch
81-JS	8	0.72	ditch relief	low	0	yes, ditch
81-JS	11	1.09	ditch relief	low	0	yes, ditch
81-JS	13	1.25	ditch relief	low	0	yes, ditch
81-LR-007	12	1.19	ditch relief	low	0	no div. potential
81-M	266	26.51	ditch relief	low	0	yes, ditch
81-MD	11	1.06	ditch relief	low	0	yes, road
81-MD	17	1.41	ditch relief	low	0	no div. potential
81-MD	18	1.64	ditch relief	low	0	yes, ditch
81-MD	19	1.76	ditch relief	low	0	yes, ditch
81-MD	21	1.88	ditch relief	low	0	no div. potential
81-MD	22	1.92	ditch relief	low	0	yes, ditch
81-MD	23	2.10	ditch relief	low	0	yes, ditch
81-MD	24	2.13	ditch relief	low	0	yes, ditch
81-MD	25	2.18	ditch relief	low	0	yes, road
81-MD	28	2.43	ditch relief	low	0	no div. potential
81-MD-007-06	4	0.43	ditch relief	low	0	yes, road
81-PM	17	1.24	ditch relief	low	0	yes, ditch
81-PM	19	1.39	ditch relief	low	0	yes, ditch
81-PM	21	1.65	ditch relief	low	0	no div. potential
81-RW-017	3	0.26	ditch relief	low	0	no div. potential
81-RW-017	5	0.47	watercourse	low	0	no div. potential
81-RW-017	6	0.63	watercourse	low	0	no div. potential
81-RW-021	5	0.47	watercourse	low	0	no div. potential
81-RW-021	7	0.67	ditch relief	low	0	no div. potential
81-RW-021	10	0.96	ditch relief	low	0	no div. potential
81-SC	6	0.56	ditch relief	low	0	yes, ditch
81-AR	3	0.32	ditch relief	low	0	no div. potential
81-AR	9	0.90	ditch relief	low	0	no div. potential
81-AR	14	1.37	ditch relief	low	0	no div. potential
81-AR	15	1.50	ditch relief	low	0	no div. potential
81-AR	17	1.74	ditch relief	low	0	no div. potential
81-AR	19	1.86	ditch relief	low	0	no div. potential

Navarro East Culverts

Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-AR	21	2.11	ditch relief	low	0	no div. potential
81-AR-001-10	1	0.04	watercourse	low	0	yes, road
81-AR-003	2	0.14	ditch relief	low	0	yes, road
81-AR-003	5	0.46	watercourse	low	0	yes, road
81-AR-043-05	11	1.11	ditch relief	low	0	yes, road
81-AR-043-05	15	1.51	ditch relief	low	0	no div. potential
81-IC-003	7	0.59	ditch relief	low	0	no div. potential
81-RC	1	0.13	ditch relief	low	0	no div. potential
81-RC	6	0.57	ditch relief	low	0	no div. potential
81-RC	8	0.78	ditch relief	low	0	no div. potential
81-RC	9	0.82	ditch relief	low	0	no div. potential
81-RC	11	1.12	ditch relief	low	0	no div. potential
81-RC	12	1.25	ditch relief	low	0	no div. potential
81-RC	16	1.61	ditch relief	low	0	no div. potential
81-RC	17	1.67	ditch relief	low	0	no div. potential
81-RC	20	1.98	ditch relief	low	0	no div. potential
81-RC	21	2.06	ditch relief	low	0	no div. potential
81-RC	22	2.16	ditch relief	low	0	no div. potential
81-RC	23	2.23	ditch relief	low	0	no div. potential
81-RC	25	2.41	ditch relief	low	0	no div. potential
81-RC	26	2.47	ditch relief	low	0	no div. potential
81-RC	27	2.59	ditch relief	low	0	no div. potential
81-RC	29	2.78	ditch relief	low	0	no div. potential
81-RC	30	2.89	ditch relief	low	0	no div. potential
81-AR-042	17	1.66	watercourse	low	0	no div. potential
81-IC-003	9	0.68	ditch relief	low	0	no div. potential
81-IC-003	11	0.86	ditch relief	low	0	no div. potential
81-IC-003	12	0.93	ditch relief	low	0	no div. potential
81-IC-003	14	1.11	ditch relief	low	0	no div. potential
81-IC-003	15	1.15	ditch relief	low	0	no div. potential
81-IC-003	16	1.29	ditch relief	low	0	no div. potential
81-IC-003	17	1.31	ditch relief	low	0	no div. potential
81-IC-003	18	1.37	ditch relief	low	0	no div. potential
81-IC-003	26	2.43	ditch relief	low	0	no div. potential
81-RC-059	13	1.26	watercourse	none	1422	no div. potential
81-RC-059	14	1.31	watercourse	none	711	no div. potential
81-RC-059	16	1.56	watercourse	none	592	no div. potential
81-LG-016	12	1.20	watercourse	none	561	no div. potential
81-LG-030-05	8	0.85	watercourse	none	546	yes, road
81-LG-030-05	11	1.12	watercourse	none	445	no div. potential
81-LG-030-05-02	1	0.08	watercourse	none	388	no div. potential
81-B-005-35	2	0.16	watercourse	none	333	no div. potential
81-JS-023	10	0.98	watercourse	none	104	no div. potential
81-LG-016	13	1.28	watercourse	none	89	no div. potential
81-LG-044-09	10	0.95	watercourse	none	59	no div. potential
81-LG-044-09	5	0.49	watercourse	none	58	no div. potential
81-LG-044-09	6	0.54	watercourse	none	57	no div. potential
81-RC	42	4.18	watercourse	none	55	no div. potential
81-CC	8	0.79	ditch relief	none	53	yes, ditch
81-M-252	5	0.53	watercourse	none	35	no div. potential
81-M-246-09	2	0.21	watercourse	none	30	no div. potential
81-M-246-09	4	0.45	watercourse	none	30	no div. potential
81-M-252	7	0.68	watercourse	none	30	no div. potential
81-M	245	24.39	ditch relief	none	24	no div. potential
81-M-252	8	0.73	watercourse	none	22	no div. potential
81-LG-044	4	0.43	watercourse	none	20	no div. potential
81-JS-023	17	1.73	watercourse	none	19	no div. potential
81-RC	53	5.24	ditch relief	none	6	no div. potential
81-BH	9	0.73	ditch relief	none	0	yes, road
81-BH	16	1.60	watercourse	none	0	yes, road
81-BH	19	1.93	watercourse	none	0	yes, road
81-M	208	20.83	ditch relief	undetermined	10	yes, ditch
81-RC-056-02	4	0.41	undetermined	undetermined	0	undetermined

Navarro East Crossings

Road Number	Site #	Mile Post	Crossing Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-FH-005	9	0.86	dipped	high	1300	no div. potential
81-SC-018-04	8	0.76	other	high	1254	yes, road
81-CC-025	7	0.67	other	high	1111	no div. potential
81-B-016	6	0.64	dipped	high	799	no div. potential
81-CC-019-03	1	0.00	dipped	high	711	no div. potential
81-RW-017	22	2.15	dipped	high	300	no div. potential
81-RC-050	1	0.02	bridge	high	290	no div. potential
81-CC-011-01	1	0.00	dipped	high	277	no div. potential
81-M-278	6	0.60	dipped	high	249	no div. potential
81-SC-018-04	5	0.50	other	high	200	no div. potential
81-RW-021	12	1.18	dipped	high	189	no div. potential
81-JS-008	1	0.05	other	high	166	no div. potential
81-M-278	7	0.66	dipped	high	148	no div. potential
81-M-250	5	0.47	dipped	high	133	no div. potential
81-JS-028	1	0.01	bridge	high	126	no div. potential
81-M-304	9	0.88	low water (temp)	high	124	no div. potential
81-SC	17	1.73	bridge	high	111	no div. potential
81-SC-018	1	0.03	bridge	high	100	no div. potential
81-B	17	1.68	bridge	high	66	no div. potential
81-SC-018-04-02	2	0.05	bridge	high	25	no div. potential
81-B	14	1.40	dipped	high	21	no div. potential
81-M-193	6	0.55	dipped	moderate	1182	no div. potential
81-RC-013-08-01	1	0.02	dipped	moderate	888	no div. potential
81-BR-028-05	3	0.22	dipped	moderate	510	no div. potential
81-RW-004	18	1.85	other	moderate	500	no div. potential
81-AR-042-05	2	0.23	other	moderate	400	no div. potential
81-MD-005	24	2.41	bridge	moderate	354	no div. potential
81-RC-056	1	0.08	other	moderate	350	no div. potential
81-RC-056	3	0.29	other	moderate	350	no div. potential
81-RC-056-02	1	0.04	other	moderate	350	no div. potential
81-FH-005	5	0.55	dipped	moderate	350	no div. potential
81-DC-044	8	0.76	dipped	moderate	345	no div. potential
81-RC-013	13	1.30	dipped	moderate	324	no div. potential
81-AR-003	10	0.99	other	moderate	320	yes, road
81-FH-005-06	1	0.09	dipped	moderate	250	no div. potential
81-RW-004	17	1.67	dipped	moderate	245	no div. potential
81-IC-014	2	0.20	dipped	moderate	238	yes, road
81-RC-013-10	1	0.00	dipped	moderate	237	no div. potential
81-CC	16	1.61	bridge	moderate	233	no div. potential
81-RC-003	10	0.97	dipped	moderate	222	no div. potential
81-AR-002	1	0.06	other	moderate	215	no div. potential
81-AR-042	22	2.16	other	moderate	210	already diverted
81-RW-004	14	1.42	dipped	moderate	185	no div. potential
81-RC	53	5.26	other	moderate	178	no div. potential
81-RC	40	3.99	dipped	moderate	177	no div. potential
81-AR-043	26	2.64	dipped	moderate	175	no div. potential
81-CC	14	1.38	dipped	moderate	162	no div. potential
81-RC-003	7	0.69	dipped	moderate	148	no div. potential
81-RC-056-02	2	0.25	dipped	moderate	140	no div. potential
81-B-016	4	0.35	dipped	moderate	129	no div. potential
81-JS	22	2.16	bridge	moderate	127	no div. potential
81-B-005-02	3	0.33	dipped	moderate	125	no div. potential
81-M-250	3	0.27	dipped	moderate	92	no div. potential
81-M-278	2	0.16	dipped	moderate	88	no div. potential
81-RC-051	5	0.47	dipped	moderate	87	no div. potential
81-JS-028	2	0.07	dipped	moderate	85	no div. potential
81-CC-024	8	0.82	dipped	moderate	80	no div. potential
81-DC	23	2.28	dipped	moderate	75	no div. potential
81-M-193	3	0.33	dipped	moderate	74	no div. potential
81-BR-009	14	1.44	dipped	moderate	71	no div. potential
81-RC-047	3	0.33	dipped	moderate	65	no div. potential
81-SC-018-04	14	1.42	dipped	moderate	65	no div. potential
81-RW-021	18	1.83	dipped	moderate	62	yes, road
81-CC-024	7	0.67	dipped	moderate	60	no div. potential
81-RW-021	24	2.37	dipped	moderate	52	yes, road
81-IC	25	2.55	dipped	moderate	50	yes, road
81-JS-026	1	0.01	bridge	moderate	50	no div. potential
81-SC-009	1	0.01	bridge	moderate	40	no div. potential
81-RW-002	8	0.82	dipped	moderate	22	no div. potential
81-WG-008-05	13	1.34	other	moderate	20	no div. potential
81-SC-018	10	1.05	dipped	moderate	17	no div. potential
81-M-202	21	2.10	dipped	moderate	15	no div. potential
81-B	11	1.12	dipped	moderate	14	no div. potential
81-LG-030-05	8	0.76	dipped	moderate	14	no div. potential
81-BR-029	6	0.65	dipped	moderate	11	no div. potential
81-RC-013-08	1	0.01	dipped	low	592	no div. potential
81-LG-016	15	1.48	other	low	389	no div. potential
81-JS-016-02	2	0.19	dipped	low	296	no div. potential
81-CC	21	2.07	dipped	low	266	no div. potential
81-DC	43	4.25	other	low	222	no div. potential
81-M-304	11	0.98	dipped	low	222	no div. potential
81-AR-001-10	2	0.21	other	low	220	yes, road
81-RC-007	2	0.24	dipped	low	220	no div. potential
81-RC-037	2	0.23	dipped	low	207	no div. potential
81-IC-022	5	0.30	other	low	200	already diverted
81-WG-008	19	1.95	other	low	200	no div. potential
81-CC-008	4	0.32	dipped	low	200	no div. potential
81-RC-013	3	0.27	humboldt	low	185	no div. potential
81-RC-045	3	0.27	dipped	low	185	no div. potential
81-WG-009-07	6	0.58	dipped	low	185	no div. potential
81-MD	1	0.11	bridge	low	181	no div. potential
81-CC-011	1	0.14	dipped	low	177	no div. potential
81-JS-023	10	0.98	dipped	low	167	no div. potential
81-JS-026	3	0.35	dipped	low	159	no div. potential
81-JS	15	1.53	bridge	low	156	no div. potential
81-DC	18	1.78	dipped	low	154	no div. potential
81-IC	10	0.96	dipped	low	150	no div. potential
81-RC-033	1	0.02	dipped	low	148	no div. potential
81-RC-047	4	0.38	dipped	low	148	no div. potential
81-CC-011-01	2	0.10	dipped	low	133	no div. potential
81-FH-005-06	3	0.34	dipped	low	130	no div. potential
81-WG-008	39	3.87	other	low	130	no div. potential
81-JS-028	4	0.42	dipped	low	128	no div. potential
81-SC-018-04	10	0.98	humboldt	low	125	no div. potential
81-IC	22	2.24	humboldt	low	120	no div. potential
81-JS-012	1	0.03	bridge	low	120	no div. potential
81-DC-044	11	1.08	dipped	low	118	no div. potential
81-AR-001	10	1.01	bridge	low	111	no div. potential
81-SC-044	1	0.12	dipped	low	111	no div. potential

Navarro East Crossings

Road Number	Site #	Mile Post	Crossing Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-AR-042	1	0.11	other	low	110	already diverted
81-FH-005	11	1.10	dipped	low	110	no div. potential
81-LG-016-06	4	0.44	humboldt	low	108	no div. potential
81-DC-021	2	0.17	other	low	108	no div. potential
81-JS-026-03	3	0.34	dipped	low	105	no div. potential
81-AR-042	3	0.29	other	low	100	yes, road
81-AR-042	5	0.54	other	low	100	already diverted
81-AR-042-30	2	0.17	dipped	low	100	no div. potential
81-IC	30	3.01	humboldt	low	100	no div. potential
81-SC-026-02	19	1.93	bridge	low	100	no div. potential
81-M-202	3	0.28	dipped	low	92	no div. potential
81-AR-042	27	2.68	other	low	90	no div. potential
81-IC-022	2	0.17	dipped	low	90	no div. potential
81-RC-056	12	1.23	other	low	90	no div. potential
81-SC-018-04	1	0.01	bridge	low	90	no div. potential
81-RC-013-10	2	0.17	dipped	low	88	no div. potential
81-RC-037-06	7	0.69	dipped	low	88	no div. potential
81-B-005	1	0.01	bridge	low	88	yes, road
81-M-202	2	0.17	dipped	low	88	no div. potential
81-LG-030-05	14	1.42	dipped	low	88	no div. potential
81-SC-018-04-03	1	0.01	dipped	low	88	no div. potential
81-M-304	10	0.93	dipped	low	88	no div. potential
81-AR-042	2	0.20	other	low	86	already diverted
81-M-194	2	0.12	dipped	low	84	no div. potential
81-RW-004	16	1.60	dipped	low	83	no div. potential
81-AR-042	23	2.18	other	low	80	no div. potential
81-M-243	4	0.42	bridge	low	80	no div. potential
81-LG-044-09	8	0.83	dipped	low	80	no div. potential
81-AR-042	24	2.40	dipped	low	75	no div. potential
81-M-194	1	0.06	dipped	low	75	no div. potential
81-SC-018-04	6	0.64	other	low	75	no div. potential
81-SC-044	3	0.29	dipped	low	75	no div. potential
81-IC	4	0.28	dipped	low	70	no div. potential
81-IC-014	3	0.32	dipped	low	70	no div. potential
81-AR-043-05	18	1.85	bridge	low	70	yes, road
81-SB-022	7	0.73	other	low	70	no div. potential
81-RC-045	5	0.52	other	low	68	no div. potential
81-SC-026-02	3	0.31	dipped	low	67	no div. potential
81-CC-016	1	0.12	humboldt	low	67	no div. potential
81-LG-044	14	1.41	dipped	low	66	no div. potential
81-WG	9	0.86	bridge	low	65	no div. potential
81-AR-001-10	7	0.63	bridge	low	62	no div. potential
81-BC	10	1.02	bridge	low	62	no div. potential
81-IC	3	0.26	dipped	low	62	yes, road
81-AR-042	20	2.04	dipped	low	60	no div. potential
81-AR-042	28	2.72	other	low	60	already diverted
81-AR-042-30	3	0.27	other	low	60	already diverted
81-IC	27	2.63	dipped	low	60	no div. potential
81-IC	32	2.88	other	low	60	already diverted
81-IC-022	3	0.28	dipped	low	60	no div. potential
81-FH-005-06	4	0.43	dipped	low	60	no div. potential
81-M-294	18	1.82	dipped	low	59	no div. potential
81-SC-022-14	10	1.00	other	low	59	no div. potential
81-BC	1	0.11	bridge	low	56	no div. potential
81-RC-013-08	2	0.07	dipped	low	55	no div. potential
81-RC-057	4	0.44	other	low	55	no div. potential
81-B	18	1.83	other	low	55	no div. potential
81-DC-044	10	1.02	dipped	low	55	no div. potential
81-RC-003	6	0.57	dipped	low	53	no div. potential
81-JS-016-02	1	0.03	dipped	low	53	no div. potential
81-PM-016	3	0.29	dipped	low	53	no div. potential
81-AR-042	4	0.44	other	low	50	no div. potential
81-AR-042-22	2	0.03	other	low	50	already diverted
81-AR-042-22	3	0.12	other	low	50	yes, road
81-IC-004	10	0.74	other	low	50	no div. potential
81-IC-022-02	1	0.03	dipped	low	50	no div. potential
81-WG-008	22	2.17	dipped	low	50	no div. potential
81-LG-044-09	2	0.24	dipped	low	50	no div. potential
81-M-284	6	0.64	dipped	low	50	no div. potential
81-BH-007	3	0.26	dipped	low	48	yes, road
81-AR-042	17	1.62	other	low	45	already diverted
81-B	13	1.27	other	low	44	no div. potential
81-BR-009	15	1.51	dipped	low	44	no div. potential
81-IC-014	1	0.14	dipped	low	43	yes, road
81-RC-059	1	0.02	dipped	low	41	no div. potential
81-IC	31	2.81	other	low	40	already diverted
81-IC-004	11	0.86	other	low	40	no div. potential
81-IC-014	6	0.59	dipped	low	40	no div. potential
81-IC-022	4	0.29	other	low	40	no div. potential
81-RC-056-03	1	0.14	other	low	40	no div. potential
81-M-247	1	0.10	bridge	low	40	no div. potential
81-FH-005	10	0.98	dipped	low	40	no div. potential
81-LG-044	16	1.62	dipped	low	40	no div. potential
81-LG-044	18	1.78	other	low	40	no div. potential
81-SC	2	0.18	bridge	low	40	no div. potential
81-JS-012-01	1	0.10	dipped	low	40	no div. potential
81-PM-016	1	0.06	humboldt	low	40	no div. potential
81-CC	22	2.11	dipped	low	40	no div. potential
81-CC-016-01	1	0.15	dipped	low	40	no div. potential
81-SC-018-04-02	3	0.08	dipped	low	37	no div. potential
81-CC-025-01	1	0.02	low water (temp)	low	36	no div. potential
81-DC-021	1	0.08	other	low	36	no div. potential
81-IC-004	7	0.62	other	low	35	no div. potential
81-AR-001-10	6	0.59	bridge	low	35	no div. potential
81-RC-037-06	8	0.76	dipped	low	35	no div. potential
81-BR-018-11	6	0.64	dipped	low	35	no div. potential
81-SC-026-02	14	1.36	dipped	low	35	no div. potential
81-BH-007	2	0.19	dipped	low	35	yes, road
81-AR-003	6	0.59	dipped	low	33	no div. potential
81-AR-019	2	0.21	dipped	low	33	no div. potential
81-JS	2	0.17	bridge	low	33	yes, ditch
81-CC-008	3	0.29	dipped	low	33	no div. potential
81-JS-026-01	3	0.33	dipped	low	32	no div. potential
81-BH-007	4	0.42	other	low	32	yes, road
81-AR-042	16	1.54	other	low	30	already diverted
81-IC	24	2.41	dipped	low	30	already diverted
81-IC	29	2.77	dipped	low	30	no div. potential
81-IC-010	1	0.06	other	low	30	already diverted
81-RC-045	6	0.58	dipped	low	30	no div. potential

Navarro East Crossings

Road Number	Site #	Mile Post	Crossing Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-B-005	7	0.68	dipped	low	30	no div. potential
81-BC-004	1	0.07	bridge	low	30	no div. potential
81-FH-013	5	0.43	dipped	low	30	no div. potential
81-WG	14	1.41	dipped	low	30	no div. potential
81-WG-008	11	1.10	dipped	low	30	no div. potential
81-WG-008	9	0.83	dipped	low	30	no div. potential
81-SC-042	8	0.76	dipped	low	30	no div. potential
81-JS-012-03	1	0.14	dipped	low	30	no div. potential
81-M-284	2	0.16	dipped	low	29	no div. potential
81-IC-014	5	0.48	dipped	low	28	no div. potential
81-LG-044-09	1	0.01	dipped	low	28	no div. potential
81-MD-005	21	2.08	dipped	low	26	no div. potential
81-IC-010	3	0.12	other	low	25	no div. potential
81-WG-008	8	0.79	dipped	low	25	no div. potential
81-SC-009-02	7	0.73	dipped	low	25	no div. potential
81-SC-009-04	1	0.11	dipped	low	25	no div. potential
81-LR-015-08	1	0.06	dipped	low	25	no div. potential
81-MD-005	22	2.13	dipped	low	24	no div. potential
81-RW-021	9	0.91	humboldt	low	24	no div. potential
81-JS-026-01	4	0.42	dipped	low	24	no div. potential
81-M-194	3	0.29	dipped	low	23	no div. potential
81-WG-008-05	3	0.29	bridge	low	23	no div. potential
81-AR-001	3	0.28	other	low	22	no div. potential
81-M-202	22	2.15	dipped	low	22	no div. potential
81-CC-019	1	0.00	dipped	low	22	no div. potential
81-AR-042	15	1.51	other	low	20	already diverted
81-AR-042-22	1	0.01	other	low	20	already diverted
81-IC	8	0.85	dipped	low	20	no div. potential
81-IC-004	8	0.68	other	low	20	already diverted
81-IC-004	9	0.72	dipped	low	20	no div. potential
81-IC-014	7	0.73	dipped	low	20	no div. potential
81-AR-003	1	0.12	dipped	low	20	no div. potential
81-AR-012	2	0.20	dipped	low	20	no div. potential
81-AR-017	6	0.58	dipped	low	20	no div. potential
81-AR-018	2	0.18	dipped	low	20	no div. potential
81-RC-047	1	0.14	dipped	low	20	no div. potential
81-BC-023	15	1.51	dipped	low	20	no div. potential
81-M-243	5	0.51	other	low	20	no div. potential
81-WG	2	0.22	bridge	low	20	no div. potential
81-WG-015	4	0.40	dipped	low	20	no div. potential
81-M-284	3	0.27	dipped	low	20	no div. potential
81-SC-021	1	0.09	dipped	low	20	no div. potential
81-SC-021	2	0.10	dipped	low	20	no div. potential
81-SC-026-02	15	1.52	dipped	low	20	no div. potential
81-SC-042	4	0.36	dipped	low	18	no div. potential
81-AR-001	9	0.88	other	low	17	no div. potential
81-SC-022-14	5	0.50	bridge	low	16	no div. potential
81-M-310	3	0.31	dipped	low	16	no div. potential
81-IC	15	1.51	dipped	low	15	no div. potential
81-IC	26	2.43	dipped	low	15	no div. potential
81-IC-010	2	0.10	other	low	15	already diverted
81-IC-018	1	0.05	dipped	low	15	yes, road
81-BC-012	2	0.24	dipped	low	15	no div. potential
81-BC-013	2	0.11	dipped	low	15	no div. potential
81-BC-013	3	0.16	dipped	low	15	no div. potential
81-M-251	1	0.06	dipped	low	15	no div. potential
81-FH-013	4	0.37	dipped	low	15	no div. potential
81-M-294-08	5	0.40	dipped	low	15	no div. potential
81-RC-051	6	0.50	dipped	low	14	no div. potential
81-M-294	19	1.91	dipped	low	14	no div. potential
81-M-294	21	2.14	dipped	low	14	no div. potential
81-SC-042	5	0.41	dipped	low	14	no div. potential
81-JS-026	15	1.49	dipped	low	14	no div. potential
81-BC-013	4	0.20	other	low	13	no div. potential
81-JS-026	11	1.06	dipped	low	13	no div. potential
81-BC-023	4	0.45	dipped	low	12	no div. potential
81-BR-028-05	2	0.16	dipped	low	12	no div. potential
81-CC	18	1.77	dipped	low	12	no div. potential
81-CC-019-06	13	1.28	dipped	low	12	no div. potential
81-AR-042	30	3.00	other	low	10	no div. potential
81-IC	11	1.05	dipped	low	10	no div. potential
81-IC	19	1.95	dipped	low	10	already diverted
81-IC	9	0.90	dipped	low	10	no div. potential
81-IC-004	6	0.55	humboldt	low	10	no div. potential
81-AR-019-16	1	0.04	dipped	low	10	no div. potential
81-BC	27	2.71	dipped	low	10	no div. potential
81-BC	28	2.83	dipped	low	10	no div. potential
81-BC-012	1	0.07	other	low	10	no div. potential
81-BC-023-05	5	0.50	dipped	low	10	no div. potential
81-BC-023-11	1	0.14	dipped	low	10	no div. potential
81-M-233	4	0.40	other	low	10	yes, road
81-WE-028	8	0.76	dipped	low	10	no div. potential
81-M-294	17	1.73	dipped	low	10	no div. potential
81-SC-018-04-02	1	0.02	dipped	low	10	no div. potential
81-M-294-08	2	0.16	dipped	low	10	no div. potential
81-CC-019-05	1	0.13	dipped	low	9	no div. potential
81-RC-019	5	0.48	dipped	low	8	no div. potential
81-CC-024	2	0.20	dipped	low	8	no div. potential
81-M-296	1	0.03	dipped	low	7	no div. potential
81-LG-030-03	5	0.53	dipped	low	6	no div. potential
81-LR-013	4	0.35	dipped	low	6	no div. potential
81-BC-011	4	0.44	dipped	low	5	no div. potential
81-BC-011	6	0.58	dipped	low	5	no div. potential
81-BC-011	8	0.80	dipped	low	5	no div. potential
81-BC-023	9	0.95	dipped	low	5	no div. potential
81-BC-023-05	4	0.43	dipped	low	5	no div. potential
81-BC-023-11	3	0.29	dipped	low	5	no div. potential
81-WE	11	1.06	dipped	low	5	no div. potential
81-WG-008-05	26	2.58	dipped	low	5	no div. potential
81-CC-019-06	3	0.34	dipped	low	5	no div. potential
81-SB-004	1	0.03	dipped	low	5	no div. potential
81-LG-030-05	3	0.25	dipped	low	4	no div. potential
81-RW-002	2	0.21	dipped	low	4	no div. potential
81-IC-004	1	0.04	dipped	low	3	no div. potential
81-WG-008-05	22	2.17	dipped	low	3	no div. potential
81-WG-008-05	23	2.19	dipped	low	3	no div. potential
81-RW-002	5	0.53	dipped	low	3	no div. potential
81-CC-019-06	6	0.59	dipped	low	2	no div. potential
81-CC-019-06	7	0.71	dipped	low	2	no div. potential

Navarro East Crossings

Road Number	Site #	Mile Post	Crossing Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
81-IC-004	2	0.17	dipped	low	1	already diverted
81-IC-004	4	0.37	dipped	low	1	no div. potential
81-MD-007	4	0.43	dipped	low	1	yes, road
81-IC	28	2.73	dipped	low	0	no div. potential
81-IC-004	5	0.44	dipped	low	0	no div. potential
81-AR-001	12	1.17	bridge	low	0	no div. potential
81-RC	14	1.39	bridge	low	0	no div. potential
81-RC	2	0.18	bridge	low	0	no div. potential
81-BC-013	1	0.02	dipped	low	0	no div. potential
81-M-233-05	1	0.01	other	low	0	no div. potential
81-FH-003	14	1.37	dipped	low	0	no div. potential
81-WG	10	0.99	low water (temp)	low	0	no div. potential
81-LG-044	11	1.06	dipped	low	0	no div. potential
81-M-294-08	3	0.27	dipped	low	0	no div. potential
81-M-294-08	4	0.29	dipped	low	0	no div. potential
81-RW-032	2	0.25	dipped	low	0	no div. potential
81-JS-012	2	0.20	dipped	low	0	no div. potential
81-M	297	29.67	bridge	low	0	no div. potential
81-PM-014	1	0.13	dipped	low	0	no div. potential
81-DC	26	2.59	dipped	low	0	no div. potential
81-FH-012	11	1.09	dipped	low	0	no div. potential
81-FH-012	5	0.51	dipped	low	0	no div. potential
81-LR-015	10	0.95	dipped	low	0	no div. potential
81-LR-015	8	0.76	dipped	low	0	no div. potential
81-LR-015	9	0.79	dipped	low	0	no div. potential
81-DH	17	1.67	bridge	none	226	no div. potential
81-DC-045	2	0.23	bridge	none	144	no div. potential
81-SB	1	0.11	bridge	none	118	no div. potential
81-WE-035-05	1	0.08	dipped	none	100	no div. potential
81-RW	2	0.21	bridge	none	66	no div. potential
81-BR-029	7	0.75	dipped	none	26	no div. potential
81-LG-044	4	0.39	dipped	none	18	no div. potential
81-CC	5	0.50	dipped	none	16	no div. potential
81-M-246-09	2	0.19	dipped	none	15	no div. potential
81-M-246-09	6	0.62	dipped	none	12	no div. potential
81-LG-044	1	0.12	dipped	none	12	no div. potential
81-LG-044	5	0.52	dipped	none	12	no div. potential
81-WG-008-05	14	1.35	other	none	10	no div. potential
81-BR-008	8	0.78	dipped	none	4	yes, road
81-BR-008	9	0.79	dipped	none	4	yes, road
81-BR-008	3	0.25	dipped	none	4	yes, road
81-BR-008	4	0.32	dipped	none	3	yes, road
81-BR-008	6	0.62	dipped	none	3	yes, road
81-CC-019-06	5	0.53	dipped	none	2	no div. potential
81-AR-042	26	2.60	low water (temp)	none	0	no div. potential
81-AR-001	6	0.56	bridge	none	0	no div. potential
81-AR-001	7	0.70	low water (temp)	none	0	no div. potential
81-M-243	1	0.05	low water (temp)	none	0	no div. potential
81-RC-008	2	0.16	low water (temp)	none	0	no div. potential
81-BV-129-15	4	0.35	dipped	none	0	no div. potential
81-BV-129-15	5	0.39	dipped	none	0	no div. potential
81-BV-129-15	6	0.41	dipped	none	0	no div. potential
81-WE-035-05	6	0.57	dipped	none	0	no div. potential
81-WE-035-05	8	0.81	low water (temp)	none	0	no div. potential
81-WG-008-05	33	3.28	low water (temp)	none	0	no div. potential
81-WG-033	14	1.42	dipped	none	0	no div. potential
81-SC-018-04	7	0.69	low water (temp)	none	0	no div. potential
81-SC-022-06	4	0.44	other	none	0	no div. potential
81-SC-022-06-01	1	0.02	other	none	0	no div. potential
81-SC-022-14	1	0.02	other	none	0	no div. potential
81-SC-027	1	0.02	low water (temp)	none	0	no div. potential
81-JS-026-03	1	0.01	dipped	none	0	no div. potential
81-BH	16	1.59	dipped	none	0	no div. potential
81-BH-018	4	0.40	dipped	none	0	no div. potential
81-M-327	2	0.18	low water (temp)	none	0	no div. potential
81-RC-057	1	0.11	undetermined	undetermined	0	undetermined

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-IC-022	7	0.70	high	10000
81-AR-017	9	0.89	high	1200
81-M-304-02	1	0.00	high	888
81-FH-003-12	5	0.49	high	700
81-CC-025	15	1.47	high	519
81-M-250	5	0.52	high	473
81-M-250	3	0.28	high	414
81-M-304	4	0.44	high	384
81-M-310	1	0.12	high	370
81-B-016	4	0.41	high	355
81-CC-025-02	1	0.13	high	296
81-M-278	7	0.75	high	222
81-M-304	9	0.89	high	222
81-SC-018-04-02	4	0.39	high	188
81-CC-019-03	1	0.02	high	144
81-B-005-20	2	0.17	high	111
81-B-016	1	0.02	high	88
81-B	14	1.41	high	14
81-AR-043-05-01	3	0.28	high	0
81-M-232	2	0.16	high	0
81-RC-003	4	0.37	moderate	1255
81-IC-014	8	0.77	moderate	800
81-WG-008	41	4.15	moderate	800
81-RC-051	4	0.40	moderate	740
81-RC-013-05	1	0.11	moderate	355
81-AR-043-05-02	4	0.32	moderate	350
81-AR-001-10	6	0.61	moderate	311
81-AR-043-05	8	0.76	moderate	297
81-BR-018-11	7	0.70	moderate	265
81-IC-022-02	1	0.08	moderate	250
81-CC-024	14	1.39	moderate	240
81-RC-013	13	1.34	moderate	237
81-RC-013-01	4	0.36	moderate	237
81-CC	8	0.84	moderate	231
81-RC-013-10	1	0.11	moderate	222
81-RW-004	17	1.66	moderate	177
81-SC-018	19	1.93	moderate	150
81-CC-019-03	2	0.19	moderate	133
81-CC-025-01	1	0.06	moderate	133
81-M-278	6	0.56	moderate	125
81-B	23	2.29	moderate	118
81-RC-013-05	3	0.32	moderate	118
81-M-260	5	0.49	moderate	111
81-M-278-06	2	0.22	moderate	88
81-JS-028	1	0.06	moderate	85
81-M-210	3	0.29	moderate	55
81-RW-017	7	0.71	moderate	50
81-JS-026	13	1.29	moderate	37
81-SC-018-05	2	0.23	moderate	30
81-M-260-06	2	0.17	moderate	25
81-B-017	2	0.16	moderate	18
81-RW-002	1	0.08	moderate	10
81-CC-011	1	0.13	low	1777
81-SC-009	3	0.25	low	1777
81-RC-035	2	0.22	low	740
81-MD-007-06	5	0.46	low	360
81-SC-018-04-03	3	0.31	low	324
81-JS-007	3	0.29	low	300
81-SB-039-09	3	0.30	low	300
81-SC-042	6	0.64	low	270
81-CC-011-03	1	0.10	low	237
81-JS-026-02	4	0.39	low	213
81-IC-010	1	0.02	low	200
81-CC	14	1.37	low	178
81-CC	11	1.07	low	177
81-IC-001	1	0.04	low	160
81-CC-011	5	0.51	low	151
81-AR-042-30	1	0.14	low	150
81-DC-022	2	0.19	low	148
81-SC-042	5	0.48	low	148
81-SC-042	2	0.16	low	140
81-LR-007-17	2	0.21	low	138
81-FH-003-12	7	0.71	low	120
81-SC-021	2	0.23	low	120
81-B	19	1.87	low	111
81-CC-025	7	0.68	low	111
81-CC-025	11	1.07	low	104
81-SC-009	7	0.65	low	93
81-SC	44	4.42	low	89
81-CC	16	1.58	low	88
81-M-294-07	3	0.34	low	83
81-SC-009-04	4	0.39	low	80
81-BR-018-17	3	0.26	low	74

Navarro East Landings

Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-MD-007-06	6	0.62	low	74
81-RW-004-12	4	0.44	low	74
81-RC-013-03	4	0.35	low	65
81-SC-026	2	0.17	low	65
81-AR-042-15	1	0.10	low	60
81-BC-011	7	0.66	low	60
81-IC-004	1	0.02	low	60
81-JS-012-01	5	0.44	low	60
81-MD-007-06	1	0.00	low	59
81-SB	9	0.92	low	56
81-LG-016-06	1	0.09	low	55
81-M	263	26.30	low	50
81-RW-004	12	1.16	low	50
81-WG-033	4	0.42	low	50
81-DC-021	1	0.01	low	46
81-SC-009	10	1.03	low	45
81-LR-021-04	1	0.08	low	44
81-M-304	1	0.03	low	44
81-LG-016-06	3	0.31	low	35
81-BH	22	2.25	low	30
81-CC-008	5	0.49	low	30
81-SC-018-04-01	1	0.02	low	30
81-CC-011	2	0.18	low	28
81-AR-043	30	3.03	low	26
81-B-005	1	0.06	low	25
81-BR-029	8	0.79	low	25
81-LG-012-01	1	0.14	low	25
81-LG-012-01	2	0.23	low	25
81-LG-012-01	4	0.40	low	25
81-LG-016-06-01	1	0.01	low	25
81-BH	12	1.17	low	24
81-AR-003	10	1.02	low	20
81-M-294-05	1	0.03	low	17
81-JS-007	2	0.19	low	15
81-JS-023-13	1	0.14	low	15
81-SC-022-14	1	0.15	low	15
81-SC-022-14	11	1.08	low	15
81-LR-015-08	1	0.08	low	12
81-AR-042	26	2.64	low	10
81-BC-001-11-01	1	0.05	low	10
81-FH-003-15	1	0.01	low	10
81-M-247	2	0.24	low	10
81-SC-009-02	1	0.13	low	10
81-SC-009-02	8	0.83	low	10
81-CC-005-01	1	0.09	low	6
81-RW-021	19	1.94	low	6
81-RC-019	3	0.29	low	5
81-SC-018	11	1.11	low	4
81-AR	11	1.14	low	0
81-AR	15	1.49	low	0
81-AR	24	2.36	low	0
81-AR	5	0.52	low	0
81-AR-001	15	1.46	low	0
81-AR-001	16	1.62	low	0
81-AR-001	18	1.77	low	0
81-AR-002	3	0.27	low	0
81-AR-003	7	0.70	low	0
81-AR-012	1	0.15	low	0
81-AR-019	17	1.74	low	0
81-AR-042-05	2	0.20	low	0
81-AR-042-30	6	0.58	low	0
81-AR-043	13	1.34	low	0
81-AR-043	21	2.06	low	0
81-AR-043-05-01	8	0.78	low	0
81-AR-043-29	2	0.18	low	0
81-AR-043-29	6	0.60	low	0
81-B	10	1.01	low	0
81-B	11	1.13	low	0
81-B-005	22	2.18	low	0
81-B-005	23	2.25	low	0
81-B-005	24	2.36	low	0
81-B-005	25	2.44	low	0
81-B-005	26	2.65	low	0
81-B-005	28	2.80	low	0
81-B-005	34	3.42	low	0
81-B-005	37	3.69	low	0
81-B-005	44	4.40	low	0
81-B-005-02	5	0.47	low	0
81-B-005-17	1	0.11	low	0
81-B-005-23	1	0.05	low	0
81-B-005-29	2	0.15	low	0
81-B-005-29	5	0.47	low	0
81-B-005-29-01	1	0.05	low	0

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-B-005-29-03	1	0.02	low	0
81-B-005-29-04	1	0.01	low	0
81-B-005-29-05	1	0.08	low	0
81-B-005-29-06	1	0.02	low	0
81-B-005-35	4	0.38	low	0
81-B-016	6	0.63	low	0
81-B-016-04	1	0.04	low	0
81-BC-001	14	1.38	low	0
81-BC-004	2	0.16	low	0
81-BC-004-04-03	2	0.17	low	0
81-BC-013	5	0.45	low	0
81-BC-023	1	0.15	low	0
81-BC-023	5	0.54	low	0
81-BH	11	1.06	low	0
81-BH	14	1.38	low	0
81-BH	15	1.41	low	0
81-BH	16	1.57	low	0
81-BH	17	1.72	low	0
81-BH	18	1.82	low	0
81-BH	19	1.95	low	0
81-BH	20	2.05	low	0
81-BH	24	2.38	low	0
81-BH	26	2.58	low	0
81-BH-018-02	2	0.16	low	0
81-BR	12	1.15	low	0
81-BR	13	1.35	low	0
81-BR	15	1.50	low	0
81-BR	18	1.84	low	0
81-BR	25	2.51	low	0
81-BR	28	2.83	low	0
81-BR	31	3.08	low	0
81-BR	32	3.18	low	0
81-BR	33	3.29	low	0
81-BR	35	3.52	low	0
81-BR	37	3.67	low	0
81-BR	40	3.99	low	0
81-BR-009	11	1.05	low	0
81-BR-009	13	1.26	low	0
81-BR-009	14	1.33	low	0
81-BR-009	15	1.47	low	0
81-BR-009	16	1.60	low	0
81-BR-009	6	0.60	low	0
81-BR-009	8	0.80	low	0
81-BR-009-04	2	0.18	low	0
81-BR-016	1	0.08	low	0
81-BR-018-07	2	0.18	low	0
81-BR-018-07	3	0.27	low	0
81-BR-018-07	5	0.50	low	0
81-BR-018-11	1	0.14	low	0
81-BR-018-11	3	0.32	low	0
81-BR-028	4	0.39	low	0
81-BR-028-05	1	0.12	low	0
81-BR-029	10	1.04	low	0
81-BR-029	3	0.30	low	0
81-BR-029	5	0.55	low	0
81-BR-029	9	0.85	low	0
81-BR-029-05	1	0.00	low	0
81-BR-029-05	2	0.10	low	0
81-BV-129-15	1	0.09	low	0
81-BV-129-15	2	0.14	low	0
81-BV-129-15	6	0.61	low	0
81-CC-004	1	0.08	low	0
81-CC-005	2	0.17	low	0
81-CC-008	3	0.30	low	0
81-CC-008	4	0.36	low	0
81-CC-019	12	1.21	low	0
81-CC-019	15	1.50	low	0
81-CC-019	17	1.72	low	0
81-CC-019	6	0.56	low	0
81-CC-019-05	1	0.05	low	0
81-CC-019-06	10	1.00	low	0
81-CC-019-06	12	1.21	low	0
81-CC-019-06	13	1.34	low	0
81-CC-019-06	2	0.15	low	0
81-CC-019-06	3	0.33	low	0
81-CC-019-06	5	0.49	low	0
81-CC-019-06	6	0.62	low	0
81-CC-019-06	8	0.83	low	0
81-DC	35	3.53	low	0
81-DC	38	3.76	low	0
81-DC-018	17	1.74	low	0
81-DC-044	7	0.72	low	0
81-DC-044	8	0.80	low	0

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-FH-003	10	0.99	low	0
81-FH-012	2	0.16	low	0
81-FH-012	8	0.81	low	0
81-FH-012	9	0.94	low	0
81-FH-013	3	0.27	low	0
81-FH-013-14	4	0.36	low	0
81-FH-014	16	1.60	low	0
81-IC	1	0.10	low	0
81-IC-003	10	1.02	low	0
81-IC-003	14	1.41	low	0
81-IC-003	16	1.61	low	0
81-IC-003	20	1.95	low	0
81-IC-003	6	0.56	low	0
81-IC-003	7	0.66	low	0
81-IC-004	2	0.17	low	0
81-IC-004	4	0.38	low	0
81-IC-022	1	0.10	low	0
81-JS-012-01	1	0.05	low	0
81-JS-012-01	4	0.35	low	0
81-JS-012-01-01	2	0.18	low	0
81-JS-023	17	1.67	low	0
81-JS-023	19	1.90	low	0
81-JS-023-05-01	1	0.15	low	0
81-JS-023-08	7	0.73	low	0
81-JS-026	14	1.33	low	0
81-JS-026	15	1.46	low	0
81-JS-026	17	1.74	low	0
81-JS-028	6	0.60	low	0
81-JS-028-05	1	0.03	low	0
CR-M212	49	4.93	low	0
CR-M212	62	6.19	low	0
81-LG-006	5	0.50	low	0
81-LG-008	11	1.07	low	0
81-LG-008-08	2	0.24	low	0
81-LG-008-08	4	0.38	low	0
81-LG-016	27	2.67	low	0
81-LG-016-24	1	0.08	low	0
81-LG-036	2	0.16	low	0
81-LG-036-02	1	0.02	low	0
81-LG-038	1	0.08	low	0
81-LG-038	3	0.31	low	0
81-LG-038	5	0.45	low	0
81-LG-042	1	0.05	low	0
81-LG-044	11	1.06	low	0
81-LG-044	14	1.44	low	0
81-LG-044	16	1.62	low	0
81-LG-044	18	1.81	low	0
81-LG-044	3	0.25	low	0
81-LG-044	6	0.61	low	0
81-LG-044	9	0.86	low	0
81-LG-044-09	11	1.05	low	0
81-LG-044-09	12	1.12	low	0
81-LG-044-09	4	0.44	low	0
81-LG-044-09	6	0.56	low	0
81-LG-044-09	8	0.77	low	0
81-LG-044-09	9	0.92	low	0
81-LG-044-09-01	1	0.01	low	0
81-LG-044-09-01	2	0.25	low	0
81-LG-044-09-02	1	0.07	low	0
81-LG-044-12	1	0.04	low	0
81-LG-044-14	1	0.04	low	0
81-LG-046	1	0.01	low	0
81-LG-048	1	0.02	low	0
81-LG-050	2	0.16	low	0
81-LG-054	1	0.03	low	0
81-LG-056	1	0.09	low	0
81-LG-070	11	1.07	low	0
81-LG-070	17	1.75	low	0
81-LG-070	3	0.34	low	0
81-LG-070	4	0.44	low	0
81-LG-070	6	0.65	low	0
81-LG-070	8	0.76	low	0
81-LG-070-05	2	0.19	low	0
81-LG-070-09	2	0.20	low	0
81-LR-002	1	0.02	low	0
81-LR-007	18	1.81	low	0
81-LR-007	21	2.06	low	0
81-LR-007	22	2.18	low	0
81-LR-007	23	2.35	low	0
81-LR-011	1	0.12	low	0
81-LR-011	2	0.19	low	0
81-LR-013	4	0.38	low	0
81-LR-014	1	0.10	low	0

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-LR-015	10	0.99	low	0
81-LR-015	11	1.02	low	0
81-LR-015	4	0.41	low	0
81-LR-015	6	0.55	low	0
81-LR-022	2	0.18	low	0
81-M	187	18.72	low	0
81-M	265	26.46	low	0
81-M-193	2	0.23	low	0
81-M-193	4	0.38	low	0
81-M-193	5	0.54	low	0
81-M-202	5	0.50	low	0
81-M-224	6	0.64	low	0
81-M-232	3	0.32	low	0
81-M-236	1	0.05	low	0
81-M-240	1	0.09	low	0
81-M-240	3	0.26	low	0
81-M-243	2	0.18	low	0
81-M-243	4	0.37	low	0
81-M-243	5	0.43	low	0
81-M-246	12	1.24	low	0
81-M-246-09	1	0.05	low	0
81-M-246-09	3	0.27	low	0
81-M-246-09	4	0.28	low	0
81-M-246-09	5	0.43	low	0
81-M-246-09	7	0.70	low	0
81-M-246-09	8	0.71	low	0
81-M-248	1	0.03	low	0
81-M-250	1	0.01	low	0
81-M-250	2	0.17	low	0
81-M-252	1	0.04	low	0
81-M-252	2	0.22	low	0
81-M-252	4	0.43	low	0
81-M-252	6	0.58	low	0
81-M-252	8	0.76	low	0
81-M-252	9	0.94	low	0
81-M-252-02	2	0.18	low	0
81-M-253	1	0.15	low	0
81-M-260	2	0.23	low	0
81-M-260	8	0.81	low	0
81-M-262	1	0.07	low	0
81-M-278	2	0.23	low	0
81-M-280	1	0.04	low	0
81-M-294	13	1.31	low	0
81-M-294	14	1.38	low	0
81-M-294	18	1.68	low	0
81-M-294	8	0.77	low	0
81-M-294-07-01	1	0.04	low	0
81-M-294-08	11	0.89	low	0
81-M-294-08	12	0.94	low	0
81-M-294-08	6	0.56	low	0
81-M-294-08	7	0.64	low	0
81-M-294-08	8	0.76	low	0
81-M-304-02	4	0.36	low	0
81-PM	16	1.59	low	0
81-RC	10	0.97	low	0
81-RC	2	0.25	low	0
81-RC	24	2.38	low	0
81-RC	33	3.25	low	0
81-RC	34	3.36	low	0
81-RC	35	3.51	low	0
81-RC	38	3.76	low	0
81-RC	41	4.09	low	0
81-RC	49	4.91	low	0
81-RC	50	5.00	low	0
81-RC	53	5.32	low	0
81-RC	7	0.72	low	0
81-RC-003	10	0.99	low	0
81-RC-003	5	0.44	low	0
81-RC-003	8	0.80	low	0
81-RC-013	12	1.16	low	0
81-RC-013	15	1.49	low	0
81-RC-013	6	0.63	low	0
81-RC-013	8	0.82	low	0
81-RC-013-08	2	0.17	low	0
81-RC-013-08	4	0.41	low	0
81-RC-013-08-01	1	0.05	low	0
81-RC-013-10	2	0.22	low	0
81-RC-015	1	0.10	low	0
81-RC-015	10	0.97	low	0
81-RC-015	12	1.19	low	0
81-RC-015	2	0.17	low	0
81-RC-015	5	0.49	low	0
81-RC-015	7	0.71	low	0

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-RC-015	8	0.82	low	0
81-RC-019	6	0.64	low	0
81-RC-035	1	0.09	low	0
81-RC-037	3	0.30	low	0
81-RC-037	7	0.75	low	0
81-RC-037	9	0.90	low	0
81-RC-037-06	1	0.00	low	0
81-RC-037-06	2	0.24	low	0
81-RC-037-06	5	0.51	low	0
81-RC-037-06	6	0.64	low	0
81-RC-037-06	8	0.84	low	0
81-RC-045	4	0.40	low	0
81-RC-045	6	0.64	low	0
81-RC-047	4	0.37	low	0
81-RC-048	1	0.02	low	0
81-RC-049	1	0.07	low	0
81-RC-050-01	1	0.02	low	0
81-RC-056-13	1	0.02	low	0
81-RC-056-13	2	0.14	low	0
81-RC-057	2	0.23	low	0
81-RW	11	1.05	low	0
81-RW	12	1.13	low	0
81-RW	13	1.24	low	0
81-RW	14	1.41	low	0
81-RW	19	1.86	low	0
81-RW	20	2.01	low	0
81-RW	22	2.24	low	0
81-RW	24	2.36	low	0
81-RW	25	2.54	low	0
81-RW	27	2.74	low	0
81-RW	5	0.50	low	0
81-RW	9	0.89	low	0
81-RW-002	5	0.52	low	0
81-RW-002	8	0.83	low	0
81-RW-004	1	0.02	low	0
81-RW-004	10	1.03	low	0
81-RW-004	2	0.14	low	0
81-RW-004	5	0.50	low	0
81-RW-004	6	0.63	low	0
81-RW-004	8	0.77	low	0
81-RW-004	9	0.90	low	0
81-RW-004-12	1	0.15	low	0
81-RW-004-12	2	0.23	low	0
81-RW-004-12	7	0.67	low	0
81-RW-007	1	0.05	low	0
81-RW-017	1	0.00	low	0
81-RW-021	14	1.45	low	0
81-RW-021	22	2.23	low	0
81-RW-021	24	2.40	low	0
81-RW-021	25	2.51	low	0
81-RW-021	27	2.73	low	0
81-RW-021-14	2	0.16	low	0
81-RW-022	3	0.26	low	0
81-RW-032	1	0.01	low	0
81-RW-032	2	0.07	low	0
81-RW-032	7	0.69	low	0
81-SB-032	1	0.05	low	0
81-SB-032	2	0.23	low	0
81-SB-039	13	1.33	low	0
81-SB-039	14	1.38	low	0
81-SC	43	4.27	low	0
81-SC-018	10	1.05	low	0
81-SC-018	16	1.60	low	0
81-SC-018	17	1.70	low	0
81-SC-018	18	1.77	low	0
81-SC-018	21	2.09	low	0
81-SC-018	5	0.49	low	0
81-SC-018	8	0.82	low	0
81-SC-018-01	10	0.96	low	0
81-SC-018-04	10	0.99	low	0
81-SC-018-04	8	0.79	low	0
81-SC-018-04-02	1	0.07	low	0
81-SC-022-06	6	0.56	low	0
81-SC-037	1	0.12	low	0
81-SC-037	5	0.49	low	0
81-SC-037	7	0.72	low	0
81-SC-037	9	0.85	low	0
81-SC-038	1	0.07	low	0
81-SC-039	3	0.28	low	0
81-SC-039	4	0.41	low	0
81-SC-042	11	1.11	low	0
81-SC-043	1	0.07	low	0
81-SC-044	4	0.42	low	0

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-SC-044	6	0.62	low	0
81-WE	24	2.37	low	0
81-WE	25	2.52	low	0
81-WE	28	2.82	low	0
81-WG	23	2.27	low	0
81-WG	27	2.71	low	0
81-WG	28	2.82	low	0
81-WG	31	3.12	low	0
81-WG-008	22	2.19	low	0
81-WG-008	8	0.76	low	0
81-WG-008-05	25	2.54	low	0
81-WG-009	15	1.52	low	0
81-WG-009	18	1.75	low	0
81-WG-009	19	1.93	low	0
81-WG-009	7	0.65	low	0
81-WG-009-04	1	0.05	low	0
81-WG-009-07-01	1	0.01	low	0
81-WG-009-12	3	0.28	low	0
81-WG-009-13	2	0.19	low	0
81-WG-009-18	3	0.34	low	0
81-WG-012	4	0.36	low	0
81-WG-033	5	0.51	low	0
81-DC	42	4.17	none	50
81-DC	44	4.39	none	50
81-M-284	4	0.42	none	20
81-BC-001	21	2.12	none	10
81-AR	32	3.24	none	0
81-AR	36	3.63	none	0
81-AR	41	4.10	none	0
81-AR	50	5.03	none	0
81-AR	56	5.56	none	0
81-AR	67	6.68	none	0
81-AR-001	8	0.82	none	0
81-AR-001-06	3	0.31	none	0
81-AR-001-10	4	0.36	none	0
81-AR-003	4	0.42	none	0
81-AR-012	2	0.23	none	0
81-AR-012	3	0.34	none	0
81-AR-012	5	0.49	none	0
81-AR-014	1	0.07	none	0
81-AR-017	2	0.21	none	0
81-AR-017	4	0.43	none	0
81-AR-017	6	0.61	none	0
81-AR-018	1	0.07	none	0
81-AR-018	4	0.38	none	0
81-AR-019	11	1.14	none	0
81-AR-019	13	1.32	none	0
81-AR-019	2	0.15	none	0
81-AR-019	7	0.73	none	0
81-AR-019-05	1	0.12	none	0
81-AR-019-16	1	0.11	none	0
81-AR-039	1	0.14	none	0
81-AR-041	1	0.05	none	0
81-AR-042	21	2.09	none	0
81-AR-043	11	1.09	none	0
81-AR-043	17	1.73	none	0
81-AR-043	19	1.94	none	0
81-AR-043	2	0.20	none	0
81-AR-043	23	2.26	none	0
81-AR-043	24	2.44	none	0
81-AR-043	4	0.38	none	0
81-AR-043	7	0.71	none	0
81-AR-043	8	0.84	none	0
81-AR-043-03	3	0.29	none	0
81-AR-043-03	4	0.39	none	0
81-AR-043-03-01	1	0.09	none	0
81-AR-043-05	13	1.28	none	0
81-AR-043-05	14	1.41	none	0
81-AR-043-05	17	1.70	none	0
81-AR-043-05	18	1.83	none	0
81-AR-043-05	6	0.59	none	0
81-AR-043-05-01	10	1.00	none	0
81-AR-043-05-01	12	1.24	none	0
81-AR-043-05-01	14	1.38	none	0
81-AR-043-05-01	5	0.51	none	0
81-AR-043-05-02	1	0.07	none	0
81-AR-043-05-02	2	0.16	none	0
81-AR-043-05-02	3	0.20	none	0
81-AR-043-05-03	2	0.23	none	0
81-AR-043-05-03	4	0.37	none	0
81-AR-043-05-03	5	0.49	none	0
81-AR-043-13	1	0.05	none	0
81-AR-043-29	3	0.35	none	0

Navarro East Landings

Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-AR-043-32	1	0.09	none	0
81-AR-043-32-01	1	0.03	none	0
81-AR-054	6	0.60	none	0
81-AR-065	3	0.25	none	0
81-AR-065	4	0.45	none	0
81-B-002	10	1.02	none	0
81-B-002	11	1.11	none	0
81-B-002	8	0.77	none	0
81-B-005	14	1.37	none	0
81-B-005	3	0.28	none	0
81-B-005	4	0.43	none	0
81-B-005	6	0.59	none	0
81-B-005	8	0.77	none	0
81-B-005	9	0.88	none	0
81-B-005-01	1	0.14	none	0
81-B-005-01	3	0.29	none	0
81-B-005-14	2	0.16	none	0
81-B-005-15	3	0.33	none	0
81-B-005-18	1	0.07	none	0
81-B-005-18	3	0.27	none	0
81-B-005-18	4	0.34	none	0
81-B-005-18	5	0.47	none	0
81-B-005-18	6	0.63	none	0
81-B-005-20	1	0.01	none	0
81-B-005-20	4	0.39	none	0
81-B-005-20	5	0.46	none	0
81-BC	14	1.36	none	0
81-BC	22	2.16	none	0
81-BC	25	2.50	none	0
81-BC	5	0.51	none	0
81-BC	7	0.75	none	0
81-BC-001	1	0.08	none	0
81-BC-001	11	1.10	none	0
81-BC-001	17	1.70	none	0
81-BC-001	25	2.45	none	0
81-BC-001	6	0.58	none	0
81-BC-001	8	0.76	none	0
81-BC-001	9	0.86	none	0
81-BC-001-07	3	0.32	none	0
81-BC-001-11	5	0.54	none	0
81-BC-001-11-02	1	0.05	none	0
81-BC-001-11-02	2	0.11	none	0
81-BC-001-13	4	0.37	none	0
81-BC-001-18	1	0.07	none	0
81-BC-004-04	10	0.99	none	0
81-BC-011	11	1.14	none	0
81-BC-011	15	1.50	none	0
81-BC-011	3	0.27	none	0
81-BC-011-01	2	0.20	none	0
81-BC-011-01	4	0.44	none	0
81-BC-012	1	0.02	none	0
81-BC-012	3	0.28	none	0
81-BC-013	3	0.25	none	0
81-BC-023	13	1.35	none	0
81-BC-023	16	1.58	none	0
81-BC-023	8	0.84	none	0
81-BC-023-05	1	0.01	none	0
81-BC-023-05	3	0.31	none	0
81-BC-023-05	6	0.56	none	0
81-BC-023-11	1	0.04	none	0
81-BC-023-11	2	0.24	none	0
81-BC-023-11	4	0.40	none	0
81-BC-023-14	2	0.19	none	0
81-BC-029	2	0.17	none	0
81-BH	7	0.70	none	0
81-BH	9	0.87	none	0
81-BH-014	2	0.19	none	0
81-BH-018	2	0.24	none	0
81-BH-018	4	0.37	none	0
81-BH-018	6	0.59	none	0
81-BH-018	7	0.73	none	0
81-BH-018	8	0.79	none	0
81-BH-018-02	4	0.36	none	0
81-BH-018-05	1	0.04	none	0
81-BR	2	0.17	none	0
81-BR	24	2.36	none	0
81-BR	4	0.38	none	0
81-BR	6	0.55	none	0
81-BR	7	0.75	none	0
81-BR-008	2	0.18	none	0
81-BR-008	4	0.43	none	0
81-BR-008	8	0.80	none	0
81-BR-009	2	0.15	none	0

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-BR-009	3	0.31	none	0
81-BR-009	5	0.47	none	0
81-BR-018	10	1.02	none	0
81-BR-018	16	1.60	none	0
81-BR-018	3	0.26	none	0
81-BR-018	4	0.38	none	0
81-BR-018	6	0.63	none	0
81-BR-018	8	0.75	none	0
81-BR-018	9	0.94	none	0
81-BR-024	2	0.23	none	0
81-BR-024	3	0.34	none	0
81-BR-024	4	0.41	none	0
81-BR-026	2	0.16	none	0
81-BR-028	7	0.66	none	0
81-BR-028	8	0.82	none	0
81-BR-032	1	0.13	none	0
81-BR-036	4	0.38	none	0
81-BR-036	5	0.53	none	0
81-BR-036	7	0.66	none	0
81-BR-036-01	1	0.02	none	0
81-BR-036-02	2	0.19	none	0
81-BR-036-02	4	0.44	none	0
81-BR-036-04	1	0.09	none	0
81-BV-129-11	4	0.38	none	0
81-BV-129-15	4	0.43	none	0
81-CC	1	0.05	none	0
81-CC	21	2.09	none	0
81-CC	24	2.36	none	0
81-CC-001	1	0.04	none	0
81-CC-005	1	0.01	none	0
81-CC-011	10	1.02	none	0
81-CC-011	8	0.84	none	0
81-CC-012	3	0.31	none	0
81-CC-012	4	0.41	none	0
81-CC-012	6	0.58	none	0
81-CC-016	1	0.09	none	0
81-CC-016	2	0.21	none	0
81-CC-016	4	0.36	none	0
81-CC-016-01	1	0.12	none	0
81-CC-016-01	2	0.19	none	0
81-CC-019	10	1.00	none	0
81-CC-019	13	1.33	none	0
81-CC-019	19	1.85	none	0
81-CC-019-05	2	0.22	none	0
81-CC-019-05	4	0.39	none	0
81-CC-019-06	1	0.03	none	0
81-CC-019-06-01	1	0.07	none	0
81-CC-024	12	1.17	none	0
81-CC-024	16	1.64	none	0
81-CC-024	2	0.19	none	0
81-CC-025	6	0.58	none	0
81-CC-025-04	1	0.06	none	0
81-CU-182-03	15	1.45	none	0
81-CU-182-05	2	0.06	none	0
81-CU-182-05	3	0.13	none	0
81-CU-182-05	6	0.56	none	0
81-CU-216	1	0.09	none	0
81-DC	11	1.08	none	0
81-DC	13	1.27	none	0
81-DC	15	1.53	none	0
81-DC	19	1.93	none	0
81-DC	2	0.16	none	0
81-DC	28	2.75	none	0
81-DC	29	2.87	none	0
81-DC	31	3.07	none	0
81-DC	32	3.24	none	0
81-DC	4	0.40	none	0
81-DC	5	0.50	none	0
81-DC	7	0.71	none	0
81-DC-018	1	0.03	none	0
81-DC-018	12	1.21	none	0
81-DC-018	3	0.35	none	0
81-DC-018	6	0.60	none	0
81-DC-019	1	0.03	none	0
81-DC-021	2	0.12	none	0
81-DC-021	3	0.23	none	0
81-DC-044	10	0.97	none	0
81-DC-044	12	1.23	none	0
81-DC-044	2	0.17	none	0
81-DC-044	5	0.50	none	0
81-FH	3	0.27	none	0
81-FH	5	0.47	none	0
81-FH	6	0.62	none	0

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-FH	9	0.86	none	0
81-FH-003	1	0.08	none	0
81-FH-003	5	0.51	none	0
81-FH-003-13	1	0.00	none	0
81-FH-005	3	0.28	none	0
81-FH-005	5	0.55	none	0
81-FH-005-06	2	0.17	none	0
81-FH-005-06	5	0.52	none	0
81-FH-012	1	0.09	none	0
81-FH-012	11	1.13	none	0
81-FH-012	5	0.55	none	0
81-FH-012-02	3	0.26	none	0
81-FH-013	1	0.10	none	0
81-FH-013	11	1.14	none	0
81-FH-013	14	1.37	none	0
81-FH-013	5	0.48	none	0
81-FH-013-09	1	0.01	none	0
81-FH-013-09	2	0.10	none	0
81-FH-014	19	1.89	none	0
81-FH-015	1	0.08	none	0
81-FH-015	2	0.17	none	0
81-FH-015-02	1	0.05	none	0
81-FH-015-04	1	0.05	none	0
81-FH-015-06	1	0.09	none	0
81-IC	13	1.25	none	0
81-IC	14	1.44	none	0
81-IC	9	0.90	none	0
81-IC-003	25	2.49	none	0
81-IC-014	4	0.37	none	0
81-IC-018	1	0.12	none	0
81-JS-001	3	0.28	none	0
81-JS-001	4	0.44	none	0
81-JS-006	1	0.01	none	0
81-JS-006	2	0.17	none	0
81-JS-008	2	0.17	none	0
81-JS-012	2	0.17	none	0
81-JS-012-03	1	0.05	none	0
81-JS-012-03	2	0.16	none	0
81-JS-013	1	0.10	none	0
81-JS-015	1	0.10	none	0
81-JS-015	3	0.33	none	0
81-JS-015	5	0.50	none	0
81-JS-015	6	0.58	none	0
81-JS-015	7	0.70	none	0
81-JS-015-01	4	0.42	none	0
81-JS-015-01	5	0.50	none	0
81-JS-016	2	0.19	none	0
81-JS-016-02	1	0.02	none	0
81-JS-016-02	2	0.19	none	0
81-JS-023	12	1.20	none	0
81-JS-023	13	1.31	none	0
81-JS-023	7	0.69	none	0
81-JS-023	8	0.83	none	0
81-JS-023-05	1	0.01	none	0
81-JS-023-05-01	2	0.25	none	0
81-JS-023-05-02	1	0.11	none	0
81-JS-023-05-02	3	0.26	none	0
81-JS-023-08	3	0.28	none	0
81-JS-023-08	5	0.49	none	0
81-JS-023-08-01	1	0.04	none	0
81-JS-023-08-03	1	0.04	none	0
81-JS-023-15	2	0.21	none	0
81-JS-026	7	0.68	none	0
81-JS-026	9	0.85	none	0
81-JS-026-01	1	0.14	none	0
81-JS-026-02	1	0.02	none	0
81-JS-026-02	2	0.22	none	0
81-JS-026-03	3	0.26	none	0
81-JS-026-03	6	0.56	none	0
81-JS-026-03-01	1	0.07	none	0
81-JS-026-15	1	0.07	none	0
81-JS-028	9	0.92	none	0
CR-M212	68	6.76	none	0
CR-M212	71	7.11	none	0
81-LG-004	4	0.35	none	0
81-LG-004	5	0.44	none	0
81-LG-006	3	0.31	none	0
81-LG-006	7	0.67	none	0
81-LG-006	8	0.74	none	0
81-LG-006-04	1	0.12	none	0
81-LG-006-04-01	1	0.02	none	0
81-LG-006-05	1	0.00	none	0
81-LG-006-05	2	0.18	none	0

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-LG-008	1	0.09	none	0
81-LG-008	2	0.22	none	0
81-LG-008	6	0.60	none	0
81-LG-008	7	0.73	none	0
81-LG-008	8	0.83	none	0
81-LG-008	9	0.93	none	0
81-LG-008-06	1	0.11	none	0
81-LG-016	16	1.63	none	0
81-LG-016	19	1.88	none	0
81-LG-016	23	2.27	none	0
81-LG-016	24	2.41	none	0
81-LG-016	3	0.27	none	0
81-LG-016-18	1	0.09	none	0
81-LG-030	4	0.37	none	0
81-LG-030	5	0.45	none	0
81-LG-030-02	1	0.02	none	0
81-LG-030-03	1	0.12	none	0
81-LG-030-03	4	0.40	none	0
81-LG-030-03	6	0.63	none	0
81-LG-030-05	10	1.03	none	0
81-LG-030-05	12	1.16	none	0
81-LG-030-05	13	1.21	none	0
81-LG-030-05	14	1.31	none	0
81-LG-030-05	16	1.62	none	0
81-LG-030-05	17	1.67	none	0
81-LG-030-05	2	0.20	none	0
81-LG-030-05	4	0.40	none	0
81-LG-030-05	5	0.49	none	0
81-LG-030-05	8	0.79	none	0
81-LG-030-05-01	1	0.05	none	0
81-LG-030-05-01	3	0.26	none	0
81-LG-030-05-02	2	0.23	none	0
81-LG-030-08	1	0.13	none	0
81-LG-080	3	0.25	none	0
81-LG-080	6	0.57	none	0
81-LG-080-15	1	0.12	none	0
81-LR	1	0.14	none	0
81-LR	12	1.15	none	0
81-LR	4	0.35	none	0
81-LR	5	0.52	none	0
81-LR	7	0.66	none	0
81-LR	8	0.78	none	0
81-LR	9	0.89	none	0
81-LR-007	11	1.13	none	0
81-LR-007	15	1.45	none	0
81-LR-007	4	0.37	none	0
81-LR-007	5	0.52	none	0
81-LR-009	1	0.05	none	0
81-LR-015	8	0.82	none	0
81-LR-021	2	0.19	none	0
81-LR-021	3	0.33	none	0
81-LR-021	5	0.48	none	0
81-LR-021-04	2	0.22	none	0
81-M	236	23.57	none	0
81-M-192	1	0.15	none	0
81-M-194	11	1.09	none	0
81-M-194	14	1.38	none	0
81-M-194	15	1.48	none	0
81-M-194	5	0.45	none	0
81-M-194	7	0.72	none	0
81-M-194-05	1	0.08	none	0
81-M-202	11	1.10	none	0
81-M-202	12	1.16	none	0
81-M-202	19	1.86	none	0
81-M-202-08	1	0.06	none	0
81-M-202-16	1	0.08	none	0
81-M-210	1	0.02	none	0
81-M-220	2	0.18	none	0
81-M-222	1	0.03	none	0
81-M-224	1	0.04	none	0
81-M-224	2	0.22	none	0
81-M-224	3	0.27	none	0
81-M-224	4	0.41	none	0
81-M-233	2	0.20	none	0
81-M-243	6	0.49	none	0
81-M-243-01	1	0.03	none	0
81-M-247	1	0.09	none	0
81-M-251	1	0.09	none	0
81-M-284	10	1.04	none	0
81-M-284	12	1.18	none	0
81-M-284	13	1.23	none	0
81-M-284-03	1	0.02	none	0
81-M-289	4	0.42	none	0

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Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-M-294	10	1.01	none	0
81-M-294	12	1.24	none	0
81-M-294	16	1.55	none	0
81-M-294	17	1.61	none	0
81-M-294	20	1.98	none	0
81-M-294	22	2.19	none	0
81-M-294	23	2.24	none	0
81-M-294	3	0.33	none	0
81-M-294-05	5	0.47	none	0
81-M-294-08	10	0.84	none	0
81-M-294-08	13	1.00	none	0
81-M-294-08	14	1.07	none	0
81-M-294-08	15	1.13	none	0
81-M-294-08	9	0.79	none	0
81-M-294-15-01	2	0.20	none	0
81-M-296	2	0.18	none	0
81-M-296-02	1	0.01	none	0
81-M-304	12	1.20	none	0
81-M-304	8	0.82	none	0
81-M-304-02	2	0.12	none	0
81-M-304-07	1	0.02	none	0
81-M-310	14	1.35	none	0
81-M-310	4	0.39	none	0
81-M-310	5	0.43	none	0
81-M-310	6	0.56	none	0
81-M-310-11	1	0.00	none	0
81-M-310-11	2	0.07	none	0
81-M-317	1	0.09	none	0
81-MD	10	0.99	none	0
81-MD	18	1.85	none	0
81-MD	20	2.00	none	0
81-MD	22	2.20	none	0
81-MD	25	2.46	none	0
81-MD	4	0.40	none	0
81-MD	7	0.68	none	0
81-MD-005	1	0.13	none	0
81-MD-005	10	1.01	none	0
81-MD-005	12	1.20	none	0
81-MD-005	15	1.47	none	0
81-MD-005	18	1.76	none	0
81-MD-005	20	1.96	none	0
81-MD-005	3	0.25	none	0
81-MD-005	4	0.40	none	0
81-MD-005	5	0.45	none	0
81-MD-005	7	0.73	none	0
81-MD-007-06	2	0.19	none	0
81-MD-016	1	0.05	none	0
81-PM-016	6	0.62	none	0
81-PM-023	1	0.08	none	0
81-RC	27	2.68	none	0
81-RC	55	5.54	none	0
81-RC-007	2	0.18	none	0
81-RC-007	3	0.35	none	0
81-RC-008	8	0.79	none	0
81-RC-008-03	1	0.06	none	0
81-RC-008-03	2	0.20	none	0
81-RC-008-03	4	0.41	none	0
81-RC-008-06	1	0.02	none	0
81-RC-008-06	2	0.16	none	0
81-RC-015	15	1.51	none	0
81-RC-015	17	1.74	none	0
81-RC-015-19	2	0.16	none	0
81-RC-056	10	0.95	none	0
81-RC-056	11	1.09	none	0
81-RC-056	12	1.18	none	0
81-RC-056	19	1.87	none	0
81-RC-056	6	0.60	none	0
81-RC-056	7	0.68	none	0
81-RC-056	8	0.85	none	0
81-RC-056-02	2	0.17	none	0
81-RC-056-02	3	0.34	none	0
81-RC-056-03	1	0.06	none	0
81-RC-056-03	2	0.19	none	0
81-RC-057	1	0.09	none	0
81-RC-057	6	0.56	none	0
81-RC-059	16	1.60	none	0
81-RC-059	7	0.69	none	0
81-RC-059-04	1	0.09	none	0
81-RC-059-04	3	0.28	none	0
81-RC-059-07	3	0.29	none	0
81-RC-059-07-01	1	0.04	none	0
81-RW-017	10	0.98	none	0
81-RW-017	11	1.09	none	0

Navarro East Landings

Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-RW-017	13	1.28	none	0
81-RW-017	14	1.44	none	0
81-RW-017	17	1.67	none	0
81-RW-017	19	1.90	none	0
81-RW-017	20	2.03	none	0
81-RW-017	23	2.27	none	0
81-RW-017	25	2.52	none	0
81-RW-017	3	0.31	none	0
81-RW-017	4	0.39	none	0
81-RW-017	5	0.53	none	0
81-RW-021	11	1.07	none	0
81-RW-021	13	1.30	none	0
81-RW-021	2	0.15	none	0
81-RW-021	6	0.61	none	0
81-RW-021	9	0.90	none	0
81-SB	3	0.25	none	0
81-SB	35	3.49	none	0
81-SB	4	0.33	none	0
81-SB	6	0.58	none	0
81-SB-039	4	0.41	none	0
81-SB-039-04	2	0.17	none	0
81-SB-039-04	5	0.49	none	0
81-SB-039-04	7	0.72	none	0
81-SB-039-07	1	0.01	none	0
81-SB-039-07	3	0.33	none	0
81-SB-039-09	1	0.11	none	0
81-SB-041	1	0.04	none	0
81-SB-041	3	0.32	none	0
81-SC	14	1.42	none	0
81-SC	26	2.55	none	0
81-SC	27	2.71	none	0
81-SC-009	4	0.36	none	0
81-SC-009-02	5	0.47	none	0
81-SC-009-02	7	0.67	none	0
81-SC-009-04-01	1	0.03	none	0
81-SC-018	3	0.25	none	0
81-SC-018-01	1	0.13	none	0
81-SC-018-01	2	0.23	none	0
81-SC-018-01	6	0.61	none	0
81-SC-018-01	8	0.79	none	0
81-SC-018-01	9	0.88	none	0
81-SC-018-04	5	0.48	none	0
81-SC-022-06	4	0.44	none	0
81-SC-022-06	5	0.51	none	0
81-SC-022-06-01	1	0.06	none	0
81-SC-022-06-01	2	0.18	none	0
81-SC-026-02	12	1.18	none	0
81-SC-026-02	14	1.38	none	0
81-SC-026-02	17	1.67	none	0
81-SC-026-02	3	0.28	none	0
81-SC-026-02	8	0.78	none	0
81-SC-026-02-01	1	0.04	none	0
81-SC-026-02-02	1	0.04	none	0
81-SC-027	2	0.17	none	0
81-SC-027	3	0.20	none	0
81-SC-027-03	1	0.10	none	0
81-WE	12	1.24	none	0
81-WE	14	1.38	none	0
81-WE	16	1.57	none	0
81-WE	22	2.23	none	0
81-WE	32	3.22	none	0
81-WE-009	1	0.04	none	0
81-WE-018	1	0.03	none	0
81-WE-028	2	0.25	none	0
81-WE-028	7	0.66	none	0
81-WE-028	8	0.79	none	0
81-WE-035	2	0.16	none	0
81-WE-035-05-01	1	0.12	none	0
81-WE-046	1	0.05	none	0
81-WG	15	1.52	none	0
81-WG	18	1.81	none	0
81-WG	2	0.19	none	0
81-WG	24	2.41	none	0
81-WG	8	0.80	none	0
81-WG-006	13	1.30	none	0
81-WG-006	8	0.85	none	0
81-WG-006-01	1	0.01	none	0
81-WG-008	10	0.99	none	0
81-WG-008	11	1.09	none	0
81-WG-008	14	1.36	none	0
81-WG-008	28	2.76	none	0
81-WG-008	3	0.31	none	0
81-WG-008	31	3.14	none	0

Navarro East Landings

Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (yd^3)
81-WG-008	7	0.70	none	0
81-WG-008	9	0.82	none	0
81-WG-008-05	12	1.20	none	0
81-WG-008-05	21	2.12	none	0
81-WG-008-05	4	0.42	none	0
81-WG-008-05-01	1	0.05	none	0
81-WG-008-05-03	1	0.07	none	0
81-WG-008-23	2	0.22	none	0
81-WG-009-07	10	1.01	none	0
81-WG-009-07-01	2	0.06	none	0
81-WG-009-11	1	0.03	none	0
81-WG-009-16	1	0.03	none	0
81-WG-011	1	0.07	none	0
81-WG-012	1	0.03	none	0
81-WG-012	2	0.19	none	0
81-WG-015	5	0.54	none	0
81-WG-015-04	1	0.03	none	0
81-WG-018	1	0.12	none	0
81-WG-021	2	0.17	none	0
81-WG-033	11	1.13	none	0
81-WG-033	13	1.32	none	0
81-WG-033	16	1.57	none	0
81-WG-033	6	0.65	none	0
81-WG-033	9	0.87	none	0
81-WG-033-04	1	0.09	none	0
81-WG-033-04	5	0.46	none	0
81-WG-033-04	7	0.66	none	0
81-WG-033-04-01	3	0.34	none	0
81-WG-033-04-02	1	0.03	none	0
81-BC-023	17	1.73	undetermined	0
81-BR-008	7	0.71	undetermined	0
81-JS-021	1	0.06	undetermined	0
81-WG-008	33	3.31	undetermined	0
81-WG-033	15	1.50	undetermined	0
81-WG-033-04	13	1.27	undetermined	0

Navarro East Roadslides

Road Number	Site #	Mile Post	Roadslide Type	Treatment Immediacy	Controllable Volume (yd^3)
81-CC-025	13	1.29	fill	high	8700
81-CC-025	20	1.72	fill	high	4444
81-RW-004	13	1.29	cutbank	high	2844
81-IC-022-02	2	0.09	fill	high	2000
81-DC	35	3.44	cutbank	high	1777
81-DC-044	1	0.01	unknown	high	1333
81-CC-025	21	1.74	cutbank	high	1111
81-LG-016	23	2.35	fill	high	900
81-RW-004	19	1.87	cutbank	high	711
81-RW-004	16	1.62	streambank	high	592
81-RC-015	6	0.55	unknown	high	284
81-CC	19	1.92	streambank	high	248
81-RW-021	12	1.18	fill	high	192
81-MD	29	2.82	fill	high	133
81-M-304	1	0.14	streambank	high	103
81-RC-013	4	0.40	streambank	high	92
81-AR-043-05-01	3	0.31	unknown	high	0
81-B-005-02	2	0.18	unknown	high	0
81-M-232	2	0.17	cutbank	high	0
81-CC-025	16	1.39	cutbank	moderate	7400
81-M	331	33.12	streambank	moderate	4400
81-M-294-08	4	0.41	unknown	moderate	2960
81-SC-018-04	3	0.19	unknown	moderate	2600
81-M	270	27.02	fill	moderate	2200
81-FH-003-12	2	0.21	fill	moderate	1000
81-WG-033	14	1.36	unknown	moderate	1000
81-MD	26	2.62	cutbank	moderate	1000
81-DC-018	8	0.78	unknown	moderate	900
81-M	304	30.44	fill	moderate	850
81-CC-025	19	1.62	cutbank	moderate	778
81-LG-016-06	2	0.23	unknown	moderate	740
81-M-278	3	0.30	cutbank	moderate	711
81-RC-003	1	0.12	cutbank	moderate	611
81-M	224	22.40	fill	moderate	555
81-M	291	29.06	streambank	moderate	550
81-IC-022-02	1	0.06	fill	moderate	500
81-FH-005	8	0.79	streambank	moderate	500
81-SB	11	1.07	fill	moderate	500
81-SC-018-04-02	3	0.30	unknown	moderate	500
81-CC-025	14	1.32	fill	moderate	400
81-MD	30	2.85	cutbank	moderate	400
81-AR-043-05-01	7	0.75	fill	moderate	370
81-RC-049	2	0.17	streambank	moderate	370
81-B-005-18	4	0.40	unknown	moderate	355
81-LG-030-04	1	0.14	fill	moderate	324
81-BH-018	2	0.17	fill	moderate	297
81-SC	11	1.05	fill	moderate	296
81-MD-029	1	0.06	cutbank	moderate	296
81-CC-025	18	1.58	cutbank	moderate	250
81-RW-004	14	1.35	cutbank	moderate	230
81-M	323	32.34	fill	moderate	225
81-B	16	1.56	unknown	moderate	222
81-FH-013	11	1.07	fill	moderate	220
81-DC-044	5	0.41	fill	moderate	180
81-B	17	1.61	streambank	moderate	177
81-WG-008	27	2.73	fill	moderate	170
81-SC	32	3.22	unknown	moderate	170
81-RC	42	4.17	unknown	moderate	166
81-M	314	31.45	streambank	moderate	160
81-LG-030-04	2	0.20	fill	moderate	155
81-CC-025	17	1.42	fill	moderate	148
81-LG-016	5	0.47	fill	moderate	140
81-LR-007	7	0.68	fill	moderate	118
81-MD	27	2.72	fill	moderate	111
81-SC-042	8	0.83	fill	moderate	100
81-BC	9	0.90	fill	moderate	70
81-WG-008-05	7	0.75	cutbank	moderate	70
81-MD-007	5	0.46	fill	moderate	59
81-SC-009-02	3	0.26	fill	moderate	50
81-SC-018-04	16	1.55	streambank	moderate	50
81-SC-027	6	0.57	fill	moderate	50
81-MD	28	2.76	fill	moderate	45
81-M-294	18	1.84	fill	moderate	33
81-DC	40	3.88	cutbank	moderate	33
81-LG-016	8	0.79	unknown	moderate	0
81-RC-013-01	2	0.16	unknown	low	2666
81-M	221	22.14	cutbank	low	1100
81-IC-022-02	3	0.13	cutbank	low	1000
81-M	198	19.83	fill	low	900
81-DC	39	3.82	cutbank	low	888
81-SC-009	3	0.30	fill	low	740
81-M	204	20.40	fill	low	630

Navarro East Roadslides

81-M	322	32.21	cutbank	low	600
81-JS-026-01	5	0.46	cutbank	low	516
81-RC-056	9	0.88	fill	low	450
81-B-005-18	1	0.05	unknown	low	444
81-AR-003	6	0.58	fill	low	400
81-RC	56	5.59	unknown	low	400
81-WG-008	20	1.97	cutbank	low	400
81-M	292	29.10	cutbank	low	400
81-M-294	19	1.92	cutbank	low	400
81-RW-004-12	6	0.58	cutbank	low	400
81-RC-013-03	3	0.27	cutbank	low	370
81-RC-013	9	0.86	streambank	low	355
81-FH-003-12	3	0.25	fill	low	350
81-M-294-07	1	0.12	cutbank	low	350
81-CC-019-06	9	0.93	cutbank	low	322
81-IC-022	3	0.29	cutbank	low	300
81-LG-016	25	2.54	fill	low	266
81-CC-025	15	1.35	cutbank	low	259
81-CC-025-05	1	0.08	cutbank	low	248
81-RC-059-04	1	0.14	fill	low	233
81-SC-018-04	2	0.16	streambank	low	233
81-MD-007-06	3	0.26	fill	low	225
81-LG-030-05	9	0.91	fill	low	222
81-M-250	4	0.40	cutbank	low	220
81-AR-043	23	2.32	fill	low	210
81-LG-030-05	3	0.28	fill	low	203
81-WG-008	5	0.54	fill	low	200
81-SB-032	3	0.29	fill	low	189
81-IC	12	1.23	fill	low	177
81-JS-012	4	0.43	fill	low	177
81-AR-001	19	1.93	cutbank	low	166
81-RW-004	20	1.91	fill	low	151
81-IC-022	5	0.47	fill	low	150
81-B	22	2.17	cutbank	low	150
81-WG-008	9	0.90	fill	low	150
81-RW-004	12	1.21	fill	low	150
81-SC-018	19	1.90	cutbank	low	150
81-BC	18	1.81	fill	low	148
81-AR-042	28	2.77	cutbank	low	140
81-DC	37	3.71	fill	low	137
81-DC-044	4	0.38	fill	low	125
81-AR-001	1	0.11	streambank	low	120
81-BR-008	8	0.75	fill	low	120
81-M	321	32.01	streambank	low	120
81-B-005-02	1	0.10	unknown	low	118
81-BC-011	9	0.86	unknown	low	111
81-M-250	5	0.44	cutbank	low	111
81-AR-042	30	3.02	cutbank	low	110
81-AR-042	16	1.56	cutbank	low	100
81-AR-042	23	2.23	fill	low	100
81-IC-022	7	0.73	fill	low	100
81-LR-007	8	0.72	cutbank	low	100
81-M	285	28.48	cutbank	low	100
81-SC-042	3	0.25	fill	low	100
81-SC-044	5	0.50	unknown	low	100
81-B-005-02	3	0.20	fill	low	93
81-SC-009	9	0.86	fill	low	93
81-RC-057	4	0.38	cutbank	low	90
81-SB	32	3.17	fill	low	90
81-SC-009	10	0.94	fill	low	90
81-RC-015	15	1.49	fill	low	88
81-CC-019-06	4	0.37	cutbank	low	87
81-LG-030-05-02	1	0.12	cutbank	low	85
81-DC-009	1	0.12	fill	low	85
81-LG-030-05	15	1.50	fill	low	82
81-SC-027	3	0.34	fill	low	80
81-WG-033	15	1.38	fill	low	75
81-LG-006	6	0.57	fill	low	75
81-RC-059	2	0.21	unknown	low	71
81-LG-030-05-02	2	0.19	cutbank	low	71
81-B-005	22	2.21	fill	low	67
81-LG-008-08	2	0.19	cutbank	low	67
81-WG-009	16	1.62	unknown	low	65
81-M-246-09	5	0.51	unknown	low	62
81-AR-042	13	1.29	fill	low	60
81-AR-042	25	2.49	cutbank	low	60
81-M-294-05	4	0.37	cutbank	low	59
81-FH-012	1	0.14	fill	low	59
81-BH	24	2.40	fill	low	57
81-M-194	4	0.36	cutbank	low	55
81-RC	31	3.05	fill	low	51
81-SB-022	7	0.69	fill	low	50
81-WE	20	2.05	unknown	low	50
81-WG-008	10	0.95	fill	low	50

81-WG-008	14	1.43	fill	low	50
81-WG-033	16	1.47	fill	low	50
81-M	293	29.34	streambank	low	50
81-SC-009-02	5	0.53	fill	low	50
81-SC-018	20	1.98	cutbank	low	50
81-SC-042	9	0.86	cutbank	low	50
81-B	10	0.98	fill	low	48
81-M	320	32.00	cutbank	low	45
81-RC	38	3.82	fill	low	44
81-DC	41	4.05	cutbank	low	42
81-RC	39	3.88	fill	low	41
81-M	294	29.36	streambank	low	40
81-SC-018	16	1.62	fill	low	40
81-JS-026	4	0.41	fill	low	40
81-M-304-02	3	0.26	cutbank	low	37
81-BH-007	6	0.58	fill	low	36
81-FH-012	2	0.19	fill	low	35
81-SC-018-04	8	0.81	cutbank	low	33
81-BC	17	1.72	fill	low	30
81-WG-008-05	2	0.17	unknown	low	30
81-M	327	32.58	fill	low	30
81-BH-018	7	0.66	fill	low	28
81-AR-042	17	1.75	cutbank	low	25
81-IC-003	6	0.57	cutbank	low	25
81-BC-023-05	5	0.50	fill	low	25
81-LR-007-17	3	0.14	cutbank	low	25
81-SC-018-04-02	1	0.14	streambank	low	22
81-IC	29	2.85	fill	low	20
81-M-296	1	0.02	fill	low	18
81-RW-004	4	0.44	fill	low	15
81-SC-018-04	15	1.54	cutbank	low	14
81-FH-012	10	1.03	fill	low	14
81-M-194	11	1.13	fill	low	12
81-IC-003	8	0.76	fill	low	10
81-BR-009	3	0.26	fill	low	10
81-BR-029	7	0.74	cutbank	low	10
81-LR-007	19	1.88	cutbank	low	10
81-LR-007-17	2	0.06	fill	low	10
81-SC-009-02	7	0.71	unknown	low	10
81-DC	34	3.38	fill	low	10
81-DC	6	0.61	cutbank	low	10
81-LR-007	15	1.53	cutbank	low	8
81-RW-004	5	0.54	fill	low	8
81-RC-013	13	1.26	cutbank	low	6
81-BR-009	17	1.67	fill	low	6
81-CC-025	5	0.53	fill	low	6
81-M	334	33.45	fill	low	5
81-LG-050	1	0.03	fill	low	2
81-AR-042	22	2.16	cutbank	low	0
81-AR-042-05	1	0.07	fill	low	0
81-AR-001-06	1	0.10	fill	low	0
81-AR-003	9	0.89	unknown	low	0
81-AR-043-05-01	10	0.96	cutbank	low	0
81-AR-043-05-01	12	1.22	unknown	low	0
81-AR-043-05-01	4	0.41	unknown	low	0
81-AR-043-05-02	1	0.05	unknown	low	0
81-AR-043-29	4	0.40	cutbank	low	0
81-RC-051	2	0.15	unknown	low	0
81-RC-051	3	0.21	unknown	low	0
81-RC-059	3	0.32	unknown	low	0
81-B-005	28	2.76	fill	low	0
81-M	223	22.30	cutbank	low	0
81-M	226	22.63	cutbank	low	0
81-M-202	6	0.65	cutbank	low	0
81-WG-009	13	1.28	cutbank	low	0
81-WG-009-18	1	0.08	fill	low	0
81-FH-003-12	5	0.51	cutbank	low	0
81-FH-013	18	1.80	cutbank	low	0
81-FH-013-14	2	0.22	cutbank	low	0
81-SB	4	0.44	cutbank	low	0
81-SB-022	1	0.07	unknown	low	0
81-SB-022	3	0.30	unknown	low	0
81-SB-022	5	0.47	unknown	low	0
81-SB-022	8	0.74	unknown	low	0
81-SB-039-04	2	0.22	fill	low	0
81-WG	15	1.53	fill	low	0
81-WG-008	15	1.51	unknown	low	0
81-WG-009-18	3	0.26	cutbank	low	0
81-BR-009	15	1.54	fill	low	0
81-LG-016	22	2.18	cutbank	low	0
81-LG-016	26	2.63	cutbank	low	0
81-LG-030-08	1	0.01	fill	low	0
81-LG-038	3	0.27	fill	low	0
81-LR-007	17	1.75	cutbank	low	0

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81-LR-007-17	1	0.03	fill	low	0
81-M	286	28.56	cutbank	low	0
81-MD-005	11	1.13	fill	low	0
81-MD-007	1	0.06	cutbank	low	0
81-RW-017	16	1.63	fill	low	0
81-RW-021	15	1.52	fill	low	0
81-RW-032	2	0.20	fill	low	0
81-RW-032	4	0.35	fill	low	0
81-SC	40	4.02	fill	low	0
81-SC-009-04	2	0.20	fill	low	0
81-SC-018-01	7	0.73	fill	low	0
81-SC-018-01	8	0.85	fill	low	0
81-CU-182-05	10	0.96	cutbank	low	0
81-CU-182-05	9	0.87	fill	low	0
81-JS-023-08-01	1	0.02	cutbank	low	0
81-PM-016	3	0.32	cutbank	low	0
81-CC	20	2.03	cutbank	low	0
81-CC-019	14	1.38	cutbank	low	0
81-CC-019	19	1.90	fill	low	0
81-CC-025	8	0.82	cutbank	low	0
81-DC	11	1.11	fill	low	0
81-DC	25	2.53	cutbank	low	0
81-DC	3	0.29	cutbank	low	0
81-DC	38	3.74	cutbank	low	0
81-FH-005	1	0.14	cutbank	low	0
81-M	326	32.56	cutbank	low	0
81-M-304	4	0.35	cutbank	low	0
81-MD	5	0.47	fill	low	0
81-IC-032	2	0.17	streambank	none	15000
81-LG-044	12	1.22	streambank	none	51
81-LG-016	7	0.66	fill	none	50
81-B-005-21	1	0.09	unknown	undetermined	0
81-BC-020	10	0.99	undetermined	undetermined	0

Navarro East Other Erosion Sites

Road Number	Site #	Mile Post	Erosion Type	Treatment Immediacy	Controllable Volume (yd^3)
81-AR-043-05-01	5	0.53	gully	high	445
81-M-278	5	0.52	gully	high	237
81-M-250	3	0.31	gully	high	133
81-B-005	1	0.08	gully	high	120
81-B-005-02	2	0.16	gully	high	118
81-M-310	1	0.09	gully	high	118
81-M-250	4	0.37	gully	high	55
81-CC	11	1.09	gully	high	55
81-M-278	4	0.39	major rilling	high	41
81-CC-019	2	0.25	major rilling	high	8
81-AR-043-05-01	12	1.20	gully	moderate	556
81-M-304	10	0.96	gully	moderate	311
81-M-260	3	0.32	gully	moderate	45
81-JS-026	13	1.27	gully	moderate	40
81-B	8	0.77	gully	moderate	23
81-B-005	2	0.14	gully	moderate	18
81-MD-005	24	2.36	gully	moderate	11
81-MD-007	2	0.23	gully	moderate	10
81-LG-038	2	0.24	major rilling	moderate	5
81-LG-038	4	0.36	gully	moderate	5
81-RW-017	16	1.61	gully	moderate	5
81-FH-003-12	3	0.33	gully	low	240
81-SC-018-04	4	0.43	major rilling	low	133
81-DC	30	3.04	gully	low	80
81-SC-018-04	1	0.10	major rilling	low	70
81-AR-043-05-01	4	0.39	gully	low	60
81-FH-005-06	5	0.50	gully	low	60
81-AR-043-05-01	2	0.22	major rilling	low	50
81-MD-007-06	1	0.03	gully	low	30
81-AR-042	23	2.27	gully	low	20
81-JS-028	2	0.25	gully	low	18
81-MD	23	2.32	gully	low	15
81-DC	38	3.80	gully	low	14
81-M-289	1	0.04	major rilling	low	12
81-DC-018	3	0.28	major rilling	low	12
81-SB	22	2.17	gully	low	10
81-MD-029-22	4	0.45	major rilling	low	10
81-SC-009	1	0.03	gully	low	10
81-SC-026-02	19	1.94	major rilling	low	10
81-CC	8	0.83	major rilling	low	10
81-CC-024	15	1.51	gully	low	10
81-JS-023	8	0.75	gully	low	9
81-BC-023	5	0.50	gully	low	8
81-RW-004	12	1.24	gully	low	8
81-B	10	1.02	gully	low	6
81-CC-024	13	1.28	gully	low	6
81-AR-042	6	0.56	gully	low	5
81-RW-004	7	0.66	major rilling	low	5
81-LR-021-04	1	0.02	major rilling	low	5
81-AR-042	10	1.04	major rilling	low	4
81-SC-018	4	0.37	major rilling	low	4
81-DC-044	3	0.22	gully	low	4
81-IC-004	1	0.04	gully	low	0
81-LR-013	2	0.16	major rilling	low	0
81-LR-015	3	0.31	gully	low	0
81-RW	15	1.51	major rilling	low	0
81-CC-012	4	0.38	major rilling	low	0
81-CC-019-05	1	0.03	major rilling	low	0
81-DC-044	2	0.15	gully	low	0
81-M	327	32.74	undetermined	low	0

Culvert Sizing Analysis for Navarro East Watercourse Culverts

Mean Annual Precipitation (in.)
40

Road Number	Site #	Culvert Diameter (in)	Area (ac)	50 year flood (cfs)	100 year flood (cfs)	50 yr Culvert Size (in)	100 yr Culvert Size (in)	50 yr pass	100 yr pass
81-RW-004	c1	18	15.9	12	13	24	24	NO	NO
81-IC	c8	36	34.2	23	25	30	30	NO	NO
81-BC-001	c4	18	35.0	24	25	30	30	NO	NO
81-JS	c7	24	52.3	33	36	30	36	NO	NO
81-MD	c5	24	53.0	34	36	30	36	NO	NO
81-M	c6	36	56.8	36	39	36	36	NO	NO
81-M	c6	24	65.7	41	44	36	36	NO	NO
81-JS-023	c9	28	136.0	77	83	42	48	NO	NO
81-SC	c2	24	139.3	78	85	42	48	NO	NO
81-IC	c8	48	159.0	88	95	48	48	NO	NO
81-M	c6	24	237.1	125	134	54	54	NO	NO
81-AR-017	c5	24	57.2	36	39	36	36	NO	NO
81-BC-023-05	c13	14	65.8	41	44	36	36	NO	NO
81-JS	c7	36	71.7	44	47	36	36	NO	NO
81-RC-044	c4	18	24.5	17	19	24	30	NO	NO
81-RW-004	c1	18	83.6	50	54	36	42	NO	NO
81-BC-023	c17	18	12.9	10	11	24	24	NO	NO
81-SB	c7	24	13.1	10	11	24	24	NO	NO
81-WE	c6	18	17.4	13	14	24	24	NO	NO
81-DC	c2	30	27.8	19	21	30	30	NO	NO
81-RW-021	c8	18	28.8	20	21	30	30	NO	NO
81-SB	c7	36	29.3	20	22	30	30	NO	NO
81-BC-001	c4	18	29.6	20	22	30	30	NO	NO
81-BC-001	c4	24	30.3	21	22	30	30	NO	NO
81-M-260	c1	24	83.9	50	54	36	42	NO	NO
81-RC	c14	18	85.2	51	55	42	42	NO	NO
81-WG-008-05	c31	36	93.0	55	59	42	42	NO	NO
81-BC	c2	24	100.1	59	63	42	42	NO	NO
81-M	c6	48	159.8	88	95	48	48	NO	NO
81-CC-025	c6	38	171.1	94	101	48	48	NO	NO
81-M	c6	36	350.4	175	189	60	60	NO	NO
81-M	c6	36	366.4	182	196	60	60	NO	NO
81-M	c6	192	424.6	207	223	60	72	NO	NO
81-SC	c2	30	474.7	228	246	72	72	NO	NO
81-M	c6	48	1412.4	589	634	72	72	NO	NO
81-RW-021	c8	18	12.2	9	10	24	24	NO	NO
81-DC	c2	30	46.3	30	32	30	30	NO	NO
81-M	c6	24	47.7	31	33	30	30	NO	NO
81-RC-044-09	c9	36	47.9	31	33	30	30	NO	NO
81-RC-013	c2	18	72.4	44	48	36	36	NO	NO
81-SC-037	c1	28	114.4	66	71	42	42	NO	NO
81-M-250	c4	36	121.6	70	75	42	42	NO	NO
81-CC-025	c6	24	140.2	79	85	42	48	NO	NO
81-M	c6	36	154.8	86	93	48	48	NO	NO
81-RC-058	c9	24	159.1	88	95	48	48	NO	NO
81-JS-023-05	c6	28	325.7	164	177	60	60	NO	NO
81-RC-008-03	c3	24	12.5	10	10	24	24	NO	NO
81-SC-009	c9	18	46.4	30	32	30	30	NO	NO
81-RC	c14	24	68.4	42	46	36	36	NO	NO
81-AR-003	c5	48	117.9	68	73	42	42	NO	NO
81-M	c6	24	31.8	22	23	30	30	NO	NO
81-WG-033-04	c9	24	37.7	25	27	30	30	NO	NO
81-IC-022	c3	36	41.6	27	30	30	30	NO	NO
81-WE	c6	36	115.5	67	72	42	42	NO	NO
81-M	c6	36	132.2	75	81	42	48	NO	NO
81-LG-016-06	c9	40	152.9	85	92	48	48	NO	NO
81-M	c6	36	235.7	124	134	54	54	NO	NO
81-M-294	c7	30	40.7	27	29	30	30	NO	NO
81-M	c6	24	53.0	34	36	30	36	NO	NO
81-IC	c8	36	71.5	44	47	36	36	NO	NO
81-AR-017	c2	24	27.4	19	21	30	30	NO	NO
81-LG-030-06	c8	24	44.6	29	31	30	30	NO	NO
81-CC	c5	30	113.8	66	71	42	42	NO	NO
81-M	c6	36	16.1	12	13	24	24	NO	NO
81-SB	c7	18	17.4	13	14	24	24	NO	NO
81-B-005	c6	24	39.4	26	28	30	30	NO	NO
81-IC	c8	18	11.4	9	10	24	24	NO	NO
81-M	c6	24	108.8	63	68	42	42	NO	NO
81-WE	c6	36	114.9	66	71	42	42	NO	NO
81-M	c6	48	135.3	77	82	42	48	NO	NO
81-JS-026	c5	36	232.8	123	132	54	54	NO	NO
81-CC-019	c9	18	11.1	9	9	24	24	NO	NO

Road Number	Site #	Culvert Diameter (in)	Area (ac)	50 year flood (cfs)	100 year flood (cfs)	50 yr Culvert Size (in)	100 yr Culvert Size (in)	50 yr pass	100 yr pass
81-RC-044-09	c9	18	12.8	10	11	24	24	NO	NO
81-RC	c14	18	23.0	16	18	24	24	NO	NO
81-DC	c2	30	36.0	24	26	30	30	NO	NO
81-RC-044	c4	24	67.0	42	45	36	36	NO	NO
81-SB	c7	18	17.3	13	14	24	24	NO	NO
81-M	c6	30	3.4	3	3	18	18	NO	NO
81-CC-025	c6	24	18.1	13	14	24	24	NO	NO
81-IC-014	c9	36	52.1	33	36	30	36	NO	NO
81-JS-026	c5	36	61.7	39	42	36	36	NO	NO
81-DH	c9	18	76.5	47	50	36	36	NO	NO
81-BC-001	c15	24	11.3	9	10	24	24	NO	NO
81-SB-022	c1	24	16.7	12	13	24	24	NO	NO
81-AR-019	c4	24	27.0	19	20	30	30	NO	NO
81-BC-001	c2	18	34.5	23	25	30	30	NO	NO
81-M	c6	12	10.3	8	9	18	24	NO	NO
81-M	c6	18	17.4	13	14	24	24	NO	NO
81-SB	c7	18	19.7	14	15	24	24	NO	NO
81-SB-022	c1	24	43.5	28	31	30	30	NO	NO
81-BC-001-07	c1	18	76.9	47	50	36	36	NO	NO
81-RC	c14	18	10.9	9	9	24	24	NO	NO
81-WE	c6	36	38.4	26	28	30	30	NO	NO
81-RW-017	c7	24	13.2	10	11	24	24	NO	NO
81-SB	c7	24	17.1	13	14	24	24	NO	NO
81-WG-008-05	c31	18	19.3	14	15	24	24	NO	NO
81-RC-058	c9	18	30.1	21	22	30	30	NO	NO
81-WG	c9	18	30.1	21	22	30	30	NO	NO
81-RC-029	c1	36	72.7	45	48	36	36	NO	NO
81-BC-004	c3	24	106.2	62	67	42	42	NO	NO
81-M-278-06	c5	18	122.7	70	76	42	42	NO	NO
81-WG-008-05	c31	3	187.7	102	110	48	48	NO	NO
81-SB	c7	24	12.7	10	11	24	24	NO	NO
81-WG-033-04	c9	24	16.4	12	13	24	24	NO	NO
81-SC	c2	20	20.2	15	16	24	24	NO	NO
81-MD	c5	24	55.9	35	38	36	36	NO	NO
81-WG-009	c2	24	2.3	2	2	18	18	NO	NO
81-WG-008-05	c31	6	16.9	12	13	24	24	NO	NO
81-SB-039	c4	24	26.8	19	20	30	30	NO	NO
81-IC-003	c9	18	3.4	3	3	18	18	NO	NO
81-IC-022	c3	24	4.7	4	4	18	18	NO	NO
81-BH	c12	24	11.4	9	10	24	24	NO	NO
81-AR-012	c1	18	18.0	13	14	24	24	NO	NO
81-WG-008-05-02	c6	18	41.4	27	29	30	30	NO	NO
81-SC	c2	24	55.4	35	38	36	36	NO	NO
81-B-005	c2	24	60.6	38	41	36	36	NO	NO
81-BR-009	c11	18	17.8	13	14	24	24	NO	NO
81-M-289	c4	18	21.2	15	16	24	24	NO	NO
81-BR-009	c18	18	27.7	19	21	30	30	NO	NO
81-M-284	c1	18	13.7	10	11	24	24	NO	NO
81-BC	c8	24	16.5	12	13	24	24	NO	NO
81-RW-004-12	c8	24	18.3	13	14	24	24	NO	NO
81-BC-001	c20	18	18.3	13	14	24	24	NO	NO
81-SC-026-02	c7	24	5.3	5	5	18	18	NO	NO
81-M	c6	18	13.6	10	11	24	24	NO	NO
81-M	c6	36	49.8	32	35	30	36	NO	NO
81-M-246	c1	36	60.0	38	41	36	36	NO	NO
81-IC	c8	36	74.4	45	49	36	36	NO	NO
81-RC	c14	18	20.3	15	16	24	24	NO	NO
81-RW-004-12	c8	18	2.2	2	2	18	18	NO	NO
81-RC-044-09	c9	18	4.8	4	5	18	18	NO	NO
81-RC	c14	24	21.3	15	17	24	24	NO	NO
81-RW-004	c1	24	2.0	2	2	18	18	NO	NO
81-AR-043	c14	18	2.7	3	3	18	18	NO	NO
81-SC-039	c5	18	3.4	3	3	18	18	NO	NO
81-BC	c2	18	3.8	3	4	18	18	NO	NO
81-RC-043-06-01	c4	18	3.8	3	4	18	18	NO	NO
81-LG-016	c1	14	4.5	4	4	18	18	NO	NO
81-RW-017	c7	18	5.2	4	5	18	18	NO	NO
81-JS-023	c9	18	6.1	5	6	18	18	NO	NO
81-MD	c5	36	6.1	5	6	18	18	NO	NO
81-M	c6	18	7.3	6	6	18	18	NO	NO
81-IC-003	c9	18	8.2	7	7	18	18	NO	NO
81-RC-043-06-01	c4	36	23.3	17	18	24	24	NO	NO
81-LG-016	c1	24	11.7	9	10	24	24	NO	NO
81-WE	c6	12	13.2	10	11	24	24	NO	NO
81-CC-025	c12	24	14.7	11	12	24	24	NO	NO
81-WG-033-04	c9	36	40.4	27	29	30	30	NO	NO

Road Number	Site #	Culvert Diameter (in)	Area (ac)	50 year flood (cfs)	100 year flood (cfs)	50 yr Culvert Size (in)	100 yr Culvert Size (in)	50 yr pass	100 yr pass
81-M	c6	30	64.0	40	43	36	36	NO	NO
81-WG-033	c1	36	2.9	3	3	18	18	NO	NO
81-AR-043	c3	18	3.4	3	3	18	18	NO	NO
81-SC-018	c3	24	10.6	8	9	18	24	YES	NO
81-WE	c6	18	10.4	8	9	18	24	YES	NO
81-SC-009	c9	18	24.5	17	19	24	30	YES	NO
81-IC-003	c9	18	10.1	8	9	18	24	YES	NO
81-RC	c14	18	10.6	8	9	18	24	YES	NO
81-RW-004-12	c8	18	10.6	8	9	18	24	YES	NO
81-M-246	c1	18	10.8	8	9	18	24	YES	NO
81-LG-044-09	c4	18	10.8	8	9	18	24	YES	NO
81-RC-044	c4	18	10.4	8	9	18	24	YES	NO

Navarro West Culverts

Road Number	Site #	Mile Post	Culvert Type	Treatment Immediacy	Controllable Volume (yd^3)	Diversion Potential
82-SM-025	15	1.49	watercourse	high	2000	no div. potential
82-BR	39	3.90	watercourse	high	1750	yes, road
82-BG-011	4	0.42	ditch relief	high	1000	no div. potential
82-SR-079-03	1	0.00	watercourse	high	1000	no div. potential
82-SC-049	16	1.55	watercourse	high	925	no div. potential
81-M	344	34.38	watercourse	high	853	no div. potential
82-PG-049-04	2	0.17	watercourse	high	800	already diverted
82-CC-006	1	0.00	watercourse	high	740	yes, road
82-BR	32	3.17	watercourse	high	600	no div. potential
82-NR-106	11	1.11	watercourse	high	500	no div. potential
82-BR-032	5	0.47	watercourse	high	445	already diverted
82-BR-021	15	1.53	watercourse	high	400	no div. potential
82-GP-172	1	0.06	watercourse	high	320	no div. potential
81-M	344	34.38	watercourse	high	250	no div. potential
82-BR	35	3.51	watercourse	high	250	yes, road
82-CC	3	0.26	watercourse	high	230	yes, road
82-DH-005	2	0.02	watercourse	high	220	yes, ditch
82-NR-106	10	0.93	watercourse	high	220	yes, road
82-BG-011	5	0.47	ditch relief	high	200	no div. potential
82-CC-006	4	0.41	watercourse	high	185	yes, road
82-SC	45	4.48	ditch relief	high	185	yes, road
82-BG-013	10	1.05	watercourse	high	173	no div. potential
82-SC	44	4.44	watercourse	high	123	no div. potential
82-SC	46	4.49	ditch relief	high	123	no div. potential
82-SC-048	7	0.35	watercourse	high	120	no div. potential
82-HR	10	0.76	watercourse	high	100	yes, ditch
82-SC-048	2	0.06	watercourse	high	74	no div. potential
82-SM	43	4.21	watercourse	high	60	no div. potential
82-HR	23	1.66	watercourse	high	60	already diverted
82-HR	5	0.36	watercourse	high	30	yes, ditch
82-SC-048	8	0.45	watercourse	high	29	no div. potential
82-HR	20	1.57	watercourse	high	20	yes, ditch
82-CC-006	2	0.14	watercourse	high	15	yes, road
82-HR	19	1.53	watercourse	high	13	yes, ditch
82-HR	22	1.63	ditch relief	high	6	yes, ditch
82-HR	16	1.36	watercourse	high	5	yes, ditch
82-MS-020	15	1.08	watercourse	moderate	2765	no div. potential
82-SC-049	12	1.17	watercourse	moderate	1100	no div. potential
82-MP	14	1.42	watercourse	moderate	830	no div. potential
82-RC-031	8	0.79	watercourse	moderate	700	no div. potential
82-SM	16	1.47	watercourse	moderate	630	no div. potential
82-BR-032	11	1.12	watercourse	moderate	520	no div. potential
82-BR	20	2.05	watercourse	moderate	500	no div. potential
82-SM	22	2.18	watercourse	moderate	490	no div. potential
82-RC-031	6	0.63	watercourse	moderate	455	no div. potential
82-NF	22	2.15	ditch relief	moderate	450	already diverted
82-MS	14	1.44	watercourse	moderate	444	no div. potential
82-BR-021	31	3.08	watercourse	moderate	410	no div. potential
82-BR-021	13	1.29	watercourse	moderate	400	no div. potential
82-SM-025	5	0.46	watercourse	moderate	400	already diverted
82-SC-049	9	0.79	watercourse	moderate	350	no div. potential
81-M	341	34.12	watercourse	moderate	340	no div. potential
82-BR-021-28	2	0.18	watercourse	moderate	310	already diverted
82-SC-049	8	0.67	watercourse	moderate	310	no div. potential
82-BG-013	11	1.08	ditch relief	moderate	300	yes, road
82-SM	5	0.51	watercourse	moderate	300	no div. potential
82-SC-049	18	1.74	watercourse	moderate	296	no div. potential
82-BP-034	9	0.88	watercourse	moderate	250	yes, road
82-BR	30	3.04	watercourse	moderate	250	yes, road
82-SM-025	6	0.52	watercourse	moderate	250	no div. potential
82-MS-003-08	7	0.59	watercourse	moderate	240	no div. potential
82-RC-031	5	0.52	watercourse	moderate	240	yes, road
82-SM-052-05	6	0.57	watercourse	moderate	240	no div. potential
82-MS-020	16	1.13	watercourse	moderate	222	no div. potential
82-BR-021	1	0.12	watercourse	moderate	220	yes, road
82-SC-049	17	1.63	watercourse	moderate	220	no div. potential
82-BR-021	27	2.71	watercourse	moderate	215	no div. potential
82-RC-031	3	0.34	watercourse	moderate	200	no div. potential
82-SR-041	4	0.37	watercourse	moderate	200	no div. potential
82-SM	6	0.55	watercourse	moderate	200	yes, road
82-SC-049	15	1.47	watercourse	moderate	198	no div. potential
82-NR-106	8	0.70	watercourse	moderate	180	no div. potential
82-BP-024	7	0.74	watercourse	moderate	178	no div. potential
82-SC	9	0.89	watercourse	moderate	175	no div. potential
82-SR-041	3	0.32	watercourse	moderate	150	no div. potential
82-BP-024	9	0.88	watercourse	moderate	148	no div. potential
82-RG-002	13	1.31	watercourse	moderate	140	yes, road
82-BG-011	2	0.14	ditch relief	moderate	138	no div. potential
82-MS-020	8	0.52	ditch relief	moderate	123	no div. potential
82-SC-048	9	0.52	watercourse	moderate	123	no div. potential
82-BR-021	4	0.31	watercourse	moderate	120	yes, road
82-MS-020	20	1.53	watercourse	moderate	120	no div. potential
82-HR	9	0.72	watercourse	moderate	100	yes, road
82-SC	47	4.57	ditch relief	moderate	99	no div. potential

82-NF	2	0.15	watercourse	moderate	90	yes, road
82-NR-106	9	0.71	watercourse	moderate	90	no div. potential
82-RG-009-08	1	0.10	ditch relief	moderate	89	no div. potential
82-MS-025	8	0.78	watercourse	moderate	88	no div. potential
82-BC	4	0.44	watercourse	moderate	75	already diverted
82-HR	2	0.06	watercourse	moderate	75	yes, ditch
82-BR-021	30	2.97	watercourse	moderate	72	no div. potential
82-SM	41	4.13	watercourse	moderate	72	no div. potential
82-DH-005	7	0.65	watercourse	moderate	70	yes, road
82-NF	6	0.63	watercourse	moderate	70	yes, road
82-SC	48	4.58	watercourse	moderate	65	no div. potential
82-BR-032	6	0.59	watercourse	moderate	60	no div. potential
82-HR	24	1.77	watercourse	moderate	60	yes, ditch
82-SC-048	4	0.16	ditch relief	moderate	46	no div. potential
82-BG	8	0.84	ditch relief	moderate	44	no div. potential
82-BR	31	3.06	watercourse	moderate	40	yes, road
82-CC	11	1.07	watercourse	moderate	40	yes, road
82-NF	1	0.05	watercourse	moderate	40	already diverted
82-SR-006	3	0.09	ditch relief	moderate	35	yes, road
82-HW-008	5	0.53	watercourse	moderate	35	already diverted
82-RG-002	15	1.46	ditch relief	moderate	30	no div. potential
82-SR-006	1	0.01	ditch relief	moderate	20	yes, ditch
82-MS-020-05	2	0.15	ditch relief	moderate	15	yes, road
82-BR-021	22	2.23	watercourse	moderate	10	yes, road
82-CC-002	8	0.76	watercourse	moderate	10	no div. potential
82-HR	4	0.30	watercourse	moderate	10	yes, ditch
82-HW-012	1	0.13	watercourse	moderate	10	yes, road
82-HR	18	1.46	watercourse	moderate	6	yes, ditch
82-HR	25	1.81	watercourse	moderate	2	yes, ditch
82-HR	12	0.93	ditch relief	moderate	1	yes, road
82-HR	15	1.27	ditch relief	moderate	1	yes, road
82-PG-041	1	0.12	watercourse	moderate	0	no div. potential
82-PG-041	3	0.27	watercourse	moderate	0	no div. potential
82-HR	3	0.28	ditch relief	moderate	0	yes, ditch
84-CO	1	0.01	ditch relief	low	999999	undetermined
81-BC-020	16	1.60	watercourse	low	1500	no div. potential
81-BC-020	17	1.75	watercourse	low	1500	no div. potential
82-BR	24	2.37	watercourse	low	1500	yes, road
82-MS-020	13	0.82	watercourse	low	1203	no div. potential
82-LB-017	18	1.78	watercourse	low	1185	no div. potential
82-MS-020	6	0.39	watercourse	low	1111	yes, road
82-EN	58	5.53	ditch relief	low	1000	yes, road
82-EN	50	4.55	watercourse	low	880	no div. potential
81-M	344	34.38	watercourse	low	853	no div. potential
82-BG-011	7	0.75	watercourse	low	830	no div. potential
82-EN	4	0.35	watercourse	low	800	no div. potential
82-FG	16	1.60	watercourse	low	740	no div. potential
82-MS-020	7	0.46	watercourse	low	740	no div. potential
82-EN	12	1.15	watercourse	low	710	no div. potential
82-EN	1	0.08	watercourse	low	690	no div. potential
82-EN	44	3.98	watercourse	low	690	no div. potential
82-PG	10	0.97	watercourse	low	625	no div. potential
82-LB-017	11	1.12	watercourse	low	592	no div. potential
82-LB-017	19	1.84	watercourse	low	592	no div. potential
82-EN	20	1.87	watercourse	low	590	no div. potential
82-MS-020-05	3	0.18	watercourse	low	580	yes, road
82-BR	25	2.40	watercourse	low	560	yes, road
82-EN	5	0.39	watercourse	low	555	yes, ditch
82-BG-013	2	0.16	watercourse	low	514	no div. potential
82-EN	51	4.58	watercourse	low	500	no div. potential
82-RG-002	7	0.68	watercourse	low	500	no div. potential
82-MS-020	12	0.67	watercourse	low	482	no div. potential
82-BP	30	2.96	watercourse	low	444	no div. potential
82-BP-034	7	0.72	watercourse	low	444	no div. potential
82-LB-017	21	1.96	watercourse	low	444	no div. potential
82-EN	16	1.42	watercourse	low	440	no div. potential
82-EN-035	4	0.43	watercourse	low	440	no div. potential
82-HT-004-09	1	0.08	watercourse	low	420	no div. potential
82-NR-099	1	0.10	watercourse	low	420	yes, ditch
82-EN-026	3	0.26	watercourse	low	415	no div. potential
82-EN-026	5	0.46	watercourse	low	400	no div. potential
82-MS-025-06	3	0.31	watercourse	low	395	no div. potential
82-EN-038	1	0.10	watercourse	low	390	no div. potential
82-SM	25	2.48	watercourse	low	380	no div. potential
82-BG	2	0.09	watercourse	low	370	yes, road
82-HT-004-09	2	0.18	watercourse	low	370	no div. potential
82-MS-025	4	0.29	watercourse	low	370	no div. potential
82-NR-048	2	0.24	watercourse	low	370	no div. potential
82-EN-035	7	0.72	watercourse	low	360	no div. potential
82-LB-017	20	1.89	watercourse	low	356	no div. potential
82-MS-020	3	0.21	watercourse	low	355	no div. potential
82-SC	7	0.70	watercourse	low	346	no div. potential
81-M	341	34.12	watercourse	low	340	no div. potential
81-DH	30	2.99	watercourse	low	333	no div. potential
82-EN	3	0.30	watercourse	low	330	no div. potential
82-RC-022	3	0.30	watercourse	low	330	no div. potential

82-RC-022-04-01	1	0.03	watercourse	low	310	yes, road
82-MS-026	1	0.03	watercourse	low	308	no div. potential
82-BG	7	0.69	watercourse	low	307	no div. potential
82-EN	52	4.70	watercourse	low	300	no div. potential
82-EN	61	6.09	watercourse	low	300	no div. potential
82-MG	4	0.33	watercourse	low	300	no div. potential
82-SC-049	7	0.57	watercourse	low	300	no div. potential
82-MS-003	5	0.51	watercourse	low	296	no div. potential
82-PG	21	2.04	watercourse	low	290	yes, road
82-RG-024	3	0.35	ditch relief	low	289	no div. potential
82-NR-106	7	0.61	watercourse	low	280	yes, road
82-EN-016	4	0.35	watercourse	low	275	no div. potential
82-RC	14	1.41	watercourse	low	275	no div. potential
82-EN-009	6	0.57	watercourse	low	270	no div. potential
81-M	344	34.38	watercourse	low	250	no div. potential
82-BC	22	2.17	watercourse	low	250	no div. potential
82-SM	32	3.17	watercourse	low	250	no div. potential
81-M	343	34.30	watercourse	low	242	yes, ditch
82-T4	11	1.05	watercourse	low	240	no div. potential
82-CA-013	1	0.08	watercourse	low	230	no div. potential
82-LB-017	22	2.01	watercourse	low	230	no div. potential
82-BG-013	7	0.55	watercourse	low	222	no div. potential
82-RG	6	0.50	watercourse	low	222	no div. potential
82-EN	21	1.91	watercourse	low	220	no div. potential
82-EN-035	3	0.27	ditch relief	low	220	no div. potential
82-NR-106	14	1.41	watercourse	low	220	no div. potential
82-RC	36	3.41	watercourse	low	220	no div. potential
82-RG	7	0.60	watercourse	low	216	no div. potential
82-EN	53	4.84	watercourse	low	215	no div. potential
82-BC	18	1.80	watercourse	low	210	yes, road
82-BG-013	8	0.83	watercourse	low	210	no div. potential
82-EN	48	4.34	ditch relief	low	210	no div. potential
82-EN-009	5	0.36	watercourse	low	210	no div. potential
82-SR-041	2	0.22	watercourse	low	210	no div. potential
82-MS-003-08	6	0.44	watercourse	low	205	no div. potential
82-EN-009	2	0.11	watercourse	low	200	no div. potential
82-RG	10	0.81	ditch relief	low	200	yes, road
82-SM	7	0.61	watercourse	low	200	yes, ditch
82-SC-049	10	0.93	watercourse	low	198	yes, road
82-MS-020-15	2	0.13	watercourse	low	197	no div. potential
82-SM-052-05	3	0.31	watercourse	low	195	no div. potential
82-RC	11	1.06	watercourse	low	190	no div. potential
82-BP	32	3.19	watercourse	low	185	yes, ditch
82-SM-052	11	1.10	watercourse	low	185	no div. potential
82-DH-005	8	0.77	watercourse	low	180	no div. potential
82-MS-025	3	0.26	watercourse	low	180	yes, road
82-NF-019	4	0.35	watercourse	low	180	no div. potential
82-NR-106	3	0.31	watercourse	low	180	yes, road
82-NR-106	12	1.16	watercourse	low	180	yes, road
82-PG	31	3.14	watercourse	low	180	no div. potential
82-T4	10	0.96	watercourse	low	180	no div. potential
82-EN	17	1.43	watercourse	low	170	yes, ditch
82-CA-013	2	0.18	watercourse	low	160	yes, road
82-NF-019	1	0.13	watercourse	low	160	yes, road
82-PG	20	1.94	watercourse	low	160	no div. potential
82-SM-025	20	1.96	watercourse	low	160	no div. potential
82-BG-011	6	0.47	ditch relief	low	150	no div. potential
82-EN	15	1.32	watercourse	low	150	yes, ditch
82-NR-106	15	1.47	watercourse	low	150	yes, road
82-PG	25	2.35	watercourse	low	150	yes, road
82-RC	12	1.19	watercourse	low	150	yes, road
82-T4	8	0.82	watercourse	low	150	no div. potential
82-T4	9	0.88	watercourse	low	150	no div. potential
82-BG-013	6	0.43	watercourse	low	148	no div. potential
82-LB-018	6	0.64	watercourse	low	148	no div. potential
82-MS-003-08	5	0.36	watercourse	low	148	no div. potential
82-MS-020	10	0.59	watercourse	low	148	no div. potential
82-RG-009-11	1	0.00	ditch relief	low	148	no div. potential
82-RG-015	3	0.26	ditch relief	low	148	no div. potential
82-EN	42	3.88	watercourse	low	145	yes, ditch
82-BG-011	1	0.05	ditch relief	low	140	yes, road
82-MS-003-08	4	0.34	watercourse	low	140	no div. potential
82-T4-017	5	0.44	watercourse	low	140	no div. potential
82-FG-004	4	0.35	watercourse	low	133	no div. potential
82-SR	12	1.25	watercourse	low	133	yes, ditch
82-BC	11	1.13	watercourse	low	130	yes, road
82-GP-075	1	0.09	watercourse	low	130	already diverted
82-SM	12	1.09	watercourse	low	130	no div. potential
82-RC	9	0.82	watercourse	low	125	yes, road
82-SR-041	11	1.06	watercourse	low	125	no div. potential
82-RG	4	0.30	ditch relief	low	123	yes, road
82-BC	16	1.60	watercourse	low	120	no div. potential
82-NR-106	16	1.56	watercourse	low	120	yes, road
82-SM-025	21	2.09	watercourse	low	120	no div. potential
82-RG-009-05	1	0.05	ditch relief	low	119	yes, road
82-SM-052	10	0.98	watercourse	low	118	no div. potential

82-PG	46	4.63	watercourse	low	115	no div. potential
82-MS-003-08	3	0.26	watercourse	low	111	no div. potential
82-RG-009	2	0.04	watercourse	low	111	no div. potential
82-BR-032	2	0.19	watercourse	low	110	yes, road
82-EN	33	3.06	watercourse	low	110	no div. potential
82-EN	34	3.10	watercourse	low	110	no div. potential
82-EN	41	3.74	watercourse	low	110	no div. potential
82-MP	13	1.29	watercourse	low	110	no div. potential
82-PG	23	2.13	watercourse	low	110	yes, road
82-RG	9	0.69	ditch relief	low	110	yes, road
82-EN-009	3	0.28	watercourse	low	105	no div. potential
82-RC	34	3.33	watercourse	low	105	yes, road
82-RG-009	3	0.14	ditch relief	low	104	no div. potential
81-M	343	34.30	watercourse	low	101	no div. potential
81-WE	9	0.89	watercourse	low	100	yes, road
82-BC	2	0.21	watercourse	low	100	no div. potential
82-EN-016	3	0.31	watercourse	low	100	no div. potential
82-NR-106	5	0.44	watercourse	low	100	yes, road
82-RC	10	0.85	watercourse	low	100	no div. potential
82-RG-002	16	1.50	watercourse	low	100	yes, road
82-SM-025	8	0.80	watercourse	low	100	yes, road
82-RG	2	0.16	ditch relief	low	99	yes, ditch
82-MS-020-15	1	0.06	watercourse	low	98	no div. potential
82-RG-009	1	0.01	ditch relief	low	96	yes, road
82-SC	21	2.11	watercourse	low	95	yes, ditch
82-BC	24	2.39	watercourse	low	90	yes, road
82-BR-021	3	0.31	watercourse	low	90	yes, road
82-GP-075	3	0.31	watercourse	low	90	no div. potential
82-SM	13	1.26	watercourse	low	90	no div. potential
82-LB-017	23	2.07	watercourse	low	89	no div. potential
82-RG-009	5	0.31	ditch relief	low	89	no div. potential
82-RG-009	8	0.65	ditch relief	low	89	no div. potential
82-MS-020	18	1.38	watercourse	low	88	no div. potential
82-MS-020	19	1.45	watercourse	low	88	no div. potential
82-MS	15	1.51	watercourse	low	85	no div. potential
82-RC	7	0.67	watercourse	low	85	no div. potential
82-SR-052	3	0.31	watercourse	low	85	yes, road
82-SM	10	0.88	watercourse	low	85	no div. potential
82-SM	11	0.94	ditch relief	low	85	no div. potential
81-BC	30	3.04	watercourse	low	80	no div. potential
82-MS-020	14	0.90	watercourse	low	80	yes, road
82-NR-106	4	0.38	watercourse	low	80	yes, road
82-RC	35	3.38	watercourse	low	80	yes, road
82-SR-059	5	0.37	watercourse	low	80	no div. potential
82-BG-013	9	0.85	ditch relief	low	79	no div. potential
82-LB-017	24	2.11	watercourse	low	78	no div. potential
82-MS-003	4	0.38	watercourse	low	78	no div. potential
82-MS-020	17	1.25	watercourse	low	78	yes, road
82-RG-009-08	2	0.15	ditch relief	low	78	no div. potential
82-BG	5	0.39	ditch relief	low	75	yes, road
82-BR-021	16	1.57	watercourse	low	75	yes, road
82-BR-021-28	3	0.25	ditch relief	low	75	no div. potential
82-EN	27	2.65	ditch relief	low	75	yes, ditch
82-EN	39	3.63	ditch relief	low	75	no div. potential
82-EN	56	5.00	watercourse	low	75	no div. potential
82-MS-020	2	0.17	watercourse	low	75	yes, road
82-SC-049	19	1.91	watercourse	low	75	undetermined
82-SR	46	4.59	watercourse	low	75	no div. potential
82-SR-059	4	0.35	watercourse	low	75	yes, road
82-T4-017	4	0.41	watercourse	low	75	no div. potential
82-EN-016	1	0.12	watercourse	low	74	no div. potential
82-LB-017	16	1.58	watercourse	low	74	no div. potential
82-RG-009	6	0.34	ditch relief	low	74	no div. potential
82-RG-012	1	0.14	ditch relief	low	74	yes, ditch
82-SC-048	1	0.03	watercourse	low	74	yes, ditch
82-EN	9	0.91	ditch relief	low	70	yes, ditch
82-BR-032	4	0.45	watercourse	low	65	no div. potential
82-EN-009	4	0.32	watercourse	low	65	no div. potential
82-RC	32	3.20	ditch relief	low	65	yes, road
82-RG-009	4	0.22	ditch relief	low	65	yes, ditch
82-RG-009-01	2	0.19	ditch relief	low	65	no div. potential
82-RG	3	0.25	ditch relief	low	62	yes, ditch
82-SC	13	1.26	watercourse	low	62	no div. potential
82-DH	10	0.62	watercourse	low	60	yes, road
82-EN	24	2.39	watercourse	low	60	yes, ditch
82-EN-046	1	0.08	ditch relief	low	60	no div. potential
82-MP-013	1	0.08	watercourse	low	60	no div. potential
82-PG	22	2.11	watercourse	low	60	no div. potential
82-RC	33	3.21	ditch relief	low	60	yes, road
82-HW	8	0.82	watercourse	low	60	yes, road
82-RG-009	9	0.81	ditch relief	low	59	yes, ditch
82-RG	8	0.65	ditch relief	low	56	yes, road
82-RG-006-02	1	0.05	ditch relief	low	56	yes, ditch
82-DH-005	4	0.32	watercourse	low	55	yes, road
82-FG	19	1.90	watercourse	low	52	no div. potential
81-BV-131-02	3	0.32	watercourse	low	50	yes, road

