Plumas Watershed Forum

Plumas County Flood Control & Water Conservation District

California Department of Water Resources

State Water Project Contractors

Annual Report

Fiscal Year 2006-2007

Plumas Watershed Forum

Annual Report
2006-2007 Fiscal Year

February 6, 2008

Plumas Watershed Forum

Part I - Overview

The watershed for California's State Water Project encompasses the mountains and waterways around the Feather River, most of which lie within Plumas County. The State Water Project is the nation's largest state-built water and power development and conveyance system. Planned, designed, constructed and now operated and maintained by the California Department of Water Resources, this unique facility provides water supplies for 23 million Californians and 755,000 acres of irrigated farmland.

The Plumas Watershed Forum was formed on May 5, 2003, as part of a larger settlement agreement resolving a lawsuit related to the State Water Project. The Department of Water Resources, the Plumas County Flood Control and Water Conservation District, and the 28 other State Water Project Contractors created the Watershed Forum to implement watershed management and restoration activities for the mutual benefit of Plumas County and the State Water Project.

The Watershed Forum is funded by the Department of Water Resources, with a commitment of $1 million dollars per year for the first four years (2003 through 2006), which was paid into the Forum on schedule. Depending on whether a new environmental impact report is successfully completed for certain changes to the water supply contracts between the Department of Water Resources and the State Water Project Contractors, the funding will be extended for an additional four years. A draft EIR was released for public review on October 19, 2007, and the comment deadline is January 14, 2008.

The following sections of this report provide a review of activities and projects undertaken by the Watershed Forum, reports of past expenditures and a budget for the current fiscal year, and the agendas and minutes from meetings of the Forum.

For more information, please visit the following websites or contact Plumas County or DWR staff at the addresses below. The Plumas County web page provides information about the Watershed Forum and specific projects that have been implemented, with an update by the first day of every month reflecting any new developments. The Department of Water Resources web page includes the settlement agreement which created the Watershed Forum, as well as the Feather River Watershed Management Strategy, the document that was created to guide the Forum's watershed investments.

Plumas County – Plumas Watershed Forum
http://www.countyofplumas.com/publicworks/watershed/index.htm

California Department of Water Resources – Monterey Agreement Overview
http://www.montereyamendments.water.ca.gov/

Plumas County Flood Control and Water Conservation District
1834 East Main Street
Quincy, CA 95971
(530) 283-6268

Northern District
California Department of Water Resources
2440 Main Street
Red Bluff, CA 96080
(530) 529-7342

Plumas Watershed Forum Timeline

6/20/03 – First Settlement payment ($1,000,000)

7/28/03 – First Watershed Forum Meeting – *Adopted Bylaws*
8/13/03 – Watershed Forum Meeting
11/7/03 – First TAC Meeting
1/9/04 – TAC Meeting
1/27/04 – Watershed Forum Meeting
3/15/04 – TAC Meeting
5/14/04 – Watershed Forum Meeting – *Adopted Feather River Management Strategy*
6/21/04 – Second Settlement Payment ($1,000,000)
6/18/04 – Deadline for Submittal of Initial Project Proposal

8/6/04 – Deadline for Submittal of Final Project Proposal
8/20/04 – TAC Meeting
8/31/04 – Watershed Forum Meeting
9/10/04 – TAC Meeting
10/26/04 –Watershed Forum Meeting – *Adopted Process for Awarding Grant Money*
12/15/04 –Request for Concept Proposals
1/21/05 – Deadline for Submittal of Initial Project Proposals
2/22/05 – TAC Meeting
4/1/05 – Deadline for Submittal of Final Project Proposals
4/28/05 – AC Meeting
5/23/05 – Watershed Forum Meeting
6/17/05 – Third Settlement Payment ($1,000,000)