82-BG	4	0.27	ditch relief	low	50	yes, road
82-BR	36	3.60	watercourse	low	50	yes, road
82-BR	37	3.67	watercourse	low	50	yes, road
82-CC	1	0.10	ditch relief	low	50	yes, road
82-EN	8	0.83	ditch relief	low	50	yes, ditch
82-EN	11	1.11	watercourse	low	50	no div. potential
82-RG-009-08	4	0.36	ditch relief	low	50	no div. potential
82-T4	12	1.14	watercourse	low	50	no div. potential
82-LB-017	25	2.13	watercourse	low	49	no div. potential
82-RG-009	7	0.40	ditch relief	low	49	no div. potential
82-RG-009-01	1	0.08	ditch relief	low	49	yes, ditch
82-RG-015	1	0.09	ditch relief	low	46	no div. potential
81-BV-131-02	2	0.24	watercourse	low	45	yes, road
81-BV-131-02	4	0.38	watercourse	low	45	yes, road
82-EN	30	2.89	ditch relief	low	45	no div. potential
82-FG	1	0.08	ditch relief	low	45	yes, road
82-MS-020	11	0.61	ditch relief	low	45	no div. potential
82-NF	21	1.83	watercourse	low	45	yes, road
82-RC-026	2	0.12	watercourse	low	45	no div. potential
82-SC	6	0.56	ditch relief	low	45	yes, road
82-SR-052-09	1	0.01	watercourse	low	45	already diverted
82-EN	7	0.73	ditch relief	low	44	yes, road
82-RG	16	1.59	ditch relief	low	44	yes, ditch
82-SR	66	6.57	ditch relief	low	43	yes, ditch
81-M	342	34.14	ditch relief	low	41	no div. potential
82-SM	1	0.03	watercourse	low	41	yes, road
82-BC-028	1	0.02	watercourse	low	40	no div. potential
82-EN	19	1.85	ditch relief	low	40	no div. potential
82-EN	35	3.22	ditch relief	low	40	no div. potential
82-EN	40	3.66	ditch relief	low	40	yes, ditch
82-EN	45	4.08	ditch relief	low	40	yes, ditch
82-EN	49	4.39	ditch relief	low	40	yes, road
82-GP-089	2	0.15	watercourse	low	40	no div. potential
82-RC-026	1	0.11	watercourse	low	40	no div. potential
82-SM	50	4.96	ditch relief	low	40	no div. potential
82-SM-025	4	0.38	watercourse	low	40	no div. potential
82-SR	19	1.94	ditch relief	low	40	yes, road
82-SR	60	5.80	watercourse	low	40	no div. potential
82-RC	1	0.05	ditch relief	low	38	yes, road
82-BG-013	4	0.38	watercourse	low	37	no div. potential
82-BG-013	5	0.41	watercourse	low	37	no div. potential
82-LB-017	17	1.60	watercourse	low	37	no div. potential
82-RG	5	0.39	ditch relief	low	37	yes, ditch
82-RG	13	1.23	ditch relief	low	37	no div. potential
82-BC	7	0.74	ditch relief	low	35	yes, road
82-EN	36	3.31	ditch relief	low	35	no div. potential
82-RC	8	0.73	ditch relief	low	35	yes, road
82-RC-022	2	0.17	ditch relief	low	35	yes, road
82-MS-003	2	0.10	watercourse	low	31	no div. potential
81-BV-131-02	1	0.03	watercourse	low	30	no div. potential
82-BR	29	2.89	watercourse	low	30	no div. potential
82-EN	23	2.35	ditch relief	low	30	yes, ditch
82-EN	29	2.82	ditch relief	low	30	no div. potential
82-EN	37	3.39	ditch relief	low	30	yes, ditch
82-EN	55	4.96	ditch relief	low	30	no div. potential
82-EN	57	5.03	ditch relief	low	30	no div. potential
82-FG-004-02	8	0.75	ditch relief	low	30	no div. potential
82-FG-004-02	12	1.16	ditch relief	low	30	no div. potential
82-NR-106	13	1.18	watercourse	low	30	yes, road
82-PG	43	4.15	watercourse	low	30	no div. potential
82-RC	5	0.53	watercourse	low	30	no div. potential
82-SC-049	5	0.49	watercourse	low	30	yes, road
82-SR	57	5.69	watercourse	low	30	yes, ditch
82-RG	11	1.07	ditch relief	low	28	no div. potential
82-EN-009-05	1	0.00	ditch relief	low	27	yes, road
82-BC-008	2	0.19	ditch relief	low	25	yes, road
82-BR-021	18	1.78	watercourse	low	25	already diverted
82-DH	3	0.16	ditch relief	low	25	yes, road
82-EN	22	2.19	ditch relief	low	25	no div. potential
82-EN	38	3.51	ditch relief	low	25	no div. potential
82-EN	47	4.31	ditch relief	low	25	yes, ditch
82-MS-003-08	1	0.05	watercourse	low	25	yes, road
82-NF	20	1.74	ditch relief	low	25	yes, road
82-NF-029	4	0.42	ditch relief	low	25	no div. potential
82-SR	2	0.21	ditch relief	low	25	yes, road
82-SR	37	3.69	ditch relief	low	25	no div. potential
82-SR	43	4.32	ditch relief	low	25	no div. potential
82-EN-009	1	0.00	ditch relief	low	24	yes, ditch
82-SC-048	6	0.33	watercourse	low	23	no div. potential
82-BG	1	0.01	ditch relief	low	22	yes, road
82-SR	16	1.56	ditch relief	low	22	yes, ditch
82-SC	22	2.19	ditch relief	low	21	no div. potential
82-SC	35	3.50	ditch relief	low	21	no div. potential
82-SC	36	3.60	ditch relief	low	21	no div. potential
82-SC	37	3.64	ditch relief	low	21	no div. potential
82-SC-039	9	0.92	ditch relief	low	21	no div. potential

82-SC-039	10	0.97	ditch relief	low	21	no div. potential
82-SC-039	11	1.03	ditch relief	low	21	no div. potential
82-SM	42	4.18	ditch relief	low	21	no div. potential
82-BC	3	0.29	ditch relief	low	20	no div. potential
82-BR-021	23	2.26	watercourse	low	20	no div. potential
82-BR-021	24	2.28	watercourse	low	20	no div. potential
82-BR-021-18	2	0.23	ditch relief	low	20	yes, road
82-CC	7	0.71	watercourse	low	20	yes, road
82-DH	9	0.44	ditch relief	low	20	yes, ditch
82-DH-005	3	0.07	ditch relief	low	20	yes, ditch
82-EN	14	1.25	ditch relief	low	20	no div. potential
82-EN	28	2.77	ditch relief	low	20	yes, ditch
82-EN	31	2.94	ditch relief	low	20	yes, ditch
82-EN	32	2.99	ditch relief	low	20	yes, ditch
82-EN	43	3.93	ditch relief	low	20	yes, ditch
82-EN	46	4.13	ditch relief	low	20	yes, ditch
82-EN	54	4.93	ditch relief	low	20	no div. potential
82-MG	7	0.71	watercourse	low	20	no div. potential
82-MS-003	3	0.20	watercourse	low	20	yes, road
82-MS-020-05	1	0.14	ditch relief	low	20	yes, road
82-NF-029	2	0.22	ditch relief	low	20	no div. potential
82-SR	4	0.41	ditch relief	low	20	yes, road
82-SR	14	1.35	ditch relief	low	20	no div. potential
82-SR	15	1.47	ditch relief	low	20	yes, ditch
82-SR-006	4	0.25	ditch relief	low	20	yes, road
82-SR-052	5	0.51	ditch relief	low	20	yes, road
82-SR-052	6	0.56	ditch relief	low	20	yes, road
82-SR-052	8	0.80	ditch relief	low	20	yes, road
82-HW	7	0.55	watercourse	low	20	no div. potential
81-BV-129	4	0.43	watercourse	low	19	no div. potential
81-BV-129-05	1	0.03	ditch relief	low	19	no div. potential
82-SC-048	3	0.14	ditch relief	low	19	no div. potential
82-SC-048	5	0.25	watercourse	low	19	no div. potential
82-FG	5	0.47	ditch relief	low	18	no div. potential
82-MS-020	4	0.30	ditch relief	low	18	yes, road
82-MS-025-06	2	0.20	watercourse	low	18	no div. potential
82-SC-049	6	0.56	ditch relief	low	18	no div. potential
82-SM	44	4.42	ditch relief	low	18	no div. potential
82-EN-016	2	0.17	ditch relief	low	17	no div. potential
82-SC	10	1.00	ditch relief	low	16	no div. potential
82-SC	14	1.38	watercourse	low	16	no div. potential
82-BG	3	0.16	ditch relief	low	15	no div. potential
82-BR	19	1.93	watercourse	low	15	yes, road
82-BR	38	3.74	watercourse	low	15	no div. potential
82-MS-020	5	0.38	ditch relief	low	15	no div. potential
82-NF	26	2.63	ditch relief	low	15	already diverted
82-SR	58	5.72	watercourse	low	15	no div. potential
82-SR-061	1	0.10	ditch relief	low	15	already diverted
82-SC	11	1.04	watercourse	low	13	no div. potential
82-PG	24	2.16	ditch relief	low	12	yes, road
82-SR	9	0.94	ditch relief	low	12	yes, ditch
82-SR	10	1.03	ditch relief	low	12	yes, ditch
82-SR-059	2	0.22	ditch relief	low	12	no div. potential
82-EN	13	1.24	ditch relief	low	11	yes, ditch
82-BR	34	3.44	watercourse	low	10	no div. potential
82-DH	5	0.24	ditch relief	low	10	yes, ditch
82-MG	2	0.17	ditch relief	low	10	yes, ditch
82-NF	8	0.75	ditch relief	low	10	already diverted
82-NF	9	0.93	ditch relief	low	10	yes, road
82-NF	16	1.59	ditch relief	low	10	already diverted
82-NF	17	1.65	ditch relief	low	10	yes, road
82-NF	18	1.65	ditch relief	low	10	yes, ditch
82-NF	19	1.66	ditch relief	low	10	yes, road
82-NF-019	5	0.45	watercourse	low	10	yes, road
82-NR-106	2	0.24	watercourse	low	10	yes, road
82-SR	59	5.78	ditch relief	low	10	yes, ditch
82-SR-006	2	0.05	ditch relief	low	10	yes, road
82-SR-006	5	0.36	ditch relief	low	10	yes, road
82-SM	9	0.79	ditch relief	low	10	yes, ditch
82-DH	6	0.26	watercourse	low	8	yes, road
82-BR-021	19	1.91	watercourse	low	7	yes, road
82-DH	2	0.09	ditch relief	low	7	yes, road
82-DH	4	0.22	ditch relief	low	7	yes, road
82-DH	8	0.41	ditch relief	low	7	yes, road
82-SM	2	0.13	ditch relief	low	7	yes, road
82-DH	1	0.05	ditch relief	low	6	yes, ditch
82-DH-005	1	0.00	ditch relief	low	6	yes, road
82-HR	6	0.40	watercourse	low	6	yes, ditch
82-HR	8	0.60	ditch relief	low	6	yes, ditch
82-HR	17	1.42	watercourse	low	6	yes, ditch
82-EN	18	1.61	ditch relief	low	5	yes, road
82-NF	4	0.40	ditch relief	low	5	no div. potential
82-SR	1	0.11	ditch relief	low	5	already diverted
82-HW	6	0.49	ditch relief	low	4	yes, road
82-SM	14	1.35	watercourse	low	4	yes, road
82-MG	3	0.21	ditch relief	low	3	yes, ditch

82-SR	3	0.22	ditch relief	low	3	yes, ditch
82-HR	7	0.50	watercourse	low	3	yes, road
82-HW	1	0.13	watercourse	low	3	yes, road
82-RG-002	2	0.22	watercourse	low	1	yes, road
82-HR	1	0.03	ditch relief	low	1	yes, ditch
82-HR	26	2.00	ditch relief	low	1	yes, ditch
81-BH	2	0.19	ditch relief	low	0	no div. potential
81-BH	3	0.31	ditch relief	low	0	no div. potential
81-BH	4	0.40	ditch relief	low	0	yes, road
82-BP	33	3.24	ditch relief	low	0	yes, road
82-BP-021	5	0.47	ditch relief	low	0	no div. potential
82-BP-024	3	0.34	ditch relief	low	0	no div. potential
82-BR-021	29	2.89	ditch relief	low	0	no div. potential
82-BR-021-28	1	0.10	ditch relief	low	0	no div. potential
82-DH	7	0.32	ditch relief	low	0	no div. potential
82-FG	3	0.21	ditch relief	low	0	yes, road
82-FG-004	2	0.21	watercourse	low	0	yes, road
82-FG-004	3	0.29	ditch relief	low	0	yes, road
82-FG-031	8	0.84	watercourse	low	0	no div. potential
82-LB-018	5	0.50	ditch relief	low	0	yes, road
82-MS	17	1.70	ditch relief	low	0	yes, road
82-NF	3	0.18	ditch relief	low	0	already diverted
82-PG	34	3.41	watercourse	low	0	no div. potential
82-PG	35	3.51	watercourse	low	0	yes, road
82-PG	36	3.53	ditch relief	low	0	no div. potential
82-PG	37	3.61	watercourse	low	0	yes, road
82-PG	38	3.83	watercourse	low	0	yes, road
82-PG	40	3.96	watercourse	low	0	no div. potential
82-PG	41	3.99	watercourse	low	0	no div. potential
82-PG	42	4.02	watercourse	low	0	no div. potential
82-RG-015-02	2	0.15	ditch relief	low	0	yes, ditch
82-SM	36	3.61	ditch relief	low	0	no div. potential
82-HR	11	0.87	ditch relief	low	0	yes, ditch
82-HR	14	1.19	watercourse	low	0	yes, road
82-GP-130	1	0.12	watercourse	none	999999	undetermined
82-GP-130	2	0.18	watercourse	none	999999	undetermined
82-GP-130	3	0.21	watercourse	none	999999	undetermined
82-GP-130	4	0.26	watercourse	none	999999	undetermined
82-GP-130-01	1	0.14	watercourse	none	999999	undetermined
82-GP-130-01	2	0.16	watercourse	none	999999	undetermined
82-GP-130-01	3	0.20	watercourse	none	999999	undetermined
82-GP-130-01	4	0.24	watercourse	none	999999	undetermined
82-GP-130-01	5	0.50	watercourse	none	999999	undetermined
82-GP-130-01	6	0.58	watercourse	none	999999	undetermined
81-M-348	5	0.55	watercourse	none	296	no div. potential
81-BV-123-02	3	0.25	watercourse	none	118	no div. potential
82-BG	10	0.96	ditch relief	none	67	no div. potential
82-MS-020	9	0.54	ditch relief	none	33	no div. potential
82-SR-079	3	0.33	ditch relief	none	28	no div. potential
82-CC	8	0.85	ditch relief	none	20	yes, road
81-M-348	1	0.14	ditch relief	none	16	no div. potential
82-HR	27	2.17	ditch relief	none	1	yes, road
78-KS-013	14	1.39	ditch relief	none	0	undetermined
78-KS-013	21	2.10	ditch relief	none	0	undetermined
78-KS-013	22	2.18	ditch relief	none	0	undetermined
78-KS-013	23	2.30	ditch relief	none	0	undetermined
82-FG	2	0.15	ditch relief	none	0	yes, road
82-MS	6	0.61	ditch relief	none	0	no div. potential
82-MS	9	0.90	ditch relief	none	0	no div. potential
82-MS	11	1.09	ditch relief	none	0	no div. potential
82-MS	12	1.25	ditch relief	none	0	no div. potential
82-MS-003	1	0.06	ditch relief	none	0	no div. potential
82-HW-012	3	0.31	watercourse	none	0	yes, road
82-HW-014	1	0.14	ditch relief	none	0	yes, ditch
82-HW-014	2	0.17	watercourse	none	0	yes, road
82-HW-014	3	0.26	watercourse	none	0	yes, road
82-SM	8	0.64	ditch relief	none	0	no div. potential
82-SM	15	1.40	ditch relief	none	0	yes, ditch
82-SM	17	1.67	ditch relief	none	0	no div. potential
82-HR	21	1.60	ditch relief	undetermined	8	yes, ditch
82-BR-021	11	1.13	watercourse	undetermined	0	undetermined
82-CA-027	1	0.07	undetermined	undetermined	0	undetermined
82-MS-020	21	1.65	undetermined	undetermined	0	undetermined
82-NR-106	6	0.52	watercourse	undetermined	0	no div. potential
82-NR-130	1	0.00	undetermined	undetermined	0	undetermined
82-PG	11	1.07	undetermined	undetermined	0	undetermined
82-PG	17	1.69	undetermined	undetermined	0	undetermined
82-PG	19	1.89	undetermined	undetermined	0	undetermined
82-RG	12	1.16	ditch relief	undetermined	0	yes, ditch
82-HR	13	0.99	watercourse	undetermined	0	yes, road
82-HW	5	0.46	undetermined	undetermined	0	undetermined

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82-GP-123-08	4	0.365	other	high	3000	no div. potential
82-GP-123-08	2	0.188	other	high	2000	already diverted
82-RG-002	23	2.318	other	high	1900	no div. potential
82-CC-006	6	0.635	other	high	1800	yes, road
82-MS	16	1.585	bridge	high	1611	no div. potential
82-GP-123-08	5	0.506	humboldt	high	1000	no div. potential
82-SM-052-02	3	0.337	other	high	830	no div. potential
82-GP-123-08	3	0.316	other	high	740	yes, road
82-SM-025	18	1.754	other	high	600	no div. potential
82-HW-009	2	0.212	other	high	600	no div. potential
82-GP-123-08-01	1	0.064	other	high	600	yes, road
82-SM-025	14	1.427	other	high	500	no div. potential
82-SM-002-03-01	1	0.09	other	high	400	no div. potential
82-HW-009	3	0.274	other	high	170	no div. potential
82-GP-172	1	0.064	other	high	100	yes, road
82-RG-002-06	18	1.766	other	high	70	no div. potential
82-HR-019	2	0.197	other	high	60	no div. potential
82-HR-017	1	0.088	other	high	60	no div. potential
82-HR-019	4	0.26	other	high	45	no div. potential
82-BV-140	1	0.067	other	high	40	no div. potential
82-BR	18	1.778	dipped	high	25	yes, road
82-HR-009	1	0.143	other	high	25	no div. potential
82-HR-019	3	0.242	other	high	0	no div. potential
82-CS	14	1.317	other	moderate	300150	no div. potential
82-MG-002	4	0.368	dipped	moderate	700	yes, road
82-GP-123	5	0.507	other	moderate	600	yes, road
82-CC-006	7	0.714	other	moderate	560	no div. potential
82-RN-005	5	0.438	dipped	moderate	400	no div. potential
82-BR-032	1	0.095	other	moderate	400	yes, road
82-BR	26	2.605	bridge	moderate	400	no div. potential
82-CS	15	1.471	other	moderate	330	no div. potential
82-NF-005	4	0.358	dipped	moderate	250	no div. potential
82-DC	1	0.094	humboldt	moderate	230	yes, road
82-MG-002	2	0.21	dipped	moderate	230	no div. potential
82-RN-018	9	0.875	dipped	moderate	230	yes, road
82-CS	17	1.625	other	moderate	230	no div. potential
82-GP-123-08	6	0.57	other	moderate	200	yes, road
82-SM-025	1	0.02	other	moderate	200	no div. potential
82-RN-005	4	0.403	dipped	moderate	200	no div. potential
82-BP-027	11	1.008	other	moderate	195	no div. potential
82-DC-003	1	0.024	dipped	moderate	180	no div. potential
82-SM-006	3	0.337	other	moderate	170	no div. potential
82-CS	13	1.269	dipped	moderate	170	yes, road
82-DC	3	0.228	dipped	moderate	160	no div. potential
82-RN-005	3	0.345	dipped	moderate	160	no div. potential
82-RG-002-06	6	0.649	other	moderate	140	no div. potential
82-BP-027	10	0.842	other	moderate	125	no div. potential
82-GP-123	3	0.333	other	moderate	120	yes, road
82-BR-004	2	0.188	dipped	moderate	100	no div. potential
82-HW-008	3	0.337	other	moderate	100	already diverted
82-RN-005	12	1.152	dipped	moderate	100	already diverted
82-BP-033	4	0.396	other	moderate	100	no div. potential
82-RG-002	26	2.501	dipped	moderate	100	no div. potential
82-CS	7	0.694	dipped	moderate	80	no div. potential
82-HW	3	0.32	other	moderate	60	no div. potential
82-DC-003	3	0.25	dipped	moderate	60	no div. potential
82-DC-008	1	0.007	dipped	moderate	40	no div. potential
82-CC-004	5	0.472	dipped	moderate	30	yes, road
82-BR-019	4	0.28	dipped	moderate	25	yes, road
82-BR-016	6	0.472	dipped	moderate	20	no div. potential
82-BV-140	5	0.462	other	moderate	8	no div. potential
82-SR	61	6.109	bridge	low	800	no div. potential
82-BV-085	1	0.104	dipped	low	550	yes, road
82-BR-021	33	3.344	other	low	430	no div. potential
82-BV-085	5	0.469	dipped	low	370	yes, road
82-BV-079	9	0.931	dipped	low	370	yes, road
82-RN-005	11	1.055	other	low	350	no div. potential
82-NR-110	2	0.196	dipped	low	300	already diverted
82-RN-019	1	0.109	dipped	low	250	yes, road
82-NF-029-13	10	0.99	dipped	low	240	yes, road
82-NF-029-17	2	0.212	dipped	low	230	no div. potential
82-DC-002	2	0.118	dipped	low	210	yes, road
82-BR-009	1	0.088	dipped	low	200	yes, road
82-NF-005	6	0.556	dipped	low	200	no div. potential
82-BR-008	17	1.619	dipped	low	200	yes, road
82-BR-019	8	0.461	other	low	180	yes, road
82-RN-005	10	1.025	other	low	170	already diverted
82-SM-025	16	1.642	other	low	150	no div. potential
82-DC-002	1	0.036	dipped	low	150	no div. potential
82-NR-110	1	0.122	dipped	low	130	yes, road
82-PG	3	0.253	bridge	low	130	no div. potential
82-CS	16	1.523	dipped	low	130	no div. potential
82-CR-036-08	3	0.282	other	low	123	no div. potential

Road Number	Site #	Mile Post	Crossing Type	Treatment Immediacy	Controllable Volume (cu yd)	Diversion Potential
82-RN-018	6	0.616	dipped	low	120	no div. potential
82-NF-029-09-02	3	0.271	dipped	low	116	no div. potential
82-NF-029-13	15	1.374	dipped	low	115	no div. potential
82-RG-002	20	2.003	humboldt	low	110	no div. potential
82-RG-002-06	11	1.13	other	low	110	no div. potential
82-BR-021	17	1.746	dipped	low	110	yes, road
82-HW-009	1	0.011	other	low	110	no div. potential
82-GP-123	10	1.025	other	low	110	yes, road
82-SM-044	1	0.048	dipped	low	110	no div. potential
82-SM-044	2	0.088	dipped	low	110	no div. potential
82-MG-033-08	2	0.157	dipped	low	100	no div. potential
82-NF-029-13	16	1.526	dipped	low	100	no div. potential
82-BR-016	4	0.381	dipped	low	100	yes, road
82-RN-018	10	0.928	dipped	low	90	yes, road
82-NF-029-09-01	2	0.156	other	low	90	no div. potential
82-NF-029-13	13	1.18	dipped	low	90	no div. potential
82-NF-029-13	4	0.371	dipped	low	90	no div. potential
82-NF-029-17	3	0.28	dipped	low	90	no div. potential
82-NF-029-13	11	1.052	dipped	low	85	no div. potential
82-NF-029-17	4	0.378	dipped	low	80	no div. potential
82-DC-007	2	0.044	dipped	low	80	no div. potential
82-PG-049-08	5	0.466	dipped	low	80	no div. potential
82-CS	2	0.235	dipped	low	75	no div. potential
82-CC-006	1	0.056	dipped	low	75	yes, road
82-NF-029-13	14	1.308	dipped	low	70	no div. potential
82-CS-018	1	0.014	dipped	low	70	yes, road
82-CS	9	0.861	dipped	low	70	already diverted
82-SR-061	3	0.288	dipped	low	70	yes, road
82-NF-029-09-02	1	0.119	dipped	low	66	no div. potential
82-BR-021-17	1	0.118	dipped	low	65	yes, road
82-NF-029-13	12	1.152	dipped	low	65	no div. potential
82-NF-029-13	18	1.791	dipped	low	65	no div. potential
82-BC	22	2.227	dipped	low	60	already diverted
82-BP-024	2	0.168	other	low	60	no div. potential
82-BP-033	5	0.477	other	low	60	no div. potential
82-SM-033	3	0.272	dipped	low	60	no div. potential
82-DC	4	0.259	dipped	low	60	no div. potential
82-CC-006	3	0.138	dipped	low	50	yes, road
82-NF-019-01	4	0.396	dipped	low	50	no div. potential
82-CS-018	2	0.095	dipped	low	50	no div. potential
82-FG	5	0.524	other	low	50	no div. potential
82-PG-049-08	4	0.411	dipped	low	50	no div. potential
82-CC-006	4	0.406	dipped	low	50	yes, road
82-DC-005	1	0.04	dipped	low	50	no div. potential
82-RN-005	9	0.92	dipped	low	50	no div. potential
82-CC	16	1.641	dipped	low	50	yes, road
82-CS	8	0.754	dipped	low	50	no div. potential
82-DC-007	1	0.007	dipped	low	45	no div. potential
82-RN-005	13	1.195	dipped	low	40	no div. potential
82-CS	18	1.736	other	low	40	no div. potential
82-NF-029-13	19	1.926	dipped	low	40	no div. potential
82-RN-018	11	0.942	dipped	low	40	yes, road
82-GP-123	8	0.743	other	low	40	yes, road
82-BV-079	6	0.62	dipped	low	40	no div. potential
82-CR-036	9	0.804	dipped	low	40	no div. potential
82-NF-019-09	1	0.105	dipped	low	40	yes, road
82-BR-008	7	0.612	dipped	low	40	yes, road
82-DC-002	3	0.24	dipped	low	40	no div. potential
82-RG-002-06	14	1.301	other	low	40	already diverted
82-DC	7	0.626	dipped	low	40	no div. potential
82-RG-002-06	13	1.301	other	low	40	already diverted
82-BR-019	7	0.435	dipped	low	40	no div. potential
82-SM-025	21	2.064	other	low	40	no div. potential
82-SM-044	3	0.177	dipped	low	38	no div. potential
82-BP-027	8	0.682	other	low	37	no div. potential
82-SC-003-03	2	0.16	other	low	37	no div. potential
82-NF-005	3	0.217	dipped	low	35	yes, road
82-RN-018	8	0.794	dipped	low	35	yes, road
82-MS-003	6	0.592	other	low	35	no div. potential
82-NF-005	2	0.15	dipped	low	35	already diverted
82-DC	2	0.154	dipped	low	35	no div. potential
82-RG-002	24	2.382	dipped	low	35	no div. potential
82-SR-018-11	4	0.434	other	low	35	no div. potential
82-DC-003	2	0.038	dipped	low	35	no div. potential
82-PG-049	6	0.613	dipped	low	35	no div. potential
82-SR	65	6.457	dipped	low	33	already diverted
82-BR-021-17	2	0.131	dipped	low	30	yes, road
82-BR-004	1	0.133	dipped	low	30	no div. potential
82-SR-079-03	1	0.14	other	low	30	no div. potential
82-GP-123	7	0.653	other	low	30	yes, road
82-EN-066	3	0.132	dipped	low	30	no div. potential
82-RG-002	25	2.499	dipped	low	30	no div. potential
82-DH-005-03	1	0.003	dipped	low	30	no div. potential

Road Number	Site #	Mile Post	Crossing Type	Treatment Immediacy	Controllable Volume (cu yd)	Diversion Potential
82-CC-006	2	0.122	dipped	low	30	yes, road
82-RN-005	1	0.027	dipped	low	28	already diverted
82-SM-002-04	2	0.182	dipped	low	25	no div. potential
82-BR-008	15	1.502	dipped	low	25	yes, road
82-T4-017	1	0.012	dipped	low	25	no div. potential
82-CR-036	8	0.733	dipped	low	25	no div. potential
82-SR	34	3.423	bridge	low	25	already diverted
82-CR-036-09	1	0.072	dipped	low	25	no div. potential
82-SR	60	5.965	dipped	low	25	no div. potential
82-CR-036	10	0.824	dipped	low	25	no div. potential
82-RN-019	4	0.269	dipped	low	25	already diverted
82-SM-038	5	0.531	dipped	low	23	no div. potential
82-RN-019	5	0.323	dipped	low	22	no div. potential
82-PG-049	8	0.751	dipped	low	22	no div. potential
82-RN-005	6	0.569	dipped	low	20	already diverted
82-T4-017	6	0.531	dipped	low	20	no div. potential
82-T4-017	3	0.227	dipped	low	20	no div. potential
82-BP	21	2.075	other	low	20	no div. potential
82-BC-028-01	1	0.011	dipped	low	20	already diverted
82-T4-017	5	0.346	dipped	low	20	no div. potential
82-BC-028-02	1	0.003	dipped	low	20	already diverted
82-CC	2	0.243	dipped	low	20	already diverted
82-BR-008	8	0.734	dipped	low	20	yes, road
82-SR-052	9	0.874	dipped	low	20	already diverted
82-PG-049	2	0.204	low water (temp)	low	20	no div. potential
82-DH-018	5	0.459	dipped	low	20	no div. potential
82-NF-028	1	0.022	bridge	low	20	already diverted
82-RC-022	5	0.531	dipped	low	20	already diverted
82-DC	6	0.589	dipped	low	20	no div. potential
82-RG-002-06	15	1.485	other	low	20	no div. potential
82-MG-003	14	0.744	other	low	16	no div. potential
82-MG-003	13	0.744	other	low	16	no div. potential
82-SR-011	3	0.322	other	low	15	yes, road
82-BP-027	9	0.795	other	low	15	no div. potential
82-SR-079-03	8	0.732	dipped	low	15	no div. potential
82-BR-008	9	0.787	dipped	low	15	yes, ditch
82-CR-036	7	0.68	dipped	low	15	no div. potential
82-RN-019	2	0.185	other	low	15	yes, road
82-FG	8	0.773	other	low	15	no div. potential
82-SR-041	12	1.179	other	low	15	already diverted
82-BC-028-01	2	0.216	dipped	low	15	already diverted
82-NF-029	16	1.597	dipped	low	15	already diverted
82-SM-002	4	0.416	other	low	12	no div. potential
82-MS-025	7	0.715	dipped	low	12	no div. potential
82-MS-025	8	0.729	dipped	low	12	no div. potential
82-SR	79	7.875	other	low	11	no div. potential
82-PG-049-08	1	0.074	dipped	low	10	no div. potential
82-NF-019	7	0.663	dipped	low	10	yes, road
82-NF-029	21	2.112	other	low	10	already diverted
82-NF-029	3	0.347	bridge	low	10	no div. potential
82-T4-016	3	0.257	dipped	low	10	no div. potential
82-BR-019	6	0.423	dipped	low	10	yes, road
82-SR-006-11	1	0.061	dipped	low	10	no div. potential
82-BR-019	5	0.375	dipped	low	10	yes, road
82-NF-029	9	0.876	humboldt	low	10	no div. potential
82-RC-003	7	0.669	dipped	low	10	already diverted
82-SR-059-12	7	0.665	dipped	low	10	already diverted
82-BR-032-02-01	1	0.069	dipped	low	10	already diverted
82-SR-059-12	2	0.224	dipped	low	10	already diverted
82-SR-079-03	4	0.38	dipped	low	10	no div. potential
82-SR-079-03	7	0.716	dipped	low	10	no div. potential
82-BV-140	6	0.538	other	low	10	no div. potential
82-NF-029	8	0.769	bridge	low	10	no div. potential
82-T4-017	4	0.307	dipped	low	10	no div. potential
82-BR-019	1	0.008	dipped	low	10	yes, road
82-HW	4	0.424	other	low	10	no div. potential
82-BC-008	1	0.02	dipped	low	10	already diverted
82-T4-016	4	0.399	dipped	low	10	no div. potential
82-BR-008	6	0.587	dipped	low	10	yes, road
82-SR-059-12	4	0.379	dipped	low	10	already diverted
82-HW-002	1	0.134	other	low	10	no div. potential
82-BR-016	3	0.347	dipped	low	10	yes, road
82-BR-019	2	0.185	dipped	low	10	yes, road
82-T4-017	2	0.118	dipped	low	10	no div. potential
82-CC	30	3.001	dipped	low	9	no div. potential
82-BR-008	16	1.537	dipped	low	8	no div. potential
82-RN-019	3	0.216	other	low	8	no div. potential
82-BV-140	3	0.348	low water (temp)	low	7	no div. potential
82-BR-019	3	0.227	dipped	low	7	yes, road
82-MG-015	1	0.142	dipped	low	5	yes, road
82-MG-015-02	1	0.061	dipped	low	5	no div. potential
82-MG-015-02	2	0.114	dipped	low	5	no div. potential
82-MG-015-02	3	0.186	dipped	low	5	no div. potential

Road Number	Site #	Mile Post	Crossing Type	Treatment Immediacy	Controllable Volume (cu yd)	Diversion Potential
82-MG-003	8	0.448	other	low	5	no div. potential
82-SR	66	6.628	other	low	4	no div. potential
82-MG-003	10	0.565	dipped	low	2	no div. potential
82-MG-003	11	0.565	dipped	low	2	no div. potential
82-BV-128-02	2	0.212	other	low	0	no div. potential
82-SC	42	4.244	bridge	low	0	no div. potential
82-SC	47	4.744	bridge	low	0	no div. potential
82-MG-003	12	0.727	other	low	0	yes, road
82-SM	39	3.917	bridge	low	0	no div. potential
82-SC	26	2.647	bridge	low	0	no div. potential
82-SR-042	2	0.197	low water (temp)	low	0	already diverted
82-RG-002-23	2	0.059	dipped	low	0	no div. potential
82-MG-003	9	0.512	other	low	0	yes, road
82-MG-003	7	0.385	other	low	0	no div. potential
82-BP-027	3	0.273	dipped	low	0	no div. potential
82-MG-003	6	0.358	other	low	0	yes, road
82-MG-003	5	0.358	other	low	0	yes, road
82-BR-032-02-01	2	0.084	dipped	low	0	yes, road
82-BP-027	7	0.647	dipped	low	0	no div. potential
82-RG-002-06	19	1.806	dipped	low	0	no div. potential
82-RG-002-23	1	0.059	dipped	low	0	no div. potential
82-BP-027	6	0.577	dipped	low	0	no div. potential
82-EN-066	1	0.012	dipped	none	50	no div. potential
82-CR-036-08	5	0.457	dipped	none	40	no div. potential
82-BR-016	5	0.415	dipped	none	30	no div. potential
82-BC-030	1	0.036	dipped	none	0	no div. potential
82-SR-061-01	1	0.007	other	none	0	no div. potential
82-BC-027	2	0.059	dipped	none	0	no div. potential
82-BC-027	1	0.01	dipped	none	0	no div. potential
82-SR-079-03	5	0.538	dipped	none	0	no div. potential
82-RG-002-06	1	0.012	dipped	none	0	no div. potential
82-MG-003	3	0.209	other	none	0	no div. potential
82-HR-017	2	0.133	dipped	none	0	no div. potential
82-MG-003	4	0.209	other	none	0	no div. potential
82-HR-009	2	0.181	other	none	0	no div. potential
82-FG-027	1	0.141	dipped	none	0	no div. potential
82-NF-004	1	0.044	low water (temp)	none	0	no div. potential
82-EN-066	2	0.095	dipped	none	0	no div. potential
82-DC-003-04	2	0.025	low water (temp)	none	0	no div. potential
82-NF-029	31	3.06	low water (temp)	none	0	already diverted
82-PG-051	1	0.018	dipped	none	0	no div. potential
82-SR-044	1	0.061	low water (temp)	none	0	no div. potential
82-SM-033	4	0.405	dipped	none	0	no div. potential
82-SR-036	2	0.21	low water (temp)	none	0	no div. potential
82-BR-021-18	5	0.507	low water (temp)	none	0	no div. potential
82-BR-021-28	4	0.414	low water (temp)	none	0	no div. potential
82-BV-043-03	4	0.43	other	none	0	no div. potential
82-PG	1	0.109	low water (temp)	none	0	no div. potential
82-SM-038	3	0.341	dipped	none	0	no div. potential
82-SC	1	0.059	low water (temp)	none	0	no div. potential
82-BV-128	1	0.1	other	none	0	no div. potential
82-BV-128	2	0.118	other	none	0	no div. potential
82-SM-038-04	1	0.111	dipped	none	0	no div. potential
82-DC-003-04	1	0.003	low water (temp)	undetermined	0	undetermined
82-GP-123	6	0.574	undetermined	undetermined	0	undetermined
82-CR-027	1	0.104	undetermined	undetermined	0	undetermined
82-SM-006	4	0.34	humboldt	undetermined	0	no div. potential
82-MG-003	2	0.208	undetermined	undetermined	0	undetermined

Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (cu yd)
82-NR-106-11	1	0.045	high	30000
82-NR-110	2	0.231	high	3000
82-HR-007	1	0.143	high	3000
82-BR-021	29	2.922	high	2400
82-BR	26	2.57	high	2300
82-MS-020	16	1.554	high	1777
82-FG	13	1.286	high	1600
82-DC-008	1	0.1	high	1500
82-CC-006	4	0.396	high	1500
82-SR-045	7	0.688	high	1400
82-BG-011	5	0.338	high	1400
82-DC-007	2	0.167	high	850
82-NF-019	8	0.829	high	800
82-RG-002	23	2.228	high	740
82-CS	6	0.603	high	600
82-DH	3	0.253	high	555
82-CS	9	0.883	high	500
82-CS	7	0.705	high	380
82-NF-019	6	0.562	high	300
82-RG-002	25	2.524	high	280
82-SR-013	1	0.14	high	275
82-SR-013	2	0.229	high	260
82-CS	10	0.932	high	230
82-SM-002-03-01	1	0.096	high	200
82-CS	5	0.498	high	150
82-BV-128-02	3	0.294	high	100
82-HR-019	3	0.252	high	50
82-CS	17	1.667	high	0
82-NR-106	16	1.598	moderate	7000
82-BR-038	1	0.024	moderate	1500
82-RN-005	14	1.448	moderate	1240
82-DC-002	5	0.499	moderate	1100
82-BR-032	10	1.014	moderate	890
82-CS	15	1.478	moderate	830
82-MS-025	11	1.13	moderate	770
82-BR	33	3.322	moderate	740
82-MS	13	1.3	moderate	700
82-SM-025	20	2.037	moderate	700
82-MS-020	5	0.493	moderate	622
82-RN-005	13	1.326	moderate	600
82-CS	12	1.186	moderate	500
82-NF-019-01-01	2	0.145	moderate	500
82-BV-043	9	0.913	moderate	500
82-BV-075	2	0.156	moderate	450
82-NF-019	3	0.286	moderate	450
82-SM-025	14	1.435	moderate	400
82-BV-128-11-01	1	0.011	moderate	400
82-MG-033	3	0.268	moderate	400
82-RC-031	7	0.693	moderate	400
82-NF-029-09-01	2	0.107	moderate	385
82-GP-123-08-01	1	0.125	moderate	380
82-BR-009	1	0.06	moderate	370
82-NF-019-01-01	1	0.007	moderate	370
82-BR	30	2.977	moderate	370
82-DC-005	1	0.055	moderate	350
82-CC-006	10	1.001	moderate	300
82-BR-021	14	1.372	moderate	300
82-BR-021	16	1.64	moderate	300
82-RN-005	9	0.938	moderate	270
82-SR-011	2	0.185	moderate	200
82-CC-028	3	0.344	moderate	200
82-RC-003	5	0.506	moderate	200
82-NF-019-09-01	1	0.001	moderate	180
82-SR-006-11	2	0.222	moderate	180
82-BR-021	10	0.978	moderate	170
82-BP	31	3.11	moderate	129
82-NF-019-01-03	2	0.167	moderate	120
82-BR-035	1	0.014	moderate	110
82-SR-006-11	3	0.271	moderate	100
82-NF-019	7	0.712	moderate	100
82-SR-006-05	2	0.166	moderate	100
82-DH	5	0.495	moderate	100
82-NF-019-09	2	0.188	moderate	100
82-BV-128-09	1	0.002	moderate	80
82-MG-003	9	0.868	moderate	60
82-CC-006	1	0.147	moderate	60
82-BV-128-11-01	2	0.1	moderate	60
82-HR	3	0.262	moderate	40
82-SM-002-03	2	0.208	moderate	30
82-HW-007	3	0.194	moderate	6
82-NR-110-01	1	0.136	moderate	0
82-CC	7	0.673	moderate	0
82-RG-002	20	2.012	moderate	0
82-CC-006	8	0.743	moderate	0
82-CC-004	2	0.196	moderate	0
82-SM-052	16	1.582	moderate	0
82-SR-061	12	1.186	low	740
82-BV-079	9	0.855	low	670
82-SR-061-01	1	0.077	low	500
82-SM	34	3.383	low	410
82-SR-061	21	2.009	low	370
82-SR-045	1	0.133	low	370
82-DH-030-04-01	1	0.044	low	370
82-NR-106	17	1.638	low	300
82-SR-079-03	2	0.237	low	300
82-BR-021	11	1.128	low	280
82-DH-030-04	1	0.105	low	280

Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (cu yd)
82-BR-021	7	0.734	low	280
82-BR-008-08	1	0.098	low	270
82-NR-106	13	1.316	low	250
82-BR-021	23	2.252	low	250
82-NF-029-27	5	0.531	low	240
82-SM-015	3	0.347	low	240
82-MG-033	6	0.597	low	230
82-SR-061	18	1.831	low	220
82-SR-061	20	1.955	low	190
82-CC-006	5	0.541	low	185
82-RG-035	3	0.258	low	180
82-GP-075	1	0.056	low	180
82-SM-025	17	1.731	low	175
82-MG-033-08	5	0.459	low	170
82-BR-021-28-01	1	0.074	low	160
82-GP-127-03	1	0.043	low	150
82-DH-028	1	0.131	low	150
82-NF-019-01-02	1	0.055	low	150
82-DH-018	4	0.409	low	150
82-BR-021	32	3.171	low	125
82-NF-019-01	6	0.556	low	100
82-BR-008	7	0.712	low	100
82-SR-019-07-01	1	0.031	low	100
82-NR-110	1	0.018	low	100
82-DC	6	0.551	low	90
82-SM-004	3	0.273	low	75
82-BV-128-06	2	0.142	low	75
82-SR-045	4	0.38	low	75
82-BV-128	8	0.77	low	70
82-MG-033-06	1	0.032	low	70
82-NF-029-15	1	0.031	low	65
82-HR-013	1	0.017	low	65
82-SM-004	1	0.13	low	60
82-NR-090	1	0.088	low	60
82-RG-006-02	1	0.066	low	50
82-BV-128-06	1	0.041	low	50
82-HR-017	2	0.2	low	50
82-MG-033	4	0.352	low	50
82-MG-033-22	1	0.067	low	50
82-HT	10	1.032	low	50
82-NR-096	5	0.457	low	50
82-HT-005	1	0.042	low	50
82-CR-036-08	6	0.626	low	50
82-EN	40	3.973	low	50
82-SR	23	2.27	low	50
82-NF-019	5	0.48	low	50
82-RG-002	29	2.894	low	45
82-HR-015	3	0.281	low	45
82-CR-036-09	1	0.049	low	45
82-SR-006-11	1	0.121	low	40
82-PG	45	4.483	low	40
82-BR-021	4	0.367	low	40
82-NR-106-01	2	0.185	low	40
82-MG-033	7	0.711	low	40
82-HR	15	1.495	low	35
82-SR-041	1	0.089	low	30
82-DH-032-02	1	0.027	low	30
82-HR-015	1	0.123	low	30
82-SR-041	8	0.76	low	30
82-BV-128-02	2	0.208	low	30
82-PG-049	1	0.003	low	30
82-BV-085	5	0.465	low	30
82-DH	31	3.065	low	30
82-RG	5	0.532	low	27
82-SR-019	5	0.502	low	25
82-SR-006	12	1.164	low	25
82-BR	10	0.997	low	22
82-DH-030-01	1	0.108	low	20
82-MG-033	15	1.395	low	20
82-MS-025	6	0.574	low	20
82-SR-041	14	1.402	low	20
82-MG-033	16	1.592	low	20
82-SR-041-11	2	0.071	low	20
82-SR-011	4	0.418	low	20
82-BV-140	5	0.506	low	20
82-SR-019	13	1.259	low	20
82-MG-033	21	2.053	low	20
82-MG-033	17	1.698	low	20
82-MG-026	1	0.008	low	16
82-SR-016	7	0.691	low	15
82-HR-019-01	1	0.006	low	15
82-HW-007-02	1	0.037	low	15
82-SM-002	2	0.177	low	13
82-BV-128	11	1.108	low	11
82-GP-069	3	0.278	low	10
82-MG-033-20	1	0.091	low	10
82-SM-002	7	0.719	low	10
82-RC-003	7	0.689	low	10
82-BR-032-02-01	1	0.001	low	10
82-SR-016	3	0.311	low	10
82-BR-004	3	0.255	low	10
82-SR-016	4	0.441	low	10
82-RG-009-11	1	0.023	low	10
82-CC-022	2	0.165	low	10
82-MG-015	18	1.753	low	10
82-SR-019-07	8	0.751	low	10
82-RC-003	9	0.949	low	10

Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (cu yd)
82-BR-008	5	0.459	low	10
82-SR-016	1	0.129	low	10
82-BV-140	2	0.15	low	10
82-SR-041	12	1.235	low	10
82-SR-041-11	1	0.007	low	10
82-BR-019	4	0.404	low	10
82-BR-021	20	1.969	low	10
82-BR-008	10	1.005	low	10
82-RG-015-05	1	0.043	low	10
82-RC-009	2	0.172	low	10
82-BC-017	1	0.021	low	5
82-BR	11	1.097	low	5
82-MG-015-02	2	0.249	low	5
82-RN-005	2	0.178	low	5
82-BC-016	1	0.044	low	5
82-MG-015	1	0.122	low	5
82-BR-001	2	0.213	low	5
82-RG	10	0.985	low	5
82-MG-033	1	0.084	low	5
82-RG-009-08	2	0.233	low	3
82-MG-026-04	1	0.08	low	3
82-HW-007	2	0.171	low	2
82-HR-009	5	0.513	low	1
82-MG-033	5	0.467	low	0
82-RC-031	4	0.405	low	0
82-MG-015-13	2	0.152	low	0
82-MG-015-08	4	0.426	low	0
82-RC-003-09	2	0.15	low	0
82-MG-033	14	1.291	low	0
82-MS-020	15	1.455	low	0
82-NF-019	2	0.22	low	0
82-NF-005	3	0.254	low	0
82-NF-019-01-02	3	0.309	low	0
82-NF-029-13-05	1	0.03	low	0
82-MS-025	4	0.391	low	0
82-MS-020-13-01	1	0.122	low	0
82-MS-020-12	1	0.08	low	0
82-MS-020	7	0.713	low	0
82-NF-029-27-01	4	0.405	low	0
82-PG	42	4.164	low	0
82-MS-020	3	0.329	low	0
82-PG-049-08	5	0.509	low	0
82-MS-020	10	0.952	low	0
82-NR-096-01	3	0.222	low	0
82-NR-104	1	0.017	low	0
82-EN-054-02	2	0.235	low	0
82-NR-123	2	0.214	low	0
82-NF-019-01	8	0.805	low	0
82-NR-130	1	0.12	low	0
82-PG-049	7	0.679	low	0
82-PG-049	8	0.783	low	0
82-MS-020	6	0.643	low	0
82-DH-005-03-01	1	0.083	low	0
82-CC-004	7	0.705	low	0
82-CC-006	7	0.68	low	0
82-CR-036	8	0.755	low	0
82-DC-003	1	0.003	low	0
82-DH-005	7	0.658	low	0
82-DH-005-02	1	0.029	low	0
82-DH-005-03	1	0.003	low	0
82-EN	63	6.311	low	0
82-DH-005-03	6	0.591	low	0
82-CC-002	8	0.752	low	0
82-DH-029	1	0.036	low	0
82-DH-030	4	0.38	low	0
82-DH-030-06	2	0.223	low	0
82-EN	13	1.278	low	0
82-EN	23	2.273	low	0
82-EN	41	4.045	low	0
82-EN-056	4	0.313	low	0
82-DH-005-03	2	0.164	low	0
82-BR-028	1	0.041	low	0
82-BG	8	0.844	low	0
82-BG-005	2	0.081	low	0
82-BG-013	7	0.689	low	0
82-BP-024	1	0.089	low	0
82-BP-024	6	0.568	low	0
82-BP-027	11	1.145	low	0
82-BR	14	1.402	low	0
82-CC-004	5	0.479	low	0
82-BR-008	12	1.191	low	0
82-CC-004	11	1.084	low	0
82-BR-032-02-01	2	0.105	low	0
82-BV-043	7	0.704	low	0
82-CC	11	1.058	low	0
82-CC	2	0.221	low	0
82-CC	9	0.905	low	0
82-CC-002	10	1.012	low	0
82-CC-002	4	0.41	low	0
82-EN-009	10	0.956	low	0
82-BR	7	0.727	low	0
82-HW-008	5	0.545	low	0
82-GP-123	6	0.627	low	0
82-GP-172-01	1	0.027	low	0
82-HR-003	3	0.25	low	0
82-HR-009-05	1	0.005	low	0
82-HT-011	1	0.019	low	0

Road Number	Site #	Mile Post	Treatment Immediacy	Controllable Volume (cu yd)
82-HT-013	1	0.014	low	0
82-HT-014	1	0.02	low	0
82-EN	43	4.277	low	0
82-HW	1	0.081	low	0
82-GP-073	2	0.24	low	0
82-HW-012	4	0.327	low	0
82-K-013	6	0.601	low	0
82-LB-004	1	0.134	low	0
82-LB-018	7	0.717	low	0
82-MG	28	2.753	low	0
82-MG-015	11	1.127	low	0
82-T4-017-06	2	0.221	low	0
82-HT-018	10	0.999	low	0
82-EN-058	1	0.035	low	0
82-EN-009	2	0.224	low	0
82-EN-009	3	0.338	low	0
82-EN-026	2	0.166	low	0
82-EN-026	5	0.514	low	0
82-EN-035-01	1	0.061	low	0
82-EN-035-02	1	0.117	low	0
82-EN-038	3	0.289	low	0
82-GP-123	13	1.274	low	0
82-EN-056	3	0.282	low	0
82-GP-073	4	0.393	low	0
82-EN-064-01	1	0.12	low	0
82-FG	20	1.95	low	0
82-FG-004	8	0.769	low	0
82-FG-004-02	7	0.719	low	0
82-FG-017	1	0.092	low	0
82-FG-021	1	0.127	low	0
82-GP-027	3	0.327	low	0
82-MG-015	16	1.586	low	0
82-EN-044	1	0.04	low	0
82-SR-016-07	1	0.049	low	0
82-SC-049	8	0.771	low	0
82-SM-017	6	0.611	low	0
82-SC-049	9	0.9	low	0
82-SR-019	14	1.358	low	0
82-SR	57	5.675	low	0
82-SR-059-12	6	0.604	low	0
82-SR-059-12	8	0.8	low	0
82-SM-017	5	0.53	low	0
82-SR-059-12-02	2	0.165	low	0
82-RN-018-09	1	0.042	low	0
82-SR	50	4.982	low	0
82-SR-006-02	1	0.022	low	0
82-SR	25	2.492	low	0
82-RG-009	5	0.53	low	0
82-SR-061	9	0.943	low	0
82-RG-009-05	1	0.078	low	0
82-RG-009-07	1	0.038	low	0
82-SR-059-12-02	1	0.111	low	0
82-SC-049	6	0.64	low	0
82-SR-019-07-04	1	0.047	low	0
82-SR-019-07	4	0.409	low	0
82-SR-019-07	1	0.012	low	0
82-SR-006	11	1.064	low	0
82-SR-019-09	1	0.084	low	0
82-SC-049	18	1.824	low	0
82-SR-006-08	2	0.104	low	0
82-SR-019-16	1	0.016	low	0
82-SM-017	4	0.355	low	0
82-SM-017	1	0.089	low	0
82-SM-017	2	0.213	low	0
82-SR-019	16	1.588	low	0
82-SR-019	8	0.776	low	0
82-RG	8	0.755	low	0
82-BG-011	6	0.486	none	800
82-MG-015-08	2	0.239	none	50
82-MG-033	19	1.856	none	20
82-MG-033	13	1.26	none	10
82-SM-002-03	1	0.057	none	10
82-MG-033-12	4	0.406	none	5

Navarro West Roadslides

Road Number	Site #	Mile Post	Roadslide Type	Treatment Immediacy	Controllable Volume (yd^3)
82-BP-027	11	1.07	deep seated	high	3700
82-FG	7	0.65	unknown	high	1480
82-SR-045	1	0.09	fill	high	1250
82-MS-020	1	0.10	fill	high	925
82-BG	6	0.59	fill	high	610
82-SM	23	2.28	fill	high	555
82-MS-003	5	0.47	fill	high	515
82-CS	4	0.38	fill	high	500
82-CS	9	0.80	streambank	high	350
82-MS-020-05	2	0.20	cutbank	high	177
82-MG-003	5	0.46	cutbank	high	60
82-SC	46	4.61	streambank	high	10
82-GP-123-08	3	0.29	fill	moderate	3000
82-MS-025	2	0.24	cutbank	moderate	1089
82-RC-031	7	0.71	fill	moderate	900
82-RG-002-06	9	0.82	streambank	moderate	900
82-BG-011	4	0.41	fill	moderate	888
82-RN-005	16	1.39	cutbank	moderate	800
82-BR	27	2.72	fill	moderate	740
82-RC-031	12	0.92	fill	moderate	680
82-CS	8	0.78	streambank	moderate	600
82-RN-005	11	1.06	cutbank	moderate	600
82-BR-021	13	1.25	fill	moderate	550
82-RN-005	9	0.84	fill	moderate	500
82-BR	39	3.85	fill	moderate	500
82-MS	12	1.15	fill	moderate	475
82-SM-052	15	1.55	fill	moderate	450
82-BR-021	27	2.68	fill	moderate	410
82-RN-005	12	1.10	cutbank	moderate	400
82-PG-049	7	0.73	fill	moderate	400
82-RN-005	5	0.44	fill	moderate	370
82-CC-006	5	0.45	fill	moderate	370
82-CC-006	6	0.60	fill	moderate	330
82-NF-029-27	4	0.39	fill	moderate	320
82-DC-008	1	0.08	streambank	moderate	300
82-RG-002-06	8	0.76	streambank	moderate	300
82-FG	8	0.69	unknown	moderate	278
82-MS-003	4	0.43	fill	moderate	259
82-RC-031	9	0.80	fill	moderate	240
82-FG-021	1	0.04	fill	moderate	233
82-RN-005	13	1.13	fill	moderate	220
82-CS	14	1.38	streambank	moderate	200
82-DC-002-02	3	0.20	cutbank	moderate	200
82-DC-003	5	0.44	streambank	moderate	200
82-RN-005	8	0.80	cutbank	moderate	200
82-HR-009	2	0.21	cutbank	moderate	200
82-SM	24	2.31	fill	moderate	200
82-BR-021	28	2.74	cutbank	moderate	200
82-CS-003	2	0.18	fill	moderate	180
82-NF-029	25	2.49	fill	moderate	180
82-PG	41	4.14	cutbank	moderate	100
82-NF-005	3	0.32	fill	moderate	100
82-DC-007	1	0.12	streambank	moderate	80
82-BG-011	3	0.31	fill	moderate	70
82-MS-025	10	1.04	fill	moderate	37
82-SR-041	5	0.50	fill	moderate	20
82-SR-041	6	0.53	fill	moderate	20
82-RN-018	9	0.87	cutbank	moderate	0
82-MS	9	0.90	unknown	moderate	0
82-MS-025	11	1.12	unknown	low	1900
82-DC-002	5	0.44	fill	low	1300
82-BG	2	0.22	fill	low	1296
82-CC-006	4	0.35	fill	low	1180
82-RC-003-09	2	0.09	fill	low	1100
82-SR-045	2	0.16	cutbank	low	610
82-SR-045	3	0.31	cutbank	low	518
82-DC-003	4	0.36	streambank	low	500
82-SM-025	1	0.04	cutbank	low	500
82-BV-043	5	0.50	fill	low	475
82-RG-032	2	0.23	cutbank	low	467
82-RG-024-03	5	0.40	fill	low	446
82-BV-043	4	0.39	fill	low	415
82-BV-043	9	0.90	fill	low	415
82-CS	16	1.56	streambank	low	380
82-SR-061	2	0.20	fill	low	370
82-BR-008-01	3	0.31	fill	low	370
82-SR-041	2	0.18	fill	low	324
82-CS	15	1.53	cutbank	low	300
82-DC-002	4	0.35	fill	low	300
82-BR-008-01	4	0.32	fill	low	290
82-RN-005	4	0.37	cutbank	low	250

Navarro West Roadslides

Road Number	Site #	Mile Post	Roadslide Type	Treatment Immediacy	Controllable Volume (yd^3)
82-GP-123	10	1.05	fill	low	240
82-RG-024-03	6	0.44	cutbank	low	238
82-RN-005	6	0.48	cutbank	low	230
82-GP-123	7	0.69	fill	low	230
82-BR-008	16	1.58	fill	low	230
82-CS	17	1.60	streambank	low	220
82-RC-031	10	0.84	fill	low	220
82-EN-026	2	0.22	cutbank	low	220
82-RN-005	7	0.54	fill	low	200
82-RG-002-06	10	0.92	streambank	low	200
82-SC-049	2	0.20	fill	low	200
82-GP-123	11	1.10	undetermined	low	190
82-SR-019-07-02	2	0.22	fill	low	190
82-RG-009	1	0.06	fill	low	185
82-RN-005	14	1.23	cutbank	low	180
82-GP-075	3	0.30	fill	low	170
82-RN-005	10	0.90	cutbank	low	160
82-DC	7	0.69	streambank	low	150
82-BR-008	13	1.34	fill	low	150
82-RG-009-05	1	0.07	fill	low	148
82-RC-031	6	0.53	fill	low	140
82-BV-075	1	0.05	cutbank	low	120
82-BV-075	2	0.08	cutbank	low	120
82-BV-075	3	0.12	cutbank	low	120
82-BP-027	16	1.59	fill	low	120
82-RC-003-09	1	0.05	fill	low	110
82-BP-024	4	0.41	fill	low	110
82-RC-031	8	0.76	cutbank	low	100
82-BG-011	8	0.79	fill	low	100
82-FG-031-05	4	0.38	unknown	low	100
82-SC	45	4.47	streambank	low	100
82-SR-006-15	1	0.05	fill	low	90
82-EN-035	1	0.12	fill	low	90
82-EN-035-05-01	1	0.04	cutbank	low	90
82-RG-032	1	0.08	cutbank	low	89
82-BR-032-02	3	0.34	fill	low	85
82-RG-024-03	3	0.31	fill	low	83
82-DC	5	0.52	streambank	low	80
82-RC	27	2.72	fill	low	80
82-RC-026	3	0.26	fill	low	80
82-CC-022	1	0.11	fill	low	80
82-NF-029	6	0.53	fill	low	80
82-EN-035	3	0.27	fill	low	80
82-SR-079-03	1	0.11	fill	low	75
82-EN	7	0.74	fill	low	75
82-NF-029	5	0.50	fill	low	70
82-RG-024-03	4	0.34	cutbank	low	70
82-FG-004-02	4	0.44	fill	low	55
82-DC-002-02	2	0.18	cutbank	low	50
82-RN-005	17	1.42	cutbank	low	50
81-BC	34	3.36	cutbank	low	50
82-SR	22	2.24	fill	low	50
82-SM-025	5	0.51	cutbank	low	37
82-BP-024	6	0.49	fill	low	36
82-RN-005	15	1.37	cutbank	low	30
82-SR-052-04	2	0.19	cutbank	low	30
82-SR-059-12	6	0.64	fill	low	20
82-SR-052	8	0.84	cutbank	low	20
82-LB-004	2	0.17	cutbank	low	20
82-MS-025	9	0.87	unknown	low	20
82-PG	42	4.22	cutbank	low	15
82-SR	28	2.79	fill	low	15
82-RG-024	4	0.45	fill	low	5
82-CS-018	2	0.24	cutbank	low	0
82-RN-018	10	0.95	cutbank	low	0
82-BR-016	1	0.11	fill	low	0
82-GP-123	8	0.72	cutbank	low	0
82-SM	36	3.58	cutbank	low	0
82-SM-025	13	1.35	fill	low	0
82-SM-033	1	0.12	fill	low	0
82-SM-044	2	0.25	cutbank	low	0
82-SM-052-02	1	0.05	fill	low	0
82-SM-052-02	2	0.15	fill	low	0
82-GP-089	3	0.27	cutbank	low	0
82-MP	10	1.03	cutbank	low	0
82-MP-013	1	0.12	cutbank	low	0
82-NF-029-27	7	0.66	cutbank	low	0
82-RC	5	0.49	fill	low	0
82-RC-031	11	0.87	fill	low	0
82-RC-031	5	0.47	cutbank	low	0
82-BV-079	8	0.76	cutbank	low	0

Navarro West Roadslides

Road Number	Site #	Mile Post	Roadslide Type	Treatment Immediacy	Controllable Volume (yd^3)
82-NF-005	5	0.47	cutbank	low	0
82-NF-005	6	0.54	cutbank	low	0
82-NF-029-13	11	1.10	cutbank	low	0
82-NF-029-13	12	1.21	cutbank	low	0
82-NF-029-13	16	1.61	cutbank	low	0
82-SR-006-11	2	0.22	cutbank	low	0
82-MG-003	10	1.01	cutbank	low	0
82-MG-003	6	0.55	cutbank	low	0
82-RG-024-03-01	1	0.06	cutbank	low	0
82-BP-024	10	0.96	fill	low	0
82-BP-024	5	0.47	cutbank	low	0
82-BP-027	17	1.66	unknown	low	0
82-FG	23	2.29	unknown	low	0
82-FG	6	0.55	cutbank	low	0
82-FG-027	3	0.29	unknown	low	0
82-FG-031	8	0.77	cutbank	low	0
82-FG-031	9	0.88	cutbank	low	0
82-MS	16	1.63	cutbank	low	0
82-MS	5	0.52	fill	low	0
82-MS	6	0.55	fill	low	0
82-MS-003	2	0.19	fill	low	0
82-MS-020	3	0.34	unknown	low	0
82-MS-020-05	1	0.11	fill	low	0
82-SR	68	6.77	cutbank	none	0
82-NF-005	4	0.40	cutbank	none	0
82-NF-029-07	1	0.15	cutbank	none	0
82-NF-029-13	10	1.02	cutbank	none	0
82-SR-006	3	0.35	cutbank	none	0
82-FG	18	1.84	unknown	none	0
82-MS	11	1.11	fill	none	0
82-SC-049	1	0.07	fill	none	0
82-PG	19	1.92	cutbank	undetermined	0
82-BP-027	13	1.31	undetermined	undetermined	0
82-BP-027	14	1.34	undetermined	undetermined	0
82-BP-027	15	1.38	undetermined	undetermined	0
82-SC	14	1.44	undetermined	undetermined	0
82-SC	15	1.48	undetermined	undetermined	0

Navarro West Other Erosion Sites

Road Number	Site #	Mile Post	Erosion Type	Treatment Immediacy	Controllable Erosion (yd^3)
82-CC-004	9	0.59	gully	high	1400
82-HR-015-04	1	0.02	gully	high	60
82-BG-011	4	0.38	gully	moderate	1300
82-CC-004	10	0.87	gully	moderate	650
82-BR-032-02	5	0.54	gully	moderate	560
82-DC-003	2	0.22	gully	moderate	500
82-BG-011	7	0.69	gully	moderate	400
82-CS	8	0.78	gully	moderate	340
82-CC-004	8	0.53	gully	moderate	300
82-NF-019-01-01	3	0.24	gully	moderate	210
82-RN-005	4	0.40	gully	moderate	200
82-BV-079	1	0.12	gully	moderate	200
82-BP-024	4	0.42	gully	moderate	200
82-GP-123	11	0.99	gully	moderate	190
82-BR-021	17	1.66	gully	moderate	160
82-CC-004	5	0.39	gully	moderate	150
82-FG	9	0.91	gully	moderate	133
82-BR-021	2	0.21	major rilling	moderate	125
82-CC-004	6	0.44	gully	moderate	100
82-BG-013	10	0.97	gully	moderate	100
82-RC-003-09	1	0.07	gully	moderate	60
82-RC-003	7	0.73	gully	moderate	50
82-CC-004	7	0.52	gully	moderate	50
82-CC-006	4	0.37	gully	moderate	20
82-GP-123	1	0.11	undetermined	low	400
82-GP-123	5	0.49	gully	low	300
82-MG-033	8	0.82	major rilling	low	300
82-MS-025	10	0.96	gully	low	300
82-NF-019-01-01	4	0.30	gully	low	260
82-GP-123	10	0.93	gully	low	200
82-NF-019-01-01	1	0.02	gully	low	150
82-BR-032-02	4	0.38	gully	low	110
82-GP-123	6	0.57	gully	low	110
82-GP-123	9	0.86	major rilling	low	90
82-NF-019-01-01	2	0.06	gully	low	90
82-DH	4	0.44	major rilling	low	75
82-BG	1	0.06	gully	low	74
82-CS	9	0.90	gully	low	60
82-RN-005	11	1.11	gully	low	60
82-BR-008-08	1	0.09	major rilling	low	50
82-GP-123	7	0.68	gully	low	50
82-BR-032-02	6	0.61	gully	low	43
82-BG-013	7	0.66	gully	low	40
82-RN-005	14	1.38	gully	low	30
82-BR-021-18	1	0.01	gully	low	30
82-SM-025	21	2.09	gully	low	25
82-SR-079-03	1	0.09	major rilling	low	25
82-BV-079	9	0.88	gully	low	25
82-RG-002-06	5	0.51	gully	low	25
82-BP-024	10	1.00	gully	low	25
82-CS	2	0.21	gully	low	20
82-BR	18	1.83	gully	low	20
82-EN	58	5.78	gully	low	20
82-SR-052	3	0.29	gully	low	15
82-CC	9	0.93	gully	low	15
82-CC-004	4	0.37	gully	low	15
82-HR-003	1	0.06	gully	low	10
82-BR	15	1.46	gully	low	10
82-CC-006	2	0.19	gully	low	10
82-DH-005-03	2	0.16	gully	low	10
82-RG-002-06	3	0.34	gully	low	10
82-FG	3	0.31	major rilling	low	10
82-BR-021-17	1	0.03	gully	low	9
82-BR-021	18	1.68	gully	low	7
82-DC-002	1	0.05	major rilling	low	5
81-BV-129	5	0.53	major rilling	low	5
82-RG-012	1	0.07	gully	low	5
82-DH-018	3	0.26	gully	low	1
82-RN-005	1	0.01	gully	low	0
82-RN-005	2	0.07	major rilling	low	0
82-SM	2	0.17	gully	low	0
82-SM-025-07	3	0.31	major rilling	low	0
82-SM-025-07	4	0.37	major rilling	low	0
82-GP-089	1	0.07	major rilling	low	0
82-GP-089	2	0.12	major rilling	low	0
82-SR-041	3	0.27	gully	undetermined	15
82-PG	3	0.33	undetermined	undetermined	0
82-BP-027	11	1.05	major rilling	undetermined	0
82-MS-003-09	3	0.25	undetermined	undetermined	0

Culvert Sizing Analysis for Navarro West Watercourse Culverts

Mean Annual Precitipation (in.)
40

Road Number	Site #	Culvert Diameter (in)	Area (ac)	50 year flood (cfs)	100 year flood (cfs)	50 yr Culvert Size (in)	100 yr Culvert Size (in)	50 yr pass	100 yr pass
82-BC	c16	24	35.6	24	26	30	30	NO	NO
82-BC	c18	18	16.5	12	13	24	24	NO	NO
82-BG	c4	24	54.1	34	37	30	36	NO	NO
82-BG-011	c10	18	19.1	14	15	24	24	NO	NO
82-BG-013	c8	18	11.6	9	10	24	24	NO	NO
82-BG-013	c7	18	11.5	9	10	24	24	NO	NO
82-BP	c9	24	32.3	22	24	30	30	NO	NO
82-BP	c9	24	31.9	22	23	30	30	NO	NO
82-BR	c9	18	27.7	19	21	30	30	NO	NO
82-BR	c9	24	78.5	48	51	36	42	NO	NO
82-BR	c9	18	12.5	10	10	24	24	NO	NO
82-BR	c9	0	11.7	9	10	24	24	NO	NO
82-BR	c9	0	6.5	5	6	18	18	NO	NO
82-BR	c9	18	36.2	24	26	30	30	NO	NO
82-BR	c9	12	8.5	7	7	18	18	NO	NO
82-BR	c9	24	58.6	37	40	36	36	NO	NO
82-BR-021	c39	18	21.8	16	17	24	24	NO	NO
82-BR-021	c39	18	20.5	15	16	24	24	NO	NO
82-BR-021	c39	18	46.2	30	32	30	30	NO	NO
82-BR-021	c39	18	36.2	24	26	30	30	NO	NO
82-BR-021	c39	18	34.0	23	25	30	30	NO	NO
82-BR-021	c39	24	33.2	23	24	30	30	NO	NO
82-BR-021	c39	18	36.4	24	26	30	30	NO	NO
82-BR-021	c39	0	18.1	13	14	24	24	NO	NO
82-BR-021-28	c2	18	66.4	41	44	36	36	NO	NO
82-BR-032	c3	18	17.3	13	14	24	24	NO	NO
82-BR-032	c3	18	18.2	13	14	24	24	NO	NO
82-CC	c6	12	15.2	11	12	24	24	NO	NO
82-CC-002	c8	18	13.0	10	11	24	24	NO	NO
82-CC-006	c8	30	338.0	170	183	60	60	NO	NO
82-CR-013	c4	12	8.7	7	8	18	18	NO	NO
82-CR-013	c4	18	11.1	9	9	24	24	NO	NO
82-DH-005	c9	36	131.0	74	80	42	42	NO	NO
82-EN	c8	18	14.3	11	12	24	24	NO	NO
82-EN	c8	18	38.0	25	27	30	30	NO	NO
82-EN	c8	18	21.0	15	16	24	24	NO	NO
82-EN-009	c9	18	15.7	12	13	24	24	NO	NO
82-EN-016	c1	14	2.7	3	3	18	18	NO	NO
82-EN-026	c4	18	13.0	10	11	24	24	NO	NO
82-HR	c1	33	66.6	41	44	36	36	NO	NO
82-HR	c1	48	208.9	112	120	54	54	NO	NO
82-HR	c1	19	10.9	9	9	24	24	NO	NO
82-HR	c1	18	16.0	12	13	24	24	NO	NO
82-HW	c2	18	15.1	11	12	24	24	NO	NO
82-HW	c2	12	7.8	6	7	18	18	NO	NO
82-HW	c2	60	472.9	227	245	72	72	NO	NO
82-HW-014	c3	16	3.8	3	4	18	18	NO	NO
82-HW-014	c3	12	3.3	3	3	18	18	NO	NO
82-LB-017	c3	12	2.7	3	3	18	18	NO	NO
82-MG	c6	18	11.3	9	9	24	24	NO	NO
82-MS-003	c9	18	15.5	12	13	24	24	NO	NO
82-MS-003-08	c5	24	36.2	24	26	30	30	NO	NO
82-MS-020	c7	18	12.6	10	10	24	24	NO	NO
82-MS-020	c7	24	69.2	43	46	36	36	NO	NO
82-MS-020	c7	18	14.8	11	12	24	24	NO	NO
82-MS-020	c7	18	10.8	9	9	24	24	NO	NO
82-MS-020	c7	24	31.8	22	23	30	30	NO	NO
82-MS-020	c7	18	18.9	14	15	24	24	NO	NO
82-MS-020	c7	18	11.3	9	10	24	24	NO	NO
82-MS-025	c2	18	18.3	13	14	24	24	NO	NO
82-MS-025	c2	12	38.5	26	28	30	30	NO	NO
82-MS-025-06	c8	12	7.7	6	7	18	18	NO	NO
82-NF	c1	48	1136.8	488	525	72	72	NO	NO
82-NF	c1	36	123.3	71	76	42	42	NO	NO
82-NF	c1	18	17.0	13	14	24	24	NO	NO
82-NF	c1	18	11.5	9	10	24	24	NO	NO
82-NF-019	c9	36	113.3	66	71	42	42	NO	NO
82-NR-048	c4	24	38.8	26	28	30	30	NO	NO
82-NR-106	c1	0	11.4	9	10	24	24	NO	NO
82-PG	c9	18	510.3	243	262	72	72	NO	NO
82-PG	c9	24	73.3	45	48	36	36	NO	NO
82-PG	c9	18	35.8	24	26	30	30	NO	NO

Road Number	Site #	Culvert Diameter (in)	Area (ac)	50 year flood (cfs)	100 year flood (cfs)	50 yr Culvert Size (in)	100 yr Culvert Size (in)	50 yr pass	100 yr pass
82-PG	c9	18	16.2	12	13	24	24	NO	NO
82-PG	c9	18	68.2	42	45	36	36	NO	NO
82-PG	c9	36	184.8	100	108	48	48	NO	NO
82-PG-041	c46	18	14.7	11	12	24	24	NO	NO
82-PG-049-04	c3	24	27.0	19	20	30	30	NO	NO
82-RC	c2	24	48.3	31	34	30	30	NO	NO
82-RC	c2	18	11.4	9	10	24	24	NO	NO
82-RC	c2	18	16.8	12	13	24	24	NO	NO
82-RC	c2	24	42.3	28	30	30	30	NO	NO
82-RC-022	c9	18	11.3	9	9	24	24	NO	NO
82-RC-026	c1	18	12.9	10	11	24	24	NO	NO
82-RC-026	c1	18	13.7	10	11	24	24	NO	NO
82-RG-002	c9	6	15.3	11	12	24	24	NO	NO
82-SC	c3	18	22.3	16	17	24	24	NO	NO
82-SC	c3	24	38.9	26	28	30	30	NO	NO
82-SC	c3	12	2.4	2	2	18	18	NO	NO
82-SC	c3	18	34.4	23	25	30	30	NO	NO
82-SC	c3	24	37.1	25	27	30	30	NO	NO
82-SC	c3	18	32.8	22	24	30	30	NO	NO
82-SC-048	c9	24	70.8	44	47	36	36	NO	NO
82-SC-048	c9	24	70.8	44	47	36	36	NO	NO
82-SC-049	c9	18	11.7	9	10	24	24	NO	NO
82-SC-049	c9	18	25.0	18	19	24	30	NO	NO
82-SC-049	c9	18	55.4	35	38	36	36	NO	NO
82-SC-049	c9	0	4.1	4	4	18	18	NO	NO
82-SC-049	c9	24	63.6	40	43	36	36	NO	NO
82-SM	c9	24	36.4	24	26	30	30	NO	NO
82-SM	c9	24	36.7	25	26	30	30	NO	NO
82-SM	c9	18	33.5	23	24	30	30	NO	NO
82-SR	c6	18	13.6	10	11	24	24	NO	NO
82-SR	c6	24	56.8	36	39	36	36	NO	NO
82-SR	c6	24	175.9	96	104	48	48	NO	NO
82-SR-052	c4	18	31.6	22	23	30	30	NO	NO
82-T4	c1	18	11.4	9	10	24	24	NO	NO
82-T4	c1	18	45.7	30	32	30	30	NO	NO
82-T4-017	c9	18	16.1	12	13	24	24	NO	NO
82-T4-017	c9	18	23.2	16	18	24	24	NO	NO
82-BG	c10	24	24.5	17	19	24	30	YES	NO
82-FG	c1	18	10.5	8	9	18	24	YES	NO
82-HW-012	c5	24	24.6	17	19	24	30	YES	NO
82-LB-017	c3	18	10.3	8	9	18	24	YES	NO
82-RC	c2	18	10.7	8	9	18	24	YES	NO
82-RC	c2	18	10.5	8	9	18	24	YES	NO
82-SC	c3	48	199.4	107	115	48	54	YES	NO

Section C
HYDROLOGY

INTRODUCTION

This section provides the available river peak flow data for the Navarro River. The peak flow data is used to show the magnitude of storm events and when they occurred. High river peak flow events are indicative of the largest storms, with large storms typically comes high erosion and sediment transport events.

The Navarro WAU does not receive any significant snow accumulations that could contribute to rain-on-snow events. Current research shows possible cumulative effects from increased peak flows from forest harvest in rain-on-snow dominated areas (Harr, 198l). However, in rain dominated areas increases in large peak flows (i.e. > 20 year event) from forest harvesting are not found (Ziemer, 1981; Wright et. al., 1990). The Navarro WAU is a rain-dominated area in the temperate coastal zone of Northern California therefore analysis on peak flow hydrologic change was not conducted.

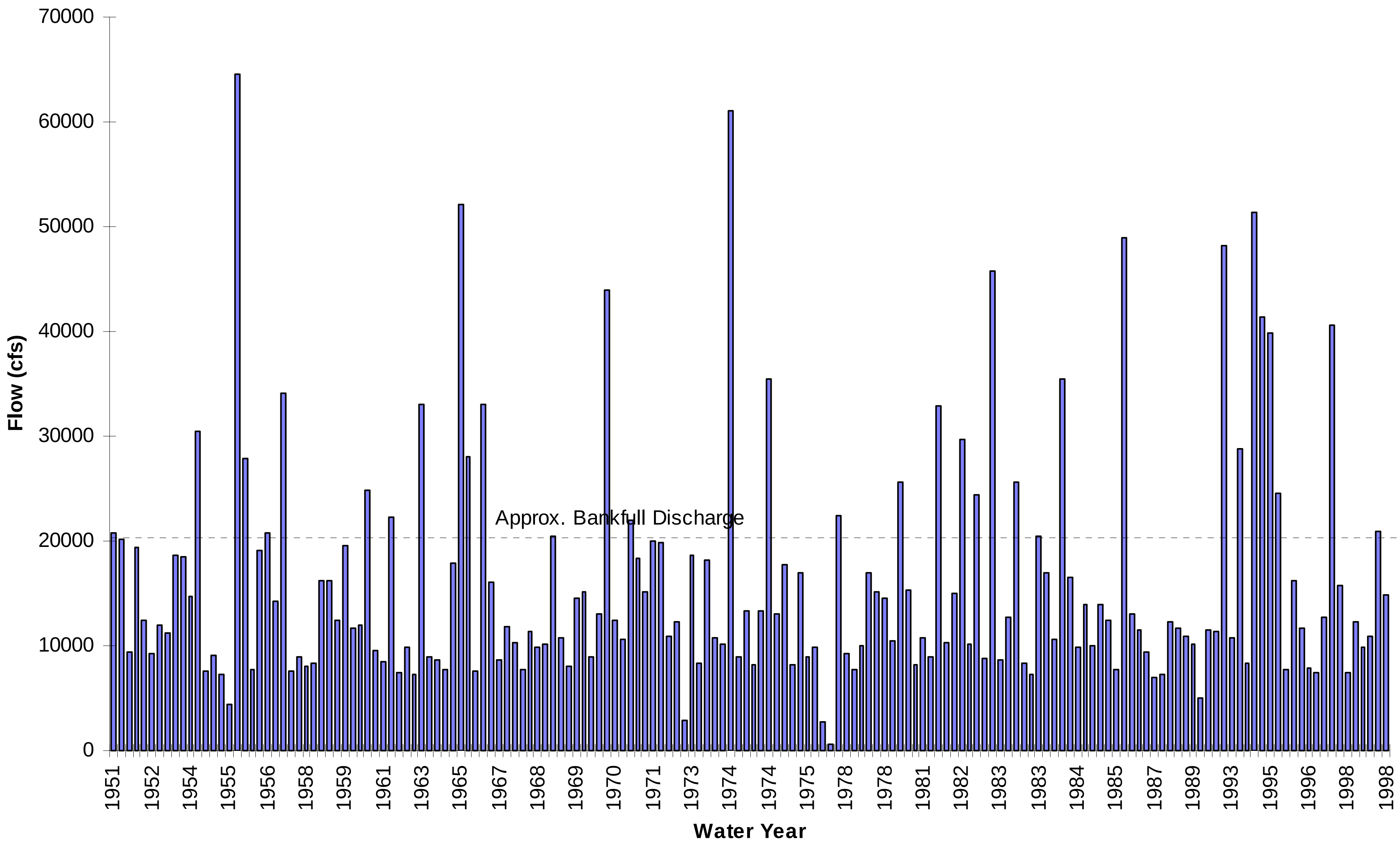
Peak Flows

The peak flow information was taken from the United States Geological Survey (USGS) gage 11468000, Navarro River near the ocean, from water years 1952-1998. All peak flows greater than base flow (7000 cfs) are shown over the period of record (Figure C-1). To estimate the recurrence interval of the flood events of the Navarro River the USGS annual peak flow series was used. An extreme value type I distribution (Gumbel, 1958) was fitted to the data. Table C-1 shows the estimated recurrence interval for peak discharges in the basin.

Table C-1. Flood Recurrence for Peak Flows of the Navarro River, 1952-1998.

Recurrence Interval (years)	Peak Discharge (cfs)
2	20430
5	34500
10	43800
25	55560
50	64300
100	72950

Figure C-1. High Peak Flows (above base flow) for Navarro River, 1951-1998



Using the peak flow record from 1952-1998, the flood of record is 1955 (64,500 cfs) considered to be greater than a 50 year event for the Navarro River (Table C-1). In the last decade alone there has been 2 storms greater than a 10 year recurrence (1993 and 1995), 5 storms greater than a 5 year recurrence (1993, 1995(3) and 1998) and 8 storms greater than bankfull discharge (approx. >1.5-2.0 year recurrence). This indicates a high number of extreme storms occurring within the last decade. The high occurrence of these extreme storms in the last decade suggests that the Navarro WAU has been subjected to stressful hydrologic conditions, possibly creating a greater incidence of landslides, road failures or surface erosion than previous decades.

Throughout the last 50 years in the Navarro WAU there have been numerous large flood events (Figure C-1). There have been 4 events >20 year recurrence (1955, 1965, 1974, and 1993 water years) and an additional 4 events > 10 year recurrence (1970, 1982, 1986, and 1996 water years). These flood events have the capacity to re-shape river or stream channels and transport large sediment loads. The meteorological events that created these large floods also can be assumed to be a major contributor to the erosion and mass wasting delivered to the watercourses in the Navarro WAU.

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Section D
RIPARIAN FUNCTION

INTRODUCTION

This module presents an assessment of the riparian function in the Navarro River Watershed Analysis Unit (WAU). This assessment was conducted during the summer of 1999. This assessment is divided into two groups: 1) the potential of the riparian stand to recruit large woody debris (LWD) to the stream channel and 2) a canopy closure and stream temperature assessment. The LWD potential assessment evaluates short-term (the next 2-3 decades) LWD recruitment. It shows the current condition of the riparian stands for generating LWD for stream habitat or stream channel stability. Field observations of current LWD levels in the stream channels and the riparian stand's ability to recruit LWD are presented in relation to channel response to LWD in order to determine the instream demands. The canopy closure and stream temperature assessment presents current canopy closure conditions and stream temperature monitoring which has been conducted. The goal of these evaluations is to provide baseline information on the current LWD loading in the channel and current status of riparian stand function in the Navarro River WAU.

LARGE WOODY DEBRIS RECRUITMENT AND INSTREAM DEMANDS

Methods

Short-term LWD recruitment potential (next 20-30 years) was evaluated in designated stream segments within the Navarro River WAU. Stream segments were designated in the stream channel condition assessment and are shown on map E-1 (Stream Channel Condition Module). Generally, stream segments were assessed on any watercourse with less than a 20 percent gradient. In this assessment, vegetation type, size and density is assumed to influence LWD recruitment with the best riparian vegetation being large conifer trees.

To determine the LWD recruitment potential, riparian stands were classified using 1996 aerial photographs and field observations from the summer of 1999. The riparian stands were evaluated for a distance of approximately one tree height on either side of the watercourse. Riparian stands were evaluated separately for each side of the watercourse. The following vegetation classification scheme for the Mendocino Redwood Company (MRC) timber inventory was used to classify the riparian stands:

Vegetation Classes

RW- greater than 75% of the stand basal area in coast redwood.

RD- combination of Douglas-fir and coast redwood basal area exceeds 75% of the stand, but neither species alone has 75% of the basal area.

MH- mix of hardwood basal area exceeds 75% of the stand, but no one hardwood species has 75% of the basal area.

CH- mix of conifer and hardwood basal area exceeds 75% of the stand, but no one hardwood or conifer species has 75% of the basal area.

Br- Brush

Vegetation Size Classes
1 - <8inches dbh
2 - 8 to 15.9 inches dbh
3 - 16 to 23.9 inches dbh
4 - 24 to 31.9 inches dbh
5 - >32 inches dbh

The size class is determined by looking at the diameters of the trees in the riparian stand. The size class which exceeds 50% of the total basal area is the size class assigned to the stand.

Vegetation Density
O - 5-20% tree canopy cover range
L - 20-40% tree canopy cover range
M - 40-60% tree canopy cover range
D - 60-80% tree canopy cover range
E - >80% tree canopy cover

The codes for vegetation classification of riparian stand condition are based on the three classes listed above. The vegetation code is a string of the classes with the vegetation class first, the size class second, and the vegetation density last. For example, the vegetation code for a redwood stand with greater than 50% of the basal area with 16-23.9 inch dbh or larger and 60-80% canopy cover would be classified RW3D.

In this assessment, vegetation type, size and density is assumed to affect LWD recruitment to the stream channel with the best riparian vegetation being large conifer trees. The LWD recruitment potential ratings reflect this. The following table presents the vegetation classification codes for the different LWD recruitment potential ratings (Table D-2).

Table D-2. Description of LWD Recruitment Potential Rating by Riparian Stand Classification for the Navarro River WAU.

Vegetation Type	**Size and Density Classes**					
	Size Classes 1-2 (Young)		**Size Class 3 (Mature)**		**Size classes 4-5 (Old)**	
	Sparse (O, L)	**Dense (M, D, E)**	**Sparse (O, L, M)**	**Dense (D, E)**	**Sparse (O, L, M)**	**Dense (D, E)**
RW	Low	Low	Low	Moderate	Moderate	High
RD	Low	Low	Low	Moderate	Moderate	High
CH	Low	Low	Low	Moderate	Low	High
MH	Low	Low	Low	Low	Low	Moderate

LWD was inventoried in watercourses during the stream channel assessment. All "functional" LWD was tallied within the active channel and the bankfull channel for each sampled stream segment. Functional LWD is that which is providing some habitat or morphologic function in the stream channel (i.e. pool formation, scour, debris dam, bank stabilization, or gravel storage). There was a 4 inch diameter (10 centimeter) and 10 foot length minimum size requirement for functional LWD. Rootwads were considered functional LWD even if they did not meet the length minimum. The LWD is classified by tree species class, either redwood, fir (Douglas-fir, hemlock, grand fir), hardwood (alder, tan oak, etc.), or unknown (if tree species is indeterminable). Length and diameter were recorded so that volume could be calculated.

LWD associated with an accumulation of 3 pieces or more was recorded and the number of LWD accumulations in the stream survey reach was tallied. LWD pieces were also assigned attributes if they fall into certain categories. These categories are: the LWD piece was part of a living tree, root associated (i.e. does it have a rootwad attached to it), part of the piece buried within stream gravel or the bank, or associated with a stream habitat enhancement structure. By assigning these attributes, the number of pieces in a segment which, for example, have a rootwad associated with the LWD can be calculated. This is important as these associations of the LWD provide context on the stability or ecological benefits that the LWD may possess.

Pieces that were partially buried were noted, as calculated volume for these pieces represent a minimum. There may likely be a significant amount of volume that is buried that we cannot measure. Also, these pieces may be more stable in the channel during high flows. The percentage of total pieces that are partially buried was calculated for each stream segment. Some consideration was given as to what percentage (0-25%, 25-50%, 50-75% and 75-100%) of the LWD pieces in the stream were recently contributed (<10 years). The LWD is further classified as a key LWD piece if it meets the following size requirement:

Table D-3. Key LWD Piece Size Requirements (adapted from Bilby and Ward, 1989)

Bankfull width (ft)	Diameter (in)	Length (ft)
0-20	12	20
20-30	18	30
30-40	22	40
40-60	24	60

Debris jams, defined as aggregates of LWD with >10 pieces, and debris accumulations, defined as aggregates of LWD with between 3-10 pieces, were noted. The total dimensions of a debris jam were recorded. The volume of the debris jam was calculated and added to total LWD volume with a correction factor of 50%. In other words, 50% of the total volume of a debris jam was considered to be “air space.” Total number of pieces and number of key pieces in each debris jam was noted. Species and dimensions were not recorded for individual pieces contained in debris jams. All volume estimates and piece counts were separated in two groups, one not considering jams and one considering all LWD pieces in the segment, debris jams included. The percentage of total volume and total pieces per segment that was contained in debris jams was also calculated.

The quantity of LWD observed was normalized by distance, for comparison through time or to other similar areas, and is presented as a number of LWD pieces per 100 meters. This normalized quantity, by distance, was performed for functional and key LWD pieces within the active and bankfull channel. The key piece quantity in the bankfull channel (per 100 meters of channel) is compared to the target for what would be an appropriate key piece loading. The target for appropriate key piece loading is derived from Bilby and Ward (1989) and Gregory and Davis (1992) and presented in Table D-4.

Table D-4. Target for Number of Key Large Woody Debris Pieces in Watercourses of the Navarro River WAU.

	# Key Pieces		
Bankfull Width (ft)	**Per 100 meters**	**Per 1000 feet**	**Per mile**
<15	6.6	20	106
15-35	4.9	15	79
35-45	3.9	12	63
>45	3.3	10	53

An in-stream LWD demand was identified in addition to the riparian stand recruitment potential, discussed previously. The in-stream LWD demand is an indication of what level of concern there is for in-stream LWD for stream channel morphology and aquatic habitat associations within the Navarro River WAU. The in-stream LWD demand was determined by stream segment considering the overall LWD recruitment, the stream segment LWD sensitivity rating (as determined in the Stream Channel and Fish Habitat Assessment for stream geomorphic units), and the level of LWD currently in the stream segment (on target or off target). Table D-5 shows how these three factors are used to determine the in-stream LWD demand.

Table D-5. In-stream LWD Demand

		Channel LWD Sensitivity Rating		
	LWD On Target **LWD Off Target**	**LOW**	**MODERATE**	**HIGH**
Recruitment Potential Rating	**LOW**	LOW	MODERATE	HIGH
		MODERATE	HIGH	HIGH
	MODERATE	LOW	MODERATE	MODERATE
		MODERATE	HIGH	HIGH
	HIGH	LOW	MODERATE	MODERATE
		LOW	HIGH	HIGH

Low In-stream LWD Demand - this classification suggests that current riparian LWD recruitment conditions and in-stream LWD are at levels which are sufficient for LWD function in these stream channel types.

Moderate In-stream LWD Demand - this classification suggests that current riparian LWD recruitment conditions and in-stream LWD are at levels which are moderately sufficient for fish habitat and stream channel morphology requirements. Consideration must be given to these areas to improve the LWD recruitment potential of the riparian stand. These areas may also be considered for supplemental LWD or stream structures placed in the stream channel.

High In-stream LWD Demand - this classification suggests that current riparian LWD recruitment conditions and in-stream LWD are at levels which are not sufficient for LWD function in these stream channel types. These areas must consider improvement of the LWD recruitment potential of the riparian stand. These areas should be the highest priority for supplemental LWD or stream structures placed in the stream channel.

Major streams and stretches of river within each Calwater Planning Watershed were further evaluated for meeting target conditions. Within each hydrologic watershed of the stream segment analyzed, the percentage of watercourses with low or moderate LWD demand and the percentage of watercourses with an appropriate number of key LWD pieces determine the overall quality rating of watercourse LWD in each stream or stream segment of a Calwater planning watershed. Under this scheme, LWD quality falls into the following categories:

ON TARGET – >80% of watercourses have low or moderate LWD demand, and >80% of stream segments have appropriate number of key LWD pieces.

MARGINAL – 50-80% of watercourses have low or moderate LWD demand, and stream segments have significant functional LWD and are approaching the number of key LWD pieces desired

DEFICIENT – <50% of watercourses have low or moderate LWD demand, and little functional or key LWD.

The percentages that define the break between each of the LWD quality ratings have the intent of realizing that streams and watersheds are dynamic. LWD loadings are naturally found to be variable. Therefore a target of 100% of stream segment meeting LWD quality demand would be inappropriate. However, it seems that if less than half of the watercourses (50%) do not meet LWD demand than a LWD deficiency is assumed.

We consider key LWD for determination of both instream LWD demand and overall LWD quality to help ensure that enough key LWD exists at both small (i.e., stream segment) and large (i.e., planning watershed) spatial scales.

Results

The large woody debris recruitment potential and in-stream LWD demand for the Navarro WAU is illustrated in Map D-1. The large woody debris recruitment potential and in-stream LWD demand provides baseline information on the structure and composition of the riparian stand and the level of concern about current LWD conditions in the stream. This map provides a tool for prioritizing riparian and stream management for improving LWD recruitment and in-stream LWD. These areas must be monitored over time to ensure that the recruitment potential is improving and that large woody debris is providing the proper function to the watercourses.

Current LWD loading is shown in Table D-6 a, b, and c. Only twelve of forty-seven channel segments surveyed in the Navarro River WAU met the key LWD targets. Generally, LWD loading in the Navarro WAU needs improvement.

Debris jams, where they occurred, were shown to be a significant portion of the total number of pieces and total volume. In the Navarro WAU, debris jams occurred in 16 segments and contained up to 90% of the total pieces and up to 100% of the total volume (See tables D-6 a and b). In the case of segment EN4, Spooner Creek, debris jams actually affected whether or not the segment met the LWD target. It was only through adding key pieces contained in debris jams that the segment exceeded the target. Although there obviously can be a significant amount of LWD trapped in debris jams, the ecological function may not be accurately represented by numbers alone. All of the pieces in a debris jam may actually have more habitat value if they were spread out in the stream as opposed to being piled up in one spot. A significant amount of the LWD volume in the Navarro River WAU was also contained in debris accumulations (4-10 LWD pieces). Up to 83 % of the volume of a segment could be found in these accumulations.

Buried LWD pieces were common in these streams. Up to 73% of the pieces in any given segment were at least partially buried (See Table D-6c). This indicates that we are unable to quantify a significant portion of the LWD volume that may be or is useful to the stream.

LWD species composition was largely redwood dominated (Table D-6b). This analysis was limited to pieces not contained within debris jams. The vast majority of LWD pieces in the Navarro WAU were redwood. The remainder of pieces consisted of an even mixture of fir, alder, hardwood, and unknown species. This may not be surprising as these streams flow through a redwood forest but it does show that the LWD currently found in these streams is more stable as redwood breaks down more slowly in streams than hardwood species.

As shown in Tables D-6 a, b and c and map D-1, there is a need for large woody debris in almost all of the channel segments of the Navarro WAU. Channel segments with LWD levels that are well below the target will need to be the priority for promoting future recruitment and restoration work. Even the stream segments that met the key piece target need good riparian stands to ensure that LWD levels are maintained to provide aquatic habitat and morphological function in the stream channels.

Table D-7 shows the instream LWD quality rating for major streams and sections of stream or river in individual Calwater planning watersheds. This quality rating will provide a tool to monitor the quality of the LWD in major streams over time. Currently the majority of the streams have a deficient LWD quality rating, with the remainder being marginal. None of the major streams in the Navarro WAU received an on target rating.

Table D-6a.-Large Woody Debris Piece Count in Selected Stream Segments of the Navarro River WAU.

Stream Segment Name	Stream Segment ID#	Total LWD Pieces w/o Debris Jams	Total LWD Pieces w/ Debris Jams	Total # of Debris Jams	Total # of Debris Accumulations	Total LWD (#/328ft) w/o Debris Jams	Total LWD (#/328ft) w/ Debris Jams	Key LWD Pieces w/o Debris Jams	Key LWD Pieces w/ Debris Jams	Key LWD Pieces/328ft w/o Debris Jams	Key LWD Pieces/328ft w/Debris Jams	% of Total Pieces in Debris Jams
N Branch Navarro	ED1	18	47	1	1	3.3	8.6	3	5	0.5	0.9	62%
Cook Creek	ED8	21	51	1	2	7.0	17.0	3	8	1.0	2.7	59%
North Fork Indian Creek	EI2	29	108	3	4	7.7	28.7	3	12	0.8	3.2	73%
John Smith Creek	EJ1	15	15	0	2	7.0	7.0	2	2	0.9	0.9	0%
John Smith Creek	EJI(2)	22	22	0	3	10.0	10.0	3	3	1.4	1.4	0%
SB Navarro	EL1	76	146	3	7	16.2	31.2	3	3	0.6	0.6	48%
South Branch Navarro	EM1	6	6	0	0	1.5	1.5	1	1	0.2	0.2	0%
Bear Creek	EM20	20	20	0	2	13.0	13.0	8	8	NA	NA	0%
Bridge Creek	EM29	14	25	1	2	5.4	9.6	3	6	1.2	2.3	44%
Bridge Creek	EM30	18	32	1	3	10.3	18.3	3	7	1.7	4.0	44%
Shingle Mill Creek	EM39	7	32	1	0	4.1	18.6	4	9	2.3	5.2	78%
Little NF Navarro	EN2	28	28	0	3	10.7	10.7	3	3	1.1	1.1	0%
Little NF Navarro	EN25	41	41	0	6	17.9	17.9	7	7	3.1	3.1	0%
Bottom Creek	EN3	12	12	0	0	6.5	6.5	5	5	2.7	2.7	0%
Sawyer Creek	EN38	29	29	0	2	21.4	21.4	4	4	3.0	3.0	0%
Spooner Creek	EN4	61	74	1	10	29.3	35.5	8	11	3.8	5.3	18%
Upper South Branch Navarro	EU1	19	56	2	3	2.8	8.3	7	14	1.0	2.1	66%
Low Gap Creek	EU20	5	21	1	0	2.4	10.3	2	3	1.0	1.5	76%
Rose Creek	EU24	9	53	1	2	5.2	30.8	3	7	1.7	4.1	83%
South Branch Navarro	EU4	17	17	0	3	5.5	5.5	4	4	1.3	1.3	0%
McGarvey Creek	EU7	29	68	3	5	9.4	22.0	11	15	3.6	4.8	57%
Flynn Creek	WF1	32	32	0	2	9.8	9.8	6	6	1.8	1.8	0%
Flynn Creek	WF1(u)	16	27	1	2	6.1	10.3	2	2	0.8	0.8	41%
Camp 16 Gulch	WF13	40	40	0	5	17.2	17.2	7	7	3.0	3.0	0%
Tank Gulch	WF26	34	34	0	6	37.5	37.5	5	5	NA	NA	0%
none	WH3	8	8	0	0	5.1	5.1	5	5	3.2	3.2	0%
Murray Gulch	WL19	25	25	0	0	14.6	14.6	10	10	5.8	5.8	0%
Flume Gulch	WL27	32	32	0	2	10.4	10.4	5	5	1.6	1.6	0%
Flume Gulch	WL28	52	52	0	3	30.0	30.0	19	19	11.0	11.0	0%
Navarro River	WL3	30	30	0	1	3.2	3.2	0	0	0.0	0.0	0%
Marsh Gulch	WL4	29	29	0	1	21.2	21.2	12	12	8.8	8.8	0%
Navarro River	WM2	28	28	0	0	3.3	3.3	0	0	0.0	0.0	0%
Skid Gulch	WM32	14	14	0	2	13.7	13.7	6	6	5.9	5.9	0%
Berry Creek	WM36	9	89	4	0	3.7	36.1	0	0	0.0	0.0	90%
Navarro River	WM5	4	4	0	0	0.6	0.6	1	1	0.1	0.1	0%
Dead Horse Gulch	WN10	38	38	0	2	32.2	32.2	7	7	5.9	5.9	0%
Dead Horse Gulch	WN11	12	12	0	0	19.9	19.9	4	4	NA	NA	0%
Coon Gulch	WN20	29	29	0	5	14.6	14.6	10	10	5.0	5.0	0%
Roller Gulch	WR11	24	24	0	2	8.9	8.9	8	8	3.0	3.0	0%
Ray Gulch	WR14	56	71	1	9	32.2	40.9	15	17	8.6	9.8	21%
Ray Gulch	WR15	41	41	0	3	25.6	25.6	13	13	8.1	8.1	0%
White Gulch	WR23	25	25	0	1	14.3	14.3	11	11	6.3	6.3	0%
Mustard Gulch	WR26	27	27	0	1	19.5	19.5	16	16	11.5	11.5	0%
Navarro River	WU1	20	20	0	1	2.8	2.8	0	0	0.0	0.0	0%
Kabiki Creek	WU15	0	NA	3	0	0.0	#VALUE!	0	NA	0.0	NA	#VALUE!
Sage Gulch	WU18	29	29	0	3	28.8	28.8	5	5	5.0	5.0	0%
Black Rock Creek	WU4	47	47	0	8	22.5	22.5	18	18	8.6	8.6	0%

Table D-6b. Large Woody Debris Volume Information in Selected Stream Segments of the Navarro River WAU.

Stream Segment Name	Stream Segment ID#	Total Volume (yd^3) w/o Debris Jams	Total Volume (yd^3) w/ DebrisJams	Total Vol/328ft (yd^3) w/o Debris Jams	Total Vol/328ft (yd^3) w/ Debris Jams	% of Total Volume in Debris Jams	% of Vol in Key Pieces w/o Jams	% of Total Volume By Species w/o Jams					% Current Recruitment (<10 yrs)
								Redwood	Fir	Alder	Hardwood	Unknown	
N Branch Navarro	ED1	51.8	125.9	9.5	23.0	59%	59%	44%	49%	0%	3%	4%	0-25
Cook Creek	ED8	30.9	130.9	10.3	43.6	76%	54%	36%	55%	0%	6%	3%	50-75
North Fork Indian Creek	EI2	111.4	251.4	29.6	66.8	56%	61%	80%	2%	0%	9%	10%	0-25
John Smith Creek	EJ1	45.1	45.1	21.0	21.0	0%	66%	48%	52%	0%	0%	1%	0-25
John Smith Creek	EJI(2)	19.7	19.7	9.0	9.0	0%	54%	62%	22%	0%	14%	1%	0-25
SB Navarro	EL1	167.6	410.2	35.8	87.5	59%	24%	76%	8%	0%	11%	4%	25-50
South Branch Navarro	EM1	9.8	9.8	2.4	2.4	0%	65%	83%	0%	0%	10%	7%	50-75
Bear Creek	EM20	72.8	72.8	47.4	47.4	0%	96%	23%	68%	0%	0%	8%	0-25
Bridge Creek	EM29	19.9	36.6	7.7	14.1	46%	73%	23%	67%	0%	6%	4%	25-50
Bridge Creek	EM30	55.1	75.9	31.4	43.3	27%	76%	94%	0%	0%	4%	1%	25-50
Shingle Mill Creek	EM39	9.2	30.0	5.3	17.5	69%	67%	54%	34%	0%	9%	2%	0-25
Little NF Navarro	EN2	57.5	57.5	21.9	21.9	0%	30%	91%	0%	0%	9%	0%	50-75
Little NF Navarro	EN25	36.7	36.7	16.0	16.0	0%	64%	85%	1%	0%	10%	4%	25-50
Bottom Creek	EN3	17.4	17.4	9.5	9.5	0%	79%	66%	0%	0%	0%	34%	25-50
Sawyer Creek	EN38	14.7	14.7	10.9	10.9	0%	71%	74%	0%	0%	1%	25%	NA
Spooner Creek	EN4	67.7	87.7	32.5	42.1	23%	49%	90%	4%	0%	0%	5%	0-25
Upper South Branch Navarro	EU1	89.0	153.0	13.3	22.8	42%	73%	67%	24%	0%	8%	1%	25-50
Low Gap Creek	EU20	13.0	21.9	6.4	10.7	41%	94%	99%	0%	0%	0%	1%	0-25
Rose Creek	EU24	40.6	107.3	23.6	62.3	62%	91%	66%	27%	0%	1%	6%	0-25
South Branch Navarro	EU4	42.6	42.6	13.7	13.7	0%	52%	98%	0%	0%	2%	1%	50-75
McGarvey Creek	EU7	81.5	174.8	26.3	56.5	53%	87%	34%	59%	0%	0%	7%	50-75
Flynn Creek	WF1	39.2	39.2	11.9	11.9	0%	44%	20%	63%	3%	7%	6%	25-50
Flynn Creek	WF1(u)	16.3	40.0	6.2	15.3	59%	41%	40%	49%	0%	9%	3%	25-50
Camp 16 Gulch	WF13	44.7	44.7	19.2	19.2	0%	76%	80%	1%	1%	4%	15%	NA
Tank Gulch	WF26	12.3	12.3	13.6	13.6	0%	51%	38%	4%	0%	44%	15%	50-75
none	WH3	36.8	36.8	23.3	23.3	0%	99%	100%	0%	0%	0%	0%	0-25
Murray Gulch	WL19	68.6	68.6	40.0	40.0	0%	77%	60%	3%	3%	33%	4%	0-25
Flume Gulch	WL27	46.7	46.7	15.2	15.2	0%	41%	57%	0%	19%	4%	19%	0-25
Flume Gulch	WL28	223.4	223.4	128.8	128.8	0%	89%	94%	0%	4%	0%	2%	0-25
Navarro River	WL3	20.5	20.5	2.2	2.2	0%	0%	20%	0%	0%	40%	39%	50-75
Marsh Gulch	WL4	148.1	148.1	108.4	108.4	0%	91%	97%	0%	0%	1%	2%	0-25
Navarro River	WM2	159.0	159.0	18.8	18.8	0%	0%	69%	24%	0%	4%	3%	50-75
Skid Gulch	WM32	34.5	34.5	33.9	33.9	0%	90%	100%	0%	0%	0%	0%	NA
Berry Creek	WM36	10.9	222.1	4.4	90.1	95%	0%	90%	0%	0%	2%	8%	0-25
Navarro River	WM5	47.2	47.2	6.5	6.5	0%	55%	44%	55%	0%	0%	1%	50-75
Dead Horse Gulch	WN10	46.0	46.0	39.0	39.0	0%	48%	71%	16%	0%	3%	10%	25-50
Dead Horse Gulch	WN11	15.3	15.3	25.3	25.3	0%	85%	91%	0%	0%	0%	8%	0-25
Coon Gulch	WN20	39.8	39.8	20.1	20.1	0%	58%	97%	2%	0%	0%	0%	0-25
Roller Gulch	WR11	65.3	65.3	24.2	24.2	0%	47%	71%	18%	0%	8%	2%	25-50
Ray Gulch	WR14	107.5	122.3	61.8	70.4	12%	69%	55%	41%	0%	0%	3%	25-50
Ray Gulch	WR15	107.5	107.5	67.1	67.1	0%	90%	35%	24%	24%	10%	15%	25-50
White Gulch	WR23	60.3	60.3	34.4	34.4	0%	83%	28%	68%	0%	0%	4%	50-75
Mustard Gulch	WR26	106.7	106.7	76.9	76.9	0%	91%	95%	0%	0%	0%	5%	0-25
Navarro River	WU1	50.7	50.7	7.0	7.0	0%	0%	26%	51%	0%	15%	8%	50-75
Kabiki Creek	WU15	0.0	33.0	0.0	21.7	100%	0%	0%	0%	0%	0%	0%	0-25
Sage Gulch	WU18	50.3	50.3	50.0	50.0	0%	73%	98%	0%	0%	0%	2%	0-25
Black Rock Creek	WU4	88.5	88.5	42.4	42.4	0%	85%	69%	25%	0%	0%	6%	25-50

Table D-6c. Large Woody Debris Attribute Information in Selected Stream Segments of the Navarro WAU

	Stream	Piece Count						Volume					
Stream	Segment	Root Associated		Buried		Alive		Root Associated		Buried		Alive	
Segment Name	ID#	#	%	#	%	#	%	Yd^3	%	Yd^3	%	Yd^3	%
N Branch Navarro	ED1	8	44%	2	11%	2	11%	35.3	68%	2.9	6%	1.0	2%
Cook Creek	ED8	1	5%	0	0%	0	0%	2.0	6%	0.0	0%	0.0	0%
North Fork Indian Creek	EI2	11	38%	2	7%	0	0%	62.7	56%	2.8	3%	0.0	0%
John Smith Creek	EJ1	1	7%	5	33%	0	0%	3.7	8%	5.2	12%	0.0	0%
John Smith Creek	EJI(2)	11	50%	9	41%	0	0%	8.3	42%	7.7	39%	0.0	0%
SB Navarro	EL1	20	26%	12	16%	0	0%	78.8	47%	30.7	18%	0.0	0%
South Branch Navarro	EM1	0	0%	0	0%	0	0%	0.0	0%	0.0	0%	0.0	0%
Bear Creek	EM20	2	10%	2	10%	0	0%	18.0	25%	0.1	0%	0.0	0%
Bridge Creek	EM29	4	29%	1	7%	0	0%	0.9	5%	0.9	5%	0.0	0%
Bridge Creek	EM30	2	11%	3	17%	0	0%	2.3	4%	1.5	3%	0.0	0%
Shingle Mill Creek	EM39	1	14%	0	0%	0	0%	2.6	28%	0.0	0%	0.0	0%
Little NF Navarro	EN2	3	11%	5	18%	0	0%	15.2	26%	8.1	14%	0.0	0%
Little NF Navarro	EN25	7	17%	5	12%	0	0%	6.1	17%	7.4	20%	0.0	0%
Bottom Creek	EN3	1	8%	3	25%	0	0%	0.2	1%	1.2	7%	0.0	0%
Sawyer Creek	EN38	10	34%	8	28%	0	0%	0.8	5%	2.9	20%	0.0	0%
Spooner Creek	EN4	12	20%	12	20%	0	0%	21.3	31%	14.1	21%	0.0	0%
Upper South Branch Navarro	EU1	7	37%	3	16%	0	0%	33.8	38%	16.2	18%	0.0	0%
Low Gap Creek	EU20	0	0%	1	20%	0	0%	0.0	0%	0.1	1%	0.0	0%
Rose Creek	EU24	1	11%	2	22%	1	11%	10.9	27%	1.4	3%	0.6	1%
South Branch Navarro	EU4	2	12%	0	0%	1	6%	0.7	2%	0.0	0%	0.4	1%
McGarvey Creek	EU7	6	21%	5	17%	0	0%	52.7	65%	2.9	4%	0.0	0%
Flynn Creek	WF1	3	9%	4	13%	2	6%	1.4	4%	1.8	5%	2.5	6%
Flynn Creek	WF1(u)	5	31%	0	0%	0	0%	7.1	44%	0.0	0%	0.0	0%
Camp 16 Gulch	WF13	5	13%	4	10%	1	3%	8.2	18%	1.4	3%	3.1	7%
Tank Gulch	WF26	0	0%	10	29%	0	0%	0.0	0%	2.5	20%	0.0	0%
none	WH3	1	13%	3	38%	0	0%	2.3	6%	22.9	62%	0.0	0%
Murray Gulch	WL19	2	8%	8	32%	1	4%	6.6	10%	5.1	7%	0.9	1%
Flume Gulch	WL27	12	38%	10	31%	4	13%	21.5	46%	4.1	9%	6.2	13%
Flume Gulch	WL28	7	13%	18	35%	4	8%	56.5	25%	81.1	37%	5.9	3%
Navarro River	WL3	3	10%	22	73%	0	0%	5.4	26%	14.0	68%	0.0	0%
Marsh Gulch	WL4	3	10%	13	45%	0	0%	51.9	35%	76.6	52%	0.0	0%
Navarro River	WM2	12	43%	4	14%	0	0%	71.9	45%	3.8	2%	0.0	0%
Skid Gulch	WM32	1	7%	3	21%	0	0%	18.6	54%	1.9	6%	0.0	0%
Berry Creek	WM36	4	44%	1	11%	0	0%	7.5	69%	0.8	7%	0.0	0%
Navarro River	WM5	1	25%	1	25%	0	0%	0.4	1%	0.4	1%	0.0	0%
Dead Horse Gulch	WN10	12	32%	3	8%	0	0%	14.8	32%	1.3	3%	0.0	0%
Dead Horse Gulch	WN11	1	8%	5	42%	0	0%	9.3	61%	2.3	15%	0.0	0%
Coon Gulch	WN20	2	7%	6	21%	0	0%	0.4	1%	4.4	11%	0.0	0%
Roller Gulch	WR11	3	13%	6	25%	0	0%	24.5	38%	10.8	17%	0.0	0%
Ray Gulch	WR14	8	14%	2	4%	1	2%	32.8	31%	0.7	1%	0.1	0%
Ray Gulch	WR15	7	17%	7	17%	3	7%	51.7	48%	12.6	12%	25.3	24%
White Gulch	WR23	6	24%	3	12%	0	0%	29.1	48%	1.0	2%	0.0	0%
Mustard Gulch	WR26	0	0%	5	19%	0	0%	0.0	0%	5.2	5%	0.0	0%
Navarro River	WU1	12	60%	6	30%	0	0%	0.0	0%	7.7	15%	0.0	0%
Kabiki Creek	WU15	0	0%	0	0%	0	0%	0.0	0%	0.0	0%	0.0	0%
Sage Gulch	WU18	1	3%	10	34%	0	0%	0.2	0%	3.7	7%	0.0	0%
Black Rock Creek	WU4	7	15%	5	11%	0	0%	14.3	16%	2.8	3%	0.0	0%

Table D-7. Instream LWD Quality Ratings for Major Streams and Sections of Streams or Rivers in Calwater Planning Watersheds for the Navarro WAU.

Stream	Calwater Planning Watershed	In-stream LWD Quality
Navarro R.	Lower Navarro River	Marginal
Navarro R.	Middle Navarro River	Marginal
Navarro R.	Upper Navarro River	Marginal
Navarro R.	Hendy Woods	Marginal
Marsh Gulch	Lower Navarro River	Marginal
Murray Gulch	Lower Navarro River	Marginal
Flume Crk.	Lower Navarro River	Marginal
Ray Gulch	Ray Gulch	Marginal
Flynn Crk.	Flynn Creek	Deficient
North Branch N.F. Navarro R.	Dutch Henry Creek	Deficient
North Branch N.F. Navarro R.	Little North Fork Navarro	Deficient
Cooks Crk.	Dutch Henry Creek	Deficient
John Smith Crk.	John Smith Creek	Deficient
Redwood Crk.	Little North Fork Navarro	Deficient
Little N.F. Navarro River	Little North Fork Navarro	Deficient
South Branch N.F. Navarro R.	Lower South Branch Navarro	Deficient
South Branch N.F. Navarro R.	Middle South Branch Navarro	Deficient
South Branch N.F. Navarro R.	Upper South Branch Navarro	Deficient
Bailey Crk.	Middle South Branch Navarro	Deficient
Bear Crk.	Middle South Branch Navarro	Marginal
Bridge Crk.	Middle South Branch Navarro	Deficient
Shingle Mill Crk.	Middle South Branch Navarro	Deficient
McGarvey Crk.	Upper South Branch Navarro	Marginal
Low Gap Crk.	Upper South Branch Navarro	Deficient
Hardscratch Crk.	Upper South Branch Navarro	Deficient
Tramway Gulch	North Fork Navarro River	Deficient
Perry Gulch	Floodgate Creek	ND
Berry Crk.	Middle Navarro River	Deficient
Floodgate Crk.	Floodgate Creek	Deficient
Black Rock Crk.	Upper Navarro River	Marginal
N.F. Indian Crk.	North Fork Indian Creek	Deficient
West Branch N.F. Indian Crk.	North Fork Indian Creek	Deficient
Cold Springs Crk.	Rancheria Creek	Deficient
Dago Crk.	Rancheria Creek	Deficient

CANOPY CLOSURE AND STREAM TEMPERATURE

Methods

Canopy closure, over watercourses, was estimated from 1996 aerial photographs. Four canopy closure classes were determined using aerial photographs. These classes are shown in table D-8. A map was produced for the Navarro WAU based on the aerial photograph interpretations (Map D-2).

Table D-8. Estimated levels of Canopy Closure from Aerial Photographs.

Stream surface not visible	>90% Canopy Closure
Stream surface visible or visible in patches	70-90% Canopy Closure
Stream visible but banks are not visible	40-70% Canopy Closure
Stream surface and banks visible	<40% Canopy Closure

During 1999 field measurements of canopy closure over select stream channels were performed. The field measurements were taken during the stream channel assessments in the Navarro River WAU. The field measurements consisted of estimating canopy closure over a watercourse using a spherical densiometer. The densiometer estimates were taken at approximately 3-5 evenly spaced intervals along a channel sample segment, typically a length of 20-30 bankfull widths. The results of the densiometer readings were averaged across the channel to represent the percentage of canopy closure for the channel segment.

Stream temperature has been monitored in Class I streams in the Navarro WAU, by Louisiana-Pacific Corp., 1989-97 and MRC in 1999-2002. In summer 2001 this was expanded to include Class II and one Class IV (Theron's Pond) watercourse as part of a herpetological study. Although Class II streams by definition do not support fish, they do flow into Class I streams and therefore affect temperature of fish bearing streams. Stream temperature monitoring used electronic temperature recorders (Stowaway, Onset Instruments) which monitor the water temperature continuously at 2 hour intervals. Stream temperatures are monitored during the summer months when the water temperatures are highest. The stream temperature recorders were typically placed in shallow pools (<2 ft. in depth) directly downstream of riffles. Map D-2 shows the temperature monitoring locations and Table D-9 a and b describes the temperature monitoring locations.

Table D-9a. Class I Stream Temperature Monitoring Locations and Time Periods in the Navarro WAU (see map D-2).

Temperature Monitoring Station	**Stream Channel Segment Number**	**Stream/River Name**	**Years Monitored**
81-1	ED1	North Branch NF Navarro	92, '93, '94, '95, '99, '00, '01, '02
81-2	EJ1	John Smith Creek	1989-94, '97, '99, '00, '02
81-3	EN1	North Branch NF Navarro	1992-95, '99, '00, '01, '02
81-4	EJ1	John Smith Creek	89, '91, '02
81-5	EJ9	Sheep Gulch	01
81-6	ED8	Cooks Creek	02
81-7	EN14	Redwood Creek	02
81-8	EN2	Little North Fork Navarro	02
82-1	WL4	Marsh Gulch	89, 1991-94, '99, '00, '01,'02
82-2	WF1	Flynn Creek	93, '94, '97, '99, '00, '01, '02
82-3	WM2	Navarro River	1989-94, '99, '00, '01
82-4	WL6	Marsh Gulch	1989
82-5	WM5	Navarro River	89, '90, '91, '92, '01, '02
82-6	WL19	Murray Gulch	01
82-7	WN10	Deadhorse Gulch	01, '02
82-8	WF13	Camp 16 Gulch	01, '02
82-9	WL27	Flume Gulch	01, '02
85-1	EL1	South Branch NF Navarro	95, '96, '99 '00, '01, '02
85-2	EI3	South Branch NF Navarro	94, '95, '96, '99, '00, '01
86-1	EI1	NF Indian Creek	93, '94, '95, '96, '00, '01, '02
86-2	EI11	NF Indian Creek	94, '95, '96, '99, '00, '01, '02
88-1	WH1	Navarro River	1990-94, '99, '00, '02

Table D-9b. Class II Stream Temperature Monitoring Locations for Summer 2001.

Temperature Monitoring Station	**Stream/River Name**
82-21	Tributary to Flynn Creek
82-22	Mustard Gulch
82-23	Black Rock Creek
82-24	Berry Creek
82-25	Tramway Gulch
82-26	Tank 4 Gulch
82-27	Coon Creek
82-28	Ray Gulch
85-20	NF Rose Creek
85-21	SF Rose Creek
86-20	West Branch Indian Creek
86-21	Theron's Pond (CIV)

Maximum and mean daily temperatures were calculated for each temperature monitoring site and year and are presented in Appendix D. Maximum weekly average temperatures (MWATs) and maximum weekly maximum temperatures were calculated for the stream temperatures by taking a seven day average of the mean and maximum daily stream temperatures.

A stream shade quality rating was derived for major tributaries or river segments within a Calwater planning watershed. The percentage of perennial watercourses in a stream segments hydrologic watershed ranked as having “on-target” effective shade determines the overall quality of the stream’s shade canopy. For streams of rivers that flow through several Calwater planning watersheds, the percentage of perennial watercourses in stream segments of that planning watershed ranked as having “on-target” effective shade determines the overall quality of the stream or river’s shade canopy. MRC uses 2 sequential sets of criteria to determine if a watershed has “on-target” effective shade, the first based on stream temperature, the second on effective shade:

- If the MWAT value for stream temperature at the outlet of a streams major basin (for North Branch Navarro the major basin is the Navarro River) lies below 15°C, then we consider that current shade conditions provide “on-target” effective shade for all watercourses in that basin.

However, if the MWAT value, for the major basin of a stream, lies above 15°C then the percentage of effective shade over each watercourse in the hydrologic watershed or planning watershed for streams and rivers that flow through a planning watershed determines the streams effective shade quality rating.

The percentage of effective shade required for an “on-target” rating varies by bankfull width of the watercourse:

- for watercourses with bankfull widths <30 feet, >90% effective shade.
- for watercourses with bankfull widths of 30-100 feet, >70% effective shade.
- for watercourses with bankfull widths of 100-150 feet, >40% effective shade.

We use the following categories of watercourse-shade rating to determine overall shade quality in each major stream or river/stream segment of a planning watershed:

ON TARGET –	>90% of perennial watercourses that contribute to the stream have “on-target” effective shade
MARGINAL –	70-90% of perennial watercourses that contribute to the stream have “on-target” effective shade, or >70% of stream with greater than 70% canopy.
DEFICIENT –	<70% of perennial watercourses that contribute to the stream have “on-target” effective shade or <70% canopy.

Major streams were further classified by a stream temperature quality rating to provide insight to the habitat quality of a stream or stream segment based on water temperature. High water temperatures indicate unsuitable habitat for salmonids and cold water amphibians. However, it is not necessarily indicative of poor land use practices. Factors such as microclimate of the area and size of the stream or river and ability of riparian vegetation to shade it influence water temperature. To expect all streams and rivers to meet an “On Target” stream temperature quality rating is inappropriate. But as a determination of where appropriate summer rearing habitat for salmonids is located the stream temperature quality rating works well.

Table D-10. Summer Stream Temperature Quality Rating for Salmonids as a Function of Maximum Weekly Average Temperature (MWAT).

MWAT (°C)	Species Historically Present		
	Coho Only	**Steelhead Only**	**Coho and Steelhead**
<15	On Target	On Target	On Target
15-17	Marginal	On Target	Marginal
17-19	Deficient	Marginal	Deficient
>19	Deficient	Deficient	Deficient

To determine the stream-temperature quality rating for each watercourse, we selected the lowest species-specific stream-temperature rating among the salmonid species historically present in that particular watercourse. For each watercourse with multiple monitoring sites, we calculated a weighted-average of the stream-temperature quality ratings of segments for that watercourse. We assigned a value of 1 to “deficient” segments, 2 to “marginal” segments, and 3 to “on-target” segments, weighting this value by each segment’s proportion of the total watercourse length in the planning watershed. For example, take a watershed with a historic coho population and the following characteristics:

Monitoring site	MWAT (°C)	Temperature quality rating	Proportion of total watercourse length
A	14.2	On Target	0.50
B	18.0	Deficient	0.25
C	15.2	Marginal	0.25

Overall temperature quality value = 3(0.50) + 1(0.25) + 2(0.25)= 2.25

We use the following ranges to convert the weighted value into an overall rating:

1.00 - 1.66 = Deficient
1.67 - 2.33 = Marginal
2.34 - 3.00 = On Target

Results and Discussion

Canopy cover is less than ideal in streams in the Navarro River WAU (see Map D-2). The entire mainstem Navarro River falls into the 0-40% canopy cover range although this is to be expected of a mainstem channel in the lower reaches of a large watershed. Other problem areas are upper South Branch of the North Fork Navarro, lower North Branch of the North Fork, and Indian Creek. Canopy cover in these areas varies but rarely exceeds 70%. Flynn Creek as well as many of the smaller tributaries appear to have adequate stream shading. Table D-11 summarizes the results of canopy closure measurements at stream segments where stream channel and fish habitat information was collected.

Table D-11. Canopy Shading Streams of the Navarro WAU, 1999.

Stream Name	Segment ID	Mean Canopy over Stream
N Branch Navarro	ED1	29
Cook Creek	ED8	68
North Fork Indian Creek	EI2	48
John Smith Creek	EJ1	87
John Smith Creek	EJI(2)	81
SB Navarro	EL1	45
South Branch Navarro	EM1	74
Bear Creek	EM20	79
Bridge Creek	EM29	36
Bridge Creek	EM30	70
Shingle Mill Creek	EM39	76
Little NF Navarro	EN2	75
Little NF Navarro	EN25	80
Bottom Creek	EN3	80
Sawyer Creek	EN38	74
Spooner Creek	EN4	81
Upper South Branch Navarro	EU1	68
Low Gap Creek	EU20	83
Rose Creek	EU24	75
South Branch Navarro	EU4	66
McGarvey Creek	EU7	69
Flynn Creek	WF1	79
Flynn Creek	WF1(u)	80
Camp 16 Gulch	WF13	90
Tank Gulch	WF26	86
Tank Gulch	WF27	95
none	WH3	87
Murray Gulch	WL19	95
Flume Gulch	WL27	93
Flume Gulch	WL28	93
Navarro River	WL3	23
Marsh Gulch	WL4	89
Navarro River	WM2	43
Skid Gulch	WM32	97
Berry Creek	WM36	62
Navarro River	WM5	34
Dead Horse Gulch	WN10	95
Dead Horse Gulch	WN11	87
Coon Gulch	WN20	89
Roller Gulch	WR11	68
Ray Gulch	WR14	94
Ray Gulch	WR15	94
White Gulch	WR23	97
Mustard Gulch	WR26	87
Navarro River	WU1	18
Kabiki Creek	WU15	95
Sage Gulch	WU18	80

Class I summer stream temperatures in the larger channels of the Navarro WAU are always above the preferred temperature range of coho salmon. Temperatures recorded in the South Branch of the North Fork Navarro River, Indian Creek and especially mainstem Navarro River are much higher than the MWAT temperature thresholds for coho salmon (17-18 C^o). Maximum temperatures in these streams approach maximum lethal temperatures for coho salmon (23 C^o) and steelhead trout (26 C^o)(Brett, 1952 and Becker and Genoway, 1979). Conversely, MWAT values recorded in some of the smaller stream channels of the Navarro River WAU such as Marsh Gulch, Murray Gulch, Flume Gulch, Deadhorse Gulch, and Sheep Gulch are ideal for coho salmon. Temperatures in John Smith Creek, Flynn Creek, and Camp 16 Gulch are favorable for salmonids (see Tables D-12, D-13 and D-14). These smaller streams are the places in the Navarro WAU where coho salmon have been found in distribution studies.

Table D-12. Maximum Daily Temperatures for each station in the Navarro River WAU.
**- data not collected

Station No.	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
81-1	**	**	**	21.5	22.5	19.1	21.2	**	**	**	20.6	21.8	20.7	21.0
81-2	19.5	22.5	19.0	19.0	18.5	17.5	**	**	20.0	**	17.8	18.0	**	17.2
81-3	**	**	**	21.5	22.5	20.5	22.3	**	**	**	20.9	21.5	19.7	19.8
81-4	22.5	**	21.5	**	**	**	**	**	**	**	**	**	**	14.1
81-5	**	**	**	**	**	**	**	**	**	**	**	**	13.9	**
81-6	**	**	**	**	**	**	**	**	**	**	**	**	**	17.1
81-7	**	**	**	**	**	**	**	**	**	**	**	**	**	13.7
81-8	**	**	**	**	**	**	**	**	**	**	**	**	**	18.9
82-1	18.0	**	15.5	16.0	15.5	15.0	**	**	**	**	15.0	15.9	15.1	14.5
82-2	**	**	**	**	**	16.5	**	**	18.1	**	18.5	19.1	16.7	**
82-3	26.5	27.5	25.0	24.0	24.5	23.5	**	**	**	**	24.2	25.4	23.7	**
82-4	18.0	**	**	**	**	**	**	**	**	**	**	**	**	**
82-5	28.0	29.5	28.5	26.5	**	**	**	**	**	**	**	**	25.7	25.3
82-6	**	**	**	**	**	**	**	**	**	**	**	**	14.3	14.9
82-7	**	**	**	**	**	**	**	**	**	**	**	**	13.3	14.1
82-8	**	**	**	**	**	**	**	**	**	**	**	**	15.4	17.4
82-9	**	**	**	**	**	**	**	**	**	**	**	**	14.9	15.2
85-1	**	**	**	**	**	**	23.1	22.1	**	**	20.1	21.2	19.6	19.8
85-2	**	**	**	**	**	24.6	24.4	23.7	**	**	21.4	21.9	20.4	**
86-1	**	**	**	**	26.6	27.4	25.7	27.2	**	**	**	24.4	26.4	25.2
86-2	**	**	**	**	**	26.2	27.6	24.3	**	**	20.0	24.7	23.4	23.2
88-1	**	28.0	26.5	26.0	27.0	25.0	**	**	**	**	27.1	27.2	**	25.0

Table D-13. Maximum Weekly Average Temperature (MWAT) for each station in the Navarro River WAU. **- data not collected

Station No.	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
81-1	**	**	**	18.7	18.7	17.6	19.4	**	**	**	18.6	19.0	18.1	17.6
81-2	17.6	18.9	16.2	16.8	16.7	15.2	**	**	16.8	**	15.7	16.3	**	15.3
81-3	**	**	**	18.7	18.7	17.5	18.6	**	**	**	17.1	18.0	16.6	17.0
81-4	19.3	**	17.4	**	**	**	**	**	**	**	**	**	**	13.5
81-5	**	**	**	**	**	**	**	**	**	**	**	**	12.8	**
81-6	**	**	**	**	**	**	**	**	**	**	**	**	**	15.5
81-7	**	**	**	**	**	**	**	**	**	**	**	**	**	12.7
81-8	**	**	**	**	**	**	**	**	**	**	**	**	**	16.3
82-1	15.8	**	13.8	14.5	**	13.0	**	**	**	**	13.6	13.7	13.8	13.0
82-2	**	**	**	**	**	14.5	**	**	16.1	**	15.7	16.6	14.9	**
82-3	22.6	22.6	21.2	21.2	21.4	19.7	**	**	**	**	21.2	21.8	20.4	**
82-4	15.8	**	**	**	**	**	**	**	**	**	**	**	**	**
82-5	22.8	23.8	22.3	21.8	**	**	**	**	**	**	**	**	21.8	21.8
82-6	**	**	**	**	**	**	**	**	**	**	**	**	13.4	13.5
82-7	**	**	**	**	**	**	**	**	**	**	**	**	12.9	13.7
82-8	**	**	**	**	**	**	**	**	**	**	**	**	14.8	14.6
82-9	**	**	**	**	**	**	**	**	**	**	**	**	13.6	13.5
85-1	**	**	**	**	**	**	19.5	19.0	**	**	17.8	18.9	17.3	17.7
85-2	**	**	**	**	**	19.8	20.3	20.2	**	**	18.3	19.0	17.5	**
86-1	**	**	**	**	20.5	20.1	20.3	20.8	**	**	**	19.5	19.6	19.2
86-2	**	**	**	**	**	21.4	20.4	20.6	**	**	16.7	20.2	19.6	19.3
88-1	**	23.5	22.3	22.1	21.8	21.2	**	**	**	**	21.4	22.2	**	21.7

Table D-14. 7-Day Moving Average of the Daily Maximum for each station in the Navarro River WAU (MWMT). **- data not collected

Station No.	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
81-1	**	**	**	20.8	21.1	18.8	20.9	**	**	**	20.2	21.4	20.1	20.4
81-2	18.9	21.2	18.4	18.3	17.9	17.1	**	**	19.4	**	17.0	17.8	**	16.8
81-3	**	**	**	20.8	21.1	20.2	21.5	**	**	**	19.9	20.6	19.2	19.2
81-4	21.9	**	20.4	**	**	**	**	**	**	**	**	**	**	13.8
81-5	**	**	**	**	**	**	**	**	**	**	**	**	13.2	**
81-6	**	**	**	**	**	**	**	**	**	**	**	**	**	16.7
81-7	**	**	**	**	**	**	**	**	**	**	**	**	**	13.7
81-8	**	**	**	**	**	**	**	**	**	**	**	**	**	18.2
82-1	17.5	**	14.7	15.7	14.9	14.5	**	**	**	**	14.6	14.6	14.8	13.9
82-2	**	**	**	**	**	15.9	**	**	17.7	**	17.5	18.4	16.0	**
82-3	25.8	25.9	24.1	23.4	23.0	22.7	**	**	**	**	23.1	24.1	23.1	**
82-4	17.5	**	**	**	**	**	**	**	**	**	**	**	**	**
82-5	27.4	28.4	27.3	25.6	**	**	**	**	**	**	**	**	23.8	24.6
82-6	**	**	**	**	**	**	**	**	**	**	**	**	14.0	14.1
82-7	**	**	**	**	**	**	**	**	**	**	**	**	13.1	14.1
82-8	**	**	**	**	**	**	**	**	**	**	**	**	15.0	16.6
82-9	**	**	**	**	**	**	**	**	**	**	**	**	14.6	14.4
85-1	**	**	**	**	**	**	21.7	21.1	**	**	19.0	20.3	19.0	18.8
85-2	**	**	**	**	**	23.9	22.8	22.6	**	**	20.5	21.0	19.5	**
86-1	**	**	**	**	25.8	27.1	25.5	26.4	**	**	**	23.8	25.9	24.6
86-2	**	**	**	**	**	25.8	24.1	23.6	**	**	19.1	24.0	22.8	22.5
88-1	**	27.5	25.5	25.1	25.9	22.8	**	**	**	**	25.8	26.5	**	24.1

Table D-15. Class II Stream Temperature Data for the Navarro River WAU.

Stream Name	Station Number	Maximum	MWAT
Tributary to Flynn Creek	82-21	14.1	13.4
Mustard Gulch	82-22	14.5	13.8
Black Rock Creek	82-23	16.0	14.9
Berry Creek	82-24	14.5	13.5
Tramway Gulch	82-25	14.5	13.6
Tank 4 Gulch	82-26	12.6	12.3
Coon Creek	82-27	14.1	13.7
Ray Gulch	82-28	13.7	13.3
NF Rose Creek	85-20	16.8	14.9
SF Rose Creek	85-21	14.9	13.8
West Branch Indian Creek	86-20	16.8	15.0
Theron's Pond (CIV)	86-21	20.2	18.2

Stream temperatures for the tributary watercourses in the lower portion of the Navarro River, in Navarro West, are all on target (Table D-16). Further, the small tributaries of the mainstem Navarro River in Navarro West are on target for stream temperatures. The mainstem of the Navarro River provides deficient water temperatures for salmonids. Sullivan et. al. (1990) developed a concept of threshold distance, that is the distance from the watershed divide where stream temperature was no longer a function of streamside canopy but a function of air temperature. Sullivan et. al. (1990) suggested this threshold distance from the watershed divide is between 40-50km in Washington. Stream temperature analysis from Coastal Northern California (Lewis et. al., 2000) suggests the threshold distance may be 70 km from the watershed divide. The proximity of the mainstem of the Navarro River's on the MRC ownership is greater than 70 km from the watershed divide demonstrating the limited ability streamside vegetation can affect stream temperatures for the Navarro River.

The North Fork of the Navarro River, both the South and North Branches exhibit stream temperatures that are either marginal or deficient to support salmonids (Table D-16). The North Fork of the Navarro River, a.k.a. Navarro East, is further inland and has higher air temperatures. Therefore, higher stream water temperatures should be expected. However, the stream shade quality is either marginal or deficient in the North Fork of the Navarro River (Navarro East). This suggests a need for improvement in stream shading to assist in maintaining more appropriate stream temperatures for aquatic organisms.

Table D-16. Stream Temperature and Stream Shade Quality Ratings for Major Streams and River/Stream Segments in Calwater Planning Watersheds for the Navarro WAU.

Stream	Planning Watershed(s)	Stream Temperature Quality	Stream Shade Quality
Navarro R.	Lower Navarro River	ND	N/a
Navarro R.	Middle Navarro River	Deficient	N/a
Navarro R.	Upper Navarro River	ND	N/a
Navarro R.	Hendy Woods	Deficient	N/a
Marsh Gulch	Lower Navarro River	On Target	On Target
Murray Gulch	Lower Navarro River	On Target	On Target
Flume Crk.	Lower Navarro River	On Target	On Target
Ray Gulch	Ray Gulch	On Target	On Target
Flynn Crk.	Flynn Creek	Marginal	On Target
North Branch N.F. Navarro R.	Dutch Henry Creek	Deficient	Deficient
North Branch N.F. Navarro R.	Little North Fork Navarro	Marginal	Marginal
Cooks Crk.	Dutch Henry Creek	ND	Marginal
John Smith Crk.	John Smith Creek	Marginal	On Target
Redwood Crk.	Little North Fork Navarro	ND	Marginal
Little N.F. Navarro River	Little North Fork Navarro	ND	Marginal
South Branch N.F. Navarro R.	Lower South Branch Navarro	Deficient	Marginal
South Branch N.F. Navarro R.	Middle South Branch Navarro	Deficient	Deficient
South Branch N.F. Navarro R.	Upper South Branch Navarro	ND	Deficient
Bailey Crk.	Middle South Branch Navarro	ND	Deficient
Bear Crk.	Middle South Branch Navarro	ND	Marginal
Bridge Crk.	Middle South Branch Navarro	ND	Deficient
Shingle Mill Crk.	Middle South Branch Navarro	ND	Marginal
McGarvey Crk.	Upper South Branch Navarro	ND	Marginal
Low Gap Crk.	Upper South Branch Navarro	ND	Marginal
Hardscratch Crk.	Upper South Branch Navarro	ND	Deficient
Tramway Gulch	North Fork Navarro River	On Target	Deficient
Perry Gulch	Floodgate Creek	ND	N/a
Berry Crk.	Middle Navarro River	On Target	Marginal
Floodgate Crk.	Floodgate Creek	ND	On Target
Black Rock Crk.	Upper Navarro River	On Target	On Target
N.F. Indian Crk.	North Fork Indian Creek	Deficient	Deficient
West Branch N.F. Indian Crk.	North Fork Indian Creek	On Target	Marginal
Cold Springs Crk.	Rancheria Creek	ND	Marginal
Dago Crk.	Rancheria Creek	ND	Marginal

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APPENDIX D

Riparian Function Module

Figure T81-01. Mean and Maximum Daily Stream Temperatures During Summer 2002 at North Branch North Fork Navarro River (Site T81-01), Mendocino County, California.

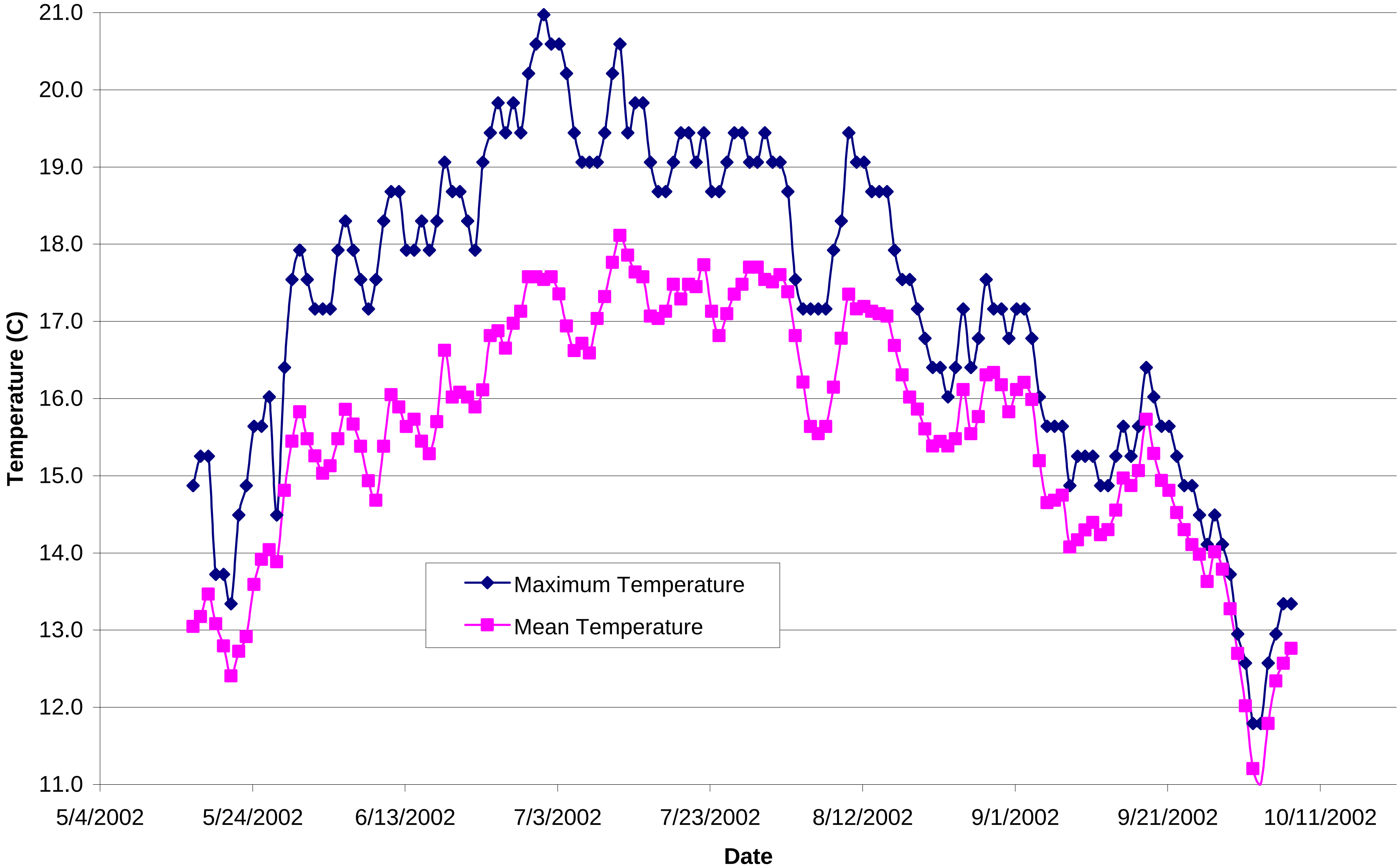


Figure T81-02. Maximum Daily Air Temperature and Mean and Maximum Daily Stream Temperatures During Summer 2002 at John Smith Creek (Site T81-02), Mendocino County, California.

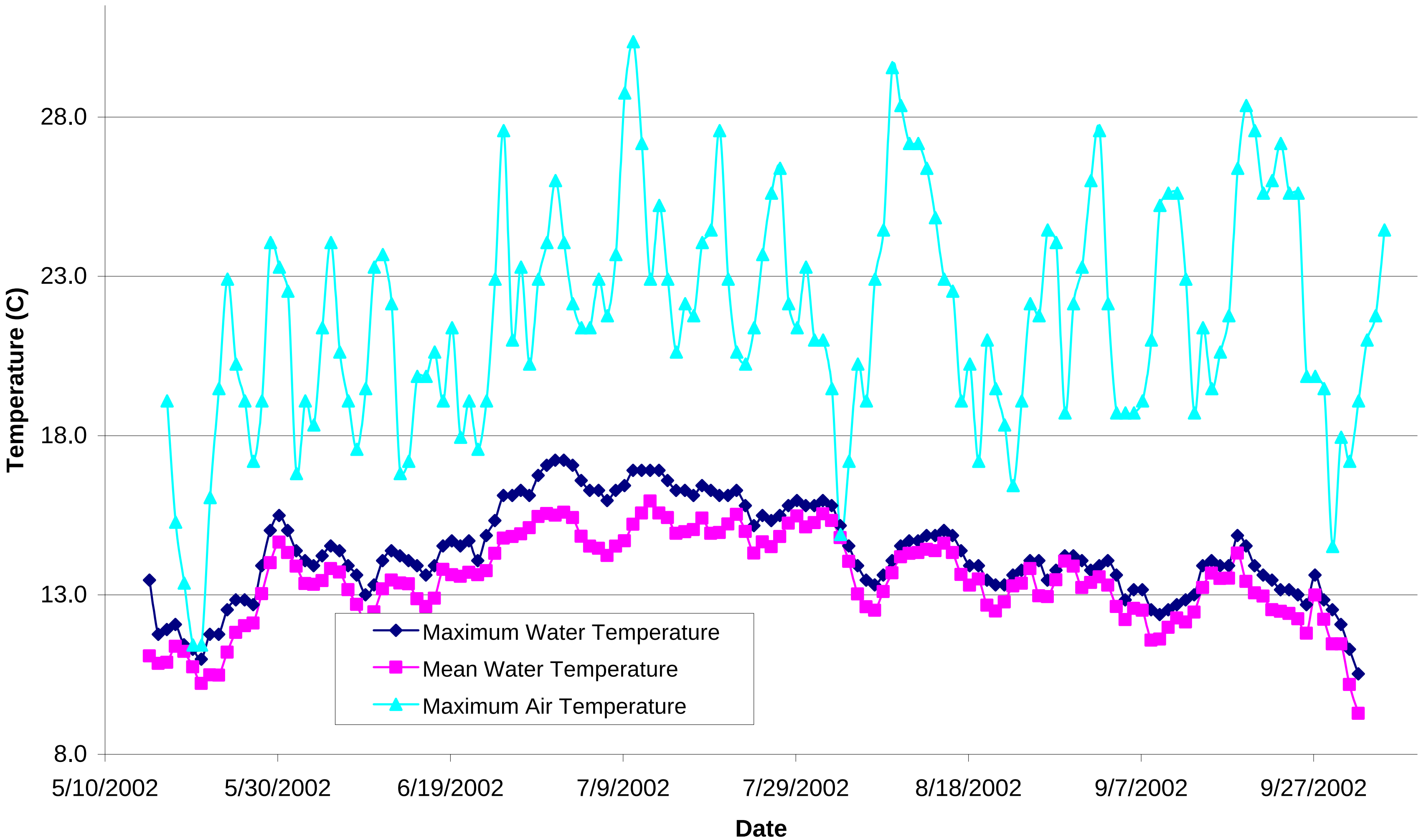


Figure T81-03. Mean and Maximum Daily Stream Temperatures During Summer 2002 at North Branch North Fork Navarro (Site T81-03), Mendocino County, California.

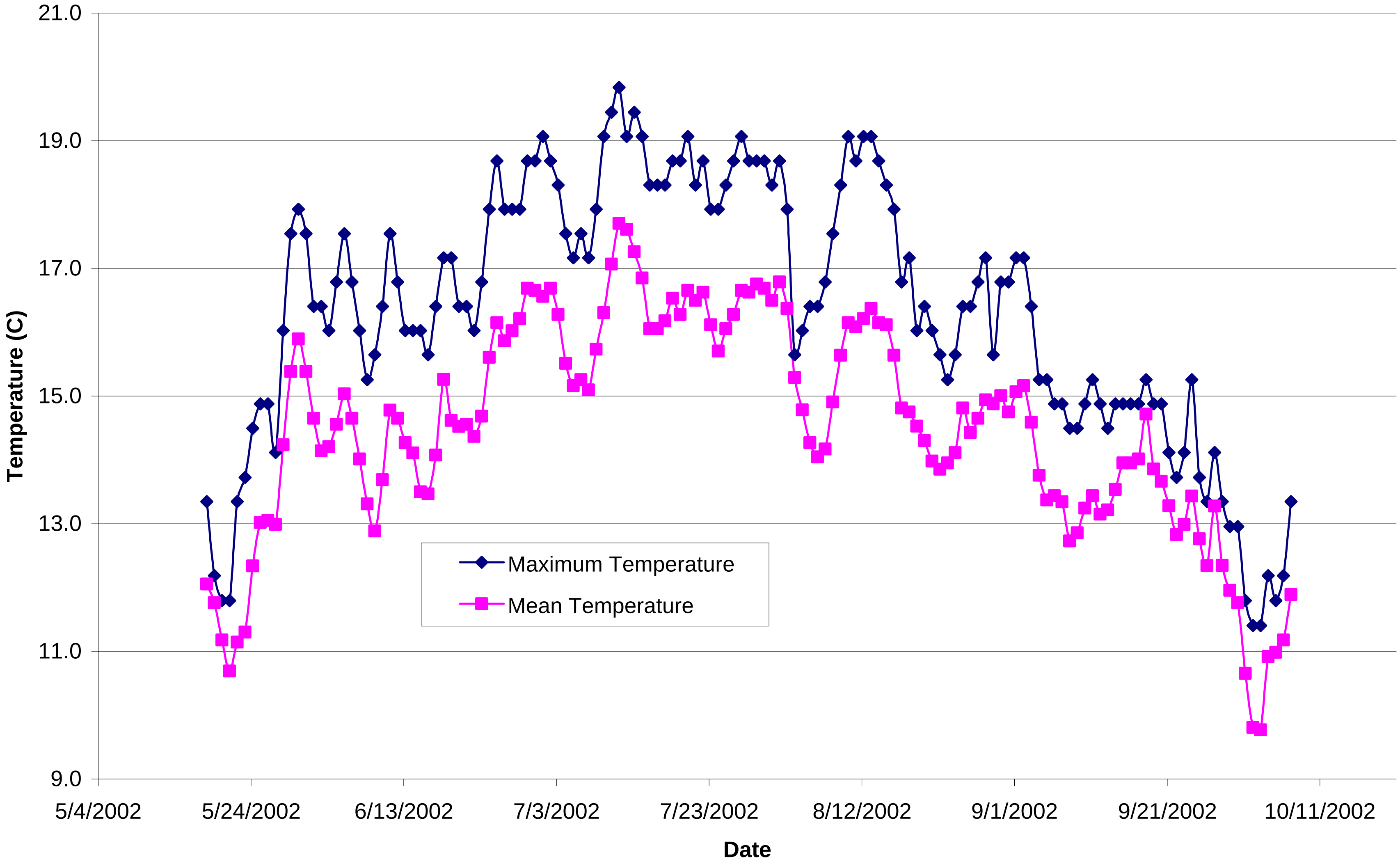


Figure T81-04. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Sheep Gulch (Site T81-04), Mendocino County, California.

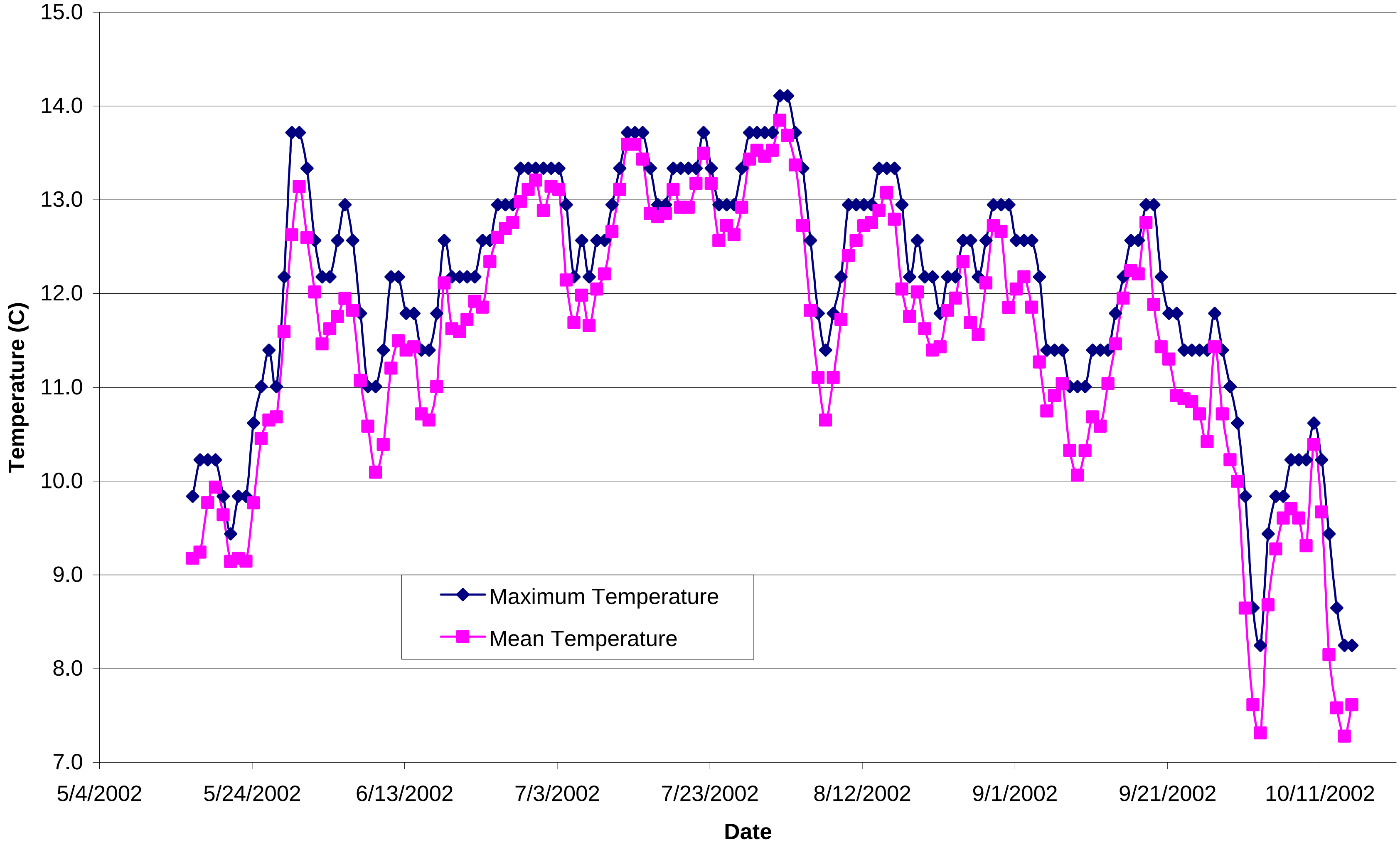


Figure T81-06. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Cooks Creek (Site T81-06), Mendocino County, California.

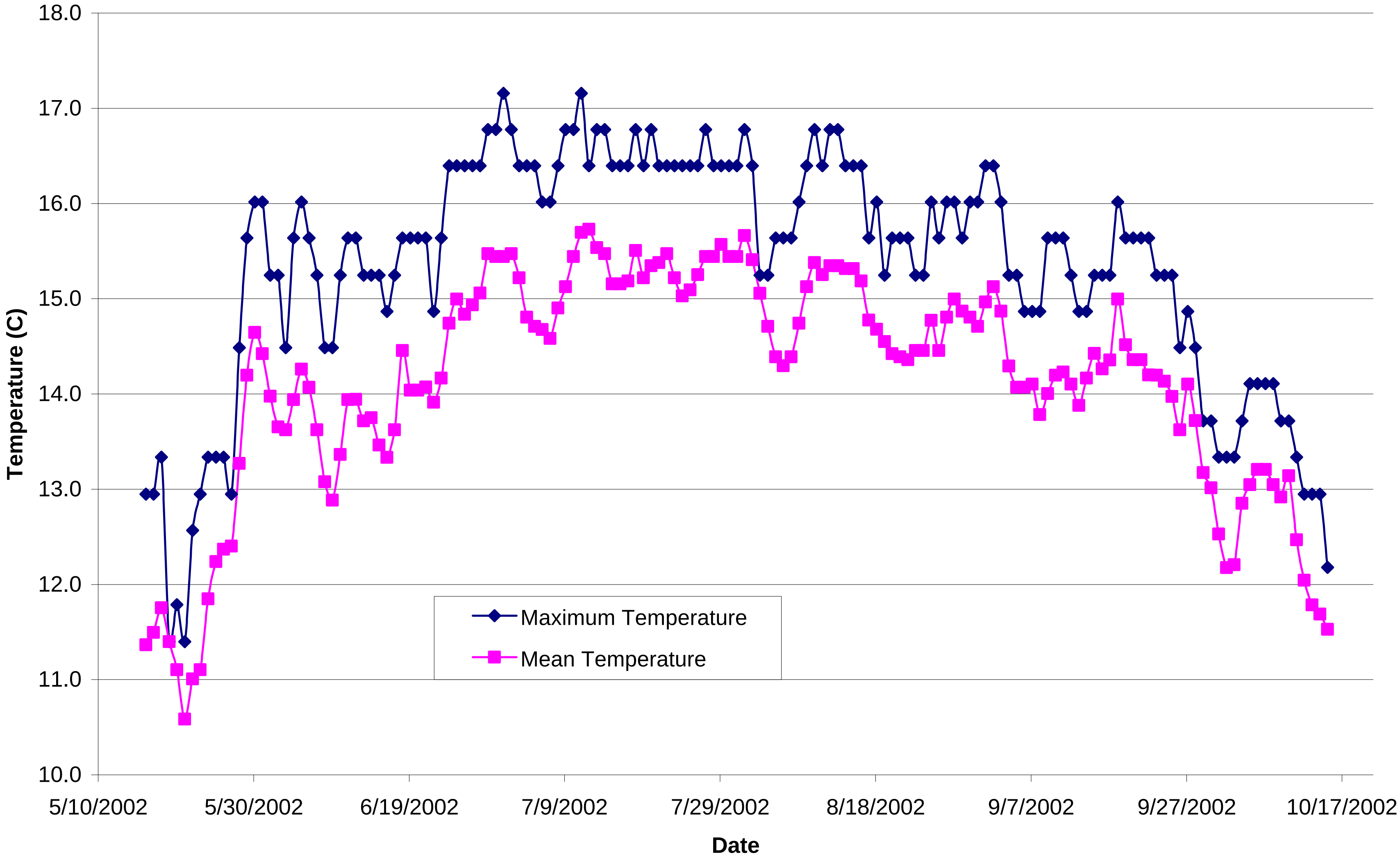


Figure T81-07. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Redwood Creek (Site T81-07), Mendocino County, California.

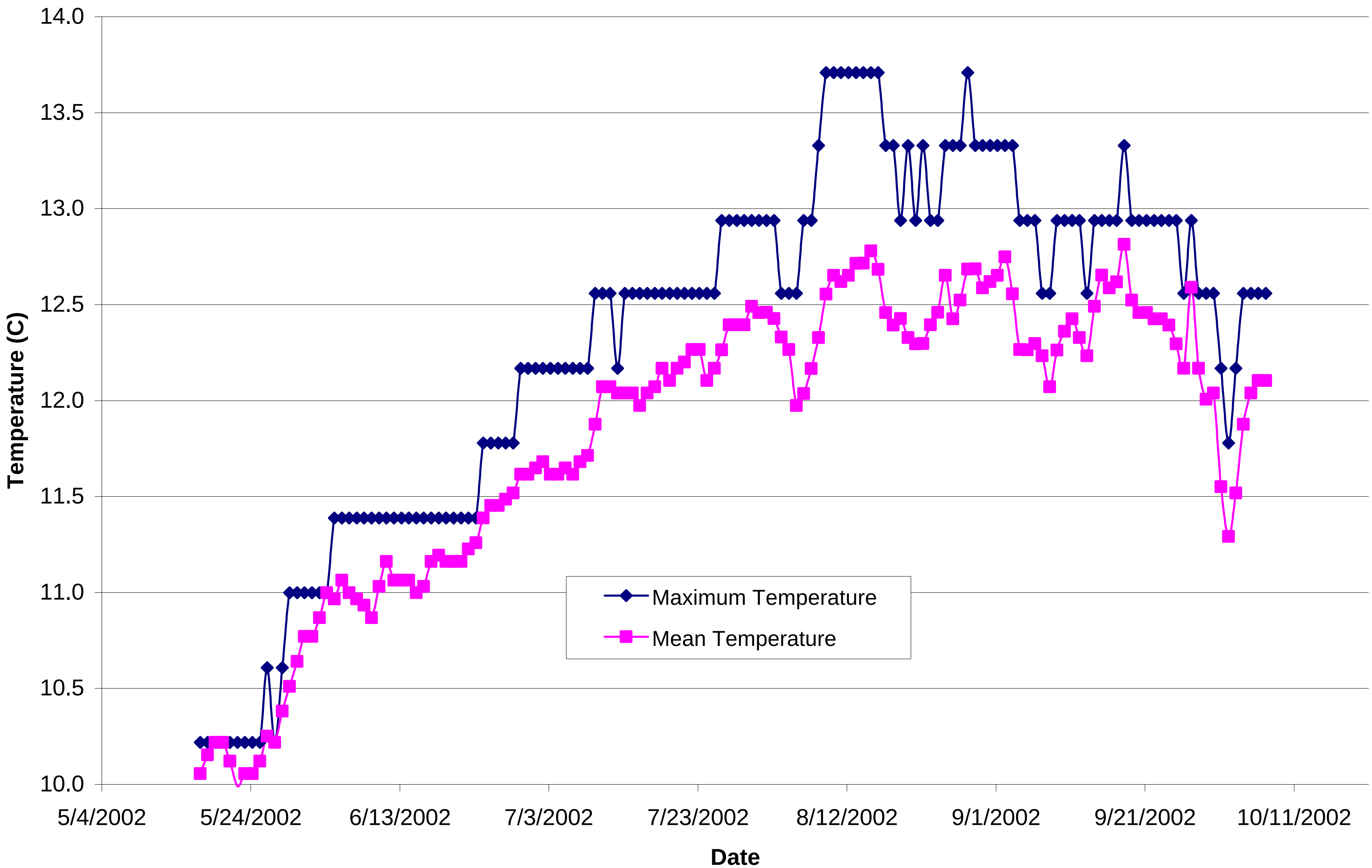


Figure T81-08. Maximum Daily Air Temperature and Mean and Maximum Daily Stream Temperatures During Summer 2002 at Little North Fork Navarro River (Site T81-08), Mendocino County, California.

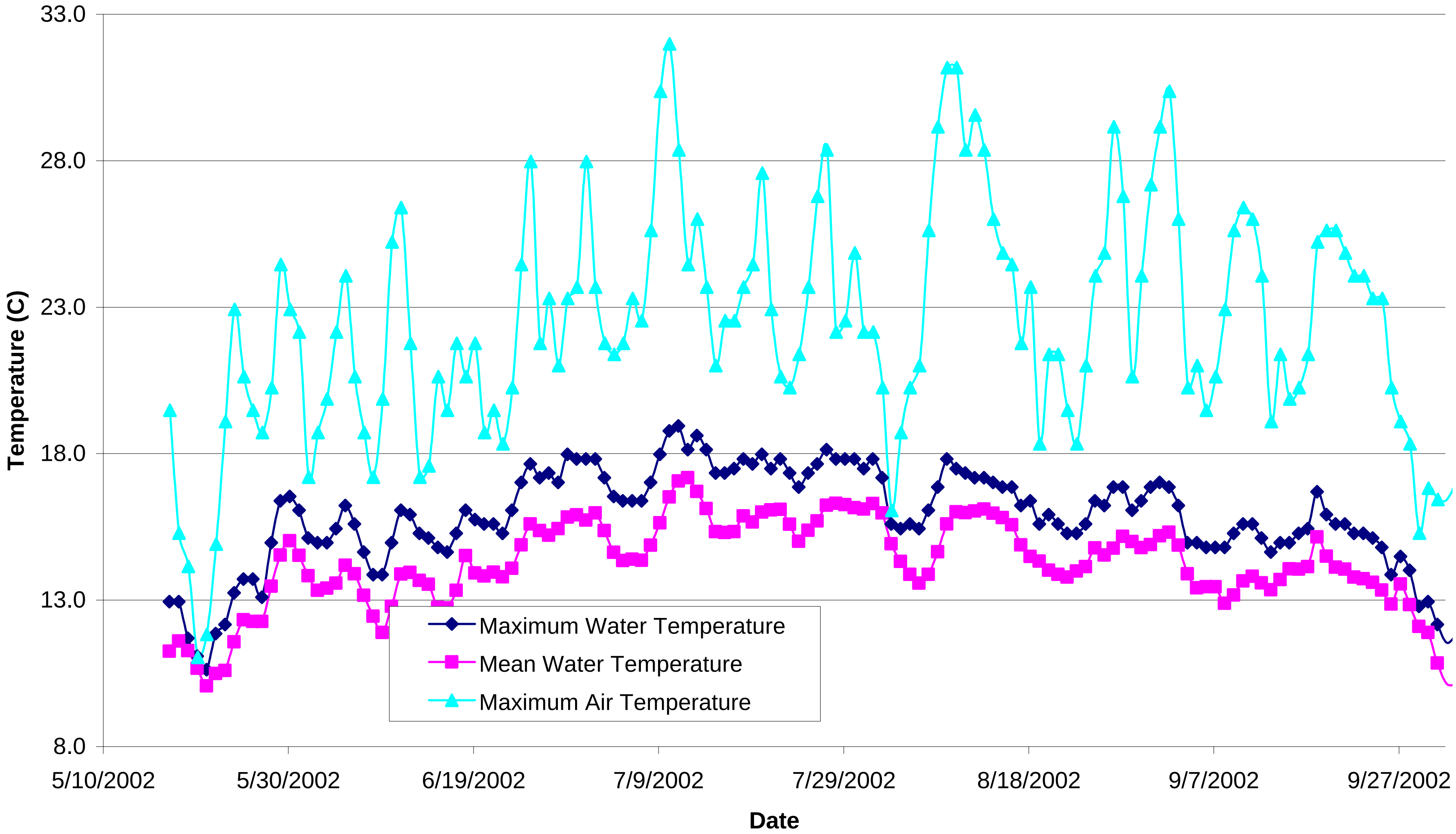


Figure T82-01. Maximum Daily Air Temperature and Mean and Maximum Daily Stream Temperatures During Summer 2002 at Marsh Gulch (Site T82-01), Mendocino County, California.

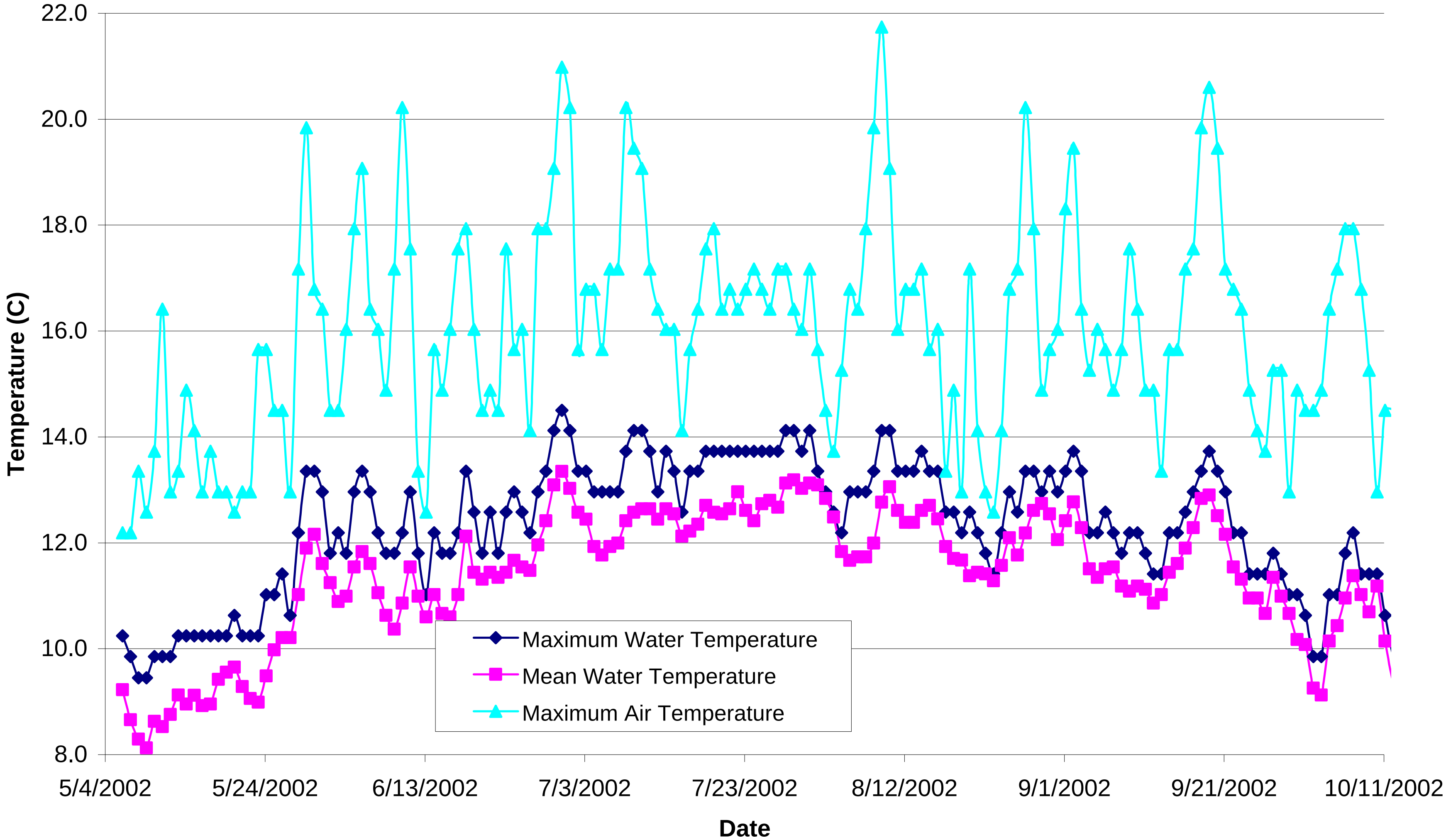


Figure T82-05. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Navarro River (Site T82-05), Mendocino County, California.

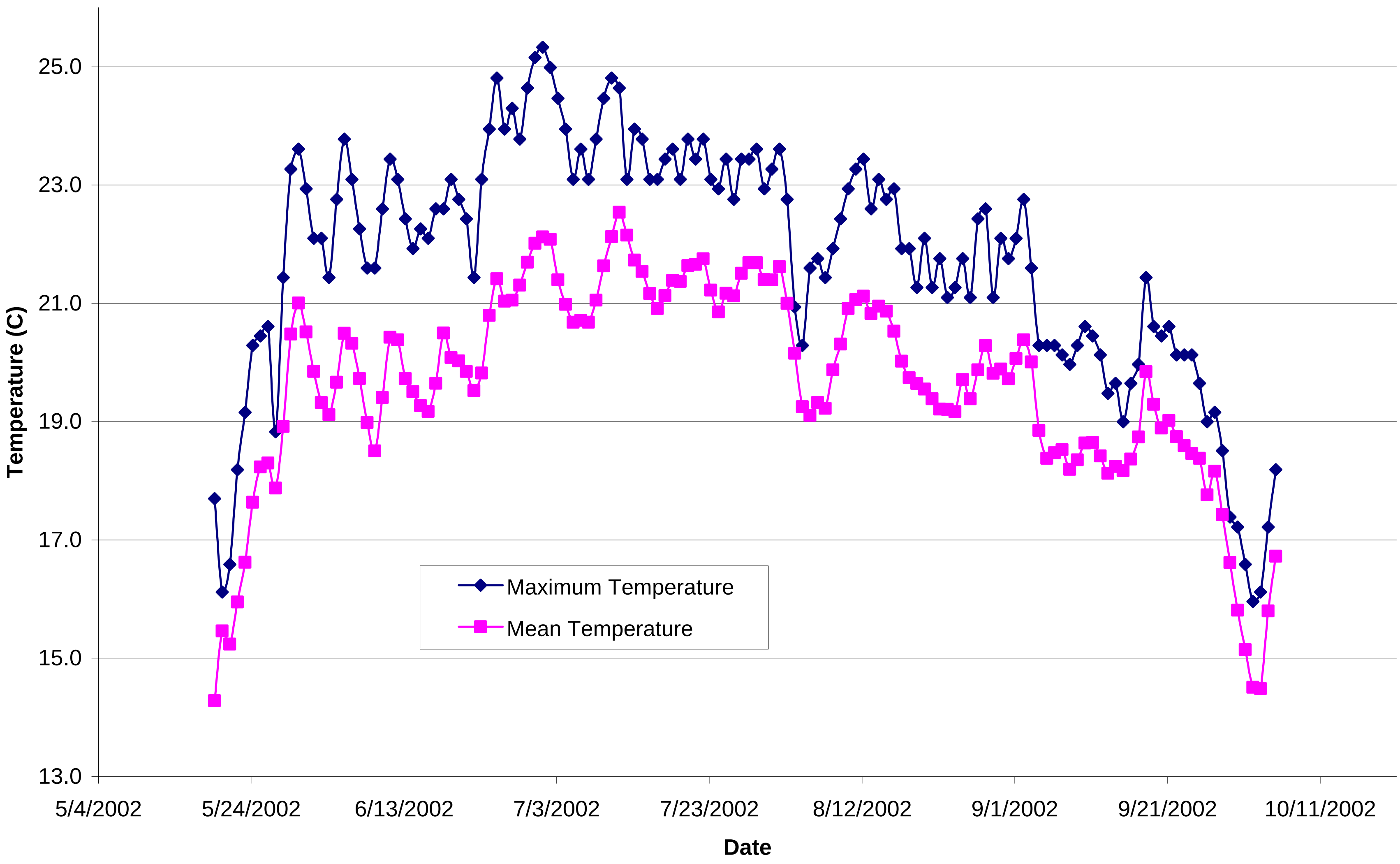


Figure T82-06. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Murray Gulch (Site T82-06), Mendocino County, California.

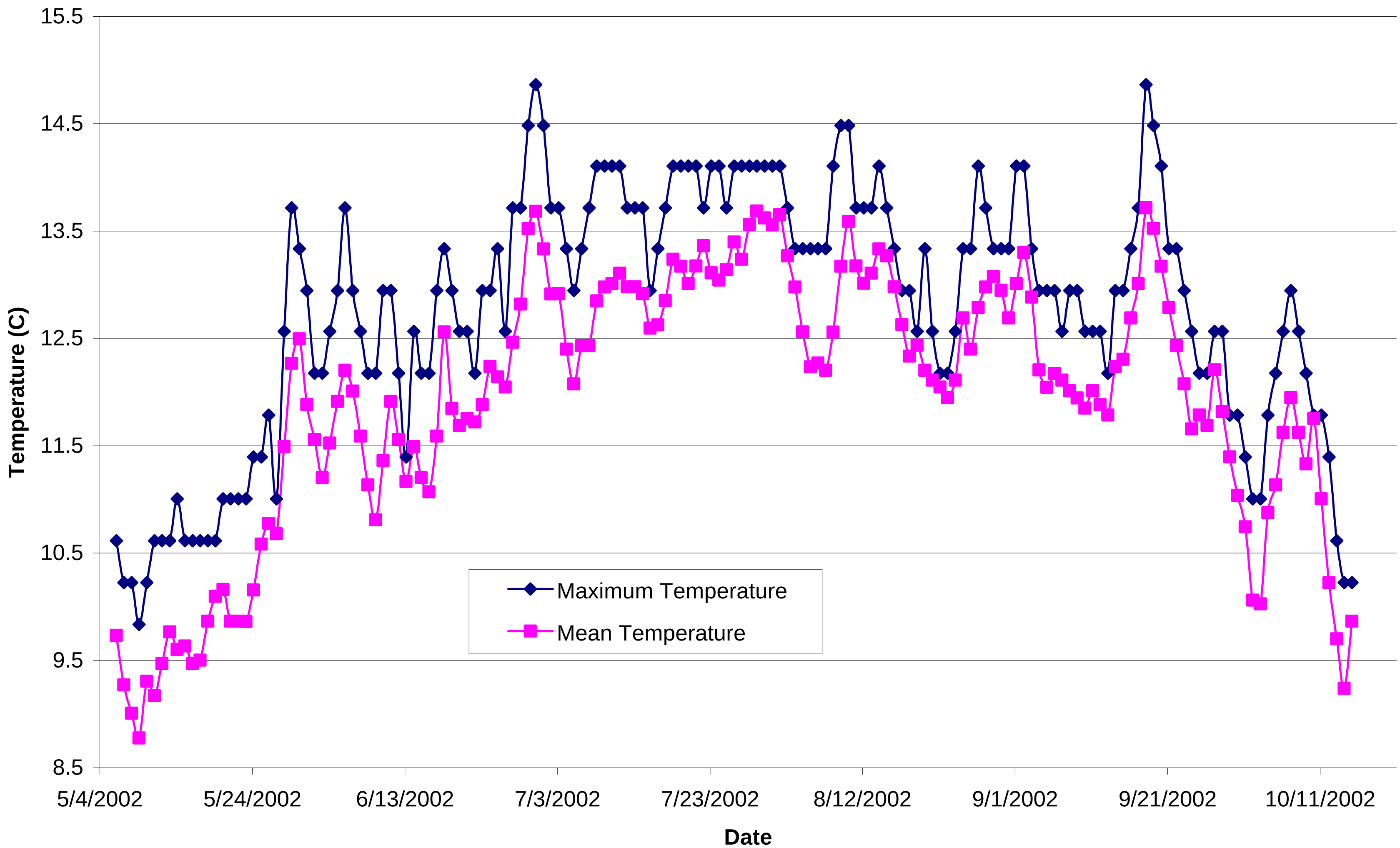


Figure T82-07. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Deadhorse Gulch (Site T82-07), Mendocino County, California.

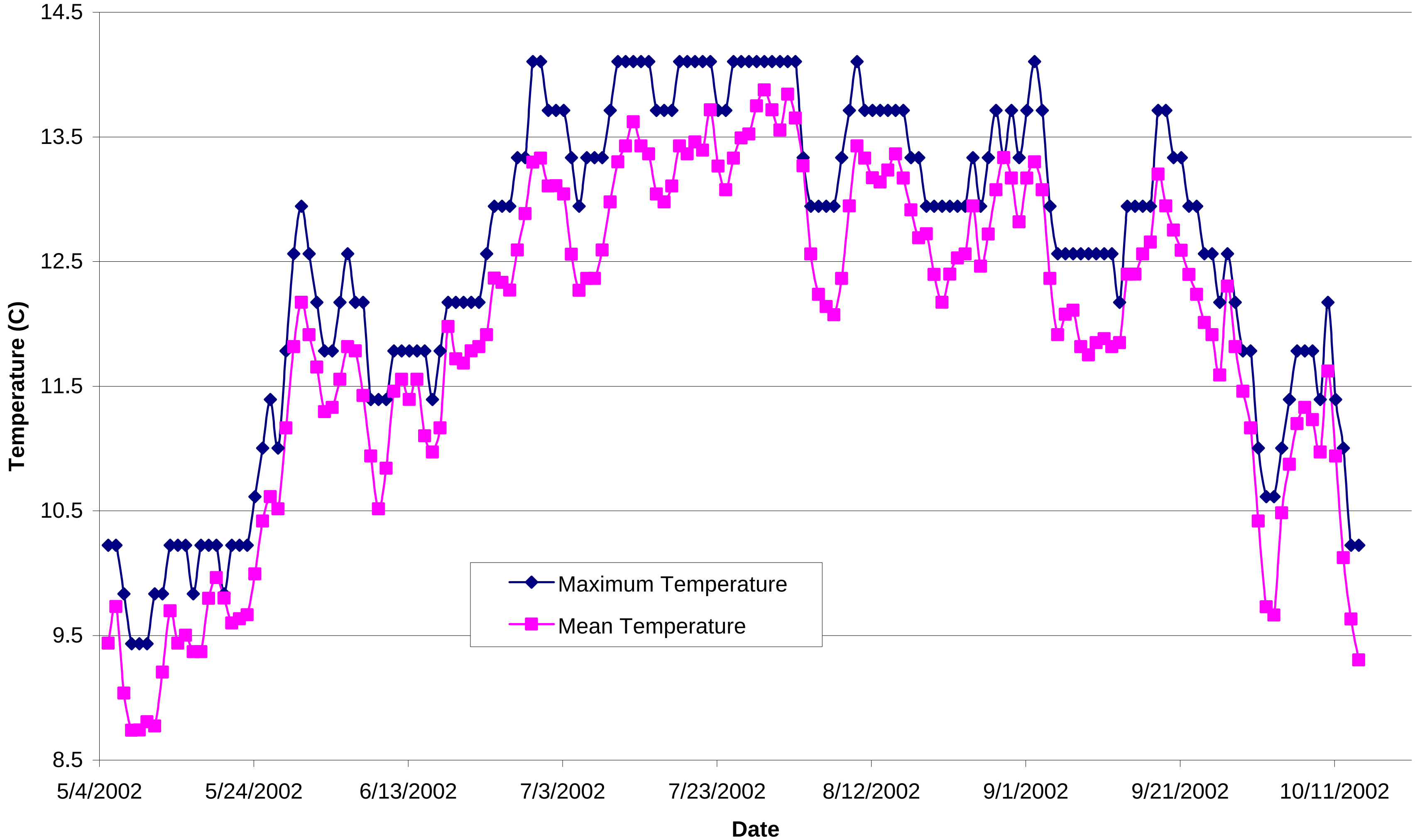


Figure T82-08. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Camp 16 Creek (Site T82-08), Mendocino County, California.

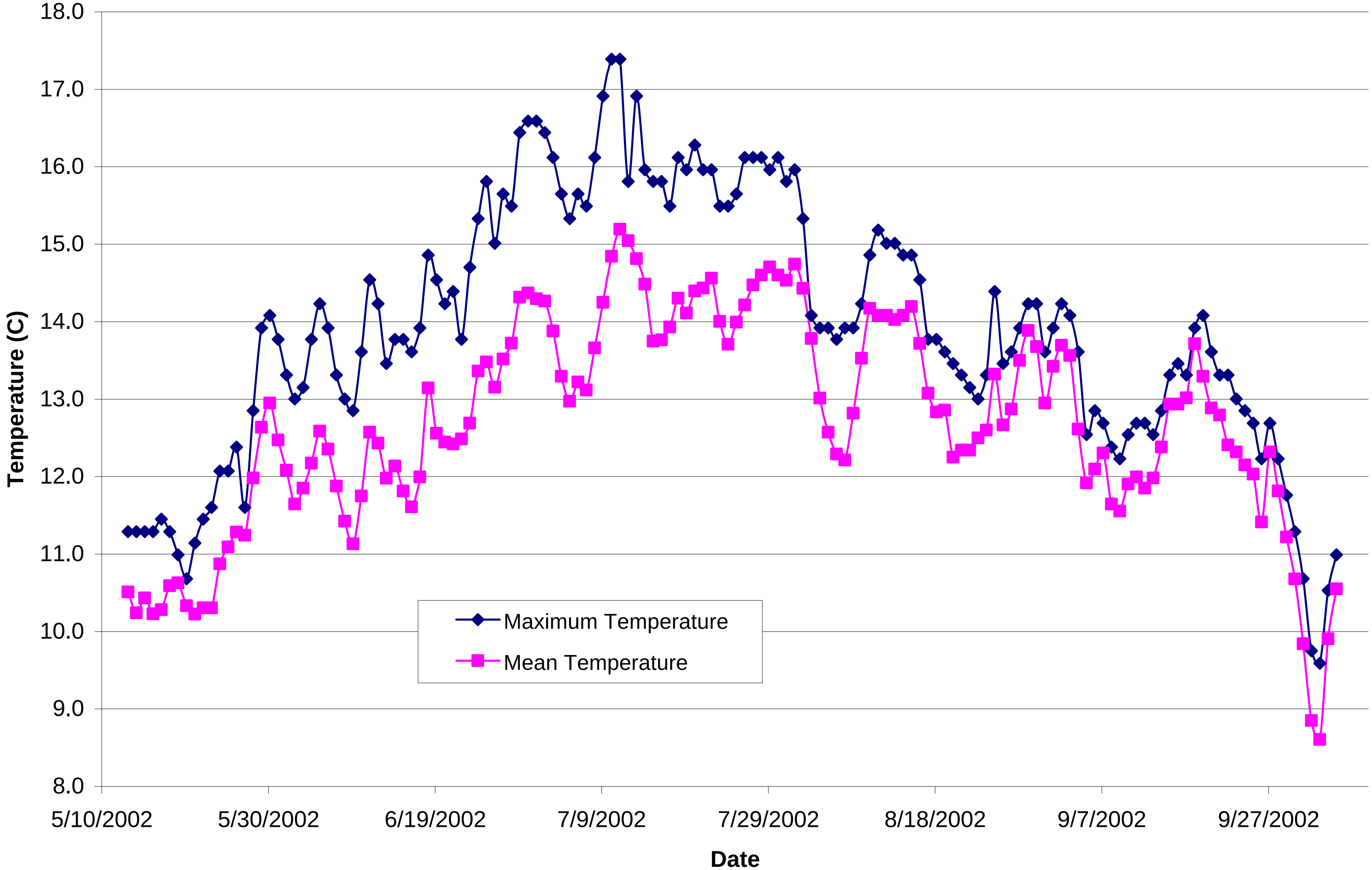


Figure T82-09. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Flume Gulch (Site T82-09), Mendocino County, California.

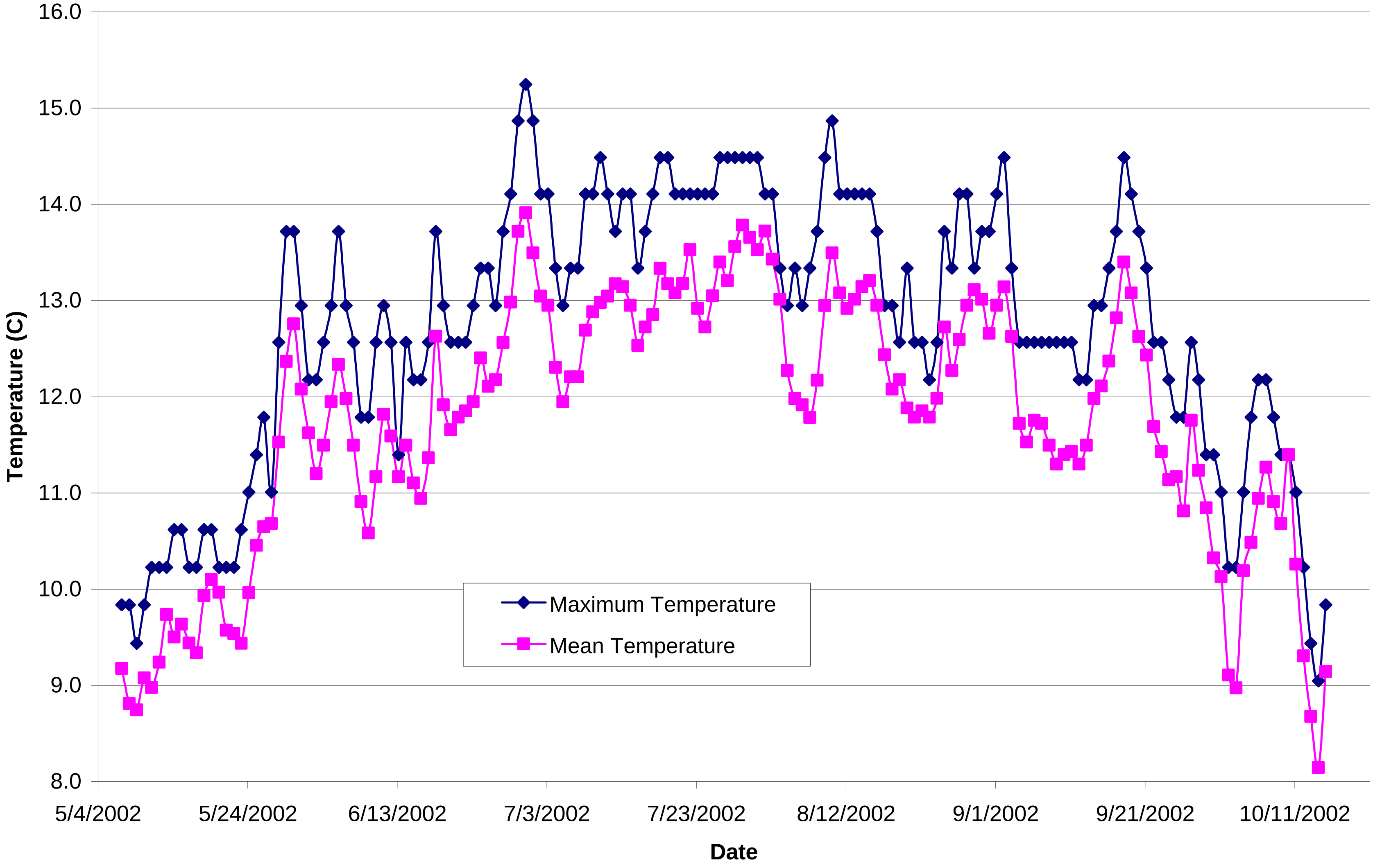


Figure T85-01. Mean and Maximum Daily Stream Temperatures During Summer 2002 at South Branch North Fork Navarro (Site T85-01), Mendocino County, California.

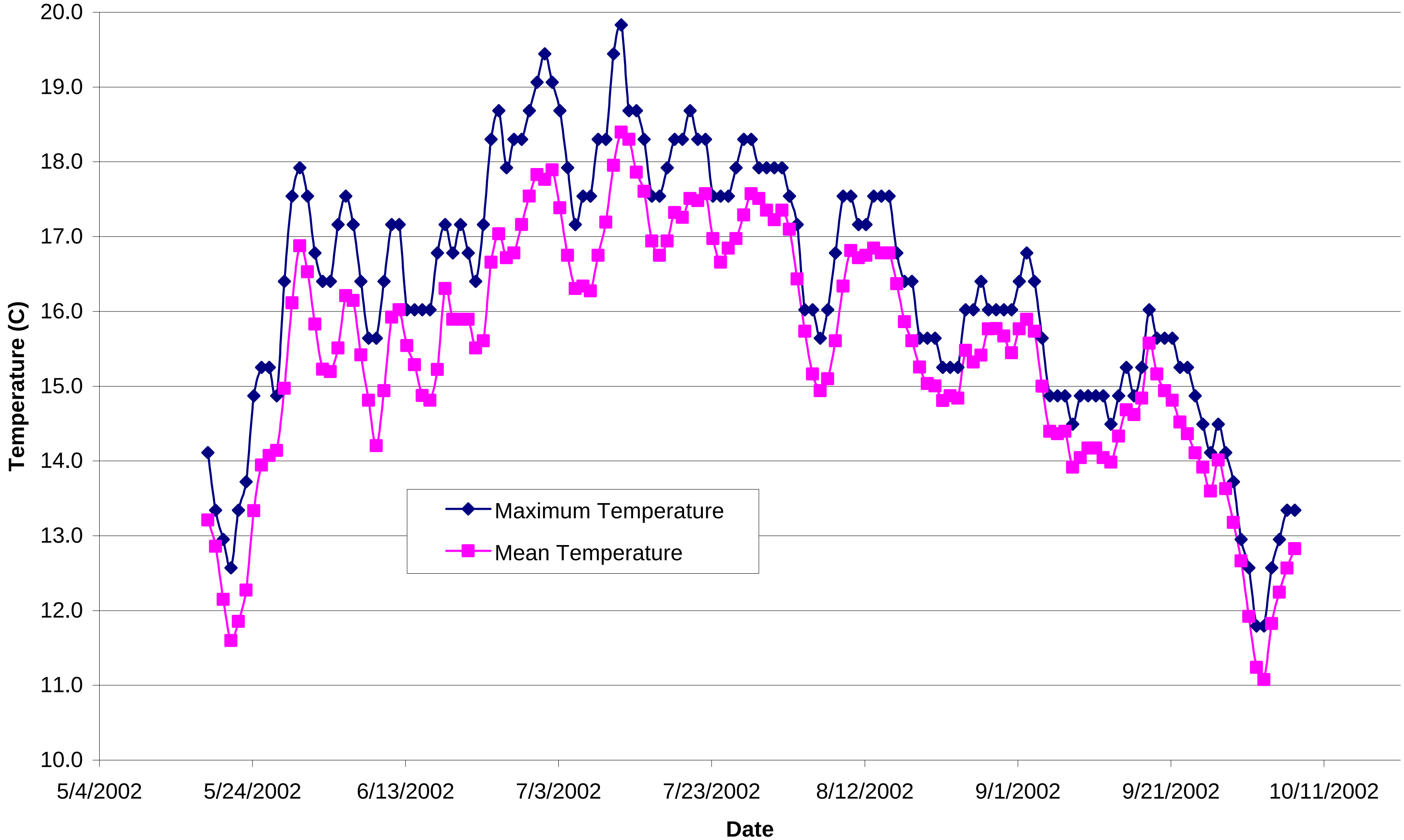


Figure T86-01. Mean and Maximum Daily Stream Temperatures During Summer 2002 at North Fork Indian Creek (Site T86-01), Mendocino County, California.

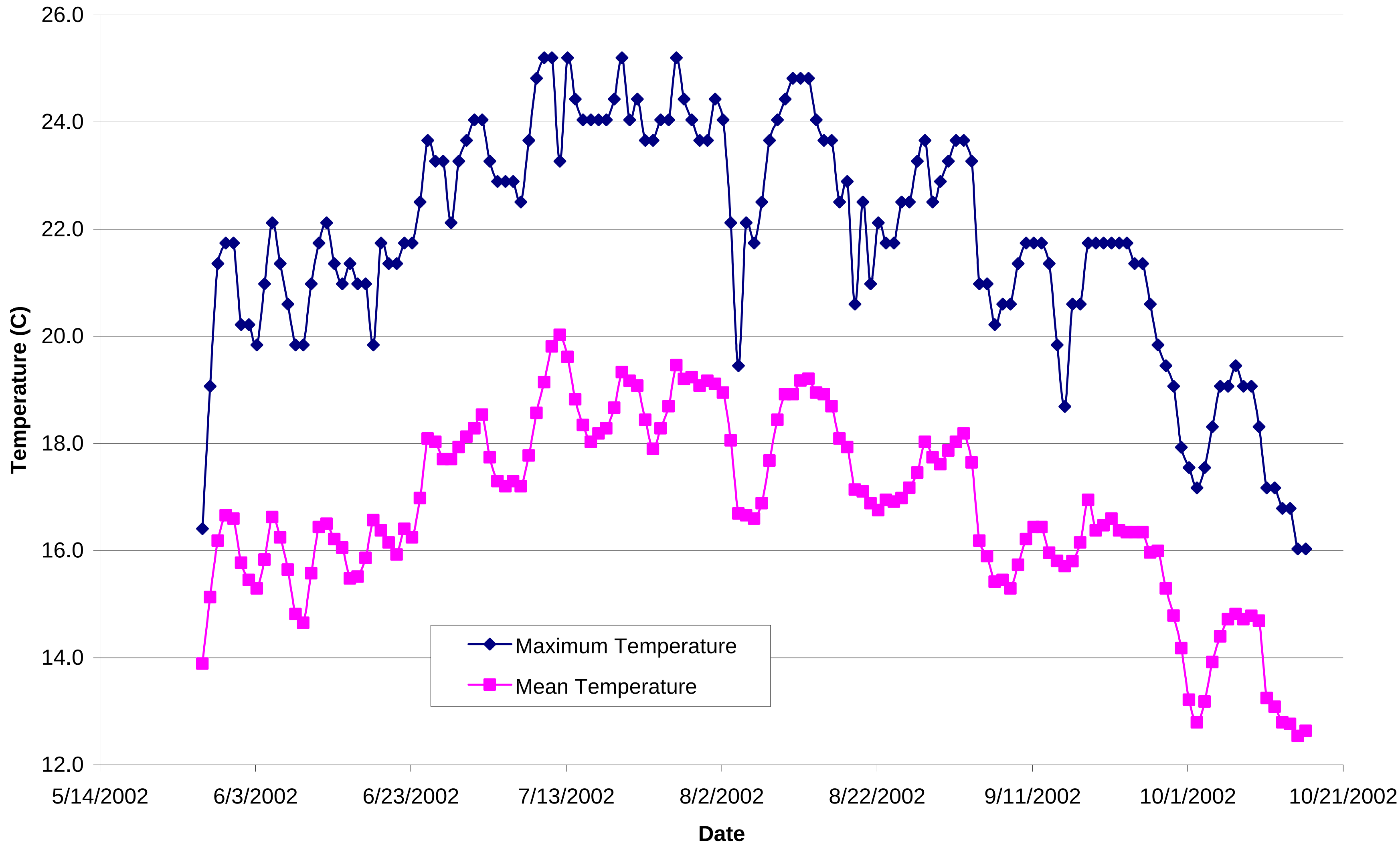


Figure T86-02. Mean and Maximum Daily Stream Temperatures During Summer 2002 at North Fork Indian Creek (Site T86-02), Mendocino County, California.

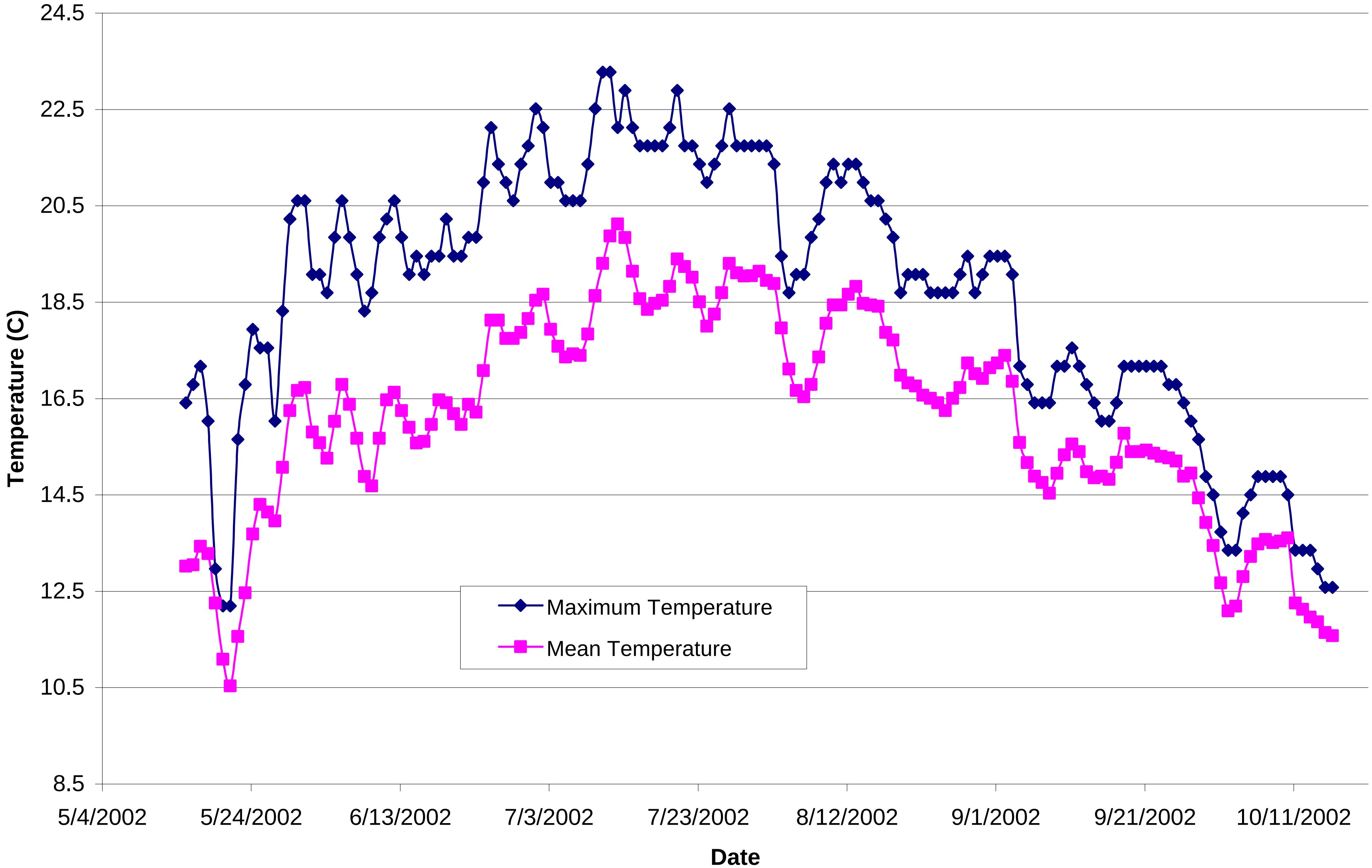


Figure T88-01. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Navarro River (Site T88-01), Mendocino County, California.

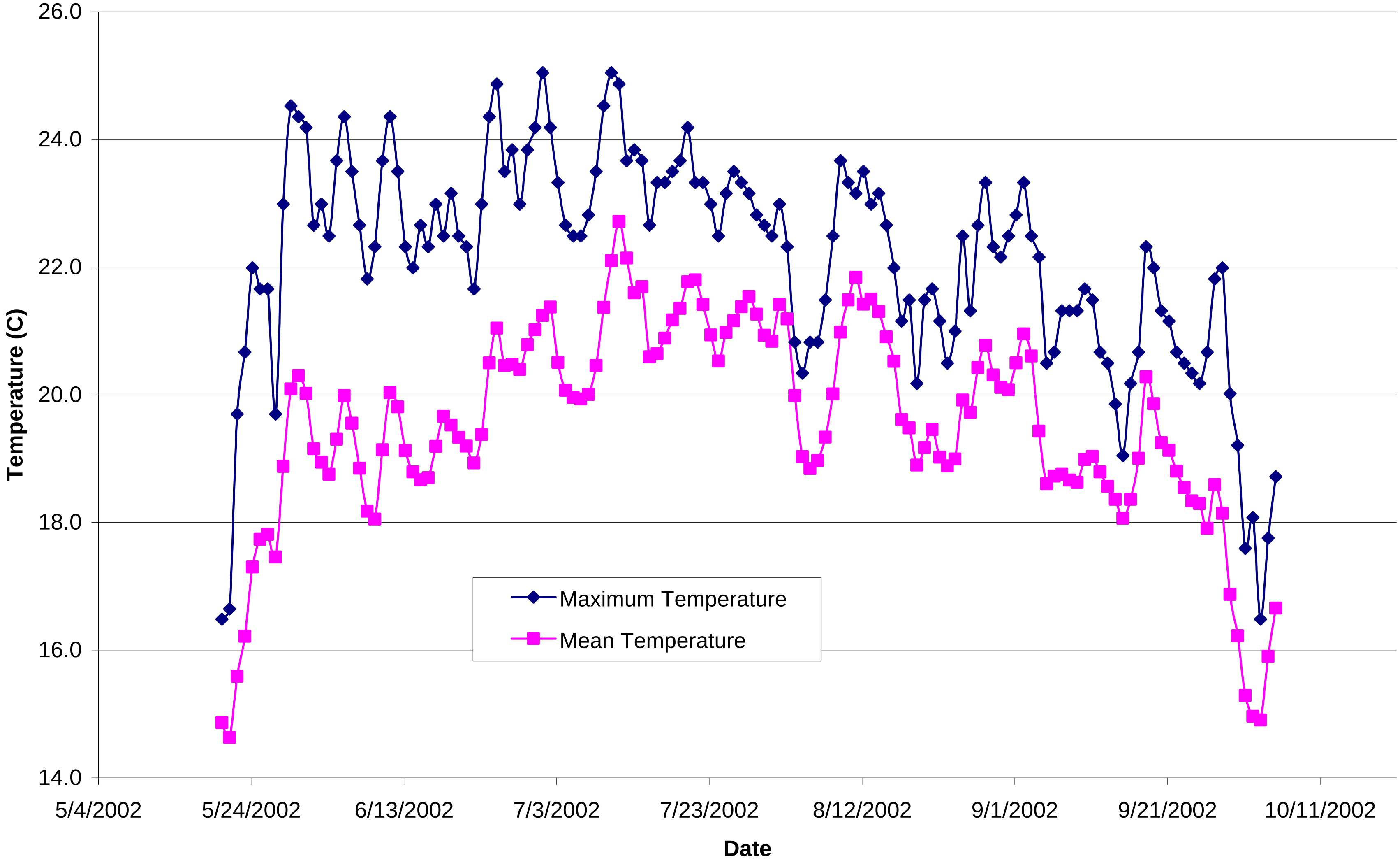


FIGURE 25. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1989) AT JOHN SMITH CREEK (MAP NO. 8; MONITOING SITE NO. 17), MENDOCINO CO., CALIFORNIA.

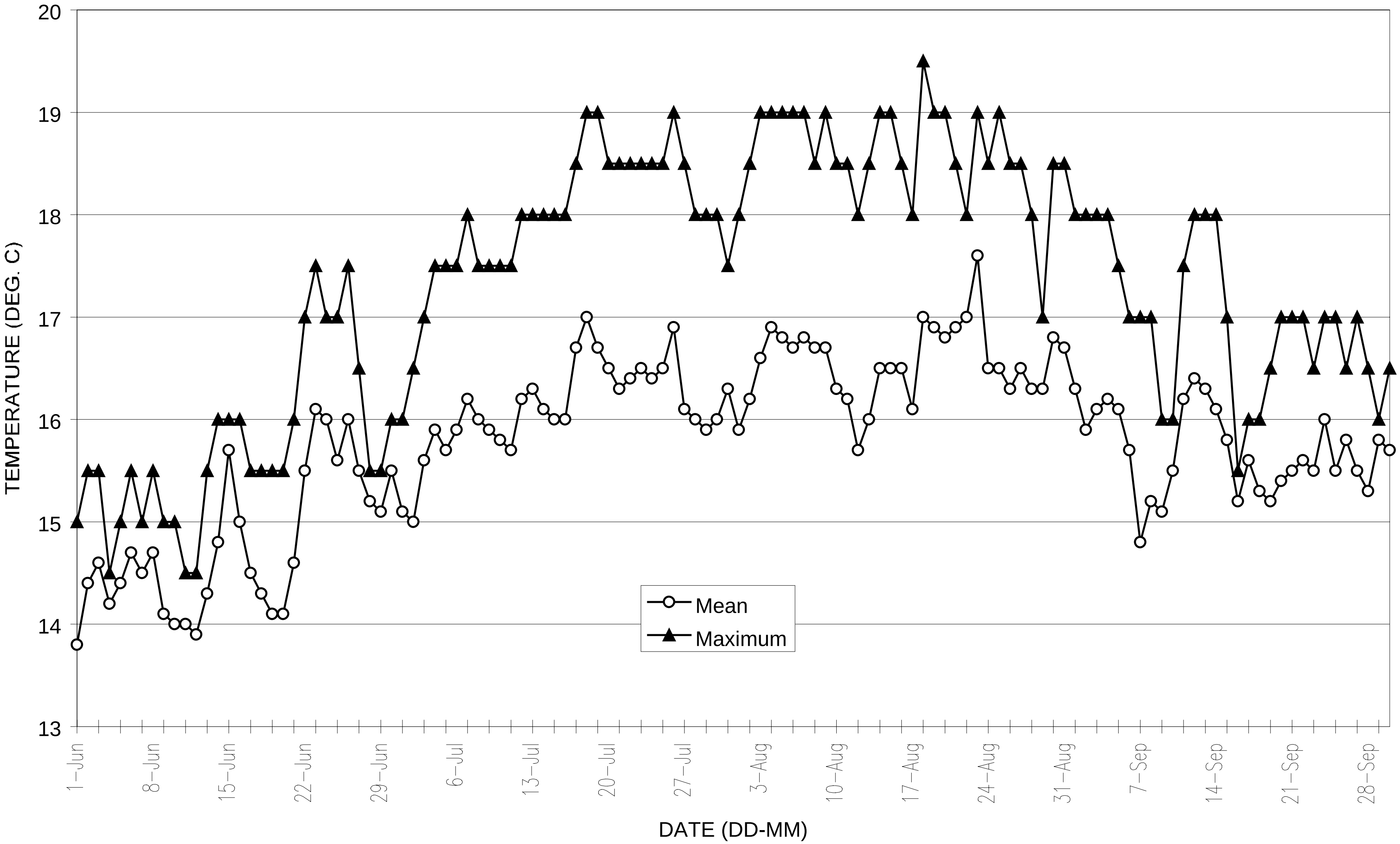


FIGURE 30. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1989) AT JOHN SMITH CREEK (MAP NO. 8; MONITORING SITE NO. 17A), MENDOCINO CO., CALIFORNIA.

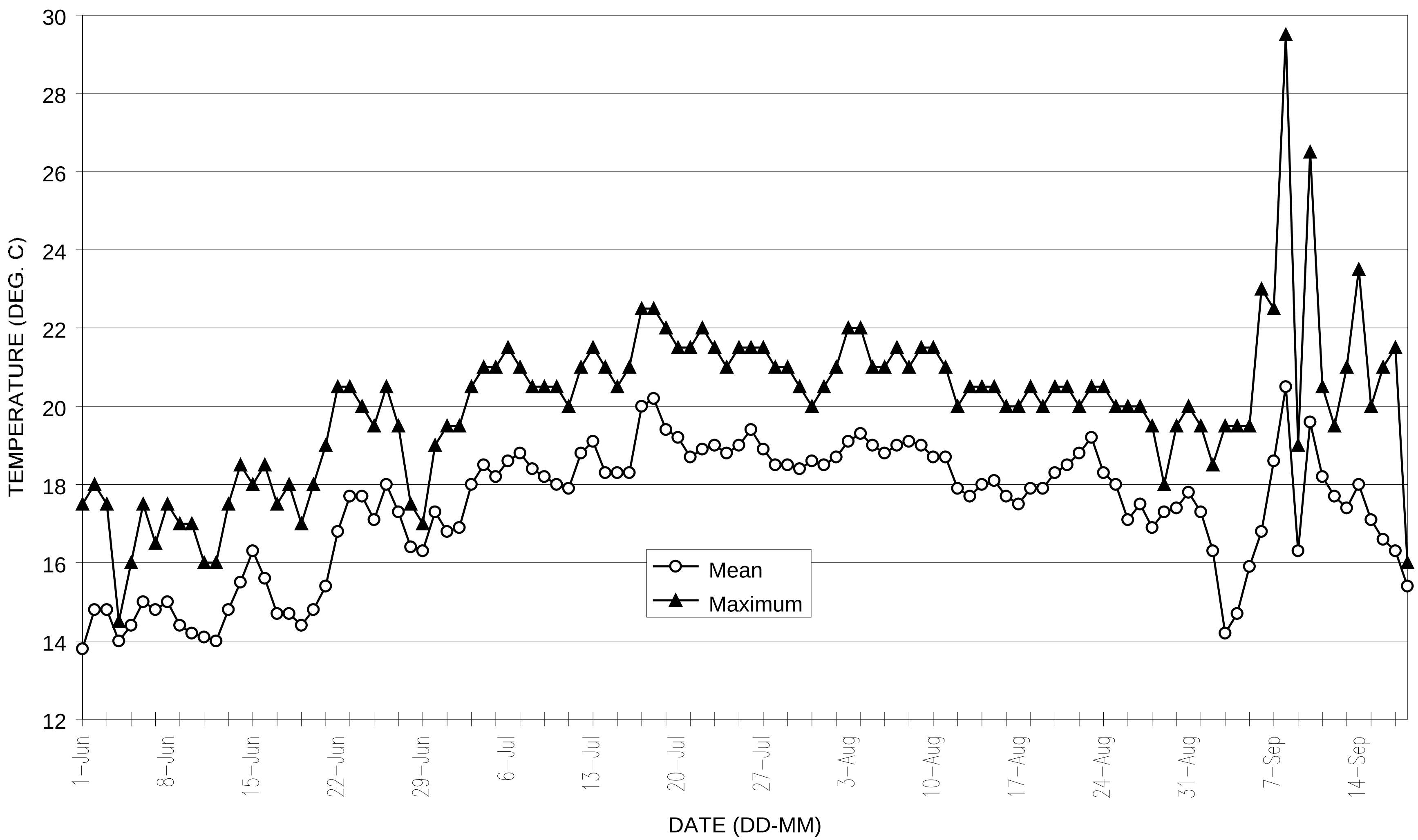


FIGURE 43. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1989) AT MARSH GULCH (MAP NO. 9; MONITOIRNG SITE NO. 16A), MENDOCINO CO., CALIFORNIA.

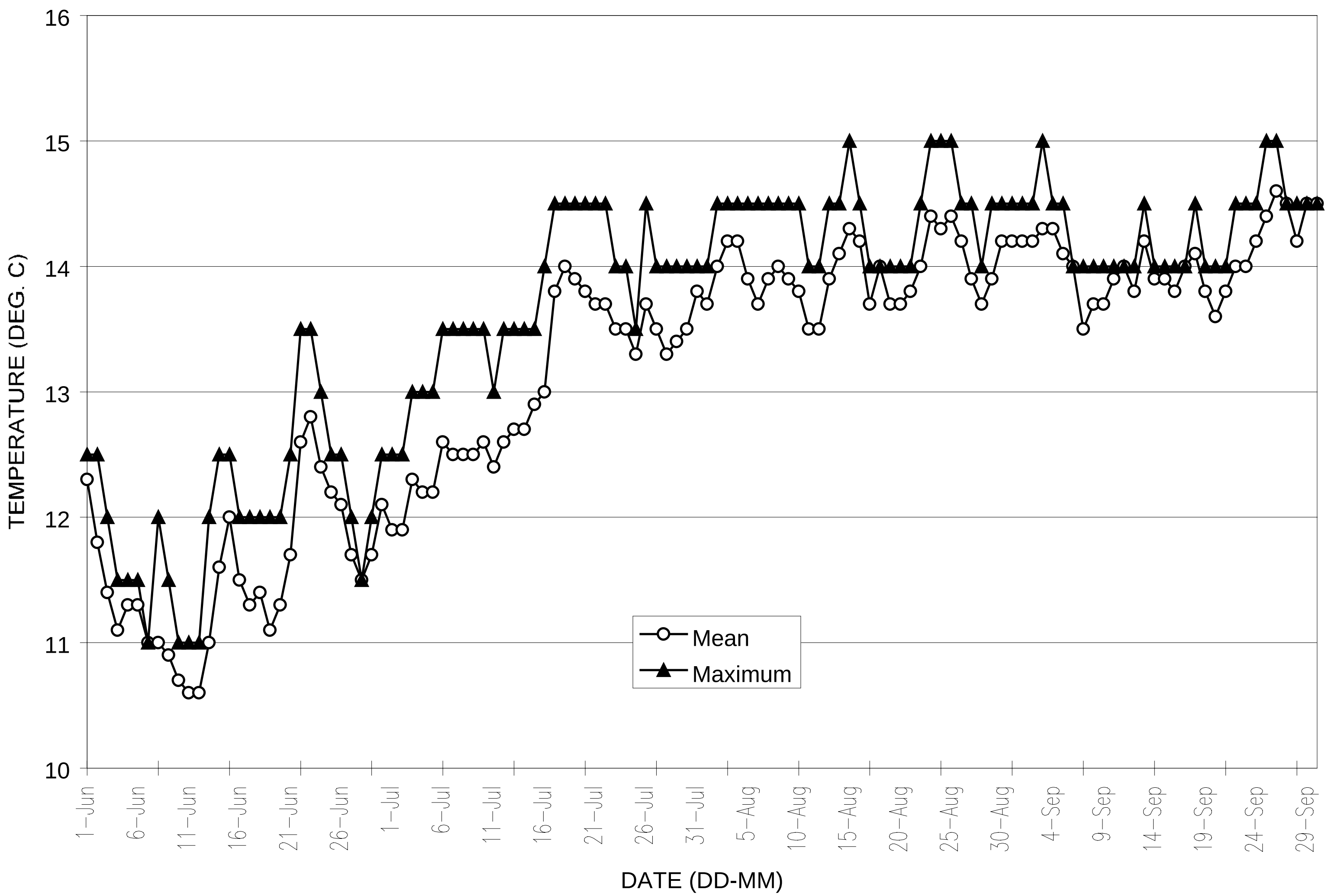


FIGURE 39. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1989) AT MARSH GULCH (MAP NO. 9; MONITORING SITE N0. 16), MENDOCINO CO., CALIFORNIA.

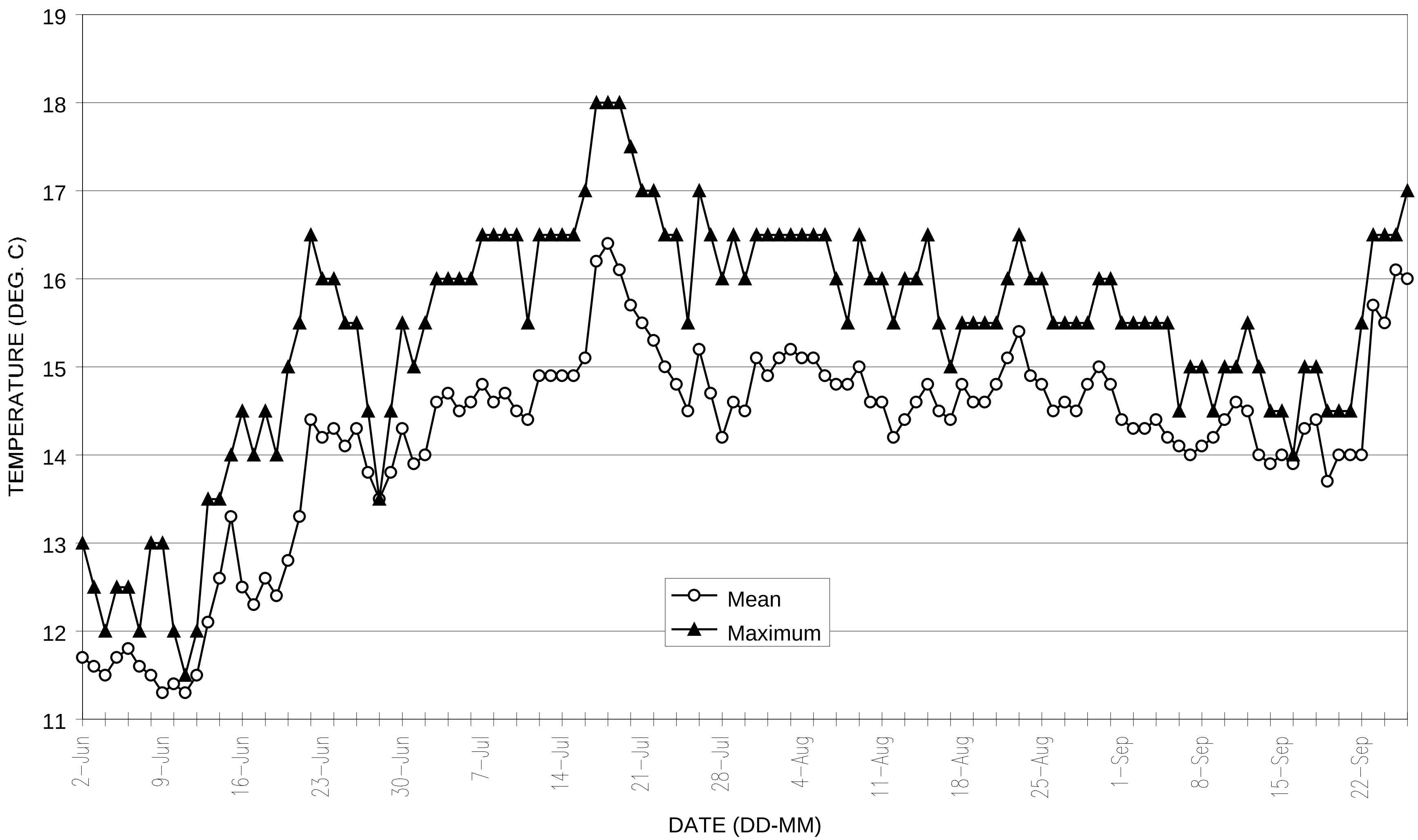


FIGURE 34. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1989) AT NAVARRO RIVER (MAP NO. 9; MONITORING SITE NO.14), MENDOCINO CO., CALIFORNIA.

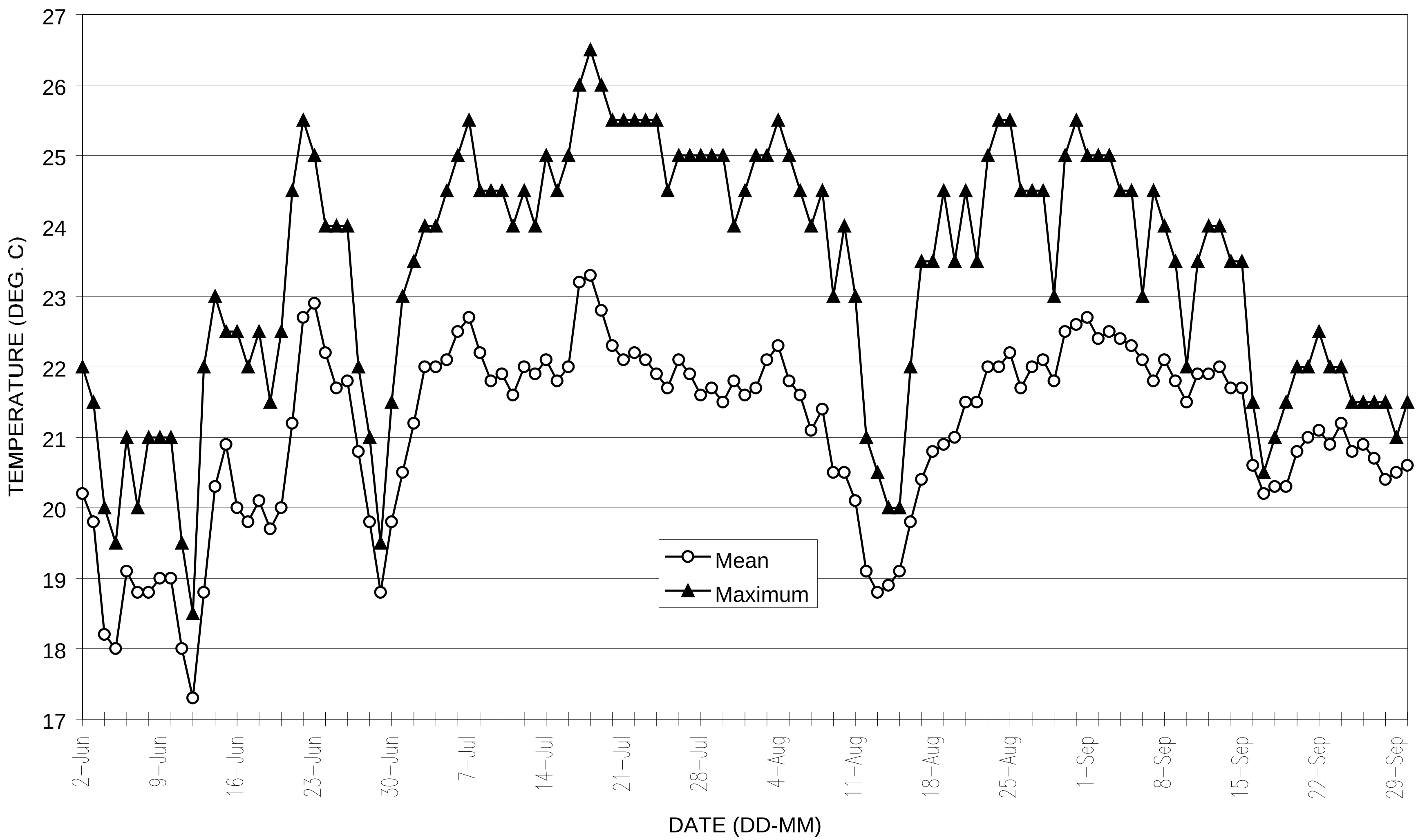


FIGURE 45. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1989) AT NAVARRO RIVER (MAP NO. 10; MONITORING SITE NO. 14A), MENDOCINO CO., CALIFORNIA.

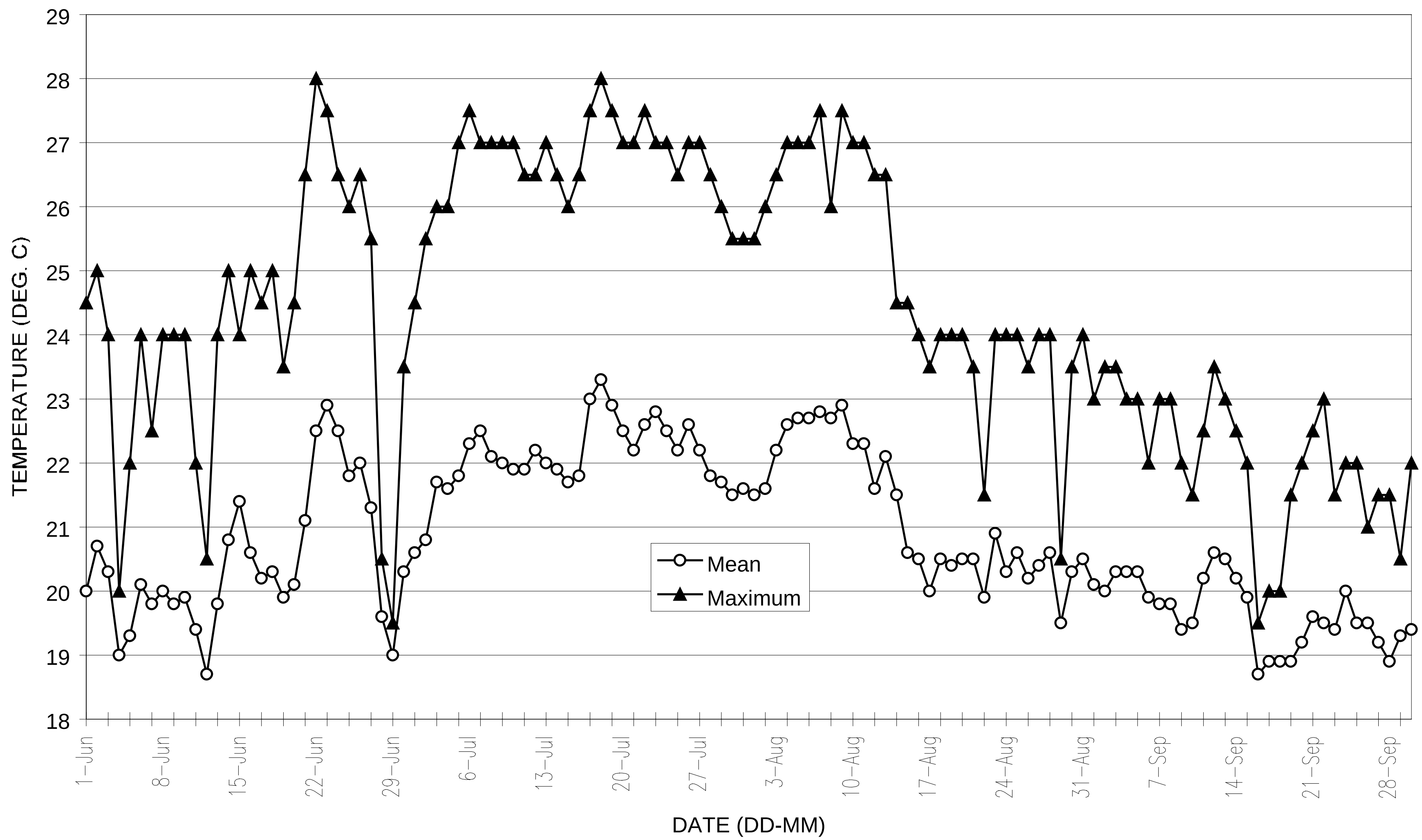


FIGURE 26. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1990) AT JOHN SMITH CREEK (MAP NO. 8; MONITORING SITE NO. 17), MENDOCINO CO., CALIFORNIA.

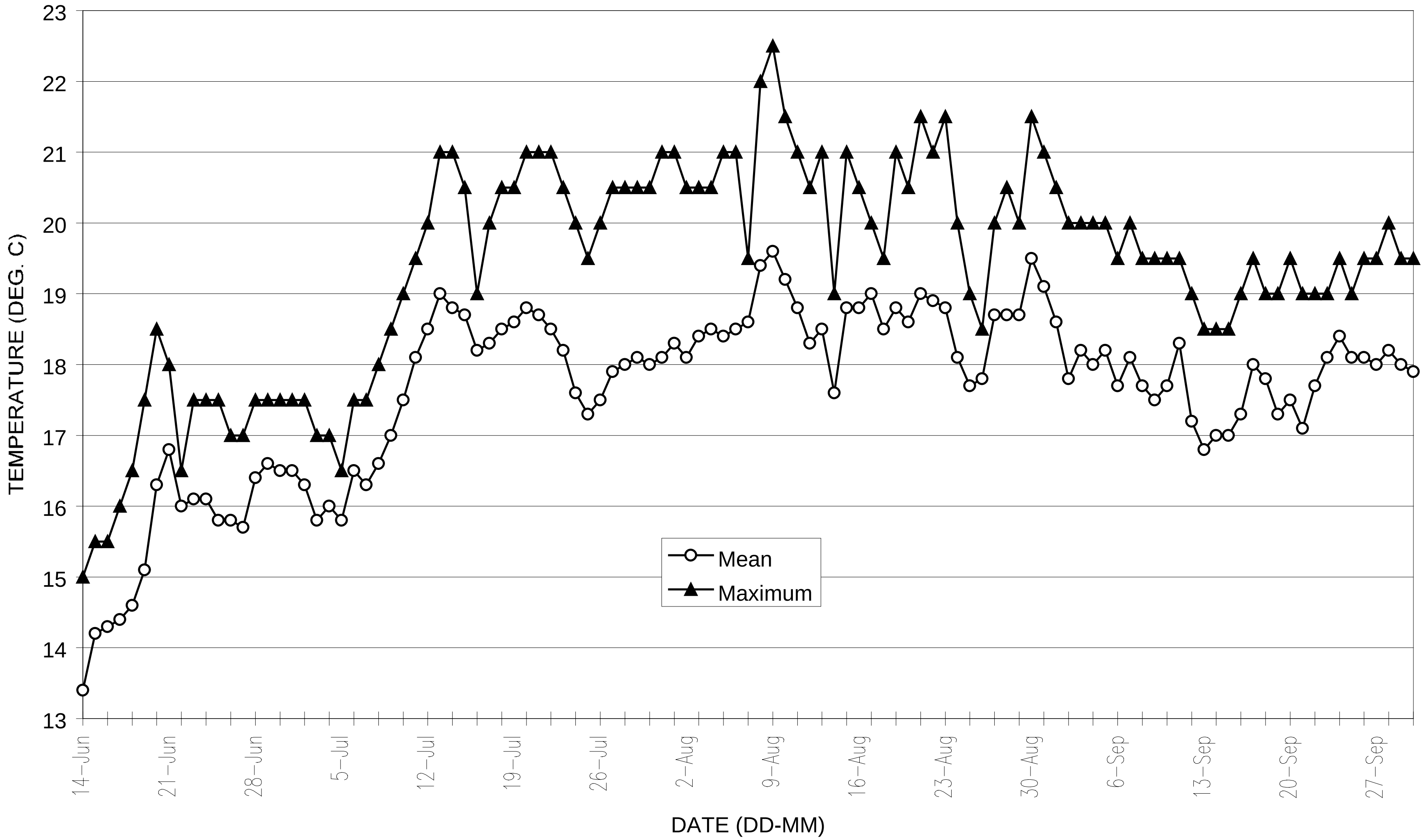


FIGURE 35. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-AUGUST 1990) AT NAVARRO RIVER (MAP NO. 9; MONITORING SITE NO. 14), MENDOCINO CO., CALIFORNIA.

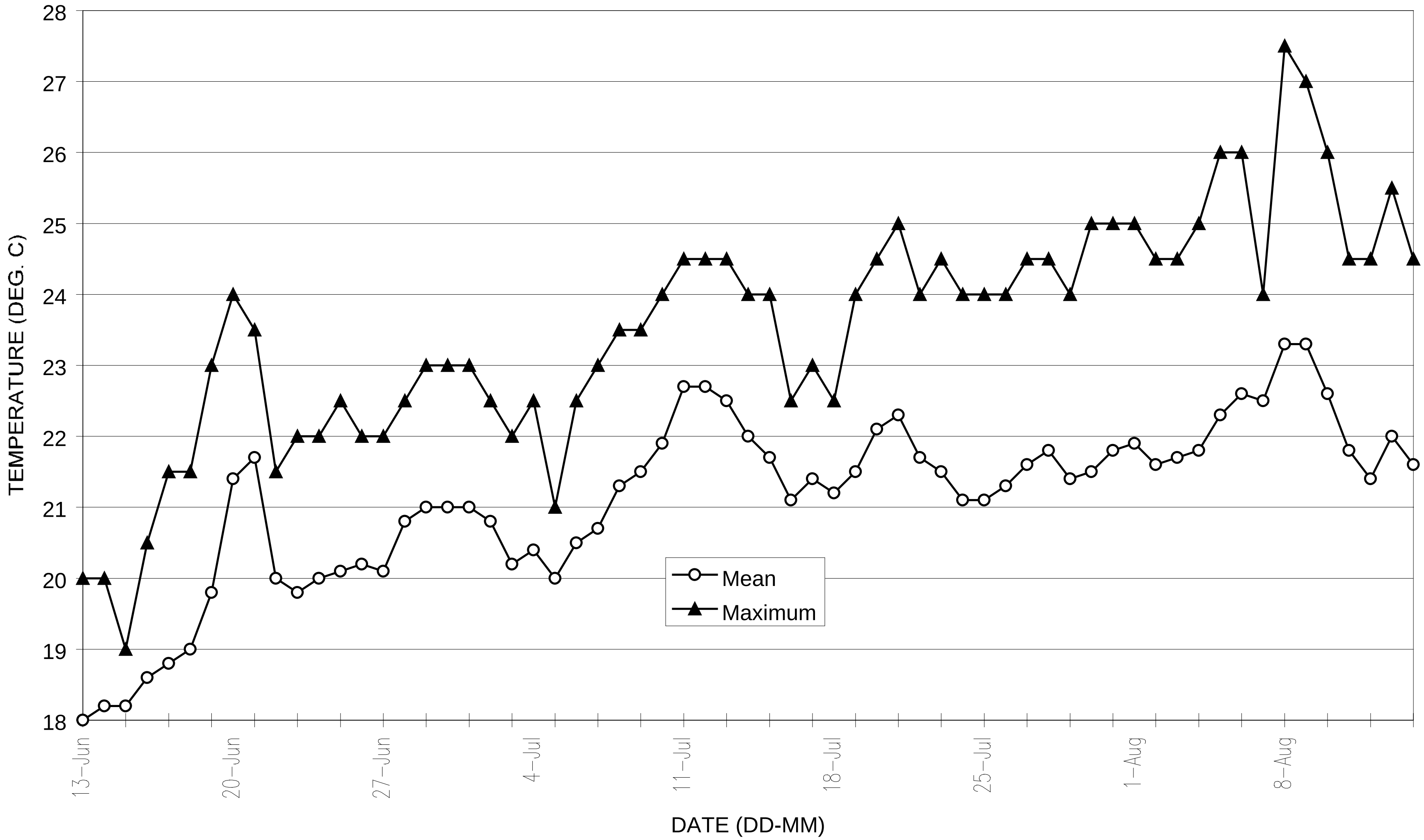


FIGURE 46. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (MAY-OCTOBER 1990) AT NAVARRO RIVER (MAP NO. 10; MONITORING SITE NO. 14A), MENDOCINO CO., CALIFORNIA.

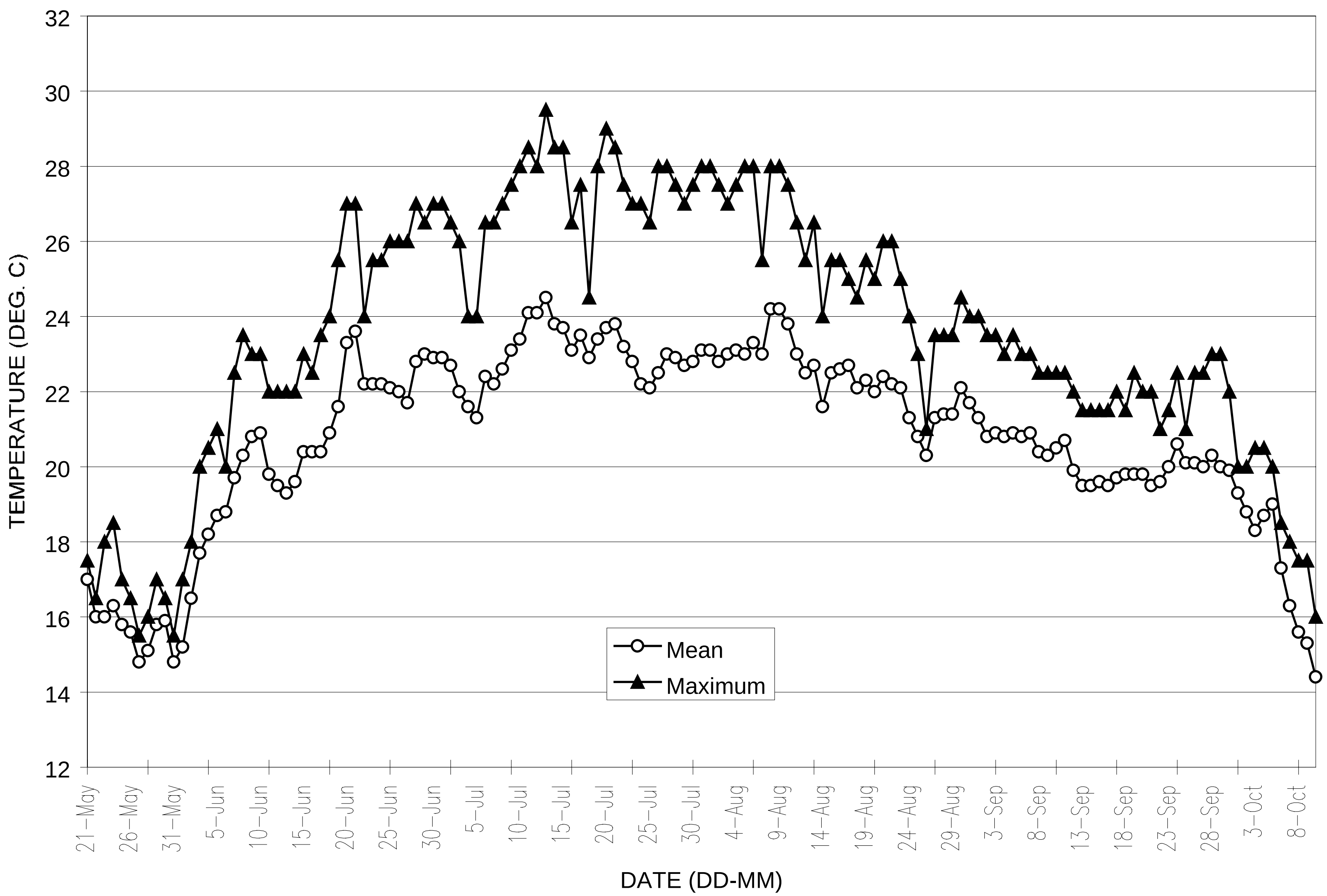


FIGURE 54. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1990) AT NAVARRO RIVER (MAP NO. 14; MONITORING SITE NO. 15), MENDOCINO CO., CALIFORNIA.

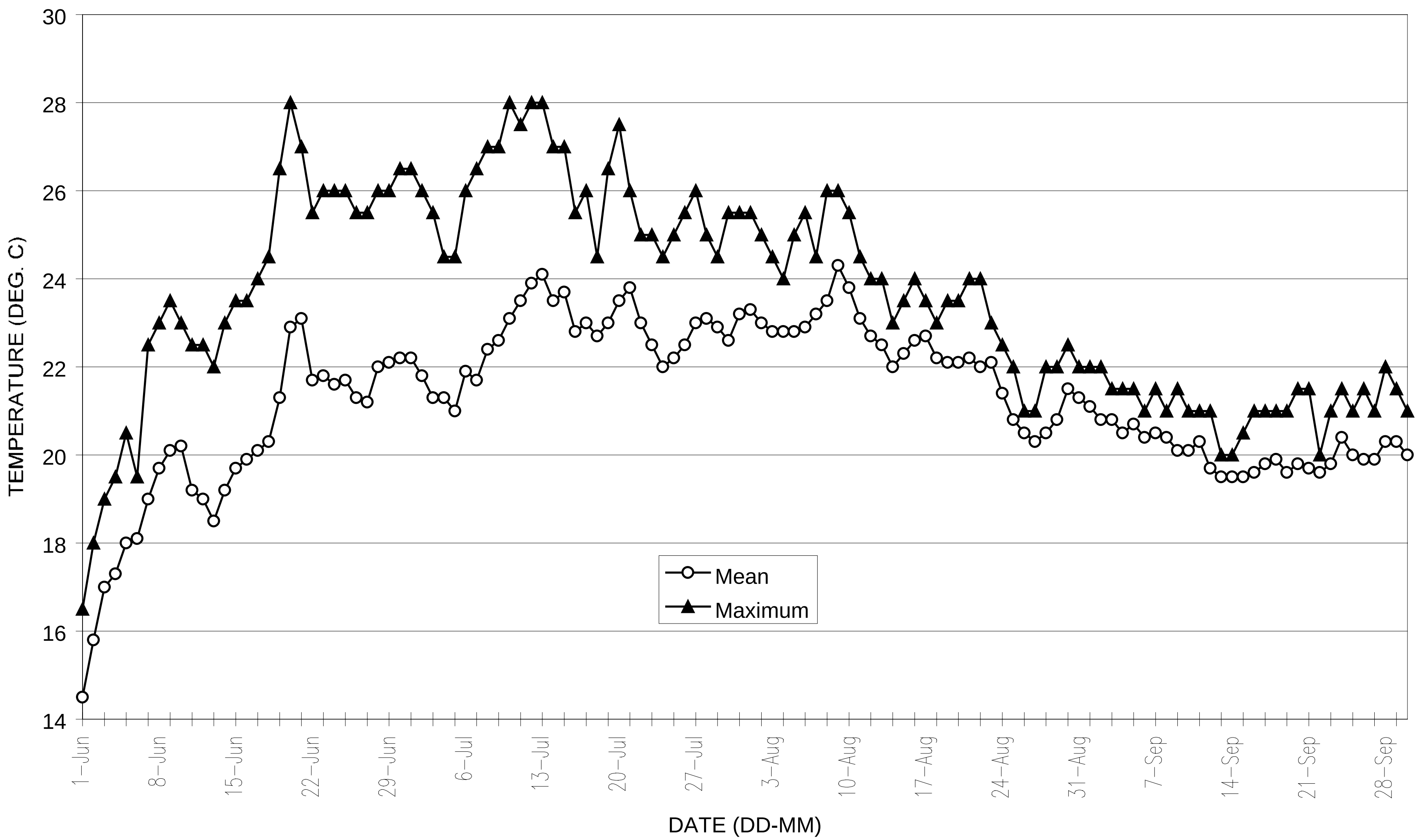


FIGURE 27.   MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1991) AT JOHN SMITH CREEK (MAP NO. 8; MONITORING SITE NO. 17), MENDOCINO CO., CALIFORNIA.

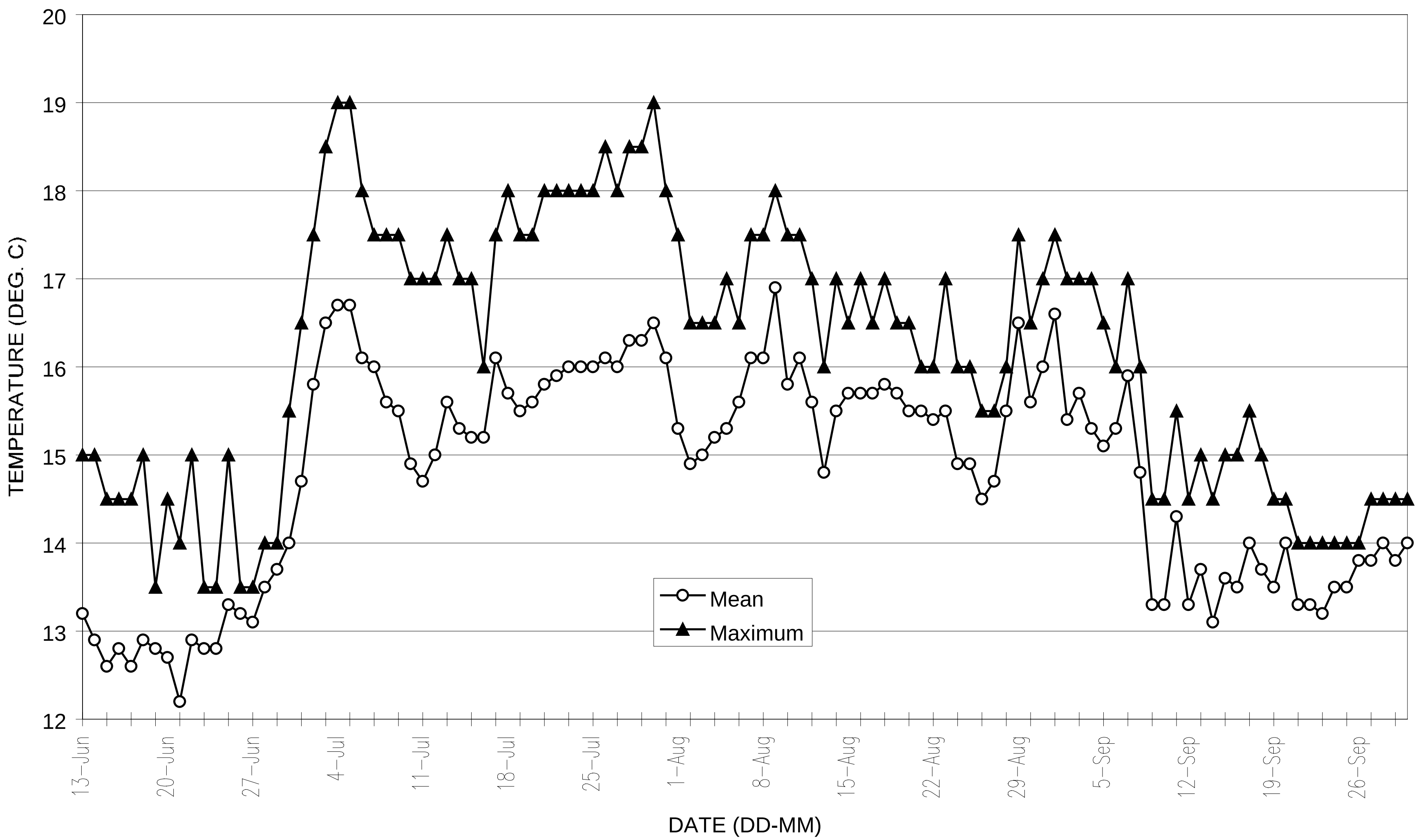


FIGURE 31. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1991) AT JOHN SMITH CREEK (MAP NO. 8; MONITORING SITE NO. 17A), MENDOCINO CO., CALIFORNIA.

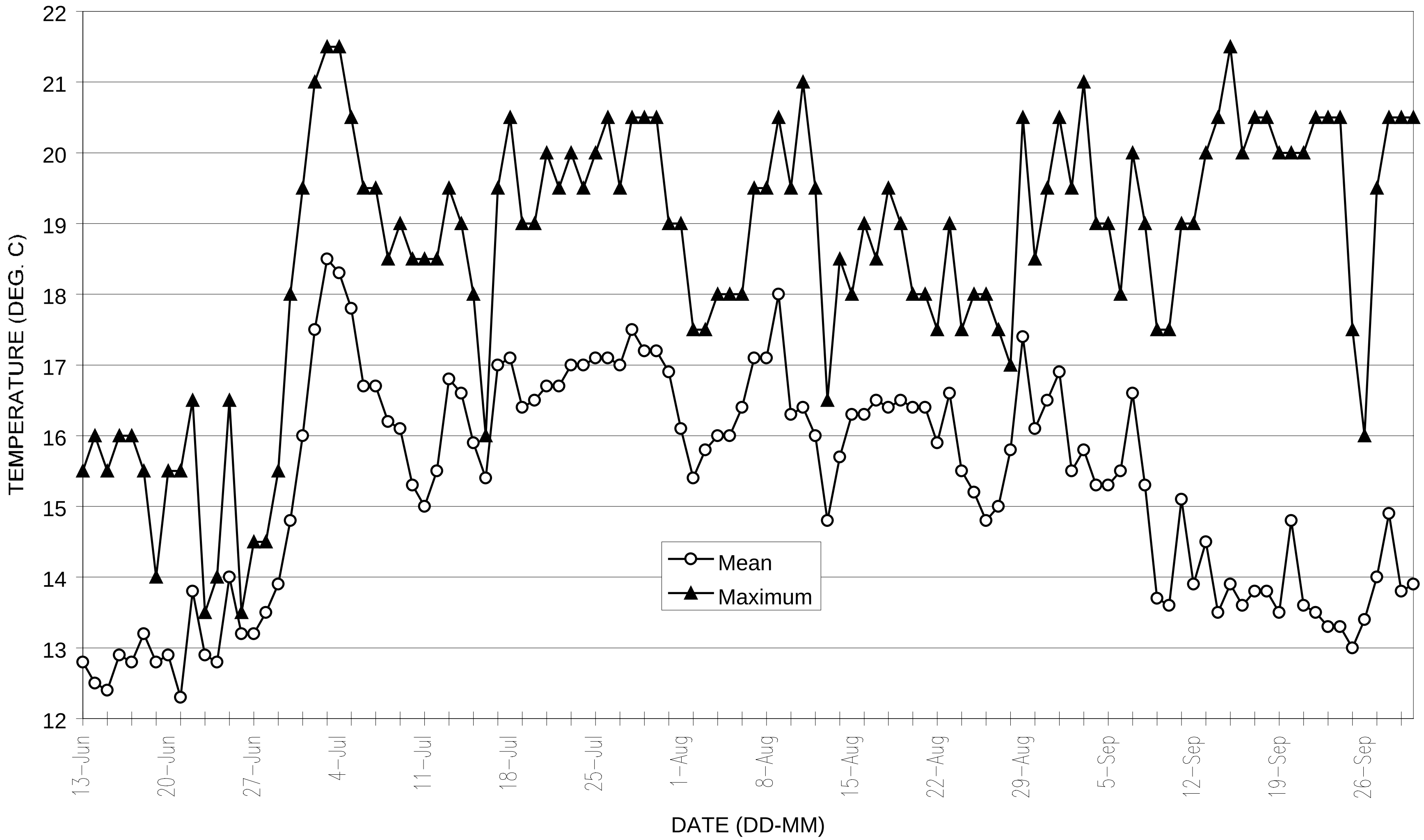


FIGURE 40. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1991) AT MARSH GULCH (MAP NO. 9; MONITORING SITE NO. 16), MENDOCINO CO., CALIFORNIA.

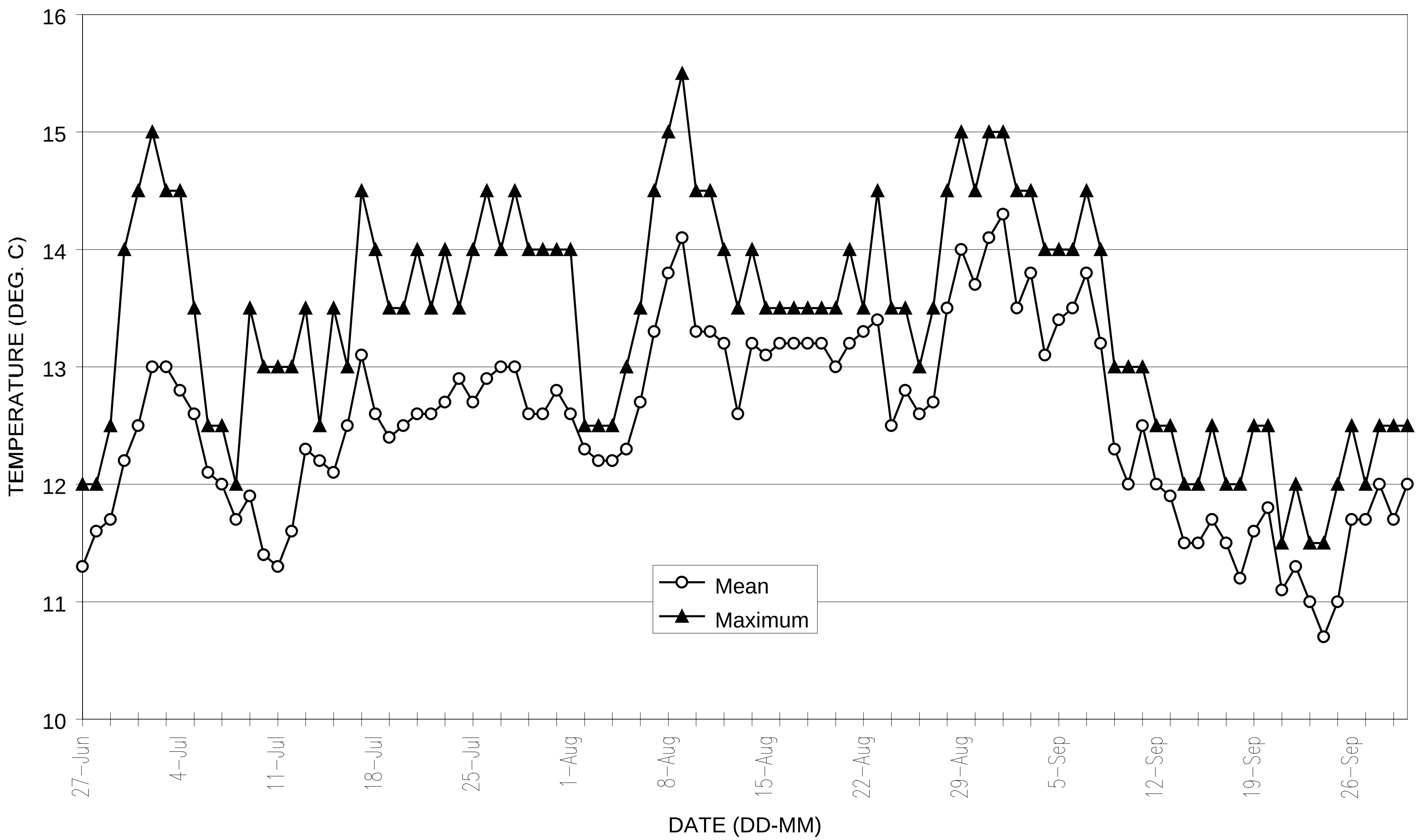


FIGURE 36. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1991) AT NAVARRO RIVER (MAP NO. 9; MONITORING SITE NO.14), MENDOCINO CO., CALIFORNIA.

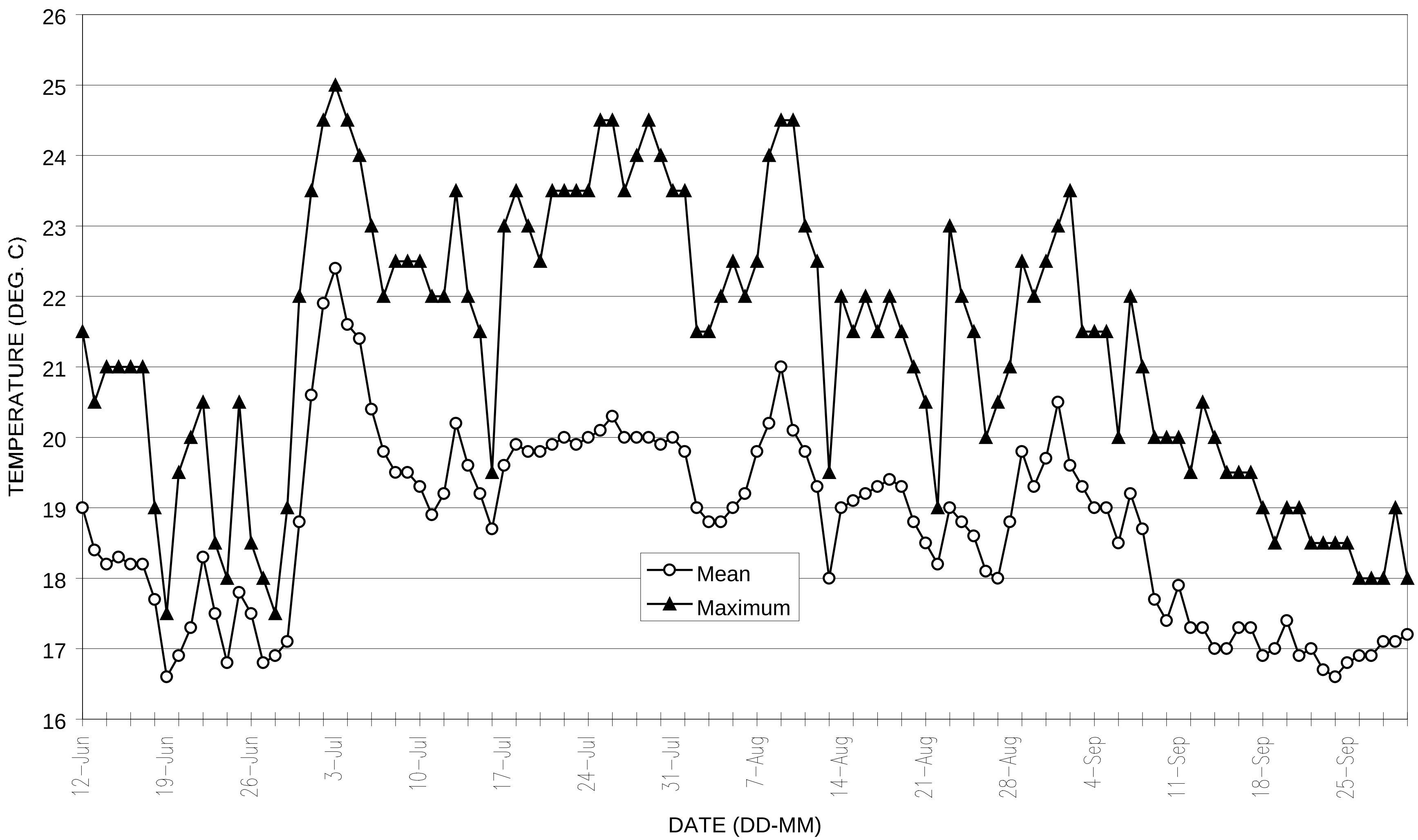


FIGURE 47. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-OCTOBER 1991) AT NAVARRO RIVER (MAP NO. 10; MONITORING SITE NO. 14A), MENDOCINO CO., CALIFORNIA.

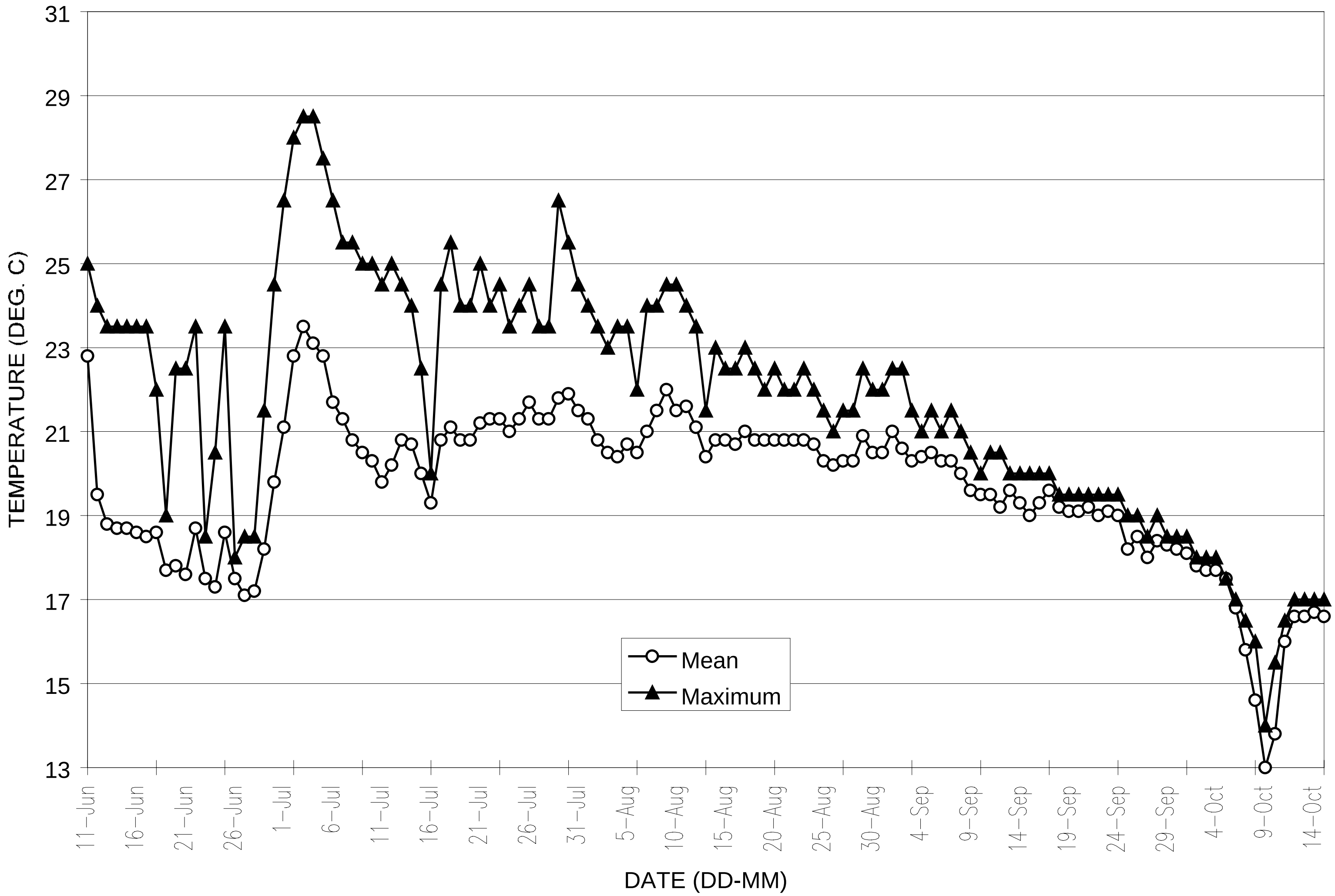


FIGURE 55. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1991) AT NAVARRO RIVER (MAP NO. 14; MONITORING SITE NO. 15), MENDOCINO CO., CALIFORNIA.