10/25/05 – Watershed Forum Meeting – *Adopted Project Administration Policy, Cost Share Policy, and Unspent Fund Policy; Approved First Annual Report*
12/14/05 – Request for Concept Proposals
1/20/06 – Deadline for submittal of Initial Project Proposals
2/17/06 – TAC Meeting
2/24/06 – CORE TAC
3/31/06 – Deadline for Submittal of Final Project Proposals
4/28/06 – CORE TAC
5/15/06 – Pre-recommendation Project Tours
5/23/06 – Forum Meeting on Full Proposals including approval or other disposition
6/15/06 – Fourth Settlement Payment ($1,000,000)

10/23/06 – Project Tours to View Results of Restoration Construction
10/24/06 – Watershed Forum Meeting

5/22/07 – Watershed Forum Meeting
7/27/07 – IRWM Coordination Meeting with Natural Heritage Institute
9/21/07 – CORE TAC Meeting

10/15/07 – RFP issued to conduct Program Review of the Plumas Watershed Forum
10/19/07 – Draft Monterey Plus EIR issued for public comment
10/23/07 – Watershed Forum Meeting

Part II – Summary of Activities

The fourth annual payment of $1 million was made to the Watershed Forum in June of 2006. No payment was made in June of 2007 because the Monterey Plus EIR had not been completed. Due to the interruption in funding, the Watershed Forum has not approved any new projects since May of 2006.

Project sponsors continue to implement the previously approved projects, with final activities scheduled for the 2008 construction season. Descriptions of individual projects are included in Part VI of this report, and a table showing all approved projects and expenditures to date is included on the following page.

New funding for the Watershed Forum will resume upon completion of the Monterey Plus EIR or upon a decision to resume funding before completion of the new EIR. To assist the Department of Water Resources and the State Water Project Contractors in deciding whether to voluntarily resume funding, in May of 2007 the Watershed Forum authorized a review of the program by an independent third party. The purpose of the program review is to evaluate the use of all settlement agreement funds to meet the objectives of the Monterey Settlement Agreement and the Feather River Watershed Management Strategy.

The Core TAC prepared a request for proposals to perform the review, and the current deadline to submit proposals is November 16, 2007. A copy of the RFP is included with this report as Appendix A. It is anticipated that the results of the review will be ready for consideration at the Forum's May 2008 meeting.

Feather River Coordinated Resource Management Group Program Director Jim Wilcox leads a Watershed Forum tour in October 2006.

Project Inventory and Expenditures
As of October 1, 2007

Project	Sponsor	Funding	Approved	Expenditures
A Fund				
Sulfur Creek Data Collection	UCCE	$ 3,000.00		$ 3,000.00
Charles Creek	FRCRM	$ 35,000.00	8/31/2004	$ 35,000.00
SVGMD Monitoring Wells	SVGMD	$ 120,984.24	8/31/2004	$ 120,984.24
Rogers Creek Road Relocation	USFS	$ 63,500.00	10/26/2004	$ 59,466.01
Charles Creek and Hosselkus Creek	FRCRM	$ 80,000.00	10/26/2004	$ 79,279.86
Low Water Crossing	USFS	$ 35,000.00	10/26/2004	$ 35,000.00
Feather River College	FRCRM	$ 92,453.00	5/23/2005	$ 90,230.67
Sierra Valley Groundwater Mgmt District	SVGMD	$ 30,000.00	5/23/2005	$ 10,723.90
Red Clover Monitoring	PluGeo	$ 28,000.00	5/23/2005	$ 22,416.87
Plumas National Forest - Aspen Restoration	PNF	$ 84,500.00	5/23/2005	$ 39,789.85
Four Creeks - Monitoring	FRCRM	$ 25,000.00	5/23/2005	$ 25,000.00
Jordan Flat	FRCRM	$ 64,000.00	5/23/2005	$ 63,994.98
Silver Creek - Burney's	FRCRM	$ 51,000.00	5/23/2006	$ 1,040.25
Spanish Creek - Kellet's	FRCM	$ 147,000.00	5/23/2006	$ 1,346.38
Ramelli Ditch	PNF	$ 85,000.00	5/23/2006	$ 0.00
Little Last Chance Creek	FRCRM	$ 115,000.00	5/23/2006	$ 15,943.14
Dixie Creek	FRCRM	$ 56,000.00	5/23/2006	$ 47,269.77
Ferris Fields	FRCRM	$ 86,000.00	5/23/2006	$ 86,000.00
Lake Davis Water Treatment Plant	PCFCD	$ 488,260.00		$ 488,260.00
Total		**$ 1,689,697.24**		**$ 1,289,623.12**