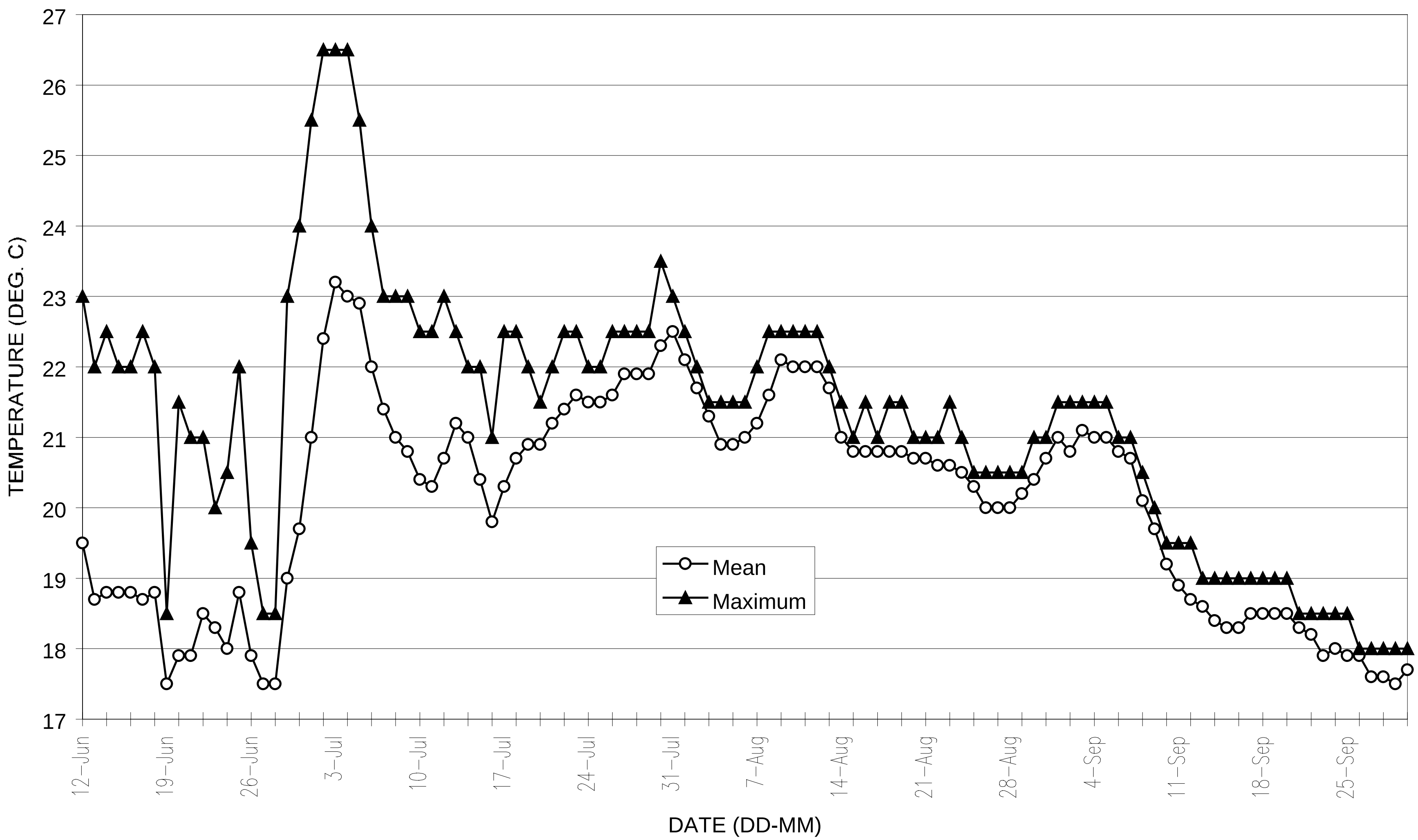


FIGURE 28. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1992) AT JOHN SMITH CREEK (MAP NO. 8; MONITORING SITE NO. 17), MENDOCINO CO., CALIFORNIA.

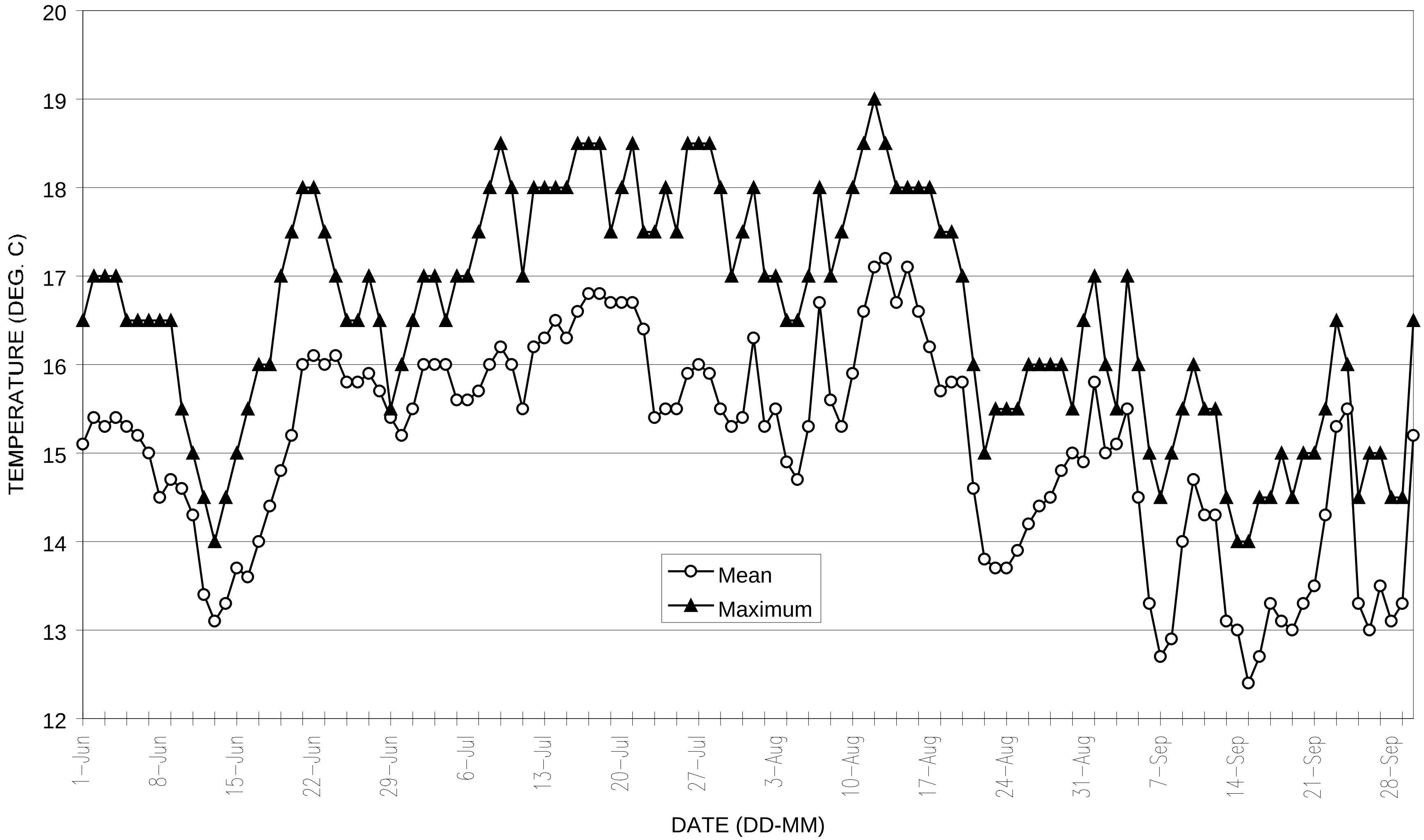


FIGURE 41. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1992) AT MARSH GULCH (MAP NO. 9; MONITORING SITE NO. 16), MENDOCINO CO., CALIFORNIA.

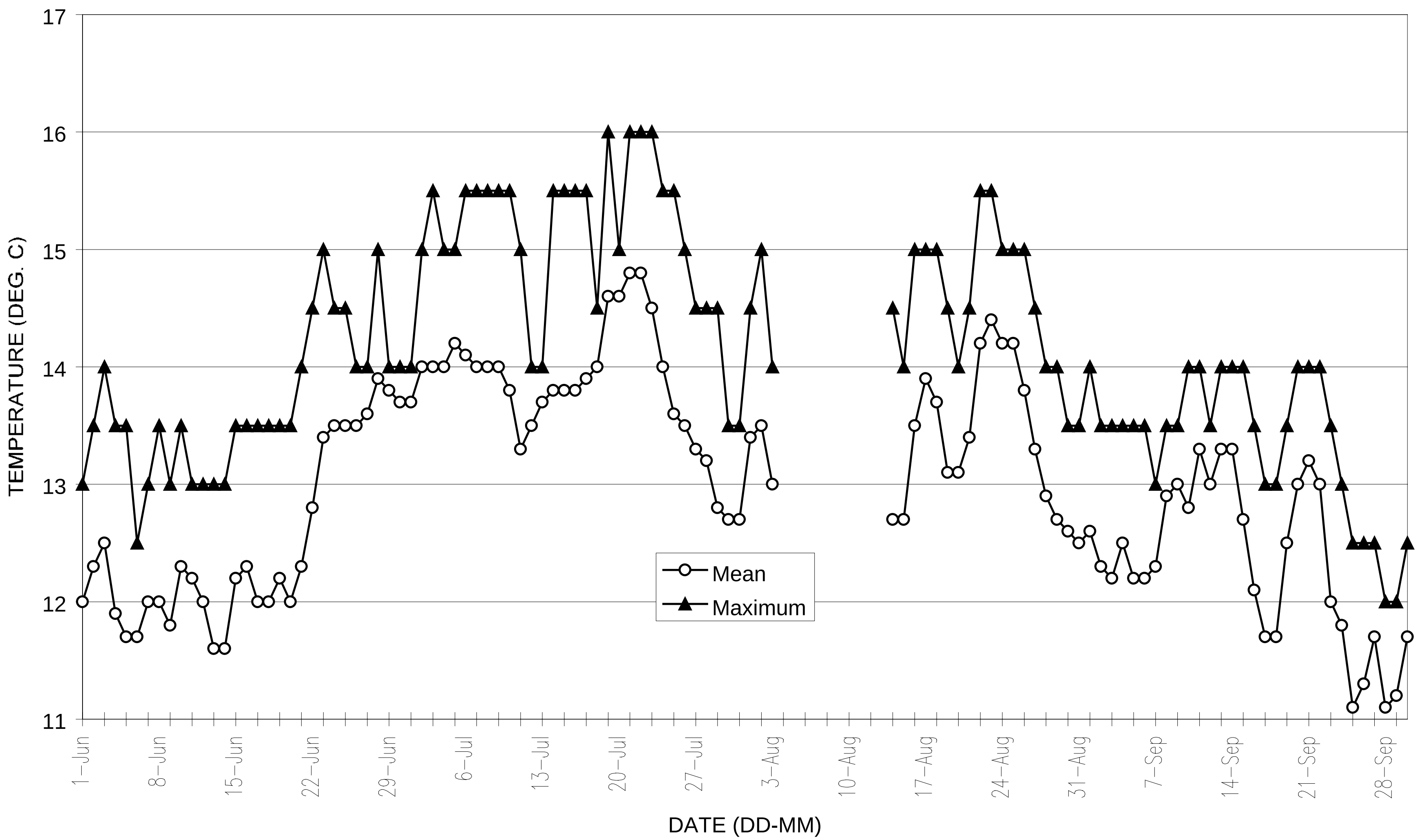


FIGURE 37. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1992) AT NAVARRO RIVER (MAP NO. 9; MONITORING SITE NO. 14), MENDOCINO CO., CALIFORNIA.

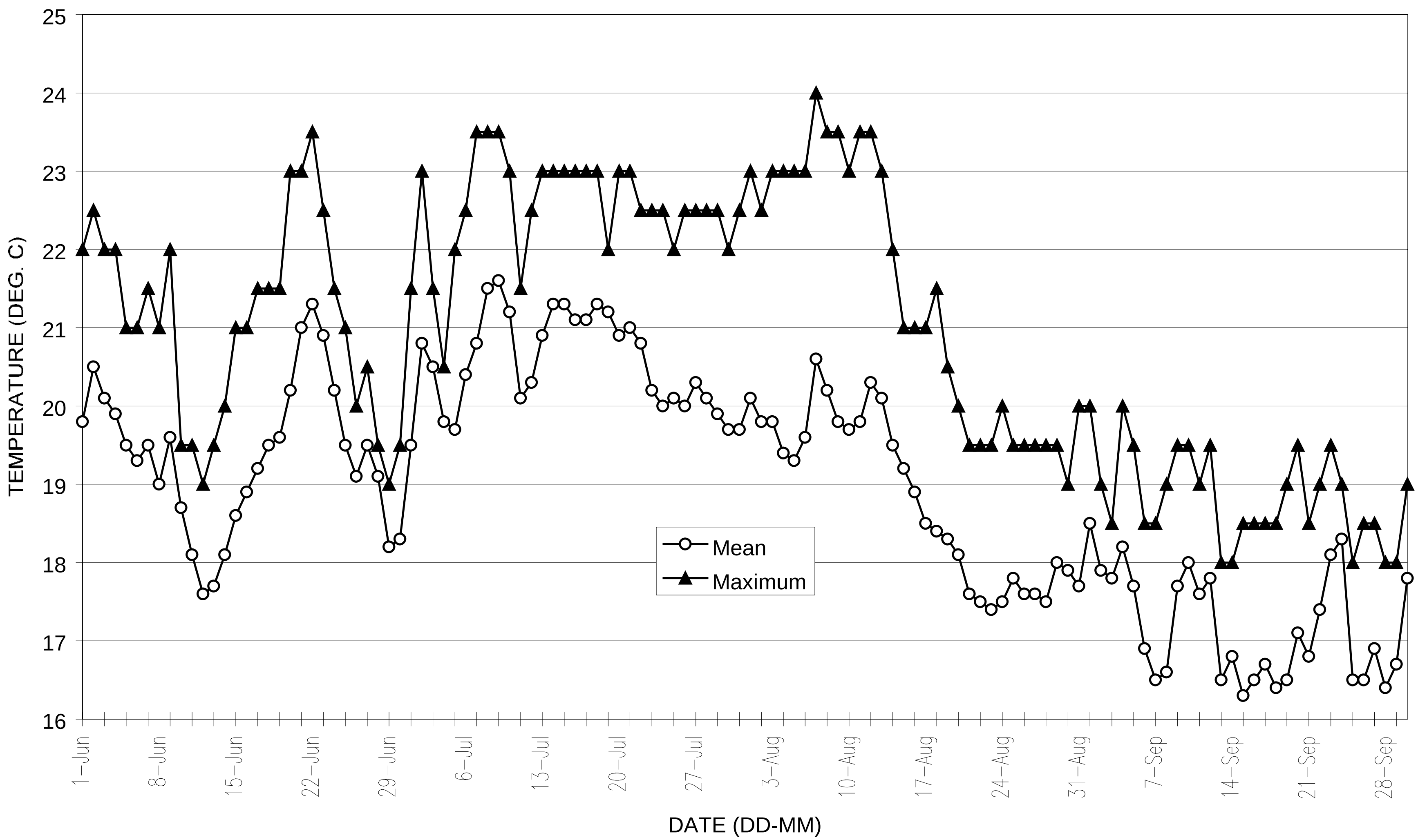


FIGURE 48. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1992) AT NAVARRO RIVER (MAP NO. 10; MONITORING SITE NO. 14A), MENDOCINO CO., CALIFORNIA.

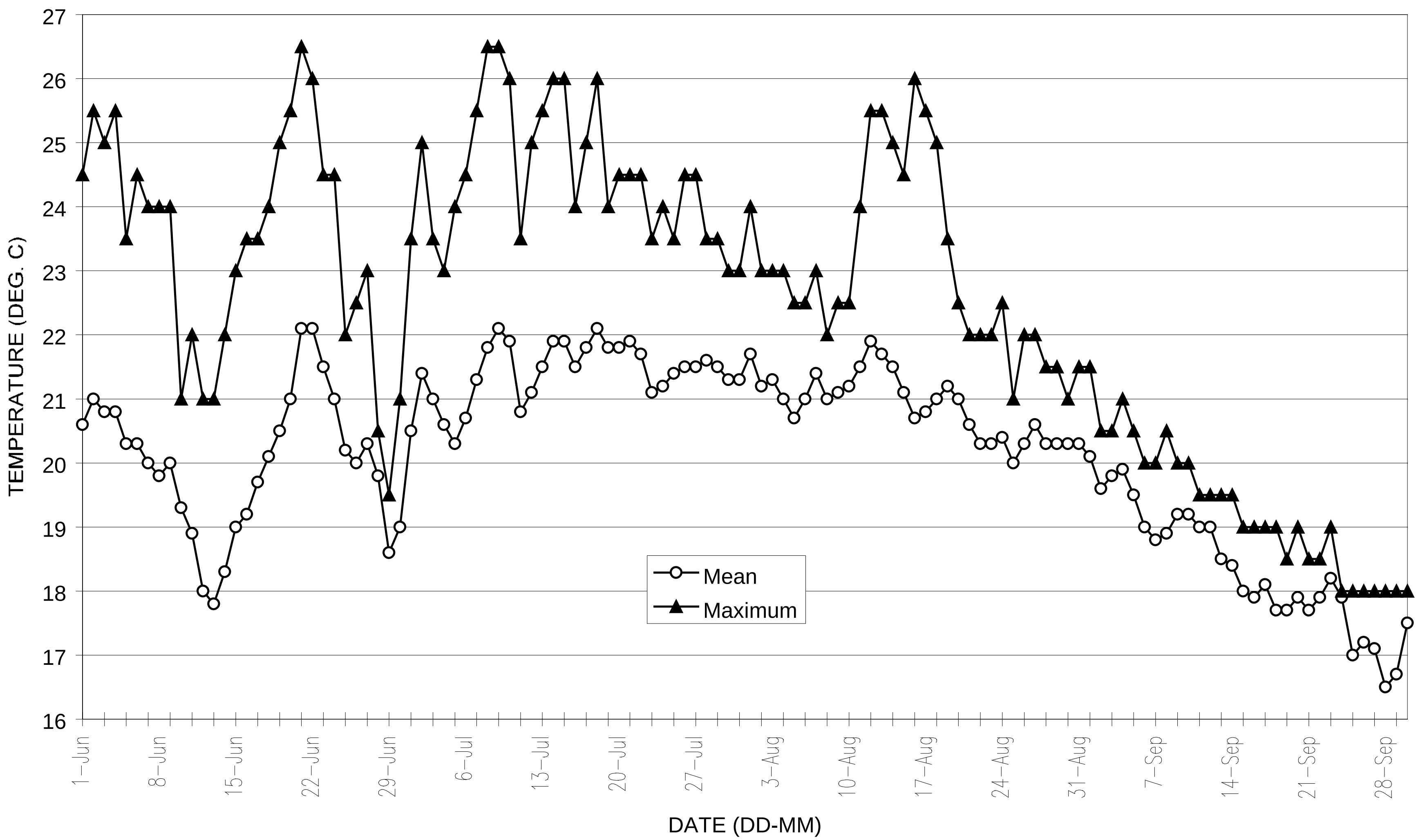


FIGURE 56. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1992) AT NAVARRO RIVER (MAP NO. 14; MONITORING SITE NO. 15), MENDOCINO CO., CALIFORNIA.

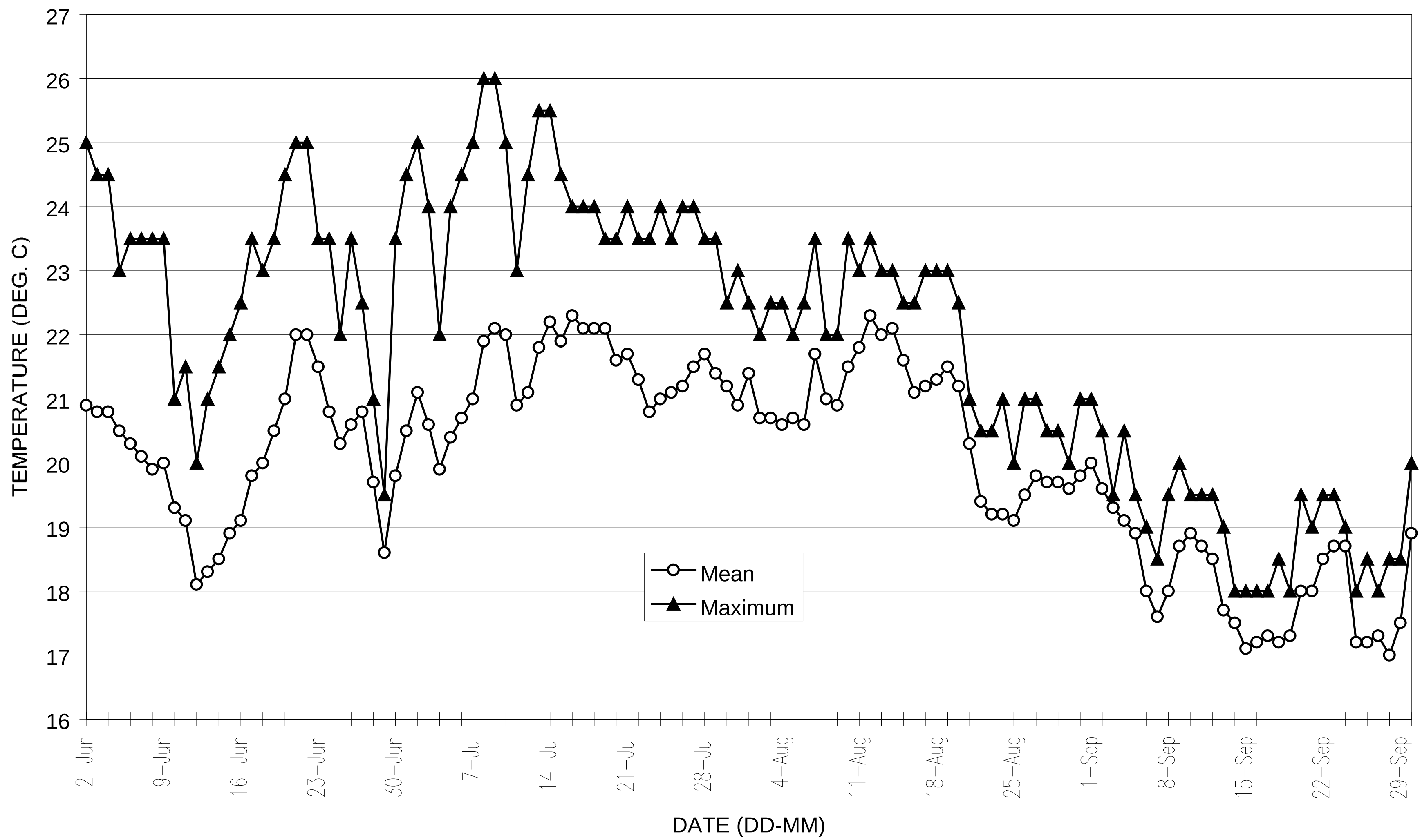


FIGURE 32. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1992) AT NORTH BRANCH OF NORTH FORK NAVARRO RIVER (MAP NO. 8; MONITORING SITE NO. 19), MENDOCINO CO., CALIFORNIA.

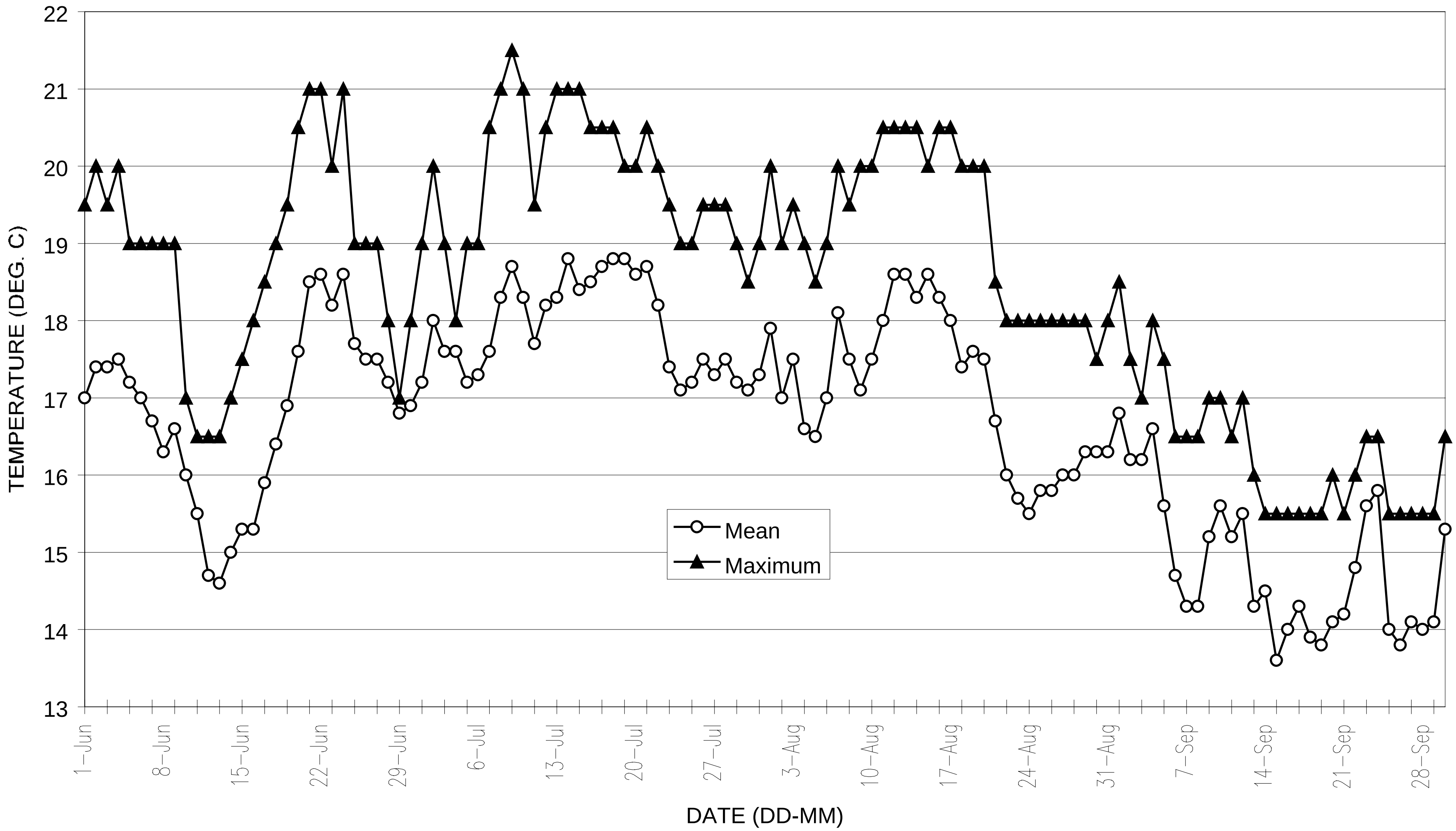


FIGURE 44. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT FLYNN CREEK (MAP NO. 9; MONITORING SITE NO. 21), MENDOCINO CO., CALIFORNIA.

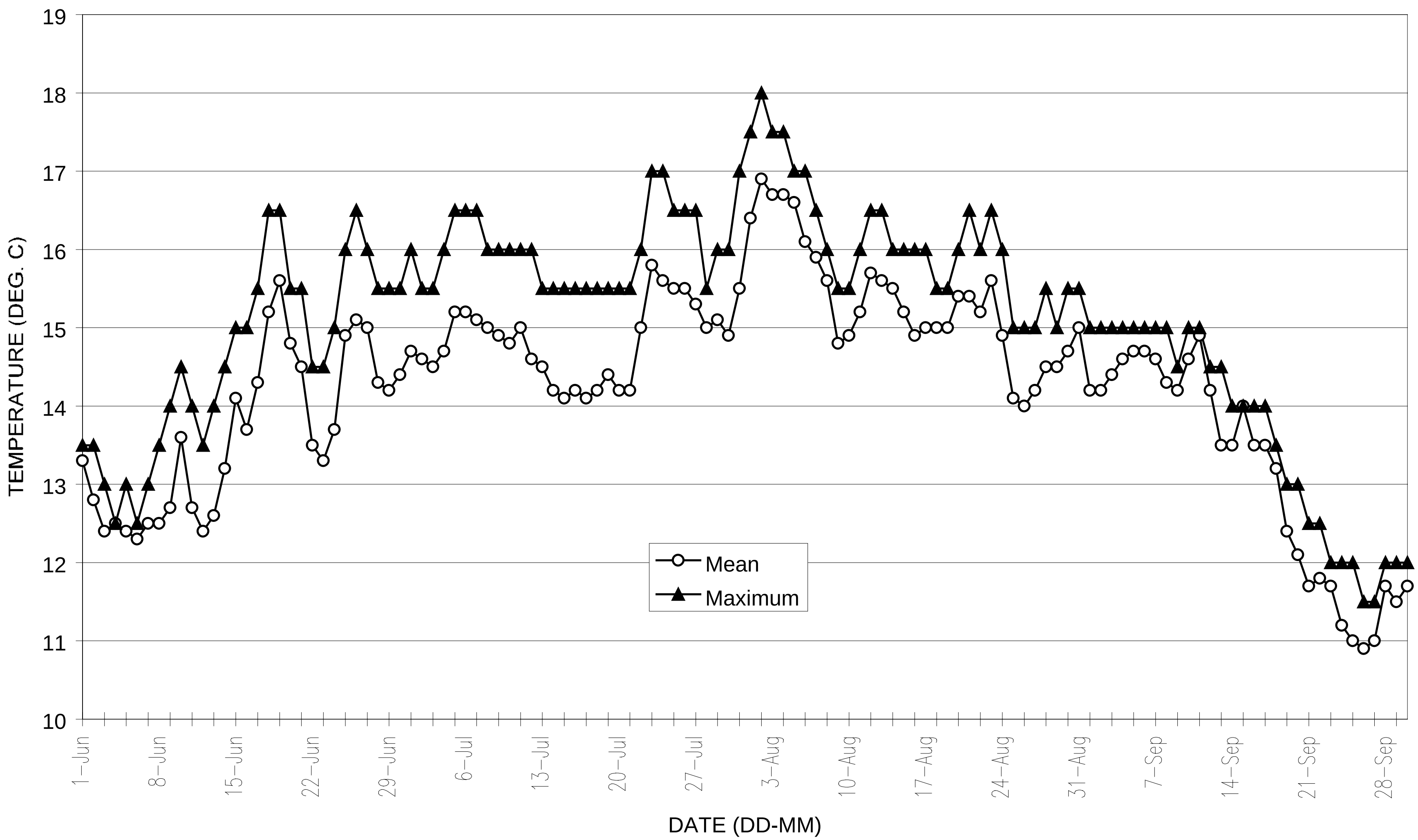


FIGURE 29. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT JOHN SMITH CREEK (MAP NO. 8; MONITORING SITE NO. 17), MENDOCINO CO., CALIFORNIA.

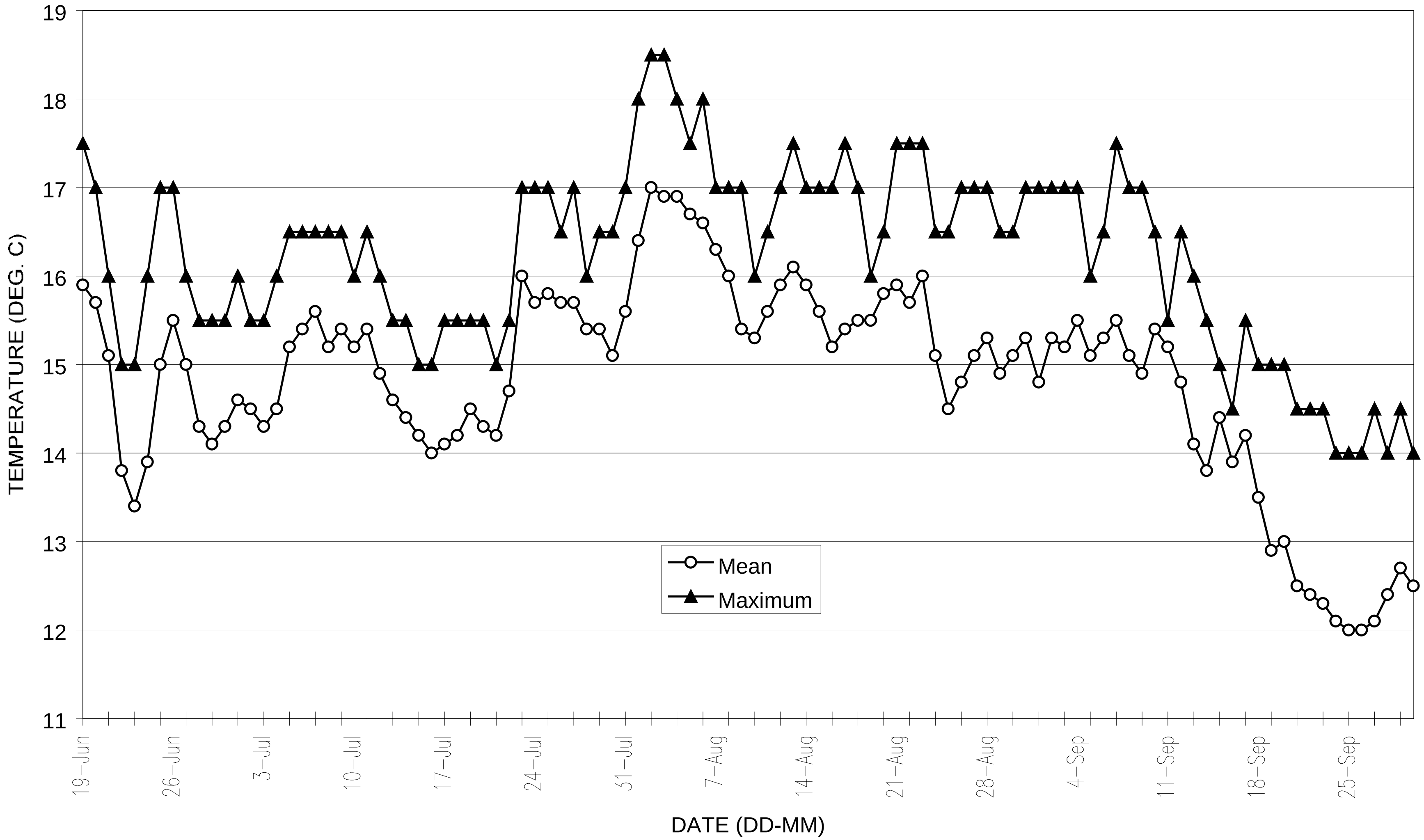


FIGURE 42. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT MARSH GULCH (MAP NO. 9; MONITORING SITE NO. 16), MENDOCINO CO., CALIFORNIA.

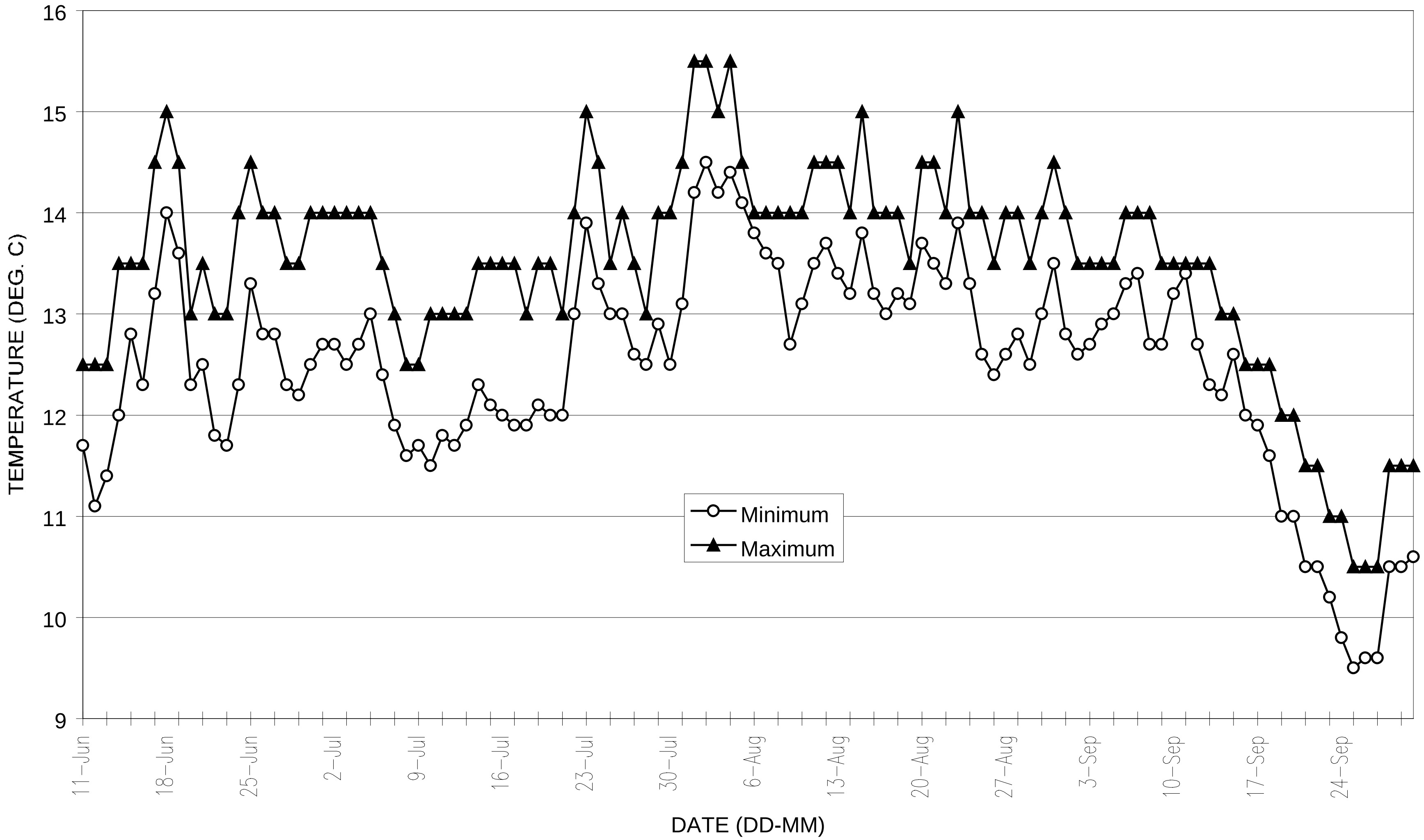


FIGURE 38. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING THE SUMMER (JULY-SEPTEMBER 1993) AT NAVARRO RIVER (MAP NO. 9; MONITORING SITE NO. 14), MENDOCINO CO., CALIFORNIA.

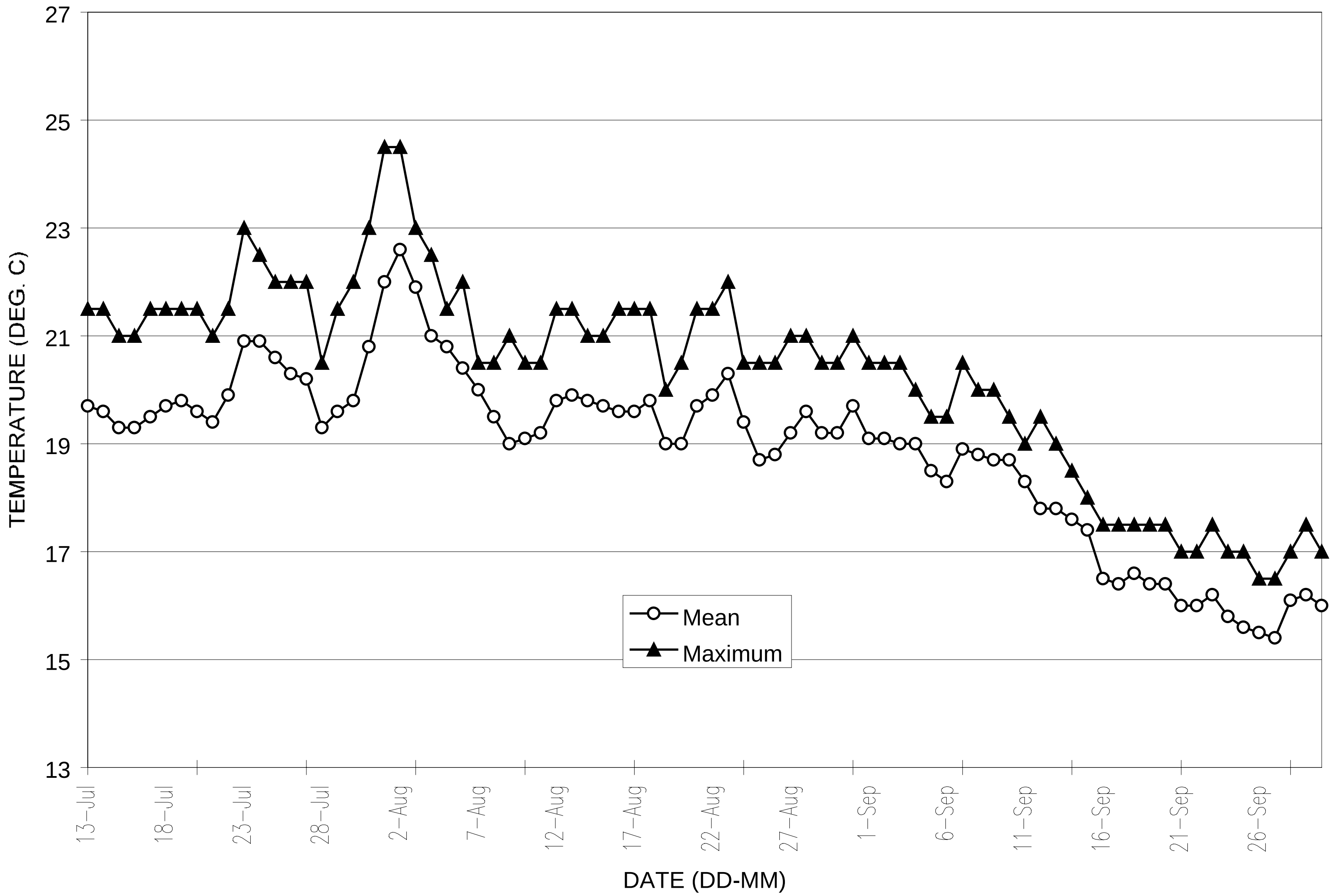


FIGURE 57. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT NAVARRO RIVER (MAP NO. 14; MONITORING SITE NO. I5), MENDOCINO CO., CALIFORNIA.

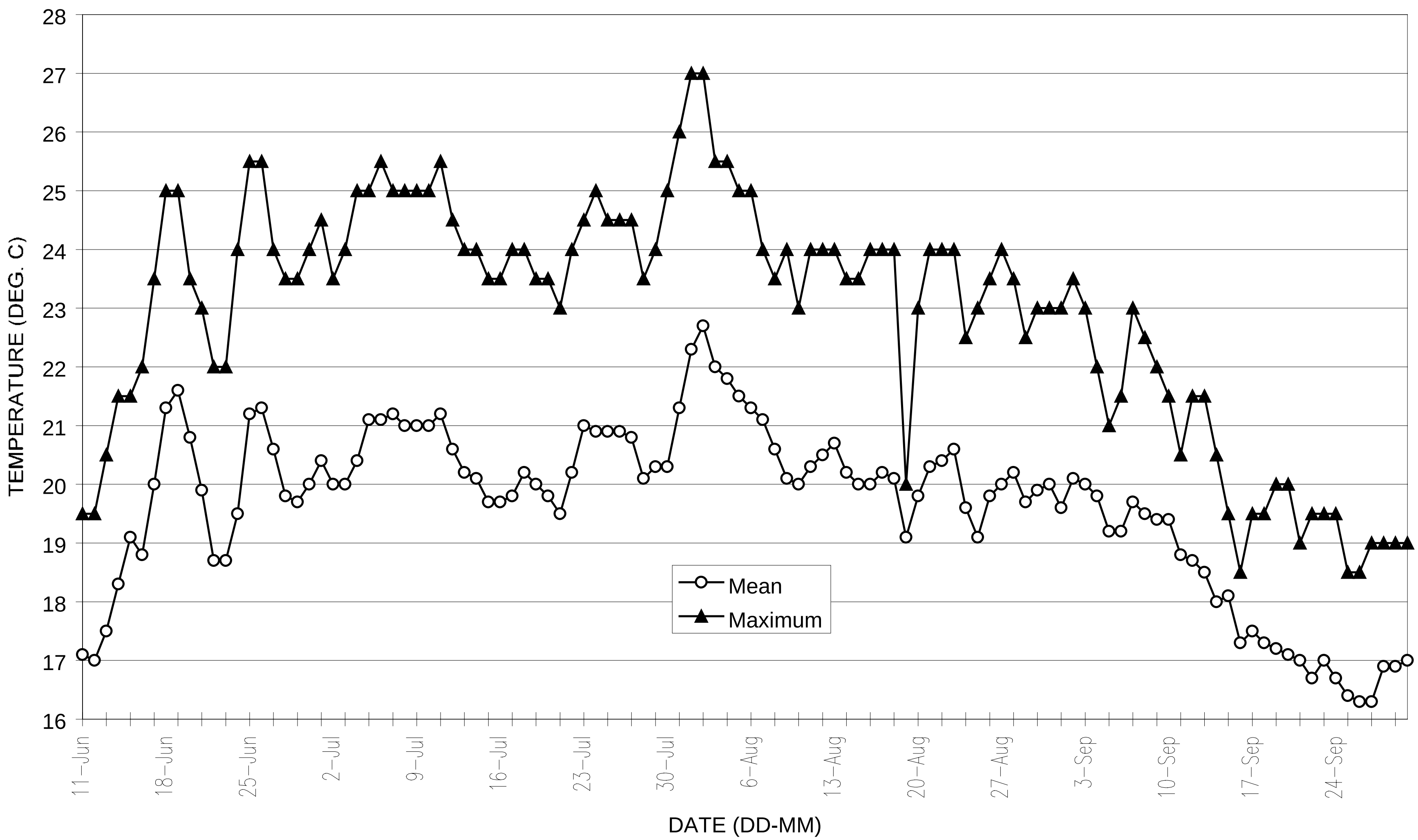


FIGURE 33. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT NORTH BRANCH OF NORTH FORK NAVARRO RIVER (MAP NO. 8; MONITORING SITE NO. 19), MENDOCINO CO., CALIFORNIA.

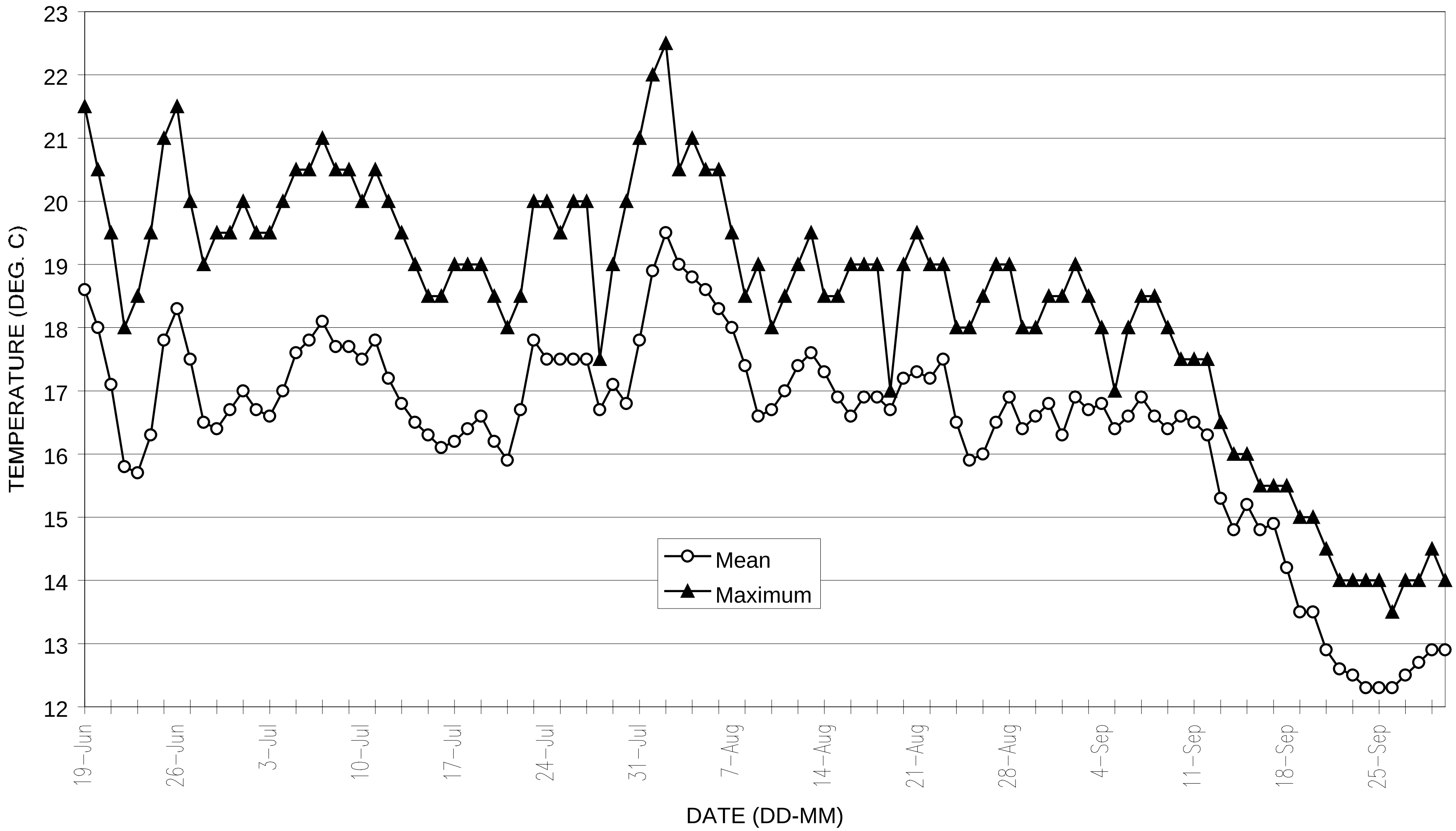


FIGURE 51. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT NORTH FORK INDIAN CREEK (MAP NO. 12; MONITORING SITE NO. 26), MENDOCINO CO., CALIFORNIA.

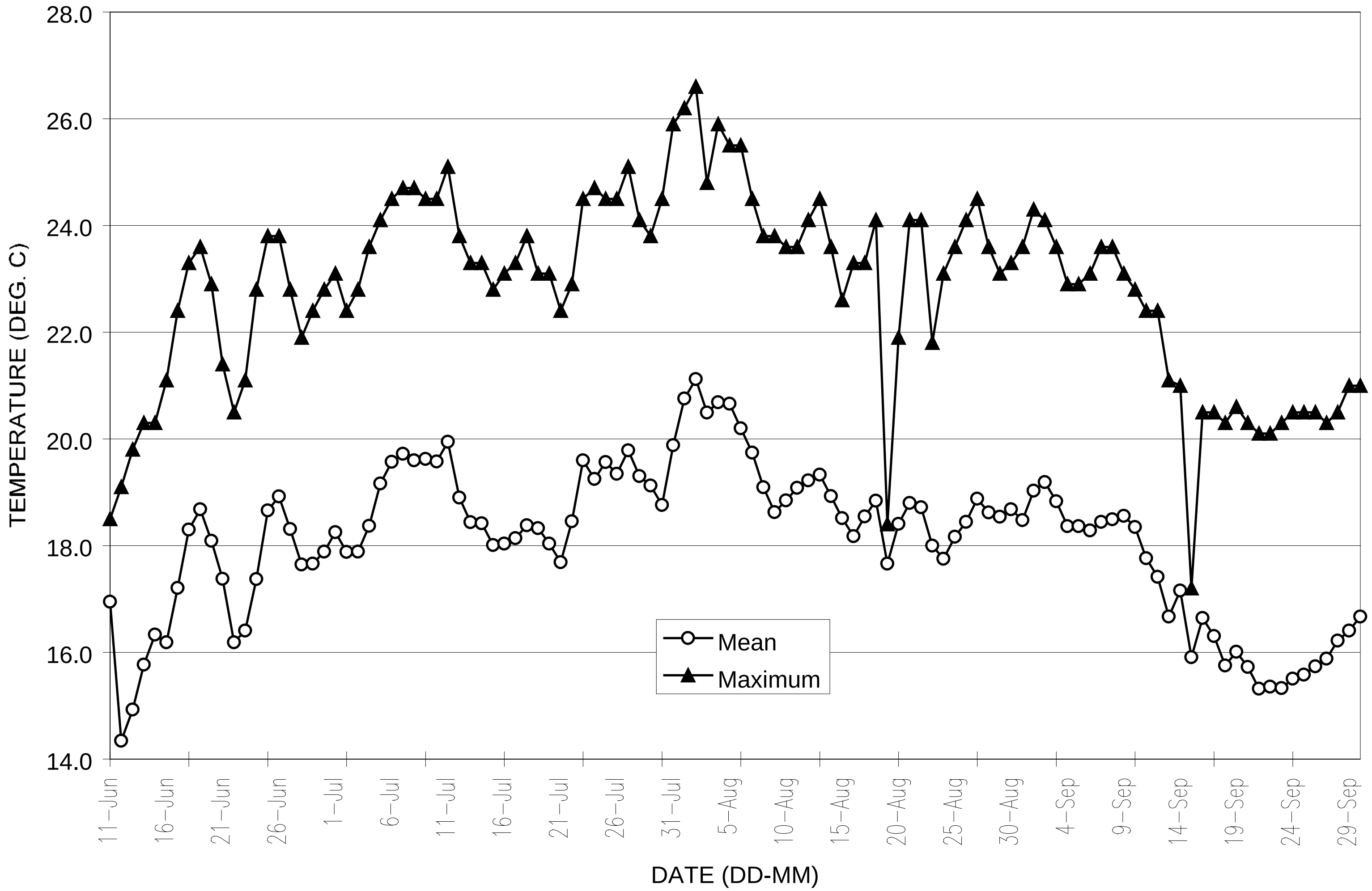


FIGURE 77. MEAN, AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT FLYNN CREEK (MAP NO. 14; MONITORING SITE NO. 82-2), MENDOCINO CO., CALIFORNIA.

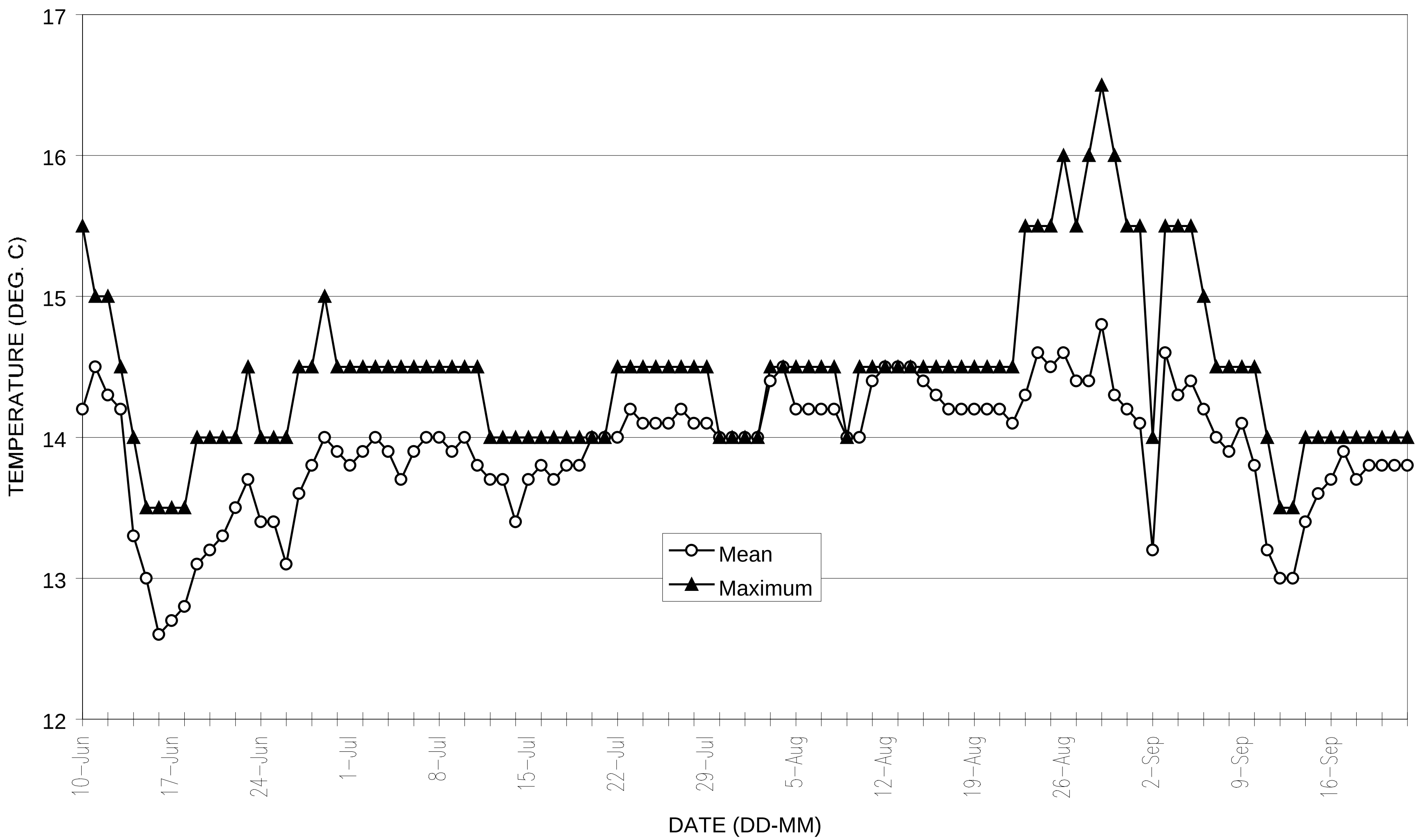


FIGURE 73. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT JOHN SMITH CREEK (MAP NO.13; MONITORING SITE NO. 81-2), MENDOCINO CO., CALIFORNIA.

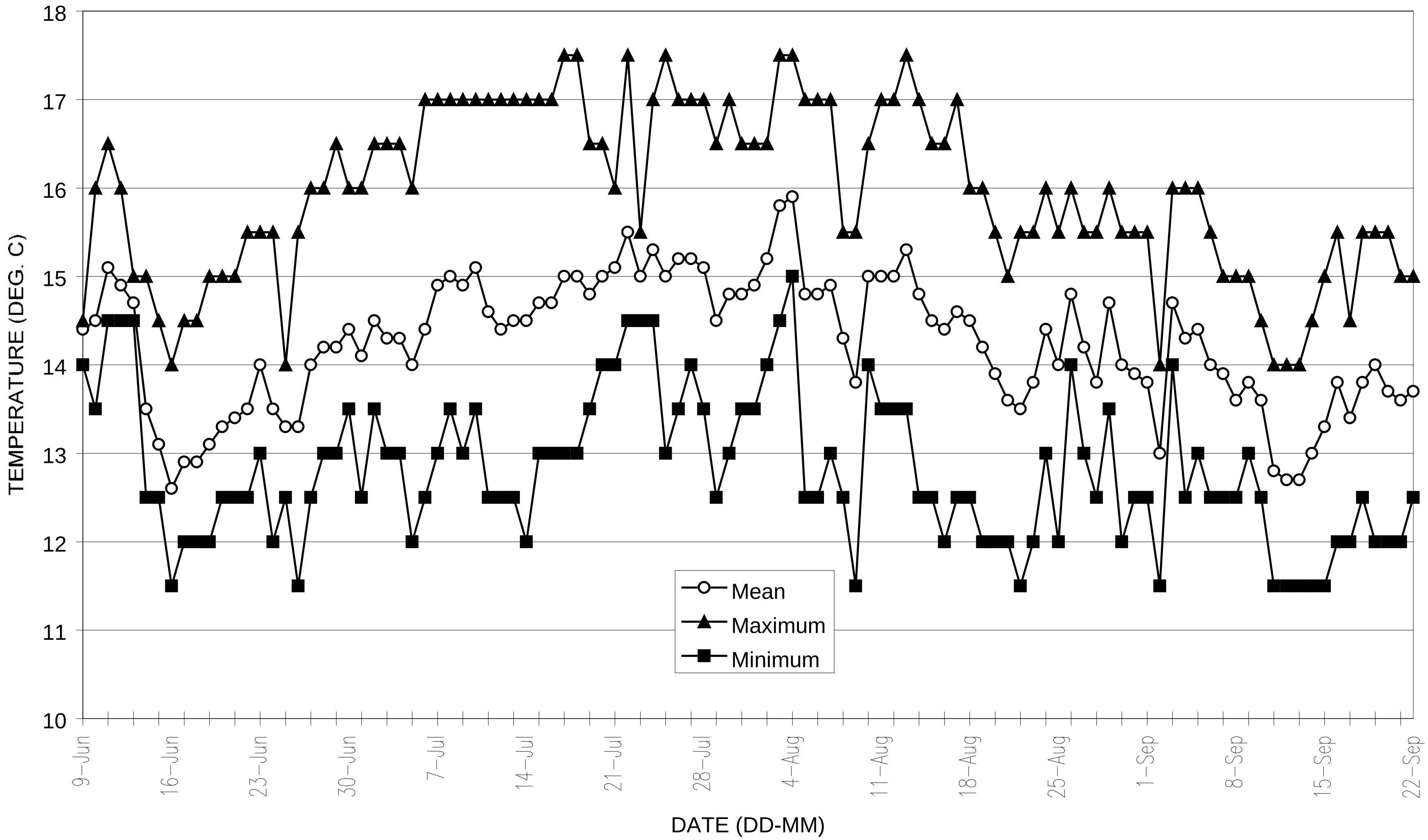


FIGURE 76. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT MARSH GULCH (MAP NO. 14; MONITORING SITE NO. 82-1), MENDOCINO CO., CALIFORNIA.

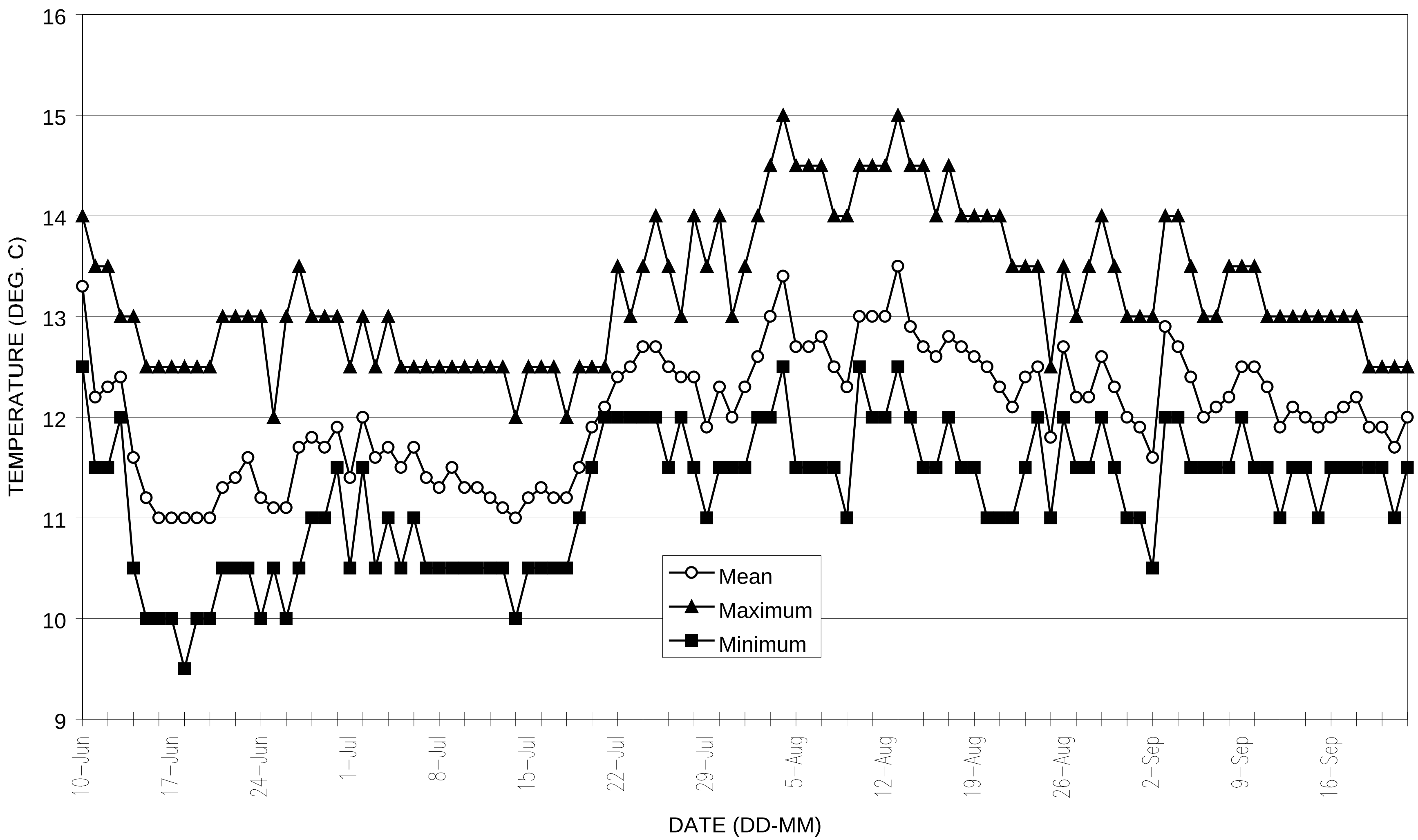


FIGURE 78. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT NAVARRO RIVER (MAP NO. 14; MONITORING SITE NO. 82-3), MENDOCINO CO., CALIFORNIA.

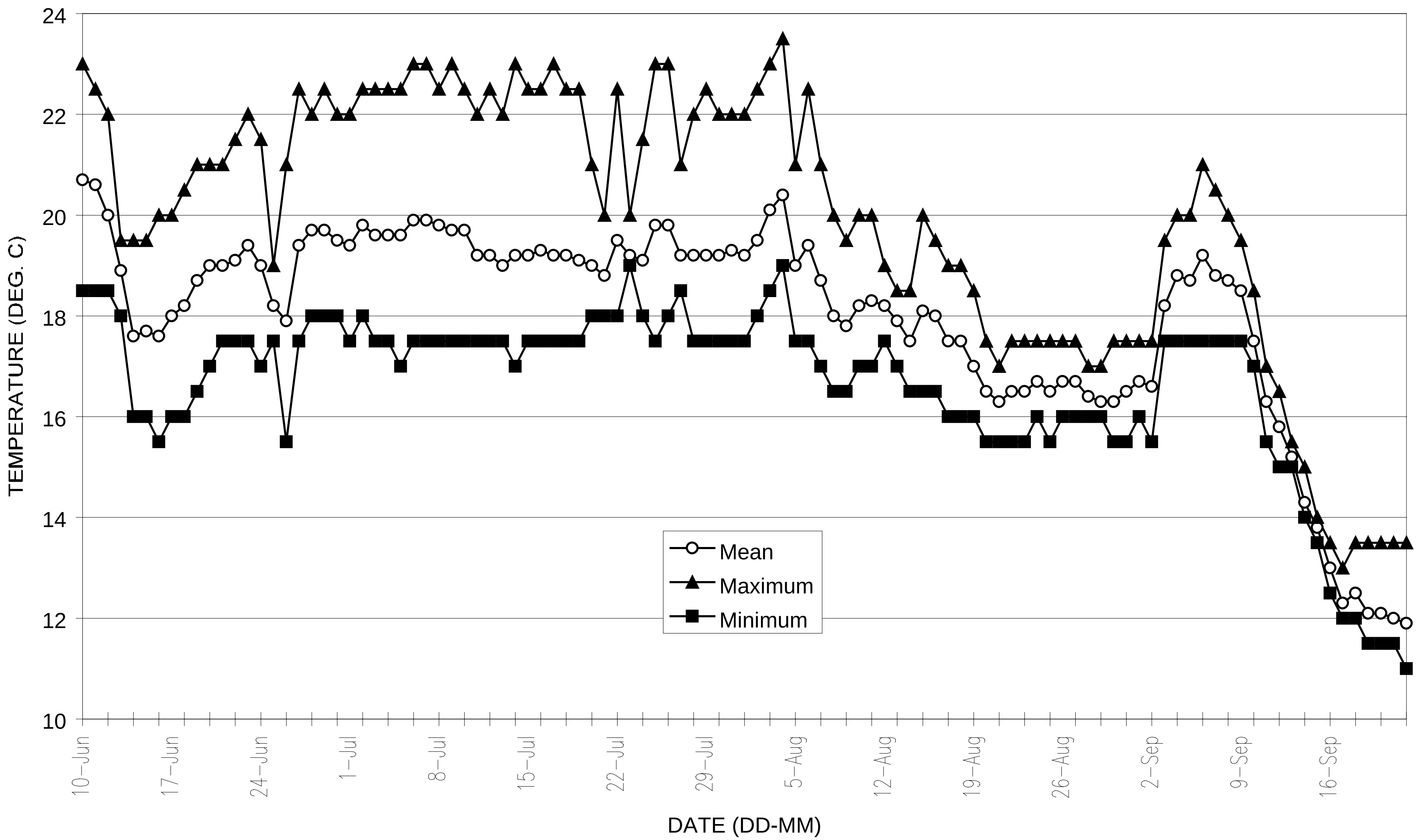


FIGURE 91. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT NAVARRO RIVER (MAP NO. 21; MONITORING SITE NO. 88-1), MENDOCINO CO., CALIFORNIA.

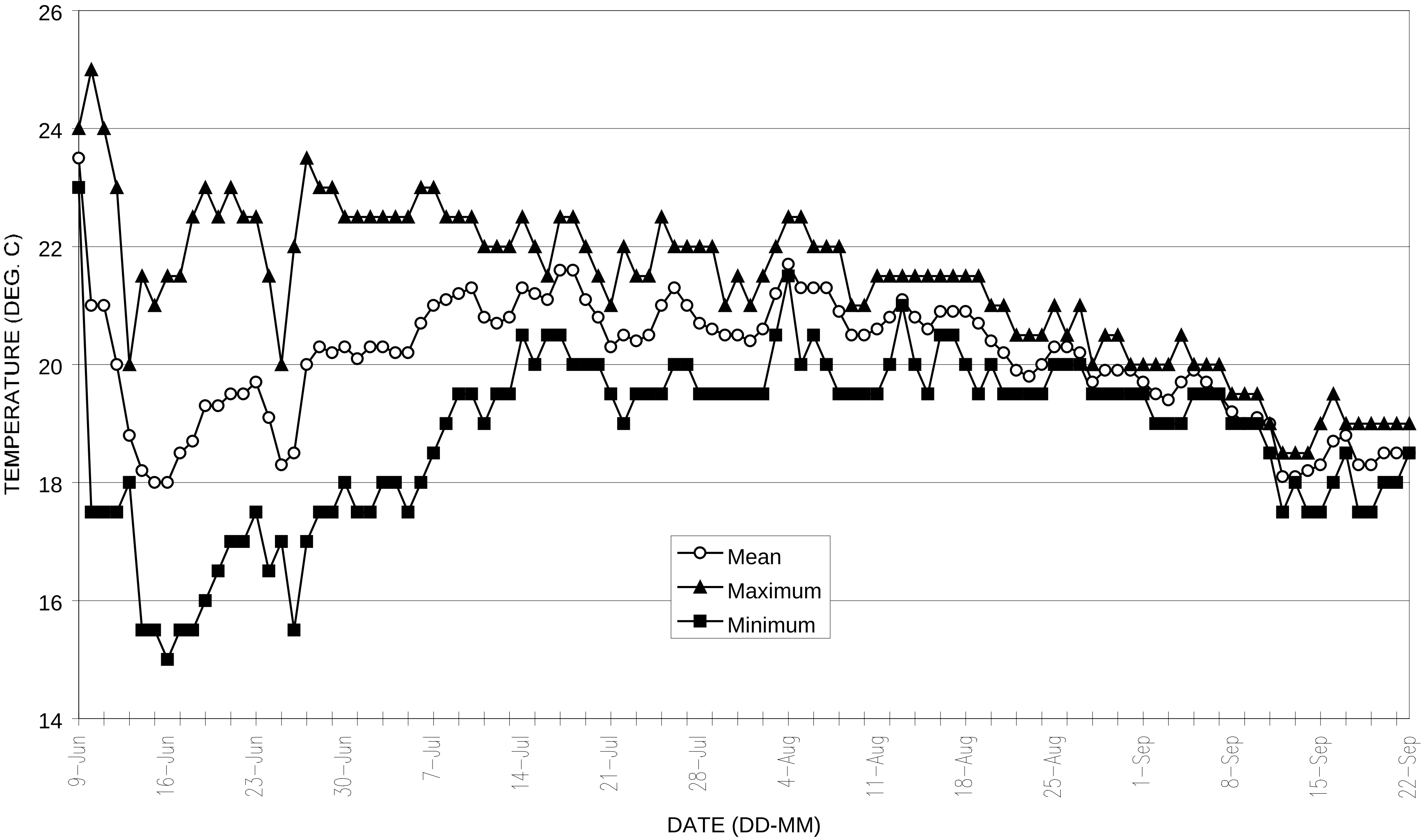


FIGURE 71. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT NORTH BRANCH OF THE NORTH FORK NAVARRO RIVER (MAP NO. 13; MONITORING SITE NO. 81-1), MENDOCINO CO., CALIFORNIA.

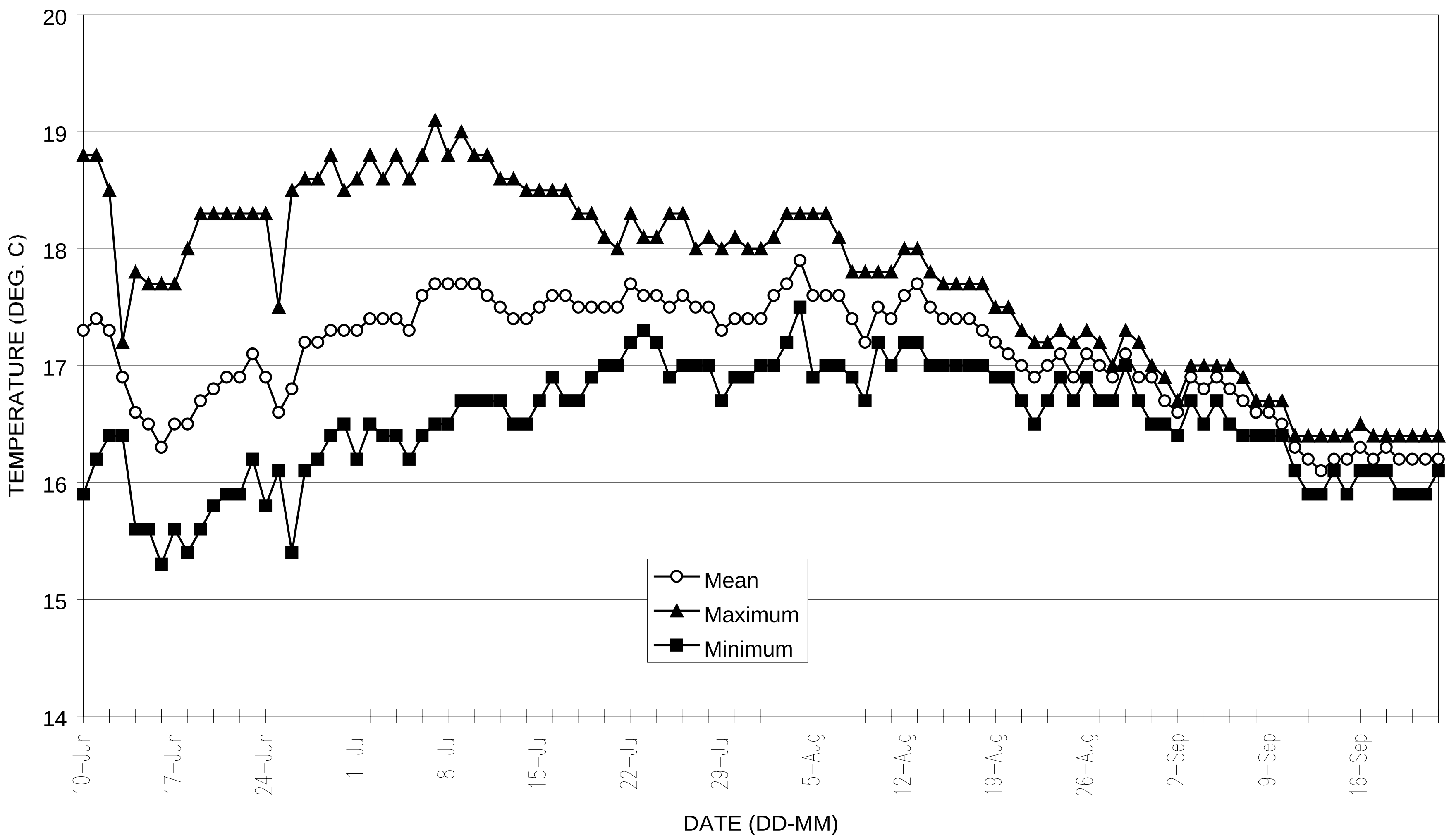


FIGURE 74. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT NORTH BRANCH OF NORTH FORK NAVARRO RIVER (MAP NO. 13; MONITORING SITE NO. 81-3), MENDOCINO CO., CALIFORNIA.

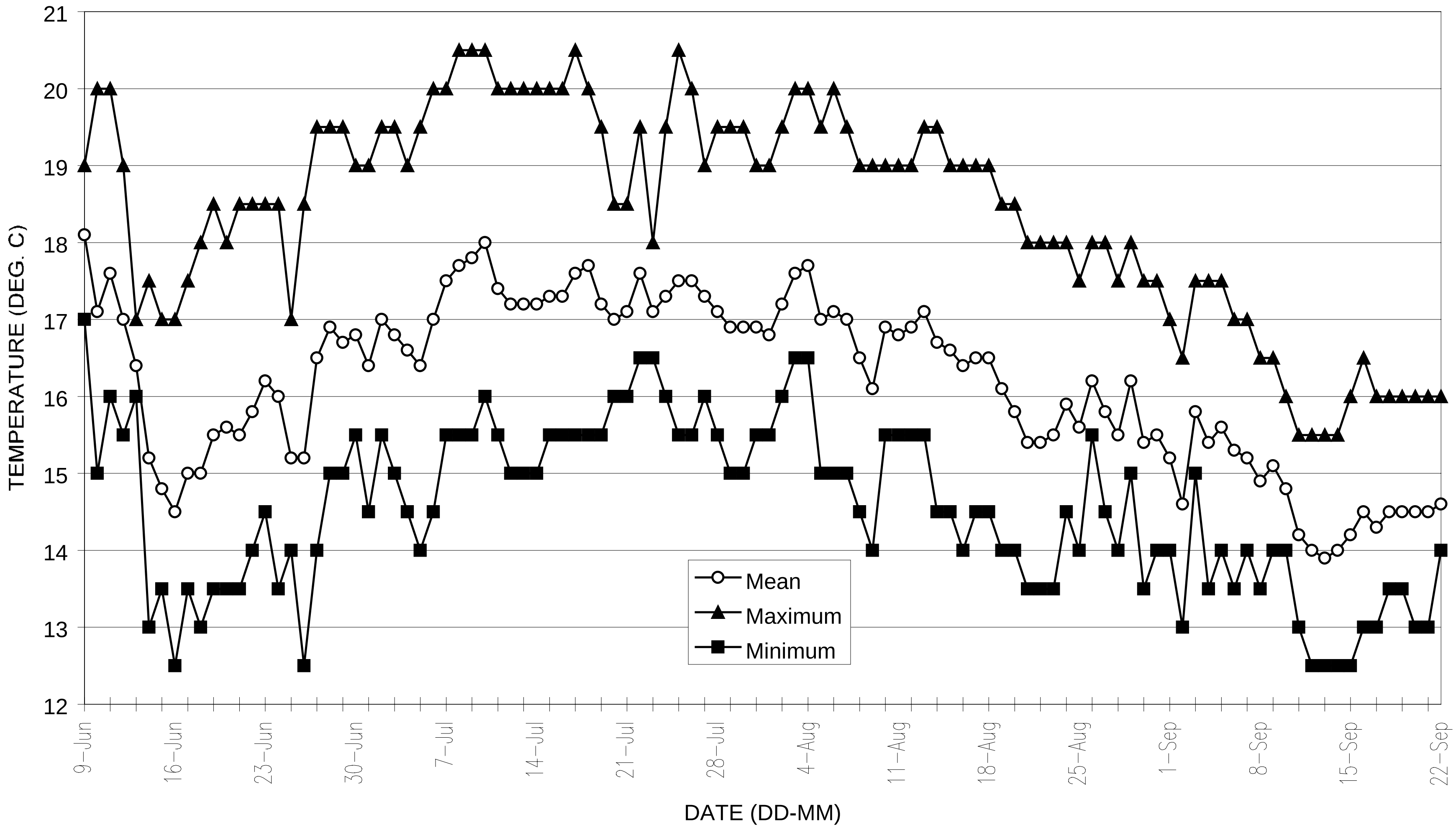


FIGURE 85. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT NORTH FORK INDIAN CREEK (MAP NO. 19; MONITORING SITE NO. 86-1), MENDOCINO CO., CALIFORNIA.

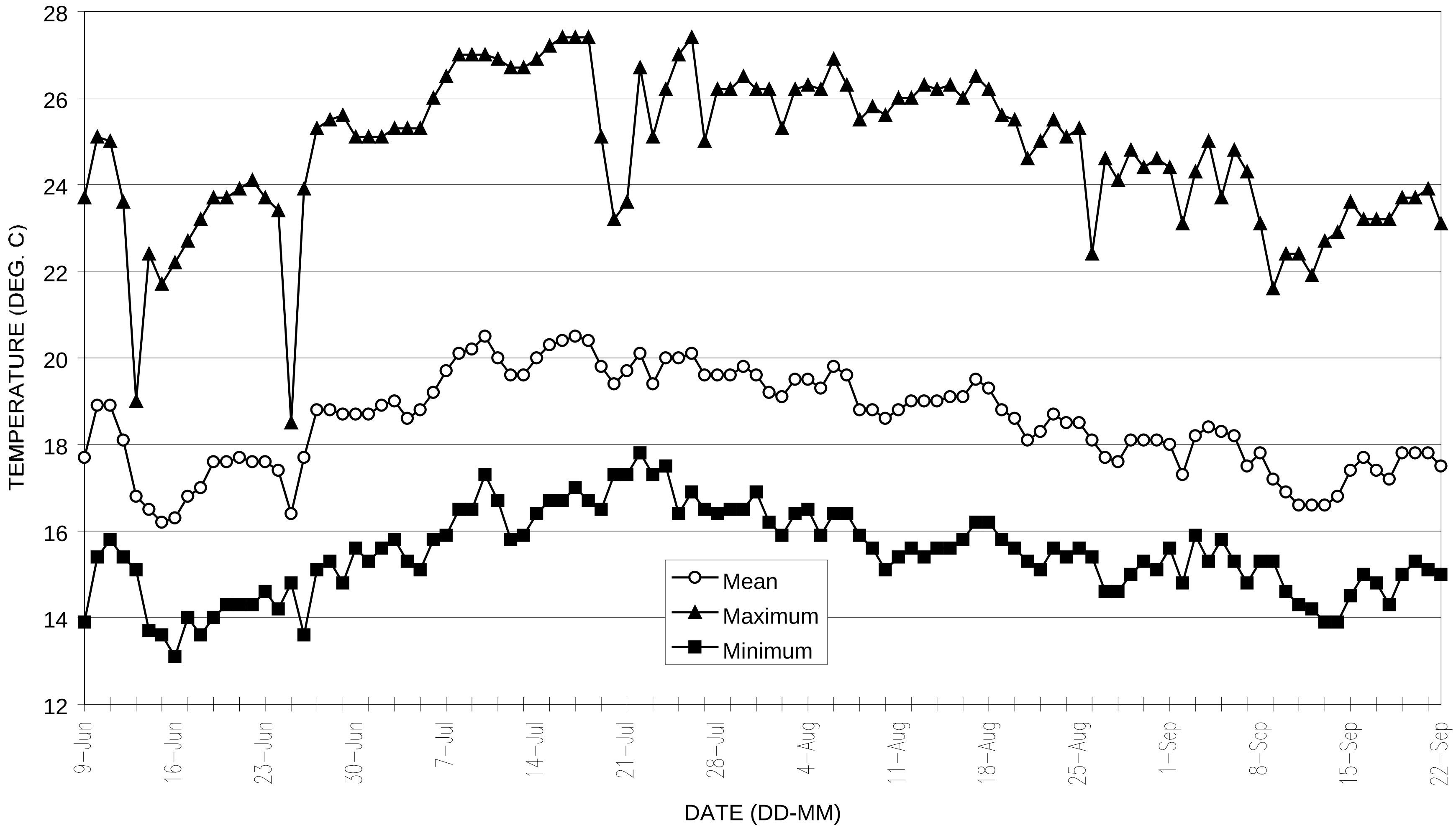


FIGURE 88. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT NORTH FORK INDIAN CREEK (MAP NO. 19; MONITORING SITE NO. 86-2), MENDOCIMO CO., CALIFORNIA.

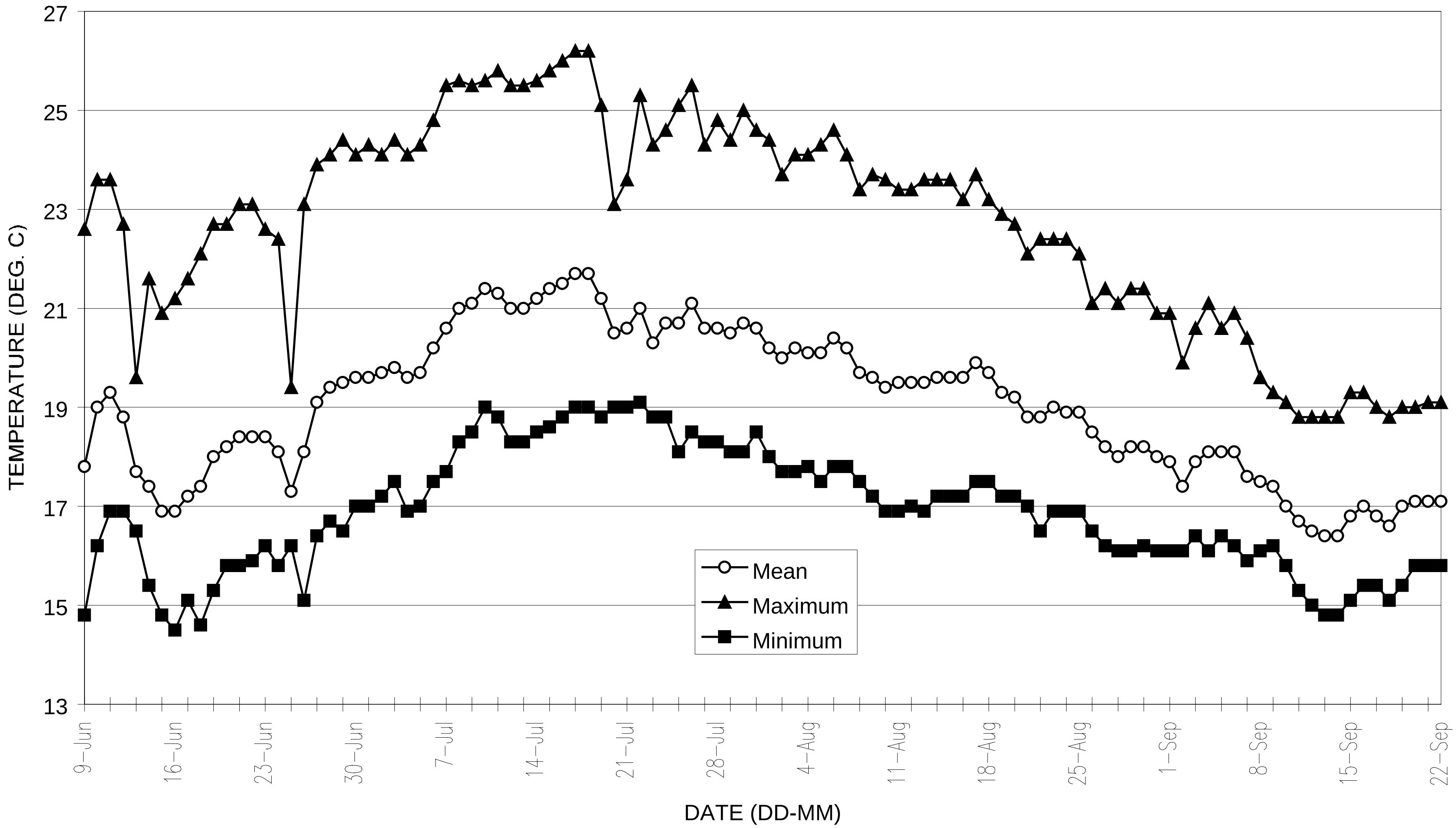


FIGURE 82. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT SOUTH BRANCH OF NORTH FORK NAVARRO RIVER (MAP NO. 15; MONITORING SITE NO. 85-2), MENDOCINO CO., CALIFORNIA.

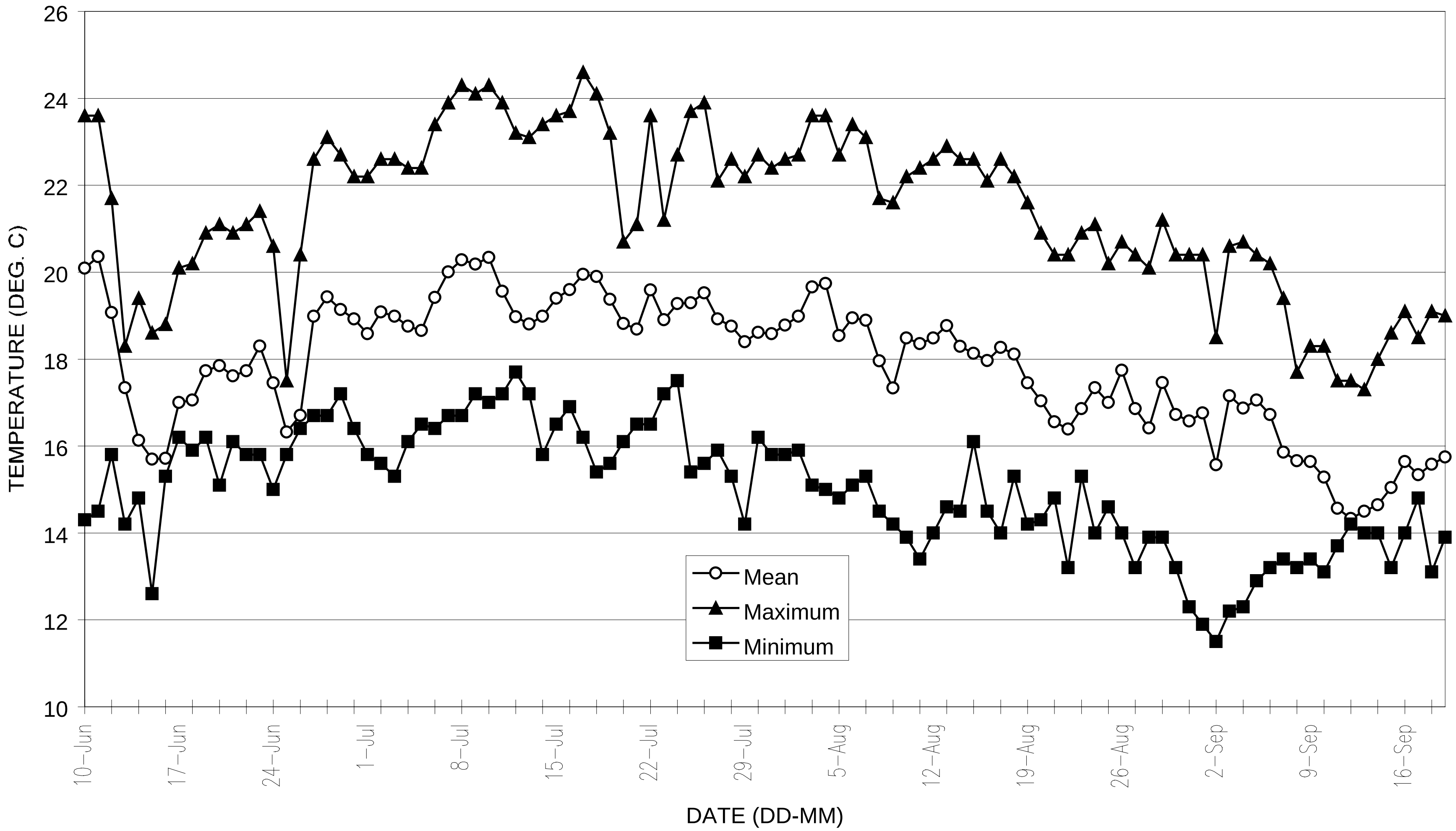


FIGURE 72. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JULY-SEPTEMBER 1995) AT NORTH BRANCH OF THE NORTH FORK NAVARRO RIVER (MAP NO. 13; MONITORING SITE NO. 81-1) MENDOCINO CO., CALIFORNIA.

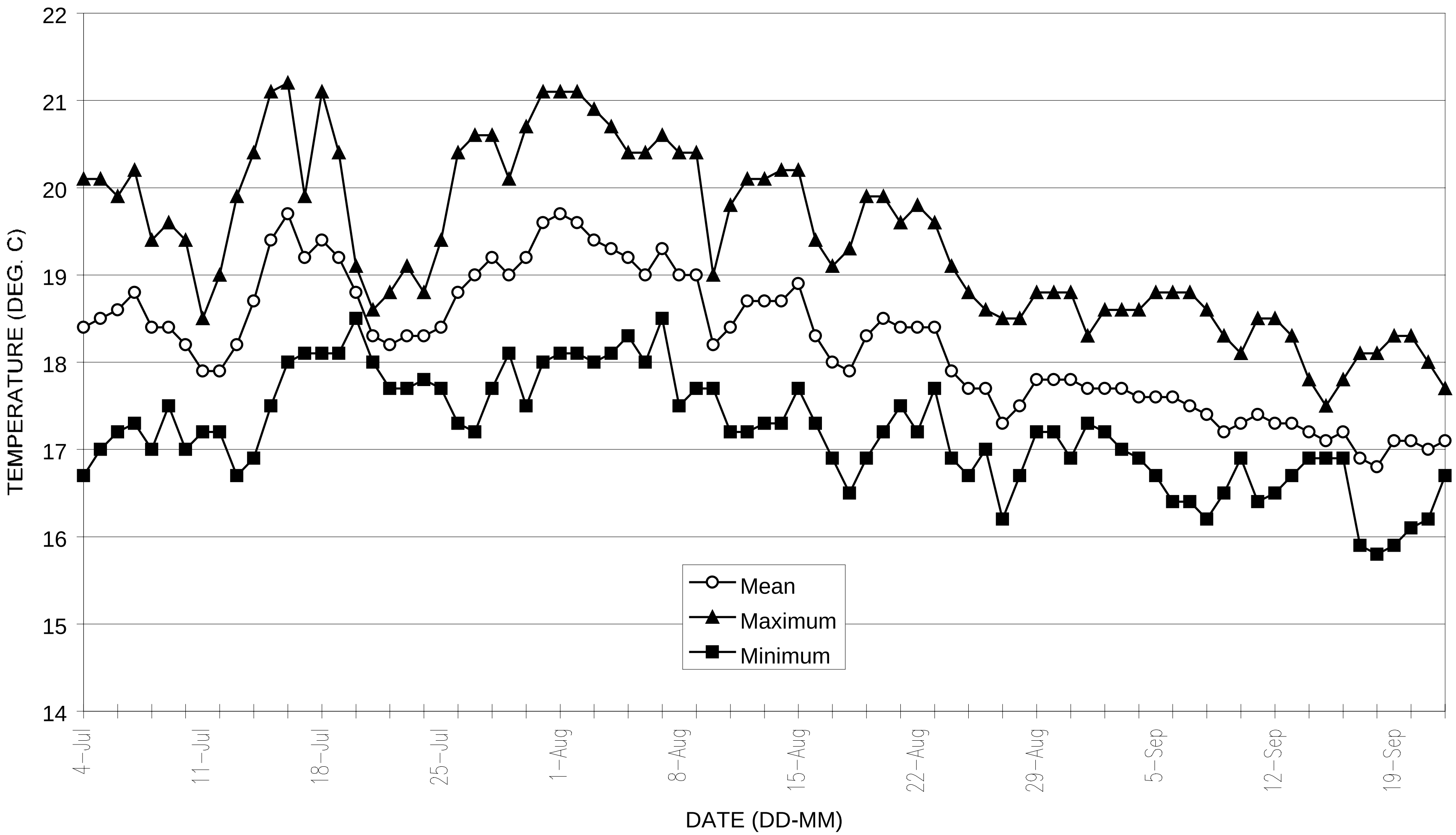


FIGURE 75. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JULY-SEPTEMBER 1995) AT NORTH BRANCH OF THE NORTH FORK NAVARRO RIVER (MAP NO. 13; MONITORING SITE NO. 81-3), MENDOCINO CO., CALIFORNIA.

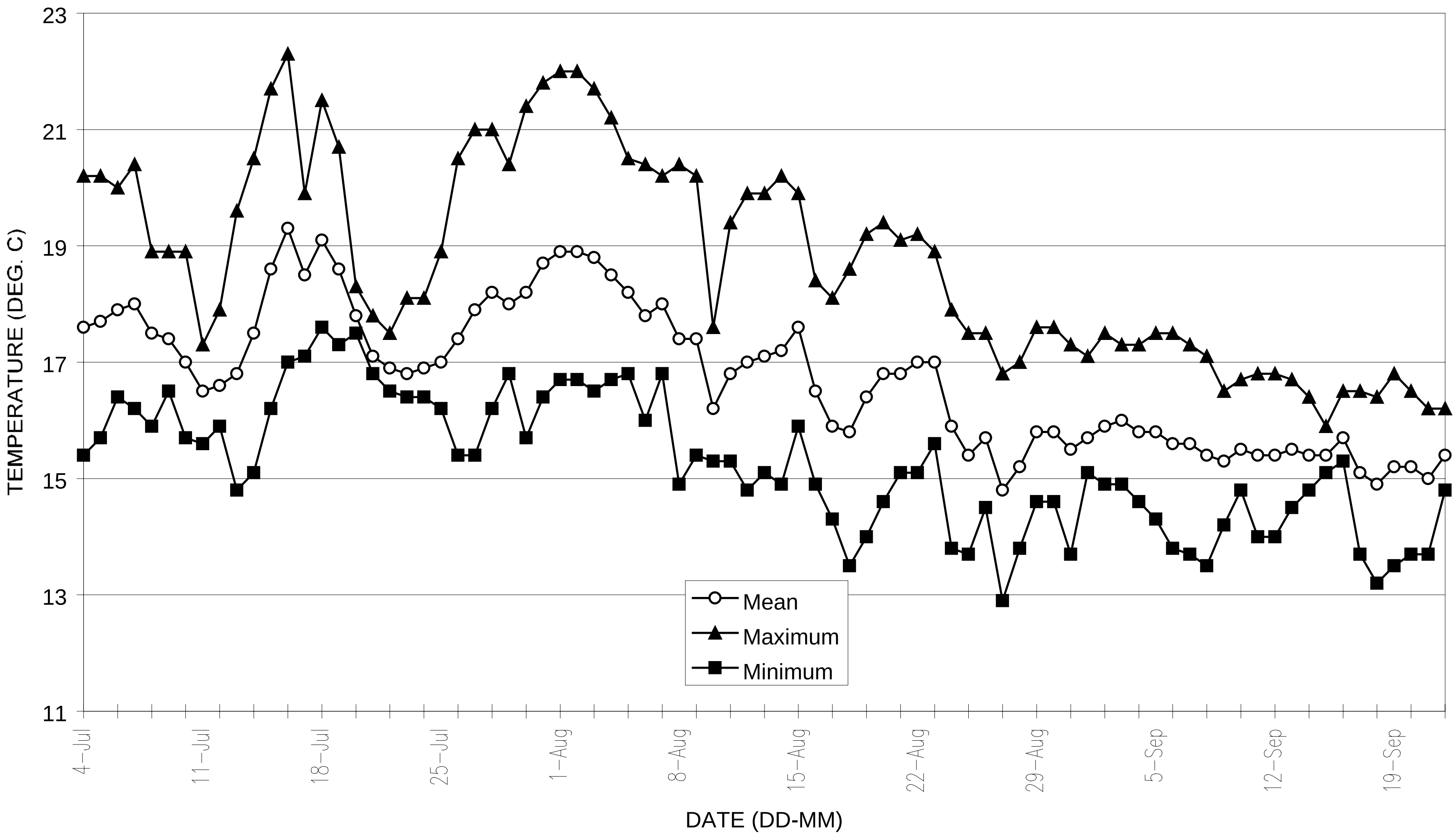


FIGURE 86. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JULY- SEPTEMBER 1995) AT NORTH FORK INDIAN CREEK (MAP NO. 19; MONITORING SITE NO. 86-1), MENDOCINO CO., CALIFORNIA.

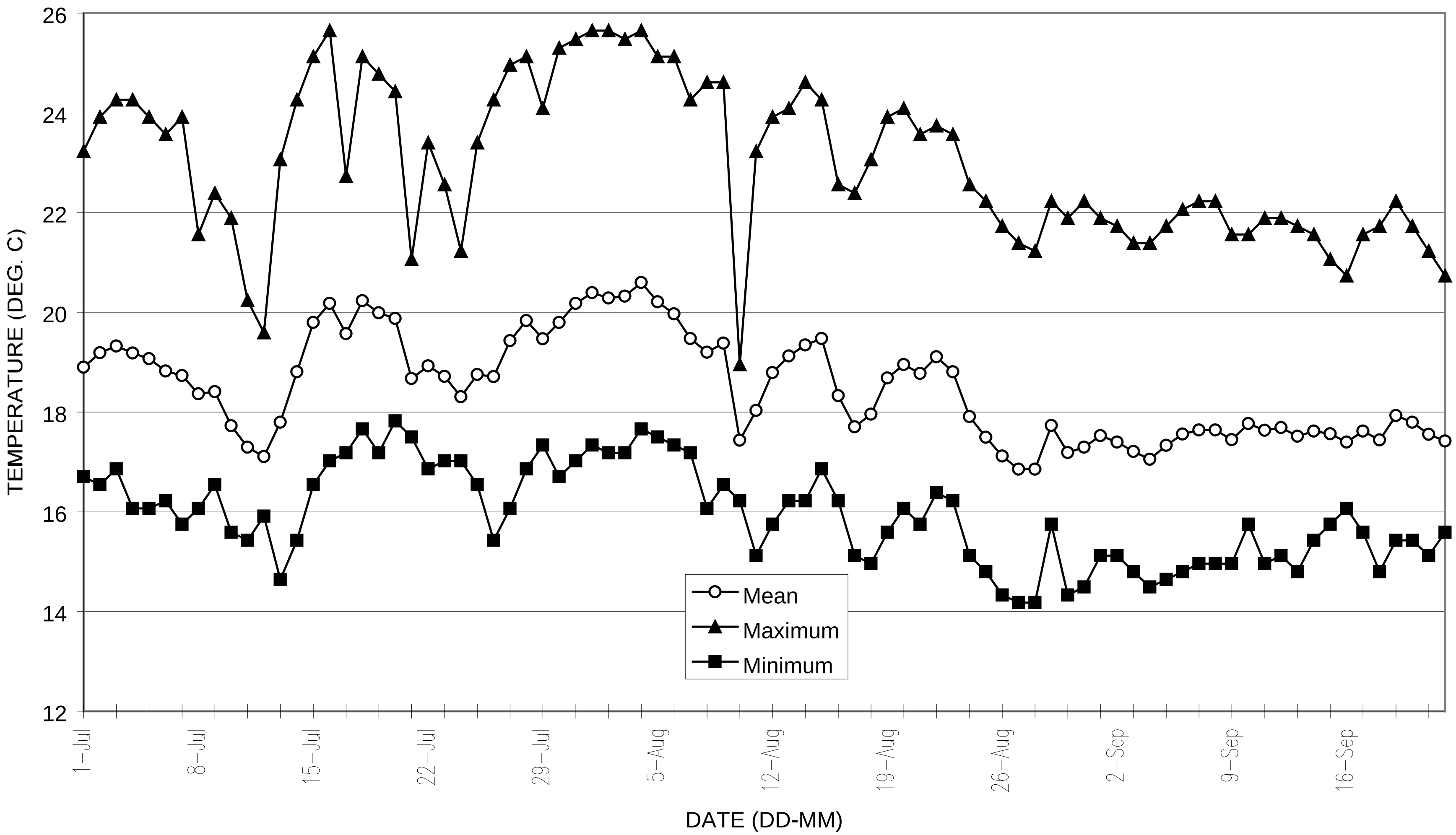


FIGURE 89. MEAN, MAXIMUM AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER(JULY-SEPTEMBER 1995) AT NORTH FORK INDIAN CREEK (MAP NO. 19; MONITORING SITE NO. 86-2), MENDOCINO CO., CALIFORNIA.

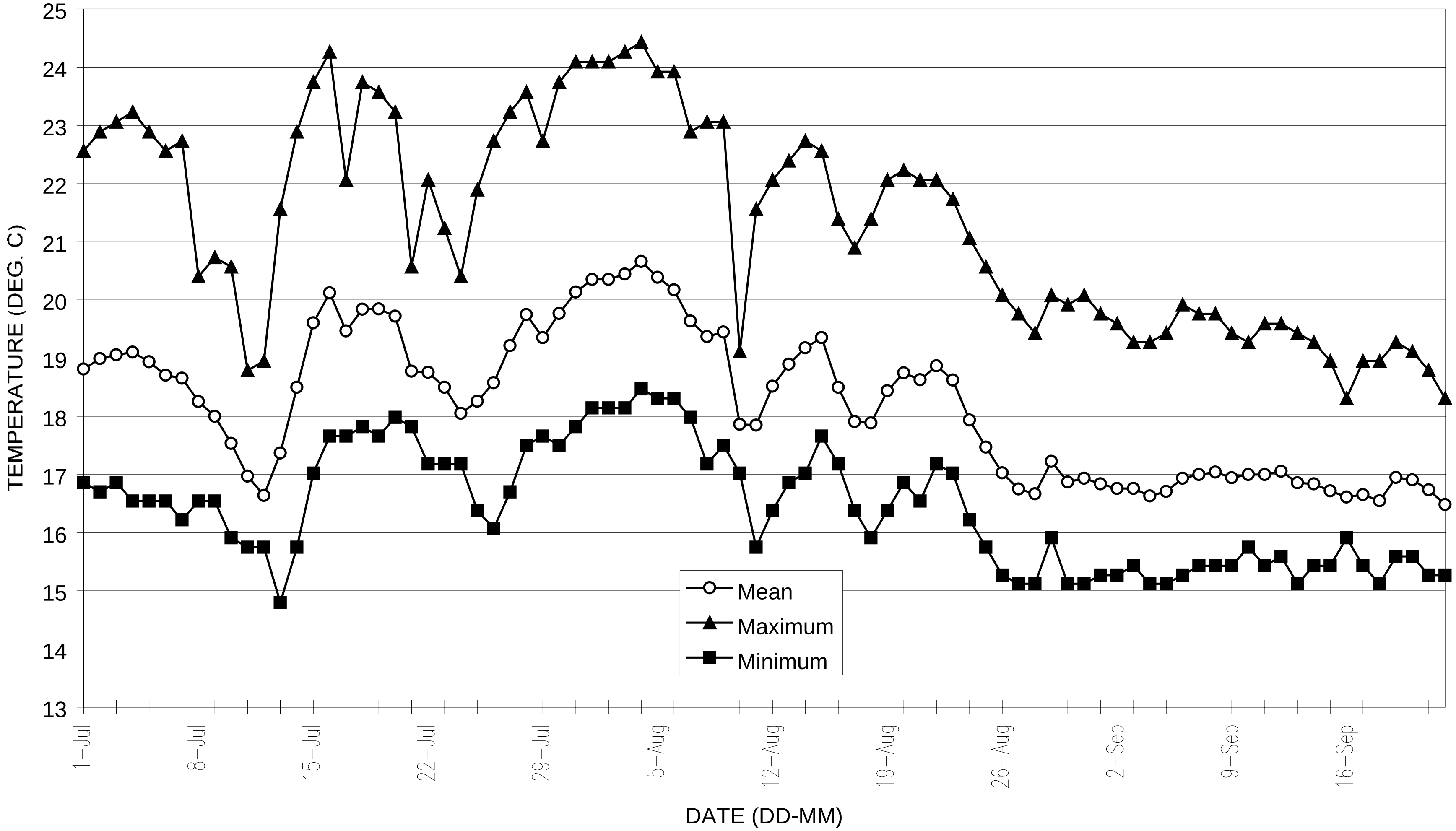


FIGURE 80. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JULY- SEPTEMBER 1995) AT SOUTH BRANCH OF THE NORTH FORK NAVARRO RIVER (MAP NO. 15; MONITORING SITE NO. 85-1), MENDOCINO CO., CALIFORNIA.

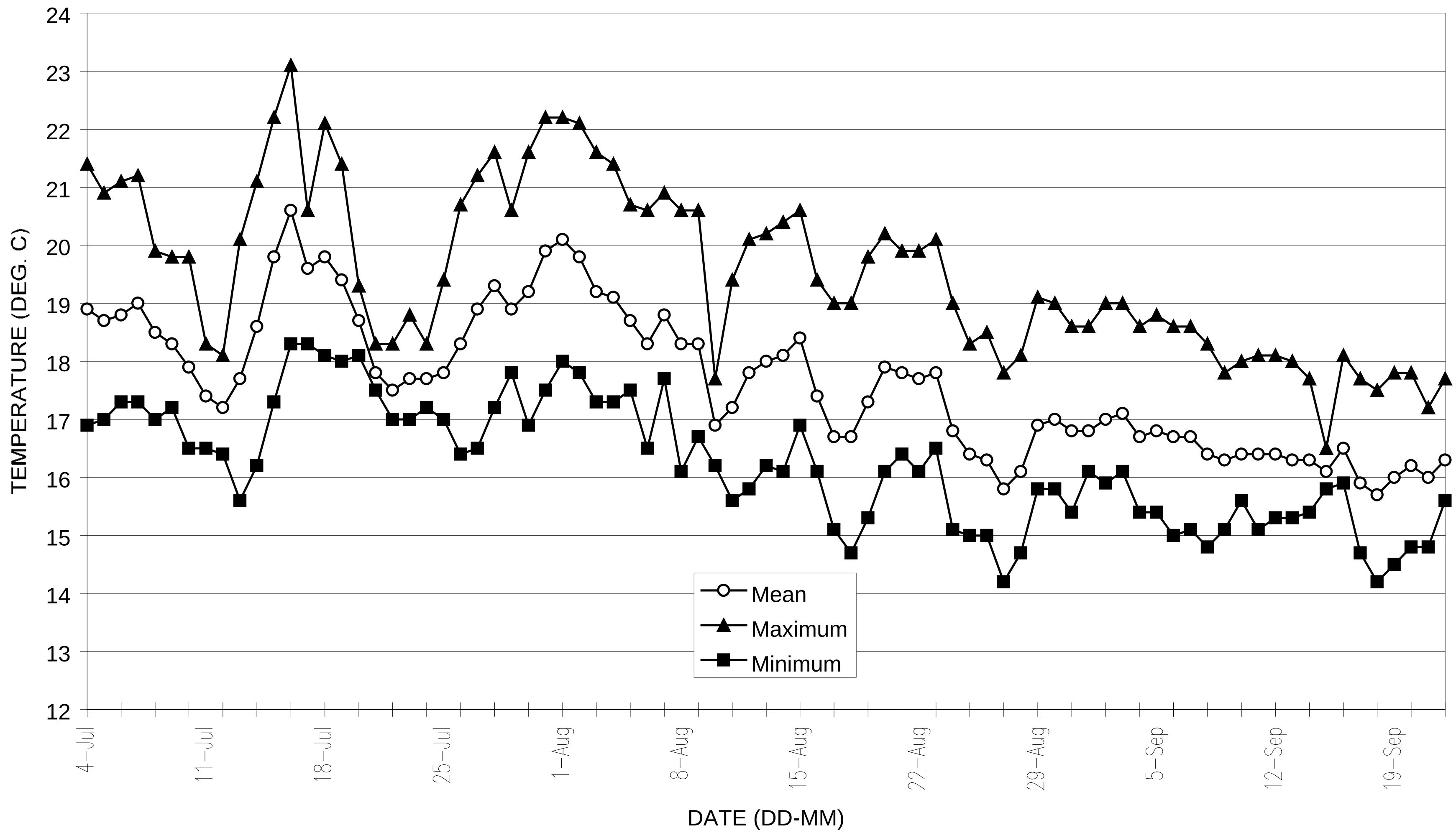


FIGURE 83. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JULY-SEPTEMBER 1995) AT SOUTH BRANCH OF THE NORTH FORK NAVARRO RIVER (MAP NO. 15; MONITORING SITE NO. 85-2), MENDOCINO CO., CALIFORNIA.

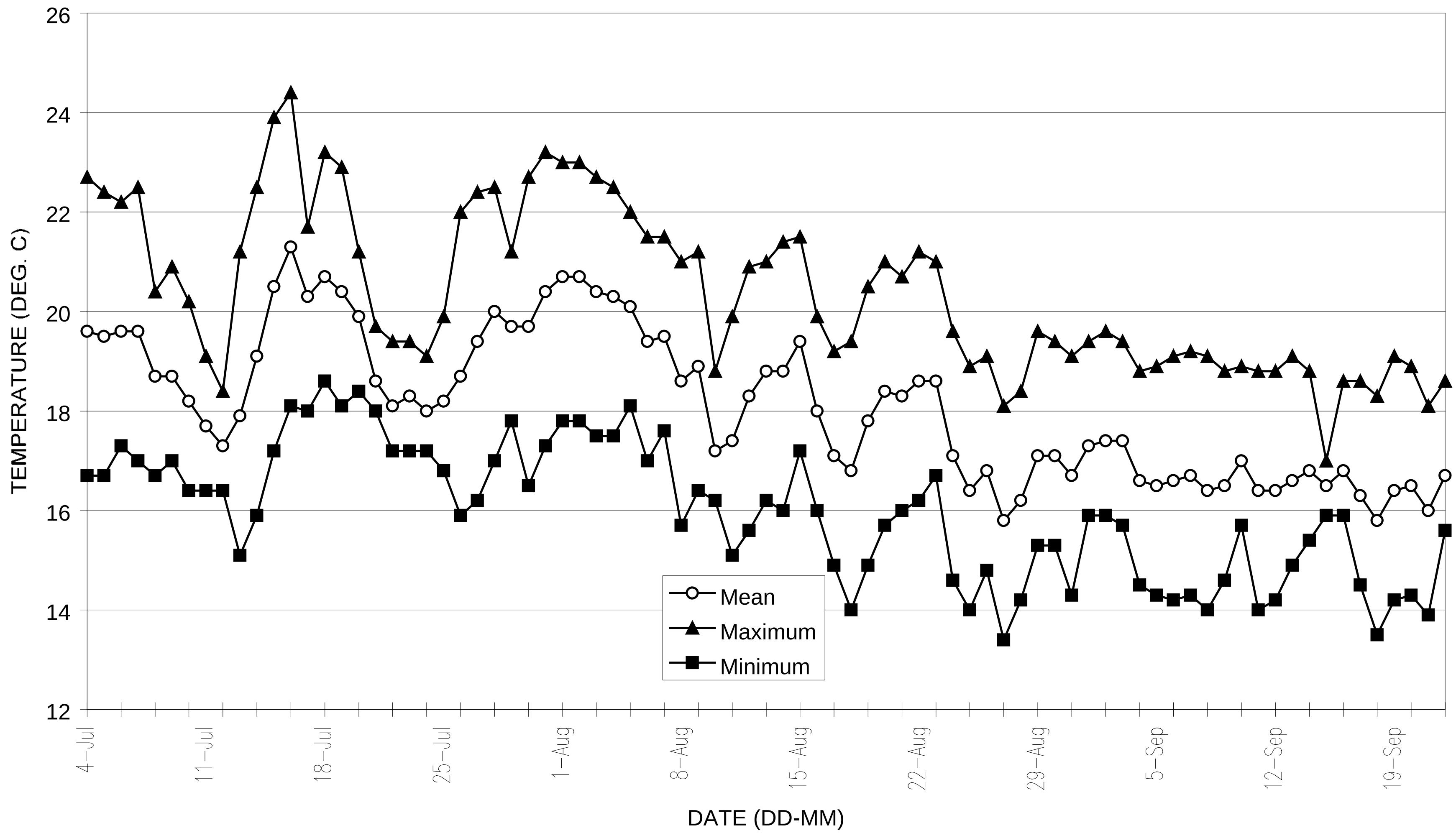


FIGURE 87. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1996) AT NORTH FORK INDIAN CREEK (MAP NO. 19; MONITORING SITE NO. 86-1), MENDOCINO CO., CALIFORNIA.

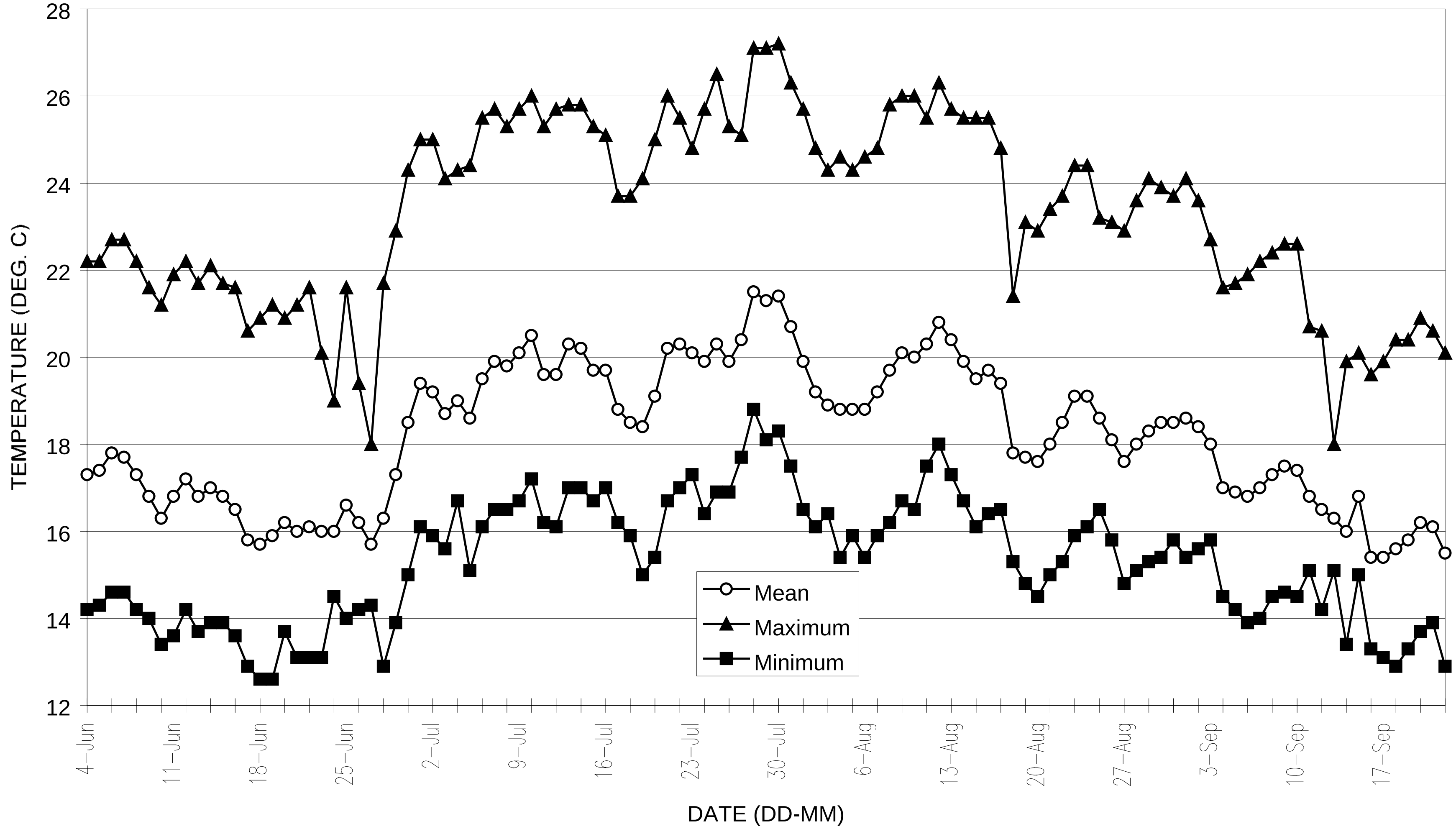


FIGURE 90. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1996) AT NORTH FORK INDIAN CREEK (MAP NO. 19; MONITORING SITE NO. 86-2), MENDOCINO CO., CALIFORNIA.

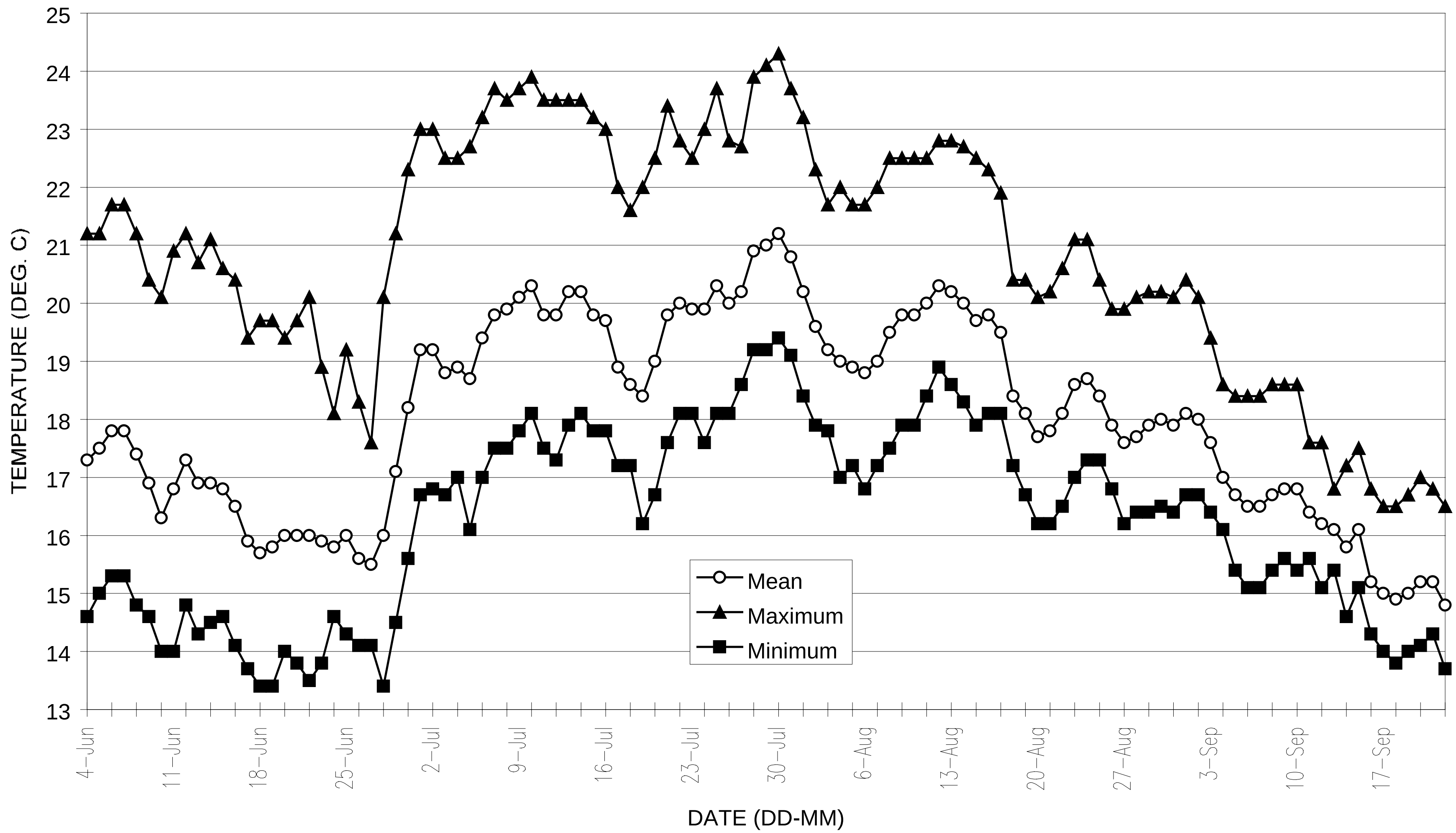


FIGURE 81. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (MAY-SEPTEMBER 1996) AT SOUTH BRANCH OF NORTH FORK NAVARRO RIVER (MAP NO. 15; MONITORING SITE NO. 85-1), MENDOCINO CO., CALIFORNIA.

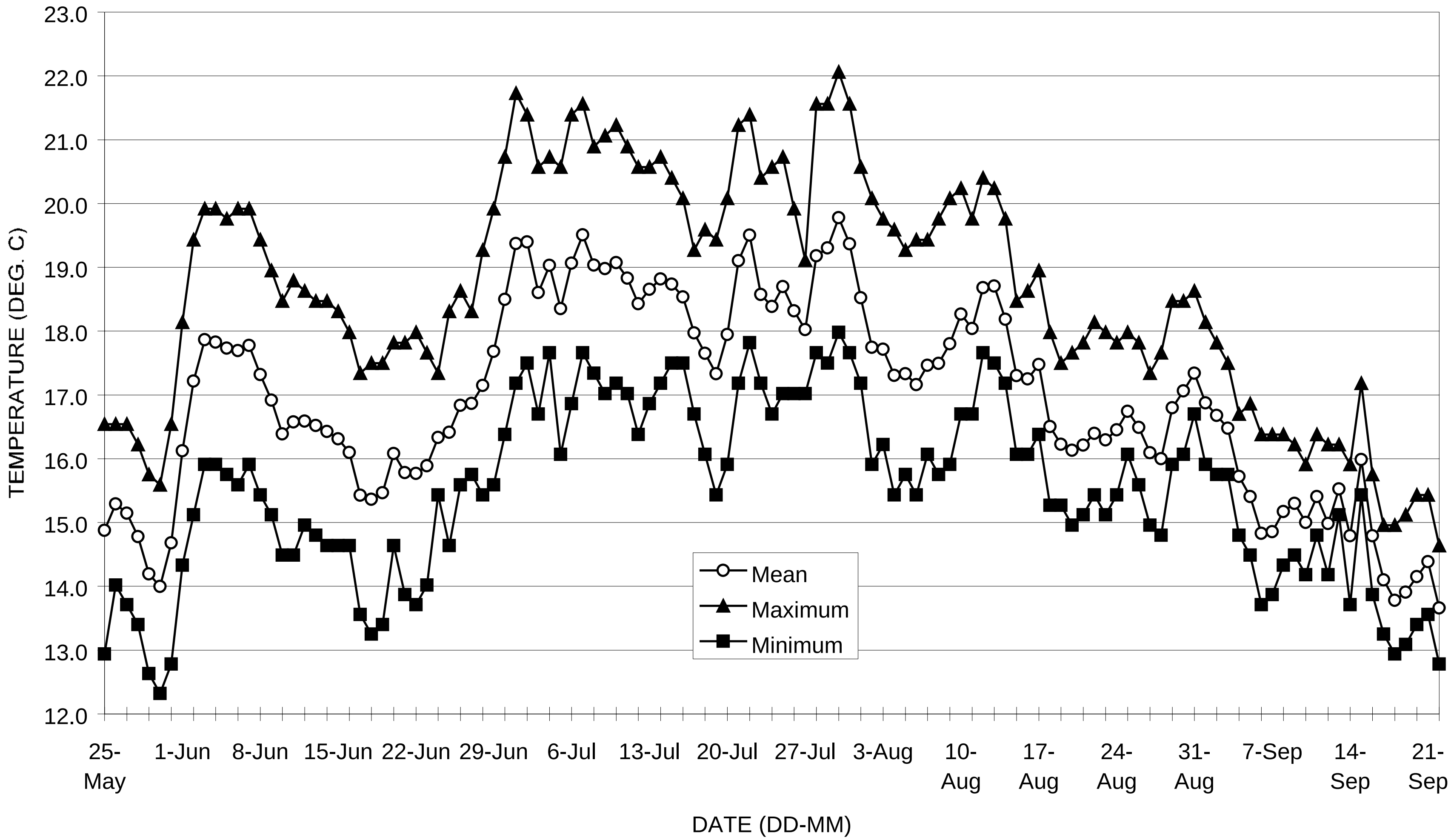


FIGURE 84. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (MAY-SEPTEMBER 1996) AT SOUTH BRANCH OF NORTH FORK NAVARRO RIVER (MAP NO. 15; MONITORING SITE NO. 85-2), MENDOCINO CO., CALIFORNIA.