B Fund				
Isotope Monitoring	Plumas Geo	$ 23,000.00	10/26/2004	$ 22,973.91
Project Coordination and Monitoring	FRCRM	$ 70,000.00	10/26/2004	$ 70,000.00
QLG and Forest Watershed	Plumas Corp	$ 50,000.00	10/26/2004	$ 50,000.00
Sierra Valley RCD Capacity Building	SVRCD	$ 50,000.00	5/23/2005	$ 50,000.00
Feather River RCD Capacity Building	FRRCD	$ 47,750.00	5/23/2005	$ 47,750.00
Forest Canopy Interception Study	Plumas Geo.	$ 21,000.00	5/23/2005	$ 17,082.23
Plumas Corp Upland Vegetation Management		$ 75,000.00	5/23/2005	$ 70,471.44
Feather River CRM Outreach	FRCRM	$ 33,668.00	5/23/2005	$ 17,879.56
Four Creeks - Development	FRCRM	$ 50,000.00	5/23/2005	$ 50,000.00
Total		**$ 420,418.00**		**$ 396,157.14**

Part III – Integrated Regional Water Management

In 2005, the Flood Control District, the County of Plumas, the Plumas National Forest, and the Sierra Valley Groundwater Management District entered a memorandum of understanding to adopt an Integrated Regional Water Management Plan ("IRWM Plan") for the Upper Feather River Watershed. These four entities form the core partnership of the IRWM program based on their water and land management authority in the region. These entities are all involved in some capacity with the Plumas Watershed Forum, and a number of other public agencies and non-governmental organizations in the region participate in both Forum activities and the IRWM program. Due to the overlapping participants and objectives of the Watershed Form and the IRWM program, an update on the IRWM program is included in this Annual Report.

In 2005, the Flood Control District took the lead in organizing and developing the initial IRWM Plan for the Upper Feather River Watershed using its own staff resources as well as Monterey B funds to obtain the assistance of Ecosystem Sciences Foundation (the same organization that helped the Forum develop the Feather River Watershed Management Strategy).

Prop. 50 IRWM Implementation Grant

The IRWM Plan provided a substantial basis for an application for a $10 million Prop. 50 IRWM implementation grant, which was submitted in the summer of 2005. The Upper Feather proposal was one of 16 applications invited to advance to Step 2 of the application process, but it was not one of the seven proposals that were originally awarded grants. However, following approval of Prop. 84 and additional IRWM funding in November of 2006, the Department of Water Resources and the State Water Resources Control Board elected to accelerate the disbursement of Prop. 50 funds and awarded full or partial grants to the remaining nine proposals. The Upper Feather proposal was awarded $7 million in funding.

The Upper Feather proposal includes the following projects:

- Stream restoration and erosion control at priority sites on the Plumas National Forest
- New wetlands to expand municipal tertiary wastewater treatment in Quincy
- Well inventory and capping in Sierra Valley to prevent groundwater contamination
- Implementing repair, restoration, and model management practices on two Feather River Land Trust ranches in Sierra and Genesee Valleys
- Modeling program in Sierra Valley to support integrated land and water management decision making

The projects create 37 acres of constructed wetlands, rewater 1,300 acres of desertified meadow, reduce summer water temperatures, improve wastewater treatment, restore 50 miles of degraded perennial streams, and provide essential data and tools for future management decisions.

The entire grant application may be reviewed at the State Water Resources Control Board website:

https://faast.waterboards.ca.gov/PublicProposalsSearch.asp

Forest Service Collaboration

Last year, it was reported that the Flood Control District and the Plumas National Forest were jointly pursuing a program related to the connection between water supplies and forest management. In conjunction with the California Hydrologic Research Laboratory at U.C. Davis, the Pacific Southwest, Pacific Northwest, and Rocky Mountain research stations of the Forest Service were seeking to combine hydrologic modeling and planning techniques that have been used to evaluate specific stream and meadow restoration projects in the Upper Feather River region with the extensive expertise of the Forest Service in modeling water impacts of upland conditions. Funding for this work was originally approved by the House of Representatives in the summer of 2006, but the change in control of Congress in November 2006 and the elimination of "earmarks" in the final appropriations for Fiscal Year 2007 resulted in no funding for the project.

The request for funding was resubmitted by Plumas County for Fiscal Year 2008, but it does not appear the project will be funded.

Plumas County is continuing to pursue funding for this project, as well as funding to pursue other collaborative initiatives with the Forest Service.

Natural Heritage Institute – Sierra Meadows Planning Grant

In the summer of 2005, the Natural Heritage Institute was awarded a $500,000 Prop. 50 IRWM planning grant to study and plan for water management in the meadow areas of the northern Sierra Nevada, focusing on the Feather, Pit, and Yuba river systems. At the same time, however, four other regional coalitions had applied for Prop. 50 implementation grants in the same area.

As the Prop. 50 IRWM program was put in place, "regions" were allowed to identify and define themselves, and it quickly became apparent to the Department of Water Resources and the State Water Resources Control Board that actual regional "integration" was lacking. At the request of the Department of Water Resources, a meeting was convened among adjoining and overlapping regions that had applied for implementation grants, including the Upper Feather coalition, the Northern California Water Association/Sacramento River coalition, Butte County, and the Cosumnes-American-Bear-Yuba (CABY) coalition. As a result of further discussions, agreement was reached to eliminate overlapping boundaries and pursue appropriate inter-regional coordination.

When Plumas County became aware of the Natural Heritage Institute planning work, consultation was initiated to determine how the specific work on the Sierra meadows could be incorporated into the IRWM plans for the Upper Feather and CABY and how best to coordinate with Lassen, Modoc, Siskiyou, and Shasta County interests. Plumas County hosted an initial meeting with the Natural Heritage Institute in July of 2007, which included representatives from the Feather River Coordinated Resource Management Group, the Department of Water Resources, and the State Water Project Contractors. The Natural Heritage Institute has since provided initial studies and reports, and additional meetings and outreach are planned. A meeting between the Department of Water Resources, the Natural Heritage Institute, and the Sierra IRWM coalitions is tentatively scheduled for early November to look at re-scoping the IRWM planning grant so its activities will support and enhance the existing IRWM plans.

IRWM Plan Update

The Upper Feather IRWM partner agencies have taken the first steps in updating the IRWM Plan by initial scoping of issues that should be addressed in the update. Issues that have already been identified as needing attention include:

- Long-term funding for watershed and water management activities, including local funding to support the Feather River Coordinated Resource Management Group and the Almanor Basin Watershed Advisory Committee
- Coordination with the Upper Feather River Watershed Group (Ag Waiver Coalition)
- Data management and integration of watershed monitoring
- Municipal drinking water and wastewater services
- New Prop. 84 requirements
- Prioritized project list

The scoping process for the IRWM Plan update will include outreach to agencies, non-governmental organizations, and other interests in early 2008. The overall timing of the IRWM Plan update will be tied to the schedule for Prop. 84 funding for both planning and implementation grants. Plumas County anticipates applying for a Prop. 84 planning grant to assist with certain components of the IRWM Plan update, with a goal of completing the update in time to be eligible to apply for the first round of Prop. 84 implementation grants.