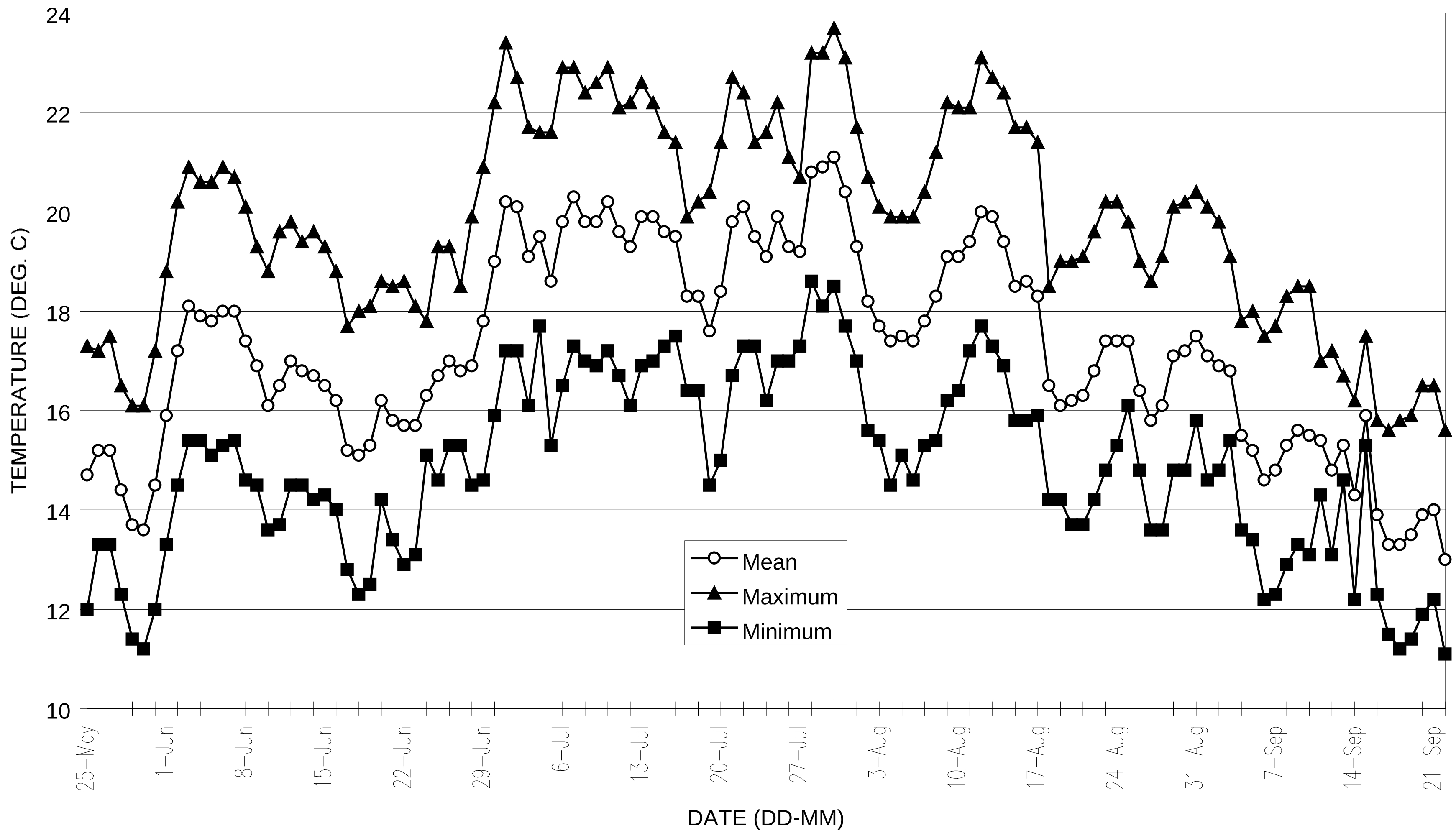


Figure 90. Mean and Maximum Daily Stream Temperatures During Summer 1997 at John Smith Creek (Site 81-2), Mendocino County, California.

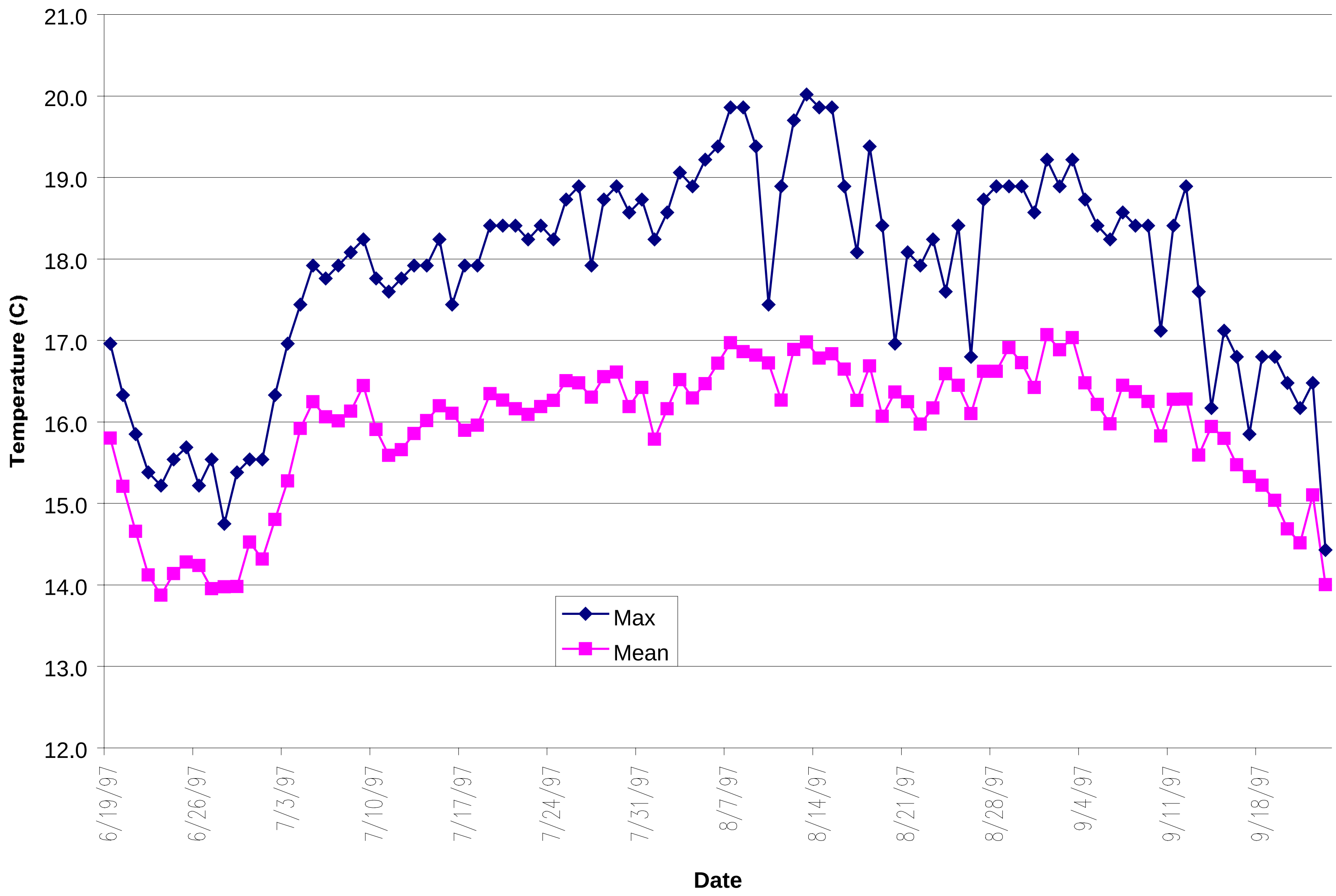


Figure 97. Mean and Maximum Daily Stream Temperatures During Summer 1997 at Flynn Creek (Site 82-2), Mendocino County, California.

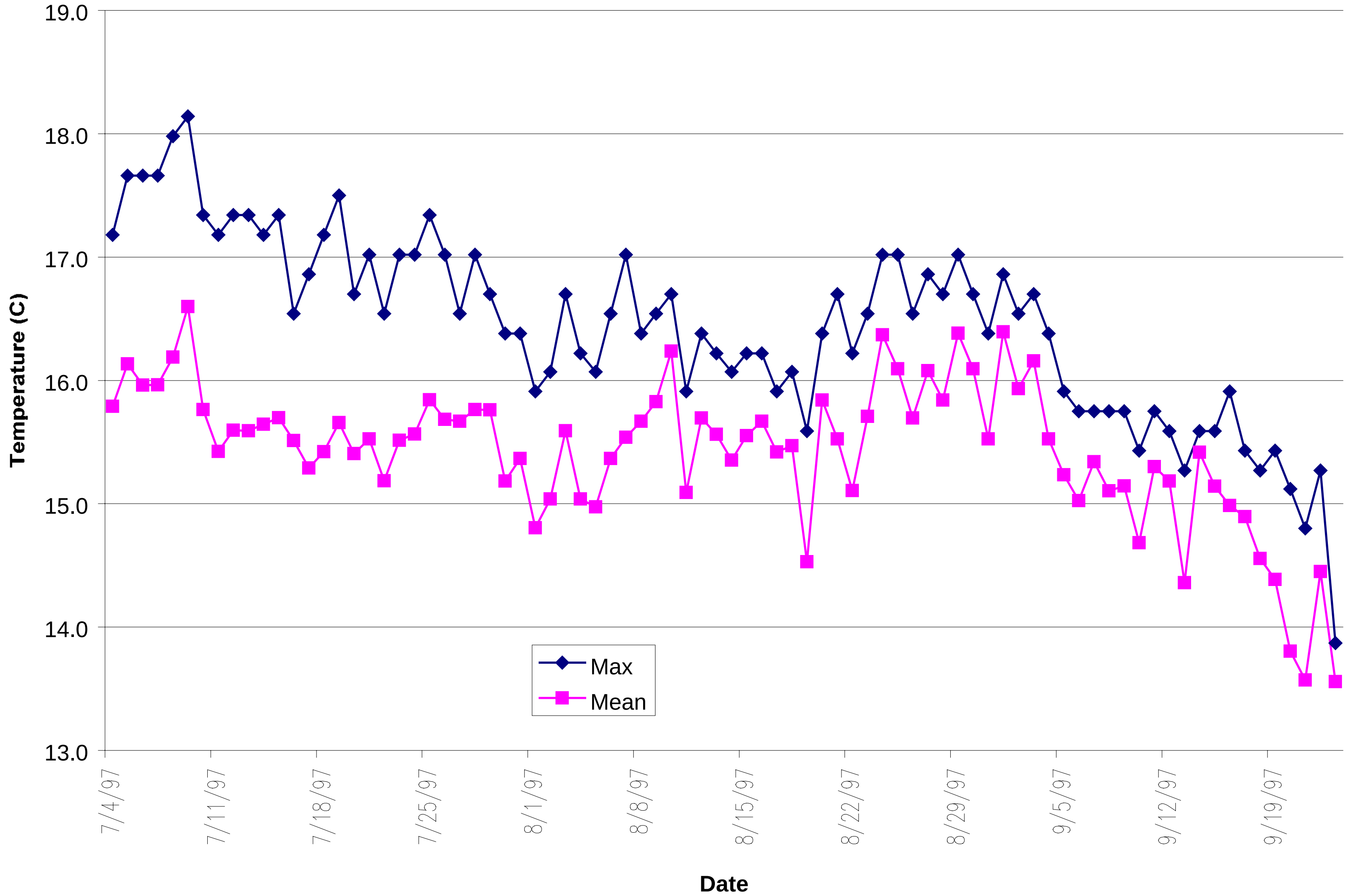


Figure 88. Mean and Maximum Daily Stream Temperatures During Summer 1999 at North Branch North Fork Navarro River (Site 81-1), Mendocino County, California.

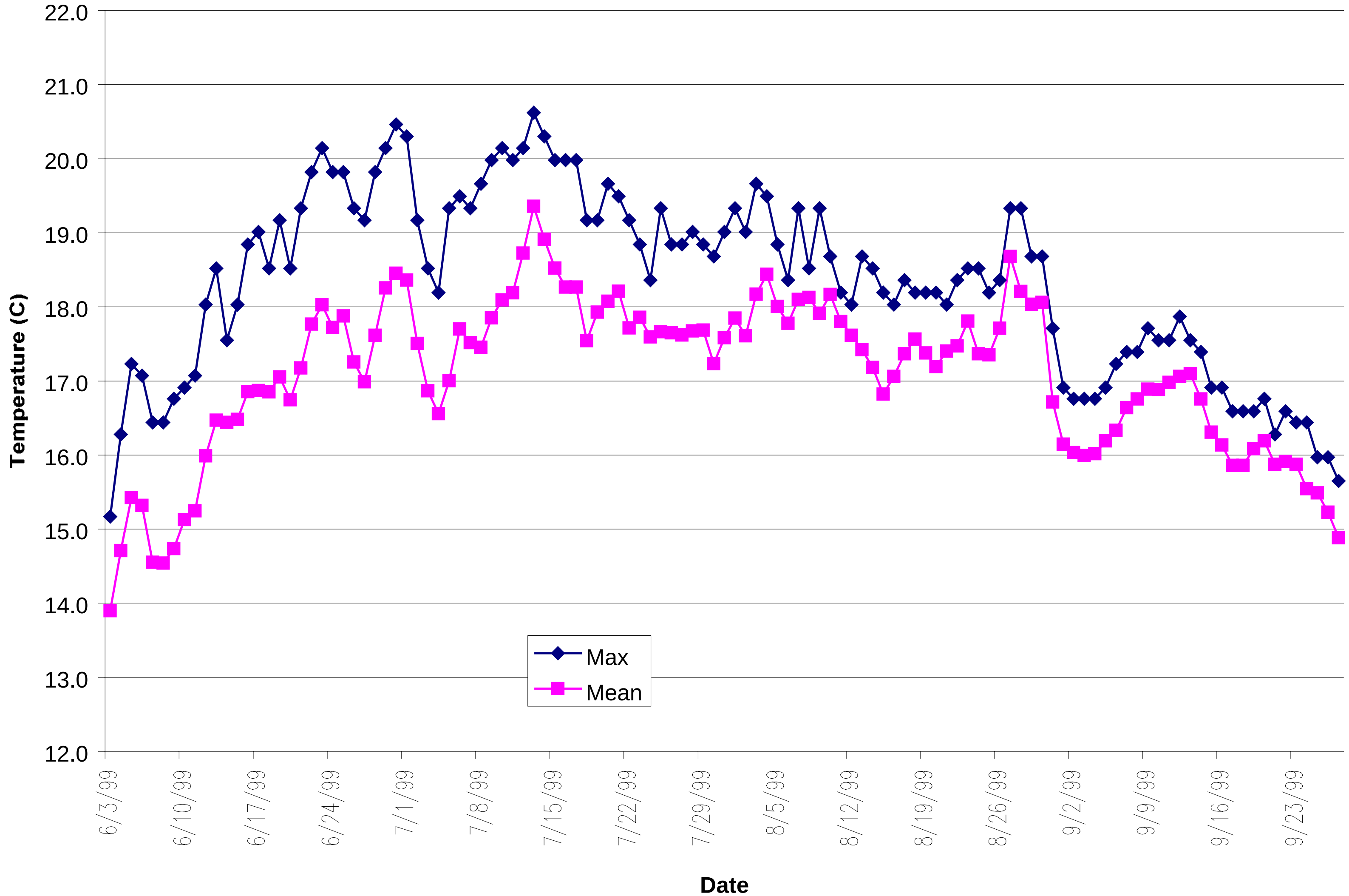


Figure 91. Mean and Maximum Daily Stream Temperatures During Summer 1999 at John Smith Creek (Site 81-2), Mendocino County, California.

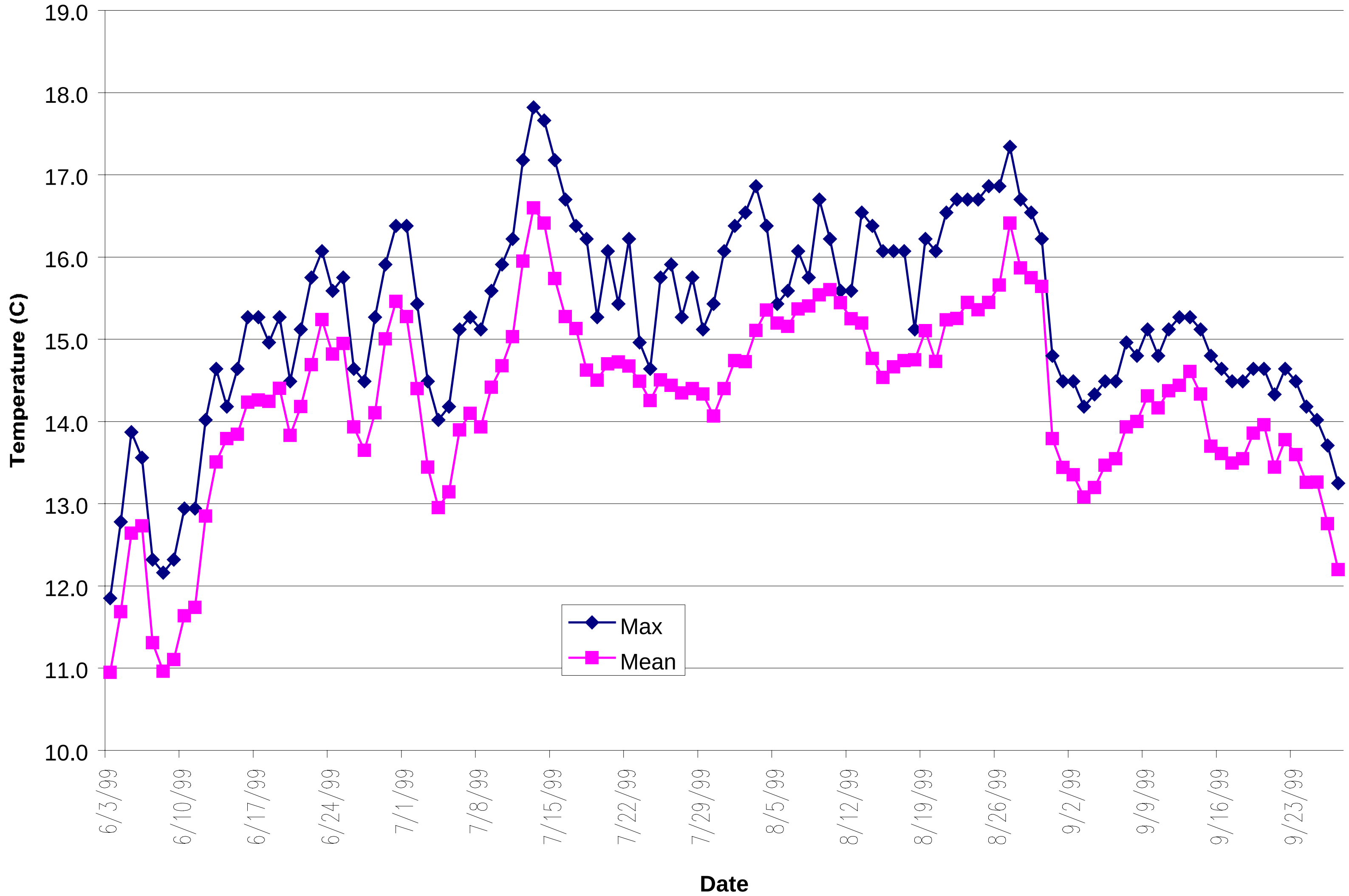


Figure 93. Mean and Maximum Daily Stream Temperatures During Summer 1999 at North Branch North Fork Navarro River (Site 81-3), Mendocino County, California.

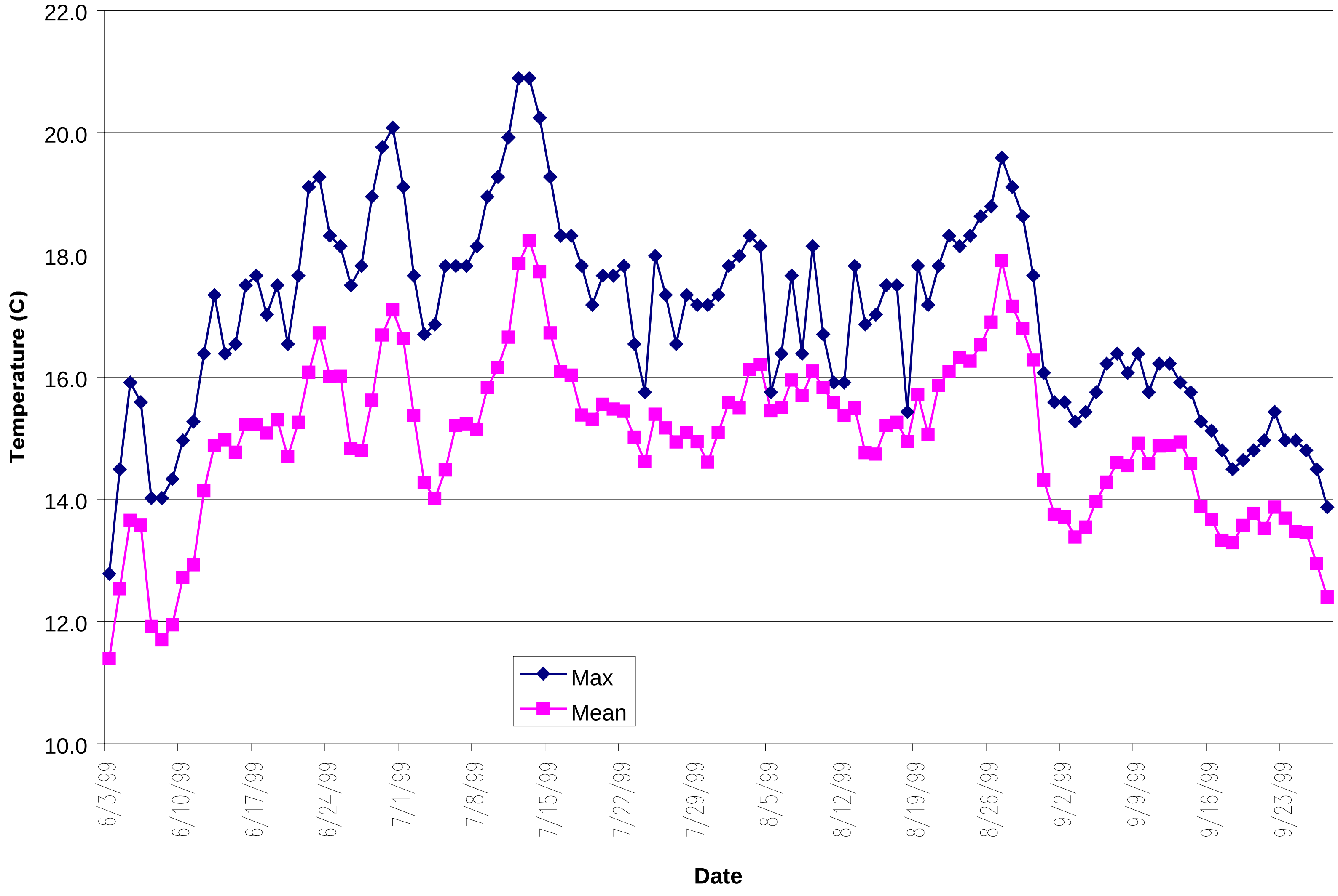


Figure 95. Mean and Maximum Daily Stream Temperatures During Summer 1999 at Marsh Gulch (Site 82-1), Mendocino County, California.

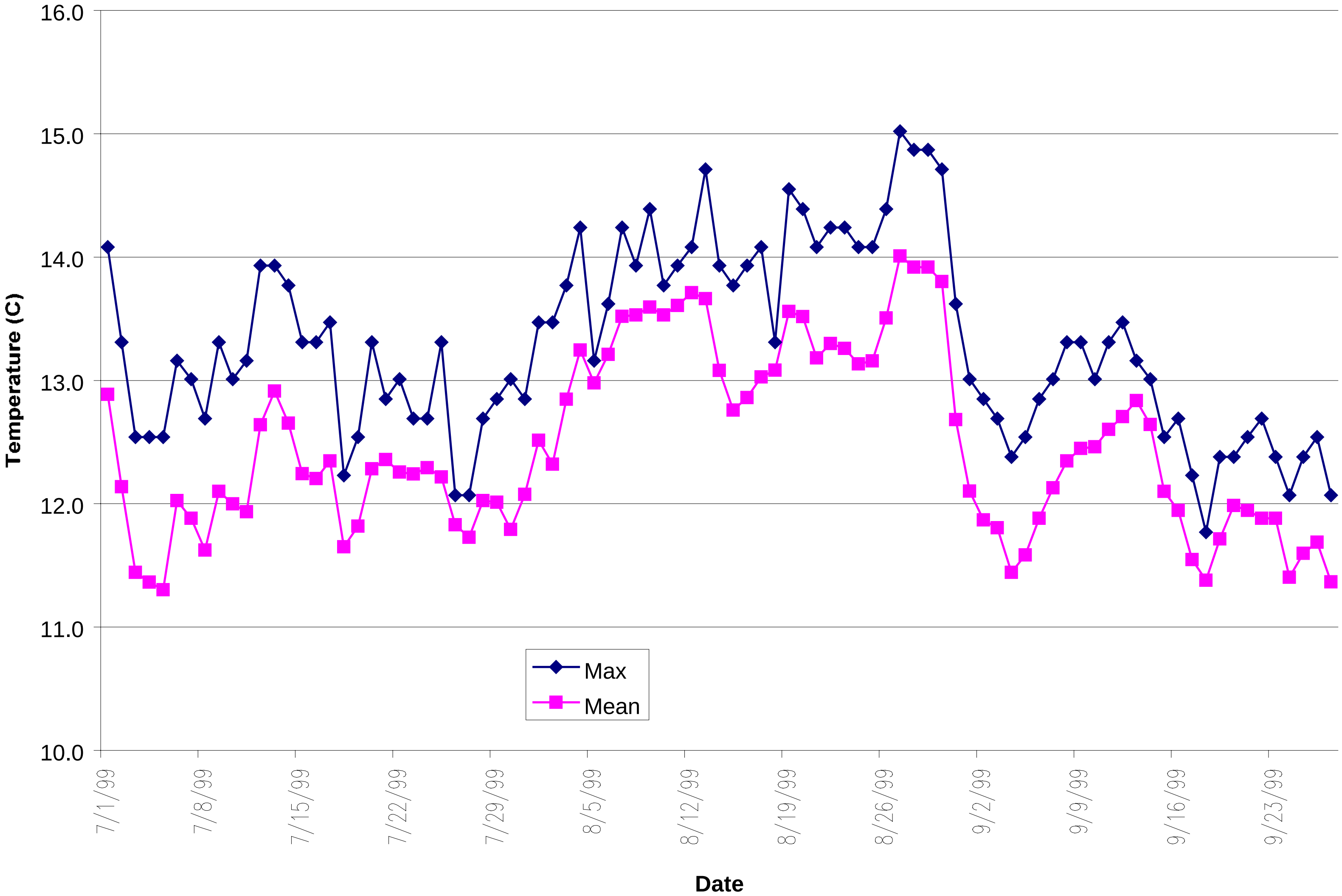


Figure 98. Mean and Maximum Daily Stream Temperatures During Summer 1999 at Flynn Creek (Site 82-2), Mendocino County, California.

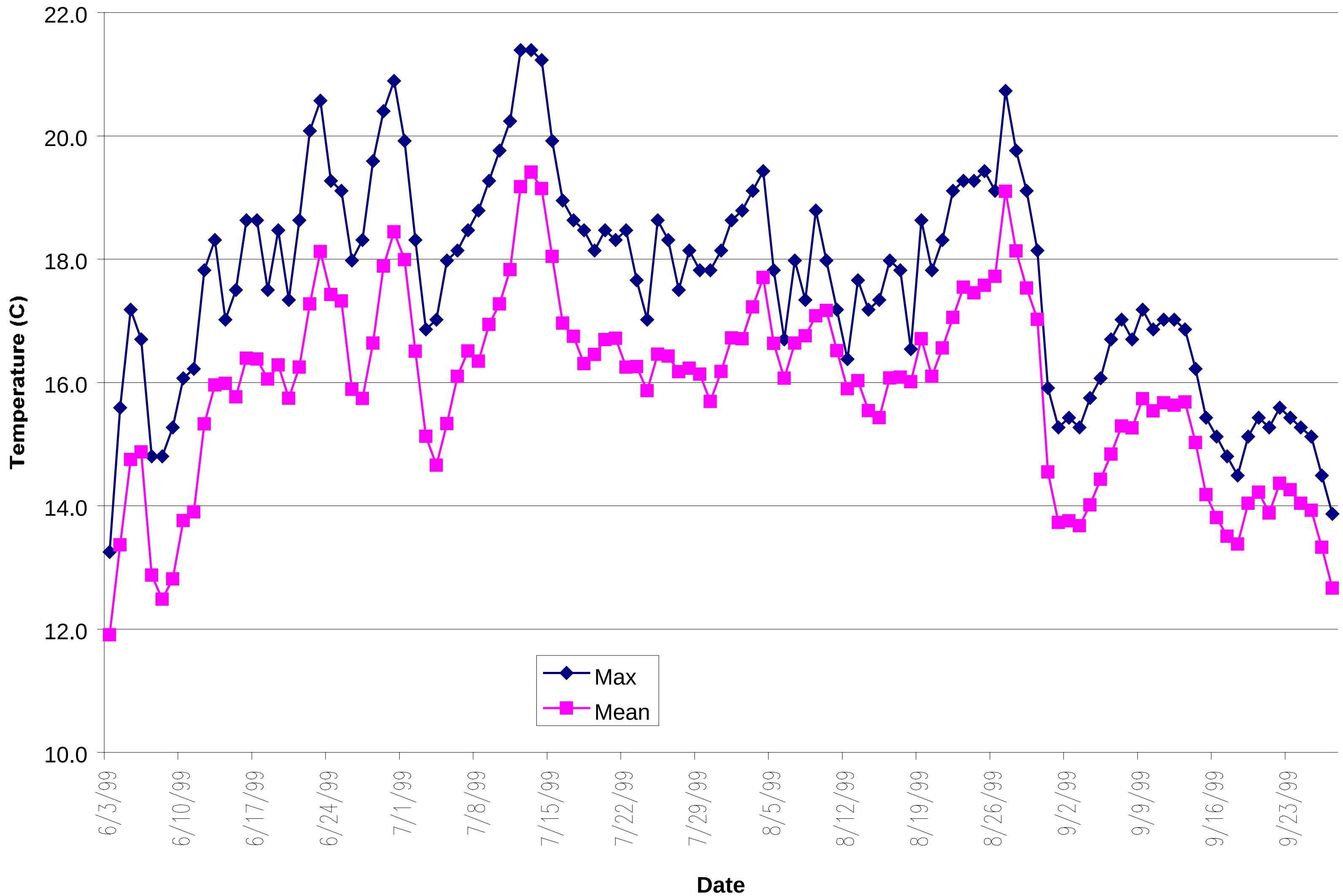


Figure 100. Mean and Maximum Daily Stream Temperatures During Summer 1999 at Navarro River (Site 82-3), Mendocino County, California.

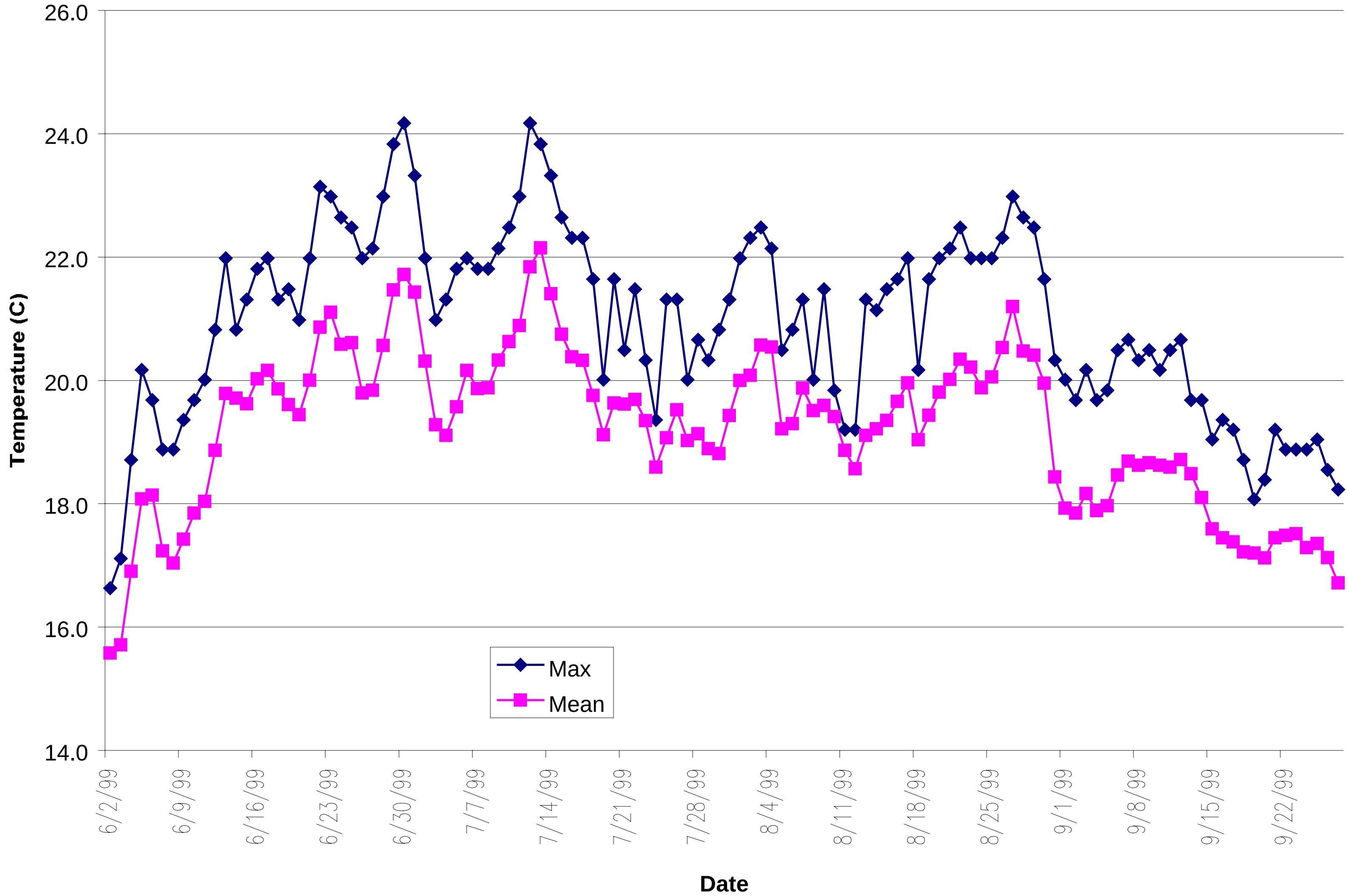


Figure 104. Mean and Maximum Daily Stream Temperatures During Summer 1999 at South Branch South Fork Navarro River (Site 85-2), Mendocino County, California.

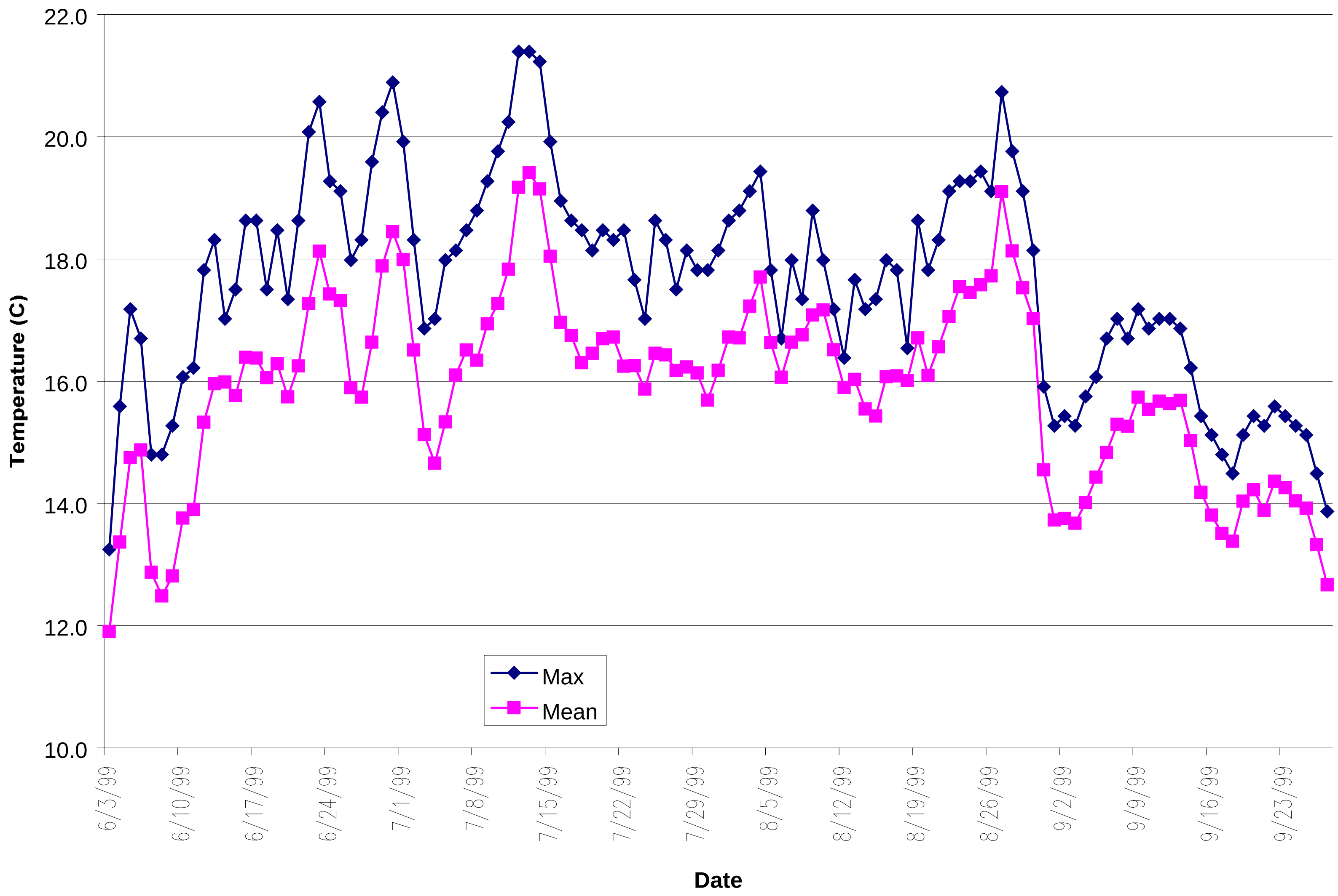


Figure 102. Mean and Maximum Daily Stream Temperatures During Summer 1999 at South Branch South Fork Navarro River (Site 85-1), Mendocino County, California.

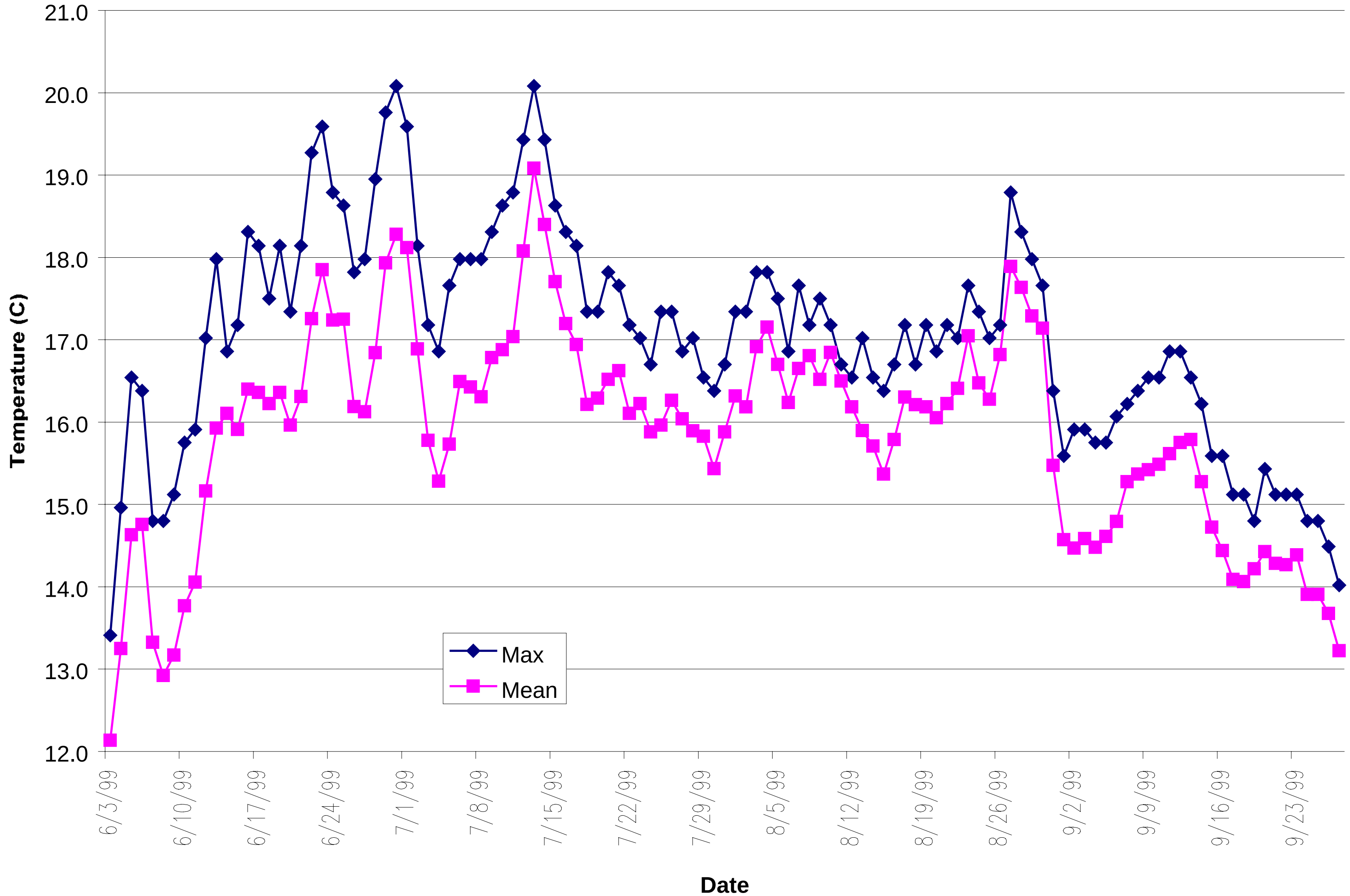


Figure 107. Mean and Maximum Daily Stream Temperatures During Summer 1999 at North Fork Indian Creek (Site 86-2), Mendocino County, California.

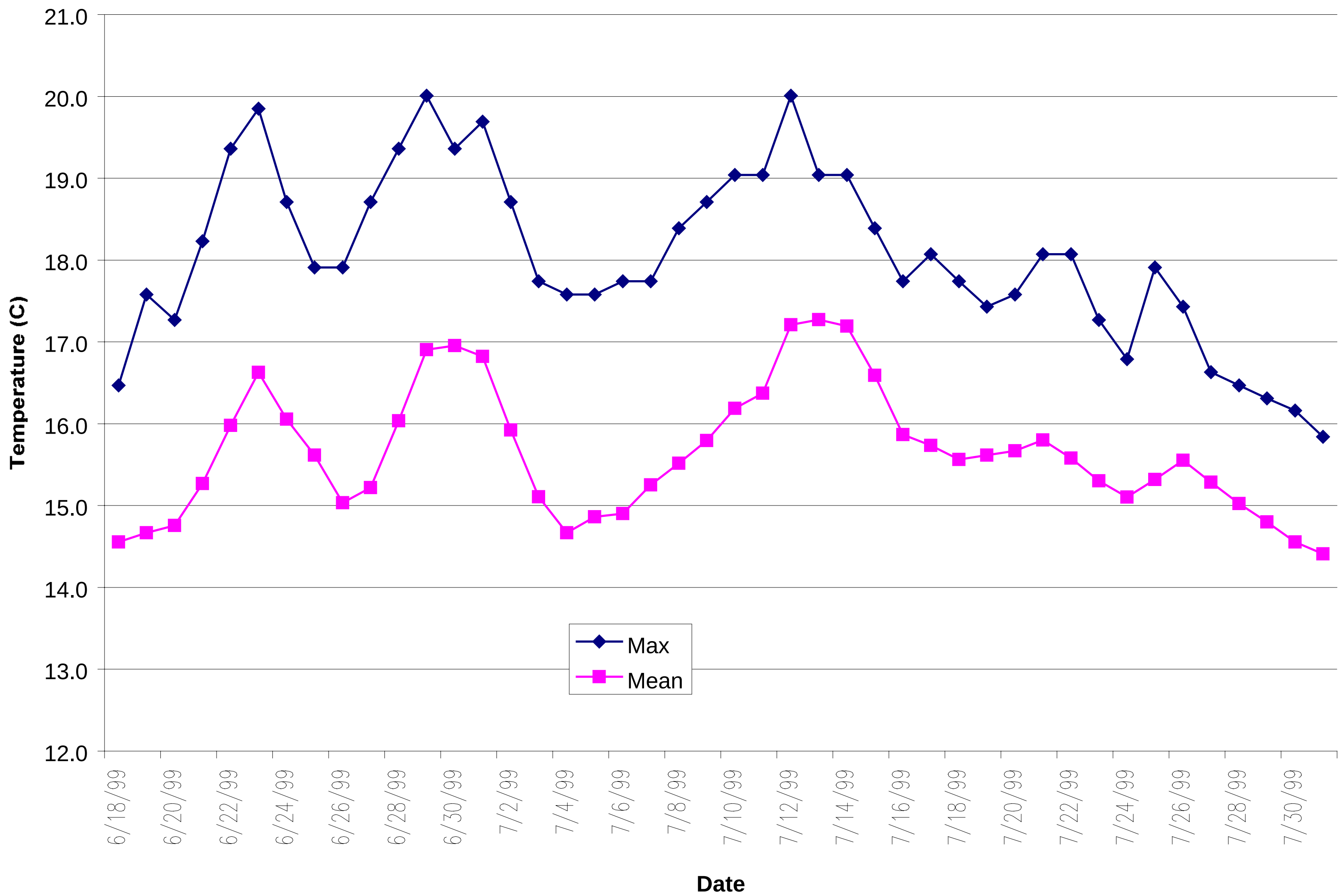


Figure 109. Mean and Maximum Daily Stream Temperatures During Summer 1999 at Navarro River (Site 88-1), Mendocino County, California.

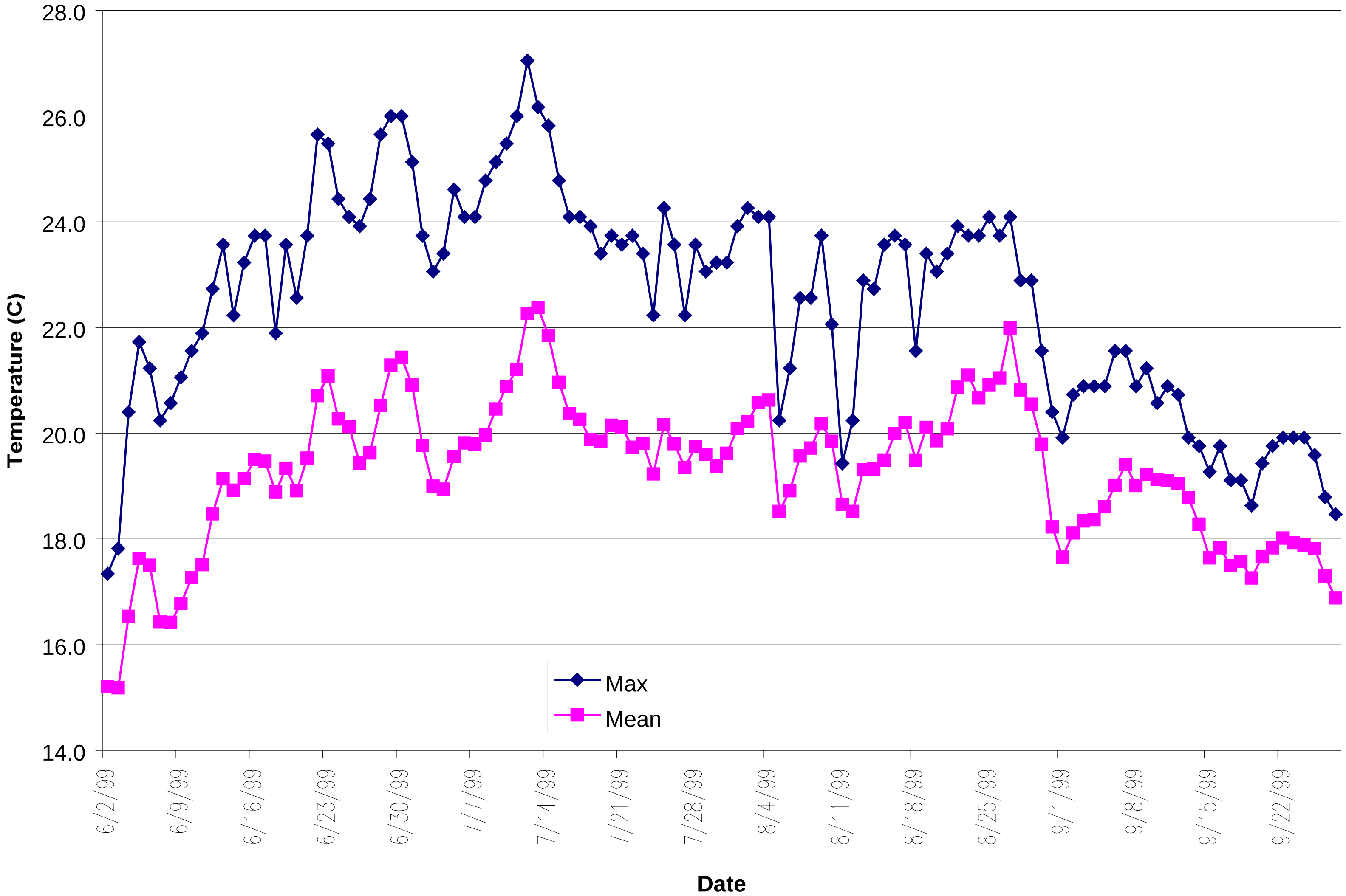


Figure 99. Mean and Maximum Daily Stream Temperatures During Summer 2000 at Flynn Creek (Site 82-2), Mendocino County, California.

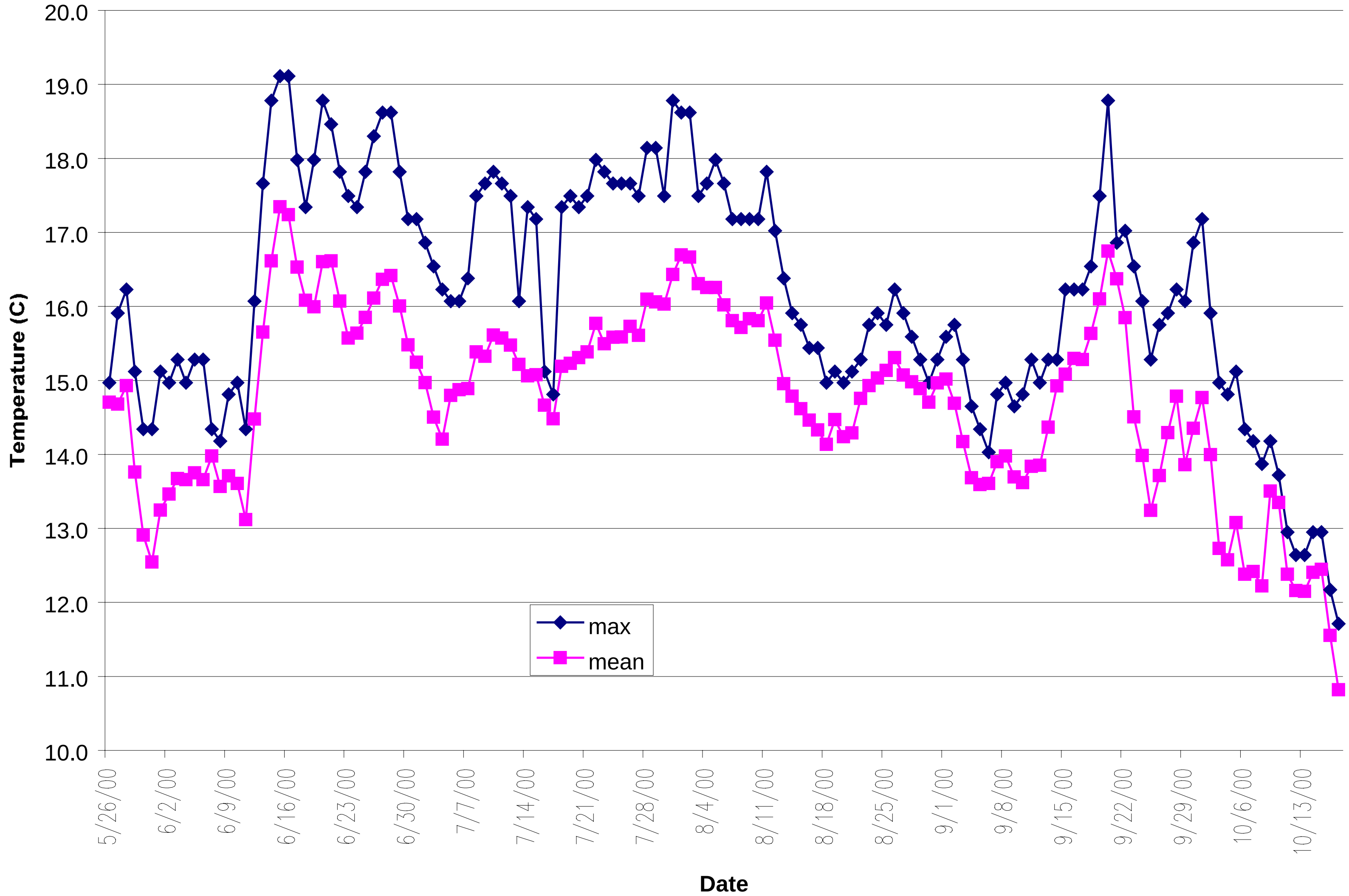


Figure 92. Mean and Maximum Daily Stream Temperatures During Summer 2000 at John Smith Creek (Site 81-2), Mendocino County, California.

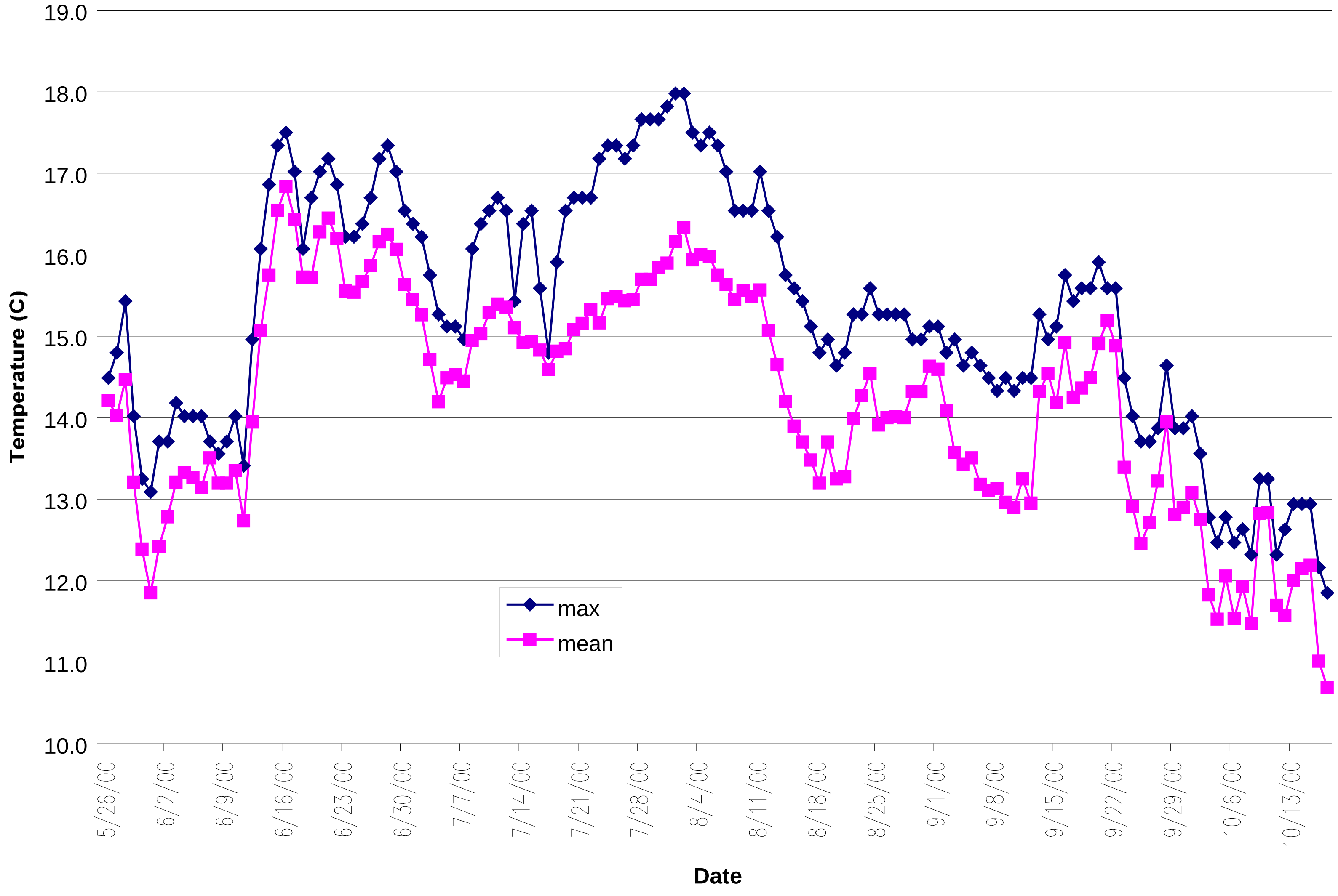


Figure 96. Mean and Maximum Daily Stream Temperatures During Summer 2000 at Marsh Gulch (Site 82-1), Mendocino County, California.

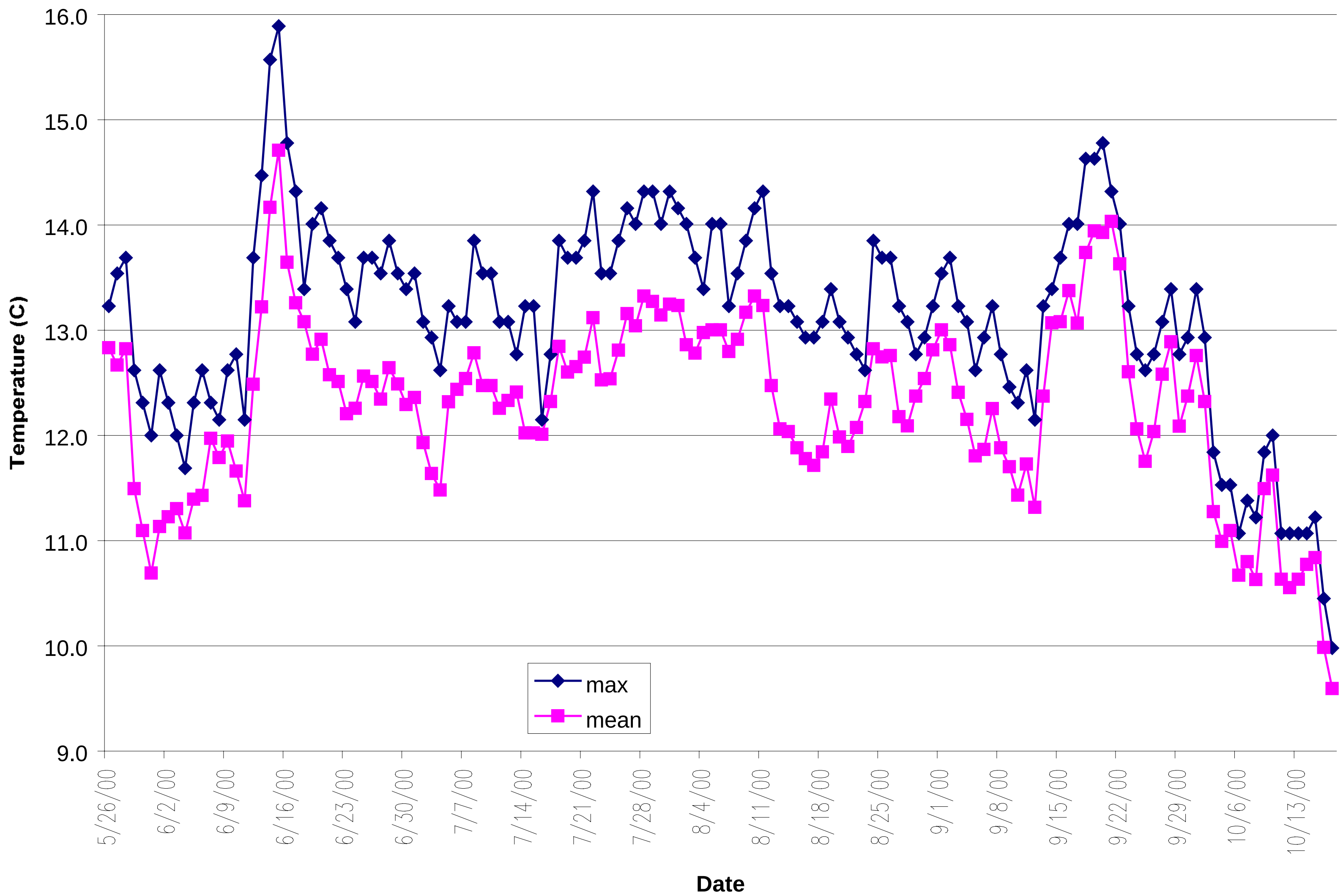


Figure 101. Mean and Maximum Daily Stream Temperatures During Summer 2000 at Navarro River (Site 82-3), Mendocino County, California.

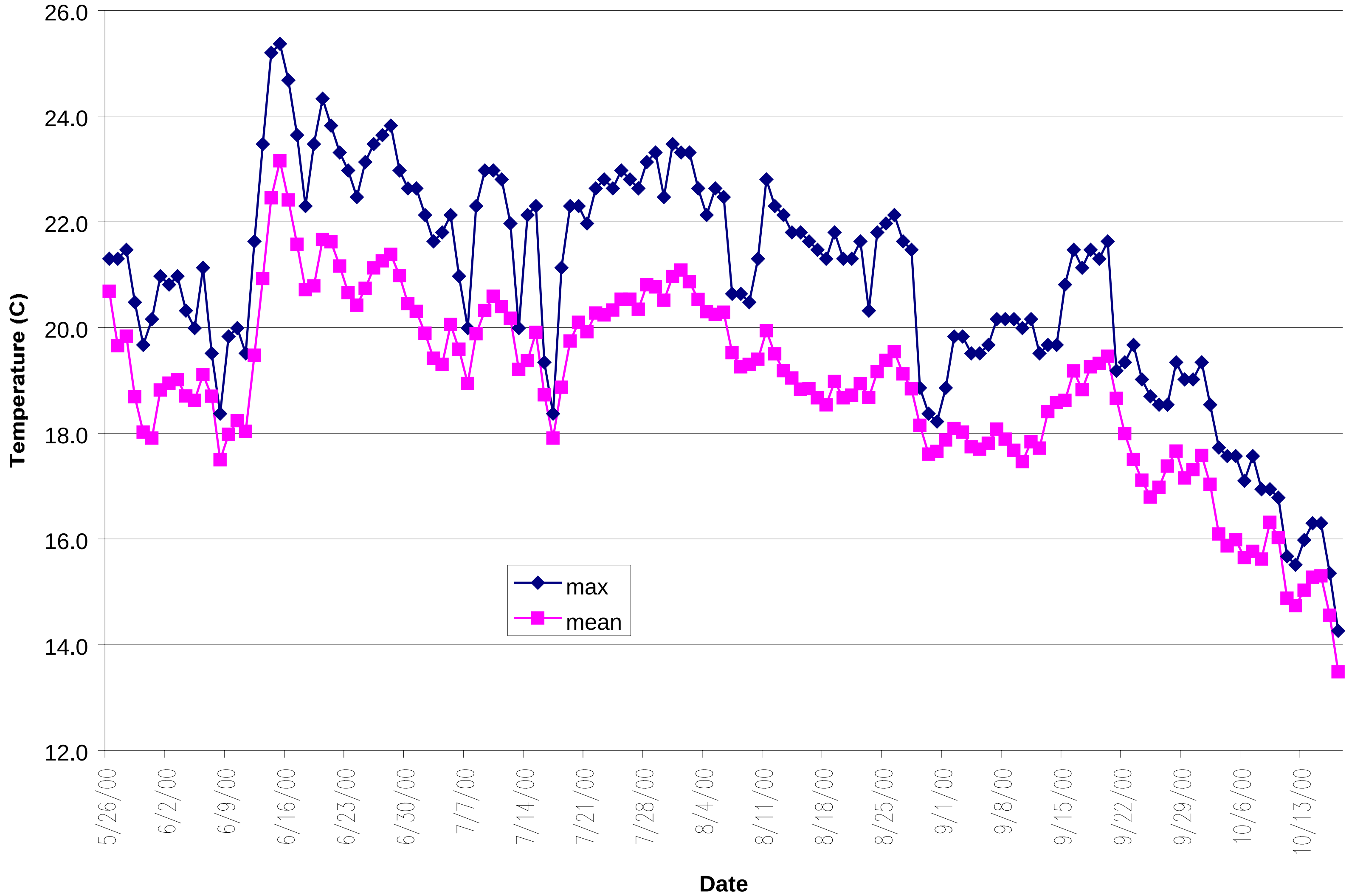


Figure 110. Mean and Maximum Daily Stream Temperatures During Summer 2000 at Navarro River (Site 88-1), Mendocino County, California.

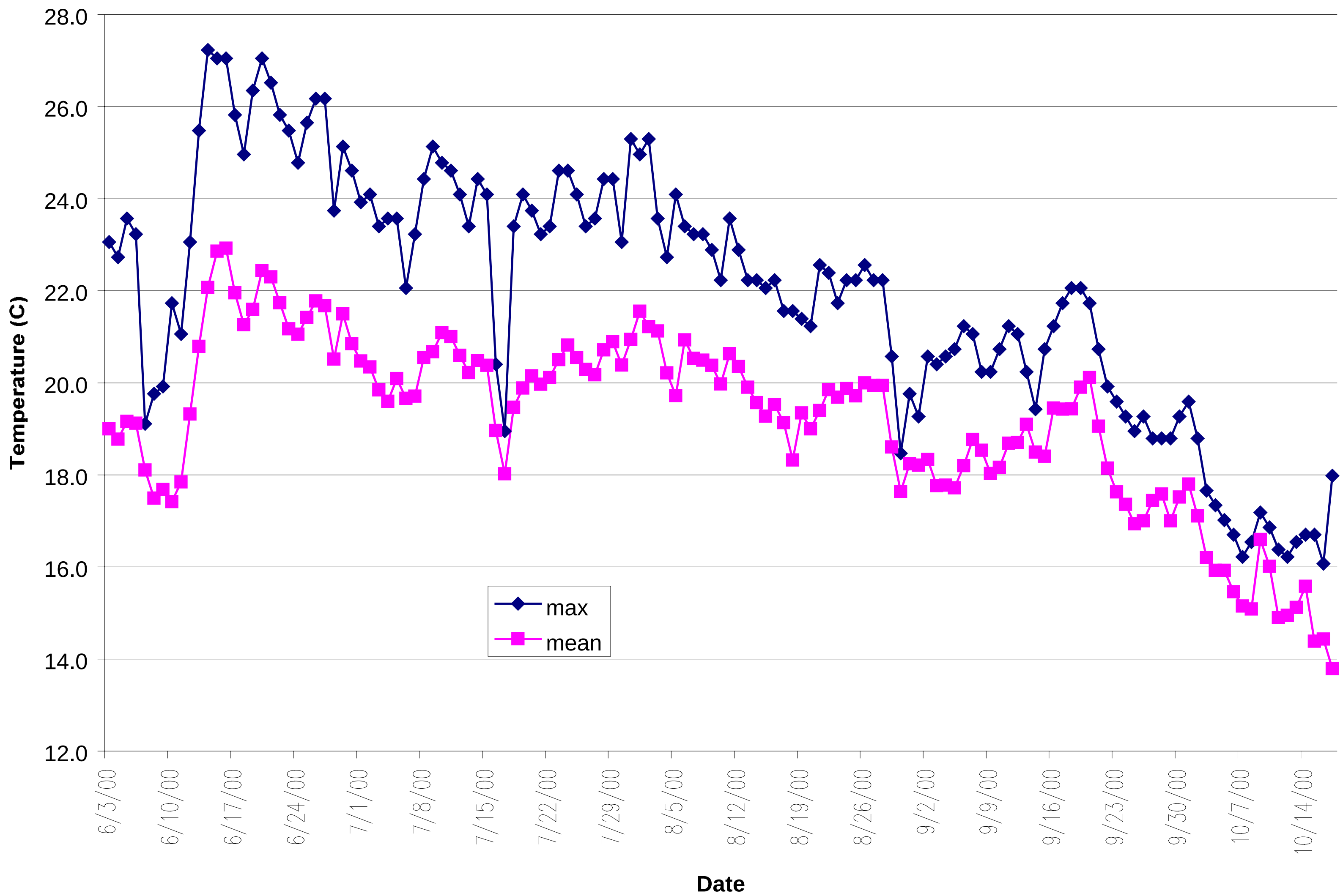


Figure 89. Mean and Maximum Daily Stream Temperatures During Summer 2000 at North Branch North Fork Navarro River (Site 81-1), Mendocino County, California.

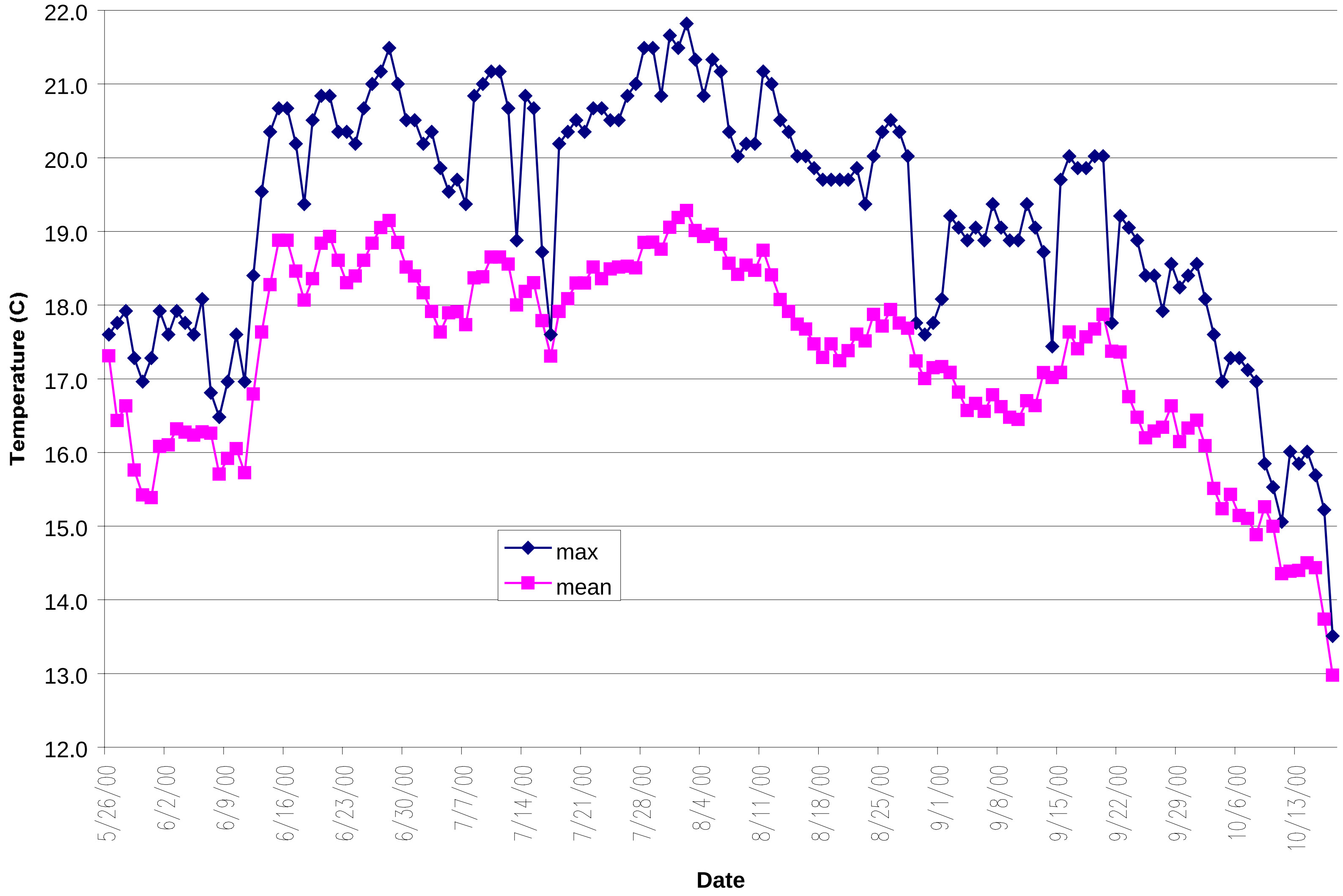


Figure 94. Mean and Maximum Daily Stream Temperatures During Summer 2000 at North Branch North Fork Navarro River (Site 81-3), Mendocino County, California.

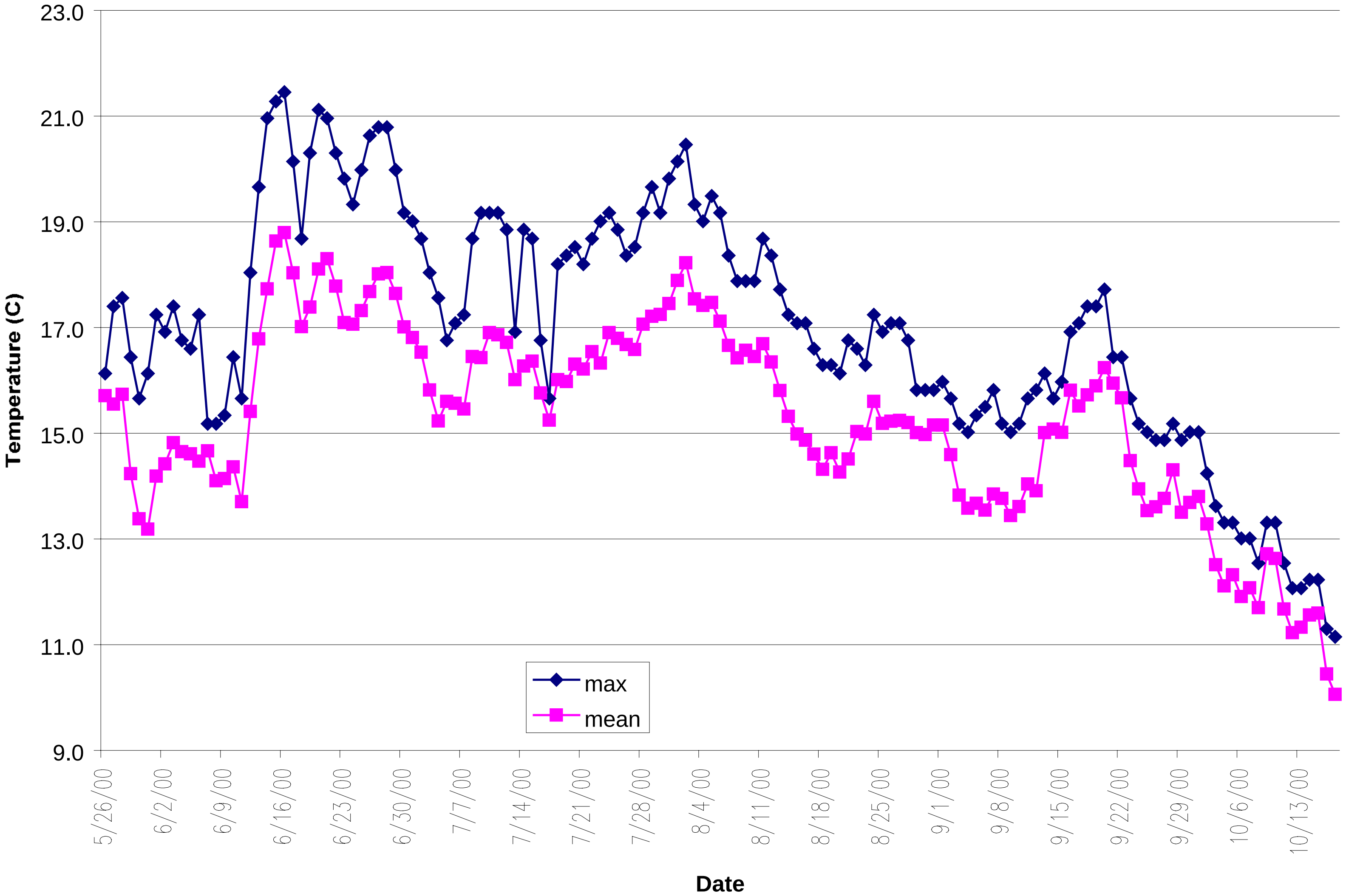


Figure 106. Mean and Maximum Daily Stream Temperatures During Summer 2000 at North Fork Indian Creek (Site 86-1), Mendocino County, California.

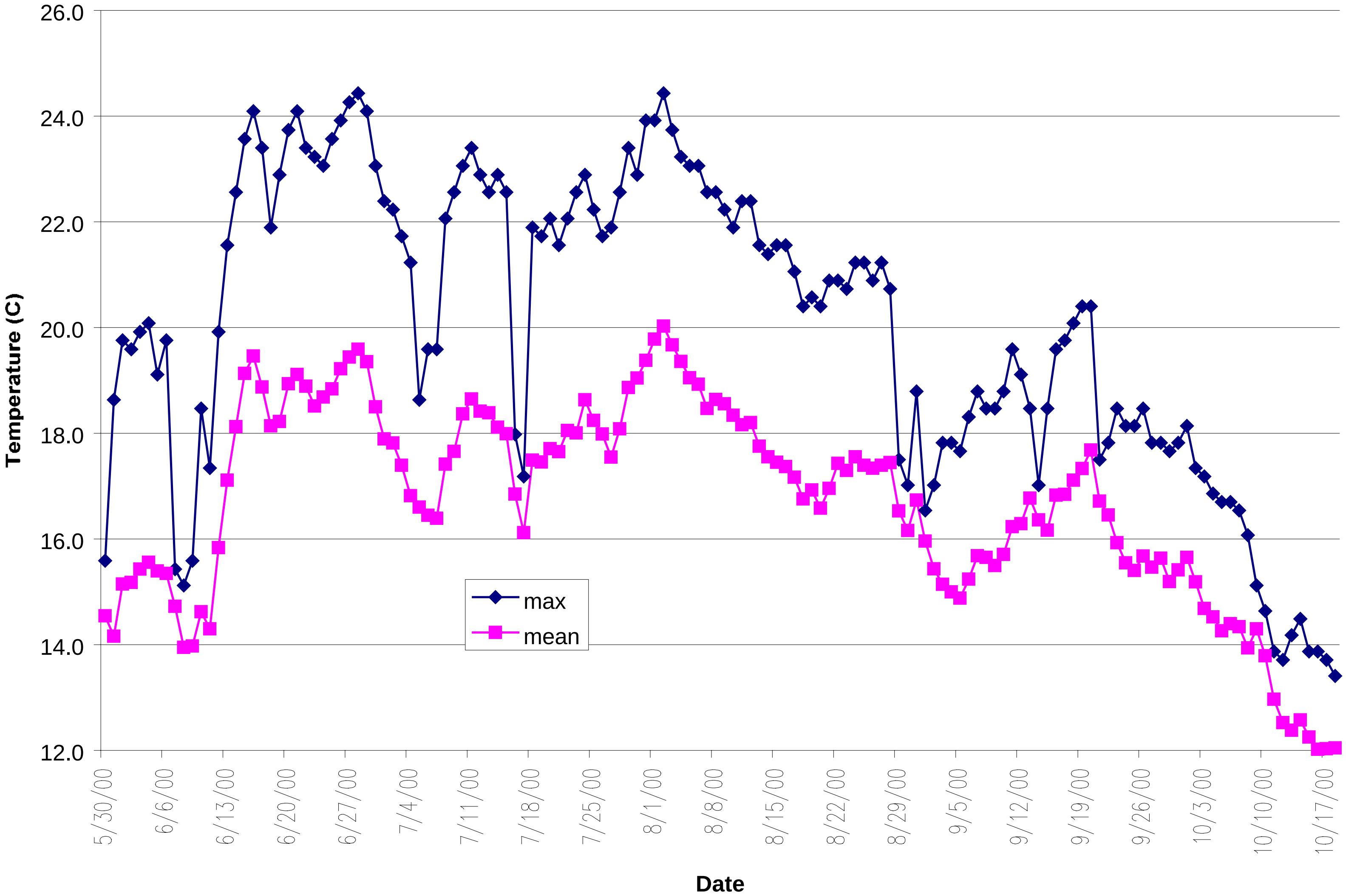


Figure 108. Mean and Maximum Daily Stream Temperatures During Summer 2000 at North Fork Indian Creek (Site 86-2), Mendocino County, California.

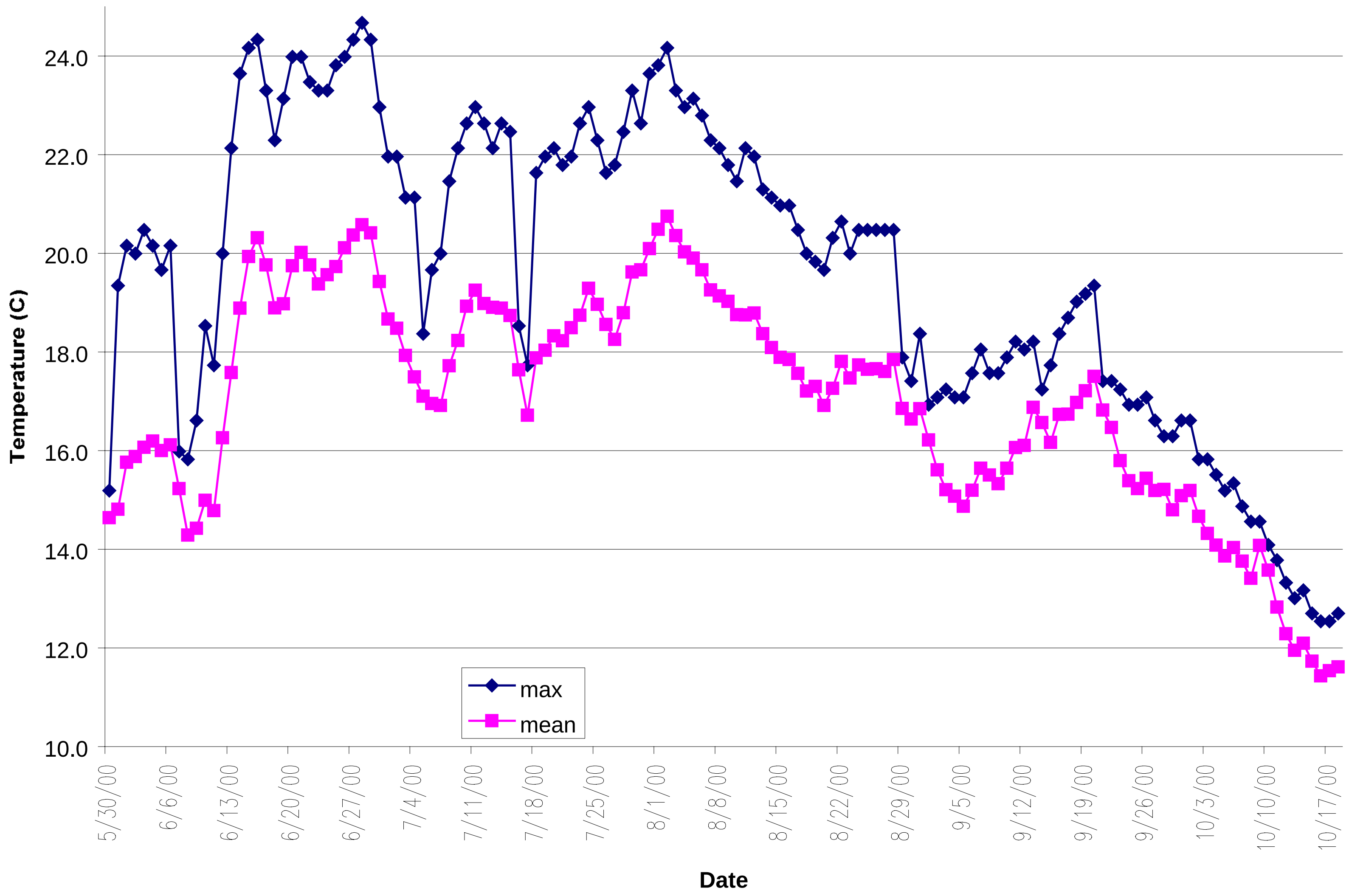


Figure 105. Mean and Maximum Daily Stream Temperatures During Summer 2000 at South Branch South Fork Navarro River (Site 85-2), Mendocino County, California.

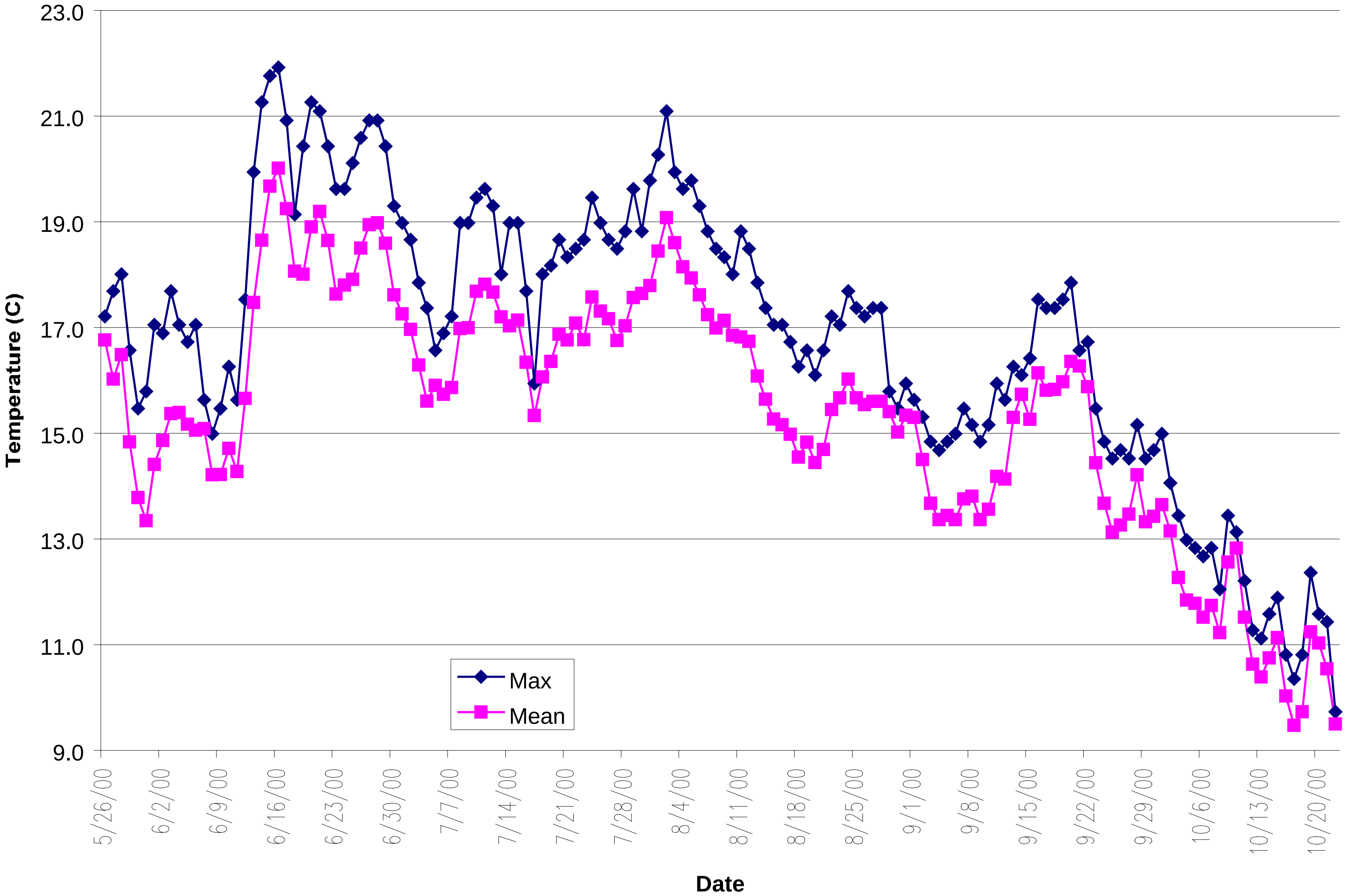
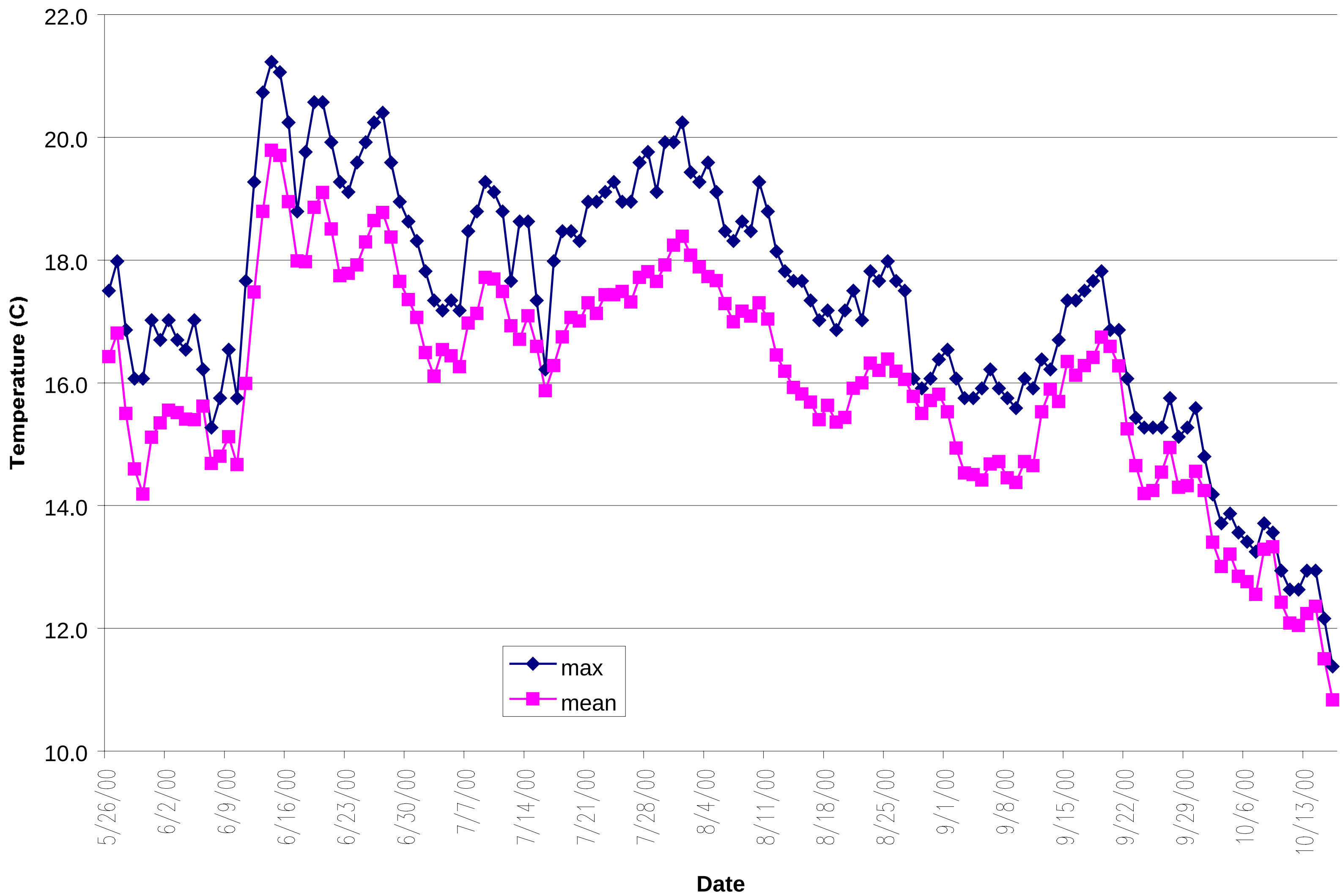
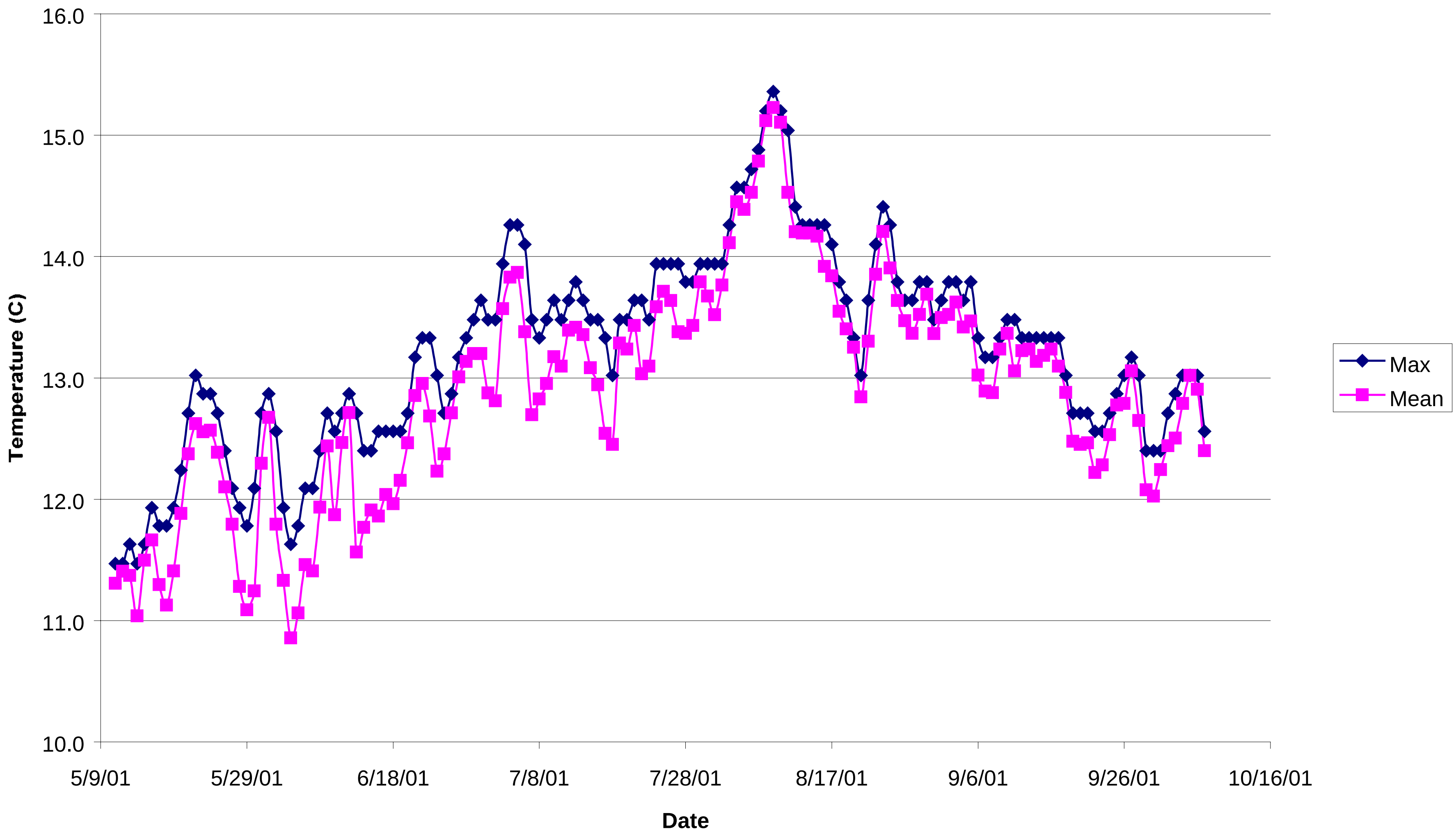


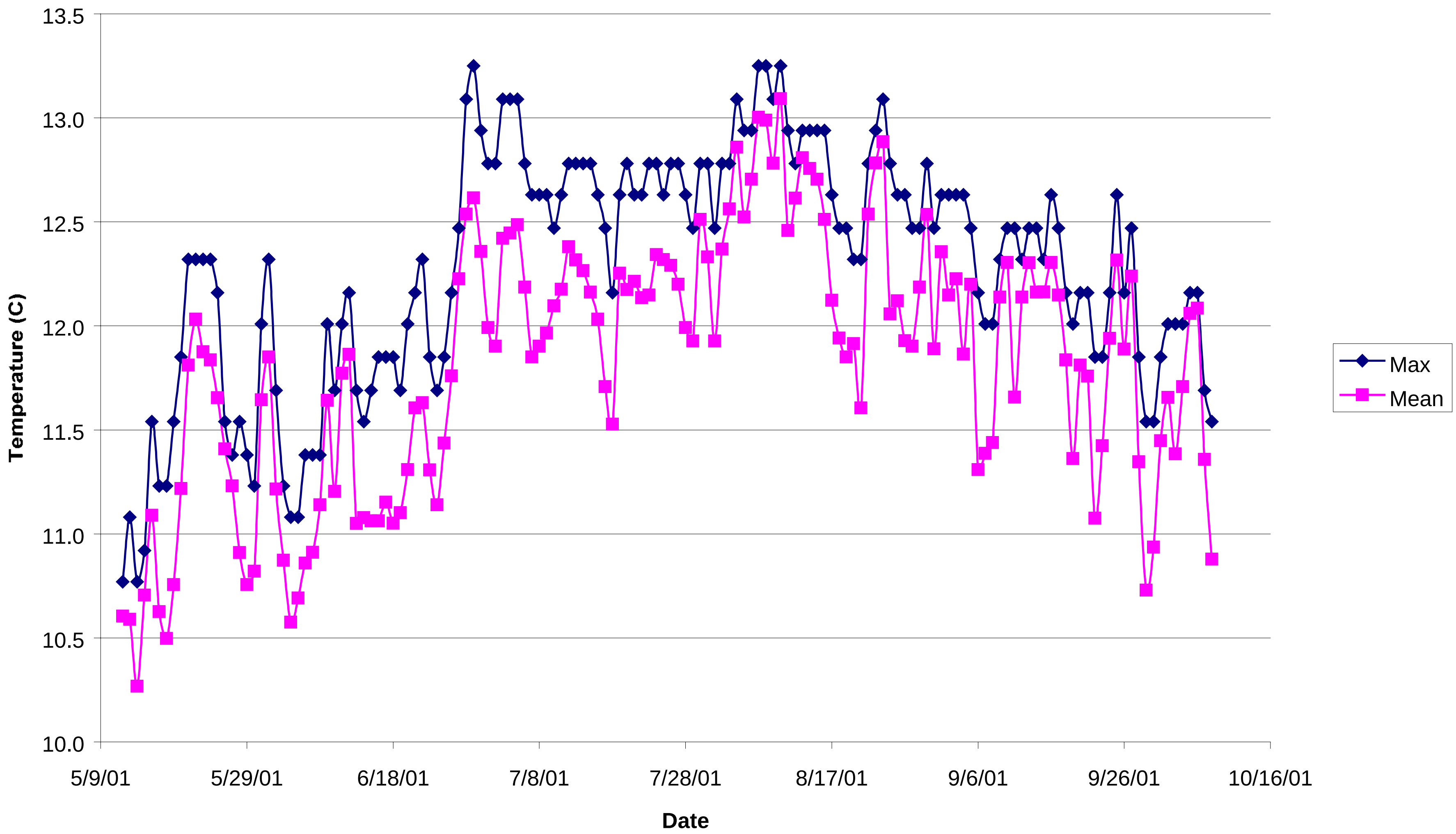
Figure 103. Mean and Maximum Daily Stream Temperatures During Summer 2000 at South Branch South Fork Navarro River (Site 85-1), Mendocino County, California.



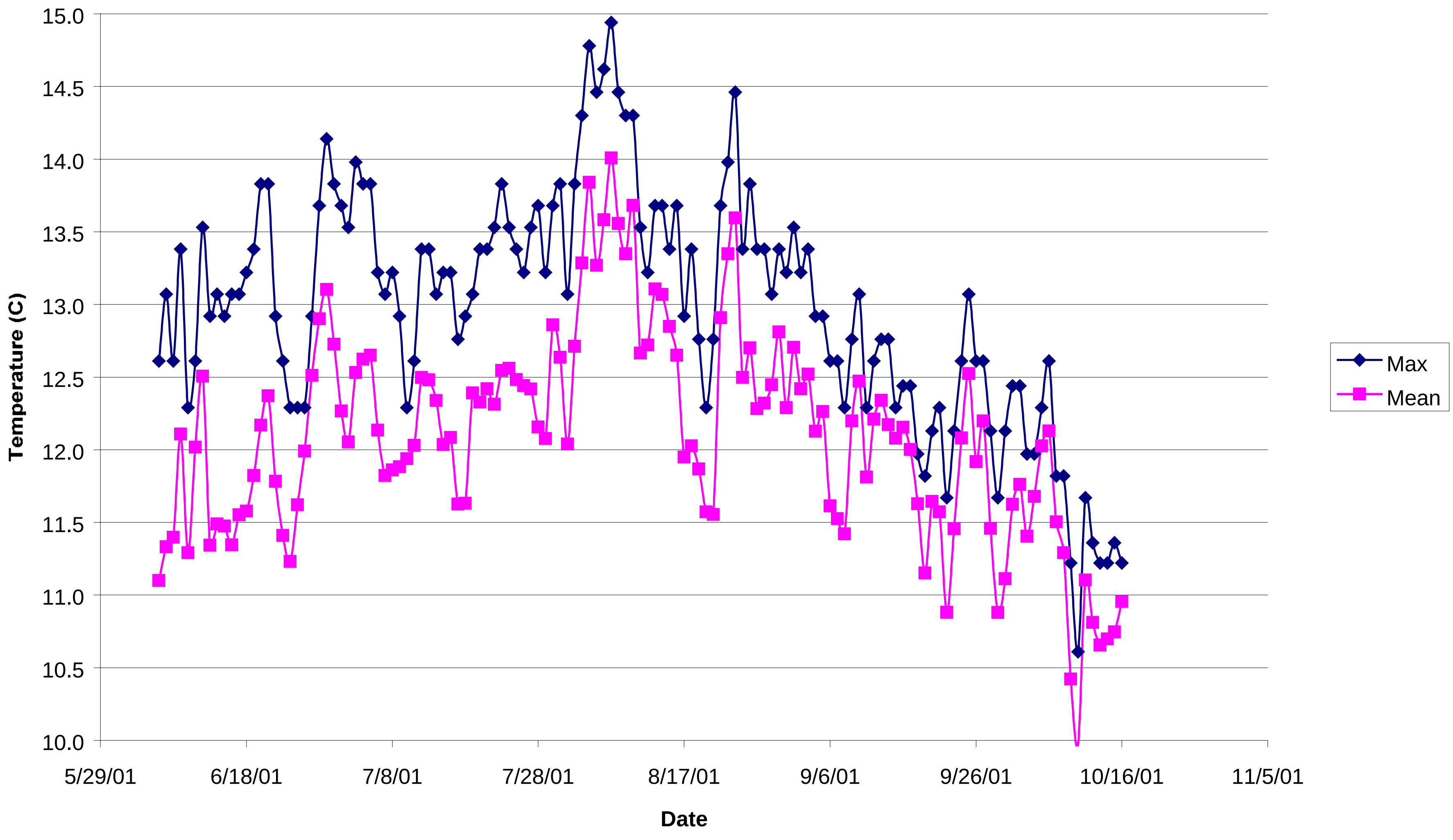
Mean and Maximum Daily Stream Temperatures During Summer 2001 at Camp 16 Gulch (Site 82-8), Mendocino County, California.



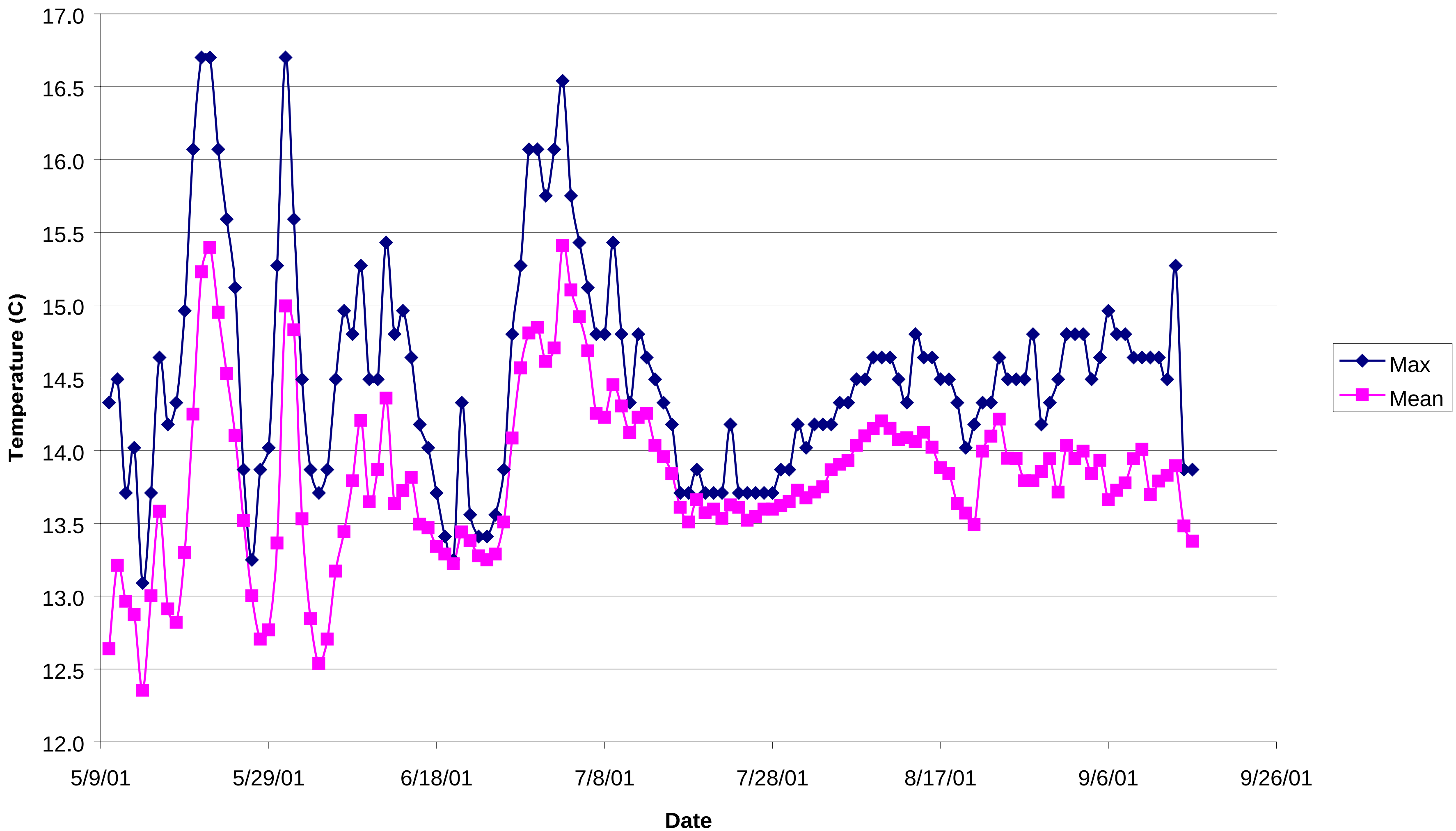
Mean and Maximum Daily Stream Temperatures During Summer 2001 at Deadhorse Gulch (Site 82-7), Mendocino County, California.



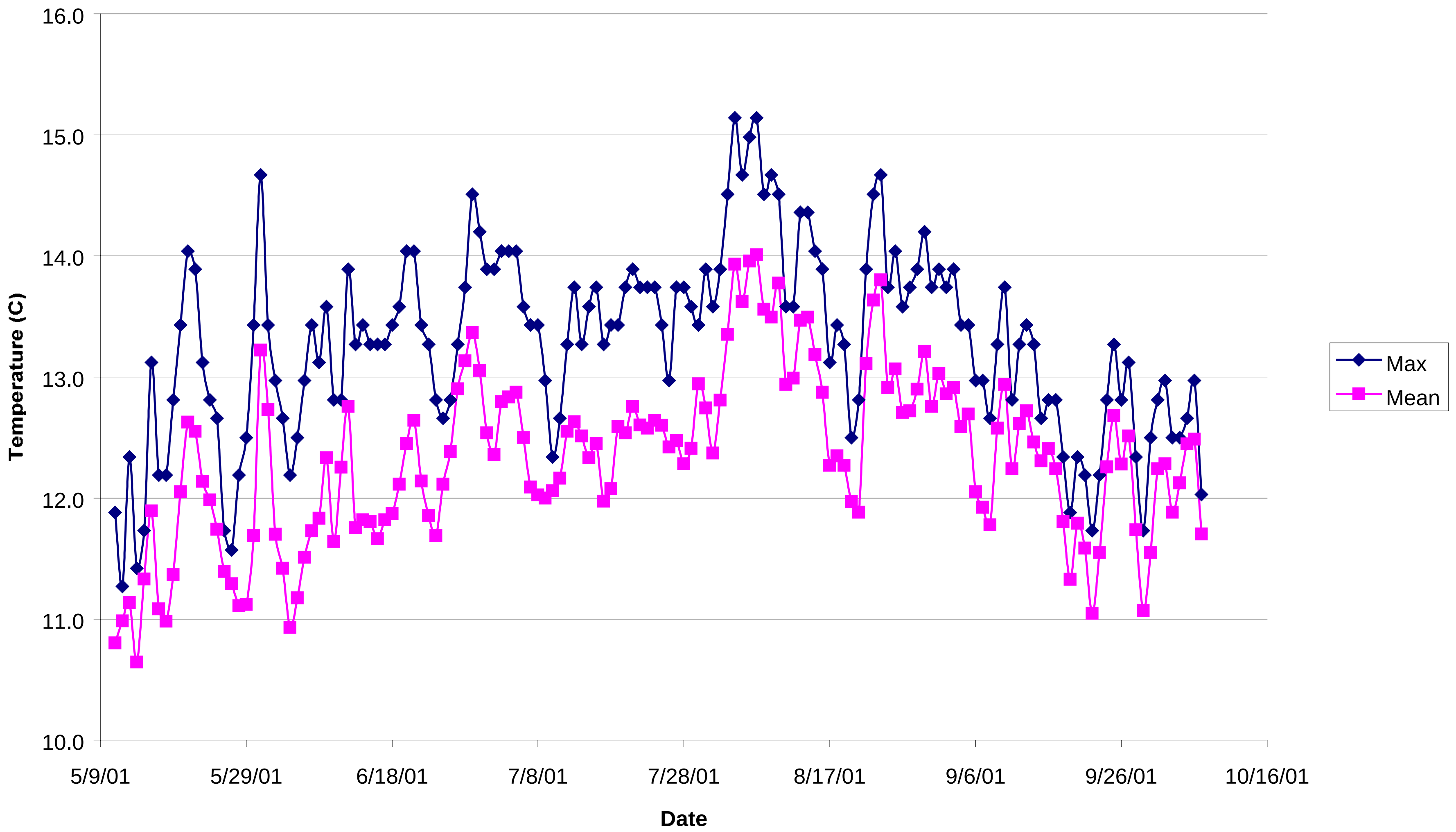
Mean and Maximum Daily Stream Temperatures During Summer 2001 at Flume Gulch (Site 82-9), Mendocino County, California.

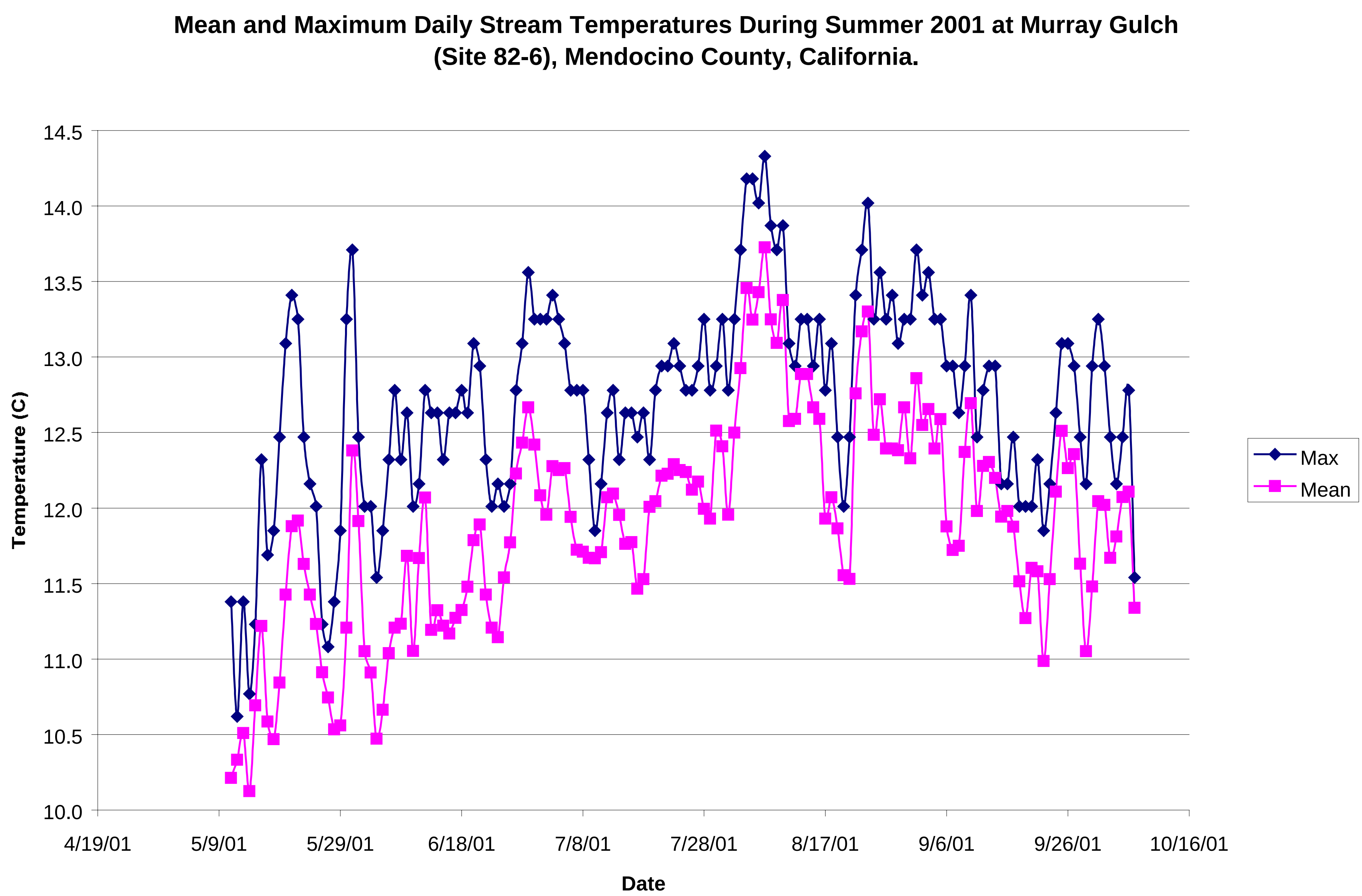


Mean and Maximum Daily Stream Temperatures During Summer 2001 at Flynn Creek (Site 82-2), Mendocino County, California.

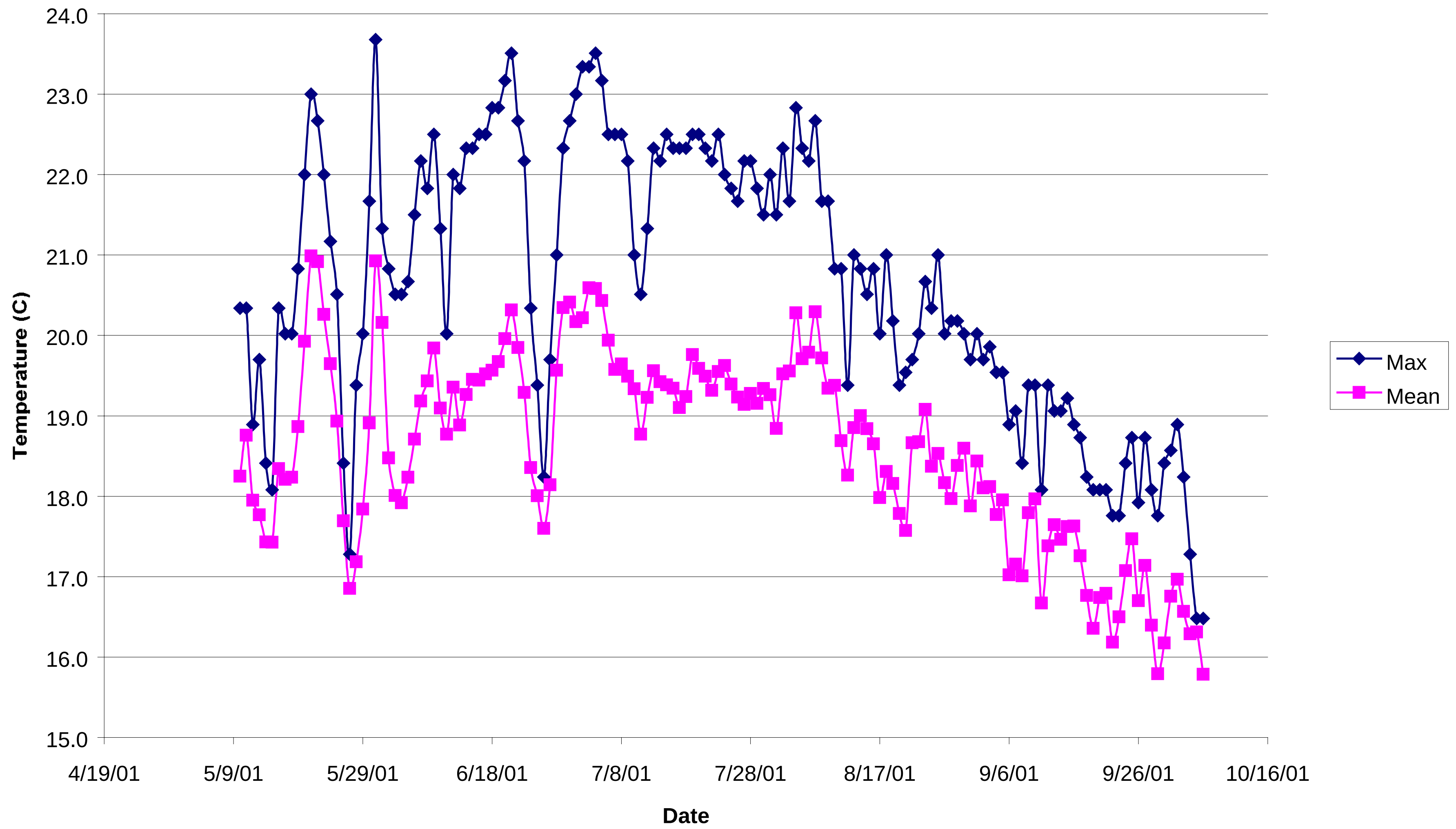


Mean and Maximum Daily Stream Temperatures During Summer 2001 at Marsh Gulch (Site 82-1), Mendocino County, California.

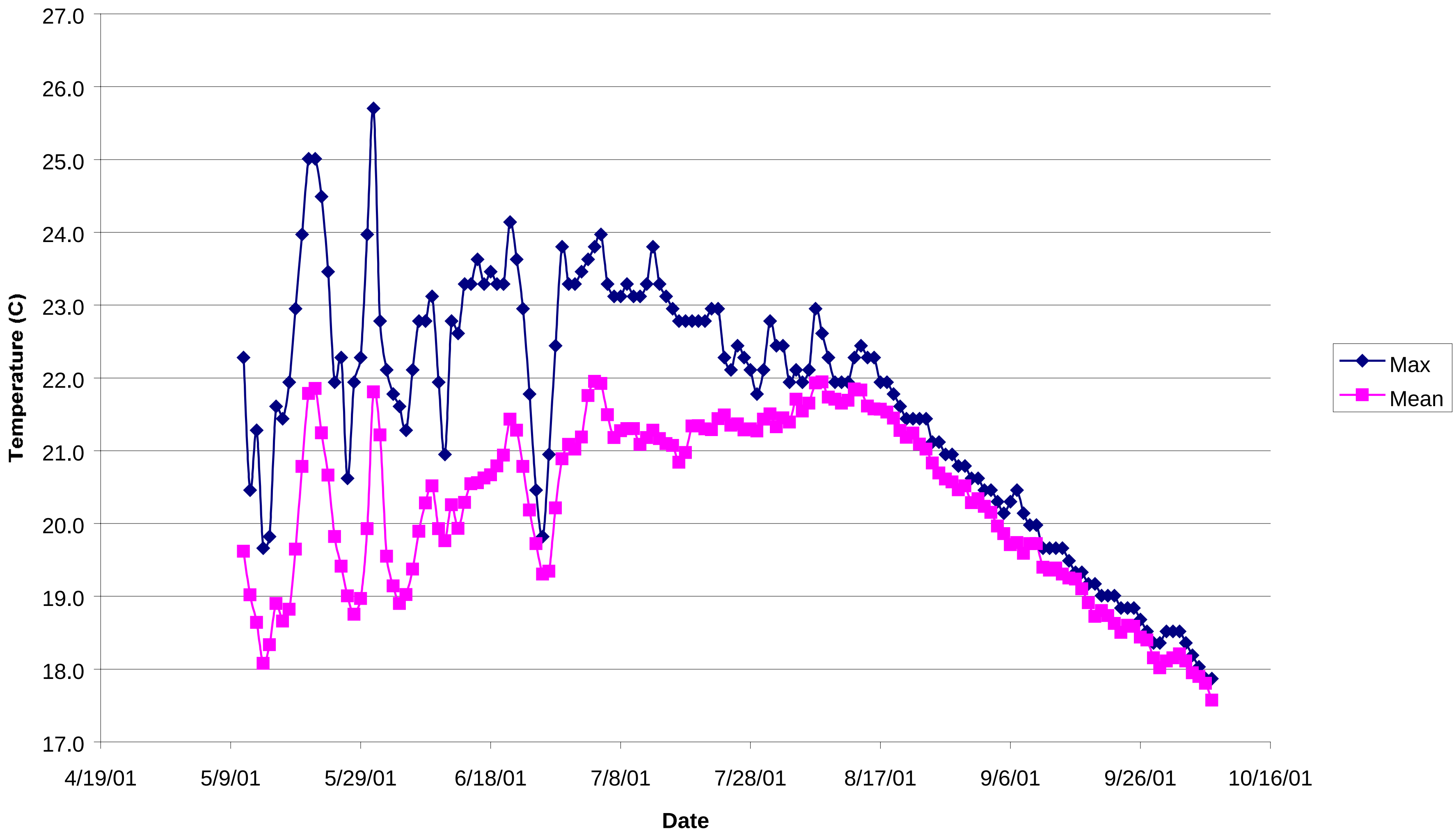


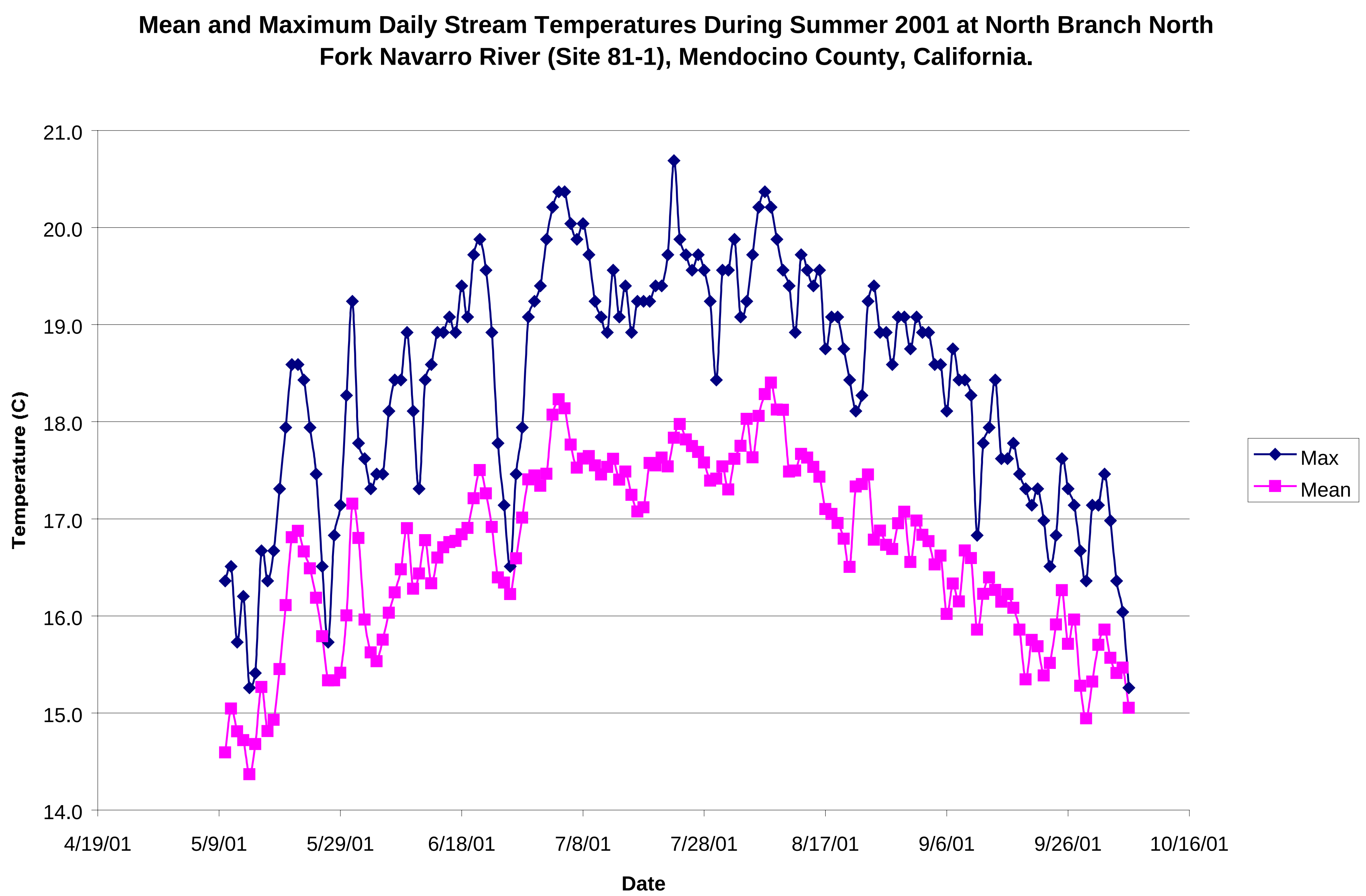

Mean and Maximum Daily Stream Temperatures During Summer 2001 at Murray Gulch (Site 82-6), Mendocino County, California.
Temperature (C)
14.5
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
4/19/01
5/9/01
5/29/01
6/18/01
7/8/01
7/28/01
8/17/01
9/6/01
9/26/01
10/16/01
Date
Max
Mean

Mean and Maximum Daily Stream Temperatures During Summer 2001 at Navarro River (Site 82-3), Mendocino County, California.

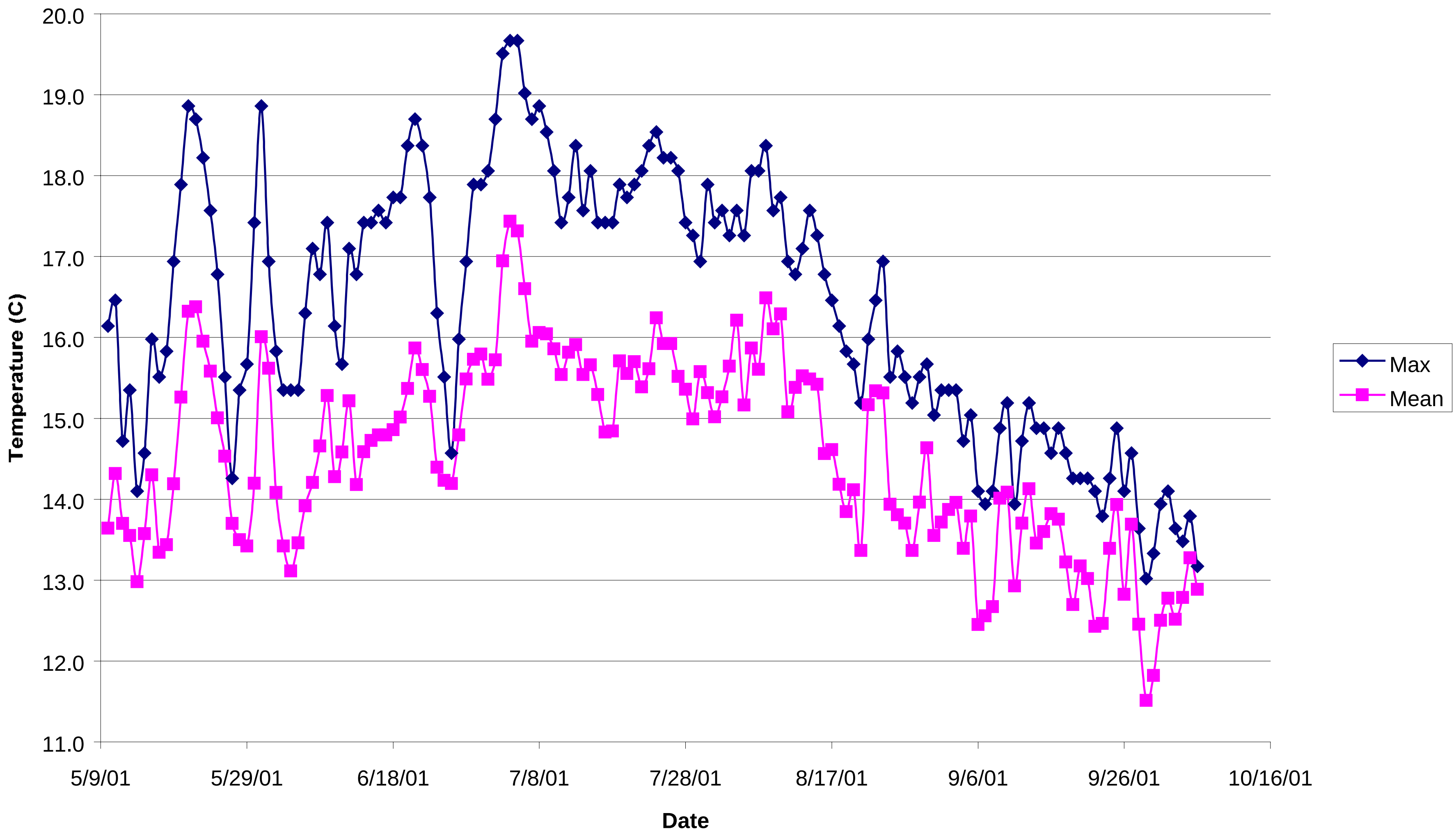


Mean and Maximum Daily Stream Temperatures During Summer 2001 at Navarro River (Site 82-5), Mendocino County, California.

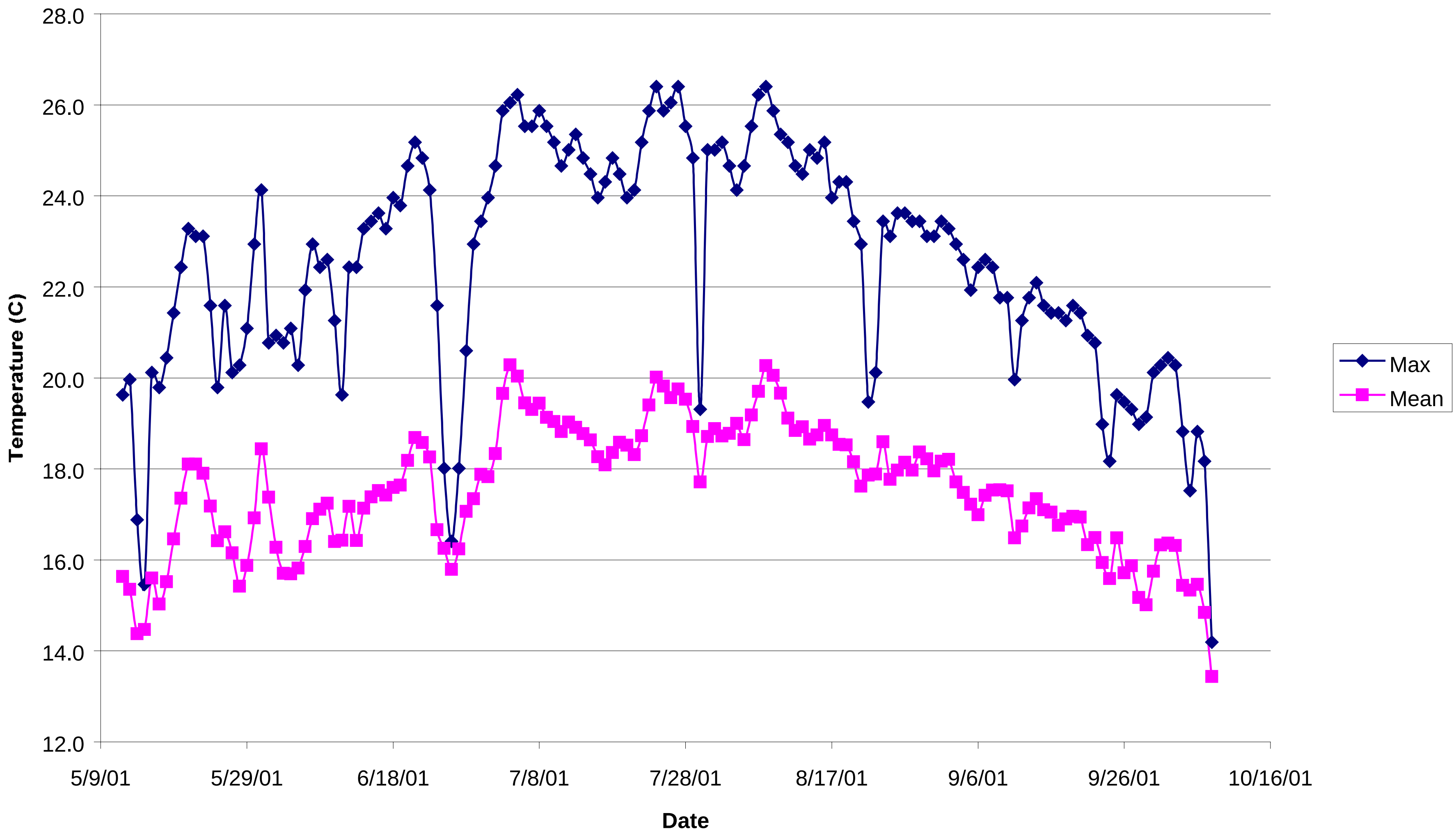


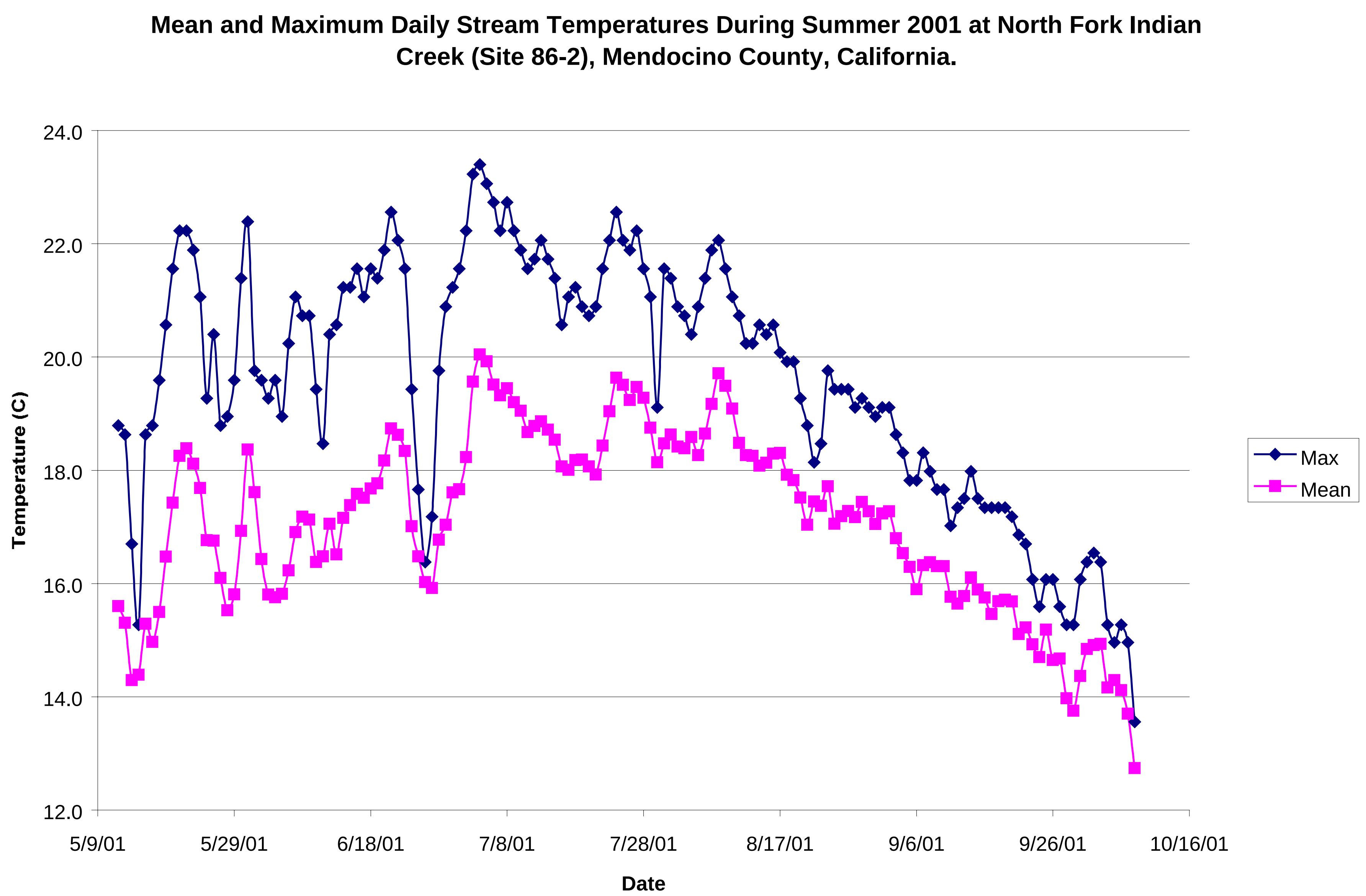

Mean and Maximum Daily Stream Temperatures During Summer 2001 at North Branch North Fork Navarro River (Site 81-1), Mendocino County, California.
Temperature (C)
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
4/19/01
5/9/01
5/29/01
6/18/01
7/8/01
7/28/01
8/17/01
9/6/01
9/26/01
10/16/01
Date
Max
Mean

Mean and Maximum Daily Stream Temperatures During Summer 2001 at North Branch North Fork Navarro River (Site 81-3), Mendocino County, California.

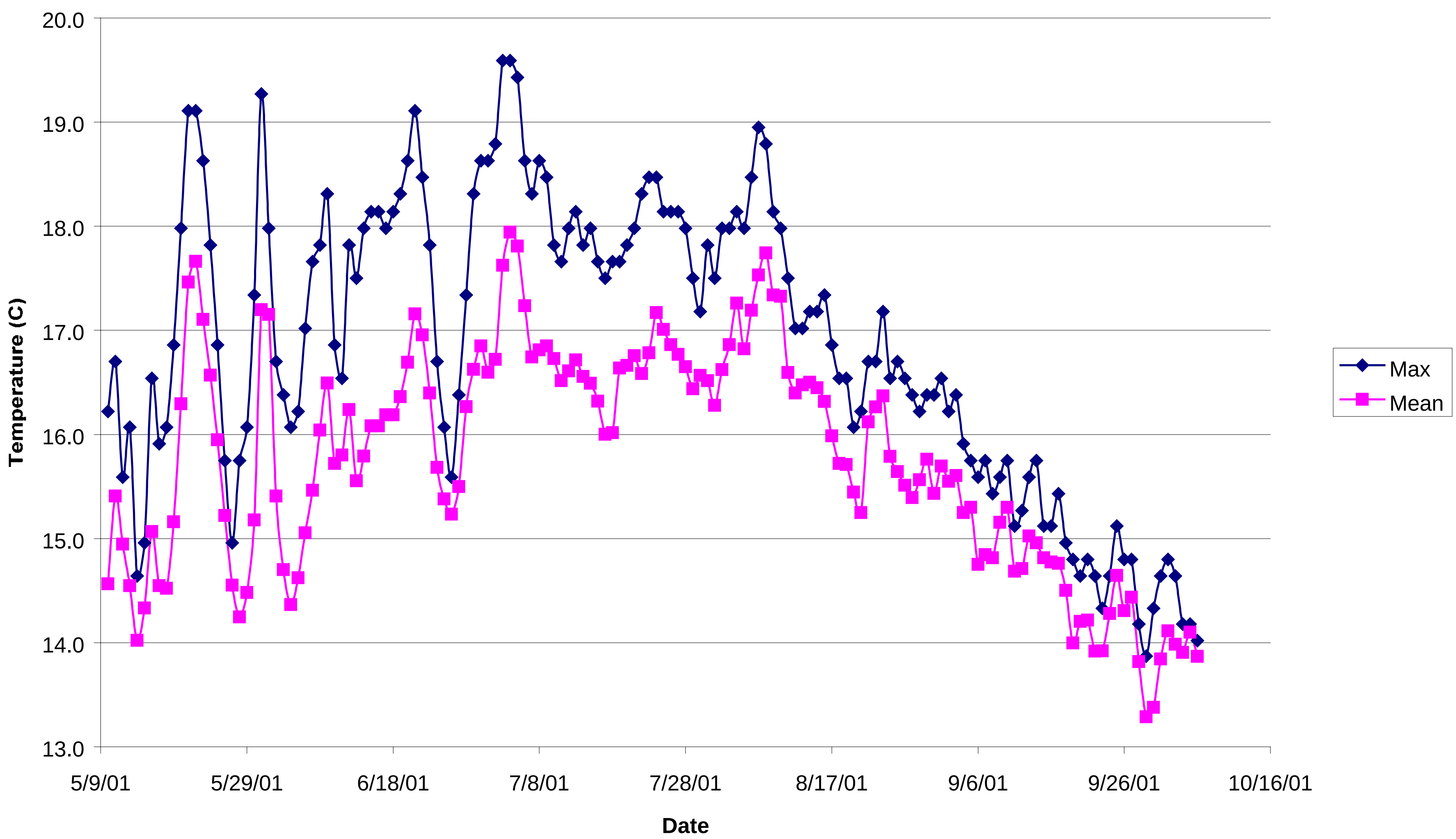


Mean and Maximum Daily Stream Temperatures During Summer 2001 at North Fork Indian Creek (Site 86-1), Mendocino County, California.

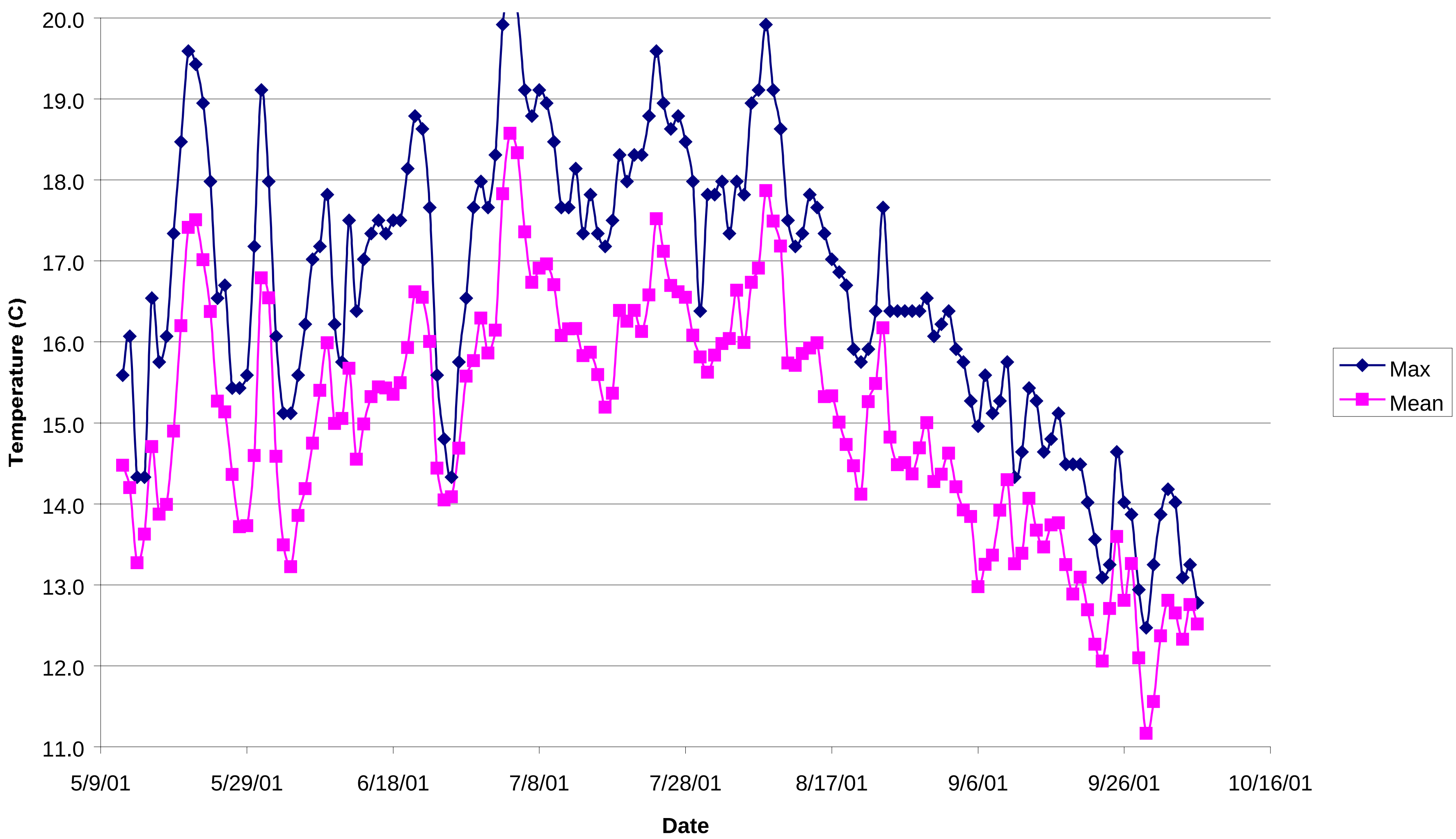



Mean and Maximum Daily Stream Temperatures During Summer 2001 at North Fork Indian Creek (Site 86-2), Mendocino County, California.
Temperature (C)
24.0
22.0
20.0
18.0
16.0
14.0
12.0
5/9/01
5/29/01
6/18/01
7/8/01
7/28/01
8/17/01
9/6/01
9/26/01
10/16/01
Date
Max
Mean

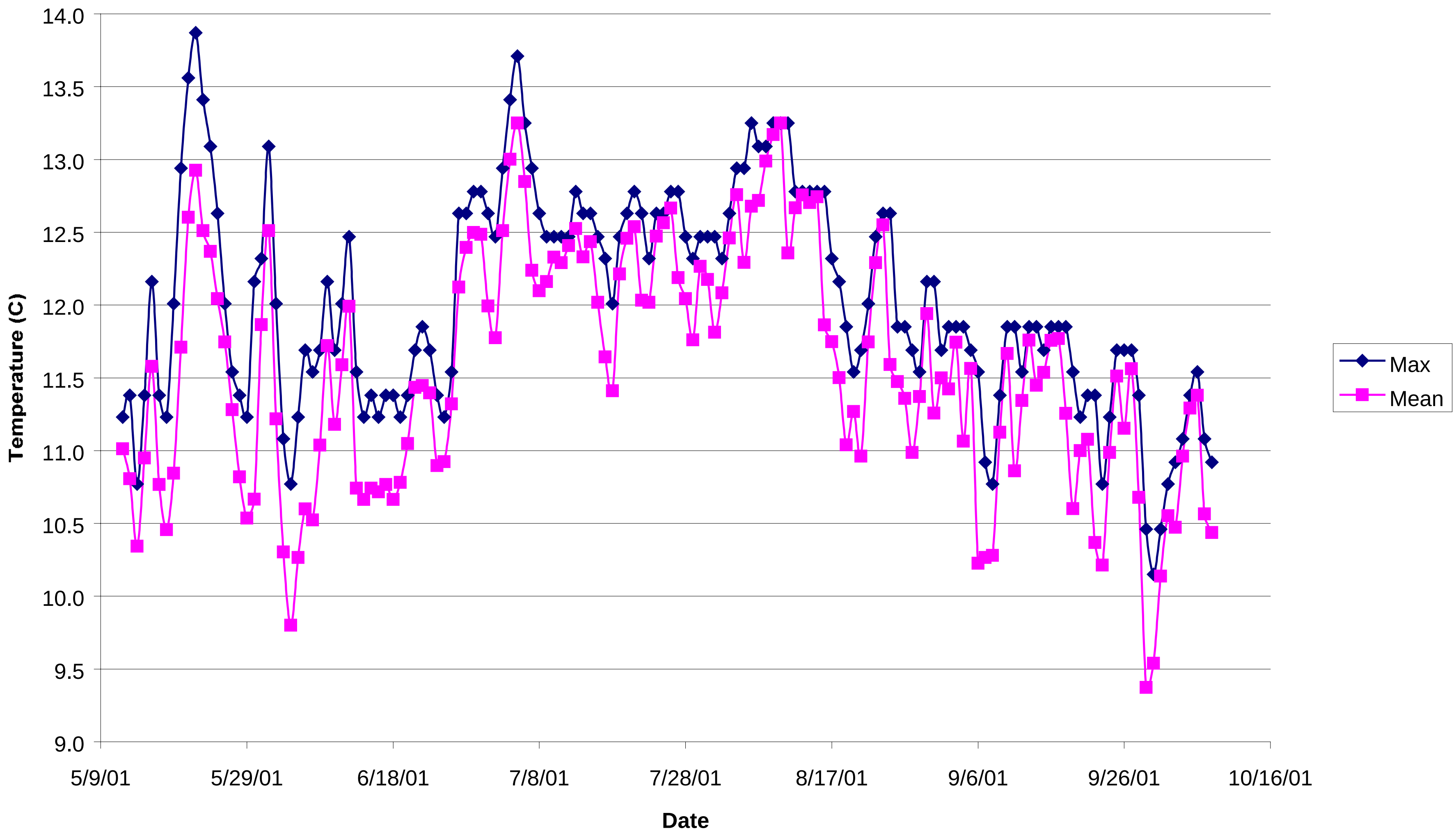
Mean and Maximum Daily Stream Temperatures During Summer 2001 at South Branch North Fork Navarro River (Site 85-1), Mendocino County, California.



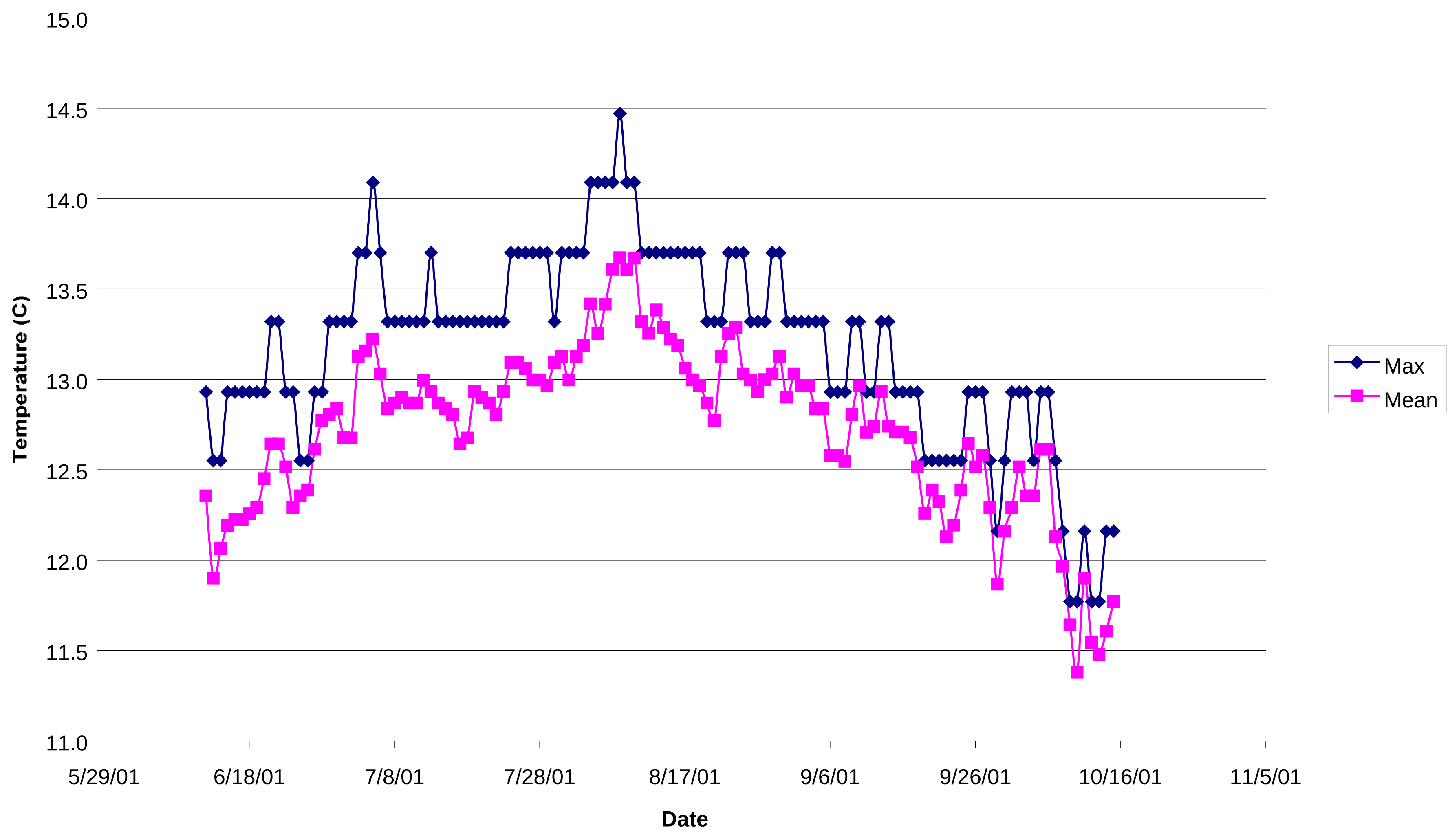
Mean and Maximum Daily Stream Temperatures During Summer 2001 at South Branch North Fork Navarro River Site (85-2), Mendocino County, California.



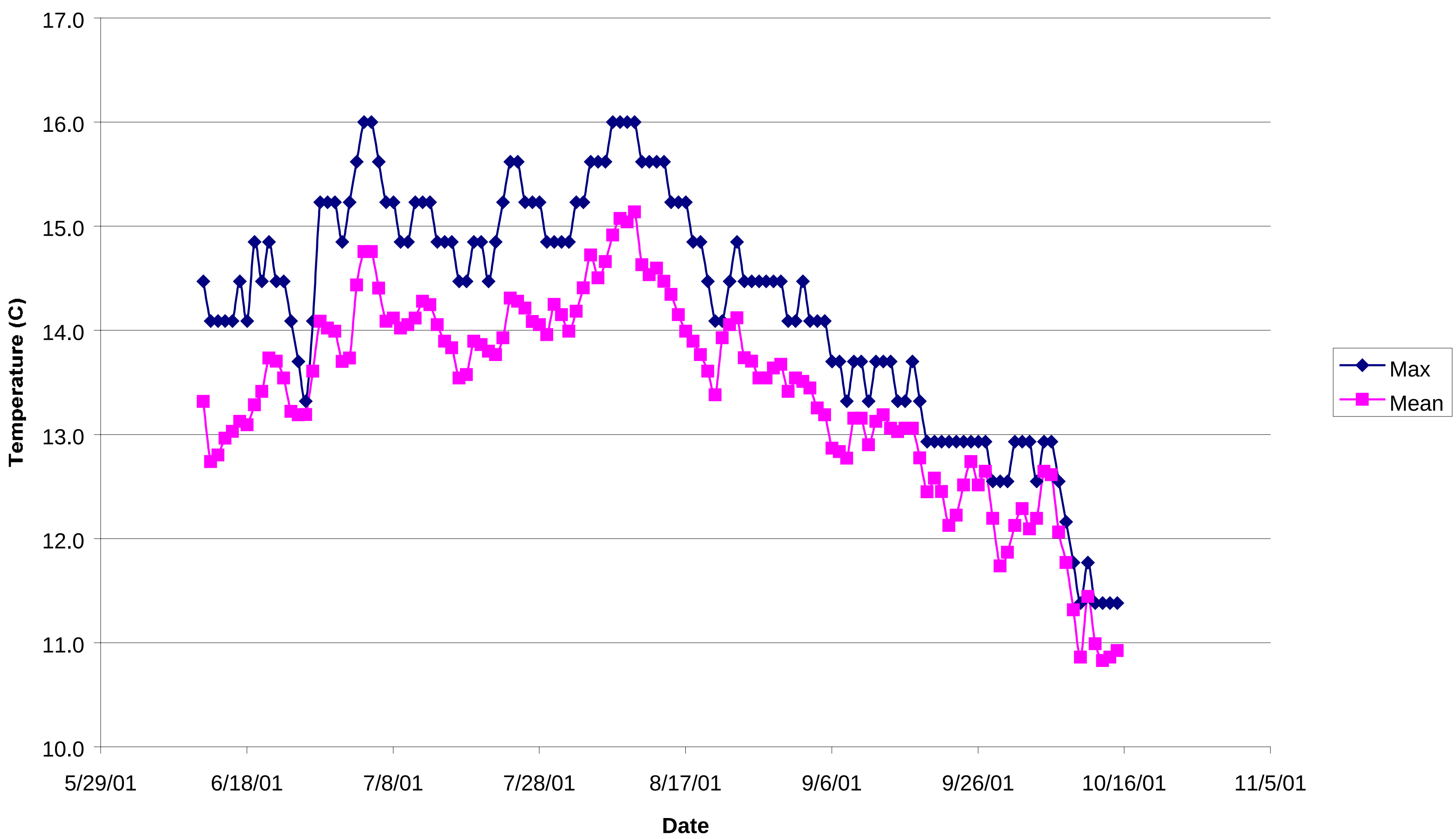
Mean and Maximum Daily Stream Temperatures During Summer 2001 at Sheep Gulch (Site 81-5), Mendocino County, California.



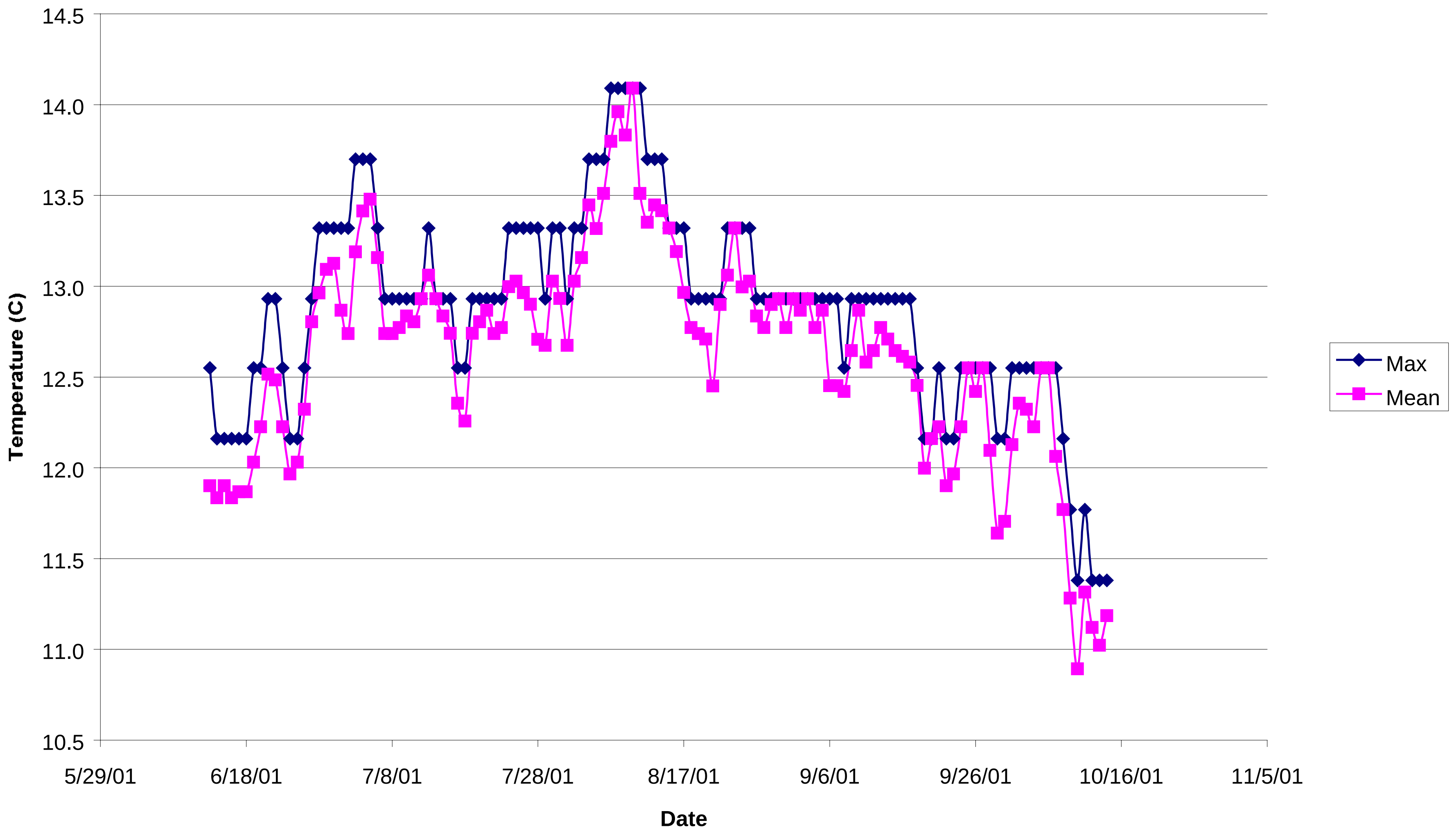
Mean and Maximum Daily Stream Temperatures During Summer 2001 at Berry Creek (82-24), Mendocino County, California.



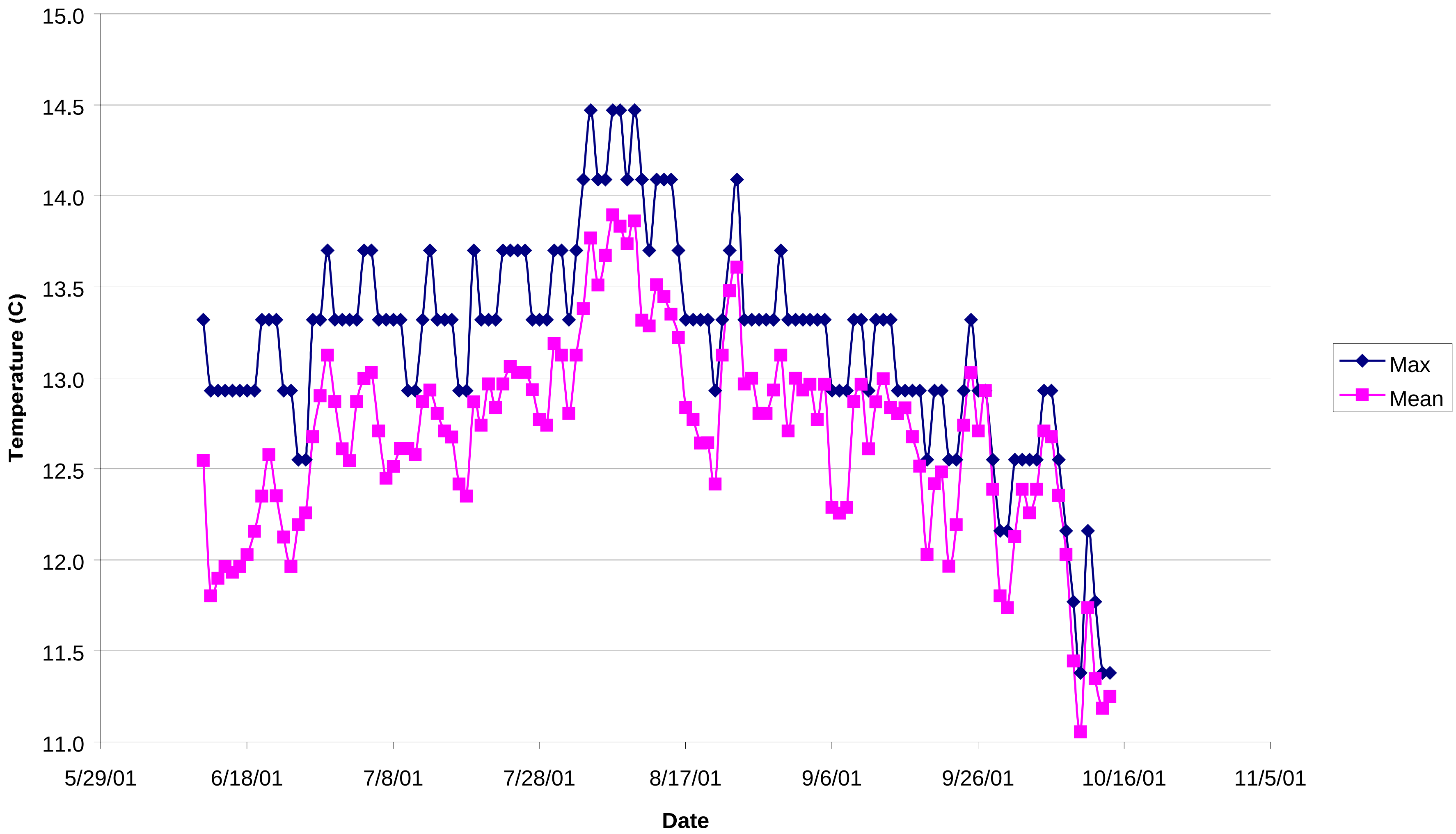
Mean and Maximum Daily Stream Temperatures During Summer 2001 at Black Rock Creek (82-23), Mendocino County, California.



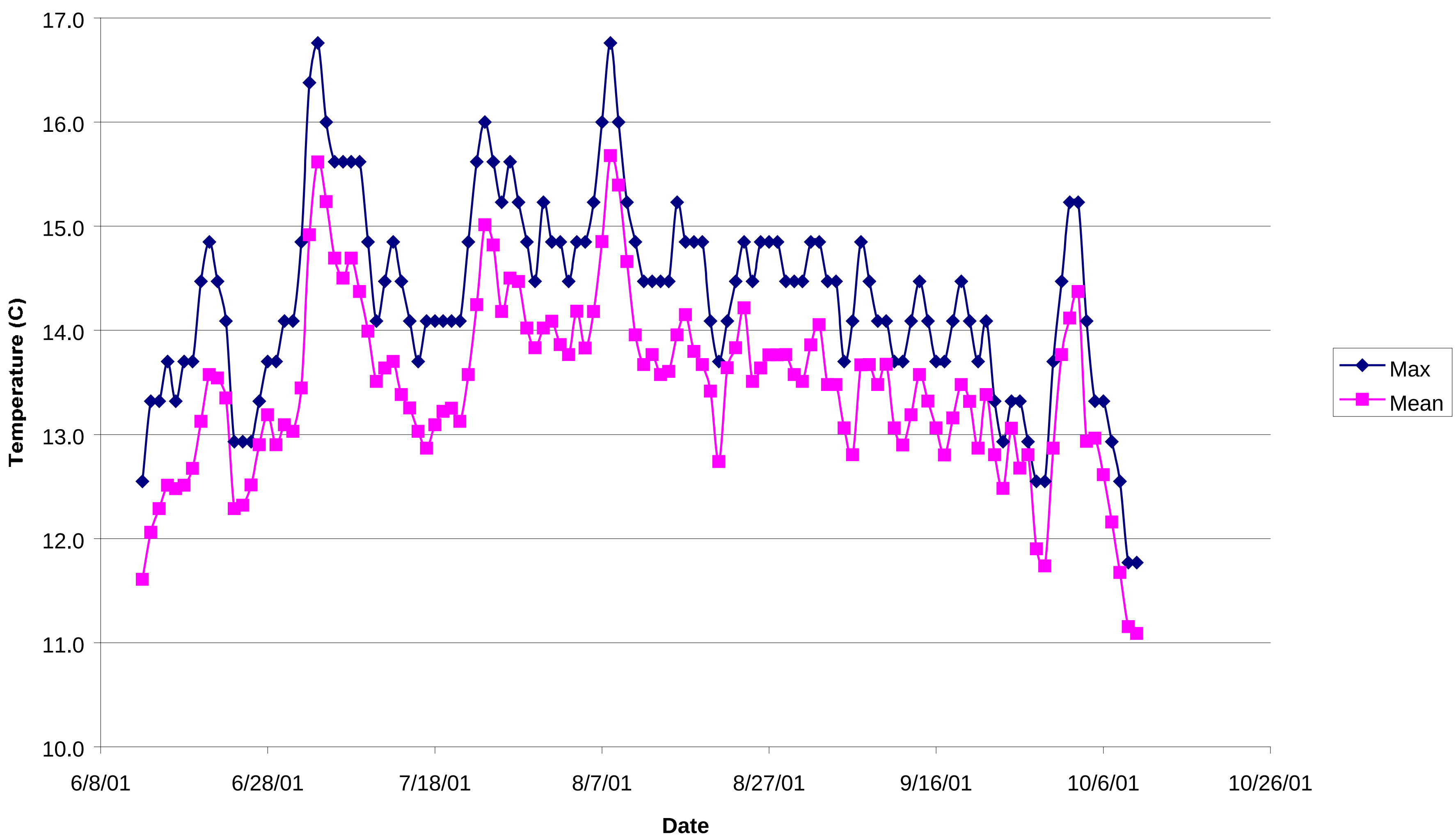
Mean and Maximum Stream Temperatures During Summer 2001 at Coon Creek(82-27), Mendocino County, California.



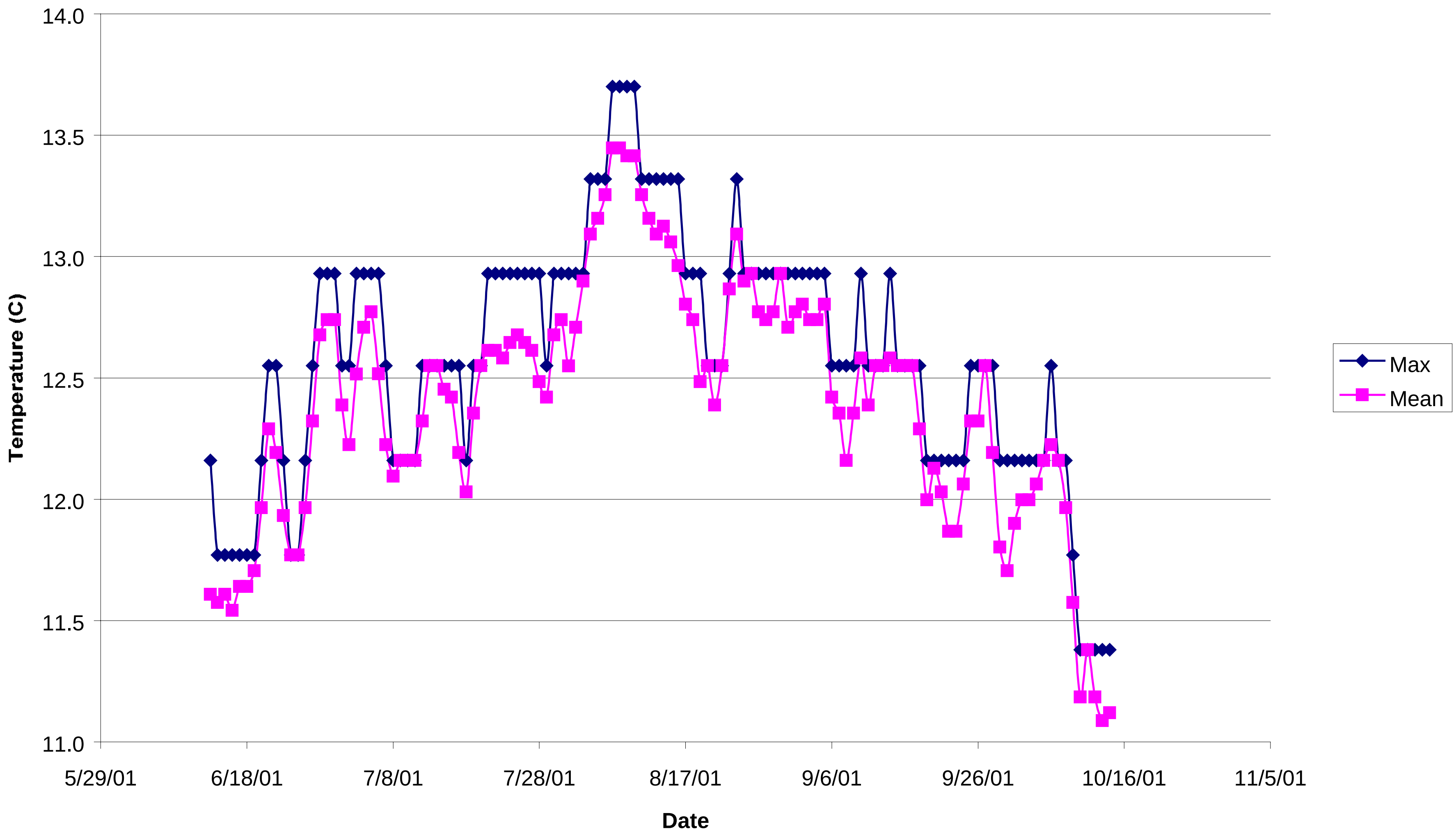
Mean and Maximum Daily Stream Temperatures During Summer 2001 at Mustard Gulch (82-22), Mendocino County, California.



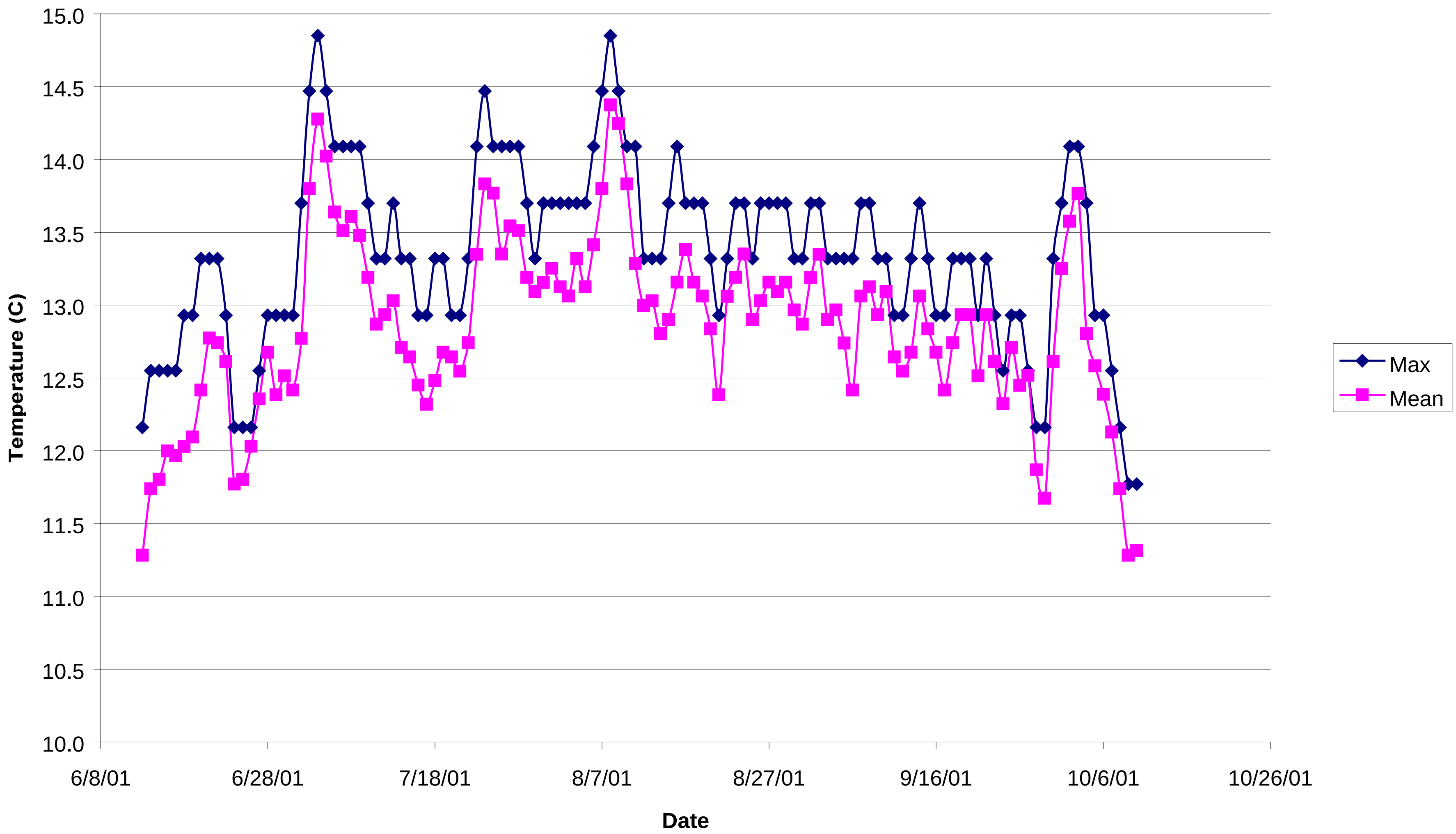
Mean and Maximum Daily Stream Temperatures During Summer 2001 at North Fork Rose Creek (85-20), Mendocino County, California.

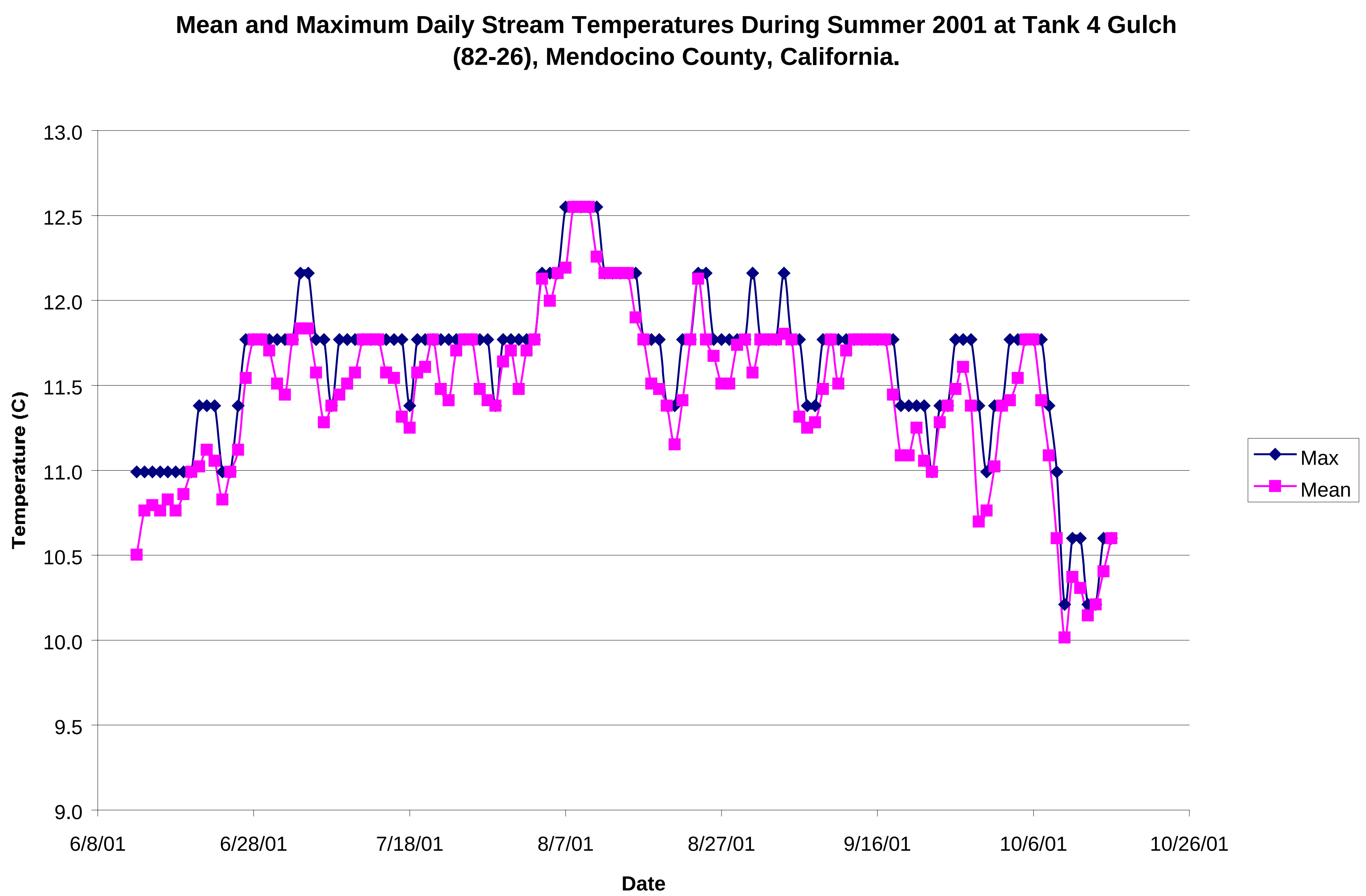


Mean and Maximum Daily Stream Temperatures During Summer 2001 at Ray Gulch (82-28), Mendocino County, California.

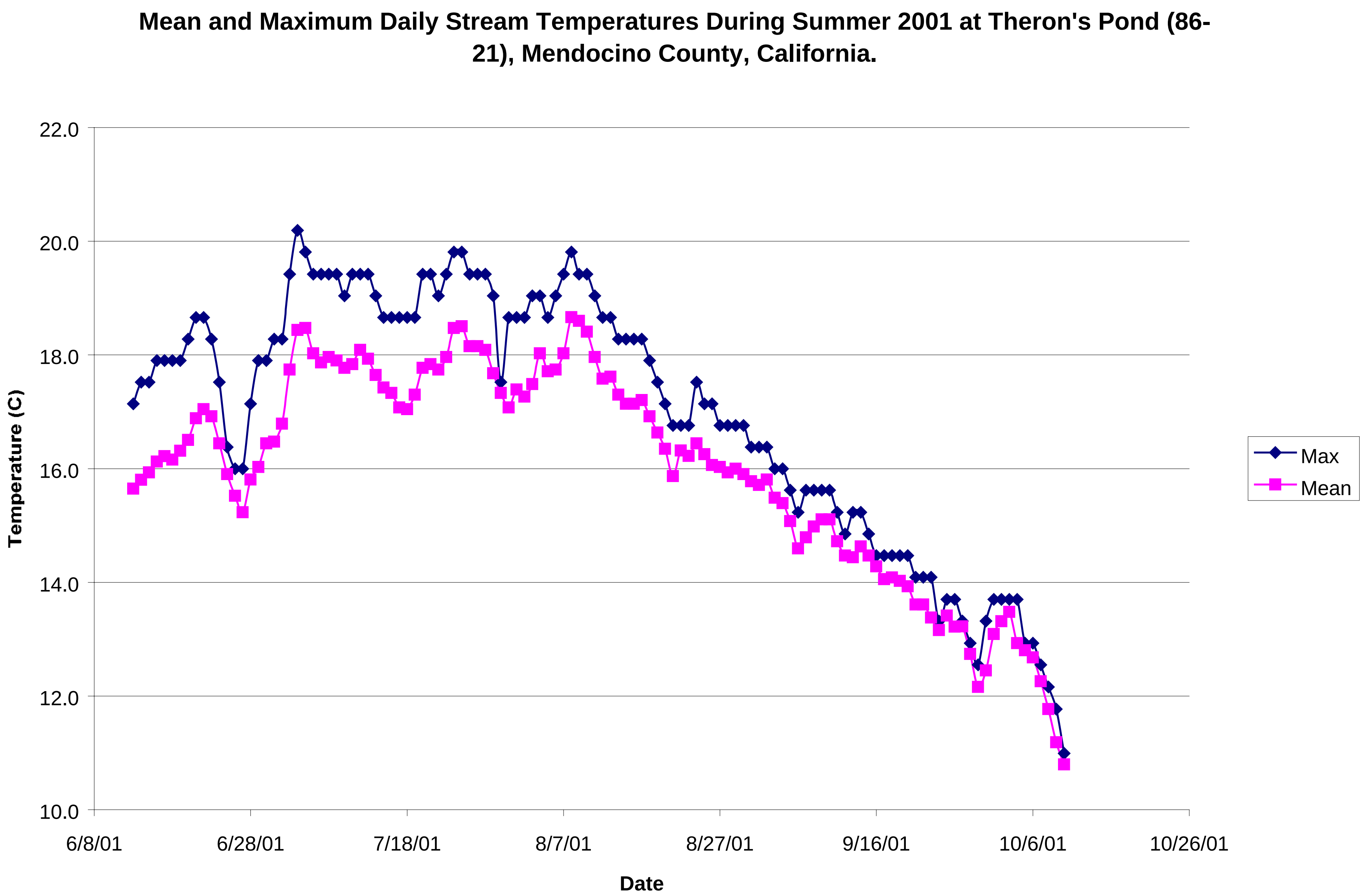


Mean and Maximum Daily Stream Temperatures During Summer 2001 at South Fork Rose Creek (85-21), Mendocino County, California.

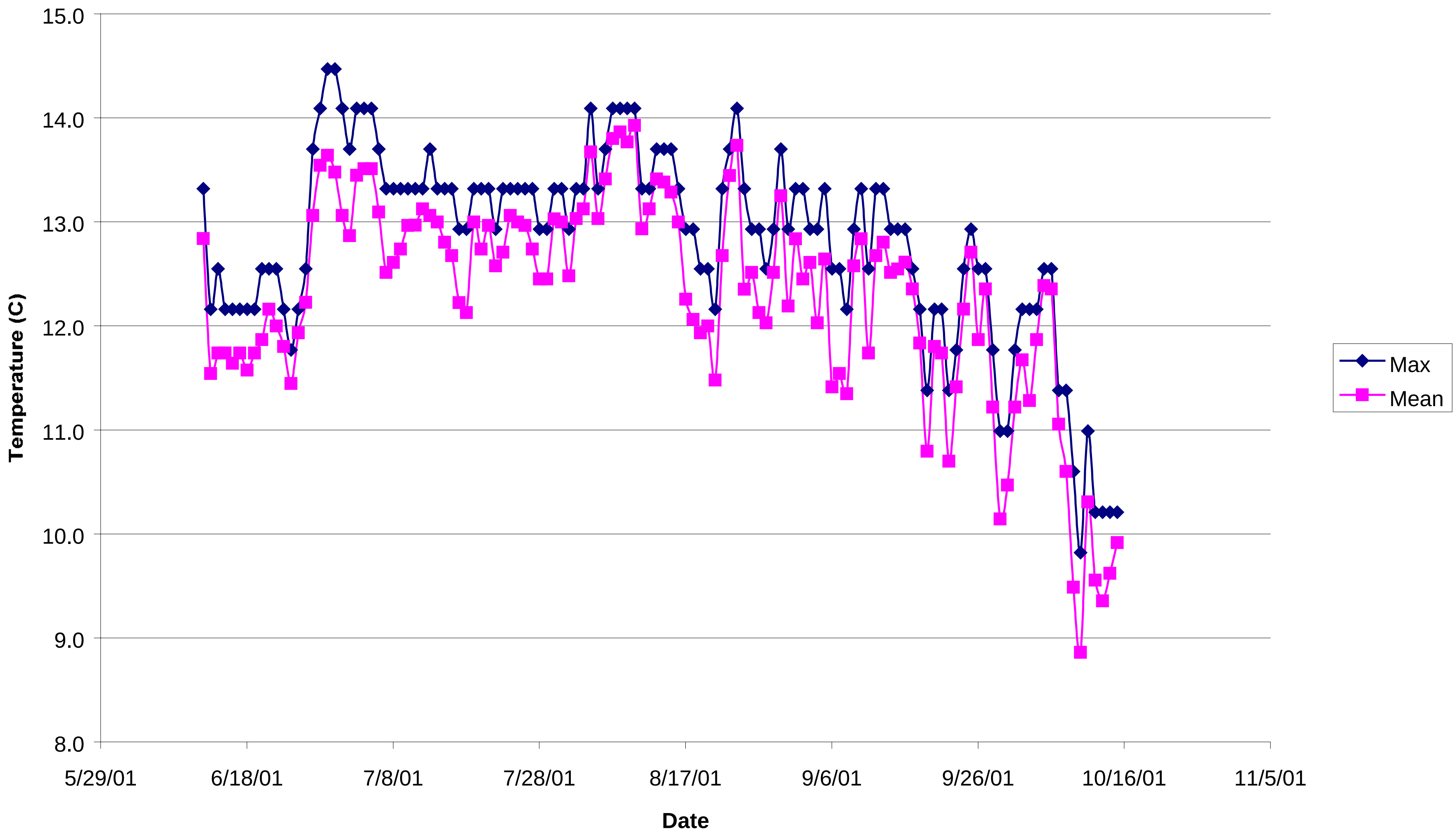


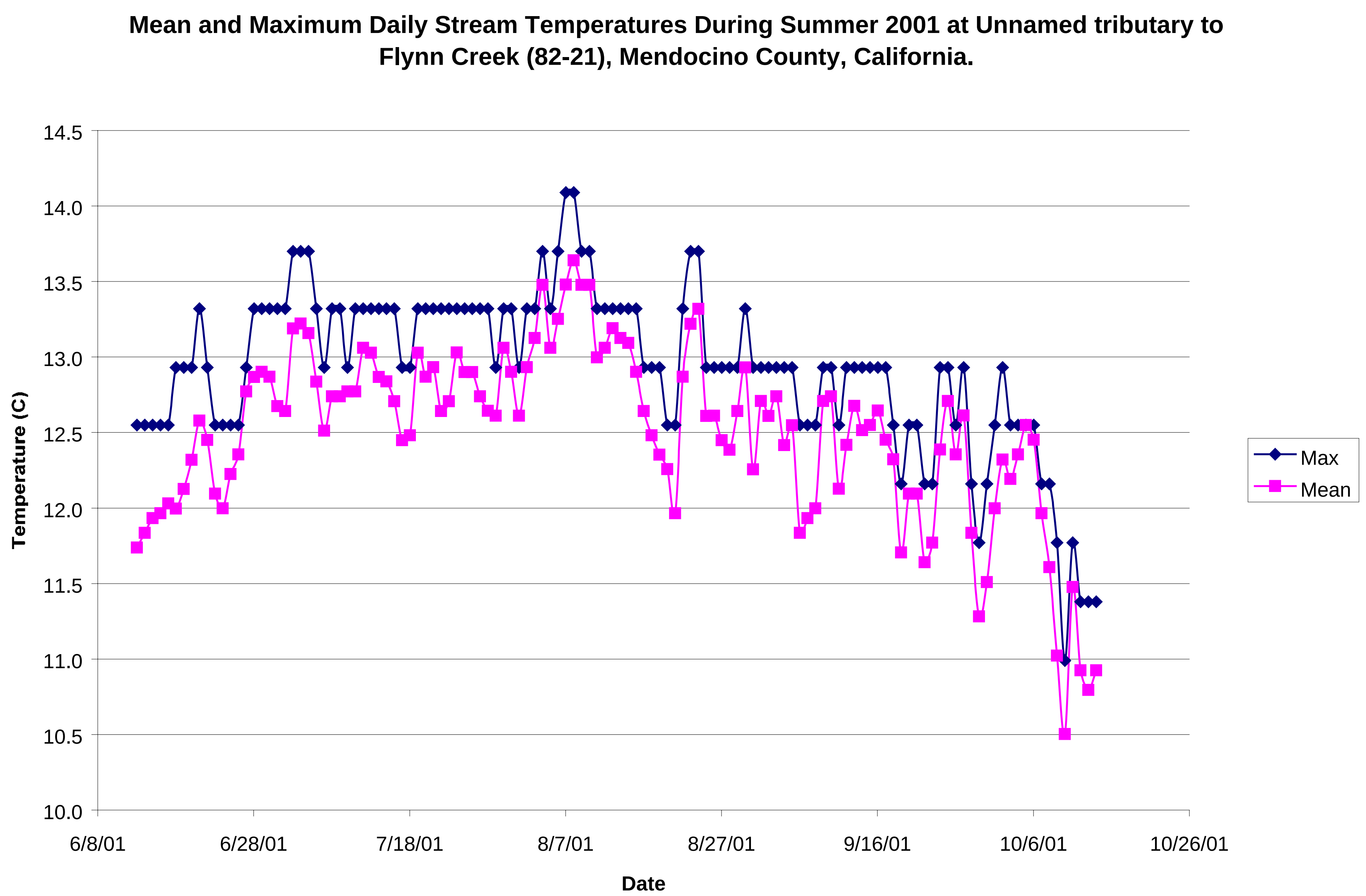


Mean and Maximum Daily Stream Temperatures During Summer 2001 at Tank 4 Gulch (82-26), Mendocino County, California.
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
Temperature (C)
6/8/01
6/28/01
7/18/01
8/7/01
8/27/01
9/16/01
10/6/01
10/26/01
Date
Max
Mean


Mean and Maximum Daily Stream Temperatures During Summer 2001 at Theron's Pond (86-21), Mendocino County, California.
22.0
20.0
18.0
16.0
14.0
12.0
10.0
Temperature (C)
6/8/01
6/28/01
7/18/01
8/7/01
8/27/01
9/16/01
10/6/01
10/26/01
Date
Max
Mean

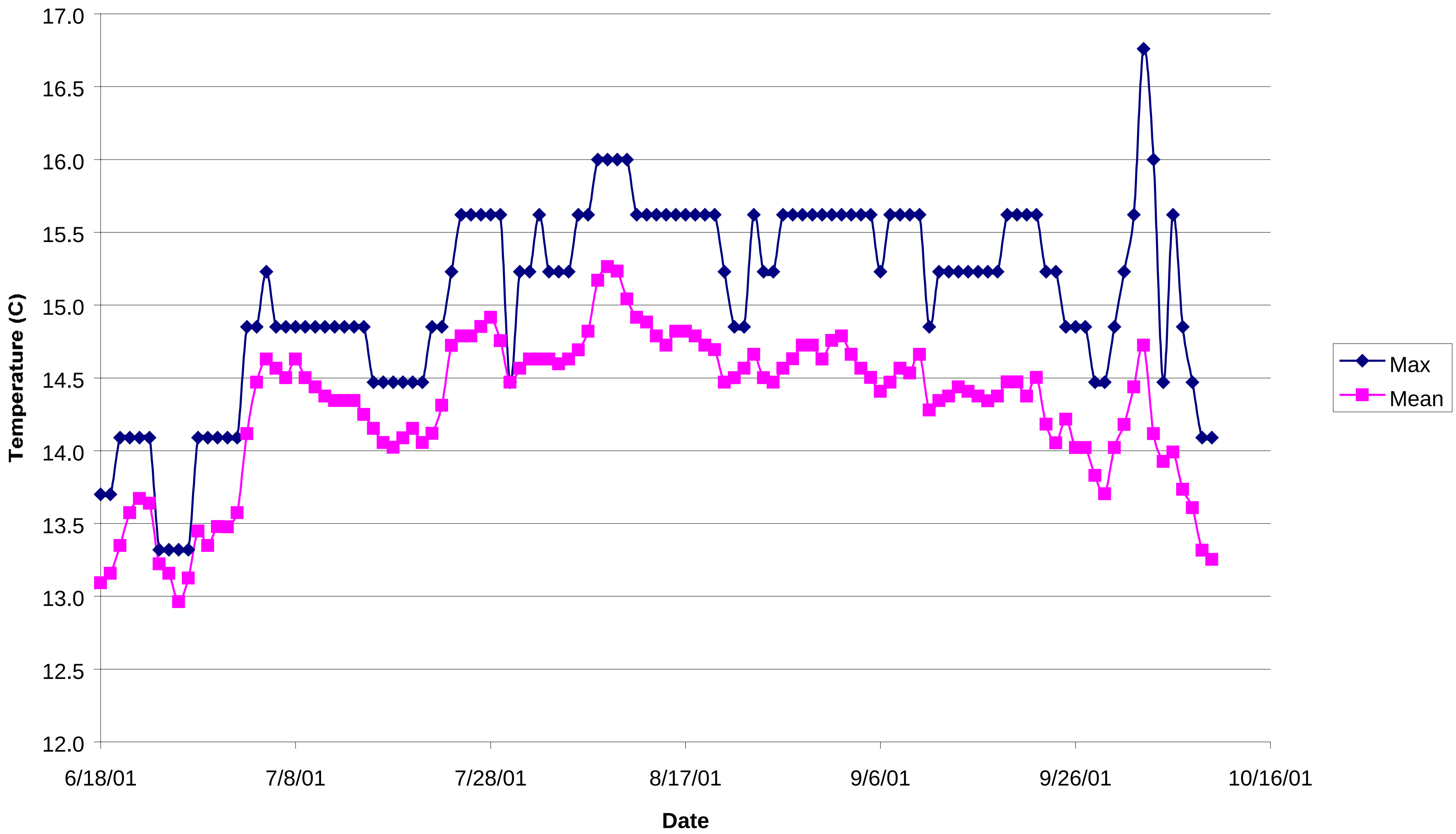
Mean and Maximum Daily Stream Temperatures During Summer 2001 at Tramway Gulch (82-25), Mendocino County, California.





Mean and Maximum Daily Stream Temperatures During Summer 2001 at Unnamed tributary to Flynn Creek (82-21), Mendocino County, California.
14.5
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
Temperature (C)
6/8/01
6/28/01
7/18/01
8/7/01
8/27/01
9/16/01
10/6/01
10/26/01
Date
Max
Mean

Mean and Maximum Daily Stream Temperatures During Summer 2001 at West Branch Indian Creek (86-20), Mendocino County, California.



Section E
STREAM CHANNEL CONDITION

INTRODUCTION

This report provides the results of an assessment of the stream channels of the Mendocino Redwood Company (MRC) ownership in the Navarro River watershed, the Navarro WAU. The assessment was conducted following a modified methodology from the Watershed Analysis Manual (Version 4.0, Washington Forest Practices Board). The stream channel analysis is based on field observations and stream channel slope class and channel confinement information developed from a digital terrain model in the company's Geographic Information System (GIS).

The goals of the assessment were to determine the existing channel conditions and identify the sensitivity of the channels to wood and sediment. Stream channels are defined by the transport of water and sediment. A primary structural control of a channel in a forested environment, besides large rock substrate, is from woody debris. Channel morphology and condition therefore reflect the input of sediment, wood and water relative to the ability of the channel to either transport or store these inputs (Sullivan et. al., 1986)

Stream channel conditions represent the strongest link between forest practices and aquatic habitat. Changes in channel condition typically reflect changes to stream habitat. Because of this the fish habitat and stream channel assessments were done in the same reaches. The results for the fish habitat parameters are presented in Section F - Fish Habitat Assessment.

METHODS

The methods of the stream channel assessment are designed to identify channel segments that are likely to respond similarly to changes in sediment or wood and group them into distinct geomorphic units. These geomorphic units enable an interpretation of habitat-forming processes dependent on similar geomorphic and channel morphology conditions. The channels are also evaluated for current channel condition to provide baseline information for the evaluation of channel conditions currently and over time.

Stream Segment Delineation

The stream channel network for the Navarro WAU was partitioned into stream segments based on three classes of channel confinement and several classes of channel gradient. These classifications were based on channel classifications prepared from digital terrain data in Mendocino Redwood Company's Geographic Information System (GIS). The slope classes used for delineation are 0-3%, 3-7%, 7-12%, and 12-20%. Channel confinement was classified by confined, moderately confined, and unconfined. Confined channels have a valley to channel width ratio of <2, moderately confined channels have a valley to channel width ratio of <4, and unconfined channels have a valley to channel width ratio of >4.

Channel segments for observations or analysis were delineated based on either a change in slope class or change in channel confinement. The channel segments were numbered with a two letter code, corresponding to the planning watershed the channel segment is located, followed by a unique number (*1 through n* for each planning watershed). For the Navarro WAU, channel segments for 17 planning watersheds are delineated. The delineated stream segments are shown on Map E-1.

Field Measurements and Observations

Selection of field sites for stream channel observations was based on gathering a sample of response (0-3% gradient) and transport (3-20% gradient) channels from each planning watershed of the WAU. No attention was focused on the source reaches (>20% gradient), this was assumed to be covered in the mass wasting analysis.

For each channel segment the bankfull width, bankfull maximum depth, bankfull average depth, floodprone depth, floodprone width, and channel bankfull width to depth ratio are measured at a cross section representative of the channel segment. A pebble count of 50 randomly selected pebbles is counted at the cross section to determine the D50 (median particle size) of the streambed. Streambed sediment characteristics are interpreted from observations of gravel bars, channel aggradation or degradation and particle size of the stream bed material. The segment is classified by morphology types based on Montgomery and Buffington (1993) and Rosgen (1994). The channel morphology is further interpreted by flood plain interaction for segment (continuous, discontinuous, inactive, none) and channel roughness characteristics. Large woody debris (LWD) functioning in the channel is inventoried (presented in Section D, Riparian Function). The number and type of pools (LWD forced, bank forced, boulder forced, free formed) are observed. The field observations are summarized and defined in Table E-1.

Stream Geomorphic Units

Channel segments were grouped into geomorphic units by similar attributes of channel condition, position in the drainage network, and gradient/confinement classes. The intent of the geomorphic units are to stratify channel segments of the Navarro WAU into units which respond similarly to the input factors of coarse and fine sediment, and LWD. These geomorphic units can then be interpreted to have similar habitat-forming processes.

Interpretations related to sediment supply, transport capacity and LWD response were the basis for development of sensitivity of geomorphic units to coarse sediment, fine sediment and LWD inputs. These interpretations were based primarily on existing conditions observed in the stream channels of the WAU. The channel sensitivity to changes to coarse sediment, fine sediment and LWD are based on how the current state of the channel is likely to respond to inputs of these variables.

Long-Term Stream Monitoring Sites

To monitor stream channel morphology conditions and stream sediment characteristics related to fish habitat, 6 long-term stream channel monitoring segments were established in the Navarro River WAU. Along these segments longitudinal profiles, cross sections and streambed D50 measurements were surveyed. Stream gravel bulk samples and permeability of spawning gravels are also measured (methods and results presented in the Fish Habitat section)(at 8 stream segments). These long-term segments will be re-surveyed and monitored over time to provide insight into long term trends in channel morphology, sediment transport and fish habitat conditions. In future surveys of the long term channel monitoring segments LWD will be included in the surveys. The long-term stream channel monitoring segment locations are shown on Map E-1.

The stream monitoring segments are typically 20-30 bankfull channel widths in length. Permanent benchmarks (PBMs) are placed at the upstream and downstream ends of the monitoring segment. The PBMs are monumented with nails in the base of large trees along with a re-bar pin in the ground adjacent to the nail.

The longitudinal profile is a survey of the thalweg, the deepest point of the channel, excluding any detached or “dead end” scours and/or side channels. At every visually apparent change in thalweg location or depth, the station along the channel and the elevation is recorded. In the absence of visually apparent changes, thalweg measurements are taken every 15-20 feet along the channel. A profile graph of the channel’s thalweg is created from the longitudinal survey (see Appendix E for longitudinal profiles for the Navarro WAU). A computer program (Longpro) developed by the USGS for Redwood National Park was used to analyze the profiles. This program converted the surveys into standardized data sets with uniform five-foot spacing between points and determined the residual water depth of each point. The residual water depth is the depth of water in pools of the channel segment defined by the riffle crest height at the outlet of the pool. No minimum pool depth is specified. The distribution, mean and standard deviation of the residual water depths for the longitudinal profile segment are calculated. This provides the ability to statistically evaluate changes in the residual water depths from the thalweg profile over time.

Along the lonitudinal profile, 3-5 channel cross sections are surveyed (locations are permanently monumented). The cross sections are located along relatively straight reaches in the monitoring segment. Cross sections are surveyed from above the floodprone depth of the channel. A graph of the cross section is created from the survey (see Appendix E for cross sections graphs for the Navarro WAU). At each cross section a pebble count is done, to determine the particle size distribution and median particle size (D50), by measuring 100 randomly selected pebbles along the cross section fall line.

Observations of the long term channel monitoring segments occurred in 1999. In 2001, 2 of the segments were re-surveyed, North Branch North Fork Navarro River and South Branch North Fork Navarro River providing a comparison of the longitudinal profile, cross sections and pebble counts for those segments.

RESULTS

Stream Channel Observations

Stream channel surveys or field observations were taken on 50 stream reaches in the Navarro River WAU during the summer of 1999. Table E-1 provides a summary of the data collected. Further detail specific to in-channel fish habitat relationships is found in Section F - Fish Habitat Assessment of this report.

Key to Table E-1.

Stream Channel Dimensions

Category	Description
ID #	The stream identification number (see Map E-1), two letter planning watershed code followed by unique number for the planning watershed. WL - Lower Navarro WR - Ray Gulch WM - Middle Navarro WN - North Fork Navarro WF- Flynn Creek WU - Upper Navarro WH - Hendy Woods WC - Rancheria Creek WI - Mill Creek WG - Floodgate Creek EJ - John Smith Creek ED - Dutch Henry Creek EL - Lower South Branch Navarro EN - Little North Fork Navarro EM - Middle South Branch Navarro EU - Upper South Branch Navarro EI - North Fork Indian Creek
Geomorphic Unit	Number of the geomorphic unit the channel segment is in.
Channel confinement	Confined-channel width to valley width ratio < 2, moderately confined-channel width to valley width ratio 2-4, unconfined-channel width to valley width ratio >4.
Surveyed Length	Length of segment surveyed.
GIS slope category	Slope class as designated by DTM in GIS.
Observed Slope	Mean slope of segment as observed in field.
Maximum Bankfull Depth	Maximum bankfull depth of representative cross section.
Mean Bankfull Depth	Average bankfull depth of representative cross section.
Bankfull width	Bankfull width of representative cross section.
Width/Depth Ratio	Ratio of bankfull channel width to average bankfull depth.
Floodprone depth	Maximum depth during flooding, estimated by 2 times max. bankfull depth (Rosgen, 1996).
Floodprone width	Width of water at floodprone depth (Rosgen, 1996).
Entrenchment Ratio	Ratio of floodprone width to bankfull channel width.

Sediment/Bedform Characteristics

Category	Description
Montgomery/Buffington Class	The channel morphology type: PR = pool/riffle, FP/R = forced pool/riffle, SP = step pool, PB = plane bed, CAS = cascade (Montgomery and Buffington, 1993)
Rosgen Class	Rosgen channel morphology classification, (Rosgen, 1994).
Floodplain Continuity	Description of floodplain/channel interaction either: continuous, inactive, discontinuous or none.
Aggradation/Degradation in Past	Evidence of past conditions.
Aggradation/Degradation Current	Current condition.
Channel Roughness	B =boulders, C=cobbles, F=bedforms, V=live woody veg., W=large woody veg., R=bedrock, Bk=banks and roots.
Gravel Bar Abundance	Qualitative measure of amount of gravel bars in segment.
Gravel Bar Type	Gravel bar type either: A=alternating point bars, P=point, M=medial or F=forced.
Gravel Bar Proportion Class	Proportion of stream segment in gravel bars: 0-25%, 25-50%, 50-75%, 75-100%.
Fine Sediment Abundance	sparse, moderate, abundant
Fine Sediment Type	type of fine sediment accumulation: P=isolated pockets, M=moderate accumulations, B=high accumulations including in gravel bars.
D50	Median gravel size of the stream bed particle distribution.

Pool Characteristics

Category	Description
Free	number of free formed pools in segment.
LWD Forced	number of LWD forced pools in segment.
Boulder Forced	number of boulder forced pools in segment.
Bank Forced	number of bank forced pools in segment.
Total # Pools	total number of pools in segment.
Pool Spacing	average space between pools by bankfull widths.
Mean Res. Pool Depth	The average of all residual pool depths in segment.

Table E-1. Stream Segment Field Observations for Navarro WAU, 1999

						Stream Channel Dimensions						
Segment Name	ID #	Geomorphic Unit	Channel Confinement	Survey Length (ft)	GIS Slope Category (%)	Field Observed Slope (%)	Maximum Bankfull Depth (ft)	Mean Bankfull Depth (ft)	Bankfull Width (ft)	Width/Depth Ratio	Floodprone Depth	Floodprone Width
N Branch Navarro	ED1	3	Confined	1794	0-3	3.4	5	3.7	73.7	19.9	10.0	205
Cook Creek	ED8	3	Confined	985	0-3	1.3	3.8	2.6	31.4	12.1	7.6	51
North Fork Indian Creek	EI2	3	Confined	1234	0-3	1.6	5.1	2.8	45.5	16.3	10.2	100
West Branch North Fork Indian Creek	EI3	7	Moderately		12-20	>20%						
John Smith Creek	EJ1	3	Confined	704	0-3	3.2	2.7	1.8	42	23.3	5.4	52
John Smith Creek	EJI(2)	3	Confined	719	0-3	0.8	2.6	1.5	25	16.7	5.2	33
SB Navarro	EL1	3	Moderately	1537	0-3	0.2	5	2.9	85.3	29.4	10.0	185.0
South Branch Navarro	EM1	3	Confined	1344	0-3	0.4	4.7	3.4	31.7	9.3	9.6	36
Bear Creek	EM20	4	Confined	504	3-7	2.6	2.5	1.8	16.8	9.3	5.0	26
Bridge Creek	EM29	4	Confined	854	0-3	1.5	1.8	1	26	26.0	3.6	33
Bridge Creek	EM30	4	Confined	575	3-7	2.2	2	1.3	21.7	16.7	4.0	40
Shingle Mill Creek	EM39	4	Confined	564	0-3	2.0	3	2.4	11.4	4.8	6.0	21
Little NF Navarro	EN2	3	Confined	860	0-3	1.4	3.7	2	32.4	16.2	7.4	48
Little NF Navarro	EN25	4	Confined	750	3-7	1.3	3.4	2.3	17.3	7.5	6.8	57
Bottom Creek	EN3	4	Confined	601	0-3	1.1	3	2	16.4	8.2	6.0	23.5
Sawyer Creek	EN38	4	Confined	444	0-3	3.0	2.5	1.5	15	10.0	5.0	22
Spooner Creek	EN4	4	Confined	684	0-3	1.6	3.2	2.2	15	6.8	6.4	24
Upper South Branch Navarro	EU1	3	Confined	2200	0-3	1.5	2.7	2.3	33.1	14.4	5.6	93
Low Gap Creek	EU20	4	Confined	671	0-3	1.6	3.3	2.8	15	5.4	6.6	19
Rose Creek	EU24	6	Confined	565	3-7	4.8	2.8	1.7	15.6	9.2	5.6	27
South Branch Navarro	EU4	3	Confined	1019	0-3	1.9	2.5	1.6	34.5	21.6	5.0	40
McGarvey Creek	EU7	4	Confined	1015	0-3	1.8	3	2.2	14.6	6.6	6.0	20
Flynn Creek	WF1	3	Confined	1075	0-3	0.5	2.5	1.9	31	16.3	4.9	135
Flynn Creek	WF1(2)	3	Confined	861	0-3	1.2	3.8	2.4	24	10.0	7.6	38
Camp 16 Gulch	WF13	4	Confined	761	0-3	1.8	2.9	1.6	16	10.0	5.8	100
Tank Gulch	WF26	4	Confined	297	0-3	0.6	2.3	1.3	9.9	7.6	4.6	33
Tank Gulch	WF27	6	Confined	192	3-7	1.5	1.7	1.3	6.4	4.9	3.4	95
none	WH3	4	Confined	519	0-3	2.4	2.8	2.1	13.4	6.4	5.6	14.5
Murray Gulch	WL19	4	Confined	562	3-7	1.3	1.5	1.25	11.2	9.0	2.9	17.8
Flume Gulch	WL27	3	Confined	1010	3-7	1.9	3.1	2.4	26.3	11.0	6.2	65
Flume Gulch	WL28	3	Confined	569	0-3	1.2	3.1	2.4	17.9	7.5	7.1	40
Navarro River	WL3	2	Confined	3097	0-3	3.2	8	6.7	129	19.3	16.0	140
Marsh Gulch	WL4	4	Confined	448	3-7	1.2	2.7	1.7	16	9.4	5.4	24.7
Racoon Gulch	WM13	4	Confined		3-7	<3%						
Navarro River	WM2	2	Moderately	2774	0-3	2.0	6.4	4.9	136	27.8	12.8	150
Skid Gulch	WM32	6	Confined	334	3-7	7.5	1.7	1.1	6.9	6.3	3.7	12.5
Berry Gulch	WM36	6	Confined	808	7-12	3.2	1.9	1.4	10.8	7.7	3.8	29
Navarro River	WM5	2	Moderately	2381	0-3	0.2	5.8	3.4	170.5	50.1	11.6	190
Dead Horse Gulch	WN10	4	Confined	387	0-3	2.7	2.4	1.25	13.7	11.0	4.8	20
Dead Horse Gulch	WN11	6	Confined	198	7-12	10.8	1.8	1.2	6.6	5.5	3.6	12
Coon Gulch	WN20	4	Confined	650	3-7	2.6	2.1	1.6	10.4	6.5	4.2	18.0
Roller Gulch	WR11	4	Confined	884	3-7	1.5	3.4	1.9	13	7.0	6.8	70
Ray Gulch	WR14	4	Confined	570	0-3	1.3	2.1	1.3	19.3	14.8	4.2	110
Ray Gulch	WR15	4	Confined	525	0-3	3.2	2.9	1.4	16	11.4	5.8	26.0
White Gulch	WR23	6	Confined	575	3-7,0-3	3.8	2.4	1	13.4	13.4	4.8	33
Mustard Gulch	WR26	4	Confined	455	0-3	1.1	2	1.1	16	14.5	4.0	100
Navarro River	WU1	2	Moderately	2371	0-3	0.45	5.7	4.7	139.5	29.7	11.4	155
Kabiki Creek	WU15	6	Confined	500	3-7	3.0	3	2.5	10.2	4.1	6.0	36.6
Sage Gulch	WU18	7	Confined	330	7-12	11.9	2.1	1.6	13.3	8.3	4.2	16
Black Rock Creek	WU4	6	Confined	684	7-12,3-7	5.5	2.4	1.2	14.3	11.9	4.8	25

Table E-1 (continued). Stream Segment Field Observations for Navarro WAU, 1999

Sediment/bedform Characteristics													Pools						
ID #	Montgomery/ Buffington Class	Rosgen Class	Floodplain Continuity	Aggradation/ Degradation in Past	Aggradation/ Degradation Current	Channel Roughness	Gravel Bar Abundance	Gravel Bar Types	Gravel Bar Proportion Class	Fine Sediment Abundance	Fine Sediment Type	D50 (mm)	Free	LWD Forced	Boulder Forced	Bank Forced	Total # Pools	Pool Spacing	Mean Res. Pool Depth (ft.)
ED1	PR	C4	Continuous	No	No	F-V	Abundant	P,M	50-75%	Abundant	B	33	1	3	0	7	11	2.2	3.5
ED8	PR	F4	None	No	No	V-F-LWD	Common	M	25-50%	Moderate	M/P	14	2	3	0	2	7	4.5	2.3
EI2	PR	C3	Continuous	No	No	C-B-F	Common	P,M	25-50%	Sparse	P	115	1	6	0	5	12	2.3	1.6
EI3	CAS	Aa2+	None			B-LWD													-
EJ1	PR	C4,F3,F4	Discontinuous	No	No	V-F-C	Common	P,F	25-50%	Sparse	P	43	2	3	0	1	6	2.8	1.9
EJI(2)	PR	E4,C4,F4	Discontinuous	No	No	F-V-LWD	Common	P, M	25-50%	Moderate	M	30	0	2	0	8	10	2.9	1.6
EL1	PR	C4,F4	Discontinuous	No	No	F-LWD-N	Common	P,M,F	25-50%	Moderate	M	20	1	10	0	9	20	0.9	2.7
EM1	PR	F4,F3,F1	None	No	No	C-R-B-V	Few	P	0-25%	Sparse	P	79	3	0	0	6	9	4.7	2.1
EM20	PR	Bc4, G4	Discontinuous	No	Aggr.	C-F-LWD	Common	P, F	25-50%	Moderate	B	36	0	5	0	2	7	4.3	0.9
EM29	PR	C4,E4,F4	Discontinuous	No	Aggr.	BK-F	Common	P	0-25%	Moderate	M	36	1	2	0	8	11	3.0	1.4
EM30	PR	F4,C4	Discontinuous	No	No	F-LWD	Common	P, F	25-50%	Moderate	M	35	0	6	0	4	10	2.6	1.3
EM39	PR,SP	F4,G4,B4	None	No	Aggr.	C-BK-F	Few	P, F	0-25%	Sparse	P	45	1	2	0	2	5	9.9	0.9
EN2	PR	F4,B4	Discontinuous	No	No	V-LWD-F	Few	P, M	0-25%	Moderate	M	29	1	5	2	2	10	2.7	1.4
EN25	PR	F4,B4,Bc4	Discontinuous	No	Aggr.	C-BK-LWD	Common	P, F	25-50%	Abundant	B	38	2	8	0	1	11	3.9	1.1
EN3	PR	F4	None	No	No	C-BK-R	Few	P	0-25%	Moderate	M	56	2	1	0	4	7	5.2	0.9
EN38	PR,SP	G4,F4	None	No	No	LWD-BK	Few	forced	0-25%	Sparse	P	38	0	1	1	4	6	4.9	1.4
EN4	PR	F4,G4	None	No	No	C-BK-LWD	Common	P, F	25-50%	Moderate	M	55	0	9	1	2	12	3.8	1.3
EU1	PR	C3,B3	Discontinuous	No	No	C-LWD	Common	P, F	25-50%	Sparse	P	75	0	1	0	8	9	7.4	2.7
EU20	PR,FPR	F3,G4,F4	None	No	No	B-C-R-BK	Common	P, F	25-50%	Moderate	M	74	1	1	1	7	10	4.5	1.6
EU24	CAS,SP	A1,A3,G3	None	No	No	R-C-B	Common	P, F	25-50%	Abundant	M	75	7	1	0	3	11	3.3	2.2
EU4	PR,SP	F3,B2,F2,G2	None	No	No	B-C-R	Common	P	0-25%	Sparse	P	96	1	1	2	3	7	4.2	1.5
EU7	PR	F3,F4,F5	None	No	Aggr.	C-F-LWD	Few	P, F	0-25%	Abundant	M	43	0	7	2	3	12	5.8	1.3
WF1	PR	C4	Continuous	No	Aggr.	F-LWD	Abundant	P, M	50-75%	Moderate	B	14	3	6	0	6	15	2.3	1.6
WF1(2)	PR	F1,F4	None	No	No	R-LWD	Few	F	0-25%	Moderate	P	26	8	2	0	4	14	2.6	1.3
WF13	SP,PR	B1,F3,F1,E4	Discontinuous	No	Aggr.		Few	P, F	0-25%	Moderate	P	18	4	4	0	5	13	3.7	1.1
WF26	PR	F4, B3	None	No	Aggr.	LWD-F	Abundant	P, M, F	50-75%			7	1	10	0	4	15	2.0	-
WF27		E4	Continuous	No	Aggr.	F-LWD	Common	P, M	25-50%			-							-
WH3	PR,SP	F4,G1	None	No	No	F-BK	Common	P	25-50%	Sparse	P	21	1	1	1	7	10	3.9	1.1
WL19	PR	F4	Inactive	Degr.	Aggr.	LWD-F	Abundant	A, M	50-75%	Moderate	M	29	0	7	0	3	10	5.0	1.0
WL27	PR,SP	F4,B3	Discontinuous	No	No	LWD-F-C-B	Common	A	25-50%	Moderate	M	52	2	7	0	9	18	2.1	1.3
WL28	PR	F4	None	No	No	LWD-F	Common	P, M	50-75%	Moderate	M	26	0	10	0	4	14	2.3	1.6
WL3	PR	F4	None	No	No	F-V-BK	Common	A, P, M	25-50%	Abundant	B	18	4	2	0	6	12	2.0	3.8
WL4	PR	F4	Inactive	No	No	C-LWD	Common	A	0-25%	Moderate	M	53	1	6	0	4	11	2.5	1.0
WM13		F4, G4	None		Degr.	F-BK-LWD													-
WM2	PR	F4	None	No	No	F-V-BK	Abundant	A, M	50-75%	Abundant	B	13	3	3	0	3	9	2.3	3.4
WM32	PR,CAS	G4,Aa3,A3	Discontinuous	No	No	LWD-C	-	-	-	Moderate	M	84	1	8	0	0	9	5.4	-
WM36	SP,FP\R,PR	G3,G4,E4B	Discontinuous	Aggr.	Aggr.	C-F	Few	P, F	0-25%	Moderate	M	34	3	2	0	1	6	12.5	0.9
WM5	PB,PR	F4,C4	Continuous	No	No	F	Common	P, M	25-50%	Abundatn	B	16	1	1	0	3	5	2.8	3.9
WN10	PR,CAS,FP\R	E4,A4	Discontinuous	No	No	LWD-C	Few	F	0-25%	Moderate	P & B	26	0	12	0	4	16	1.8	1.6
WN11	SP,CAS	A3,Aa3+	None	No	No	C-R-LWD	Few	F	0-25%	Sparse	P	-							-
WN20	SP,FP\R	E4B,B4	Continuous	No	No	LWD-B-C	Few	P, F	0-25%	Sparse	M	38	0	7	0	2	9	6.9	1
WR11	PR	E4	Continuous	Aggr.	No	V-LWD	Few	P	0-25%	Moderate	M	13	2	6	0	3	11	6.2	1.6
WR14	PR	C4	Continuous	No	No	LWD-F	Common	A, F	25-50%	Sparse	P	14	0	12	0	3	15	2.0	1.7
WR15	PR-SP	F4,A1,C4,B4	None	No	No	LWD-R	Few	F	0-25%	Moderate	M	11	5	8	0	1	14	2.3	-
WR23	PR,FP/R	C4,B4	Continuous	No	No	LWD	Few	P	0-25%	Moderate	M	16	2	9	0	2	13	3.3	1.6
WR26	PR	C4	Continuous	No	Aggr.	LWD-F	Abundant	P, M, F		Moderate	M	24	0	11	0	1	12	2.4	1.1
WU1	PR	F4	None	No	Aggr.	F-B	Common	A	25-50%	Abundant	M	18	0	4	2	2	8	2.1	2.8
WU15	PR,FP\R	F4,B3,G3	None	Aggr.	Degr.	LWD-C	Few	F	0-25%			75							-
WU18	CAS	Aa1+,A1,A3	None	No	No	R-LWD	Few	F	0-25%	Sparse	P	-	4	2	1	0	7	3.5	-
WU4	SP, FP/R, CAS	A3,B4	None	No	No	C-LWD-B	Few	F	0-25%	Sparse	P	55	0	6	2	2	10	4.8	0.8

Stream Geomorphic Units

Stream geomorphic units were developed for the stream network on the MRC property in the Navarro River watershed. These units are general representations of stream channels with similar sensitivities to coarse sediment, fine sediment and large woody debris inputs. Seven stream geomorphic units were developed for interpretation of stream channel response to forest management interactions in the Navarro WAU. The seven stream geomorphic units are described below.

Geomorphic Unit I. Estuarine Channel of the Navarro River.

Segment: WL1

General Description: The river channel within this unit flows through a confined canyon bottom at the mouth of the Navarro River at the ocean. The channels are low gradient (0-1 percent) in this unit, with limited mudflat and wetland areas adjacent to the channels due to the confined canyon. Ocean tides influence the stage of these channels with high tides raising the river level. The channel substrate is predominantly a consolidation of deposited fine silt and clay materials.

Associated Channel Types:
This unit primarily exhibits regime morphology. The Rosgen classifications (Rosgen, 1994) for these channels are predominantly F6 and F5.

Fish Habitat Associations:
Spawning habitat in this geomorphic unit is limited due to availability and has poor site potential because of silt/clay substrate that is dominant in this unit. Rearing salmonids for food and shelter uses highly productive estuarine habitat. Meadow /wetland vegetation along the fringes of the channel provide roughness to slow water flow providing overwintering habitat to juvenile salmonids.

<u>Conditions and Response Potential</u>
Coarse Sediment: Low Response Potential
These channels due to their low gradient and tidal influence are typically not areas of coarse sediment deposition. The breakdown of the competence of coarse sediment as it is transported through the watershed usually results in low levels of coarse sediment reaching the estuarine channels. However, if coarse sediment supply is high then deposition can occur at the upper end of these channels.

Fine Sediment: Moderate Response Potential
Typically estuarine channels are low gradient which slow river flow allowing fine sediment deposition, potentially influencing channel morphology. The confined characteristics of the Navarro River estuary makes large scale fine sediment deposition unlikely because the confined channels direct more stream power and sediment transport. Though high fine sediment supply will likely result in bar formations. A decrease in sediment supply could result in channel degradation or bank erosion.

Large Woody Debris(LWD): Low Response Potential
The regime morphology of this channel does not typically respond greatly to LWD inputs. Although large wood is often the only roughness element of these channels, the high

sedimentation rate and large size of the channel limits pool development. The primary role for wood in habitat development is refuge and cover.

Geomorphic Unit II. Low Gradient, Confined Channel of the Navarro River.

Includes Segments: *Field observed* – WU1, WM5, WM2, WL3
Extrapolated - WL2, WM1, WM3, WM4, WU2

General Description: The channels within this unit meander through confined canyons. High terraces and hillslopes control the lateral movement of the channels. The channels are typically confined on one bank by hillslopes and high terraces on the other, and occasionally has narrow floodplains present, typically on the inside of meander bends. Alternating gravel bars on meander bends often define the bankfull width. The bankfull channel varies from 100 to 200 feet in width. The sinuous path of the flow in these channels lowers the river gradient and creates alternating pool-riffle morphology. This makes the channel very stable, with only limited bank erosion observed even on poorly vegetated outside edges of meander bends despite the confined nature of the channel. The channels in this unit are low gradient (0-2 percent), but sediment transport capacity is high due to the highly confined channel keeping water energy directed within the channel. High flow events within these channels will move all but the most stable large woody debris (LWD) accumulations or push accumulations to the channel margins. The channel bed varies from sand to gravel sized particles.

Associated Channel Types:
This unit primarily exhibits pool/riffle and plane bed morphology. The Rosgen classifications (Rosgen, 1994) for these channels are predominantly F4 with isolated areas of C4.

Fish Habitat Associations:
These channels are low gradient, depositional channels of a large watershed. These channels typically have sand to small gravel substrate that is not highly desirable for spawning habitat. The large size of these channels makes for a very wide bankfull channel with low shade, making for high summer water temperatures thus poor summer rearing habitat for salmonids. The lack of LWD combined with small substrate makes these channels also poor areas for over-wintering habitat, though salmonids likely can find refuge in the deep pools along these channels. These channels overall do not provide highly productive salmonid habitat.

Conditions and Response Potential

Coarse Sediment: Moderate Response Potential
These channels are depositional areas for coarse sediment. Coarse gravel accumulations are common in point and medial gravel bars in this unit. The high confinement of these channels create relatively high sediment transport capacity. However, if the supply of coarse sediment surpasses the transport capacity the impact can be filling of pools or increased scour of the bed.

Fine Sediment: Moderate Response Potential
The channels of this unit have high fine sediment transport capacity due to high flow capacity of the channel. However, the Navarro watershed has a relatively high background sediment rate. This high rate of sediment input can result in pool filling or bed fining from high fine sediment accumulations. Fine sediment accumulations were observed in this unit on the top of gravel bars, accumulated in the bed of plane bed reaches, along pool margins, and in some pools.

Large Woody Debris: Moderate Response Potential
Large woody debris is sparse in this unit. The LWD that is present is providing stream habitat development and cover. The confined high energy flow and large channels of this unit require very large LWD pieces or debris jams to keep the LWD in place. Very large LWD is recruited

into channels infrequently due to the long growing times of streamside trees. However, LWD in this unit is still important because the channels in this unit gain greater pool depths and cover, for fish habitat diversity, with increased LWD.

Geomorphic Unit III. Confined and Moderately Confined Low Gradient Channel Segments in the Navarro River Watershed.

Includes Segments: *Field observed* – ED1, ED8, EI2, EJ1, EJ1(2), EL1, EM1, EN2, EU1, EU4, WF1,WF1(2), WL27
Extrapolated – WN1, WN2, WN3, WG4, WG2, EL2, EL3, EM2, EU2, EU3, EI1, EI11, EI19, ED2, ED3, EN1

General Description:
The channels within this unit meander through confined canyons. Hillslopes or inner gorge topography typically controls the lateral movement of the channels. In wider areas of the valley bottom, high terraces are present and occasionally floodplains are present, though discontinuously. The bankfull channel varies from approximately 15 to 75 feet in width. The channels in this unit are low gradient (0-2 percent), but sediment transport capacity is high due to the confined channel keeping water energy directed within the channel and relatively large drainage areas producing greater water flow.

Associated Channel Types:
This unit primarily exhibits pool/riffle morphology, with some forced pool/riffle morphology. The Rosgen classifications (Rosgen, 1994) for these channels are primarily F4 and F3 with occasional areas of C4.

Fish Habitat Associations:
The confined channels of these units have a high sediment transport capacity during high flows, which flushes fine sediment, with the potential to create high quality spawning gravel. This same high-energy transport, in conjunction with LWD, dominates pool development. Currently this unit has low amounts of large woody debris, however due to the confined canyons wood recruitment would have a positive effect on the quality of in-stream habitat. Overwintering habitat can be limited in areas without large cobble/boulder and bedrock substrates. LWD when present in this unit provides overwintering habitat for juvenile salmonids.

Conditions and Response Potential

Coarse Sediment: Moderate Response Potential
These channels are depositional areas for coarse sediment. The high confinement of these channels creates relatively high sediment transport capacity. If the supply of coarse sediment surpasses the transport capacity of the stream, pools can be filled, and the influence of large woody debris and bedrock controlled sections are reduced. If significant amounts of coarse sediment are supplied to these channels then the channels are vulnerable to widening, creating greater bank erosion, or limited lateral movement reducing meander and increasing bed scour. However, because of the natural confinement of these channels, the tendency toward widening or adjustments in meanders are minimized.

Fine Sediment: Moderate Response Potential
The channels of this unit have high fine sediment transport capacity due to high flow capacity of the channel. However, when there is a high fine sediment supply in transport, accumulations of fine sediment do occur in this unit. Sparse to abundant accumulations of fine sediment was observed in this unit. These accumulations were observed in the gravel bars, along channel margins, and in some pools.

Large Woody Debris: High Response Potential

The alluvial composition of the bed material in conjunction with a low gradient channel makes these channels highly responsive to LWD inputs. LWD is a dominant influence for pool development, sediment storage behind LWD accumulations and stabilization of bank and bedforms within the channels in this unit. LWD forced pool/riffle morphology is evident in some reaches within this unit.

Geomorphic Unit IV. Confined Low Gradient Channel Segments of Small Tributary Streams in the Navarro River Watershed.

Includes Segments: *Field observed* – EM20, EM29, EM30, EM39, EN25, EN3, EN38, EN4, EU20, EU7, WF13, WF26, WH3, WL19, WL28, WL4, WM13, WN10, WN20, WR11, WR14, WR15, WR26
Extrapolated – WL5, WL6, WL7, WL8, WL9, WL29, WL30, WR1, WR2, WR3, WR13, WR23, WR32, WF2, WF3, WN24, WN28, WC1, ED10, ED11, EN14, EN15, EN43, EN40, EN24, EJ2, EJ3, EJ9, EJ12, EM3, EM4, EM31, EU18, EU21

General Description:
The channels within this unit flow through confined canyons. Hillslopes or inner gorge topography typically controls the lateral movement of the channels. Some terraces are present and occasionally floodplains are present, though discontinuously. The bankfull channel is typically less than 15-25 feet in width. The channels in this unit are low gradient (1-3 percent). These channels exhibit moderate sediment transport capacity. The confined channel keeps water energy directed within the channel but the relatively smaller drainage area does not produce water energy as high as Unit III.

Associated Channel Types:
This unit primarily exhibits pool/riffle morphology, forced pool/riffle morphology and some step pool morphology. The Rosgen classifications (Rosgen, 1994) for these channels are primarily F4, F3 and G4 with occasional areas of C4, B3, and B4.

Fish Habitat Associations:
Spawning habitat and gravel are moderate amounts in this unit, but spawning gravel quality is good where present. These channels are confined within narrow canyons that produce good recruitment potential for LWD. The recruited LWD in turn facilitates pool development and offers shelter. Rearing habitat availability can be good where sufficient LWD creates good pool habitat and shelter, however summer rearing can be absent because some of the streams in this unit can go subsurface during the summer rearing period. Young fish would have to migrate to other areas to survive through the summer months. Overwintering habitat is provided by large cobble/boulder and bedrock substrates. LWD when present in this unit also provides overwintering habitat for juvenile salmonids.

<u>Conditions and Response Potential</u>
Coarse Sediment: High Response Potential
These channels are depositional areas for coarse sediment. The moderate sediment transport capacity makes these channels vulnerable to changes in supply of coarse sediment. Fluctuations of coarse sediment can occur that will surpass the transport capacity of the stream. When this occurs pools can be filled, the influence of large woody debris and bedrock controlled sections are reduced and the channels can aggrade. Aggradation of the channel can create greater bank erosion, or produce limited lateral movement increasing localized bed scour thus causing the channels to entrench.

Fine Sediment: Moderate Response Potential
The channels of this unit have high fine sediment transport capacity due to high flow capacity of the channel. However, when there is a high fine sediment supply in transport, accumulations of fine sediment do occur in this unit. Sparse to abundant accumulations of fine sediment was

observed in this unit. These accumulations were observed in the gravel bars, along channel margins, and in some pools.

Large Woody Debris: High Response Potential
The alluvial composition of the bed material in conjunction with a low gradient channel makes these channels highly responsive to LWD inputs. LWD is a dominant influence for pool development, sediment storage behind LWD accumulations and stabilization of bank and bedforms within the channels in this unit. LWD forced pool/riffle morphology is evident in some reaches within this unit.

Geomorphic Unit V. Channel Migration/Avulsion Channel Segments in the Navarro River Watershed.

Includes Segments: WN23, WR10, WR12, WF1 (Partial)

General Description: Channels within this unit flow through unconfined to moderately confined canyon sections in the Navarro River watershed. The channels in this unit are low gradient (<1 percent), with a high degree of deposition. Channels within this unit frequently access the floodplain and abandoned or avulsion channels at high flows. The unconfined channels in combination with access of the floodplain and avulsion channels during high flows makes channel migration to avulsion channels common in this unit. The channel substrate, and adjacent terraces is predominantly a consolidation of fine deposited materials of the silt and clay size classes.

Associated Channel Types:
This unit primarily exhibits pool/riffle morphology, however plane bed morphology is occasionally present. The Rosgen classifications (Rosgen, 1994) for these channels are predominantly C4, C5, C6 with areas of E5 or E6 depending on the substrate or bank configuration.

Fish Habitat Associations:
A high propensity for channel migration causes streams to spread out over the floodplain rather than concentrating flows through a narrow channel. While this increased wetted area may enhance spawning habitat area, it also increases fine sediment deposition in areas of lesser flow. During drought conditions or low summer flows, it is not uncommon for side channel flow to go subsurface. In these situations, rearing habitat is limited to the main channel and deeper residual pools. The unconfined, low gradient nature of these streams combined with large amounts of woody debris result in an abundance of wood-forced pools creating good summer-rearing habitat. These segments are often lacking bedrock and the large cobble/boulder substrates associated with overwintering habitat. However, the LWD provides the roughness element to slow water velocities and provide key overwintering habitat to juvenile salmonids.

Conditions and Response Potential

Coarse Sediment: Moderate Response Potential

Coarse gravel accumulations are primarily in point and LWD forced gravel bars, with some medial bars. In a few isolated circumstances the channels do show evidence of having some aggradation in the past. The unconfined channels and migrating channel areas are not considered high sediment transport areas, but do provide a large amount of sediment storage opportunities buffering impacts from high coarse sediment loads. However, based on evidence of some past and current aggradation, if the coarse sediment supply is high then the channels could be adversely affected lowering channel complexity and fish habitat quality.

Fine Sediment: Low Response Potential

Moderate to high accumulations of fine sediment is observed in this unit. However, the substrate and terraces in this unit are composed of fine material. The unconfined and low gradient characteristic of this unit facilitates high fine sediment deposition. This deposition provides for the flat morphology of the stream channels, and thus the fine material composition of the channel banks, substrate and terraces. This process of fine sediment deposition appears to be the natural process in this unit. This unit is not anticipated to be adversely affected by future fine sediment deposition provided the channel migration and floodplain characteristics are not altered.

Large Woody Debris: High Response Potential

LWD is common to abundant in this unit with some areas with sparse accumulations. LWD is functional for stream habitat development or cover in this unit. The greatest portion of pool formation in this unit is LWD forced. The channel substrate and terraces in this unit are predominantly composed of fine particles (silt and clay), providing little in the way of roughness elements for stream habitat or channel diversity. LWD and streamside vegetation in this unit is the primary source of channel roughness for stream habitat development and quality. In the areas where channel migration is prevalent, LWD recruitment across the entire canyon bottom is essential to ensure adequate LWD for channel roughness and habitat as the channel migrates.

Geomorphic Unit VI. Moderate Gradient Confined Transport Segments.

Includes Segments: *Field observed* – EU24, WF27, WM32 (partial), WM36, WN11 (partial), WR23, WU4.
Extrapolated – WL10, WL11, WL20, WL21, WL22, WL23, WL31, WL32, WR5, WR8, WR16, WR18, WR20, WR27, WR36, WR40, WN8, WN13, WN14, WN20, WN26, WF6, WF9, WF17, WF18, WF21, WM36, WU7, WU15, WH4, WH12, WC2, WC3, WC8, WI1, WI2, WI3, ED4, ED12, ED14, ED17, ED27 (partial), ED30, EJ5, EJ7, EJ4, EJ10, EJ11, EJ13, EJ14, EJ17, EL9, EL18, EN5, EN6, EN8, EN16, EN17, EN19, EN20, EN26, EN27, EN39, EN45, EM5, EM6, EM7, EM8, EM16, EM20, EM27, EM32, EM40, EM41, EI5, EI6, EU5, EU8.

General Description:
Stream channel segments in this unit are confined to moderately confined within canyons. Typically valley widths are between 2 and 5 bankfull channel widths. This valley width is sufficient to allow some isolated terrace formation and channel meandering. The channel segments in this unit are near the transition between deposition and transport channels. Due to the moderate gradient (3-8 percent) of the channels, they are responsive to aggradation and degradation from changes in the stream sediment supply. The stream bed of these channels varies from gravel to boulder sized particles. The terraces in this unit appear to be created from large episodic sediment loads such as frequent mass wasting. The gradient of the stream is high enough that stream segments in this unit easily down-cut through the terrace deposits when flow is concentrated.

Associated Channel Types:
This unit primarily exhibits step pool and cascade morphology, with areas of pool/riffle morphology. The Rosgen classifications (Rosgen, 1994) for these channels vary from A1-4 and G1-4 with areas of B3, B4 and C4 depending on the bank configuration, slope and channel substrate.

Fish Habitat Associations:
Spawning areas in this unit are infrequent, due to lack of accumulations of gravel sized particles. The steeper gradient segments of this unit typically form step-pool, cascade, and some pool-riffle habitat. The step-pools that are typically boulder formed, and offer substrate refugia, which provide both rearing and overwintering habitat.

Conditions and Response Potential

Coarse Sediment: Moderate Response Potential
The channels in this unit have relatively high sediment transport capacity. In the lower gradient sections of these channels coarse sediment can create pool filling and aggradation, resulting in increased bank erosion and poor stream habitat. The step pool sections of these channels have relatively stable cobble and boulder component that can remain relatively static except in extreme flows. Increased coarse sediment supply can create pool filling, but is only moderately influential on the morphology because pool filling at these moderate gradients creates lower channel roughness which in turn promotes more step pool or cascade development, provided high inputs of coarse sediment subside.

Fine Sediment: Low Response Potential

The channels of this unit have high fine sediment transport capacity due to high flow capacity of the channel. However, when there is a high fine sediment supply in transport, accumulations of fine sediment do occur but typically have short residence times in this unit. Sparse to moderate accumulations of fine sediment was observed in this unit. These accumulations were observed in the bed and along channel margins.

Large Woody Debris: Moderate Response Potential

The high confinement or entrenchment of these channels provides little opportunity for the channel to meander or develop a floodplain. Water energy is concentrated within the confines of canyon walls or stream banks making the role of LWD less sensitive as channels with less confinement or entrenchment. LWD is less likely to enter the channel because it becomes suspended over the channels narrower bankfull width. The role of LWD is typically as sediment storage or forced step pool development in these channels. Bed morphology in channels with slope gradients of 4-10% is typically step pool (Montgomery and Buffington, 1993). The large bed forming material of step pool morphology is generally stable making the role of LWD in these channels less sensitive than other channel types.

Geomorphic Unit VII. High Gradient Transport Segments.

Includes Segments: EL4, EL5, EL6, EL7, EL8, EL10, EL11, EL12, EL13, EL14, EL15, EL16, EL17, EL19, ED5, ED6, ED7, ED9, ED13, ED15, ED16, ED18, ED19, ED20, ED22, ED23, ED24, ED25, ED27, ED29, ED31, ED32, ED33, ED34, EJ8, EJ14, EJ15, EJ16, EJ18, EN7, EN9, EN10, EN11, EN12, EN13, EN18, EN21, EN22, EN23, EN28, EN29, EN30, EN31, EN32, EN33, EN34, EN35, EN36, EN37, EN41, EN42, EN44, EN46, EN47, EN48, EN49, EN50, EN51, EN52, EM9, EM10, EM11, EM12, EM13, EM14, EM15, EM17, EM17, EM18, EM19, EM21, EM22, EM23, EM24, EM25, EM26, EM33, EM34, EM35, EM36, EM37, EM38, EM42, EM43, EM44, EM45, EM46, EM47, EM48, EM49, EM50, EI3, EI4, EI6, EI7, EI8, EI10, EI12, EI13, EI14, EI15, EI16, EI18, EU6, EU9, EU10, EU11, EU12, EU13, EU15, EU16, EU19, EU22, EU23, EU25, EU26, EU27, EU28, EU29, EU30, EU31, EU32, EU33, EU34, EU35, EU36, WI4, WC4, WC5, WC6, WC7, WC9, WC10, WC11, WH5, WH6, WH7, WH8, WH9, WH10, WH11, WH13, WH14, WU3, WU5, WU6, WU7, WU8, WU9, WU10, WU11, WU12, WU13, WU14, WU16, WU18, WU19, WU20, WU21, WU23, WU24, WG3, WG4, WG5, WG6, WM8, WM9, WM10, WM12, WM14, WM15, WM16, WM17, WM18, WM19, WM20, WM21, WM22, WM24, WM25, WM26, WM27, WM28, WM29, WM30, WM32(partial), WM33, WM34, WM35, WM38, WM39, WM40, WM41, WM42, WM43, WM44, WM47, WN4, WN5, WN6, WN7, WN9, WN11(partial), WN12, WN15, WN16, WN17, WN19, WN21, WN22, WN25, WN27, WN29, WN30, WN31, WN32, WN33, WF7, WF8, WF10, WF11, WF12, WF19, WF20, WF22, WF23, WF24, WF25, WF28, WF30, WR4, WR6, WR7, WR9, WR17, WR19, WR21, WR22, WR24, WR25, WR28, WR29, WR30, WR31, WR34, WR35, WR37, WR38, WR39, WL17, WL18, WL24, WL25, WL26, WL33, WL34, WL35, WL36, WL37, WL38, WL39, WL40.

General Description:
Channel segments in this unit are high gradient transport reaches from 8-20% with high sediment transport capacity. The channel segments in this unit typically flow through tightly confined, steep-sided, V-shaped canyons. These are typically zones of scour during high flows, and periodically influenced by shallow-seated landslides. Stream substrate is typically from cobble to large boulders. Typically, there is no water flow in this unit in the summer drought season.

Associated Channel Types:
This unit varies morphology from step pool to cascades with some occasional waterfalls. The cascades and waterfalls occur in the steepest segments of this unit and only during winter storm events. The Rosgen (Rosgen, 1996) classification for these channels varies between A2, A3, and AA2, AA3 depending on channel gradient and substrate composition.

Fish Habitat Associations:
The high gradient channels of this unit prevent coho salmon from accessing these areas. Potential for steelhead trout utilization is low due to the high gradient; 8% to 20%. Rearing would be unlikely because stream flow typically goes subsurface in the summer months.

Conditions and Response Potential

Coarse Sediment: Low Response Potential
Typically the channel morphology in this unit is cascade, with some step pool morphology at the lower gradients observed in these channels. These channels have bed material that is coarse and relatively immobile. Down cutting or bank erosion are not common in these high gradient, large substrate dominated channels even with increases in sediment supply. Debris flows can cover

the substrate creating the cascade morphology but this is generally short-lived due to the high sediment transport capacity of the channels.

Fine Sediment: Low Response Potential

The high gradient of the channels in this unit creates a high fine sediment transport capability. Pools or storage areas for fine sediment in these channels are limited making the impacts from fine sediment minimal. Down cutting or bank erosion are not common in these high gradient, large substrate dominated channels even with increases in sediment supply.

Large Woody Debris: Low Response Potential

The role of LWD in these channels is to provide storage of sediment and also as a source for downstream LWD. LWD is needed in these channels however the need for LWD as a source for downstream LWD is episodic and therefore the least sensitive as other channel types. The storage of sediment by LWD in these channels is necessary, but can be accomplished by a range of size classes of LWD not necessarily very key LWD pieces.

DAM UNDER CONSTRUCTION ON THE NAVARRO RIVER - PROBABLY USED IN WATER DRIVING LOGS TO MILL.
#03399 GEORGIA PACIFIC

Long Term Stream Monitoring

During the Summer of 1999 six long term channel monitoring segment were surveyed for longitudinal profiles, cross sections, and particle size distribution, while eight segments for stream gravel permeability and stream gravel composition in the Navarro River WAU. In 2001, 2 of the segments were re-surveyed, North Branch North Fork Navarro River and South Branch North Fork Navarro River providing a comparison of the thalweg, cross sections and pebble counts for those segments. The plots of the surveys are included in the appendix of this module (Appendix E) for display. The results of the stream gravel bulk samples and permeability are presented in section F - Fish Habitat Assessment of this report.

Literature Cited

Montgomery, D. and J. Buffington. 1993. Channel classification, prediction of channel response, and assessment of channel condition. Washington State Timber/Fish/Wildlife report TFW-SH10-93-002. Washington.

Rosgen, D. 1994. A classification of natural rivers. Catena 22, 169-199.

Rosgen, D. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO.

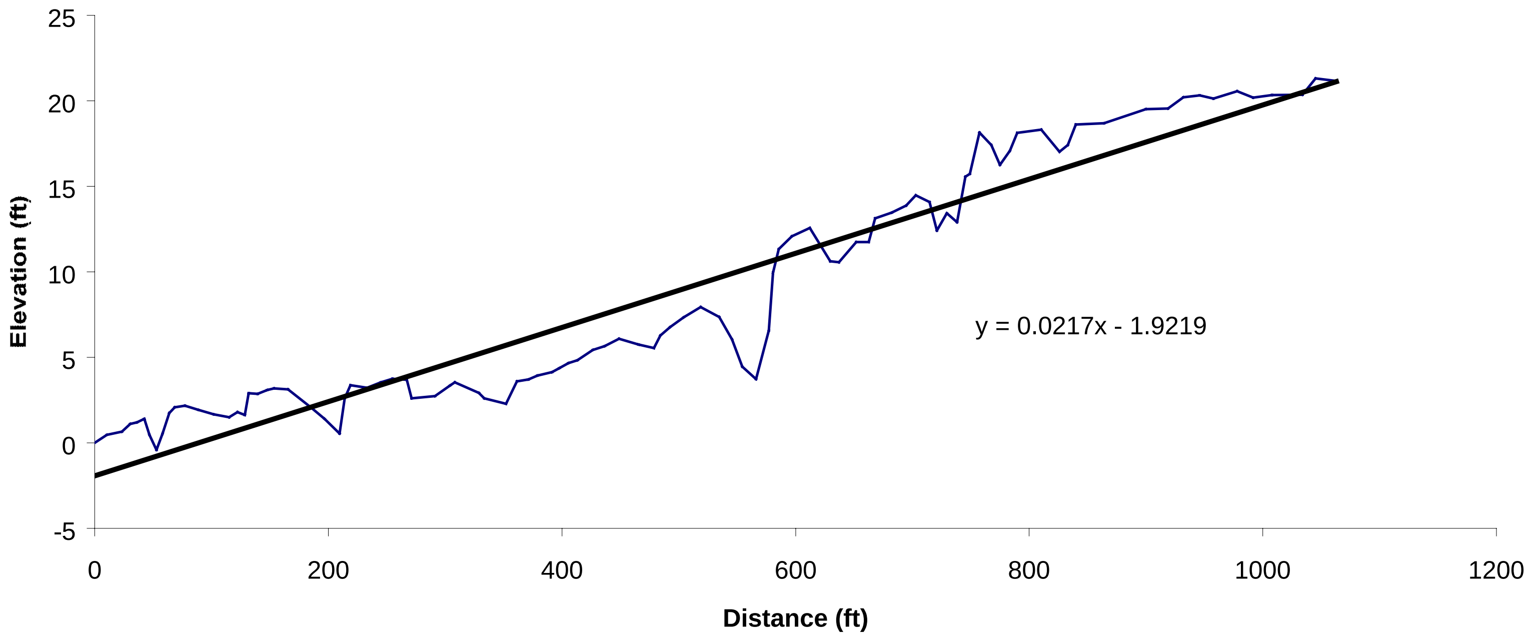
Sullivan, K., T. Lisle, C. Dollhof, G. Grant, and L. Reid. 1986. Stream channels: the link between forests and fishes. In: Salo E.O. and T. Cundy. Streamside Management: Forestry and Fishery Interactions. Proc. of Symposium held at the Univ. of Washington, Feb 12-14, 1986, Seattle, WA: 39-97.

Washington Forest Practice Board. 1997. Standard methodology for conducting watershed analysis. Version 4.0. WA-DNR Seattle, WA.

Appendix E

Stream Channel Condition Module

South Branch North Fork Navarro River Thalweg Profile 11/5/99



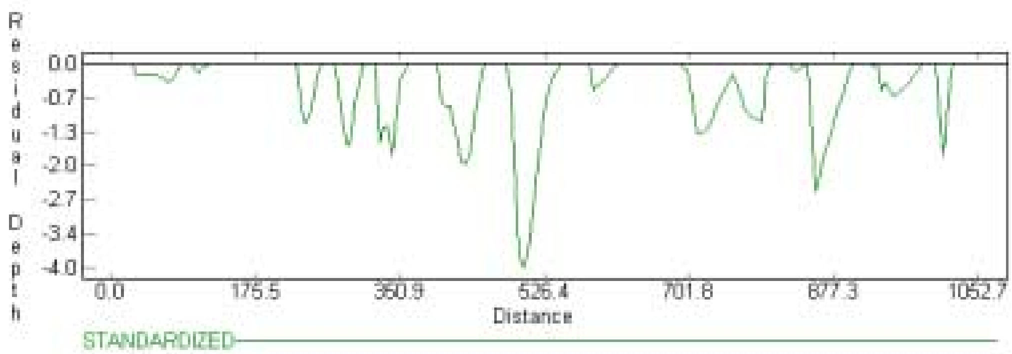
South Branch North Fork Navarro River Residual Depth Statistics 1999

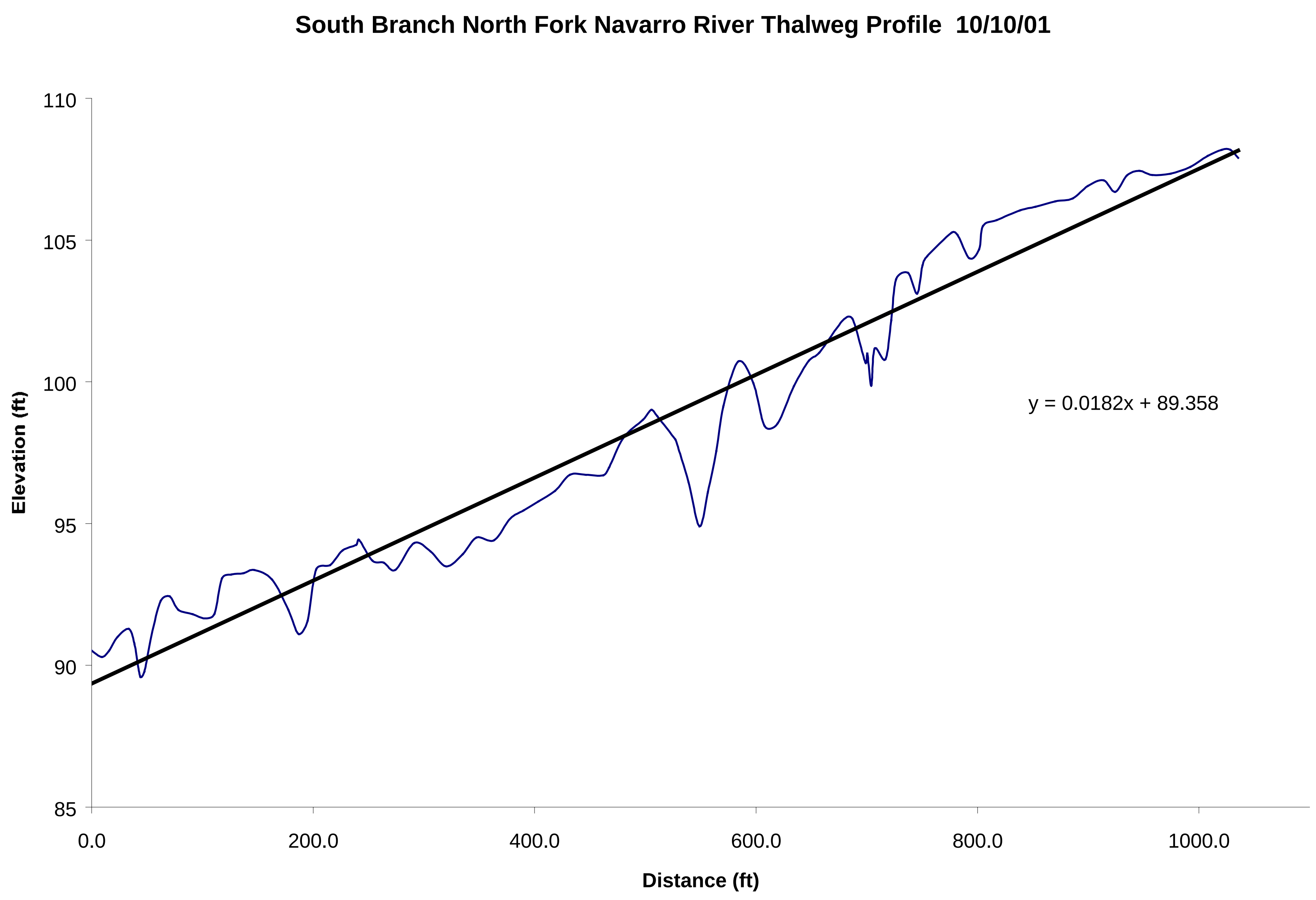
Top Elevation: 21.32
Bottom Elevation: -0.42
Reach Length: 1052.70

Reach Step Distance: 5.00

Max Residual Depth: 4.02
Mean Residual Depth: 0.46
Standard Deviation: 0.73

Number of non-zero Residual Depths: 121
Percent of Reach as pool: 57.35
Percent of Reach as riffle: 42.65





South Branch North Fork Navarro River Thalweg Profile 10/10/01
110
105
100
95
90
85
Elevation (ft)
0.0
200.0
400.0
600.0
800.0
1000.0
Distance (ft)
y = 0.0182x + 89.358

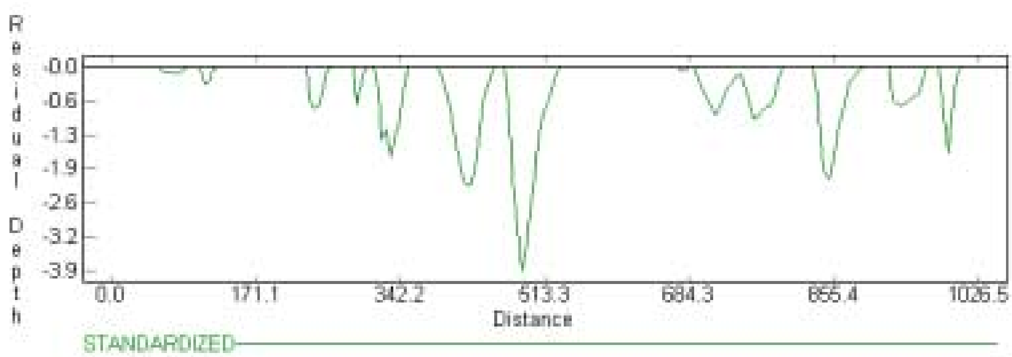
South Branch North Fork Navarro River Residual Depth Statistics 2001

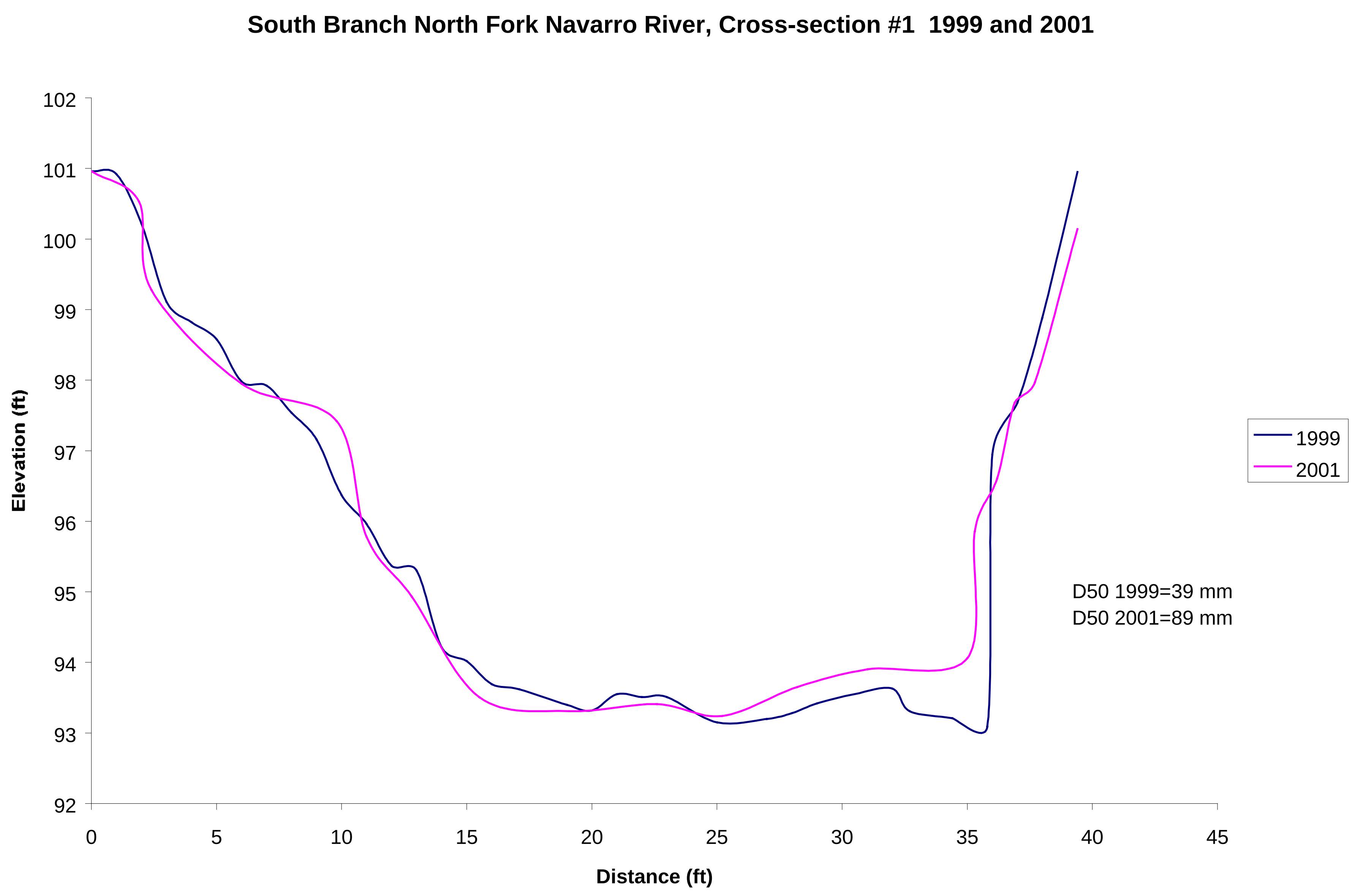
Top Elevation: 108.18
Bottom Elevation: 89.60
Reach Length: 1026.50

Reach Step Distance: 5.00

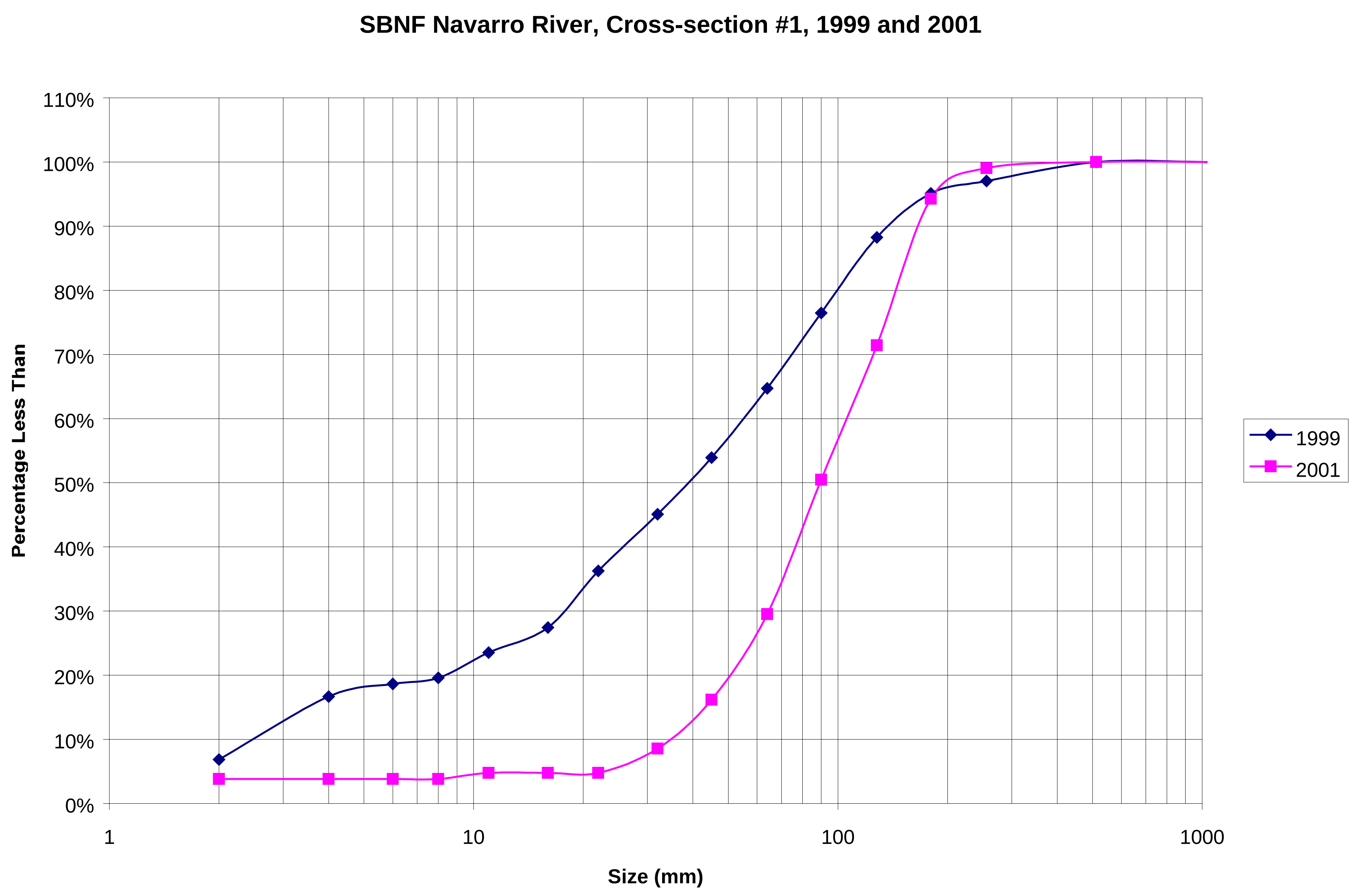
Max Residual Depth: 3.87
Mean Residual Depth: 0.40
Standard Deviation: 0.69

Number of non-zero Residual Depths: 102
Percent of Reach as pool: 49.76
Percent of Reach as riffle: 50.24



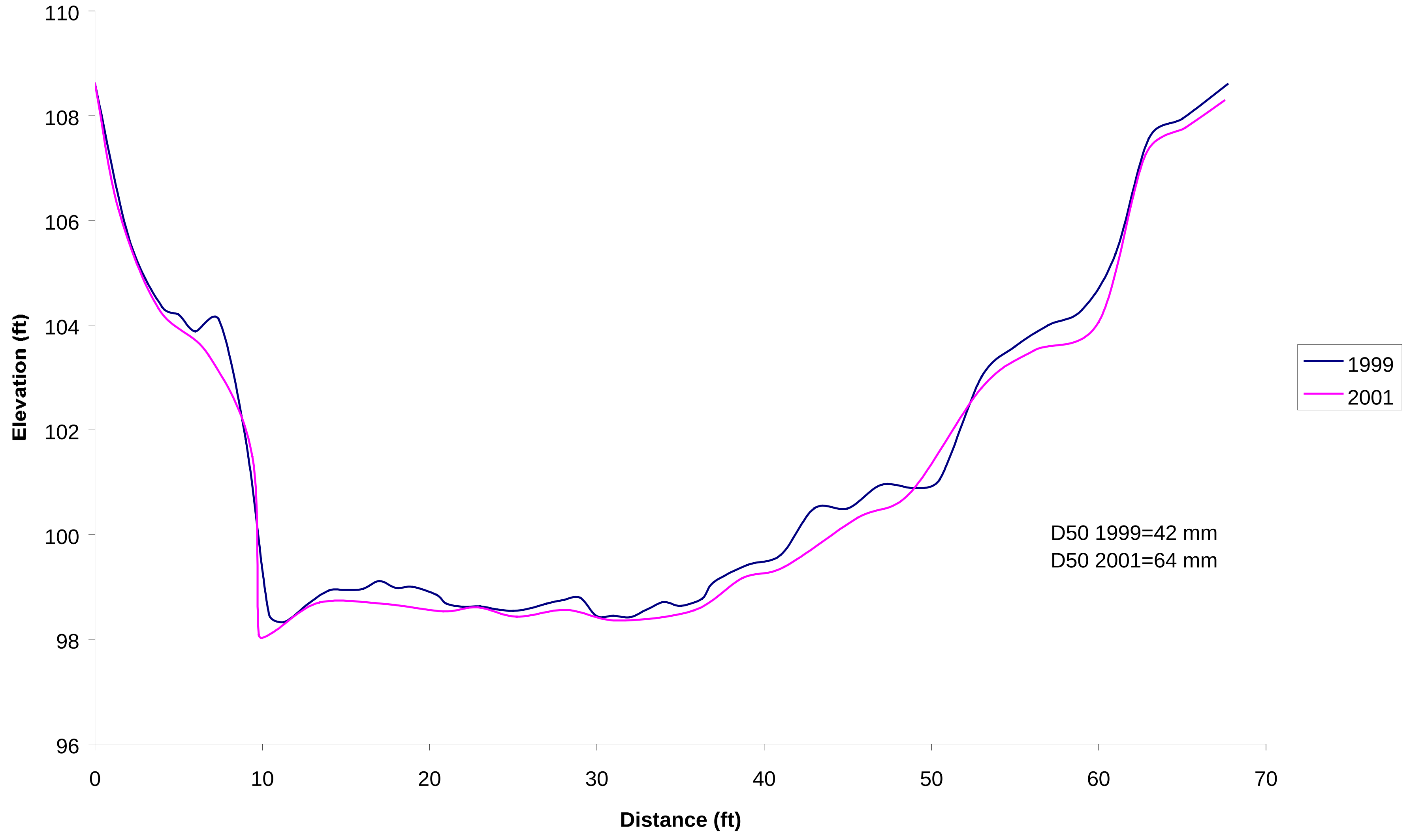


South Branch North Fork Navarro River, Cross-section #1 1999 and 2001
Elevation (ft)
102
101
100
99
98
97
96
95
94
93
92
0
5
10
15
20
25
30
35
40
45
Distance (ft)
1999
2001
D50 1999=39 mm
D50 2001=89 mm

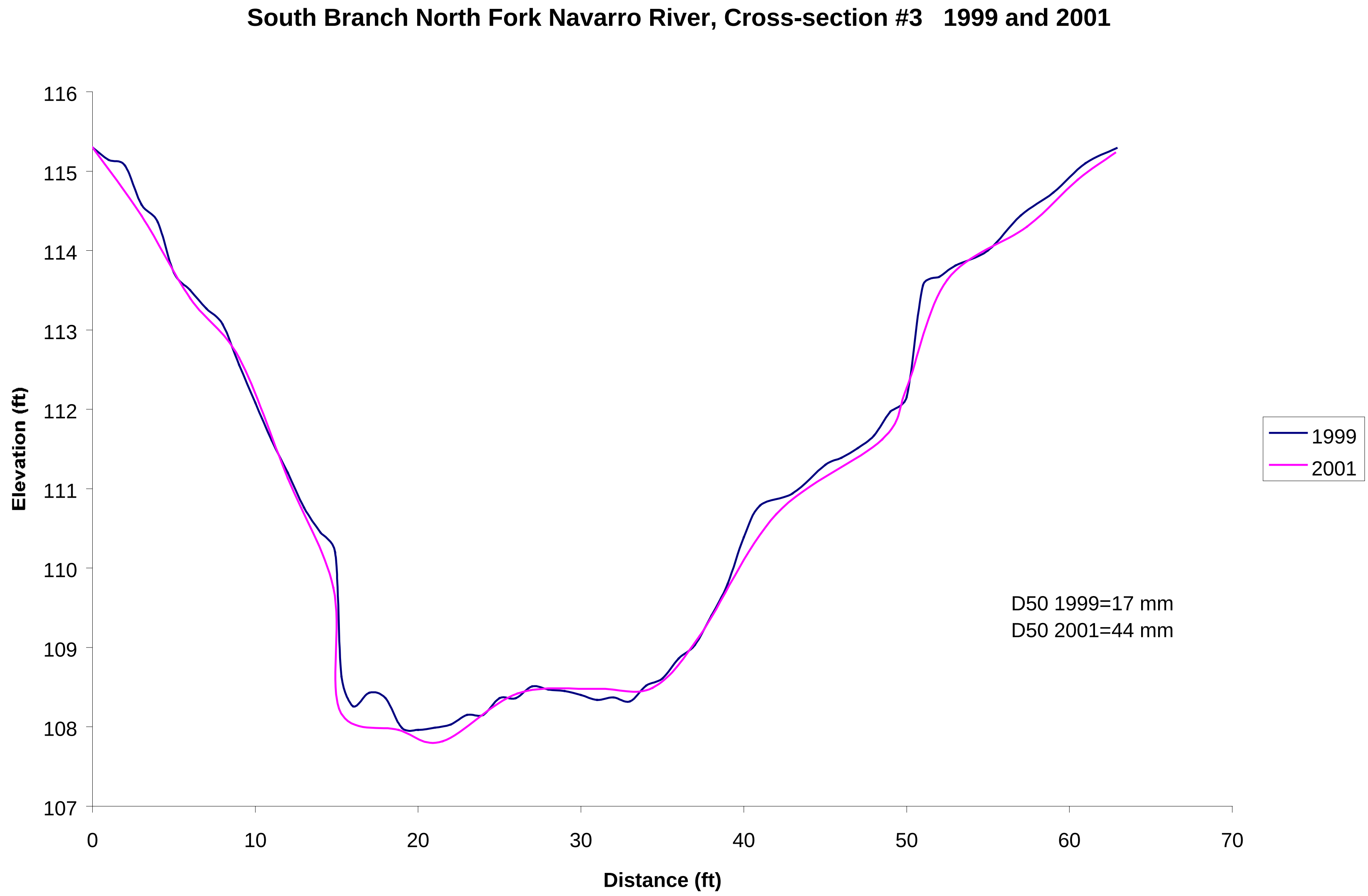


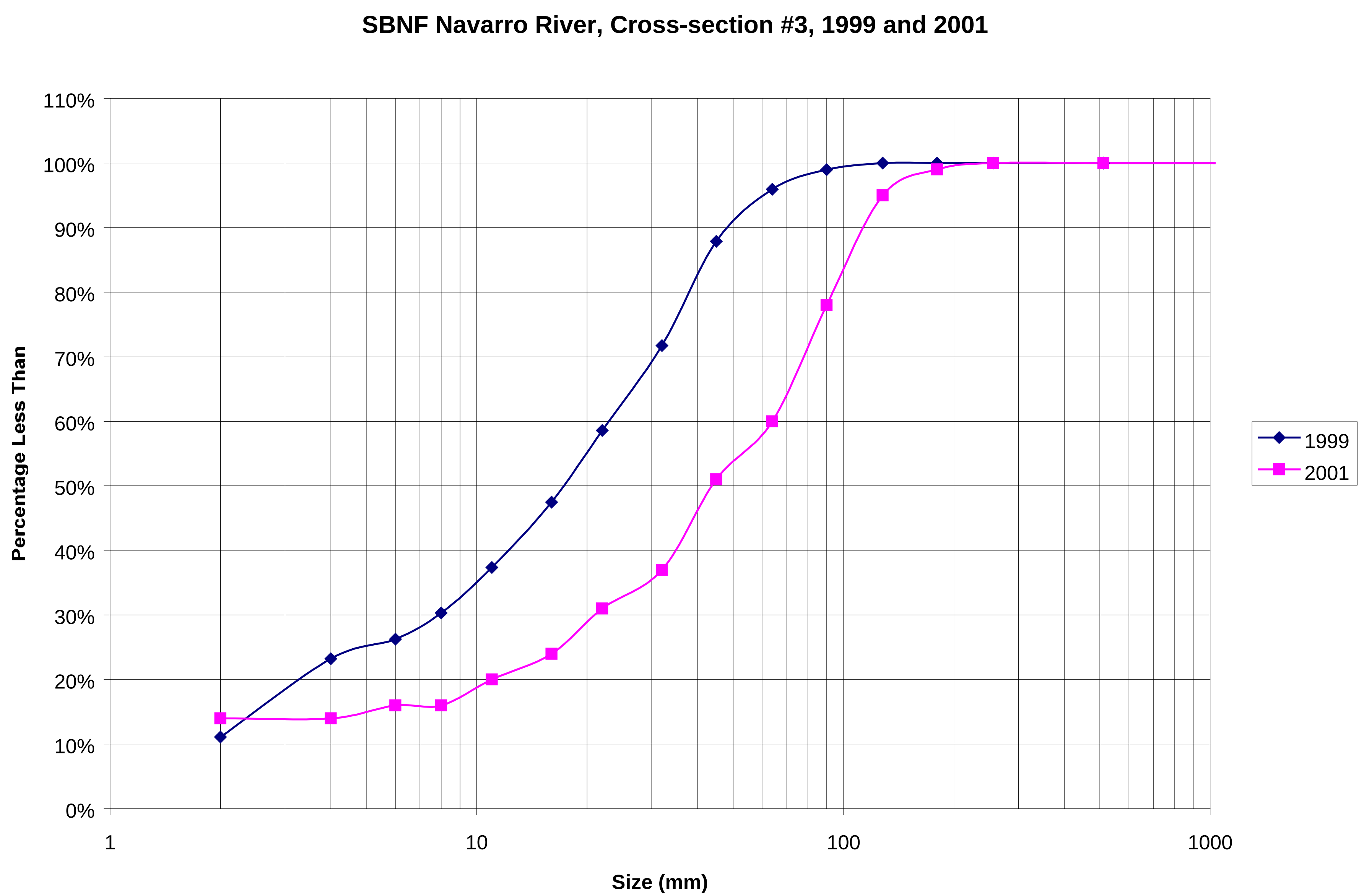
SBNF Navarro River, Cross-section #1, 1999 and 2001
Percentage Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)
1999
2001

South Branch North Fork Navarro River, Cross-section #2 1999 and 2001



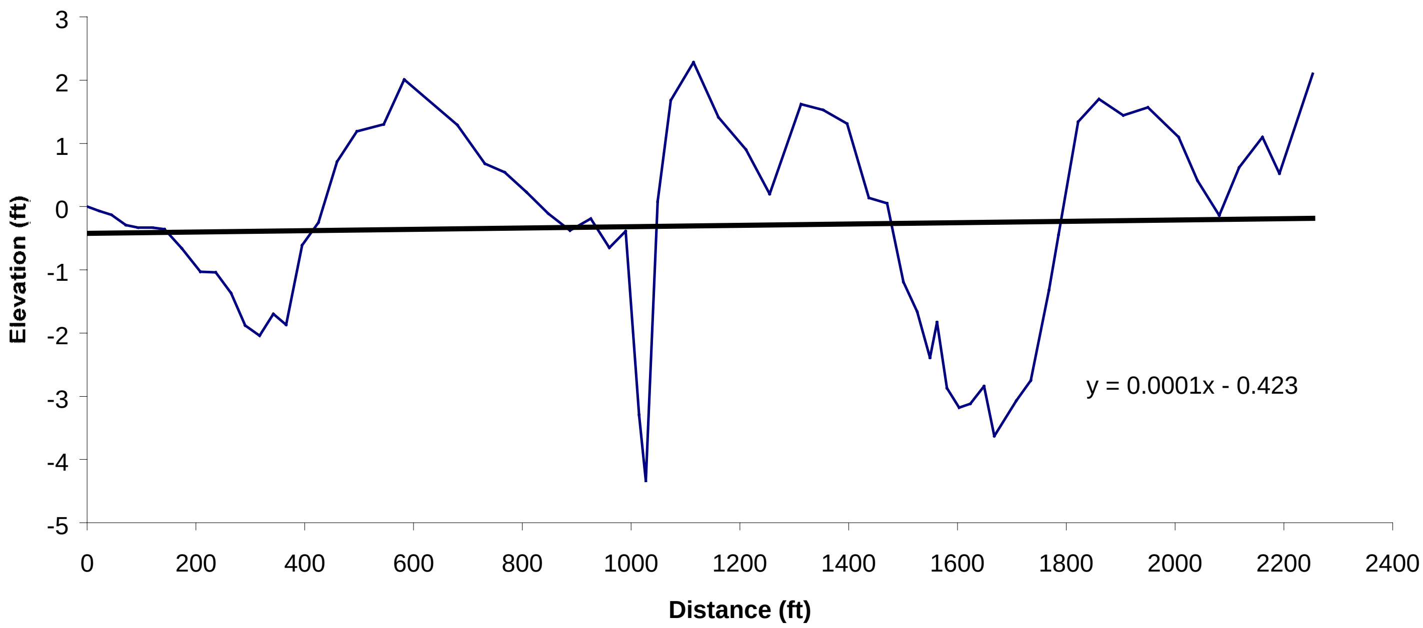
SBNF Navarro River, Cross-section #2, 1999 and 2001
Percentage Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)
1999
2001


South Branch North Fork Navarro River, Cross-section #3 1999 and 2001
Elevation (ft)
116
115
114
113
112
111
110
109
108
107
0
10
20
30
40
50
60
70
Distance (ft)
1999
2001
D50 1999=17 mm
D50 2001=44 mm



SBNF Navarro River, Cross-section #3, 1999 and 2001
Percentage Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)
1999
2001

Navarro Mainstem Thalweg



Mainstem Navarro River 1999 Residual Depth Statistics

Top Elevation: 2.28
Bottom Elevation: -4.34
Reach Length: 2231.40

Standardized Statistics:
Number of data points in raw data: 69
Number of data points in Standardized data: 446

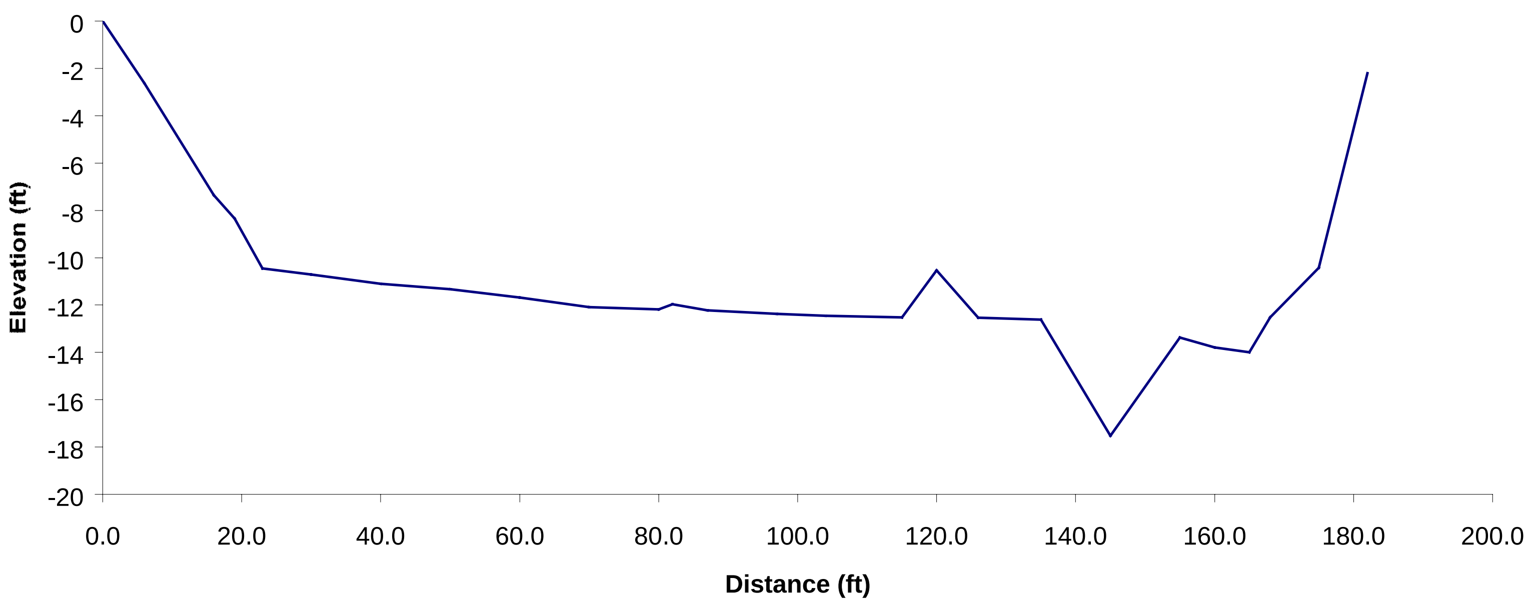
Reach Step Distance: 5.00

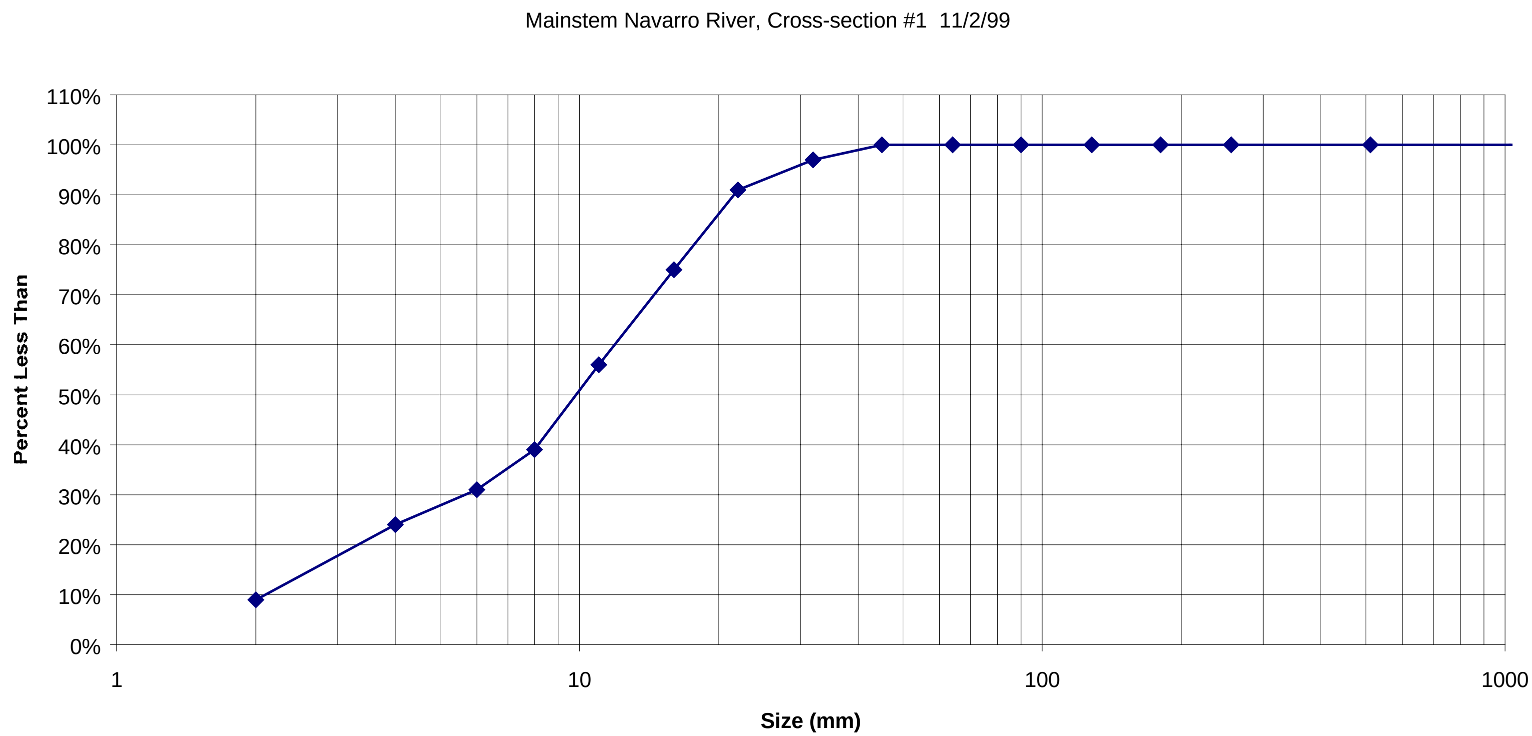
Max Residual Depth: 6.08
Mean Residual Depth: 1.67
Standard Deviation: 1.53

Number of non-zero Residual Depths: 411
Percent of Reach as pool: 92.15
Percent of Reach as riffle: 7.85

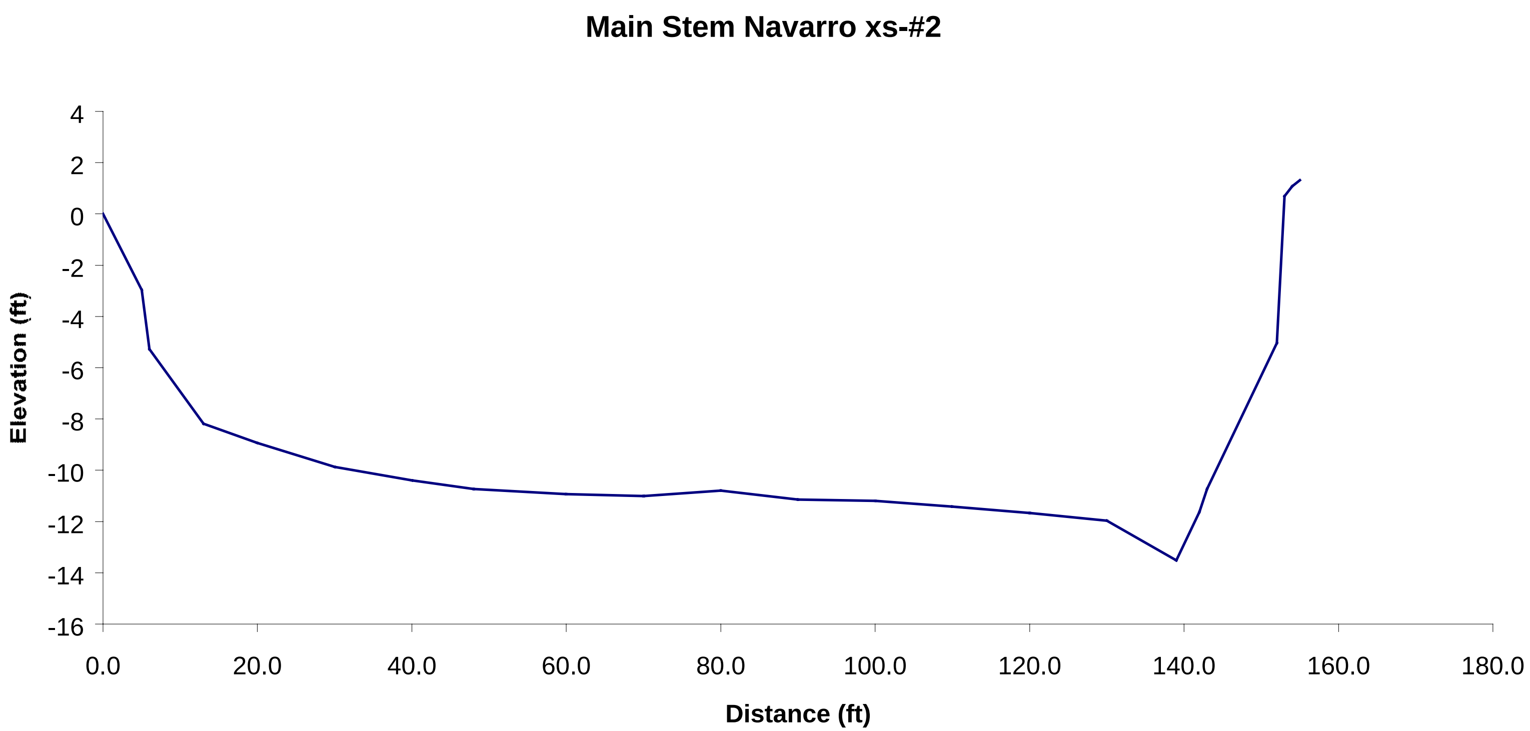
****Added artificial point at beginning of data set which was 1' higher than the previous.**

Mainstem Navarro River Cross-section #1 11/4/99

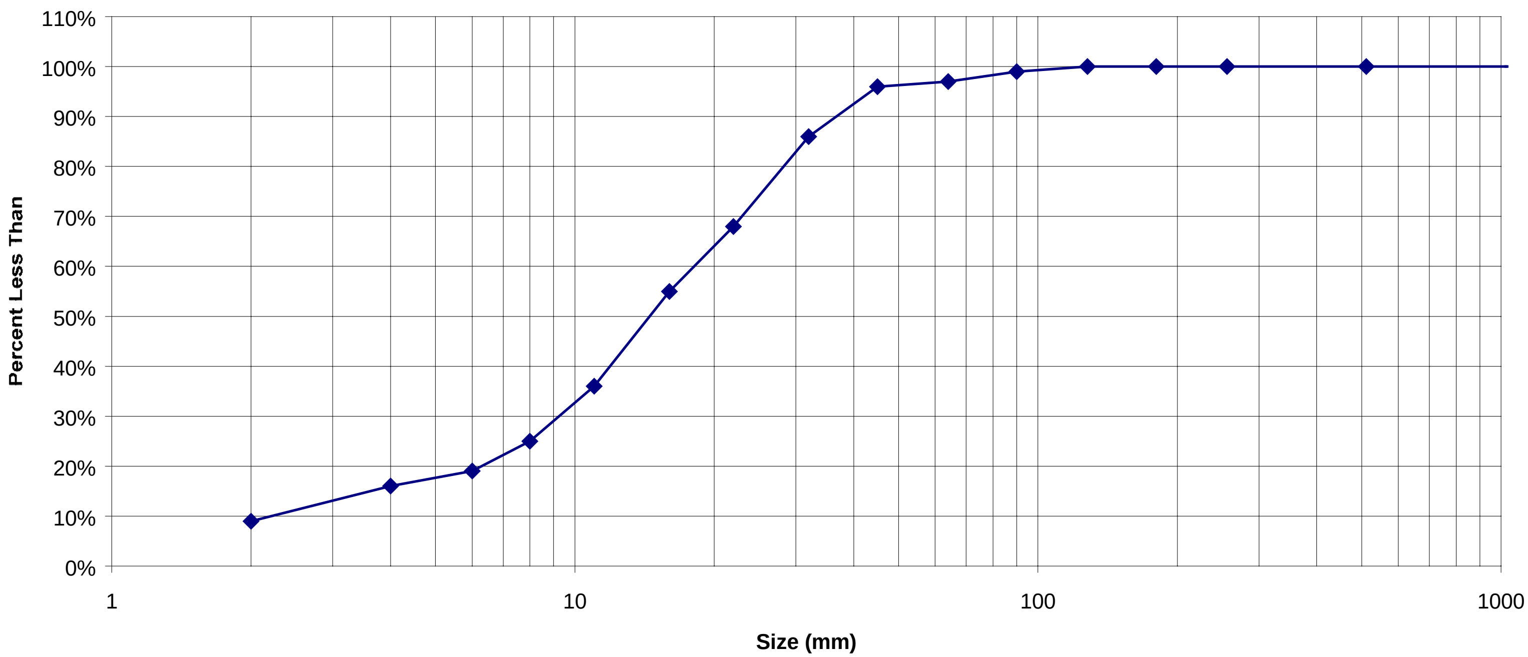


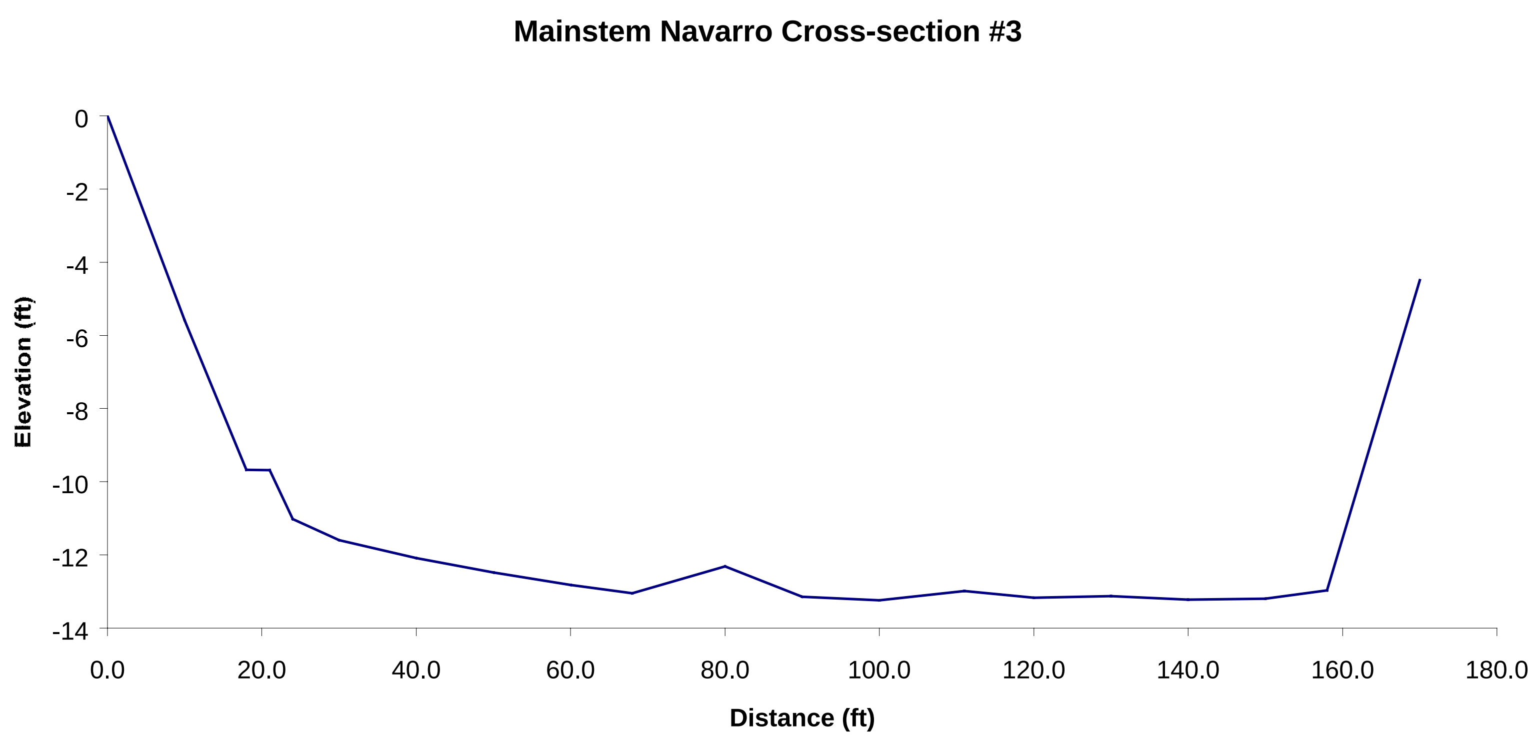


Mainstem Navarro River, Cross-section #1 11/2/99
Percent Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)

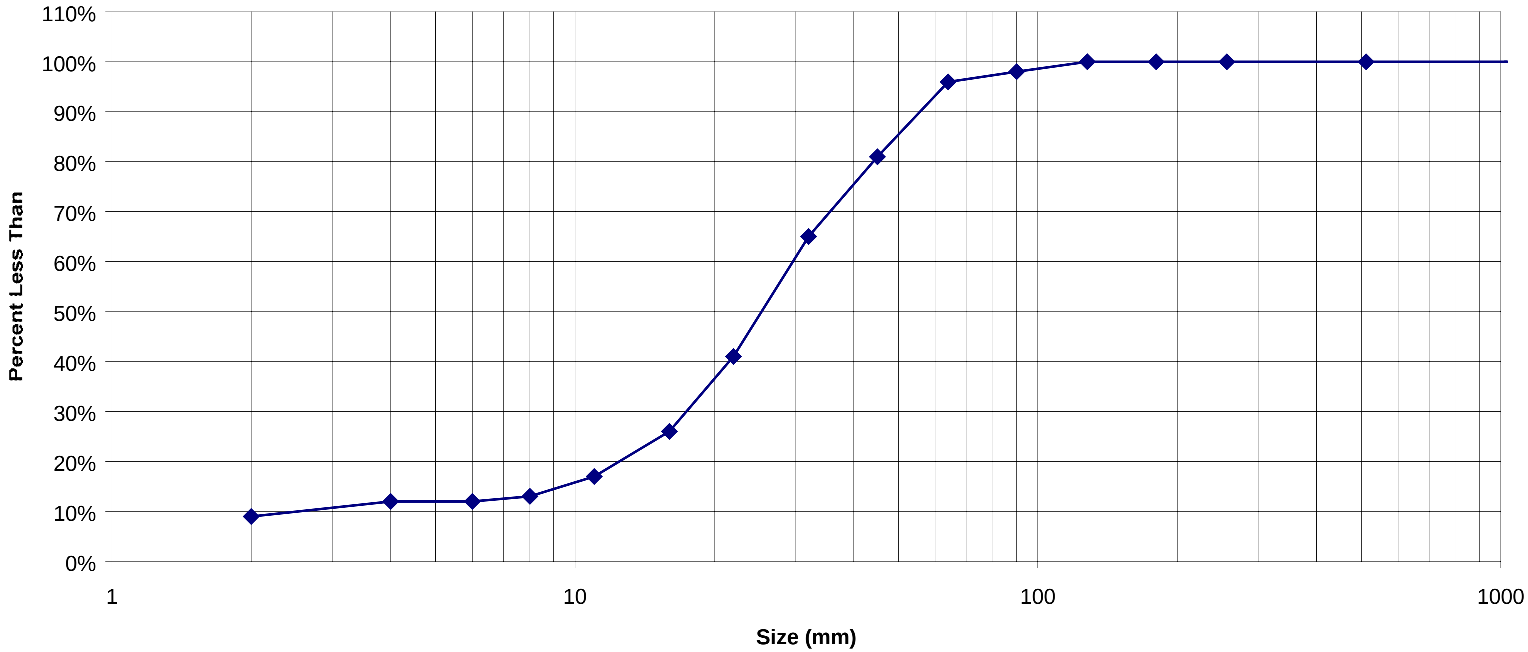

Main Stem Navarro xs-#2
Elevation (ft)
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
Distance (ft)

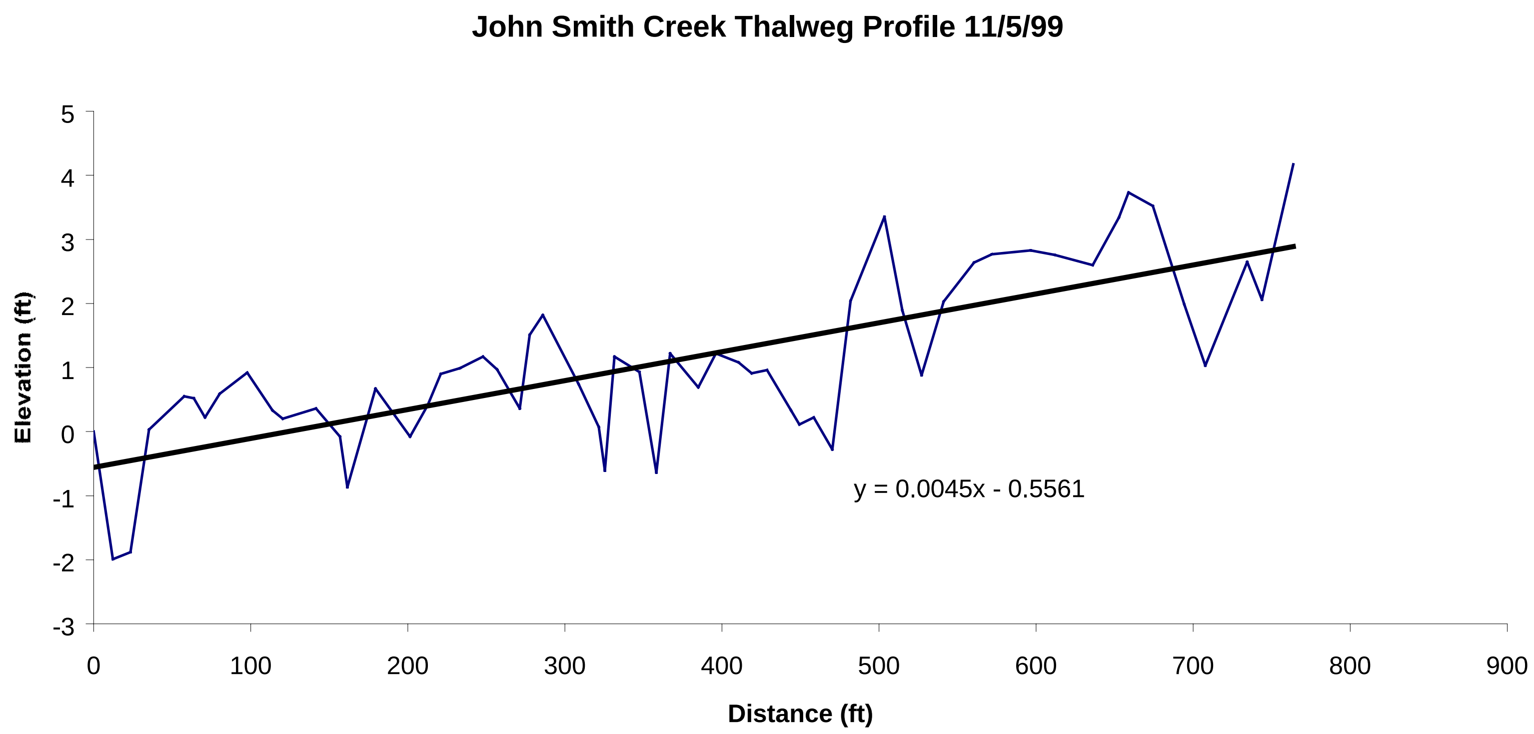
Mainstem Navarro River, Cross-section #2 11/2/99




Mainstem Navarro Cross-section #3
0
-2
-4
-6
-8
-10
-12
-14
Elevation (ft)
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
Distance (ft)

Mainstem Navarro River, Cross-section #3 11/2/99




John Smith Creek Thalweg Profile 11/5/99
Elevation (ft)
5
4
3
2
1
0
-1
-2
-3
0
100
200
300
400
500
600
700
800
900
Distance (ft)
y = 0.0045x - 0.5561

John Smith Creek 1999 Residual Depth Statistics

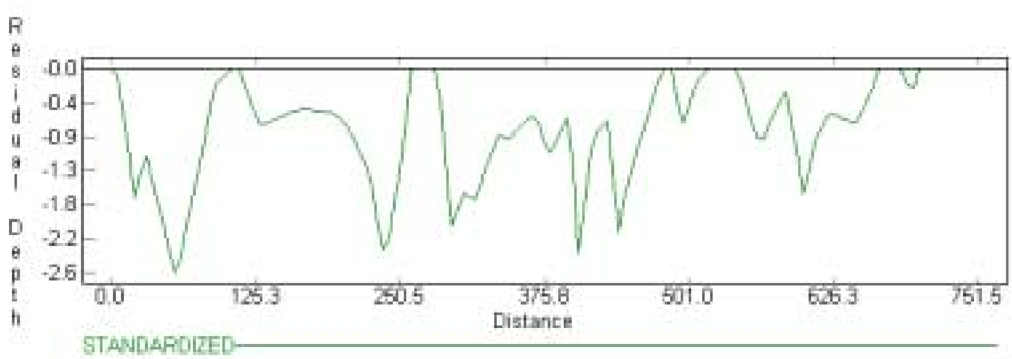
Top Elevation: 4.17
Bottom Elevation: -1.99
Reach Length: 751.50

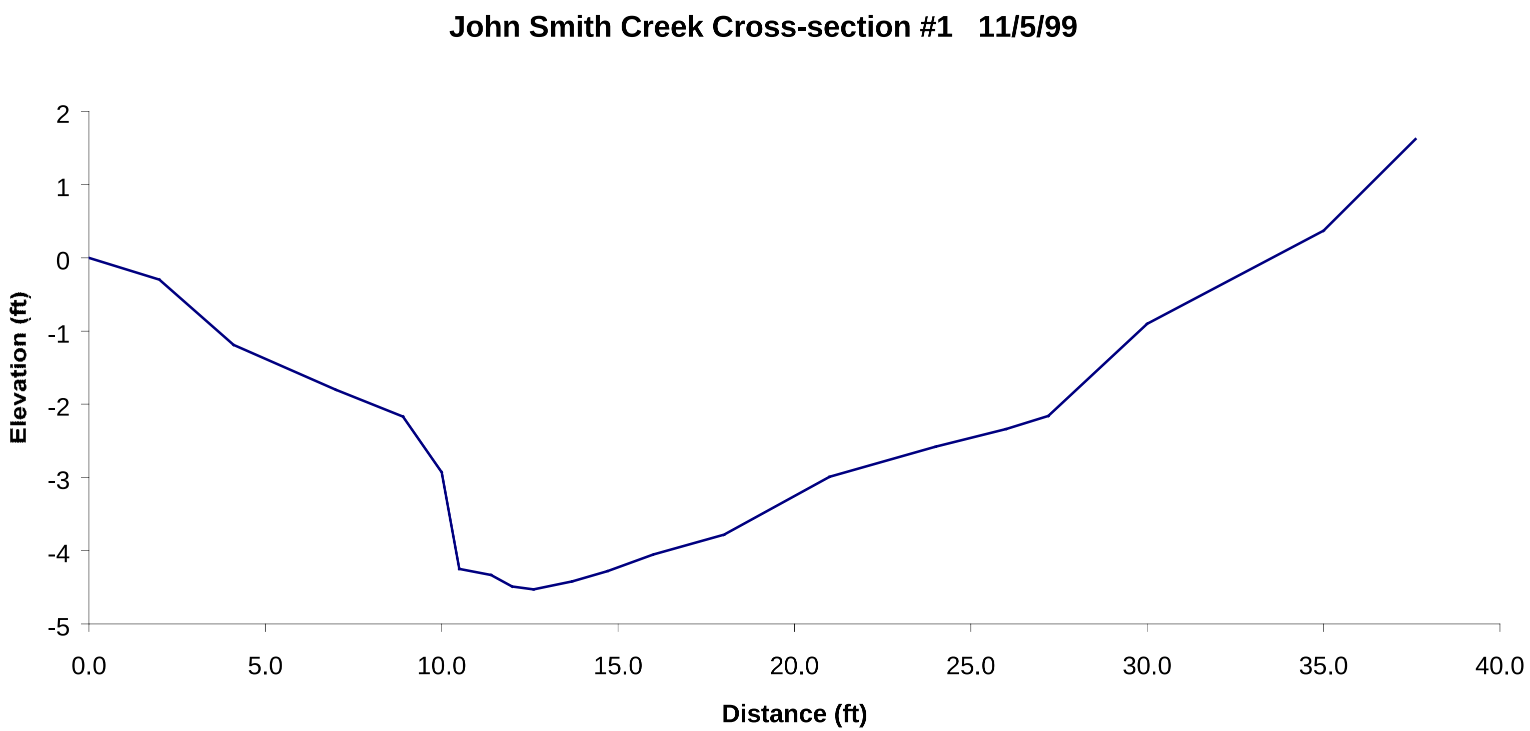
Standardized Statistics:
Number of data points in raw data: 57
Number of data points in Standardized data: 150

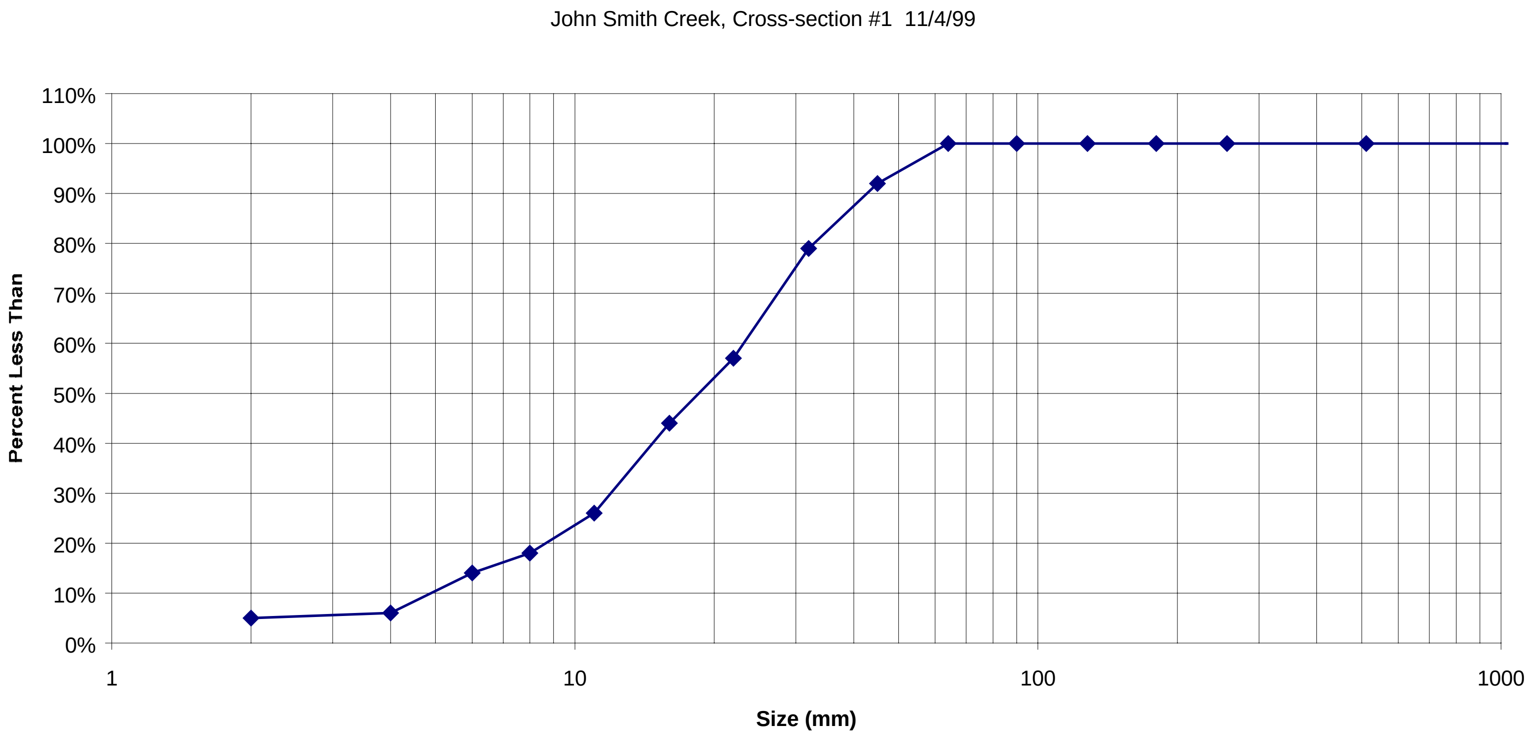
Reach Step Distance: 5.00

Max Residual Depth: 2.64
Mean Residual Depth: 0.76
Standard Deviation: 0.65

Number of non-zero Residual Depths: 126
Percent of Reach as pool: 84.00
Percent of Reach as riffle: 16.00

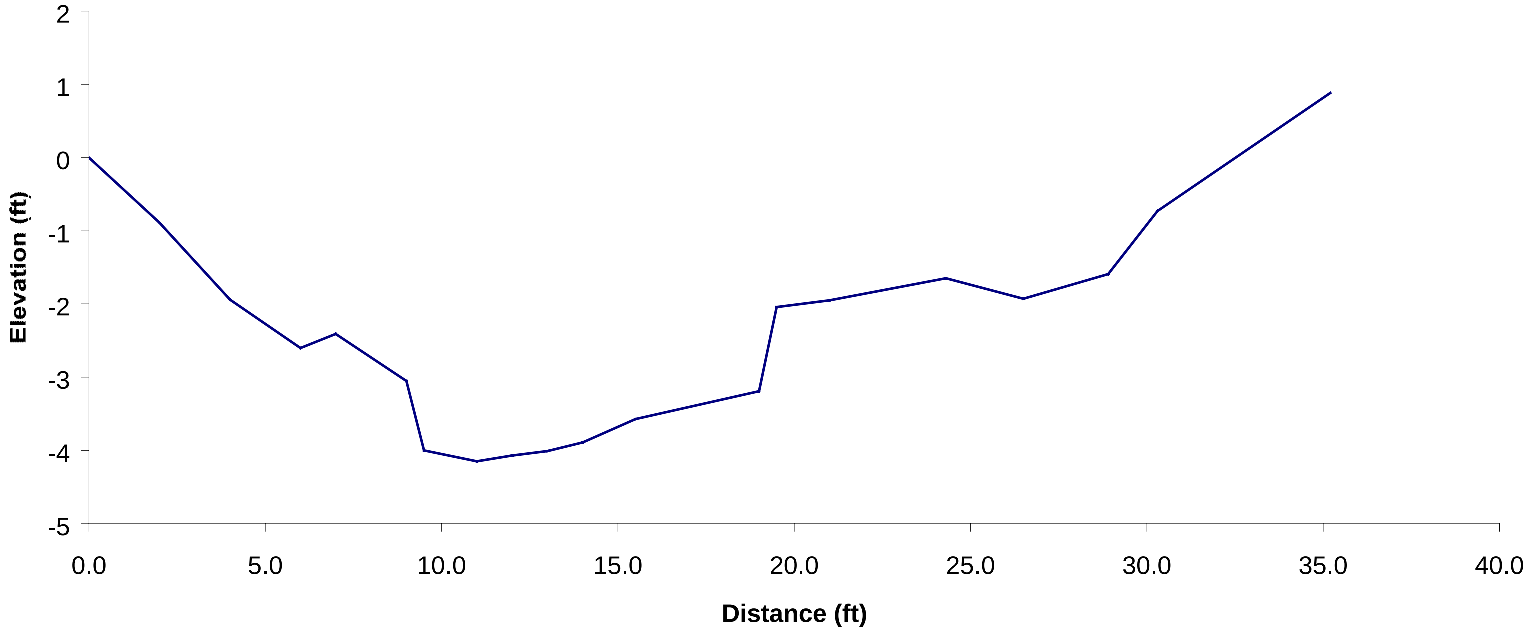


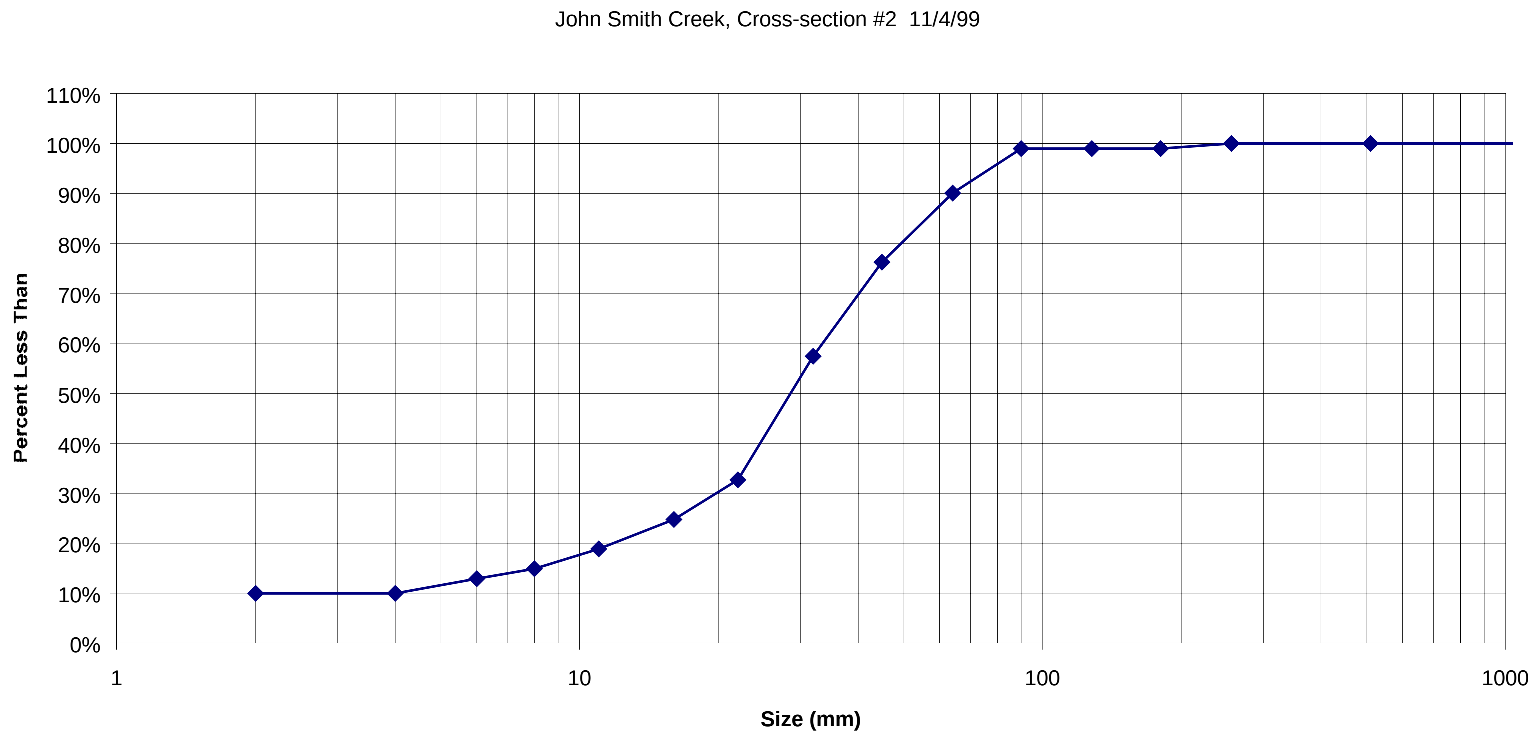

John Smith Creek Cross-section #1 11/5/99
2
1
0
-1
-2
-3
-4
-5
Elevation (ft)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
Distance (ft)



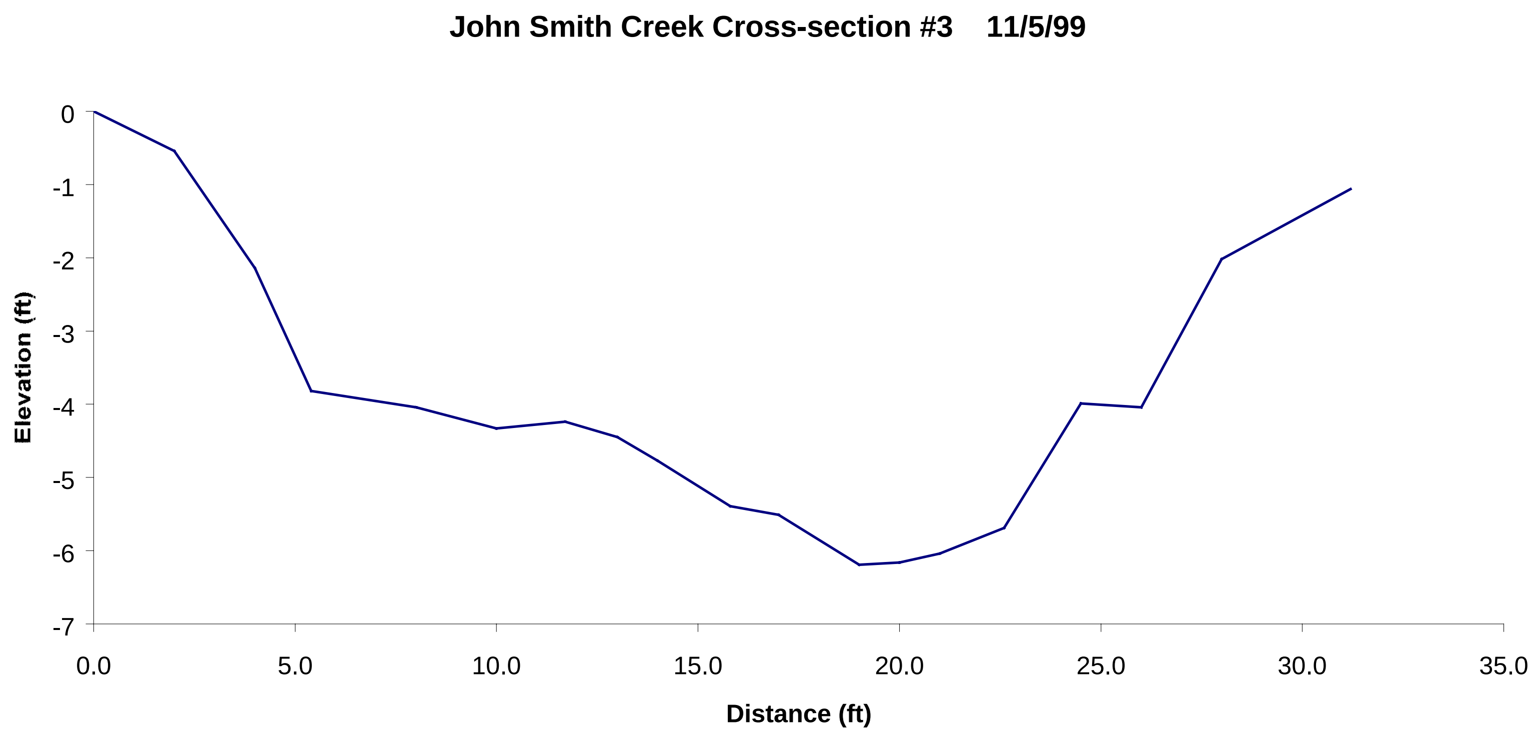
John Smith Creek, Cross-section #1 11/4/99
Percent Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)

John Smith Creek Cross-section #2 11/5/99

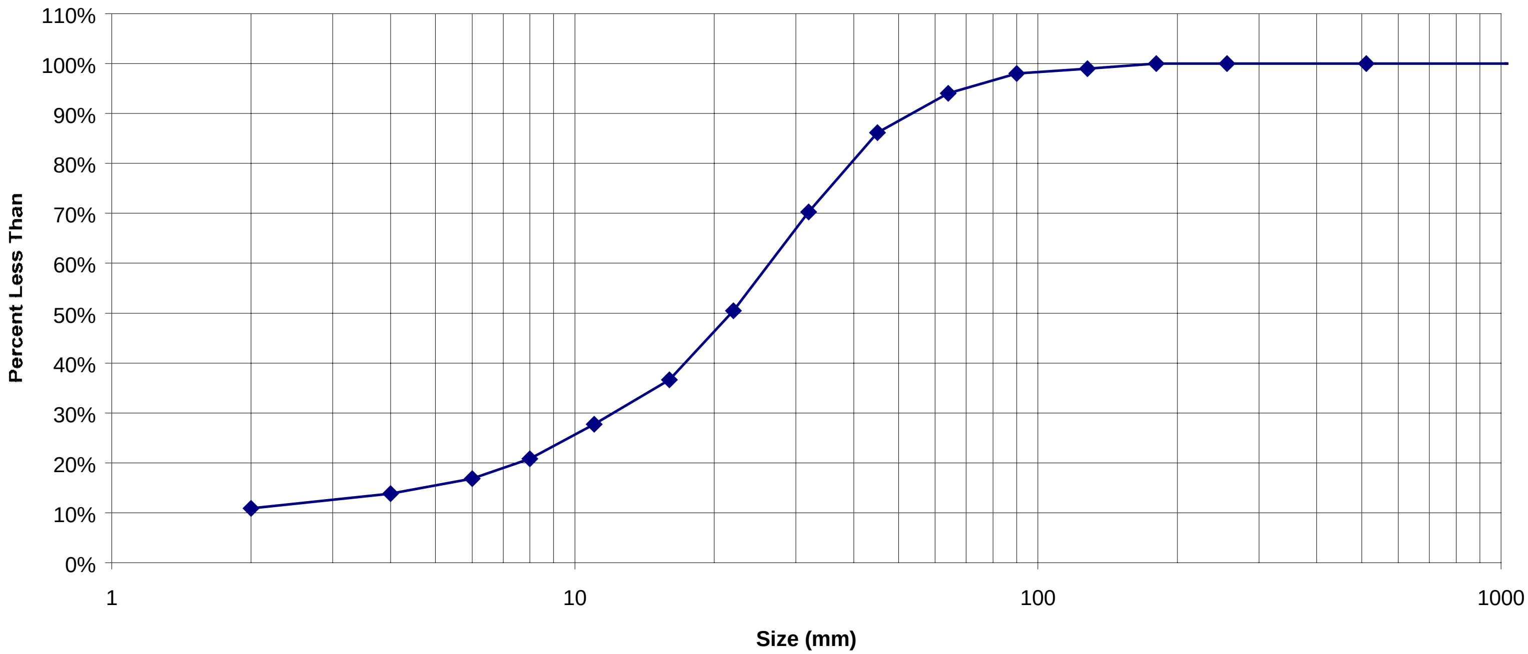


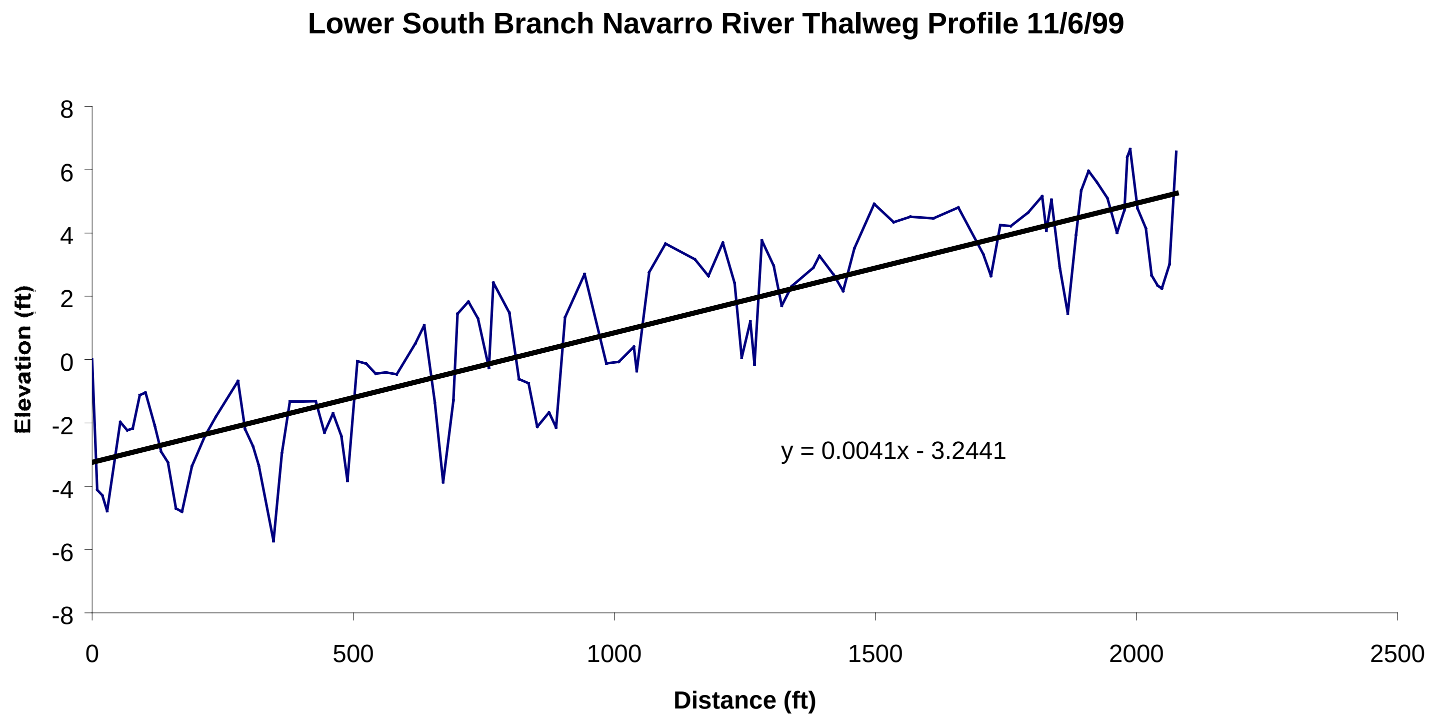


John Smith Creek, Cross-section #2 11/4/99
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent Less Than
1
10
100
1000
Size (mm)


John Smith Creek Cross-section #3 11/5/99
Elevation (ft)
0
-1
-2
-3
-4
-5
-6
-7
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
Distance (ft)

John Smith Creek, Cross-section #3 11/4/99




Lower South Branch Navarro River Thalweg Profile 11/6/99
Elevation (ft)
8
6
4
2
0
-2
-4
-6
-8
0
500
1000
1500
2000
2500
Distance (ft)
y = 0.0041x - 3.2441

Lower South Branch Navarro River 1999 Residual Depth Statistics

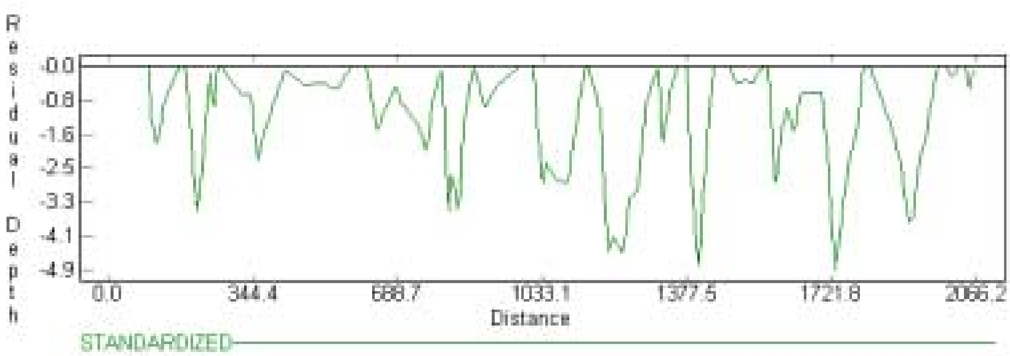
Top Elevation: 6.64
Bottom Elevation: -5.73
Reach Length: 2066.20

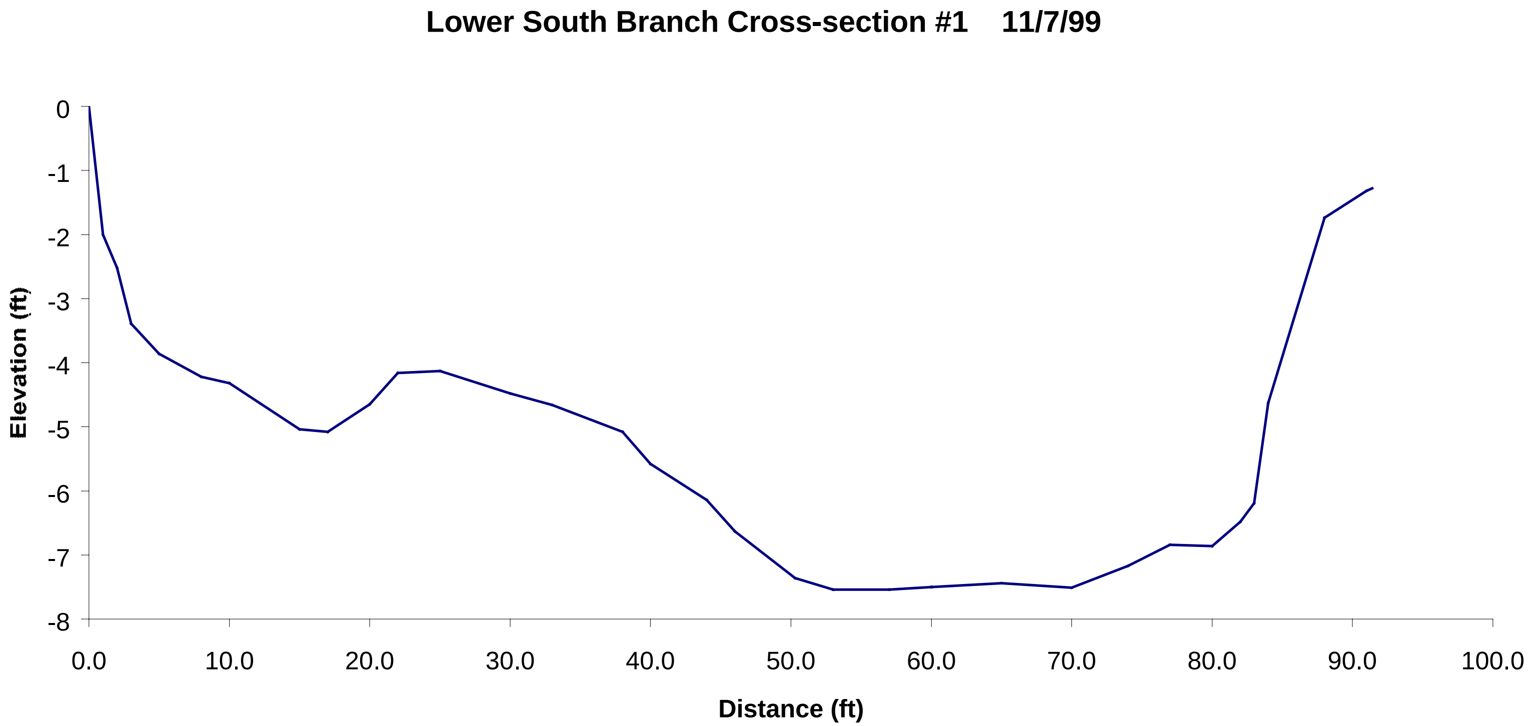
Standardized Statistics:
Number of data points in raw data: 105
Number of data points in Standardized data: 413

Reach Step Distance: 5.00

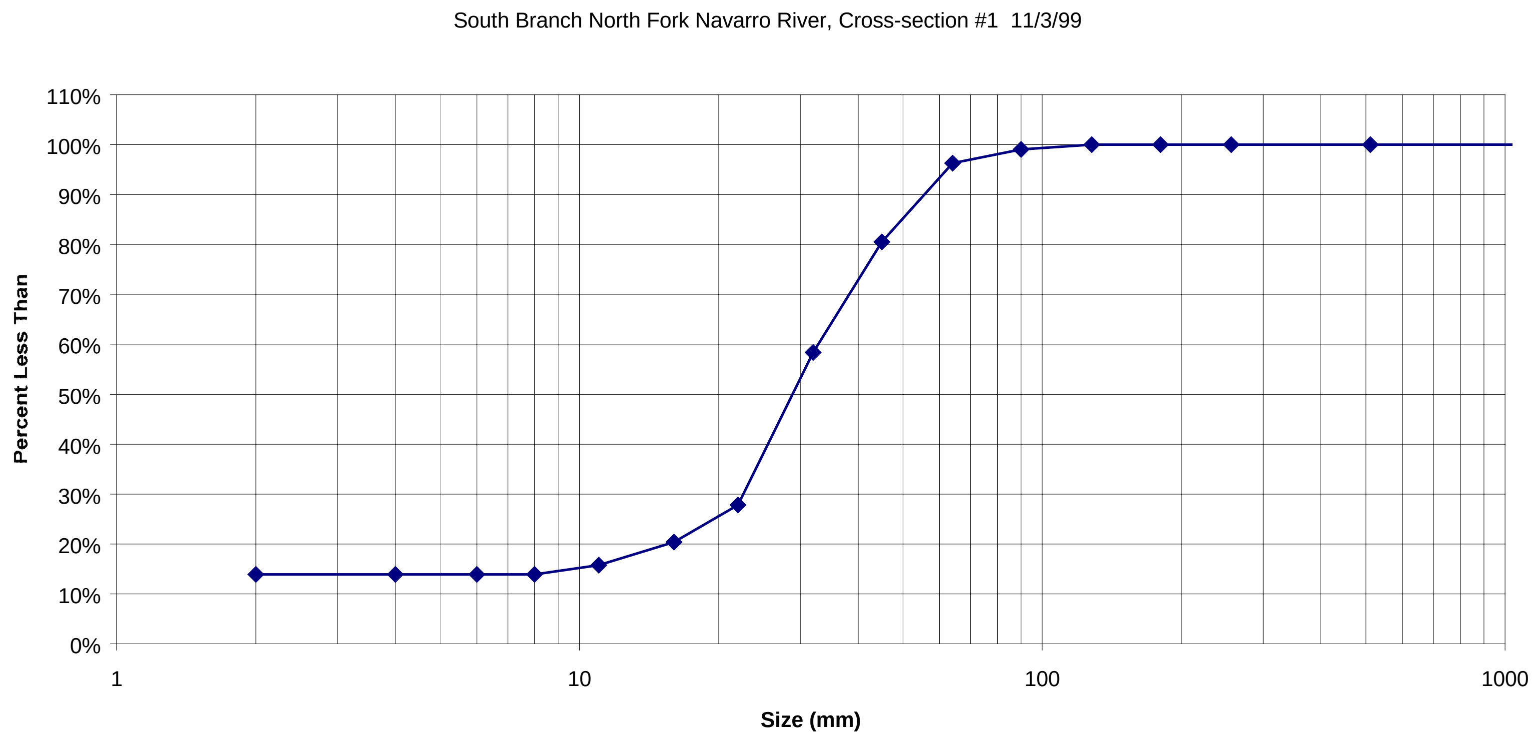
Max Residual Depth: 4.93
Mean Residual Depth: 1.12
Standard Deviation: 1.19

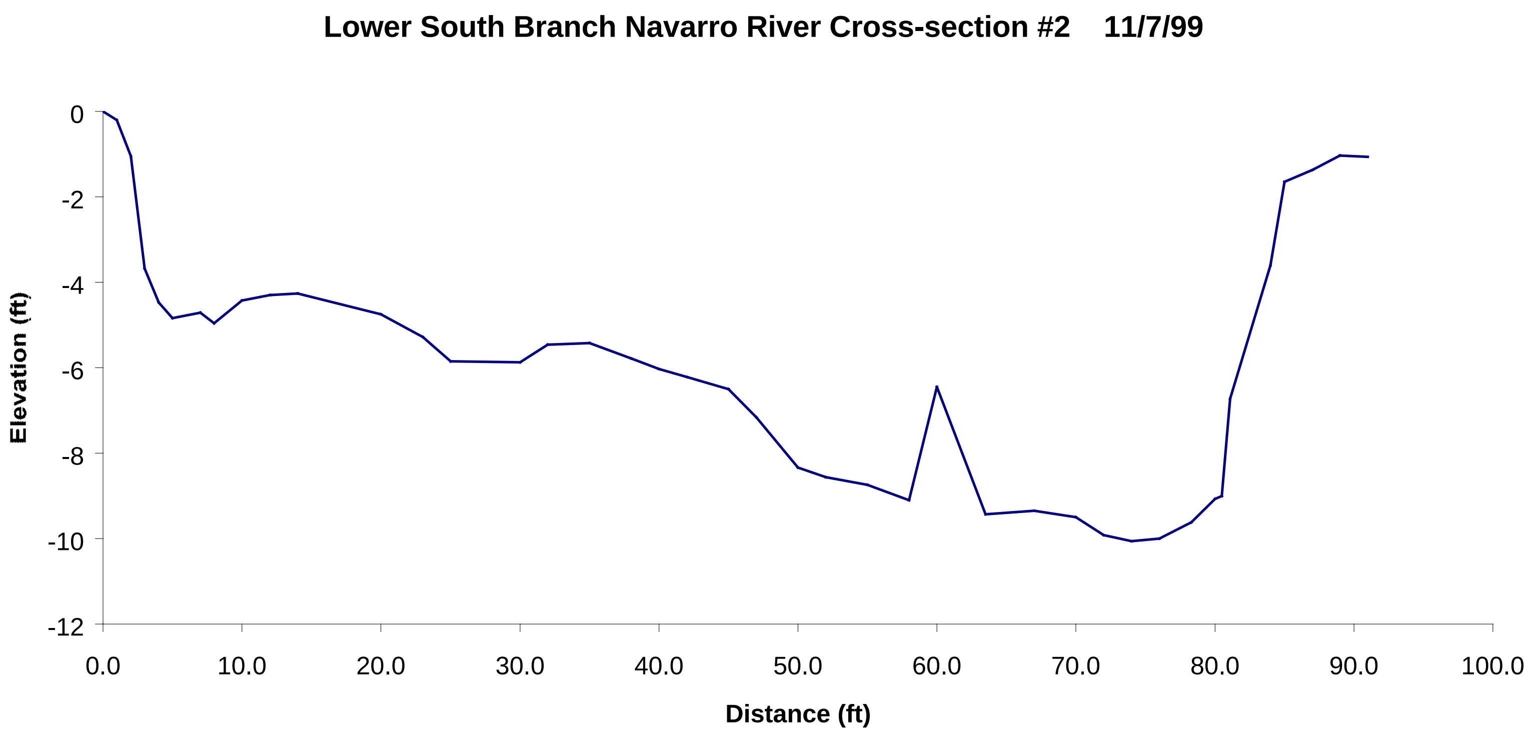
Number of non-zero Residual Depths: 349
Percent of Reach as pool: 84.50
Percent of Reach as riffle: 15.50

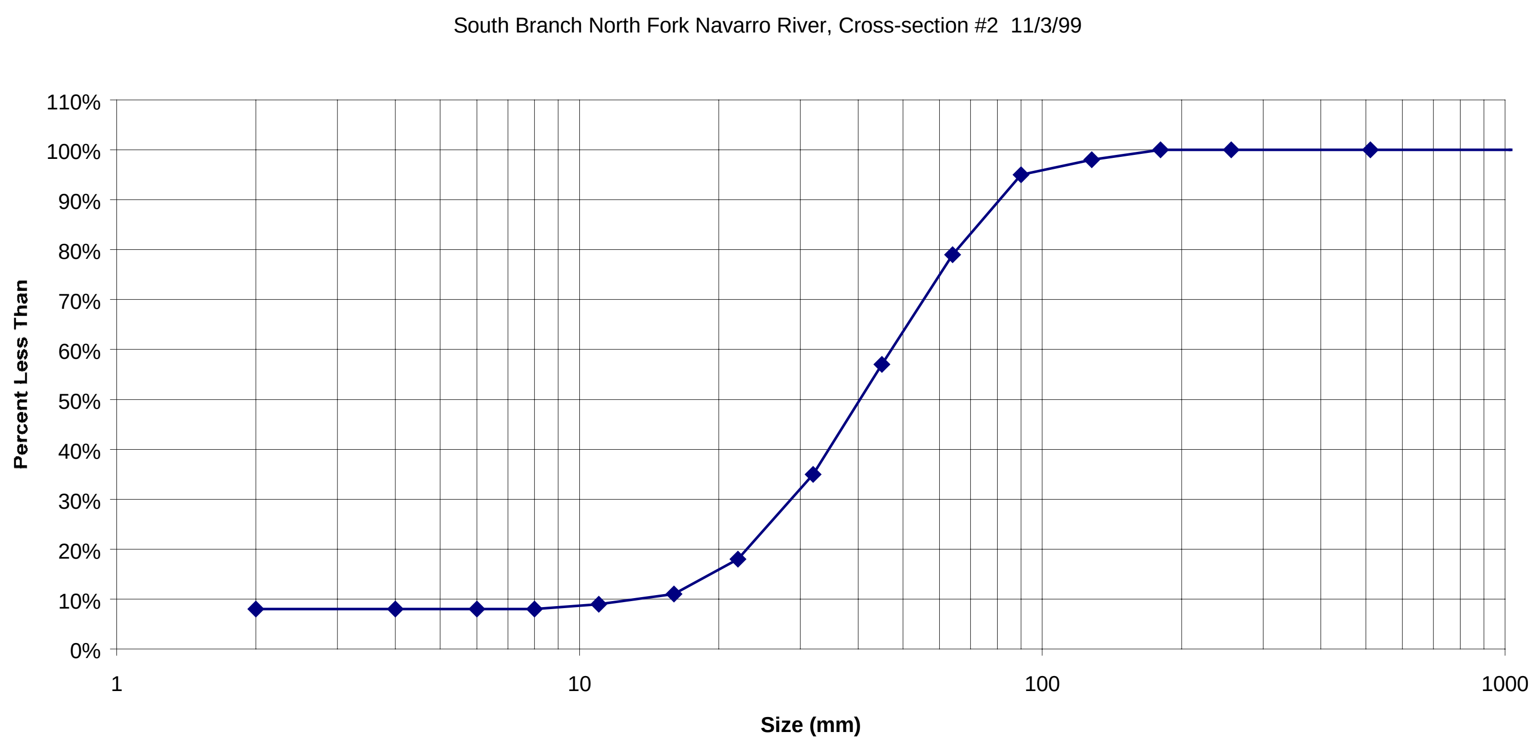




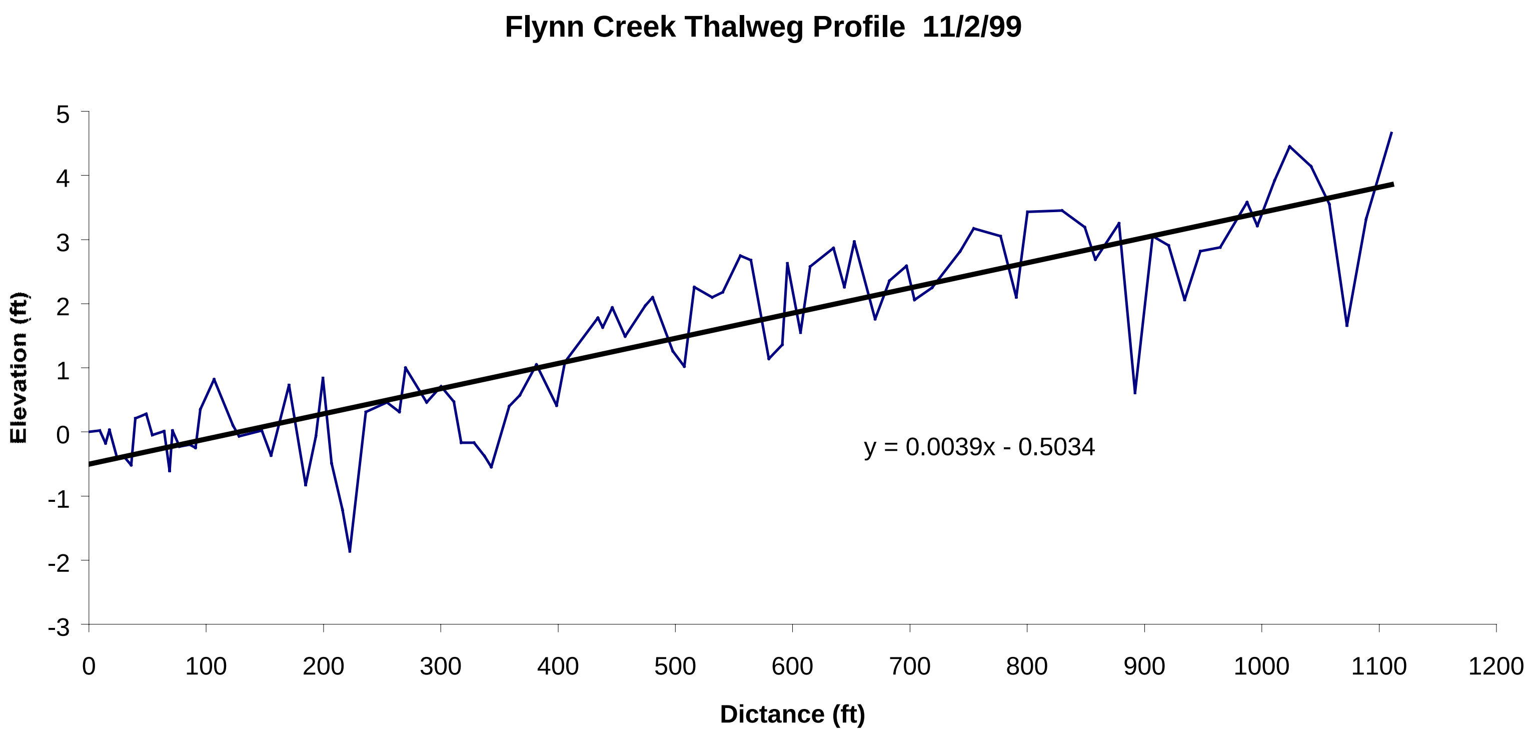
Lower South Branch Cross-section #1 11/7/99
0
-1
-2
-3
-4
-5
-6
-7
-8
Elevation (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Distance (ft)


South Branch North Fork Navarro River, Cross-section #1 11/3/99
Percent Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)


Lower South Branch Navarro River Cross-section #2 11/7/99
0
-2
-4
-6
-8
-10
-12
Elevation (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Distance (ft)



South Branch North Fork Navarro River, Cross-section #2 11/3/99
Percent Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)



Flynn Creek Thalweg Profile 11/2/99
Elevation (ft)
5
4
3
2
1
0
-1
-2
-3
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Dictance (ft)
y = 0.0039x - 0.5034

Flynn Creek 1999 Residual Depth Statistics

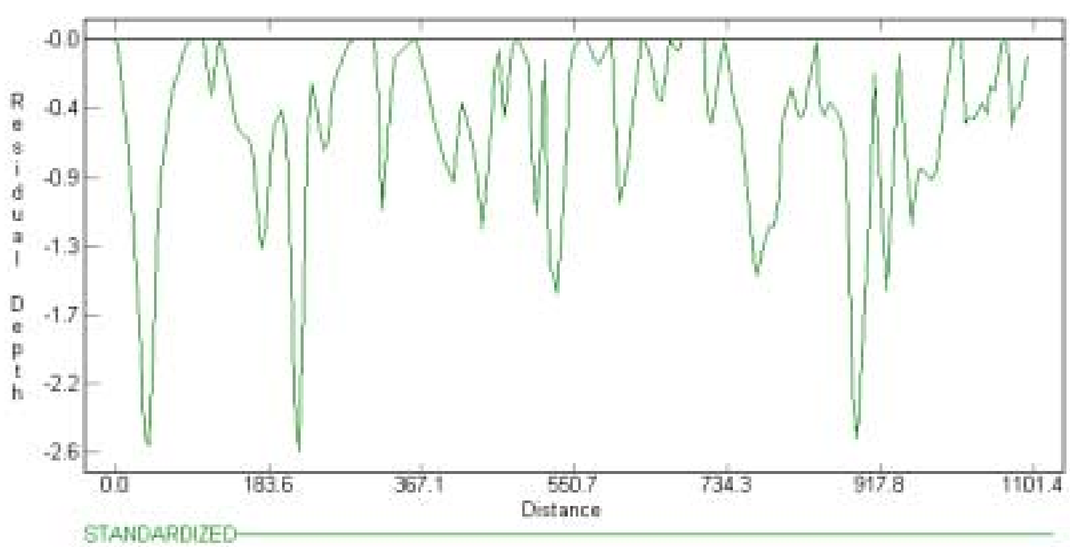
Top Elevation: 4.66
Bottom Elevation: -1.86
Reach Length: 1101.40

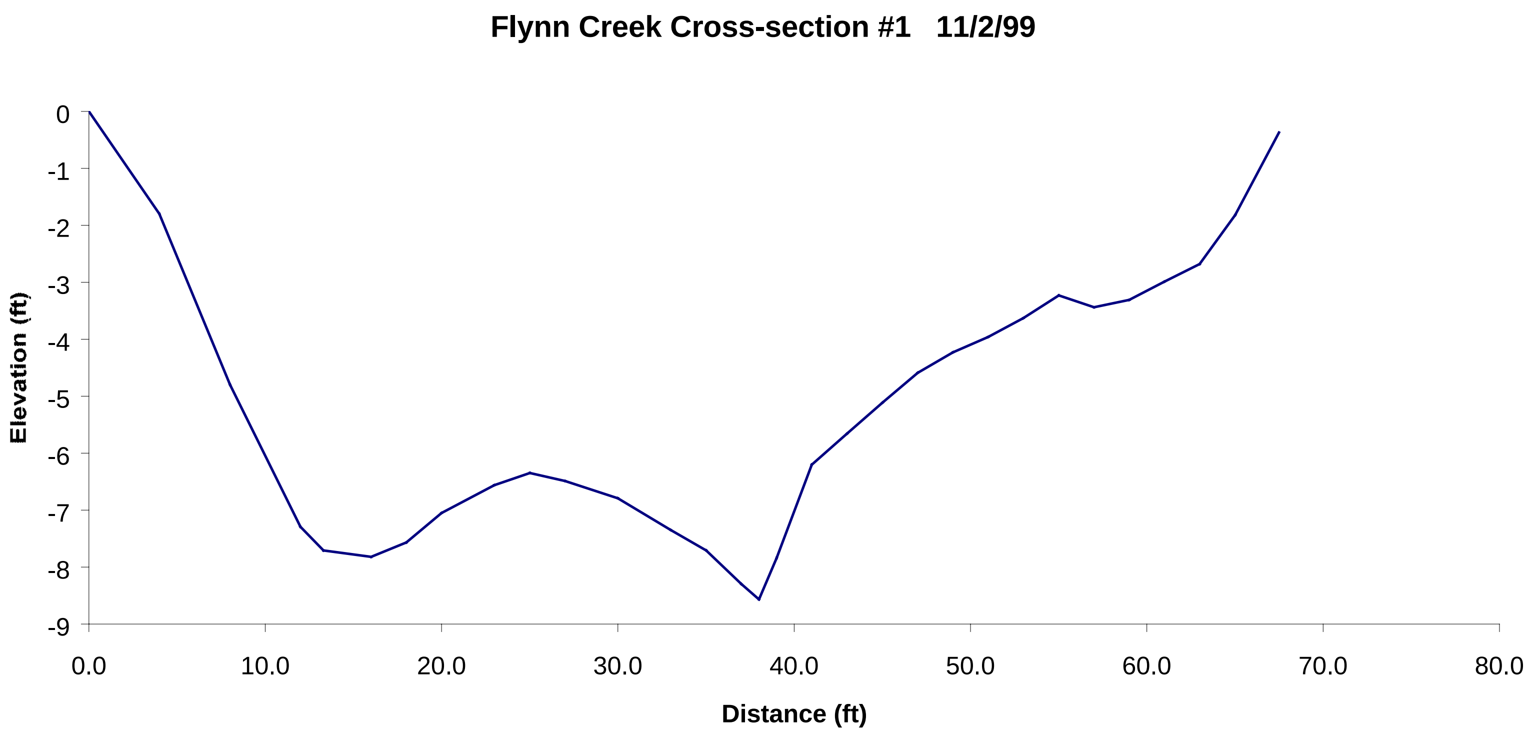
Standardized Statistics:
Number of data points in raw data: 94
Number of data points in Standardized data: 220

Reach Step Distance: 5.00

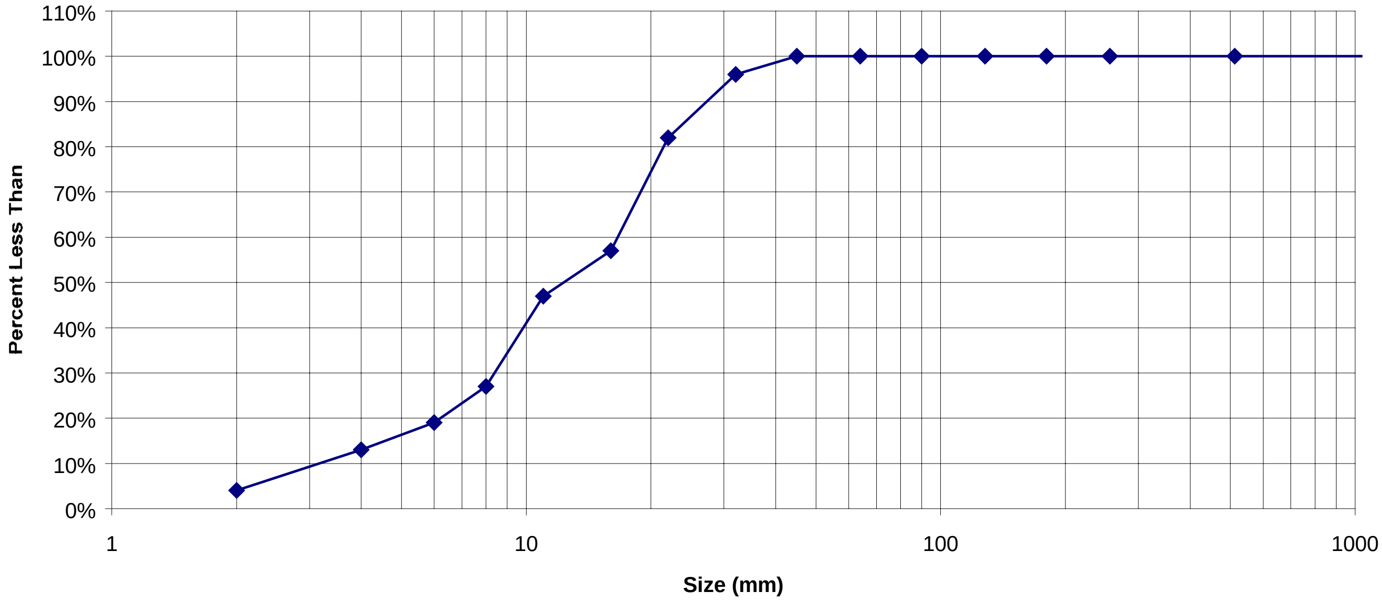
Max Residual Depth: 2.59
Mean Residual Depth: 0.54
Standard Deviation: 0.55

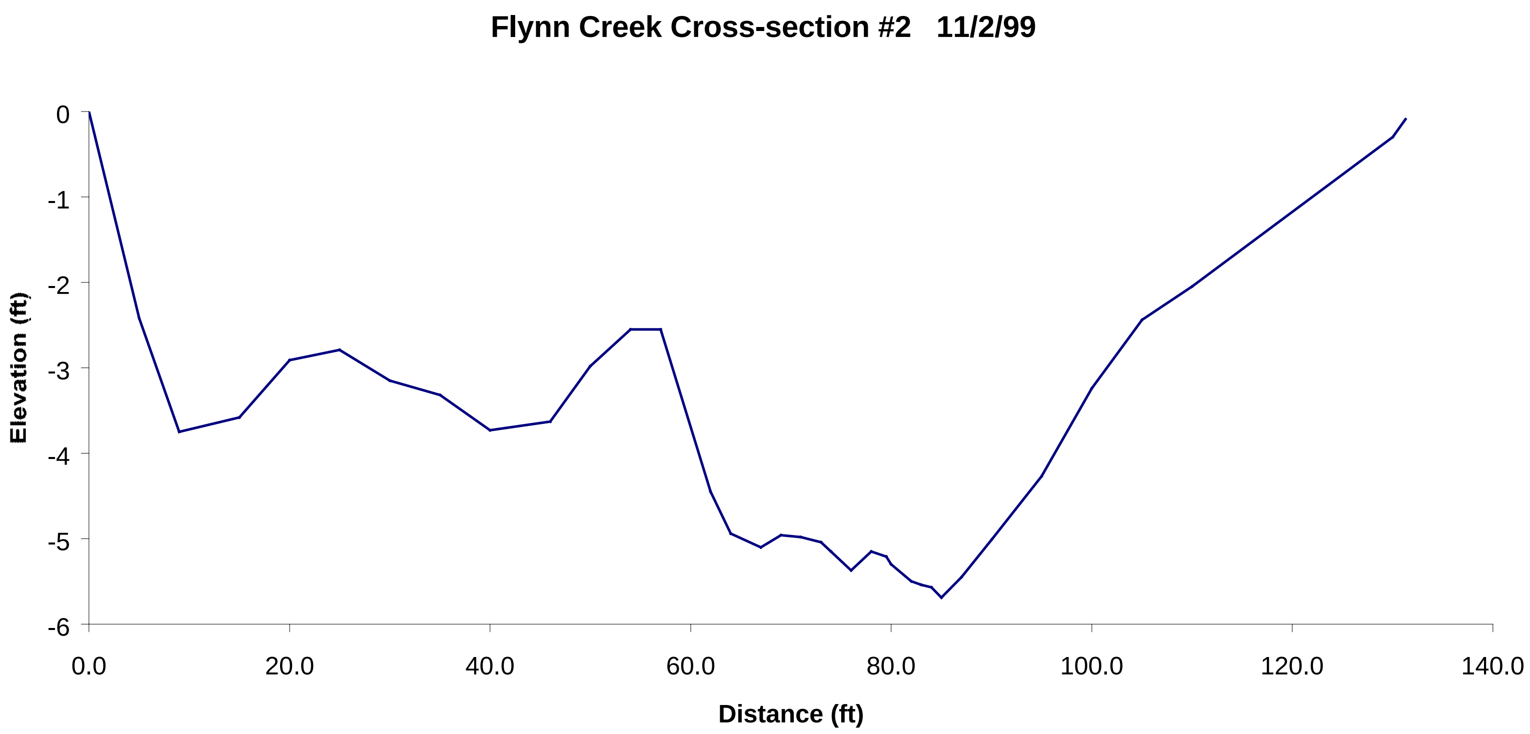
Number of non-zero Residual Depths: 188
Percent of Reach as pool: 85.45
Percent of Reach as riffle: 14.55



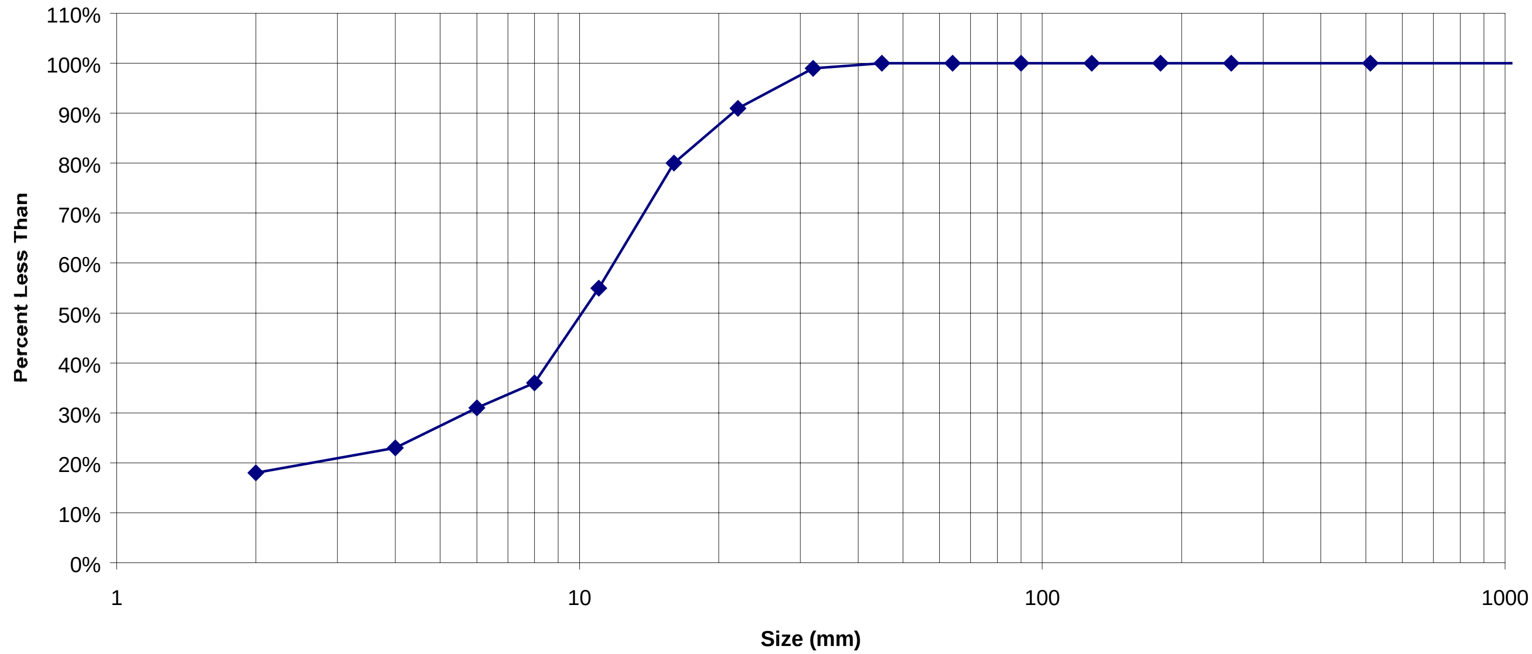

Flynn Creek Cross-section #1 11/2/99
Elevation (ft)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
Distance (ft)

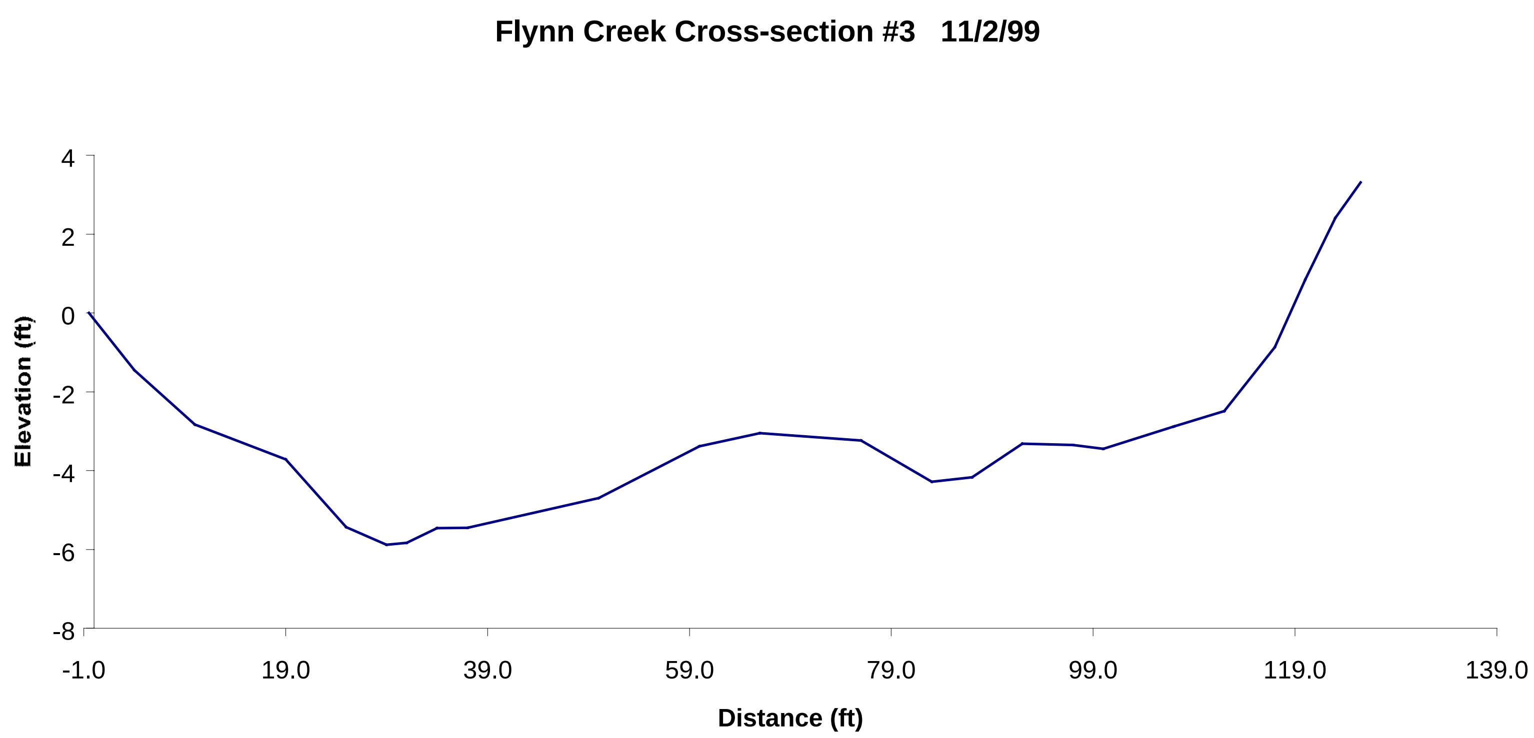
Flynn Creek, Cross-section #1 11/2/99

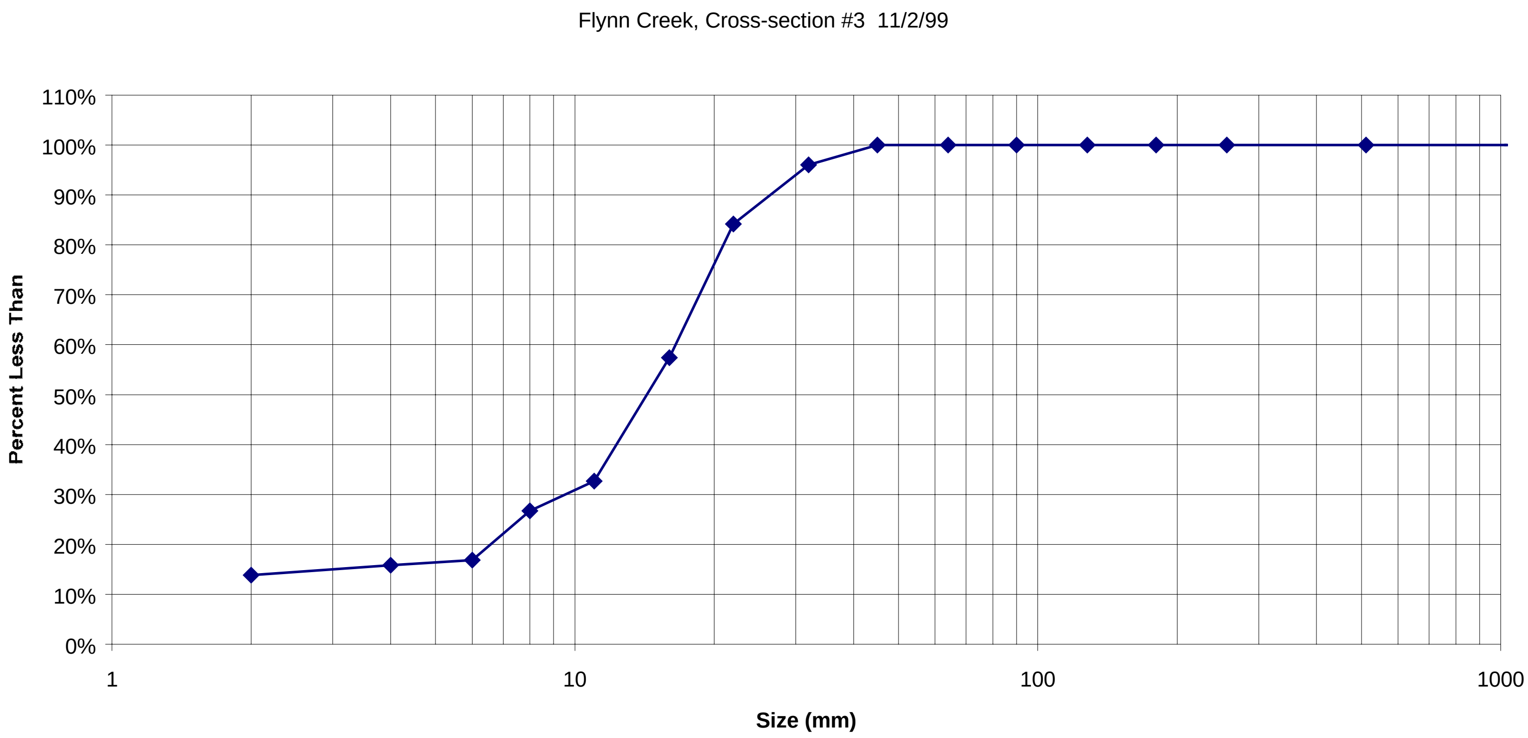



Flynn Creek Cross-section #2 11/2/99
Elevation (ft)
0
-1
-2
-3
-4
-5
-6
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Distance (ft)

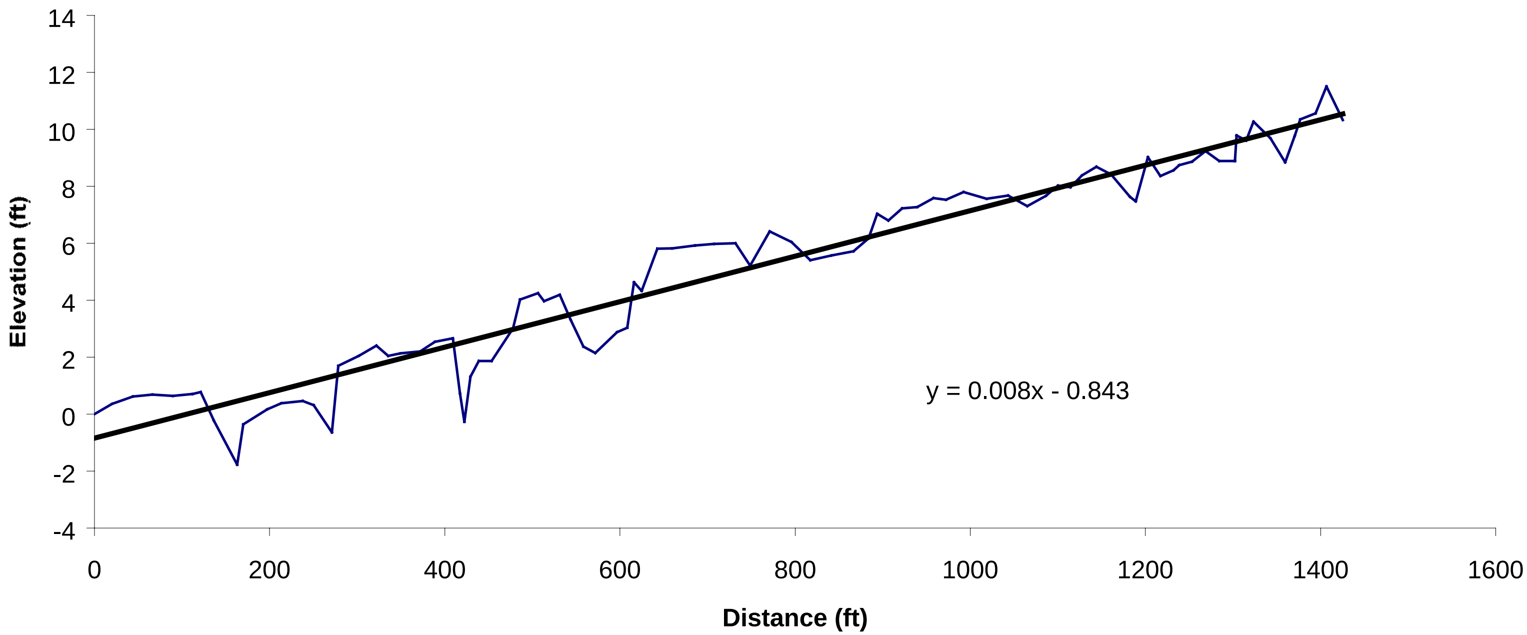
Flynn Creek, Cross-section #2 11/2/99




Flynn Creek Cross-section #3 11/2/99
Elevation (ft)
4
2
0
-2
-4
-6
-8
-1.0
19.0
39.0
59.0
79.0
99.0
119.0
139.0
Distance (ft)


Flynn Creek, Cross-section #3 11/2/99
Percent Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)

North Branch North Fork Navarro River Thalweg Profile 11/8/99



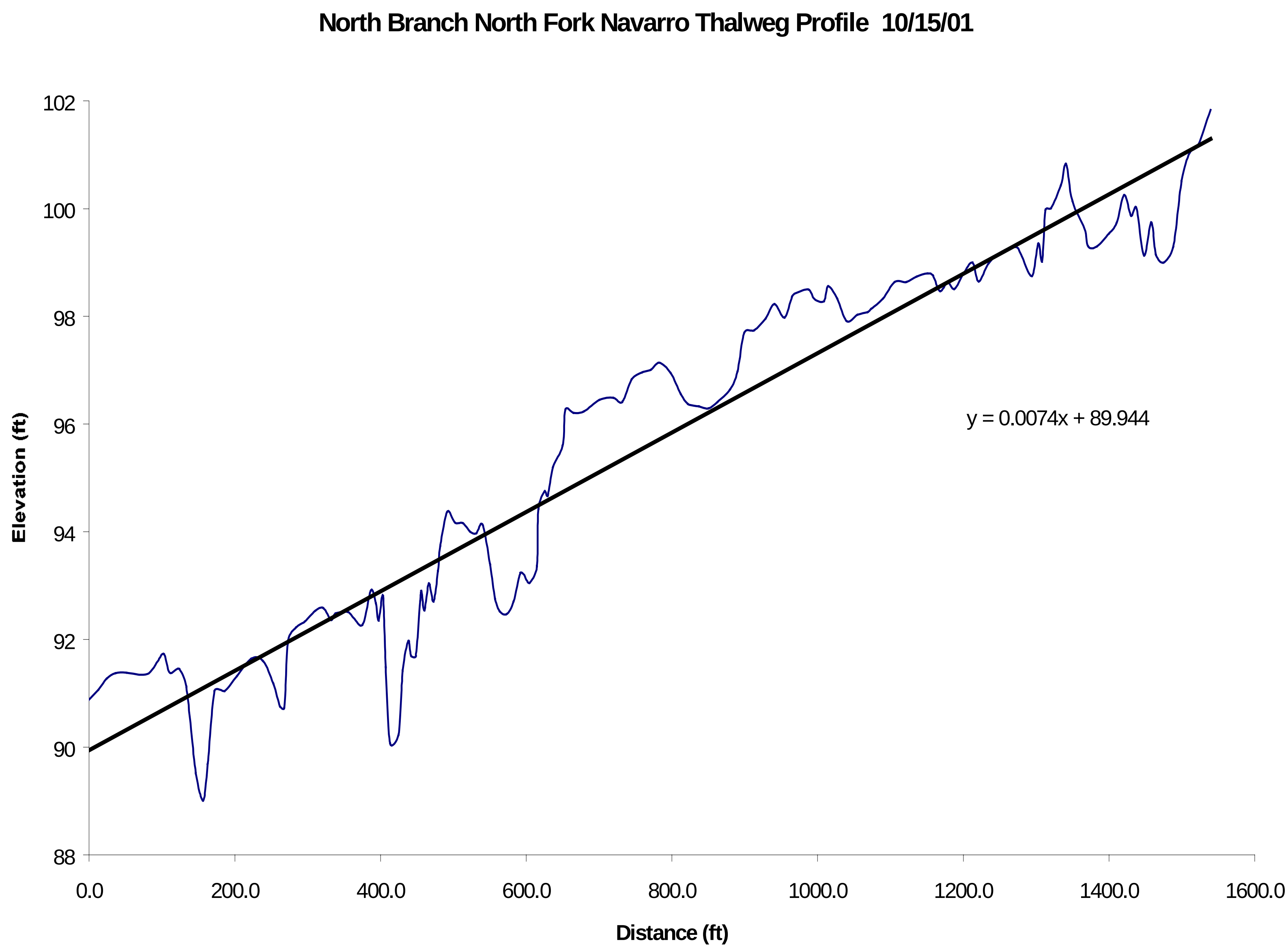
North Branch North Fork Navarro River Residual Depth Statistics 1999

Top Elevation: 11.51
Bottom Elevation: -1.78
Reach Length: 1405.27

Reach Step Distance: 5.00

Max Residual Depth: 2.54
Mean Residual Depth: 0.38
Standard Deviation: 0.52

Number of non-zero Residual Depths: 191
Percent of Reach as pool: 67.97
Percent of Reach as riffle: 32.03


North Branch North Fork Navarro Thalweg Profile 10/15/01
Elevation (ft)
102
100
98
96
94
92
90
88
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Distance (ft)
y = 0.0074x + 89.944

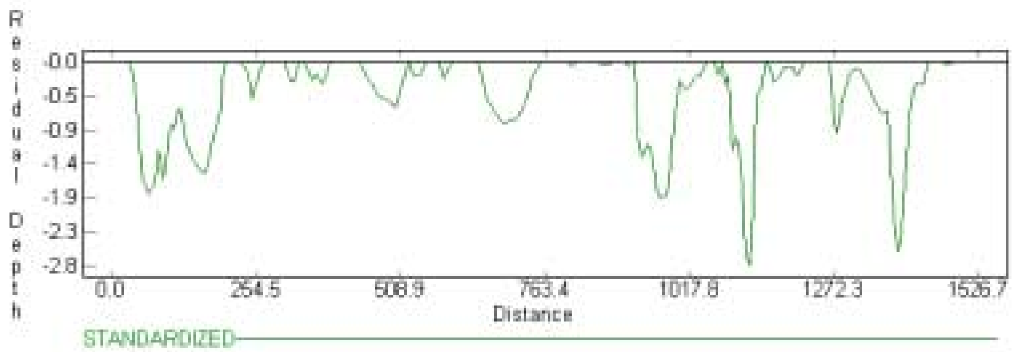
North Branch North Fork Navarro River Residual Depth Statistics 2001

Top Elevation: 101.83
Bottom Elevation: 89.01
Reach Length: 1526.70

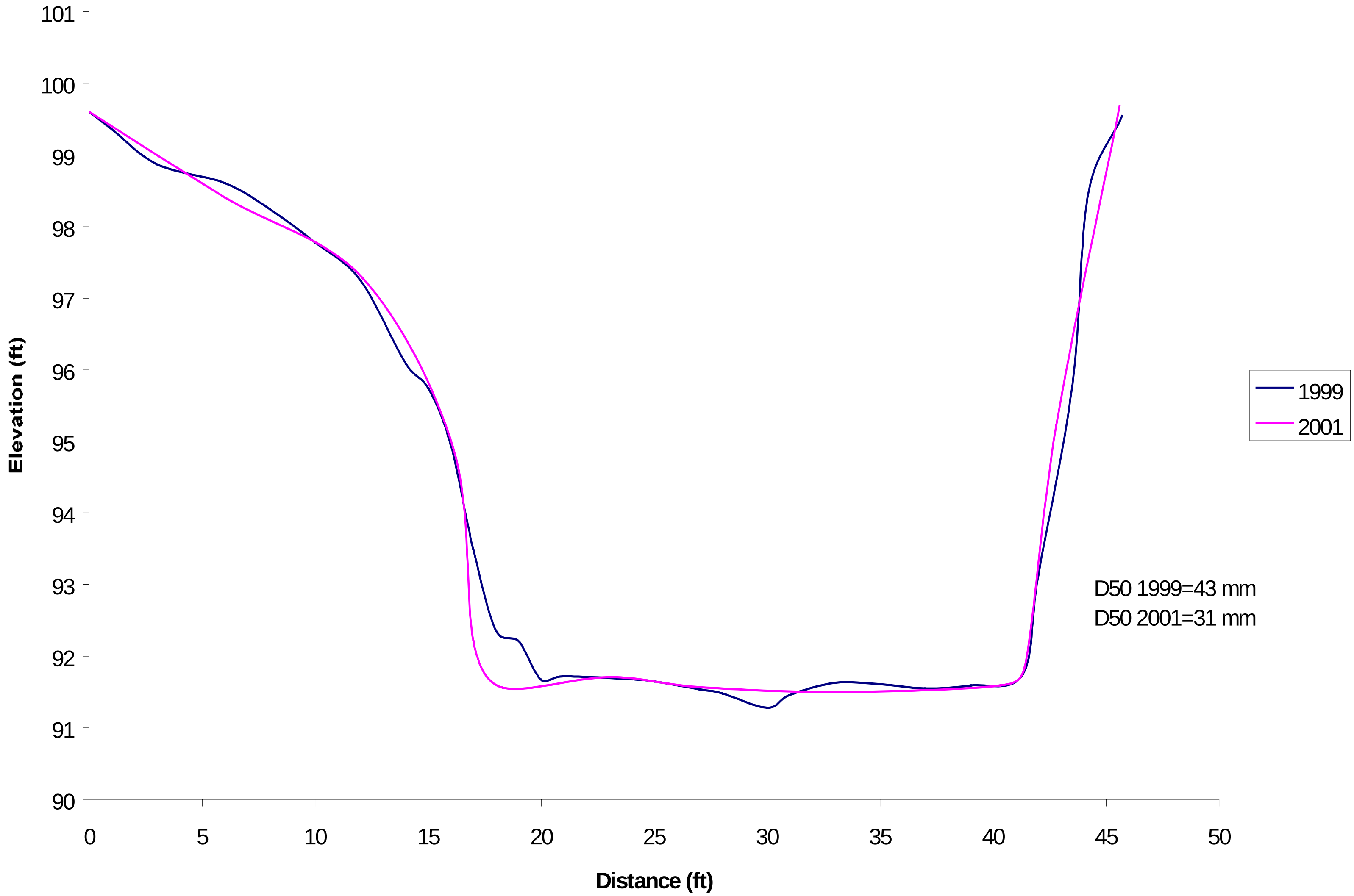
Reach Step Distance: 5.00

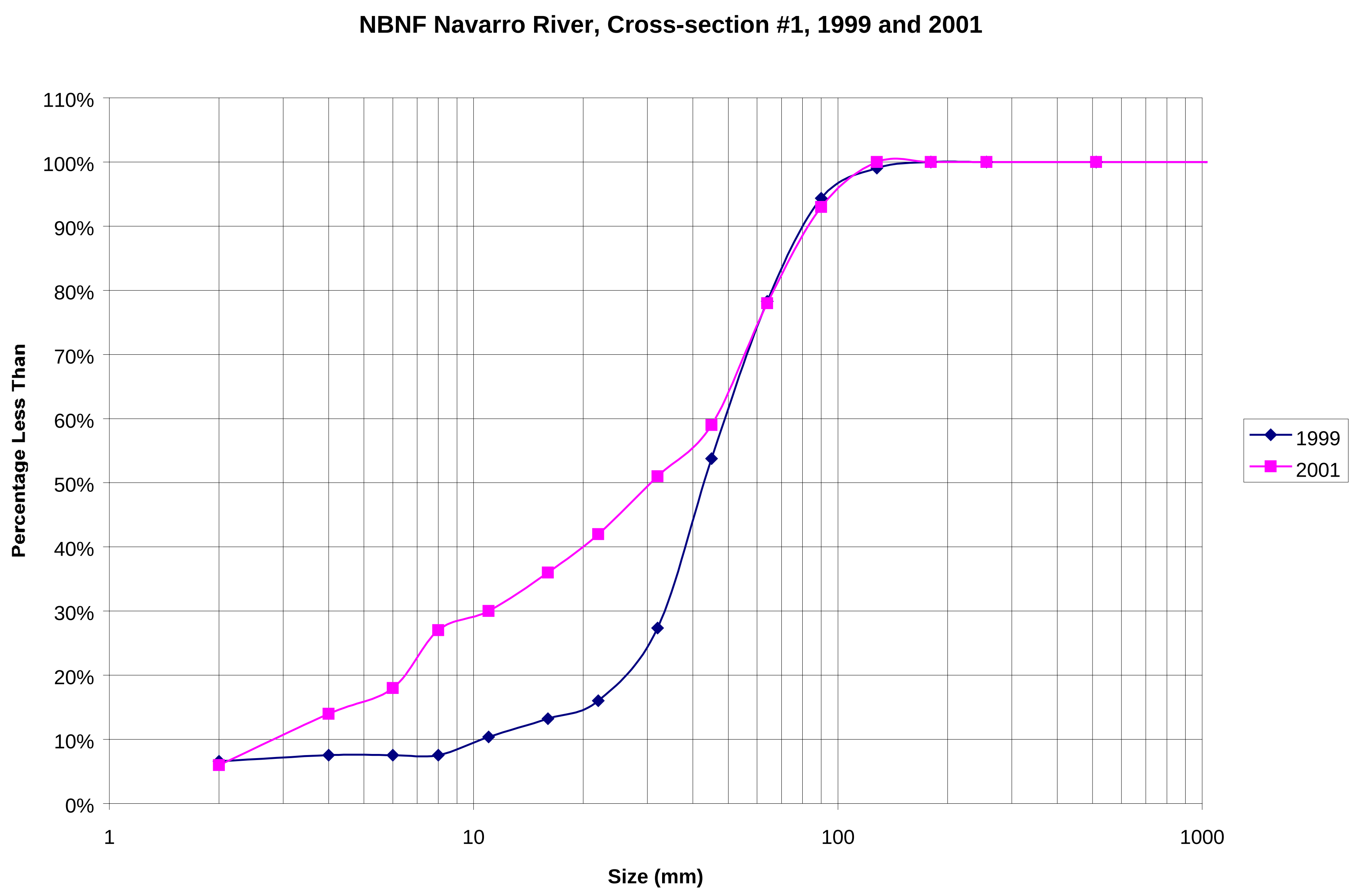
Max Residual Depth: 2.82
Mean Residual Depth: 0.43
Standard Deviation: 0.60

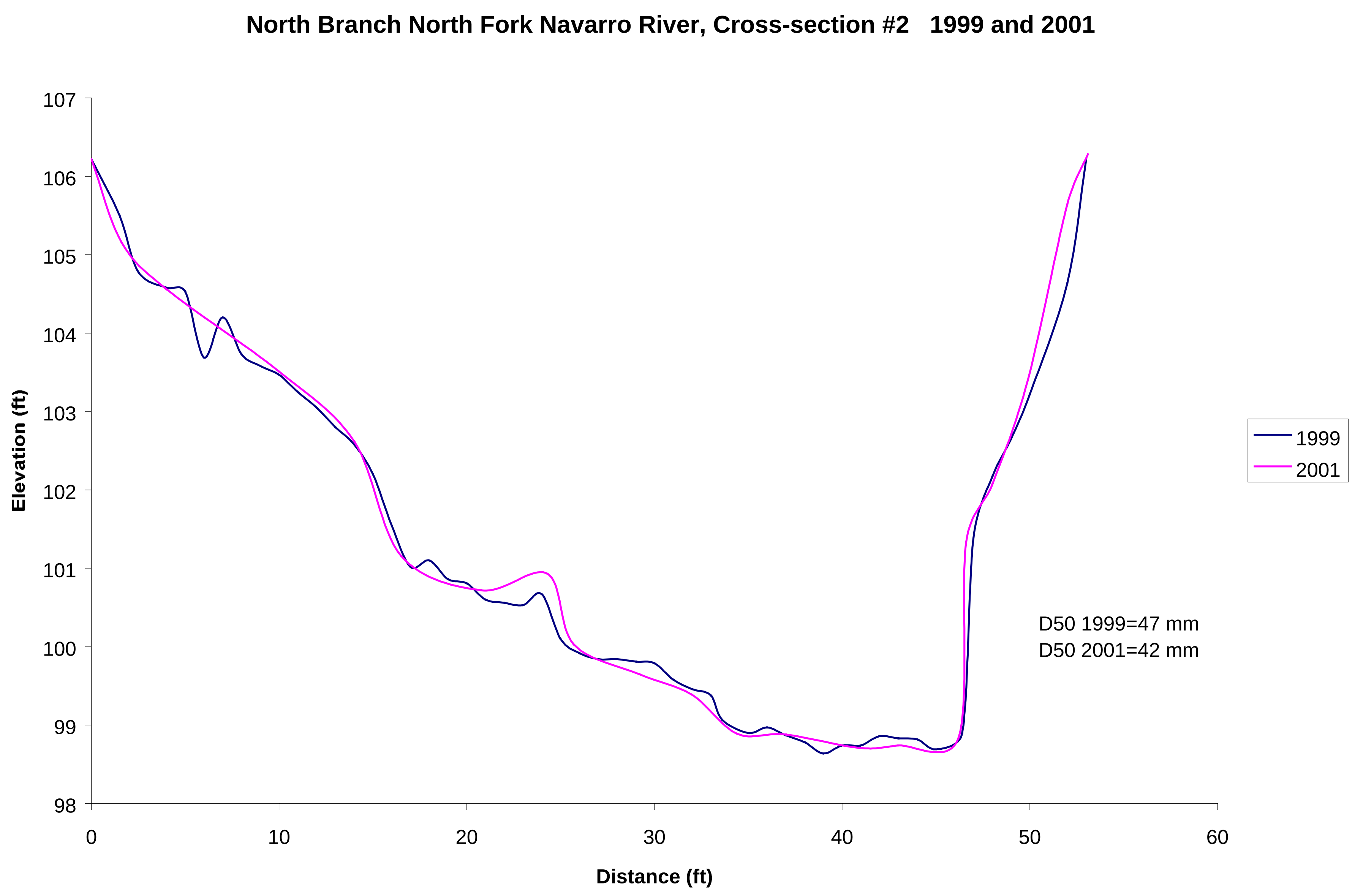
Number of non-zero Residual Depths: 209
Percent of Reach as pool: 68.52
Percent of Reach as riffle: 31.48



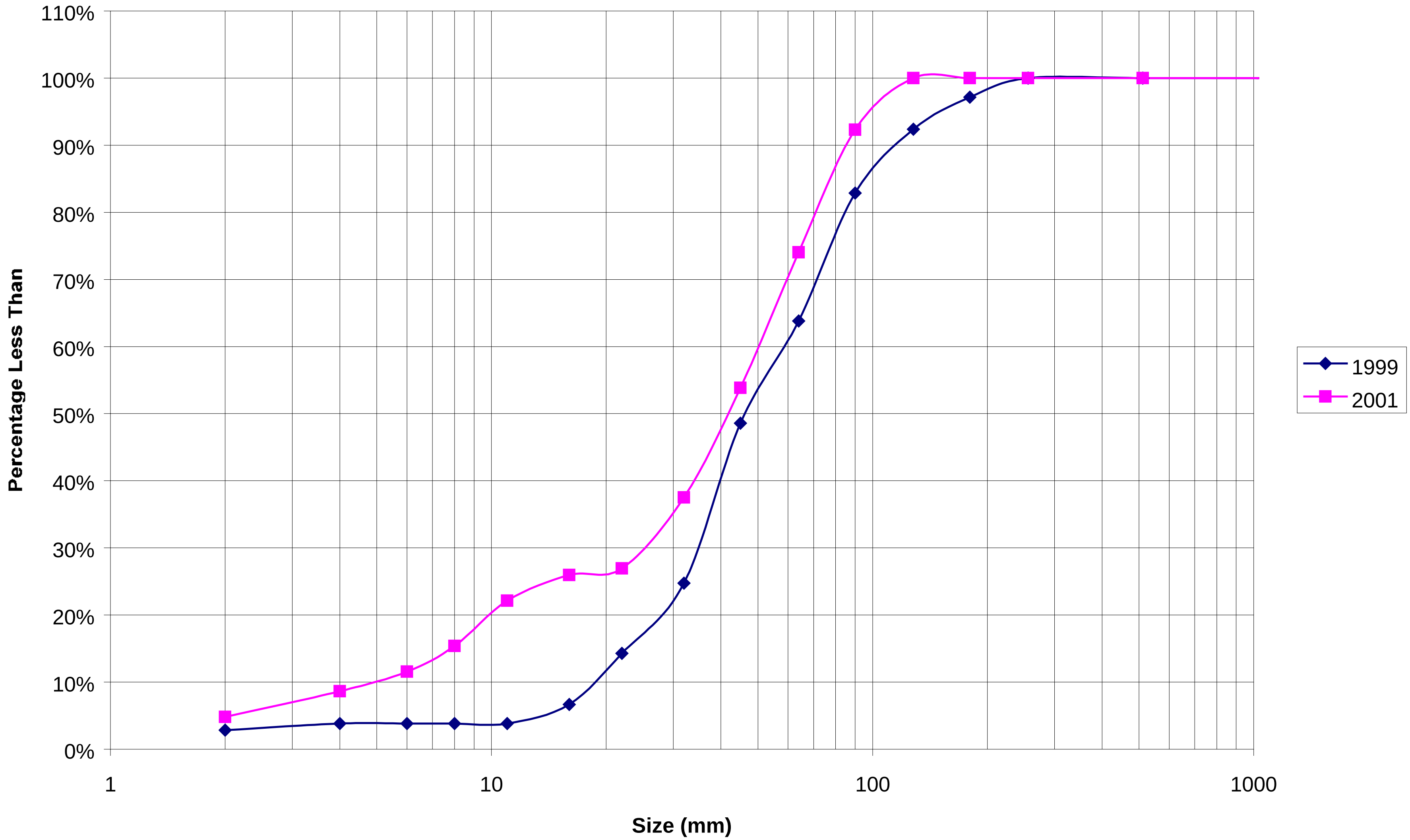
North Branch North Fork Navarro River, Cross-section #1 1999 and 2001

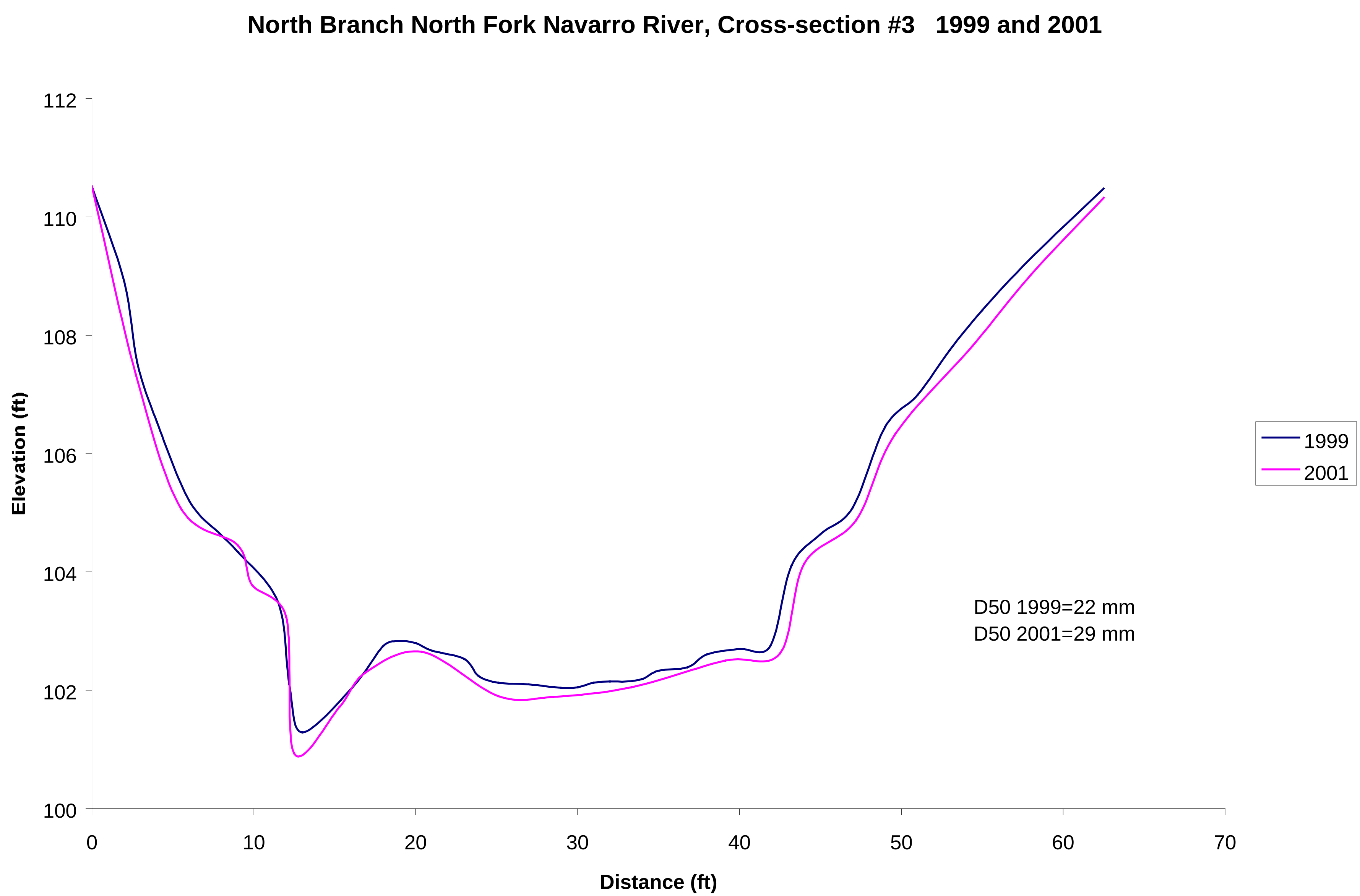



NBNF Navarro River, Cross-section #1, 1999 and 2001
Percentage Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)
1999
2001

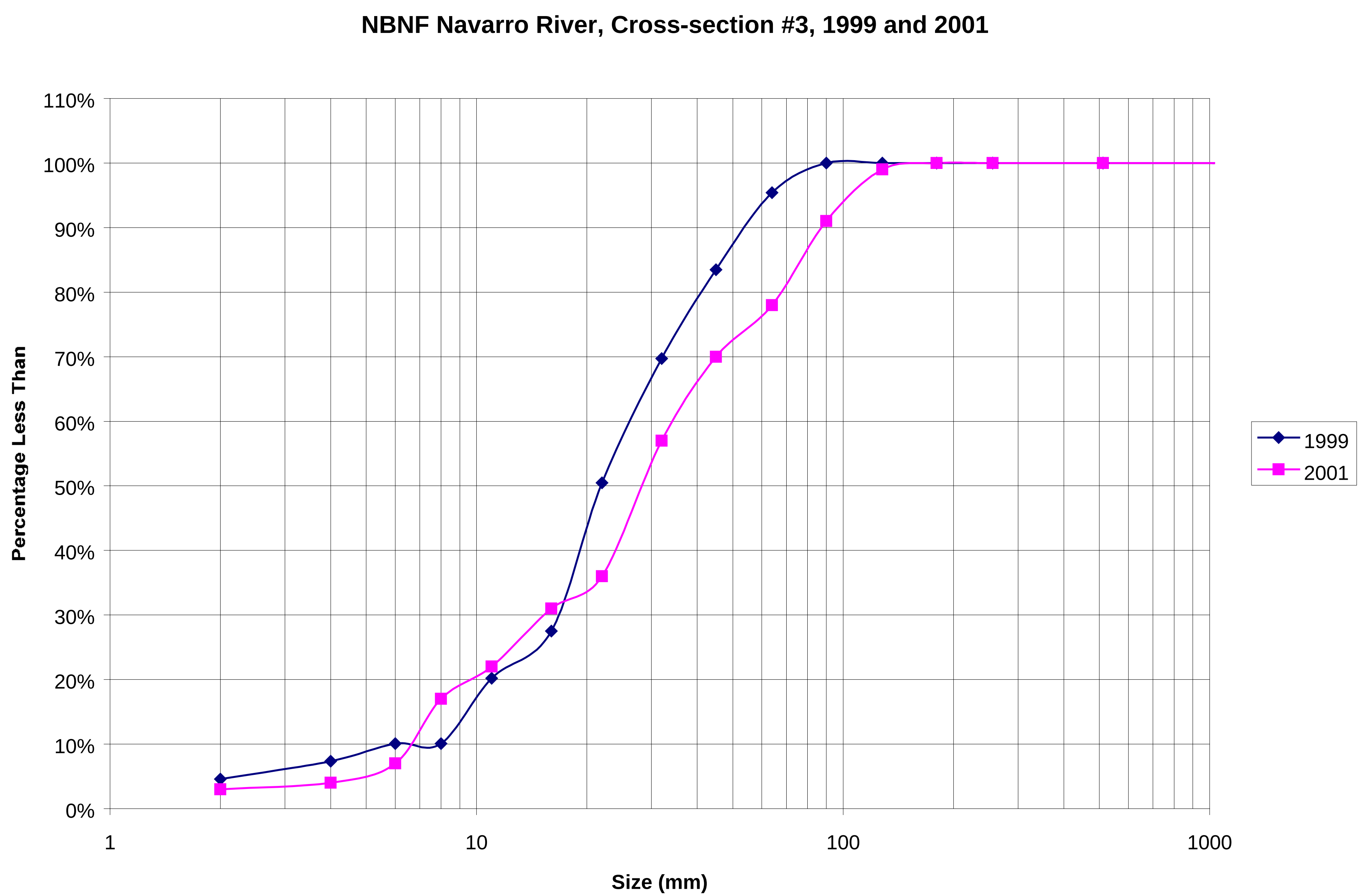

North Branch North Fork Navarro River, Cross-section #2 1999 and 2001
Elevation (ft)
107
106
105
104
103
102
101
100
99
98
0
10
20
30
40
50
60
Distance (ft)
1999
2001
D50 1999=47 mm
D50 2001=42 mm

NBNF Navarro River, Cross-section #2, 1999 and 2001

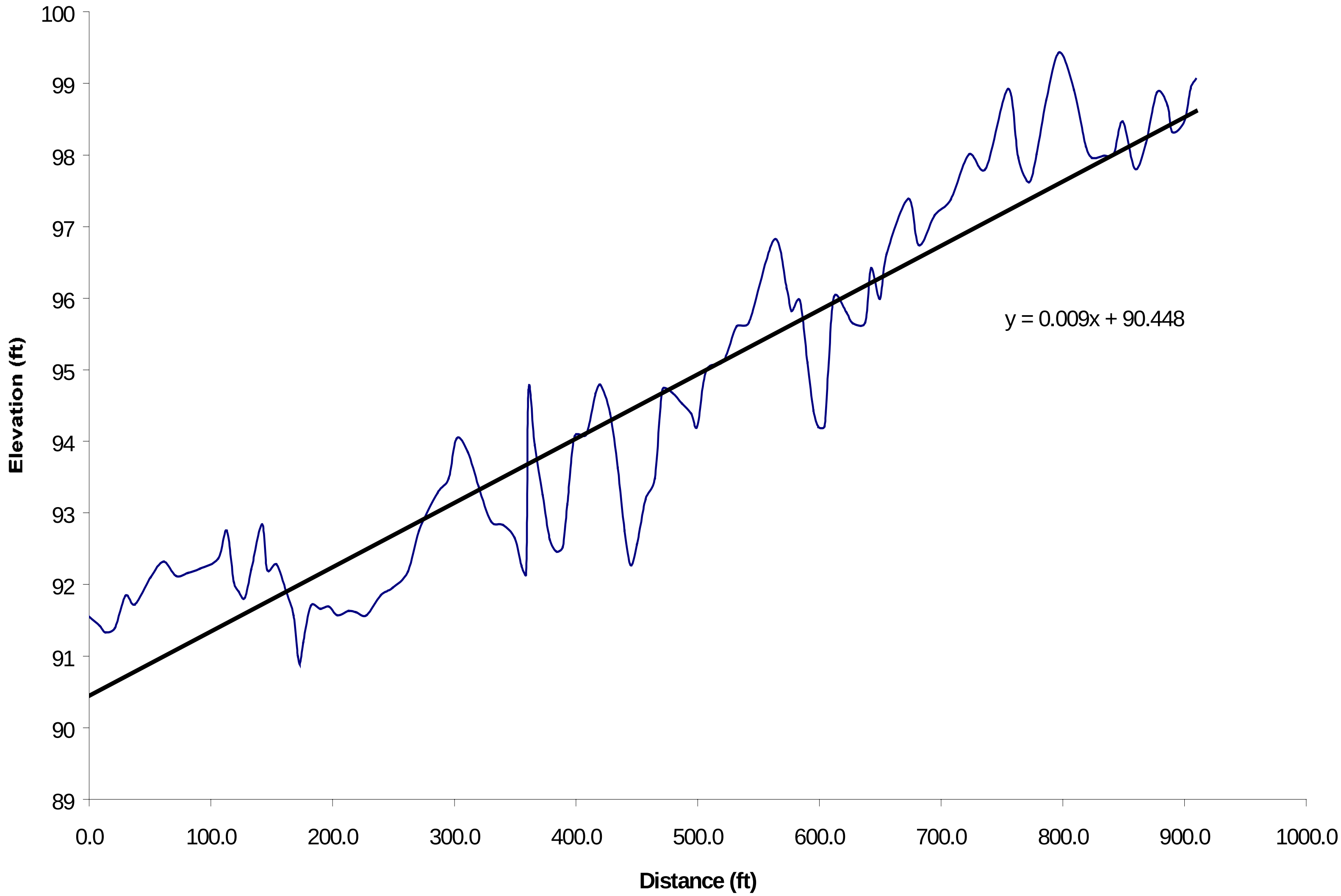




North Branch North Fork Navarro River, Cross-section #3 1999 and 2001
112
110
108
106
104
102
100
Elevation (ft)
0
10
20
30
40
50
60
70
Distance (ft)
1999
2001
D50 1999=22 mm
D50 2001=29 mm


NBNF Navarro River, Cross-section #3, 1999 and 2001
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percentage Less Than
1
10
100
1000
Size (mm)
1999
2001

Little North Fork Navarro Thalweg Profile 10/11/01



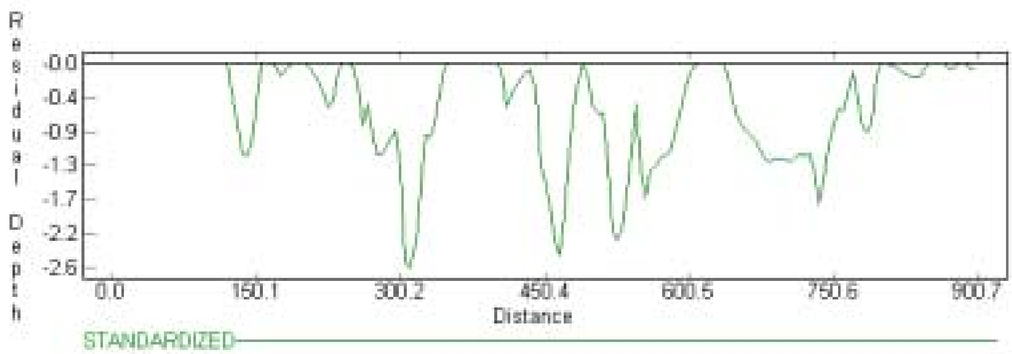
Little North Fork Navarro River Residual Depth Statistics 2001

Top Elevation: 99.43
Bottom Elevation: 90.89
Reach Length: 900.70

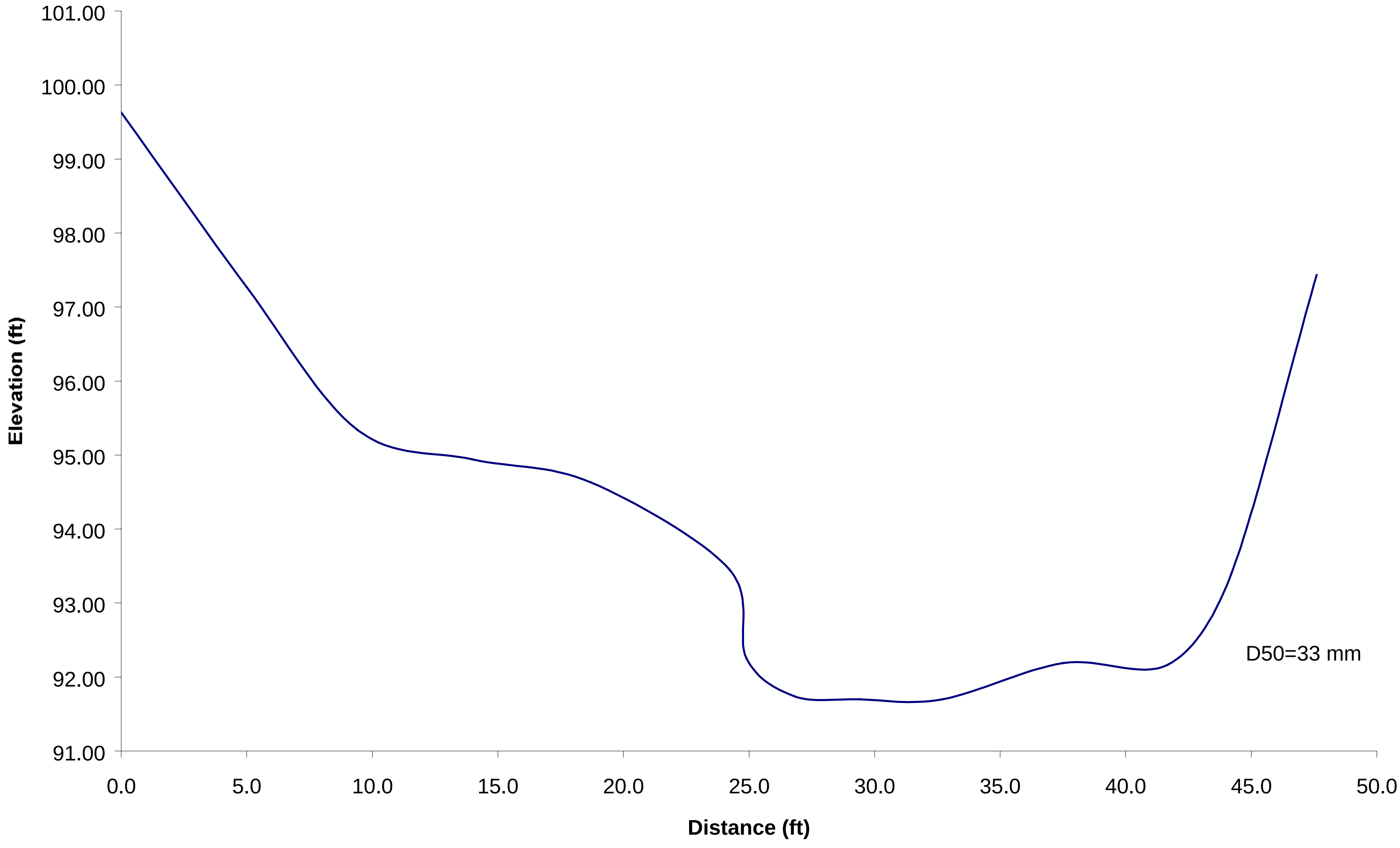
Reach Step Distance: 5.00

Max Residual Depth: 2.62
Mean Residual Depth: 0.55
Standard Deviation: 0.65

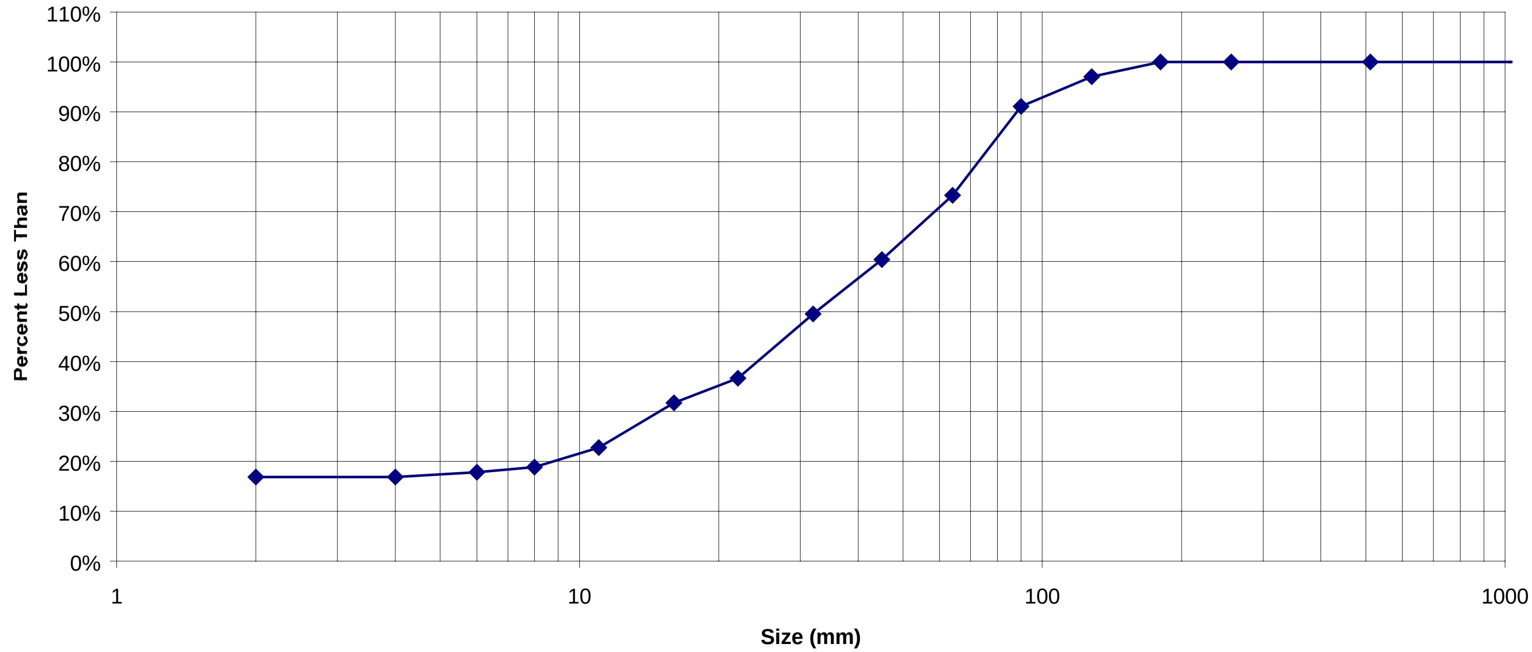
Number of non-zero Residual Depths: 121
Percent of Reach as pool: 67.22
Percent of Reach as riffle: 32.78

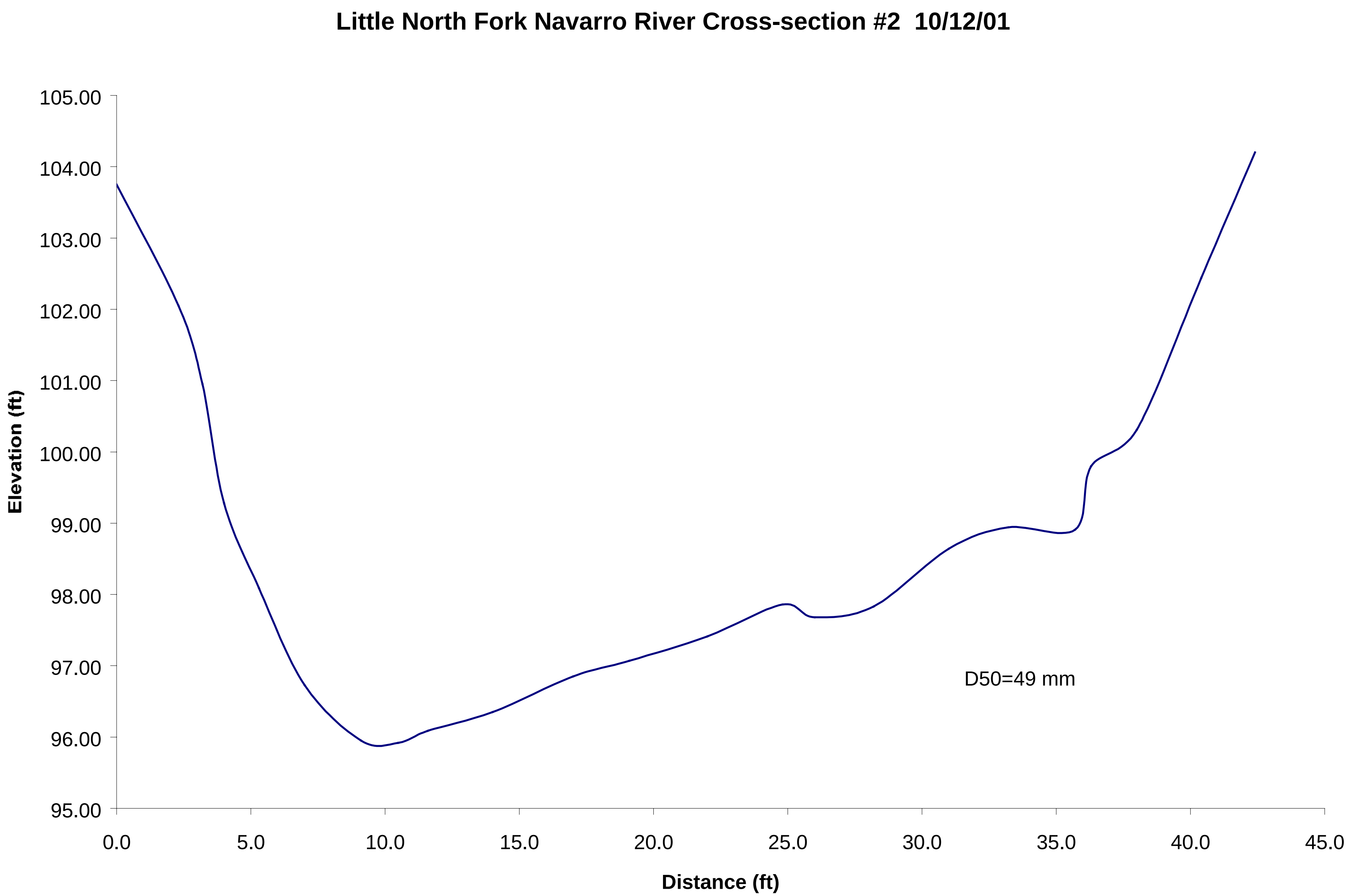


Little North Fork Navarro River Cross-section #1 10/12/01

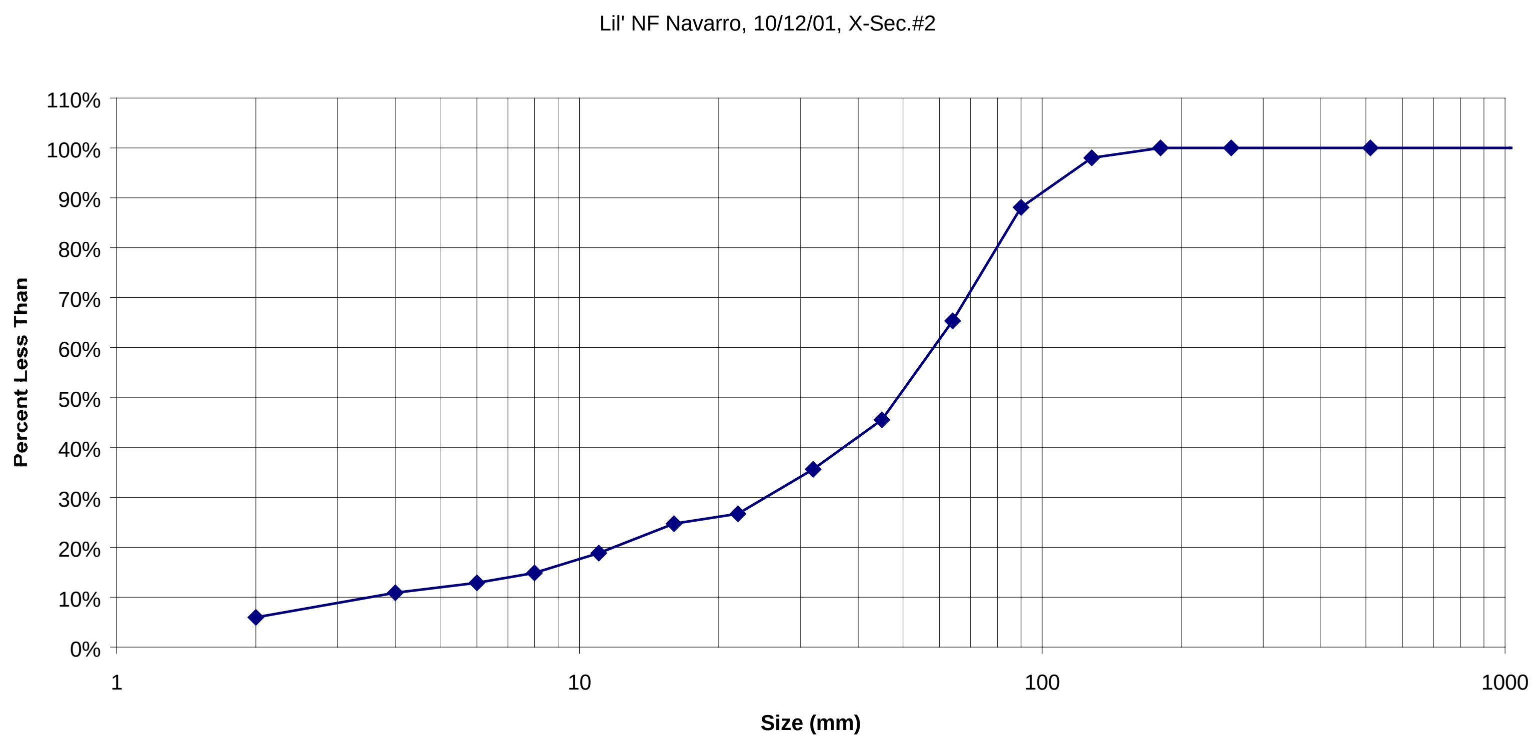


Lil' N.F. Navarro, 10/12/01, X-Sec.#1

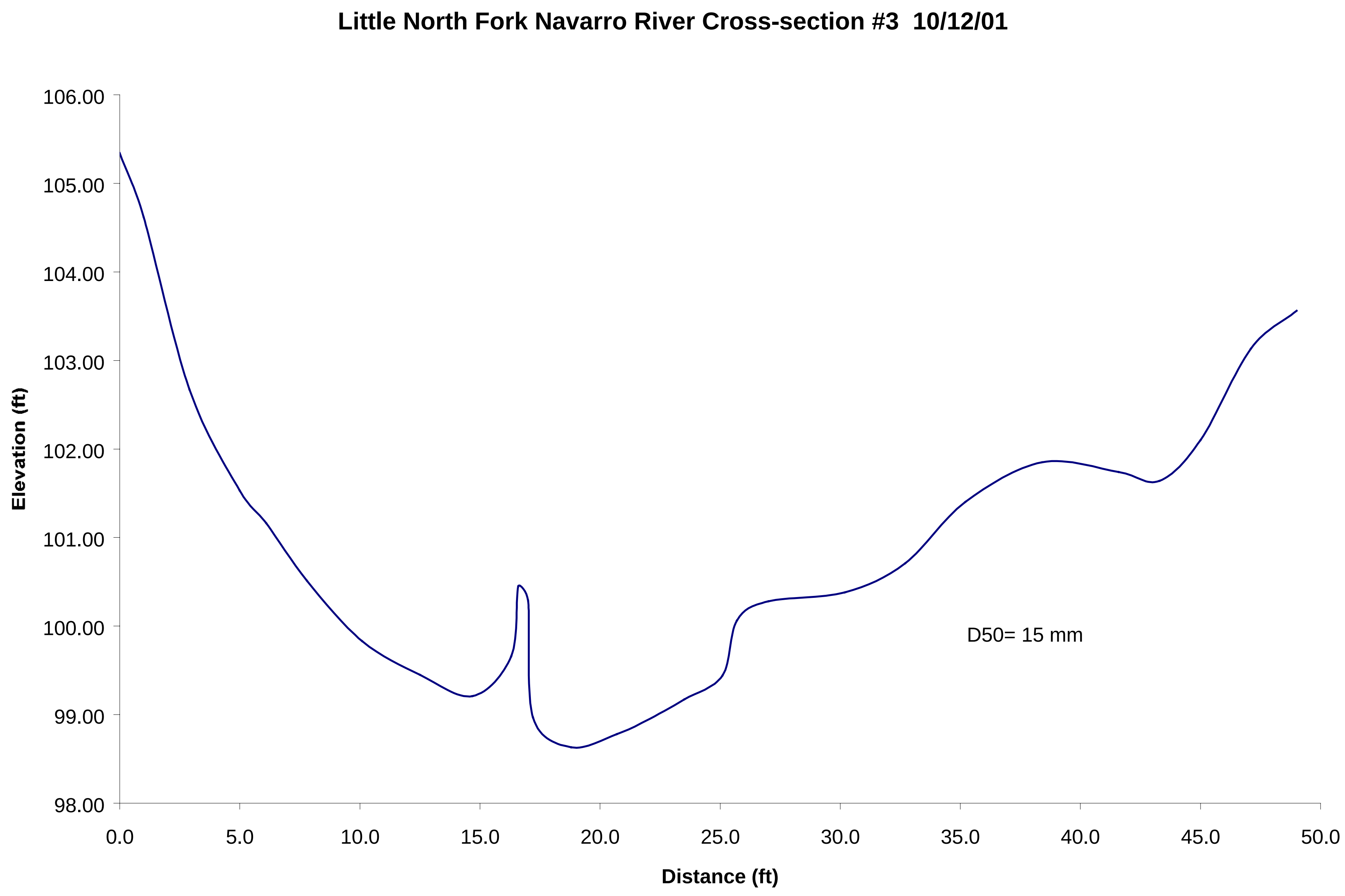




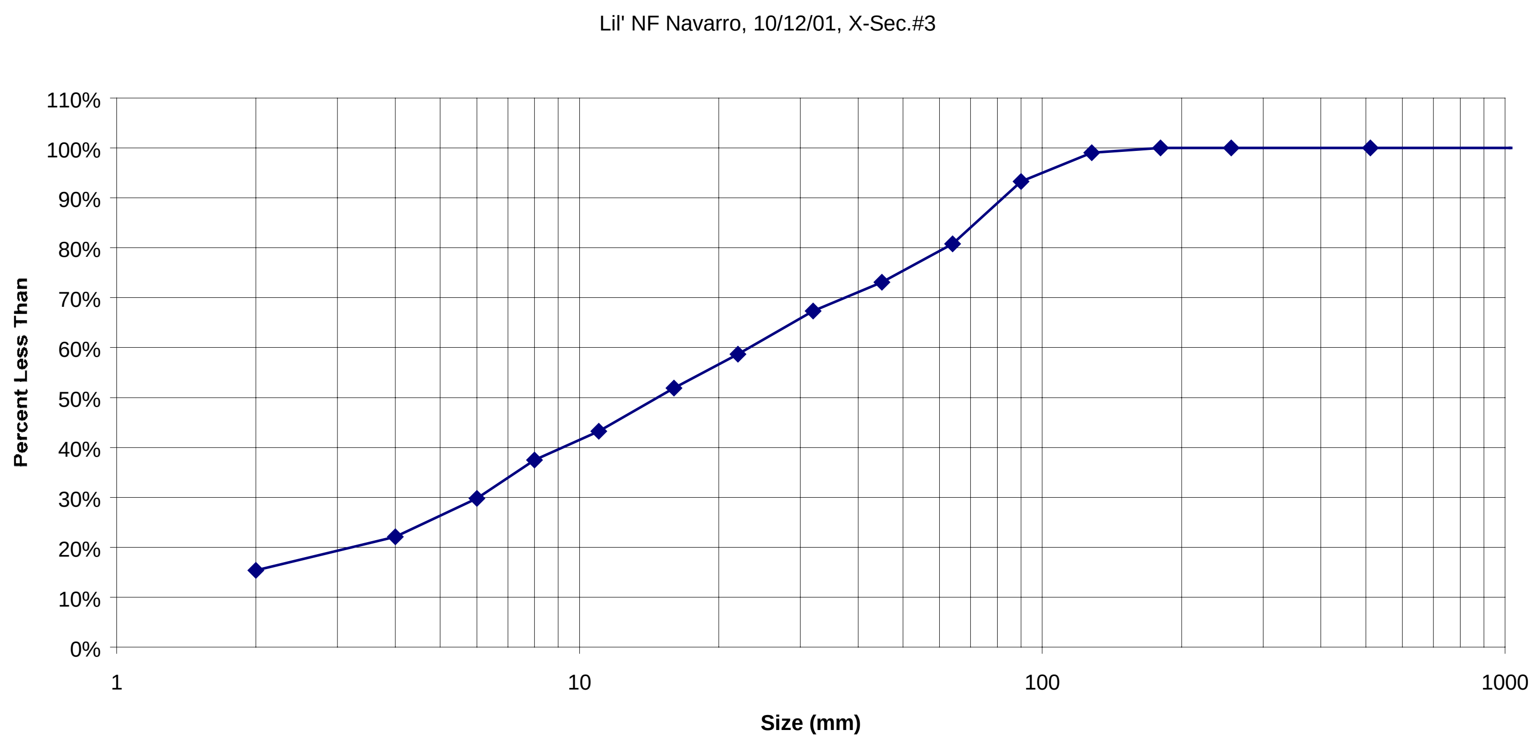
Little North Fork Navarro River Cross-section #2 10/12/01
105.00
104.00
103.00
102.00
101.00
100.00
99.00
98.00
97.00
96.00
95.00
Elevation (ft)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
Distance (ft)
D50=49 mm



Lil' NF Navarro, 10/12/01, X-Sec.#2
Percent Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)



Little North Fork Navarro River Cross-section #3 10/12/01
Elevation (ft)
106.00
105.00
104.00
103.00
102.00
101.00
100.00
99.00
98.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
Distance (ft)
D50= 15 mm



Lil' NF Navarro, 10/12/01, X-Sec.#3
Percent Less Than
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
10
100
1000
Size (mm)

SECTION F
FISH HABITAT CONDITION
AND AQUATIC SPECIES DISTIRBUTION

INTRODUCTION

The anadromous fish species inhabiting the Navarro River WAU are steelhead trout (*Oncorhynchus mykiss*), coho salmon (*O. kisutch*) and Pacific lamprey (*Lampetra tridentata*). Non-anadromous species include sculpin (*Cottus spp.)*, threespine stickleback (*Gasterosteus aculeatus*), California roach (*Lavinia symmetricus*), and Sacramento sucker (*Castomus occidentalis*). On MRC's property there are approximately 63 stream miles of habitat being utilized by coho and 95 stream miles of habitat being utilized by steelhead in the Navarro River watershed.

Field surveys were conducted to evaluate the quality and quantity of salmonid habitat in the Navarro WAU. Surveys included salmonid habitat typing and assessment, stream gravel permeability measurements and bulk gravel samples. The fish habitat assessment evaluated spawning, rearing and overwintering habitats based on targets derived from scientific literature (Bilby and Ward, 1989; Bisson et al., 1987; CDFG, 1998; Montgomery et al., 1995; Washington Forest Practices Board, 1995) and professional judgment. The habitat data are combined into indices of habitat quality for the different life history stages.

Aquatic species distribution surveys were conducted by the previous landowners (Louisiana-Pacific Corp.) from 1994-1996, and were repeated by MRC from 2000-2002 (MRC 2002). The study consisted of single pass electrofishing or snorkeling surveys in the summer months to assess aquatic species distribution and composition in the Navarro WAU. All organisms observed were identified to the lowest possible taxonomic level.

Permeability and bulk gravel samples were taken in select fish bearing reaches of the Navarro WAU to determine an index of spawning gravel quality. Permeability and gravel particle size distributions are stream substrate parameters, which affect survival of incubating salmonid embryos. Salmonid eggs buried under up to a foot of gravel depend on sufficient intragravel water flow for their survival and development. Fine sediment within spawning gravel can impede intragravel water flow, reducing the delivery of dissolved oxygen to eggs, which can increase mortality in the egg to emergence stage. Forest management practices may increase the delivery of fine sediment to the stream channel, potentially impacting spawning gravel. The assessment of substrate permeability and composition are useful in monitoring the effects of increased sediment delivery on salmonid spawning and incubation conditions.

METHODS

Fish Habitat Assessment

The habitat inventory used to evaluate the habitat condition of the Navarro WAU was conducted during low flow conditions using methods modified from the California Salmonid Stream Restoration Manual (Flosi et al., 1998). Stream segments were created based on stream gradient and channel confinement (see section E Stream Channel Condition module). Fish habitat conditions were determined by sampling representative stream segments throughout the watershed. Factors that determined fish habitat assessment locations included fish presence, accessibility and stream channel type (response, transport or source reach). Since high gradient streams were likely to be non-fish bearing, survey efforts were concentrated on low gradient reaches of the stream network.

A distance of 20-30 bankfull widths determined the survey length to ensure that approximately two meander bends of the stream channel were observed. Data collected during the fish habitat and stream channel surveys provided information on pool, riffle and flatwater frequency; pool spacing; spawning gravel quantity and quality; overwintering substrate; shelter complexity and large woody debris (LWD) frequency, condition and future recruitment.

The fish habitat observations were evaluated for quality for each salmonid life stage: spawning, summer rearing and overwintering. Table F-1 displays the targets used for rating measured habitat parameters. These indices are based on scientific literature (Bilby and Ward, 1989; Bisson et al., 1987; Bjornn and Reiser, 1994; CDFG 1998; Montgomery et al., 1995; Washington Forest Practices Board, 1995) and professional judgment. Spawning habitat conditions are evaluated on the basis of gravel availability and quality (gravel sizes, subsurface fines, embeddedness), and are evaluated for preferred salmonid spawning areas located at the tail-outs of pools. Summer rearing habitat conditions for salmonids are evaluated on the size, depth and availability of pools and the complexity and quantity of cover (particularly large woody debris). Overwintering habitat is evaluated on the size, depth and availability of pools, the proportion of habitat units with cobble or boulder-dominated substrate and the quantity of cover.

The habitat data are combined into indices of habitat quality for the different salmonid life stages. Measured fish habitat parameters were weighted and given a numeric scale to develop a quality rating for individual life history stages. Parameters were divided into subsets that correspond with individual life history stages (spawning, summer rearing, and overwintering habitat). Parameters were scored as follows: 1 (poor), 2 (fair), and 3 (good). Parameter weights were applied to the total score calculated as shown below. The parameter codes (see Table F-1) are in bold and the weights in parentheses.

Spawning Habitat

E (0.25) + **F** (0.25) + **G** (0.25) + **H** (0.25)

Summer Rearing Habitat

A (0.20) + **B** (0.15) + **C** (0.15) + **D** (0.15) + **F** (0.15) + **I** (0.20)

Overwintering Habitat

A (0.20) + **B** (0.15) + **C** (0.15) + **D** (0.10) + **I** (0.20) + **J** (0.20)

The overall score is rated as follows:
1.00 - 1.66 = Poor
1.67 - 2.33 = Fair
2.34 - 3.00 = Good

TableF-1. Fish Habitat Condition Indices for Measured Parameters

Fish Habitat Parameter	Feature	Fish Habitat Quality Poor	Fair	Good
Percent Pool (By length) **(A)**	Anadromous Salmonid Streams	<25%	25-50%	>50%
Pool Spacing (Reach length/Bankfull/#pools) **(B)**	Anadromous Salmonid Streams	≥ 6.0	3.0 - 5.9	≤ 2.9
Shelter Rating (Shelter value x % of habitat covered) **(C)**	Pools	<60	60-120	>120
% Of Pools that are ≥3 ft. residual depth **(D)**	Pools	<25%	25-50%	>50%
Spawning Gravel Quantity (% of Surface Area) **(E)**	Pool Tail-outs	<1.5%	1.5-3%	>3%
Percent Embeddedness **(F)**	Pool Tail-outs	>50%	25-50%	<25%
Subsurface Fines (L-P watershed analysis manual) **(G)**	Pool Tail-outs	2.31-3.0	1.61-2.3	1.0-1.6
Gravel Quality Rating (L-P watershed analysis manual) **(H)**	Pool Tail-outs	2.31-3.0	1.61-2.3	1.0-1.6
Key LWD +root wads / 328 ft of stream. **(I)**	Streams < 40 ft. BFW	<4.0	4.0-6.5	>6.6
	Streams ≥ 40 ft. BFW	<3.0	3.0-3.8	>3.9
Substrate for Over-wintering **(J)**	All Habitat Types	<20% of Units Cobble or Boulder Dominated	20-40% of Units Cobble or Boulder Dominated	>40% of Units Cobble or Boulder Dominated

Aquatic Species Distribution

A hierarchical framework was used to select the initial locations of survey sites in each stream. Major streams were broken into lower, middle and upper reaches. Smaller streams were divided into lower and upper reaches. One site is surveyed in each reach, resulting in 3 sites in larger streams, and 2 sites in smaller streams. Additional sites are added directly downstream and upstream of potential migration barriers to determine which salmonid species these barriers are impacting.

A survey site contains a minimum of two consecutive habitat sequences (pool-riffle sequences) and has a minimum length of ninety feet. The survey method used to determine the aquatic species present is single pass electrofishing or snorkeling.

The effort put forth at each survey site is not sufficient to delineate the absence of a species. If future fishery research develops reasonable methods to determine the probability that a species is absent, these methods will be incorporated into future distribution surveys.

Prior to initiating surveys water quality is measured using a Horiba™ U-10 Water Quality Checker. Measurements taken are water temperature (°C), conductivity (microS/cc), dissolved oxygen (mg/L), and pH. Air temperature is measured with a pocket thermometer and water visibility is estimated. Stream discharge is estimated or measured with a Swoffer™ Model 2100 flow meter. The actual physical parameters measured at each site vary depending on equipment availability. Horiba™ U-10 Water Quality Checkers were not used prior to the surveys in 2000.

The primary survey method is electrofishing using a Smith-Root™ Model 12 (Smith-Root Inc., Vancouver, WA) backpack electrofisher. One person operates the backpack electrofisher while one or two other individuals use dip nets to capture the stunned species. The captured specimens are placed into a five-gallon bucket containing stream water. The aquatic species are enumerated, measured to fork length (fish) or snout-vent length (amphibians) and released back into the units from which they were captured. All vertebrate species are identified to the lowest possible taxonomic level.

Diving (snorkeling) is used to assess species presence when stream conditions are considered adequate or when elevated stream temperatures have the potential to adversely impact the health of the animals being electrofished. The basic survey unit for diving consists of a minimum of two pools, however if riffles are deep enough to allow underwater observation these units are sampled. Depending on the channel width, one to four divers are used for the field surveys. The diver(s) enters the survey unit from the downstream end and waits approximately one-minute before proceeding upstream to observe species. If the water velocity is too fast for divers to proceed upstream, the unit is surveyed by floating downstream. Dive slates are used to record data underwater. During the survey, salmonid species are enumerated by size class according to pre-determined size class categories (<70mm, 70–130mm, >130mm). All other vertebrate species observed during the field surveys are identified to the lowest possible taxonomic level.

Permeability and Stream Bulk Gravel Samples

Steam gravel permeability and bulk gravel samples were collected on eight stream monitoring segments in the Navarro River WAU in 1999. In 2001, two segments were surveyed for permeability and no bulk gravel samples were collected. The stream gravel permeability was measured using a 1-inch diameter standpipe similar to the standpipe discussed in Terhune (1958) and Barnard and McBain (1994) with the exception that our standpipe is smaller in diameter. We used the smaller diameter standpipe because we hypothesize that it creates fewer disturbances to the stream gravel when inserted. Bulk stream gravel samples were taken with a 12-inch diameter sampler as described in Platts, Megahan and Minshall (1983).

An electric pump was used to create the water suction in the standpipe for the permeability measurements. The permeability measurements were taken at a depth of 25 centimeters, near the maximum depth of coho and steelhead spawning. The permeability measurements were taken in 4 randomly selected pool tail-out sections along the monitoring segment. At each pool tail-out sampled permeability measurements were taken at 3 sites; the ¼, ½ and ¾ mark of the wetted channel. This gave a total of 12 permeability sites along each monitoring segment in 1999. A recent analysis of MRC permeability data has shown that more samples should be taken to more accurately predict the survival to emergence percentage calculated from the permeability data. From a power analysis it was determined that 26 measurements per segment are needed to predict within 20 percent accuracy the survival of emerging fry (Stillwater Science, 2000). Future measurements will be evenly distributed among all pool tail-outs in the segments. Caution must be taken in interpreting calculated values from the Navarro permeability measurements of 1999 as the number of samples is lower than desirable.

A bulk gravel sample was taken in 1999 in each of the 4 randomly selected pool tail-outs, except for segment WM2 which only had 2 samples. The gravel sample was taken directly over the permeability site that is closest to the thalweg of the channel. After the bulk gravel samples were collected the gravel was dried and sieved through 7 different size-class screens (50.8, 25.4, 12.5, 6.3, 4.75, 2.36, 0.85 mm). The weight of each gravel size class was determined for each of the bulk gravel samples using a commercial quality scale.

From the sieved bulk gravel samples the percent fine particles less than 0.85 mm sieve size class was determined. The survival index for steelhead trout was calculated from the bulk gravel samples using the method described in Tappel and Bjorn (1983). The index for percent survival of steelhead was used because Tappel and Bjorn (1983) only present two survival indices for chinook salmon and steelhead trout. The steelhead index was used because it more closely approximates the fishery in the Navarro WAU (coho salmon and steelhead trout). Chinook salmon are larger fish than coho or steelhead and can spawn in larger substrate making the index based on Chinook salmon impractical for the Navarro WAU.

In the year 2001, a total of 26 permeability measurements were taken in each selected monitoring segment. Bulk gravel samples were not collected in 2001. The measurements were evenly distributed among all pool tail-outs in the segments, with any additional measurements taken in tail-outs behind the deepest pools. The measurement location in each tail-out was randomly selected from an evenly selected 12-point grid in the tail-out. At each measurement location permeability repetitions were taken until the permeability readings no longer were increasing.

The median permeability measurement for each permeability site in the monitoring segment was used as representative of the site. To characterize the entire monitoring segment the natural log of the mean of the median permeability measurements was determined. The natural log of the permeability is used because of a relationship developed from data from Tagart (1976) and McCuddin (1977) (Stillwater Sciences, 2000) to estimate survival to emergence from permeability data. This relationship equates the natural log of permeability to fry survival ($r^2 = 0.85$, $p<10^{-7}$). This index needs further improvements, but is currently all we have for interpreting permeability information and biological implications. This relationship is:

$$\text{Survival} = -0.82530 + 0.14882 * \ln \text{permeability}$$

It is important to understand that the use of this survival relationship is only an index of spawning gravel quality in the segment. The permeability measurements were taken in randomly selected pool tail-outs and are not indicative of where a salmon may select to spawn. Furthermore, spawning salmon have been shown to improve permeability in gravel where a redd was developed (MRC, 2000). Therefore the survival percentage developed is only indicative of the quality of potential spawning habitat and not as an absolute number.

RESULTS AND DISCUSSIONS

Salmonid Habitat Condition and Aquatic Species Distribution

Tables F-2 and F-3 summarize the 1999 fish habitat assessment data. A total of 40 segments were evaluated. The habitat parameters used to evaluate individual stream segments can be found in Table F-2. The 'rating' is the quality value for calculation of weighted habitat indices (see Table F-1). The ratings were used to calculate habitat quality for each life history stage. A summary of the habitat ratings corresponding to each life history stage can be found in Table F-3.

Map F-1(a) and F-1(b) were generated using data collected during the distribution surveys. Some additional field work was conducted to investigate the location of migration barriers. If no adult salmonid migration barrier was found, then the upper extent of salmonid (steelhead and coho) distribution is mapped as far upstream as juveniles have been found. In most circumstances this is close to the actual extent of salmonid distribution. However, in some streams salmonid distribution may extend further upstream.

Table F-4 indicates scientific names of the species discussed. There are three taxonomic uncertainties that are important to note. 1) Juvenile steelhead and resident rainbow trout cannot be distinguished between in the field. For the purpose of this report, *Oncorhynchus mykiss* juveniles are referred to as "steelhead" if there is not a known migration barrier downstream. If there is a migration barrier downstream the juveniles are referred to as "rainbow trout". 2) California roach of the sub-species *Lavinia symmetricus navarroensis* are known to occur in the Navarro River watershed. It is unknown if other California roach sub-species occur in the drainage. California roach are not identified to the sub-species level in this report. 3) The Navarro River watershed is known to contain signal crayfish (*Pacifastacus leniusculus*). Other species of crayfish may also be present. Crayfish are not identified to the species level in this report.

The Navarro River WAU is comprised of seventeen planning watersheds of which fifteen were surveyed for fish habitat and/or aquatic species distribution. The planning watersheds range in size from 3,500 to 8,900 acres. The discussion of results is separated into planning watersheds and stream names of the Navarro River WAU. Some streams lack fish habitat or aquatic species distribution information. Available information for each stream is summarized in the discussion below.

Lower Navarro River Planning Watershed

Mainstem Navarro River (Habitat segment WL3)

Habitat

Spawning, summer rearing and over-wintering habitat rated fair. The segment was deficient in large woody debris and over-wintering substrate.

Steelhead

This segment was surveyed during the summer of 1995, 1996, 2000, 2001 and 2002. Each year multiple age classes of juvenile steelhead were observed.

Coho Salmon

Though coho are found in tributaries to the mainstem Navarro River, coho have not been found in the mainstem during summer. This may be due to high summer water temperatures. Annual maximum weekly average temperatures (MWAT) typically exceed 20° C. (See Section D "Riparian Function").

Other Species

Other species found in this segment include California roach, threespine stickleback, sculpin, crayfish, and bullfrog.

Marsh Gulch (Habitat segment WL4)

Habitat

Summer rearing and over-wintering habitat rated fair. Spawning habitat rated poor due to highly embedded gravel and large quantities of sub-surface fine sediment.

Steelhead

Steelhead have been found as far upstream as Site 82-2. Increased stream gradient up-stream of Site 82-2 is believed to impede upstream passage of adult steelhead.

Coho Salmon

Coho have been found as far upstream as Site 82-1. Between Site 82-1 and Site 82-2 stream gradient increases slightly. The increased gradient may impede the upstream passage of adult coho.

Other Species

Other species found in Marsh Gulch include coast range sculpin, prickly sculpin, Pacific lamprey, California roach, Olympic tailed frog, Pacific giant salamander and crayfish.

Murray Gulch (Habitat segment WL19)

Habitat

Spawning and summer rearing habitat rated fair. Over-wintering habitat rated poor due to a lack of deep pools and over-wintering substrate.

Steelhead

Steelhead have been found as far upstream as Site 82-46. Increased stream gradient upstream of site 82-46 is believed to impede upstream passage of adult steelhead.

Coho Salmon

Coho have been found as far upstream as Site 82-3. Upstream of Site 82-3 stream gradient increases slightly. The increased gradient may impede the passage of adult coho.

Other Species

Other species found in Murray Gulch include California roach, prickly sculpin, Pacific giant salamander, Olympic tailed frog, red legged frog, and crayfish.

Flume Gulch (Habitat segments WL27 and WL28)

Habitat

Spawning, summer rearing and over-wintering habitat rated fair in both segments. However, both segments lacked deep pools.

Steelhead

Steelhead have been found upstream as far as Site 82-8. The upper extent of steelhead distribution is unknown and merits investigation.

Coho Salmon

Coho have been found as far upstream as Site 82-7. Upstream of Site 82-7 stream gradient increases. The increased gradient may impede the upstream passage of adult coho.

Other Species

Other species found in Flume Gulch include coast range sculpin, prickly sculpin, California roach, Pacific giant salamander, and crayfish.

Ray Gulch Planning Watershed

Barton Gulch (Habitat data has not been collected)

Steelhead

Steelhead have only been found at Site 82-05. However, sampling at site 82-06 is difficult due to vegetation overhanging the stream channel. No known barrier to steelhead migration exists in Barton Gulch.

Coho Salmon
Coho have not been found in Barton Gulch.
Other Species
Other species found in Barton Gulch include prickly sculpin, threespine stickleback, California roach, Pacific giant salamander, and crayfish.
Comments
The Hwy 128 road crossing should be surveyed to determine if it has the potential to impede salmonid migration.

<u>Roller Gulch (Habitat segment WR11)</u>
Habitat
Spawning habitat rated fair. Summer rearing and over-wintering habitat rated poor, primarily due to a lack of deep pools, large woody debris and over-wintering substrate.
Steelhead
Steelhead have not been found in Roller Gulch. Steelhead may be absent from Roller Gulch because the lower reach is marshy and lacks a defined channel that fish can migrate through.
Coho Salmon
Coho have not been found in Roller Gulch.
Other Species
Other species found in Roller Gulch include sculpin, threespine stickleback, Pacific giant salamander, California newt, rough skinned newt, yellow legged frog and red legged frog.

<u>Ray Gulch (Habitat segments WR14 and WR15)</u>
Habitat
Summer rearing and over-wintering habitat rated fair in both segments. Spawning habitat rated good in segment WR14 and poor in segment WR15. In general, both segments were deficient in deep pools and over-wintering substrate. Large woody debris was abundant.
Steelhead
Steelhead have been found as far upstream as Site 82-45. Surveys have not been conducted upstream of this site due to limited surface water during the survey season.
Coho Salmon
Coho have not been found in Ray Gulch.
Other Species
Other species found in Ray Gulch include prickly sculpin, California roach, threespine stickleback, bull frog, red-legged frog, Pacific giant salamander, and crayfish.
Comments
The Hwy 128 road crossing should be surveyed to determine if it has the potential to impede salmonid migration.

<u>Mustard Gulch (Habitat segment WR26)</u>
Habitat
Spawning, summer rearing and over-wintering habitat rated fair. The segment was deficient in over-wintering substrate and deep pools. Large woody debris was abundant.
Steelhead
Steelhead have not been found in Mustard Gulch since 1995. In 1995 steelhead were found at Site 82-11.
Coho Salmon
Coho have not been found in Mustard Gulch.
Other Species
Other species found in Mustard Gulch include prickly sculpin, California roach, threespine stickleback, Pacific giant salamander, and crayfish.

Comments
The Hwy 128 road crossing should be surveyed to determine if it has the potential to impede salmonid migration.

White Gulch (Habitat Segment (WR23) (Aquatic species distribution surveys have not been conducted in White Gulch)
Habitat
Summer rearing and over-wintering habitat rated poor, primarily due to a lack of deep pools and over-wintering substrate. Spawning habitat rated fair.

Middle Navarro River Planning Watershed
Mainstem Navarro River (Habitat segments WM2 and WM5)
Habitat
Spawning, summer rearing and over-wintering habitat were rated fair in both segments. Segment WM2 was deficient in large woody debris. Segment WM5 was deficient in large woody debris, and substrate suitable for over-wintering. Additionally, fine sediment levels were high.
Steelhead
Multiple age classes of juvenile steelhead have been found in these segments.
Coho
Though coho are found in tributaries to the mainstem Navarro River, coho have not been found in the mainstem during summer.
Other Species
Other species found in these segments include California roach, prickly sculpin, three spine stickleback and crayfish.

Tramway Gulch (Habitat data has not been collected)
Steelhead
Steelhead have been found as far upstream as site 82-16. Surveys have not been conducted upstream of this site.
Coho Salmon
Coho have not been found in Tramway Gulch.
Other Species
Other species found in Tramway Gulch include Pacific giant salamander and crayfish.

Berry Creek (Habitat segment WM36)
Habitat
Spawning habitat rated good. Summer rearing and over-wintering habitat rated poor, primarily due to a lack of deep pools and large woody debris.
Steelhead
Steelhead have been found as far upstream as Site 82-29. Upstream of Site 82-29 there is a log jam that appeared to be a barrier to upstream salmonid migration in 2002. It is believed that the log jam will eventually break up allowing steelhead to migrate further upstream.
Coho Salmon
Coho have not been found in Berry Gulch.
Other Species
Other species found in Berry Gulch include Pacific giant salamander, yellow legged frog, rough skinned newt, and crayfish.

Floodgate Creek Planning Watershed

Perry Gulch (Habitat data has not been collected)

Steelhead

Steelhead have been found at Site 82-26. Surveys have not been conducted upstream of this site due to a change in land ownership.

Coho Salmon

Coho have not been found in Perry Gulch.

Other Species

Other species found in Perry Gulch include California roach, sculpin, yellow legged frog, Pacific giant salamander, and crayfish.

Comments

Perry Gulch could not be surveyed in 2000-2002 due to limited surface water during the survey season.

Floodgate Creek (Habitat data has not been collected)

Steelhead

Steelhead have been found at Site 82-30. Surveys have not been conducted further upstream due to a change in land ownership.

Coho Salmon

Coho have not been found in Floodgate Creek.

Other Species

Other species found in Floodgate Creek include California roach, threespine stickleback, prickly sculpin, yellow legged frog, Pacific giant salamander, rough skinned newt, and crayfish.

Upper Navarro River Planning Watershed

Mainstem Navarro River (Habitat segment WU1)

Habitat

Spawning, summer rearing and over-wintering habitat all rated fair. Similar to the lower Navarro River segment, this segment was deficient in large woody debris, and substrate suitable for over-wintering.

Steelhead

Steelhead have been found within this segment.

Coho

Though coho are found in tributaries to the mainstem Navarro River, coho have not been found in the mainstem during summer.

Other Species

Other species found within this segment include California roach, prickly sculpin, threespine stickleback and yellow legged frog.

Black Rock Creek (Habitat segment WU4)

Habitat

Spawning and over-wintering habitat were rated fair. Summer rearing habitat was rated poor, primarily due to shallow pool depths and a lack of large woody debris.

Steelhead

Steelhead have been found at Site 82-40. Upstream of Site 82-40 there is a log jam that appeared to be a barrier to salmonid migration in 2002. It is believed that the log jam will eventually break up allowing salmonids to migrate further upstream.

Coho Salmon

Coho have not been found in Black Rock Creek.

Other Species
Other species found in Black Rock Creek include Pacific giant salamander, yellow legged frog and crayfish.

Sage Gulch (Habitat data has not been collected)
Steelhead
Steelhead have been found at Site 82-33. There is a waterfall directly upstream of Site 82-33 that is believed to be a barrier to upstream salmonid migration.
Coho Salmon
Coho have not been found in Sage Gulch.
Other Species
Other species found in Sage Gulch include Pacific giant salamander, yellow legged frog and crayfish.

Mill Creek Planning Watershed
Hungry Hollow Creek (Habitat data has not been collected)
Steelhead
Neither steelhead nor resident rainbow trout have been found in Hungry Hollow Creek. A waterfall downstream of MRC's property is believed to impede upstream migration of adult steelhead.
Coho Salmon
Coho have not been found in Hungry Hollow Creek.
Other Species
Other species found in Hungry Hollow Creek include rough skinned newt, California newt, Pacific giant salamander and yellow legged frog.

Hendy Woods Planning Watershed
Mainstem Navarro River (Habitat segment WH2)
Habitat
Spawning and summer rearing habitat were rated fair. Over-wintering habitat was rated poor due to a lack of large woody debris, deep pools and over-wintering substrate.
Steelhead
Juvenile steelhead of multiple age classes have been found in this segment.
Coho
Though coho are found in tributaries to the mainstem Navarro River, coho have not been found in the mainstem during summer.
Other Species
Other species found in this segment include prickly sculpin, California roach, threespine stickleback and crayfish.

North Fork Indian Creek Planning Watershed
North Fork Indian Creek (Habitat segment EI2)
Habitat
Spawning habitat was rated good. Both summer rearing and over-wintering habitat were rated fair. The segment was deficient in deep pools.
Steelhead
Multiple age classes of steelhead have been found throughout North Fork Indian Creek.
Coho Salmon
Coho have not been found in North Fork Indian Creek.

Other Species
Other species found in North Fork Indian Creek include California roach, Pacific lamprey, rough skinned newt, California newt, Pacific giant salamander, and yellow legged frog.

West Branch North Fork Indian Creek (Habitat data has not been collected)
Steelhead
Steelhead have been found at Site 86-6. Upstream of site 86-6 stream gradient increases. The increased gradient is believed to impede upstream passage of adult steelhead.
Coho Salmon
Coho have not been found in West Branch North Fork Indian Creek.
Other Species
Other species found in West Branch North Fork Indian Creek include yellow legged frog, California newt and Pacific giant salamander.

Sherman Gulch (Habitat data has not been collected)
Steelhead
Steelhead have been found at Site 86-2. Surveys have not been conducted further upstream due to a change in land ownership.
Coho Salmon
Coho have not been found in Sherman Gulch.
Other Species
Other species found in Sherman Gulch include yellow legged frog and Pacific giant salamander.

Rancheria Creek Planning Watershed
Dago Creek (Habitat data has not been collected)
Steelhead
Steelhead have been found at Site 88-5. Surveys have not been conducted further upstream due to a change in property ownership.
Coho Salmon
Coho have not been found in Dago Creek. It is possible that coho occur downstream of the area that has been surveyed.
Other Species
Other species found in Dago Creek include sculpin, Pacific giant salamander, and California newt.

Cold Springs Creek (Habitat data has not been collected)
Steelhead
Steelhead have been found at Site 88-2. Surveys have not been conducted further upstream due to a change in property ownership.
Coho Salmon
Coho have not been found in Cold Spring Creek. It is possible that coho occur downstream of the area that has been surveyed.
Other Species
Other species found in Cold Springs Creek include Pacific giant salamander and yellow legged frog.

North Fork Navarro River Planning Watershed

Dead Horse Gulch (Habitat segment WN10)

Habitat

Spawning, over-wintering and summer rearing habitat rated fair. This segment was deficient in deep pools and fine sediment levels were high.

Steelhead

Steelhead have been found at Site 82-14. Surveys have not been conducted upstream of this site due to limited surface water during the survey season.

Coho Salmon

Coho have been found at Site 82-14.

Other Species

Other species found in Dead Horse Gulch include California roach, sculpin, Pacific giant salamander and crayfish.

Comments

The Hwy 128 road crossing should be surveyed to determine if it has the potential to impede salmonid migration.

Coon Creek (Habitat segment WN20)

Habitat

Spawning, over-wintering and summer rearing habitat rated fair. The segment was deficient in deep pools and fine sediment levels were high.

Steelhead

Steelhead have been found as far upstream as Site 82-17. Surveys have not been conducted upstream of this site due to limited surface water during the survey season.

Coho Salmon

Coho have not been found in Coon Creek.

Other Species

Other species found in Coon Creek include Pacific giant salamander and crayfish.

Comments

The Hwy 128 road crossing should be surveyed to determine if it has the potential to impede salmonid migration.

Flynn Creek Planning Watershed

Flynn Creek (Habitat segments WF1 and WF1(U))

Habitat

Across these segments: spawning habitat ratings ranged from fair to good, over-wintering habitat ratings ranged from poor to fair and summer rearing habitat rated fair. The segments were deficient in large woody debris and deep pools.

Steelhead

Steelhead have been found as far upstream as Site 82-25. Surveys have not been conducted upstream of this site due to limited surface water during the survey season..

Coho Salmon

Coho have been found as far upstream as Site 82-25.

Other Species

Other species found in Flynn Creek include threespine stickleback, coastrange sculpin, prickly sculpin, California roach, Pacific giant salamander, yellow legged frog, and crayfish.

Camp 16 Gulch (Habitat segment WF13)

Habitat

Spawning habitat rated good. Summer rearing and over-wintering habitat rated fair. The segment was deficient in large woody debris and deep pools.

Steelhead
Steelhead have been found as far upstream as Site 82-22. Surveys have not been conducted upstream of this site due to limited surface water during the survey season.
Coho Salmon
Coho have been found as far upstream as Site 82-22.
Other Species
Other species found in Camp 16 Gulch include prickly sculpin and Pacific giant salamander.

Tank 4 Gulch (Habitat data has not been collected)
Steelhead
Steelhead have been found as far upstream as Site 82-24. Surveys have not been conducted upstream of this site due to limited surface water during the survey season.
Coho Salmon
Coho have been found at site 82-23.
Other Species
Other species found in Tank 4 Gulch include sculpin, Pacific giant salamander and crayfish.

Lower South Branch Navarro River Planning Watershed
South Branch North Fork Navarro River (Habitat segment EL1)
Habitat
Spawning habitat rated good. Over-wintering habitat rated fair and summer rearing habitat rated poor due to shallow pools and very little large woody debris.
Steelhead
Multiple age classes of juvenile steelhead have been found in this segment.
Coho
Coho have been found within this segment.
Other Species
Other species found within this segment include coast range sculpin, California roach, three spine stickleback, Pacific lamprey, yellow legged frog, Pacific giant salamander and crayfish.

Middle South Branch Navarro River Planning Watershed
South Branch North Fork Navarro River (SBNF) (Habitat segment EM1)
Habitat
Spawning, summer rearing and over-wintering habitat rated fair. The segment was deficient in deep pools and fine sediment levels were high.
Steelhead
Steelhead have been found within this segment.
Coho
Prior to 2002, coho had only been found at Site 85-1, near the mouth of the SBNF. In 2002 coho were found upstream of this segment as far as Site 85-18, approximately 15 stream miles upstream of where they had previously been found.
Other Species
Other species found in this stretch of river include Pacific lamprey, California roach, threespine stickleback, yellow legged frog, Pacific giant salamander and crayfish.

Bailey Creek (Habitat data has not been collected)
Steelhead
Steelhead have been found as far upstream as Site 85-4. Surveys have not been conducted further upstream due to limited surface water during the survey season.
Coho Salmon
Coho have not been found in Bailey Creek.

Other Species
Other species found in Bailey Creek include prickly sculpin, Pacific giant salamander and crayfish.

Camp Creek (Habitat data has not been collected)
Steelhead
Steelhead have been found as far upstream as Site 85-23. Between Site 85-23 and Site 85-24 there is a culvert that is a barrier to upstream salmonid migration. MRC is currently making plans to remove this barrier.
Coho Salmon
Coho have not been found in Camp Creek.
Other Species
Other species found in Camp Creek include sculpin and Pacific giant salamander.

Bear Creek (Habitat segment EM20)
Habitat
Spawning habitat rated fair. Summer rearing and over-wintering habitat rated poor, primarily due to a lack of deep pools, large woody debris and over-wintering substrate. The substrate was highly embedded.
Steelhead
Steelhead have been found as far upstream as Site 85-30. Directly downstream of Site 85-6 there is a waterfall that is a barrier to adult steelhead upstream migration. Resident rainbow trout have not been found above the waterfall.
Coho Salmon
Prior to 2002, coho had not been found in Bear Creek. In 2002, coho were found at Site 85-5.
Other Species
Other species found in Bear Creek include California newt, yellow legged frog, Pacific giant salamander and crayfish.

Bridge Creek (Habitat segments EM29 and EM30)
Habitat
Summer rearing and over-wintering habitat rated fair in both segments. Spawning habitat rated fair in segment EM29 and good in segment EM30. Both segments were deficient in deep pools and large woody debris,
Steelhead
Steelhead have been found at Site 85-25. Directly upstream of this site there is a series of bedrock cascades. Two culverts are perched on top of the cascades. The culverts are a barrier to adult salmonid upstream migration.
Coho Salmon
Prior to 2002, coho had not been found in Bridge Creek. In 2002, coho were found at Site 85-25 (downstream of the culverts discussed above).
Other Species
Other species found in Bridge Creek include prickly sculpin, Pacific giant salamander, yellow legged frog and crayfish.
Comments
Removal of the culverts to allow for fish passage is currently being planned by Mendocino Redwood Company.

Shingle Mill Gulch (Habitat segment EM39)

Habitat

Spawning habitat rated fair. Summer rearing and over-wintering habitat rated poor, primarily due to a lack of deep pools.

Steelhead

Steelhead have been found at Site 85-8. Directly upstream of this site a culvert was present prior to the summer of 2002. This culvert was believed to be a barrier to adult steelhead upstream migration. Resident rainbow trout had been found upstream as far as Site 85-9. In 2002, the culvert was replaced with a bridge that will not impede steelhead migration.

Coho Salmon

Coho have not been found in Shingle Mill Gulch.

Other Species

Other species found in Shingle Mill Gulch include Pacific giant salamander, yellow legged frog and crayfish.

Upper South Branch Navarro River Planning Watershed

South Branch North Fork Navarro River (SBNF) (Habitat segments EU1 and EU4)

Habitat

Spawning, summer rearing and over-wintering habitat rated fair in both segments. Both segments were deficient in large woody debris.

Steelhead

Multiple age classes of steelhead have been found in this stretch of river.

Coho

Prior to 2002, coho had only been found at Site 85-1, near the mouth of the SBNF. In 2002 coho were found as far upstream as Site 85-18.

Other Species

Other species found in this stretch of river include California roach, yellow legged frog, Pacific giant salamander and crayfish.

McGarvey Creek (Habitat segment EU7)

Habitat

Spawning habitat rated fair. Summer rearing and over-wintering habitat rated poor, primarily due to a lack of deep pools and over-wintering substrate.

Steelhead

Steelhead have been found as far upstream as Site 85-12. Surveys have not been conducted further upstream due to limited surface water during the survey season.

Coho Salmon

Coho have not been found in McGarvey Creek.

Other Species

Other species found in McGarvey Creek include California roach, threespine stickleback, Pacific giant salamander, yellow legged frog and crayfish.

Burns Gulch (Habitat data has not been collected)

Steelhead

Steelhead have been found at Site 85-15. It is believed that increasing stream gradient upstream of Site 85-15 impedes upstream migration by adult steelhead.

Coho Salmon

Coho have not been found in Burns Gulch.

Other Species

Other species found in Burns Gulch include Pacific giant salamander, yellow legged frog and crayfish.

Rose Creek (Habitat segment EU24)
Habitat
Spawning habitat rated fair. Summer rearing and over-wintering habitat rated poor, primarily due to a lack of deep pools.
Steelhead
Steelhead have been found as far upstream as Site 85-22. Surveys have not been conducted further upstream
Coho Salmon
Coho have not been found in Rose Creek.
Other Species
Other species found in Rose Creek include California roach, Pacific giant salamander, yellow legged frog and crayfish.

Low Gap Creek (Habitat segment EU20)
Habitat
Spawning, summer rearing and over-wintering habitat rated fair. The segment was deficient in large woody debris and deep pools.
Steelhead
Steelhead have been found as far upstream as Site 85-17. Surveys have not been conducted further upstream due to a change in land ownership.
Coho Salmon
Prior to 2002, coho had not been found in Low Gap Creek. In 2002, coho were found upstream as far as Site 85-31.
Other Species
Other species found in Low Gap Creek include sculpin, California roach, California newt, yellow legged frog, Pacific giant salamander and crayfish

Hardscratch Creek (Habitat data has not been collected)
Steelhead
Steelhead have been found as far upstream as Site 85-20. Surveys have not been conducted further upstream due to a change in land ownership.
Coho Salmon
Prior to 2002, coho had not been found in Hardscratch Creek. In 2002, coho were found as far upstream as Site 85-18.
Other Species
Other species found in Hardscratch Creek include Pacific lamprey, California roach, yellow legged frog, Pacific giant salamander and crayfish.

Dutch Henry Creek Planning Watershed
Deer Creek (Habitat data has not been collected)
Steelhead and Coho Salmon
A waterfall near the mouth of Deer Creek impedes adult salmonid migration. Resident rainbow trout have not been found upstream of the waterfall.
Other Species
Other species found in Deer Creek include Pacific giant salamander, yellow legged frog and crayfish.

North Branch North Fork Navarro River (Habitat segment ED1)
Habitat
Summer rearing and over-wintering habitat were rated fair in this segment. Spawning habitat was rated good. The segment was deficient in large woody debris.

Steelhead
Multiple age classes of steelhead have been found in this segment.
Coho
Coho have been found in this segment.
Other Species
Other species found in this segment include sculpin, California roach, three spine stickleback, yellow legged frog, northwestern pond turtle and crayfish.

Cooks Creek (Habitat segment ED8)
Habitat
Summer rearing and over-wintering habitat were rated fair. Spawning habitat was rated good. This segment was deficient in deep pools.
Steelhead
Steelhead have been found as far upstream as Site 81-5.
Coho Salmon
Coho have been found as far upstream as Site 81-4.
Other Species
Other species found in Cooks Creek include prickly sculpin, threespine stickleback, California roach, Pacific giant salamander, yellow legged frog, rough skinned newt and crayfish.

John Smith Creek Planning Watershed
John Smith Creek (Habitat segments EJ1 and EJ1(2))
Habitat
Summer rearing and over-wintering habitats were rated fair in both segments. Spawning habitat was rated fair in segment EJ1 and good in segment EJ1(2). These segments were deficient in large woody debris and deep pools.
Steelhead
Steelhead have been found upstream as far as Site 81-30. Surveys have not been conducted further upstream due to limited surface water during the survey season.
Coho Salmon
Coho have been found upstream as far as Site 81-30.
Other Species
Other species found in John Smith Creek include threespine stickleback, Pacific giant salamander, yellow legged frog and crayfish.
Comments
In the summer of 2002 the culvert at the outlet of John Smith Creek was replaced with a bridge. The culvert was a partial barrier to upstream adult salmonid migration and a complete barrier to upstream juvenile salmonid migration. This bridge was installed with an extra wide channel with rock boulder clusters in the stream bed to promote stream habitat and hydraulic conditions conducive to salmonid migration for a wide range of stream flows.

Sheep Gulch (Habitat data has not been collected)
Steelhead
Steelhead have been found upstream as far as Site 81-29. Surveys have not been conducted further upstream due to limited surface water during the survey season.
Coho Salmon
Coho have been found at Site 81-9,
Other Species
Other species found in Sheep Gulch include yellow legged frog and Pacific giant salamander.

Little North Fork Navarro River Planning Watershed

Big Gulch (Habitat data has not been collected)

Steelhead

Steelhead have been found at Site 81-13. Upstream of Site 81-13 there is a series of small log jams which have resulted in sediment accumulation. It is believed that this formation is a temporary barrier to adult steelhead upstream migration.

Coho Salmon

Prior to 2002, coho had not been found in Big Gulch. In 2002, coho were found at Site 81-13.

Other Species

Other species found in Big Gulch include California roach, sculpin, threespine stickleback, yellow legged frog, Pacific giant salamander, and crayfish.

Little NF Navarro River (Habitat segments EN2 and EN25)

Habitat

Spawning and over-wintering habitat rated fair in both segments. Summer rearing habitat was rated fair in segment EN2 and poor in segment EN25. Both segments were deficient in large woody debris and deep pools.

Steelhead

Steelhead have been found as far upstream as Site 81-19. Steelhead have not been found at Site 81-20. Migration barriers have not yet been surveyed for between these sites.

Coho

Coho have been found as far upstream as Site 81-19.

Other Species

Other species found in Little North Fork Navarro River include prickly sculpin, California roach, threespine stickleback, Sacramento sucker, Pacific giant salamander, newt, yellow legged frog and crayfish.

Redwood Creek (Habitat data has not been collected)

Steelhead

Steelhead have been found at Site 81-15. Upstream of Site 81-15 there is a series of small log jams which have resulted in sediment accumulation. It is believed that this formation is a temporary barrier to adult steelhead upstream migration.

Coho Salmon

Prior to 2002, coho had not been found in Redwood Creek. In 2002, coho were found at Site 81-15.

Other Species

Other species found in Redwood Creek include prickly sculpin, California newt, yellow legged frog and Pacific giant salamander.

Bottom Creek (Habitat segment EN3)

Habitat

Spawning, summer rearing and over-wintering habitat were rated fair. The segment was deficient in large woody debris and deep pools.

Steelhead

Steelhead have been found as far upstream as Site 81-27. Upstream of Site 81-27 stream gradient increases. The increased gradient is believed to impede upstream passage of adult steelhead.

Coho

Coho have been found as far upstream as Site 81-27.

Other Species

Other species found in Bottom Creek include prickly sculpin, Pacific giant salamander and crayfish.

Spooner Creek (Habitat segment EN4)
Habitat
Spawning and summer rearing habitat rated fair. Over-wintering habitat rated poor. The segment was deficient in quality over-wintering substrate, deep pools and large woody debris.
Steelhead
Steelhead have been found as far upstream as Site 81-26. Surveys have not been conducted further upstream.
Coho
Coho have been found as far upstream as Site 81-32.
Other Species
Other species found in Spooner Creek include prickly sculpin, Pacific giant salamander, California newt, and yellow legged frog,

Sawyer Creek (Habitat segment EN38)
Habitat
Spawning, summer rearing and over-wintering habitat rated fair. The segment was deficient in large woody debris and deep pools.
Steelhead
Steelhead have been found as far upstream as Site 81-22. Steelhead have not been found at Site 81-23. The segment of stream between these sites has not yet been surveyed for migration barriers.
Coho
Coho have been found as far upstream as Site 81-22.
Other Species
Other species found in Sawyer Creek include prickly sculpin, Pacific giant salamander, rough skinned newt and crayfish.

Table F-2 Summary of Fish Habitat Parameters and Corresponding Ratings. Navarro River Watershed Analysis Unit 1999.

Segment	**A.** % Pool:Riffle: Flatwater by stream length		**B.** Pool Spacing		**C.** Shelter rating		**D.** % of all pools with residual depth ≥3 ft.		**E.** Spawning gravel quantity (%)		**F.**% Embed-dedness		**G.** Sub-surface fines		**H.** Gravel Quality		**I.** Key LWD + rootwads / 328 ft. with Debris Jams		**J.** % Over-wintering substrate	
	%	Rating	Spacing	Rating	Score	Rating	%	Rating	%	Rating	%	Rating	Score	Rating	Score	Rating	Score	Rating	%	Rating
ED1	67:31:2	Good	2.2	Good	60	Fair	38	Fair	>3	Good	25-50	Fair	3	Good	2	Fair	0.9	Poor	69	Good
ED8	75:25:0	Good	4.5	Fair	46	Poor	18	Poor	>3	Good	25-50	Fair	3	Good	2	Fair	2.7	Poor	55	Good
WF1	59:30:11	Good	2.3	Good	41	Poor	7	Poor	>3	Good	0-25	Good	1	Poor	2	Fair	1.8	Poor	0	Poor
WF1(U)	83:17:0	Good	2.6	Fair	48	Poor	6	Poor	>3	Good	0-25	Good	3	Good	2	Fair	0	Poor	76	Good
WF13	54:46:0	Good	3.7	Fair	68	Fair	0	Poor	1.5-3	Fair	0-25	Good	3	Good	2	Fair	2.6	Poor	76	Good
WH3	80:16:4	Good	3.9	Fair	46	Poor	0	Poor	1.5-3	Fair	25-50	Fair	2	Fair	2	Fair	0.6	Poor	16	Poor
EJ1	46:54:0	Fair	2.8	Good	76	Fair	7	Poor	1.5-3	Fair	25-50	Fair	2	Fair	2	Fair	0.9	Poor	94	Good
EJ1(2)	75:8:17	Good	2.9	Good	20	Poor	0	Poor	>3	Good	0-25	Good	3	Good	2	Fair	1.4	Poor	0	Poor
EN2	68:11:21	Good	2.7	Good	71	Fair	0	Poor	>3	Good	25-50	Fair	2	Fair	2	Fair	1.1	Poor	0	Poor
EN3	85:15:0	Good	5.2	Fair	41	Poor	0	Poor	1.5-3	Fair	25-50	Fair	3	Good	2	Fair	2.7	Poor	33	Fair
EN4	57:19:24	Good	3.8	Fair	58	Poor	6	Poor	>3	Good	25-50	Fair	2	Fair	2	Fair	1.3	Poor	18	Poor
EN25	54:39:7	Good	3.9	Fair	44	Poor	0	Poor	>3	Good	>50	Poor	2	Fair	2	Fair	1.3	Poor	74	Fair
EN38	53:47:0	Good	4.9	Fair	95	Fair	0	Poor	1.5-3	Fair	25-50	Fair	3	Good	2	Fair	2.2	Poor	44	Fair
WL3	79:13:8	Good	2.0	Good	41	Poor	33	Fair	>3	Good	25-50	Fair	2	Fair	2	Fair	0	Poor	0	Poor
WL4	38:17:45	Fair	2.5	Good	46	Poor	0	Poor	1.5-3	Fair	>50	Poor	1	Poor	2	Fair	4.4	Fair	47	Fair
WL19	16:6:78	Poor	5.0	Fair	53	Poor	0	Poor	1.5-3	Fair	0-25	Good	1	Poor	2	Fair	4.7	Fair	0	Poor
WL27	15:24:61	Poor	2.1	Good	72	Fair	0	Poor	1.5-3	Fair	25-50	Fair	1	Poor	2	Fair	1.0	Poor	42	Good
WL28	52:37:11	Good	2.8	Good	67	Fair	7	Poor	1.5-3	Fair	25-50	Fair	1	Poor	2	Fair	11.0	Good	0	Poor
EM1	55:16:29	Good	4.7	Fair	38	Fair	18	Poor	>3	Good	25-50	Fair	1	Poor	2	Fair	0.2	Poor	73	Good
EM20	49:51:0	Fair	4.3	Fair	38	Poor	0	Poor	>3	Good	>50	Poor	2	Fair	2	Fair	5.2	Fair	0	Poor
EM29	54:15:31	Good	3.0	Fair	49	Poor	0	Poor	>3	Good	25-50	Fair	2	Fair	2	Fair	1.9	Poor	0	Poor
EM30	54:25:21	Good	2.6	Good	45	Poor	0	Poor	>3	Good	25-50	Fair	3	Good	2	Fair	2.3	Poor	31	Fair
EM39	28:41:31	Poor	9.9	Poor	41	Poor	0	Poor	>3	Good	>50	Poor	2	Fair	2	Fair	4.7	Fair	40	Fair

Table F-2 continued. Summary of Fish Habitat Parameters, with Scores and Corresponding Ratings. Navarro River Watershed Analysis Unit 1999.

Segment	**A.** % Pool:Riffle: Flatwater by stream length		**B.** Pool Spacing		**C.** Shelter rating		**D.** % of all pools with residual depth ≥3 ft.		**E.** Spawning gravel quantity (%)		**F.**% Embed-dedness		**G.** Sub-surface fines		**H.** Gravel Quality		**I.** Key LWD + rootwads / 328 ft. with Debris Jams		**J.** % Over-wintering substrate	
	%	Rating	Spacing	Rating	Score	Rating	%	Rating	%	Rating	%	Rating	Score	Rating	Score	Rating	Score	Rating	%	Rating
WU1	70:9:21	Good	2.1	Good	46	Poor	44	Fair	>3	Good	25-50	Fair	2	Fair	2	Fair	0	Poor	0	Poor
WU4	35:61:4	Fair	4.8	Fair	59	Poor	0	Poor	1.5-3	Fair	25-50	Fair	1	Poor	2	Fair	2.4	Poor	63	Good
EI2	61:12:27	Good	2.3	Good	42	Poor	17	Poor	>3	Good	25-50	Fair	3	Good	2	Fair	3.2	Fair	100	Good
EU1	85:8:7	Good	7.4	Poor	76	Fair	45	Fair	1.5-3	Fair	25-50	Fair	2	Fair	2	Fair	0.7	Poor	20	Fair
EU4	79:0:21	Good	1.3	Good	40	Poor	7	Poor	1.5-3	Fair	25-50	Fair	3	Good	2	Fair	1.3	Poor	93	Good
EU7	18:72:10	Poor	5.8	Fair	53	Poor	0	Poor	1.5-3	Fair	25-50	Fair	2	Fair	2	Fair	4.8	Fair	7	Poor
EU20	51:22:27	Good	4.5	Fair	29	Poor	6	Poor	1.5-3	Fair	25-50	Fair	3	Good	2	Fair	1.5	Poor	43	Good
EU24	16:13:71	Poor	3.3	Fair	40	Poor	14	Poor	1.5-3	Fair	25-50	Fair	2	Fair	2	Fair	4.1	Fair	21	Fair
WN10	60:19:21	Good	1.8	Good	87	Fair	0	Poor	1.5-3	Fair	25-50	Fair	1	Poor	2	Fair	5.9	Fair	0	Poor
WN20	50:35:15	Good	6.9	Poor	43	Poor	0	Poor	1.5-3	Fair	25-50	Fair	1	Poor	2	Fair	5.0	Fair	38	Fair
WM2	87:13:0	Good	2.3	Good	77	Fair	50	Fair	1.5-3	Fair	<25	Good	2	Fair	2	Fair	0	Poor	33	Fair
WM5	86:5:9	Good	2.8	Good	56	Poor	50	Fair	1.5-3	Fair	<25	Good	1	Poor	2	Fair	0.1	Poor	14	Poor
WR11	23:77:0	Poor	6.2	Poor	22	Poor	0	Poor	>3	Good	25-50	Fair	2	Fair	2	Fair	3.0	Poor	0	Poor
WR14	73:27:0	Good	2.0	Good	70	Fair	0	Poor	>3	Good	>50	Poor	3	Good	3	Good	9.8	Good	0	Poor
WR15	69:25:6	Good	2.3	Good	51	Poor	5	Poor	1.5-3	Fair	25-50	Fair	2	Fair	2	Fair	8.1	Good	0	Poor
WR23	14:86:0	Poor	3.3	Fair	72	Fair	0	Poor	>3	Good	>50	Poor	2	Fair	2	Fair	6.3	Fair	0	Poor
WR26	42:58:0	Fair	2.4	Good	53	Poor	0	Poor	>3	Good	25-50	Fair	2	Fair	2	Fair	11.5	Good	0	Poor
WM36	18:82:0	Poor	12.5	Poor	85	Fair	0	Poor	1.5-3	Fair	25-50	Fair	3	Good	3	Good	0	Poor	22	Fair
EL1	35:42:23	Fair	0.9	Good	43	Poor	20	Poor	>3	Good	25-50	Fair	2	Fair	3	Good	0.6	Poor	80	Poor

Table F-3. Summary of Fish Habitat Ratings for Three Life History Stages. Navarro River WAU, 1999.

Segment	Slope gradient class (percent)	Spawning habitat score	Spawning habitat rating	Rearing habitat score	Rearing habitat rating	Over-wintering habitat score	Over-wintering habitat rating
ED1	0-3	2.50	Good	2.15	Fair	2.35	Good
ED8	0-3	2.50	Good	1.70	Fair	1.95	Fair
WF1	0-3	2.25	Fair	2.00	Fair	1.70	Fair
WF1(U)	0-3	2.75	Good	1.85	Fair	1.95	Fair
WF13	0-3	2.50	Good	2.00	Fair	2.10	Fair
WH3	0-3	2.00	Fair	1.70	Fair	1.55	Poor
EJ1	0-3	2.00	Fair	1.80	Fair	2.05	Fair
EJ1(2)	0-3	2.75	Good	2.00	Fair	1.70	Fair
EN2	0-3	2.25	Fair	2.00	Fair	1.85	Fair
EN3	0-3	2.25	Fair	1.70	Fair	1.75	Fair
EN4	0-3	2.25	Fair	1.70	Fair	1.55	Poor
EN25	3-7	2.00	Fair	1.55	Poor	1.75	Fair
EN38	0-3	2.25	Fair	1.85	Fair	1.90	Fair
WL3	0-3	2.25	Fair	2.00	Fair	1.80	Fair
WL4	3-7	1.50	Poor	1.70	Fair	1.90	Fair
WL19	3-7	2.00	Fair	1.65	Poor	1.35	Poor
WL27	3-7	1.75	Fair	1.60	Poor	1.85	Fair
WL28	0-3	1.75	Fair	2.40	Good	2.25	Fair
EM1	0-3	2.00	Fair	1.85	Fair	2.10	Fair
EM20	3-7	2.00	Fair	1.55	Poor	1.55	Poor
EM29	0-3	2.25	Fair	1.70	Fair	1.55	Poor
EM30	3-7	2.50	Good	1.85	Fair	1.90	Fair
EM39	0-3	2.00	Fair	1.20	Poor	1.40	Poor
WU1	0-3	2.25	Fair	2.00	Fair	1.80	Fair
WU4	3-7,7-12	1.75	Fair	1.50	Poor	1.75	Fair
EI2	0-3	2.50	Good	2.05	Fair	2.30	Fair
EU1	0-3	2.00	Fair	1.85	Fair	1.85	Fair
EU4	0-3	2.25	Fair	1.85	Fair	2.10	Fair
EU7	0-3	2.00	Fair	1.50	Poor	1.35	Poor
EU20	0-3	2.25	Fair	1.70	Fair	1.95	Fair
EU24	3-7	2.00	Fair	1.50	Poor	1.55	Poor
WN10	0-3	1.75	Fair	2.20	Fair	2.45	Good
WN20	3-7	1.75	Fair	1.75	Fair	1.80	Fair
WM2	0-3	2.25	Fair	2.30	Fair	2.15	Fair
WM5	0-3	2.00	Fair	2.15	Fair	1.80	Fair
WR11	3-7	2.25	Fair	1.15	Poor	1.00	Poor
WR14	0-3	3.00	Good	2.55	Good	2.25	Fair
WR15	0-3	2.00	Fair	2.25	Fair	2.10	Fair
WR23	0-3,3-7	2.00	Fair	1.50	Poor	1.50	Poor
WR26	0-3	2.25	Fair	2.05	Fair	1.90	Fair
WM36	7-12	2.50	Good	1.30	Poor	1.35	Poor
EL1	0-3	2.50	Good	1.65	Poor	1.90	Fair

Table F-4. Species List for Aquatic Species Distribution Surveys in the Navarro River Watershed.

Common Name	Scientific Name
Coho Salmon	*Oncorhynchus kisutch*
Chinook Salmon	*Oncorhynchus tshawytscha*
Steelhead/Rainbow Trout	*Oncorhynchus mykiss*
Pacific Lamprey	*Lampetra tridentata*
Threespine Stickleback	*Gasterosteus aculeatus*
Sacramento Sucker	*Castomus occidentalis*
Sculpin	*Cottus spp.*
Prickly Sculpin	*Cottus asper*
Coast Range Sculpin	*Cottus aleuticus*
California Roach	*Lavinia symmetricus*
Bull Frog	*Rana catesbeiana*
Yellow Legged Frog	*Rana boylii*
Northern Red Legged Frog	*Rana aurora aurora*
Olympic Tailed Frog	*Ascaphus truei*
Pacific Giant Salamander	*Dicamptodon tenebrosus*
Newt	*Taricha spp.*
California Newt	*Taricha torosa*
Rough Skinned Newt	*Taricha granulosa*
Northwestern Pond Turtle	*Clemmys marmorata marmorata*
Crayfish	*Pacifasticus spp.*

Permeability and Bulk Gravel Samples

The results from the bulk gravel samples and permeability measurements are presented in Table F-5. The lowest survival ratings calculated were found in the North Branch Navarro River. These low ratings are likely due to a high proportion of fine sediment within small substrate. The survival-to-emergence index calculated for the permeability data showed survival rates that ranged from 19% to 63% (Table F-5). The highest gravel permeability was found in the mainstem Navarro, which subsequently relates to the highest survival-to-emergence index rating. The high permeability is probably due to the high sand content of the mainstem Navarro River's substrate. Sand is highly permeable. However, the predominance of smaller substrate in the mainstem Navarro River is not preferred spawning substrate size.

Percent survival index from permeability was found to be fair in Flynn Creek, South Branch North Fork Navarro and John Smith Creek, 58%, 46% and 48% respectively. Percent survival index from permeability was very low in both segments of the North Fork Navarro, 19% and 23%. Fine sediment levels in the North Fork Navarro are fair, ranging from 7 to 12%.

These survival indices reflect conditions at pool tail-outs where a spawning fish has not worked the gravel into a redd. Therefore they reflect the relative quality of stream gravel that a spawning fish encounters upon entering the stream. Areas of stream gravel with a high survival percentage would likely be preferred by spawning fish and likely have better survival success for emerging fish. Areas of stream gravel with a low survival index percentage may not be of completely poor quality; particularly because the permeability and gravel quality will be improved following redd development.

Generally, the percentage of fine sediment (<0.85 mm) was not found to be high in the Navarro River watershed with the exception of the mainstem Navarro River. Fine sediment (particles smaller than .85mm) measurements exceeded 10% on several occasions throughout the Navarro WAU. However, we feel the use of permeability as an indicator of current stream gravel quality is the better indicator of conditions necessary for developing fish embryos. In most of the laboratory studies of fish emergence from incubating eggs, survival is related to the proportion of fine particles or the size class distribution of the gravel fish embryos are developed in. These measures are used to indicate the ability of water borne nutrients and dissolved oxygen to reach the embryos. Therefore, measures of fine particles or size class distribution indices, etc. are surrogates for gravel permeability. Direct measure of the permeability conditions that occur in the stream gravel is the best indication of this quality. When using permeability as an indicator of spawning gravel quality in Navarro River WAU, the results suggest improvement needed for the quality of spawning gravel.

Table F-5. Permeability, Survival Indices and % Fines collected from Long-Term Channel Monitoring Segments in the Navarro River WAU.

Seg ID	Stream	Year	Permeability cm/hr	Standard Error Permeability	Percent Survival Index	Tappel and Bjorn Percent Survival (steelhead)	% Fines <0.85mm
WL27	Flume Gulch	1999	1,396	596	25%	21-68%	8-13%
WM2	Navarro River	1999	3,651	1,954	40%	0-19%	13-25%
WM5	Navarro River	1999	17,464	5,401	63%	0-69%	7-26%
WF1	Flynn Creek	1999	13,103	1,726	58%	17-100%	3-13%
EL1	S.Branch N.Fork Navarro	1999	5,467	1,626	46%	29-87%	4-13%
EN1	N.Branch N.Fork Navarro	1999	944	164	19%	44-72%	7-12%
EN1	N.Branch N.Fork Navarro	2001	15,149	6,695	61%	--	--
EN2	Little N. Fork Navarro	1999	1,241	137	23%	41-70%	7-11%
EN2	Little N. Fork Navarro	2001	5,217	2,736	45%	--	--
EJ2	John Smith Creek	1999	6,516	1,644	48%	51-100%	5-10%

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Section G
SEDIMENT INPUT SUMMARY

INTRODUCTION

The estimated sediment inputs for the Navarro WAU have been summarized and are presented. The purpose of this summary is to determine the relative amount of different sediment sources to assist with priorities for erosion control and interpretation of stream channel conditions in relation to sediment inputs. A sediment budget provides quantification of sediment inputs, transport, and storage in a watershed (Reid and Dunne, 1996). In this case we are not doing a true sediment budget, only an estimation of the sediment inputs. However, this estimation is useful for source analysis, numeric targets, and allocation of responsibility as needed in a Total Maximum Daily Load (TMDL) for 303(d) listed rivers, such as the Navarro River. However, care must be used when interpreting these estimated values; by no means can the estimates be considered absolute. Rather, the sediment input estimates are best interpreted for relative comparisons between processes and planning watersheds.

This section combines and summarizes the sediment input results from the Mass Wasting and Surface and Point Source Erosion modules of the watershed analysis for the Navarro WAU. Sediment input for the Navarro WAU is estimated from hillslope mass wasting, road associated mass wasting, road surface and point source erosion, and skid trail erosion. The sediment inputs have been estimated for thirty-two years (1969-2000).

SEDIMENT INPUTS

The average estimated sediment input for the past thirty-two years for the Navarro WAU is 1300 tons/square mile/year. The Navarro WAU is broken down into two areas Navarro West and Navarro East for sediment inputs (see Tables G-1 a and b for the planning watersheds that are in these areas). Sediment inputs over the last thirty two years in Navarro West have come from hillslope mass wasting (25%), road mass wasting (23%), road surface and point source erosion (49%) and to a lesser extent skid trail erosion (3%) (Figure G-1a). In Navarro East sediment inputs came from hillslope mass wasting (9%), road mass wasting (61%), road surface and point erosion (27%), and to a lesser extent skid trail erosion (3%) (Figure G-1b). The breakdown of total sediment input is presented by planning watershed for the Navarro WAU (Table G-1a and Table G-1b). The greatest amount of sediment inputs per unit area is estimated to be from the North Fork Indian Creek planning watershed, primarily due to one very large landslide within a proportionately smaller ownership area then other planning watersheds.

Road associated erosion is the dominant sediment contributing process in the Navarro WAU. The road associated mass wasting and surface and point source erosion combined to account for 88% of the estimated sediment inputs in the Navarro East. In Navarro West road associated mass wasting and road surface and point source erosion combined to account for 72% of the sediment input. Mass wasting from roads accounts for 61% of the sediment inputs in the Navarro East. While in Navarro West mass wasting associated with roads accounted for 23% of the sediment input. Future forest practices must give the potential of mass wasting and road erosion careful attention in the Navarro WAU to reduce this sediment input over time.

One road in the Navarro WAU has been responsible for a considerable amount of the management associated sediment inputs. That road is the Masonite Road (M Road). It is estimated that the Masonite Road has contributed about 30% of the surface and point source erosion in the Navarro WAU and is associated with 20% of the mass wasting sediment inputs. Our estimate of sediment yield for the past 32 years for the Masonite Road is 23,500 tons/yr. This equates to about 20% of the total sediment yield in the Navarro WAU the last 32 years.

Figure G-1a. Estimated Percentage of Sediment Input for Navarro West 1969-2000.

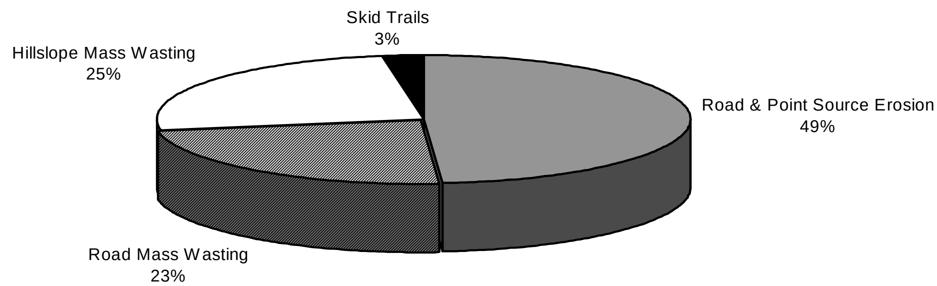

Figure G-1b. Estimated Percentage of Sediment Input for Navarro East 1969-2000.

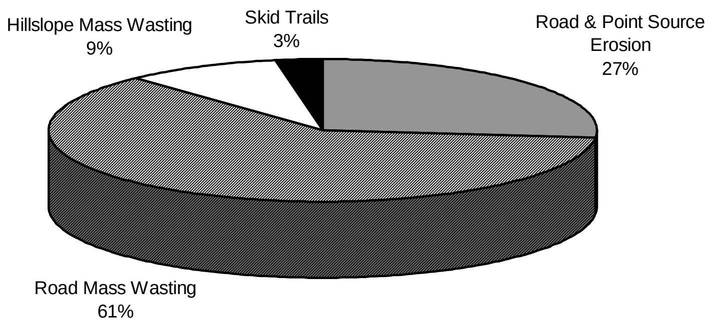

Table G-1a. Estimated Sediment Inputs by Input Type for Calwater Planning Watersheds of Navarro West, 1969-2000.

Planning Watershed	Road Surface and Point Source Erosion ($Tons/Mi^2/Yr.$)	Hillslope Mass Wasting ($Tons/Mi^2/Yr.$)	Road Mass Wasting ($Tons/Mi^2/Yr.$)	Skid Trails ($Tons/Mi^2/Yr.$)	Total ($Tons/Mi^2/Yr.$)
Rancheria Creek	1270	540	490	64	2364
Flynn Creek	105	118	93	10	326
Floodgate Creek	68	84	353	3	508
Hendy Woods	860	0	4	10	874
Lower Navarro River	221	214	235	13	683
Middle Navarro River	273	697	508	43	1521
Upper Navarro River	993	1020*	264	35	2312
Ray Gulch	1389	57	73	24	1543
North Fork Navarro River	316	126	178	42	662
Mill Creek	184	67	516	47	814

* -The higher percentage of hillslope mass wasting in Upper Navarro is due to a large deep-seated landslide (“Floodgate slide”).

Table G-1b. Estimated Sediment Inputs by Input Type for Calwater Planning Watersheds of Navarro East, 1969-2000.

Planning Watershed	Road Surface and Point Source Erosion (Tons/Mi^2/Yr.)	Hillslope Mass Wasting (Tons/Mi^2/Yr.)	Road Mass Wasting (Tons/Mi^2/Yr.)	Skid Trails (Tons/Mi^2/Yr.)	Total (Tons/Mi^2/Yr.)
Dutch Henry	311	187	1222	27	1747
Lower South Branch Navarro River	131	210	495	24	860
Middle South Branch Navarro River	518	193	935	86	1732
Upper South Branch Navarro River	238	114	534	66	952
Little North Fork Navarro River	753	48	604	68	1473
North Fork Indian Creek	267	244	3105**	1	3617
John Smith Creek	824	37	100	40	1001

**- high value due to one very large landslide within a relative small area of MRC land

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SECTION H
CASUAL MECHANISMS AND PRESCRIPTIONS

INTRODUCTION

The following Causal Mechanism Reports and Prescriptions were specifically prepared for use in the Navarro Watershed Analysis Units (WAU). These prescriptions are meant to help address issues to aid in the stewardship of aquatic resources of the Mendocino Redwood Company ownership in the Navarro WAU. The prescriptions are meant to be used in addition to the current California Forest Practice Rules and company policies. At the time of the publication of this watershed analysis MRC's forest management policies are governed by interim guidelines prior to the issuance of a Habitat Conservation Plan and Natural Community Conservation Plan (HCP/NCCP). Once the HCP/NCCP is approved, the conservation strategies set forth in these documents will become the company policies. A prescription is only presented if it deviates from or adds clarification to these policies.

The land management prescriptions presented here are the protections that Mendocino Redwood Company will pursue to provide protection of aquatic resources. In addition to these prescriptions Mendocino Redwood Company will build and maintain all of its roads at high design standards such as presented in the Handbook for Forest and Ranch Roads (Weaver and Hagans, 1994).

The causal mechanism reports present the situations where watershed conditions have a likelihood of affecting a vulnerable resource. By addressing each of these situations with an appropriate prescription the situations that could impact sensitive resources will either be removed or their impact significantly lessened. This is to attempt to provide protection to watershed values from receiving significant or cumulative impacts from future management actions.

Monitoring will be conducted in the Navarro WAU to ensure that these prescriptions are providing necessary protection to aquatic resources (see Section I, Navarro WAU Monitoring Plan). This monitoring is part of an adaptive management approach that tests the hypothesized protections the prescriptions are developed to meet. If it is found that the prescriptions are not providing the appropriate protections, then they will be updated and improved.

CAUSAL MECHANISMS AND PRESCRIPTION REPORTS

Each Causal Mechanism Report and Prescription has specific headings to provide background on the watershed situation and prescription. The following is the description of these headings.

> *Resource Sensitive Area*: the area or topic encompassed by the prescription.
> *Input Variable and Process*: this briefly states what is the source variable or input to a vulnerable resource.
> *Situation Sentence:* presents the situation that will be addressed by the prescription.
> *Prescriptions:* specific land management actions or recommendation for the proposed causal mechanism.

Causal Mechanism Report and Prescription #1

Resource Sensitive Area: Mass Wasting Map Unit (MWMU) 1

Input Variable(s): Coarse and fine sediment from mass wasting and bank erosion.

Situation Sentence:
Small shallow seated landslides and bank erosion are common within the over-steepened slopes of the MWMU 1 topography. The immediate proximity of watercourses to landslides of this MWMU 1 provides direct delivery of fine and coarse sediment. Marginal to deficient salmonid rearing habitat due to high coarse sediment levels is common in the Navarro WAU. Fine sediment inputs can reduce spawning habitat quality. Fine sediment can also create higher than natural turbidity during storm flows potentially affecting fish physiology, reduce feeding or in the worst cases increase mortality.

Prescriptions:

MWMU 1 Road placement, construction, and management:

- New road construction in MWMU 1 will not occur unless it is the only access available. If new road construction must occur it will only be to gain entry in and out of MWMU 1 and construction developed with the approval of a California Registered Geologist. The exception is when the road is the best alternative.
- Seasonal roads (roads subjected to annual use) in MWMU 1, including newly constructed roads and re-opened existing roads, will have the surface armored with rock.
- Temporary roads (roads only used periodically, every few years or decades) in MWMU 1 will be storm-proofed (such as suggested in Weaver and Hagans, 1994) prior to the winter period and the surface stabilized with grass seed, mulch, or other cover product.
- Any road that is within MWMU 1 will not have winter period heavy truck or log hauling traffic unless armored with a rock surface.
- The slopes of the inner gorge or the first 50 feet, whichever is longer, will be an equipment exclusion zone (EEZ) except for designated crossings and existing truck roads.

MWMU 1 timber harvest:

- MWMU 1 will receive no harvest on inner gorge slopes unless approved by a California Registered Geologist. On other areas (non-inner gorge slopes) within MWMU 1 in addition to the riparian protections set as company policy timber harvest must retain a minimum of 50% overstory canopy dispersed evenly across the slopes.
- The MWMU 1 protections will extend from the edge of the watercourse transition line up to the break in slope of the inner gorge and 25 feet of additional slope distance after the break in slope of the inner gorge.
- For those areas that do not have well defined inner gorge topography in MWMU 1 timber harvest must retain 50% overstory canopy.
- The area directly adjacent to the break in slope of the inner gorge will retain those trees with a root mass that maintains the stability of that slope break.
- Trees within 10 feet of the bankfull channel will be retained, except for redwood clumps. At least 50% of a redwood clump must be retained with emphasis on leaving the trees most likely to deliver to the stream in this 10 foot zone.

Causal Mechanism Report and Prescription #2

Resource Sensitive Area: Mass Wasting Map Unit (MWMU) 2

Input Variable(s): Coarse and fine sediment from mass wasting and bank erosion.

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Situation Sentence:
The incised topography adjacent to watercourses of MWMU 2 has high risk for shallow seated landslide sediment delivery and bank erosion. The landslides in MWMU 2 are typically associated with destabilization of the toe of a watercourse's steep side slopes. Landslides or soil failures could be aggravated by soil disturbance by heavy equipment, road building or removal of ground stabilizing vegetation. The immediate proximity of watercourses to these soil failures provides direct delivery of fine and coarse sediment. Marginal to deficient rearing habitat due to high coarse sediment levels occurs in the Navarro WAU. Fine sediment inputs can reduce spawning habitat quality. Fine sediment can also create higher than natural turbidity during storm flows potentially affecting fish physiology, reduce feeding or in the worst cases increase mortality.

Prescriptions:

MWMU 2 Road construction, placement or management:

- Alternatives to road construction or road use, such as cable yarding, helicopter yarding or alternative road placement, will be pursued in MWMU 2.
- New road construction in MWMU 2 will not occur unless it is the only access available. If new road construction must occur it will only be to gain entry in and out of MWMU 2 and construction developed with the approval of California Registered Geologist. The exception is when the road is the best alternative.
- The slopes of the inner gorge or the first 50 feet, whichever is longer, will be an equipment exclusion zone (EEZ) except for designated crossings and existing truck roads.

MWMU 2 Timber Harvest:

- MWMU 2 will receive no harvest on inner gorge slopes unless approved by a California Registered Geologist. On other areas (non-inner gorge slopes) within MWMU 2 in addition to the riparian protections set as company policy timber harvest must retain a minimum of 50% overstory canopy dispersed evenly across the slopes.
- Trees within 10 feet of the bankfull channel will be retained, except for redwood clumps. At least 50% of a redwood clump must be retained with emphasis on leaving the trees most likely to deliver to the stream in this 10 foot zone.

Causal Mechanism Report and Prescription #3

Resource Sensitive Area: Mass Wasting Map Unit (MWMU) 3

Input Variable(s): Coarse and fine sediment from mass wasting.

Situation Sentence:
Steep and/or convergent slopes of MWMU 3 can have shallow seated landslides associated with them. These landslides can travel moderate distances across hillslopes to reach streams or draws where sediment delivery and sometimes debris torrents or flows occur. When sediment delivery occurs with these landslides, sediments will travel down the watercourses and are delivered to river and stream channels. If the frequency and amount of shallow seated landslides are increased from management actions in MWMU 3 this can contribute to poor rearing habitat, downstream aggradation or high turbidity.

Prescriptions:
Forester will utilize available resources for identification of unstable areas or areas with predicted slope instability. These include Map A-1 of Mass Wasting Assessment for the Navarro WAU, Division of Mines and Geology landslide maps (if available), or past Timber Harvest Plans.

Forester will walk the ground of this unit prior to prescribing operations. If upon field review the unit is confirmed to meet the definition of MWMU 3 and a significant risk of sediment delivery is identified the following guidelines apply:

- No road or landing construction activity will occur in areas identified in the field as having a significant likelihood of sediment delivery to a watercourse from mass wasting unless a site-specific assessment is conducted and operations approved by a California Registered Geologist.
- Harvest operations must retain at least 50% of the overstory canopy unless a site-specific assessment is conducted and operations approved by a California Registered Geologist.

Causal Mechanism Report and Prescription #4

Resource Sensitive Area: Rockslides

Input Variable(s): Coarse and fine sediment from mass wasting.

Situation Sentence:
Rockslides are deep-seated landslides within the Navarro WAU. These features can be active, dormant or have sections of the landslide active with sections of the landslide dormant. Increases in sub-surface water from loss of evapo-transpiration or concentrated water from road drainage can activate or accelerate movement and sediment delivery from these features. The increased sediment delivery could contribute to adverse fish habitat by pool filling, increased channel scour, fine sediments smothering spawning gravel and loss of stream channel complexity.

Prescriptions:

No harvest or new road construction will occur on active portions of rockslides with a risk for sediment delivery unless approved by a California Registered Geologist.

Causal Mechanism Report and Prescription #5

Resource Sensitive Area: Roads in Little North Fork Navarro, John Smith Creek, Ray Gulch, Hendy Woods, Rancheria Creek and Upper Navarro River Planning Watersheds

Input Variable(s): Coarse and fine sediment from surface and point source erosion.

Situation Sentence:
The roads within the Little North Fork Navarro and John Smith Creek planning watersheds are observed to have high past sediment inputs. These two planning watersheds are also important areas for salmonid spawning and rearing, particularly coho salmon. The roads within the Ray Gulch, Hendy Woods, and Upper Navarro River planning watersheds are also observed to have high past road associated sediment inputs.

Prescriptions:

John Smith Creek, Ray Gulch, Upper Navarro, Little North Fork Navarro River, Rancheria Creek and Hendy Woods planning watersheds had the highest rates of road associated erosion. In all of these cases the roads in the planning watersheds had a high amount of point source erosion. This probably indicates older legacy roads that are having a high amount of culvert or landing failures or inappropriate drainage creating gully erosion. These planning watersheds with a high rate of erosion should be considered priorities for erosion control work when considering work in a watershed context (i.e. “buttoning-up the entire watershed”).

Causal Mechanism Report and Prescription #6

Resource Sensitive Area: High and Moderate Erosion Hazard Roads

Input Variable(s): Coarse and fine sediment from surface and point source erosion.

Situation Sentence:
The erosion hazard ratings suggest the likelihood and amount of future sediment delivery to be delivered from a road. The high erosion hazard roads would be considered the greatest risk, with the moderate erosion hazard roads next.

These roads commonly have areas of long undrained road lengths that increase the amount of fine sediment delivery. Many of these roads are directly adjacent to watercourses. Water drainage off these roads can increase or cause point source erosion contributing both fine and coarse sediment deliveries to watercourses. If the frequency and amount of erosion is increased from management actions this can contribute to poor rearing habitat, high turbidity or decreased spawning habitat quality.

Prescriptions:

The roads with a high erosion hazard rating should be given special attention for maintenance or erosion control. These roads should be considered high priority roads for rock surface, improved and increased road drainage relief, design upgrades or decommissioning.

The moderate erosion hazard roads should be given similar attention, but not as high a priority as the high erosion hazard roads.

Causal Mechanism Report and Prescription #7

Resource Sensitive Area: Masonite Road (M Road)

Input Variable(s): Coarse and fine sediment from surface and point source erosion and mass wasting.

Situation Sentence:
The Masonite road was found to be a significant sediment producer in the Navarro WAU. The road was estimated to produce 20% of the past sediment inputs and represents 25% of the controllable erosion in the Navarro WAU. The Masonite road is in close proximity to sections of the North and South Branches of the North Fork Navarro River. These sections provide spawning and rearing habitat for coho salmon and steelhead trout.

Prescriptions:

A management plan has been developed for the Masonite road, across all watersheds (not just the Navarro WAU). The plan presents a prioritization of where road restoration work should occur and a timeline and process for that restoration.

Causal Mechanism Report and Prescription #8

Resource Sensitive Area: High and moderate treatment immediacy sites for roads in the Navarro WAU.

Input Variable(s): Sedimentation from surface and point source erosion.

Situation Sentence:
Individual culverts, bridges, landings and road erosion sites were inventoried and ranked based on their priority for treatment and relative degree of likelihood of sediment delivery. All have a significant concern for a large discrete input of coarse and fine sediment to watercourses. In the Navarro WAU 276 controllable erosion sites have high treatment immediacy and 466 controllable erosion sites have moderate treatment immediacy. If the frequency and amount of erosion is increased from management actions this can contribute to poor rearing habitat, or degradation of spawning habitat quality.

Prescriptions:

The high treatment immediacy controllable erosion sites will be the highest priority for erosion control, upgrade, or modifications to existing design. These sites will be scheduled for repair based on operational considerations of harvest scheduling, proximity and availability of equipment, magnitude of the problem, and accessibility to the site.

The moderate treatment immediacy controllable erosion sites will be the next highest priority (relative to the high treatment immediacy sites) for erosion control, upgrade, or modifications to existing design. The moderate treatment immediacy sites will typically be addressed when in close proximity to high treatment immediacy sites.

It is recommended that road site corrections attempt to follow the order of treatment immediacy as presented in Appendix B.

Causal Mechanism Report and Prescription #9

Resource Sensitive Area: Diversion potential sites along roads in the Navarro WAU.

Input Variable(s): Coarse and fine sediment from point source erosion.

Situation Sentence:
When roads cross watercourses the resulting crossing structure (culvert or bridge) has a potential to fail. When the crossing fails the watercourse has potential to either stay within the "natural" channel or be diverted away from the channel. Typically a diversion away from a "natural" channel in a failed crossing is due to low areas adjacent to the crossing that allows water to be routed either down the road surface or through fill material. This potential for diversion of water if a crossing failed can be a secondary erosion process that can create significant sediment inputs, sometimes greater than the actual crossing failure itself. This water diversion potential is an important concern to correct on roads. Currently there are 610 culverts or crossings in the Navarro WAU that have a diversion potential. If the frequency and amount of erosion is increased from management actions this can contribute to poor rearing habitat, downstream aggradation or high turbidity.

Prescriptions:

These diversion potential sites will be a high priority for correction. These sites will be scheduled for repair based on operational considerations of harvest scheduling, proximity and availability of equipment, magnitude of the problem, and accessibility to the site. It is very likely that these sites will be addressed when in close proximity to high treatment immediacy sites.

It is recommended that road site corrections attempt to follow the order these diversion potential sites are presented in Appendix B.

Causal Mechanism Report and Prescription #10

Resource Sensitive Area: Undersized culverts in the Navarro WAU.

Input Variable(s): Sedimentation from surface and point source erosion.
Water quality; turbidity from fine sediment.

Situation Sentence:
Culverts must pass not only water beneath roads but the sediment and debris that is transported down the watercourses. If a culvert is not properly sized for the water, sediment and debris that must be conveyed through it can plug or be over topped. This can cause water to flow over road fill material creating point source erosion of the road or potentially having the fill material at the crossing completely fail. In the Navarro WAU 260 culverts were determined (remotely) to not be able to pass the 50-year flood. Additional 16 culverts were determined not to be able to pass the 100-year flood.

Prescriptions:

The 260 culverts that will not pass the 50 year flood will be visited in the field and a determination will be made if the culverts are indeed under-sized (identification of under-sized culverts was done by an office-based evaluation that could be inaccurate). If after field review the culverts are found to be under-sized it will be a high priority for replacement to a watercourse crossing structure that will pass the 100-year flood.

The 16 culverts that will not pass the 100 year flood will be visited in the field and a determination will be made if the culverts are indeed under-sized for this sized flood event (identification of under-sized culverts was done by an office-based evaluation that could be inaccurate). If after field review the culverts are found to be under-sized for the 100 year flood it will be a moderate priority for replacement to a watercourse crossing structure that will pass the 100-year flood. Typically the upgrade will occur once the culvert has reached the end of its operational life.

The field review will consist of determining the cross section area of the bankfull channel and comparing it the cross sectional area of the culvert in question. A rule of thumb is that to pass the 100 year flood the culvert opening area needs to be 3 times as large as the bankfull channel cross section area (Cafferata, Spittler, and Wopat, 2000).

Causal Mechanism Report and Prescription #11

Resource Sensitive Area: Fish passage barriers from culverts in the Navarro WAU.

Input Variable(s): Barrier to fish migration.

Situation Sentence:
Culverts must pass not only water beneath roads but the sediment and debris that is transported down the watercourses and the fish migrating through the stream. If a culvert is not properly sized for the water it must pass or has too a steep grade or a high drop at the outlet it can be a barrier for fish migration. There are 3 culverts currently identified as complete barriers to upstream fish migration. These are on the Masonite road at Bridge Creek, Camp Creek and an unnamed tributary to the North Branch North Fork Navarro River just downstream of John Smith Creek. Removal of these barriers can make available additional stream lengths for spawning, rearing and over-wintering habitat.

Prescriptions:

The 3 known culverts should be removed. In the case of Bridge Creek and Camp Creek a bridge should be built at the watercourse crossing. The unnamed tributary below John Smith Creek will be evaluated for appropriate watercourse crossing design for fish passage. All of these crossings should be a high priority for fish passage improvement.

Other fish migration barriers likely exist and need to be investigated over time.

Causal Mechanism Report and Prescription #12

Resource Sensitive Area: Aquatic Management Zone

Input Variable(s): Large woody debris recruitment

Situation Sentence*:*
Large woody debris (LWD) is an important component of stream habitat. Large woody debris provides sediment storage in channels, creates areas of scour for pool creation, provides cover for fish habitat and adds channel roughness for habitat complexity. Historic forest management practices did not require watercourse protection measures like current California Forest Practice Rules mandate. Historic removal of LWD from the Navarro River WAU has created a deficient of LWD available for fish habitat and stream channel diversity. Historic harvesting practices have removed many of the large conifer trees which provide the current and future large woody debris recruitment needed in these areas.

This watershed analysis has presented, by stream segment, the instream LWD demand based on riparian stand recruitment potential and instream LWD conditions. The majority of streams in the Navarro WAU have a high LWD demand, suggesting lack of LWD and short term LWD recruitment potential

Prescriptions:

The company policies for streamside stand retention are considered to be appropriate at this time for LWD recruitment. Monitoring of LWD recruitment will be done to determine if this is correct.

In the interim MRC will promote attempts to place LWD in stream channels to provide habitat structure. The stream locations with high instream LWD demand should be considered the highest priority for LWD placement. The moderate instream LWD demand segments would be next.

When planning for instream LWD placement the following major streams in the Navarro WAU are recommended for a higher level of consideration, due to instream LWD demands and coho salmon habitat improvement:

Little North Fork Navarro River
John Smith Creek
South Branch North Fork Navarro River
Flynn Creek
Marsh Gulch
Murray Gulch

Causal Mechanism Report and Prescription #13

Resource Sensitive Area: Canopy closure over Class I and II watercourses

Input Variable(s): Canopy closure and stream temperature

Situation Sentence:
Stream temperatures in the Navarro River WAU range from deficient to rearing salmonids to within preferred range. The range of stream temperatures in the Navarro WAU reflects a range of environmental conditions. A few areas of the Navarro WAU do have stream canopy conditions below what would naturally be expected in those locations. High water temperature can be deleterious and even fatal to many fish and aquatic species and warrant concern. Therefore, promoting appropriate stream canopy cover is important. Areas that are unnaturally low in canopy should be targeted for restoration and concern given to management activities that do not promote increased canopy. Two areas within the Navarro WAU have stream canopy that appear to be unnaturally low. These are the North Branch North Fork Navarro from approximately John Smith Creek downstream to the crossing at highway 128, and the South Branch North Fork Navarro from Malcom's bridge downstream to the confluence with the North Branch.

Prescriptions:

The company policies for streamside canopy and riparian management are considered to be appropriate at this time.

The 2 river reaches with unnaturally low canopy, the North Branch North Fork Navarro from approximately John Smith Creek downstream to the crossing at highway 128, and the South Branch. North Fork Navarro from Malcom's bridge downstream to the confluence with the North Branch will have the following considerations for canopy improvement:

- Tree planting along the river for restoration of riparian vegetation should be emphasized.
- Restoration harvest within the AMZ will not remove trees providing effective shade.
- Stream temperatures will be monitored to determine if temperatures are lowering as canopy grows in over time.

Literature Cited

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Section I

MONITORING

INTRODUCTION

Aquatic resources monitoring will be conducted in the Navarro WAU. This monitoring is to assist Mendocino Redwood Company to assess impacts to aquatic resources associated with past or future timber harvest and related forest management activities in the Navarro WAU. The monitoring suggested in this plan is monitoring that MRC across all its lands including the Navarro WAU. However, other monitoring efforts not mentioned here may be conducted by MRC in the Navarro WAU. Currently a comprehensive monitoring plan is being developed for the MRC lands. Once that plan is finalized it will supercede the monitoring presented here.

The monitoring is a combination of hillslope and in-stream assessments. Forest harvesting and related activities can influence or alter inputs of sediment, wood, and heat (solar radiation). It is these inputs that are the focus of the monitoring. Methods to evaluate factors that could alter the input of sediment, heat, or wood are the hillslope monitoring portion of this plan. Evaluation of factors which could be influence the stream channel, water or fish habitat are the focus of the in-stream monitoring.

Monitoring Plan Goals

- Test the efficacy of the Navarro WAU prescriptions to address impacts to aquatic resources from timber harvest and related forest management activities.
- To assess long term channel conditions. Are current and future forest management practices inhibiting, neutralizing or promoting stream channel conditions for aquatic habitat?

A monitoring report will be produced each year that monitoring is conducted in the Navarro WAU. The report will cover the monitoring and analysis that has occurred up to that year; if no monitoring is conducted in a given year than no report will be produced. The goal will be to have a report completed by February of the year following the monitoring.

The monitoring matrix (Table I-1) outlines the hillslope and in-stream monitoring MRC will be conducting in the Navarro WAU. The monitoring will be performed periodically. MRC will be developing a property wide aquatic monitoring strategy. Once that monitoring strategy is complete, the precise timing of the monitoring in the Navarro WAU will be finalized. The information collected in this monitoring effort will be used as part of an adaptive management approach to the Navarro WAU. The monitoring results will be compared to the baseline information generated in the Navarro River Watershed Analysis to discover if aquatic habitat or water quality concerns are improving, staying the same or degrading. If aquatic habitat or water quality concerns are not improving then the land management prescriptions will be altered to better protect those impaired resources.

Table I-1. Monitoring Matrix for Mendocino Redwood Company Lands Including the Navarro Watershed Analysis Unit.

Monitoring Objectives	**Reasoning, Comments**	**Technique**
1. Determine effectiveness of measures to reduce management created mass wasting.	Management created mass wasting is significant contributor of sediment delivery.	Evaluation of mass wasting following a large storm event or after approximately 20 years.
2. Determine effectiveness of erosion control practices on high and moderate surface erosion hazard roads and landings.	Roads provide sediment delivery in the Navarro WAU.	Watercourse crossings, landings, and road lengths for erosion evaluation.
3. Determine in-stream large woody debris amounts over time.	Large woody debris is needed for stream channel and aquatic habitat improvement in the Navarro WAU.	Stream LWD inventories and mapping of LWD designation areas in select stream reaches and long term channel monitoring sites.
4. Determine if stream temperatures are staying within properly functioning range for salmonids.	Stream temperature can be a limiting factor for salmonid growth and survival.	Stream temperature probes and assessment conducted in strategic locations.
5. Determine if fine sediment in stream channels is creating effects deleterious to salmonid reproduction.	Many forest practices can produce high fine sediment amounts. Need to ensure fine sediments are not impacting salmonid reproduction.	Permeability measurements on select stream reaches (bulk gravel samples if necessary).
6. Determine long-term channel morphology changes from coarse sediments.	Channel morphology can be altered from sediment increases, possibly affecting aquatic habitat.	Thalweg profiles and cross section surveys on select stream reaches.
7. Determine presence and absence of fish species in Class I watercourses.	Management practices and resource protections can affect distribution of aquatic organisms.	Electro-fishing and snorkeling observations at select locations to determine species composition and presence.