The current version of the IRWM Plan is available on the Plumas County website at:

http://www.countyofplumas.com/publicworks/watershed/IRWMP_063005.pdf

Part IV

Financial Reports

Funding Summary

Majority/A Fund Budget

Minority/B Fund Budget

Plumas Watershed Forum

Funding Summary as of October 1, 2007

A Fund Projects	
Project Funding Expended	$1,290,000.00
Funding Committed	$400,000.00
Total A Fund Projects	$1,690,000.00

Uncommitted A Funds	**$101,000.00**

B Fund Projects	
Project Funding Expended	$396,000.00
Funding Committed	$24,000.00
Total B Fund Projects	$420,000.00

Program Administration			
	A	**B**	**Total**
2004-05	$42,227.38	$64,470.14	$106,697.52
2005-06	$26,496.16	$35,920.59	$62,416.75
2006-07	$38,200.64	$6,684.35	$44,884.99
2007-08	$47,275.00	$600.00	$47,875.00
2008-09	$50,000.00	$0.00	$50,000.00
Total	$204,199.18	$107,675.08	$311,874.26

2007-2008 Majority "A" Fund Budget

	06-07 Budget		06-07 Actual		07-08 Budget	
Beginning Fund Balance	$ 1,522,333.00		$ 1,522,333.00		$ 864,013.88	
Revenue						
46611 Revenue from Settlement	$ -		$ -			
43010 Interest	$ 9,800.00		$ 63,004.64		$ 15,000.00	
Total Assests	**$ 1,532,133.00**				**$ 879,013.88**	
Expenditures - District Staff						
5100 Regular Wages			$ 211.07		$ 21,962.00	
51020 Other Wages	$ 57,258.00		$ 35,731.50		$ 15,000.00	
51070 UI	$ 49.00		$ 31.30		$ 110.00	
51080 Retirement	$ 1,791.00		$ 778.09		$ 4,126.00	
51090 Group Insurance	$ -				$ 1,832.00	
51100 OASDI	$ 729.00		$ 443.96		$ 1,680.00	
51110 Workers Comp	$ 173.00		$ 397.80		$ 322.00	
51119 Liability	$ -				$ 133.00	
Total Salary & Benefits	**$ 60,000.00**		**$ 37,593.72**		**$ 45,165.00**	
Service & Supplies						
52020 Communications	$ 250.00		$ 76.15		$ 85.00	
52170 Miscellaneous	$ 200.00		$ 38.52			
52180 Office Expense	$ -				$ 275.00	
52190 Professional Services/Projects	$ 1,293,076.00		$ 683,123.76		$ 680,822.03	
USFS -Beckwourth Road Relocation**		$ 4,034.00		$ -		$ -
CRM - Hosselkus		$ 72,399.00		$ 71,678.14		$ 720.14
USFS Charles Creek Low Water Crossing		$ 35,000.00		$ 35,000.00		$ -
Feather River College		$ 12,111.00		$ 9,798.25		$ 2,222.33
SVGMD Well Enhancement		$ 21,804.00		$ 2,527.94		$ 19,276.10
Plumas Geohydrology - Red Clover		$ 25,398.00		$ 17,497.11		$ 7,901.24
USFS - Clark's Creek Aspen Restoration		$ 83,001.00		$ 22,769.88		$ 60,230.71
CRM - Four Creeks Monitoring		$ 11,064.00		$ 11,063.95		$ -
CRM - Jordan Flat		$ 5.00		$ -		$ -
CRM - Dixie		$ 56,000.00		$ 13,255.12		$ 42,744.88
CRM - Ferris		$ 86,000.00		$ 7,869.06		$ 78,130.94
CRM - Meadow Valley Silver Ck		$ 51,000.00		$ 1,040.25		$ 49,959.75
CRM - Meadow Valley Spanish		$ 147,000.00		$ 1,346.38		$ 145,653.62
CRM - Little Last Chance Ck		$ 115,000.00		$ 1,017.68		$ 113,982.32
Lake Davis Water Treatment Facility		$ 488,260.00		$ 488,260.00		$ -
USFS - Ramelli Ditch		$ 85,000.00		$ -		$ 85,000.00
Program Review						$ 75,000.00
		$ 1,293,076.00		$ 683,123.76		$ 680,822.03
52370 Publications	$ 2,000.00				$ 600.00	
52420 Rents & Leases	$ 800.00		$ 135.00			
52440 Special Dept. Expenses	$ 100.00					
52550 Auditor Fees	$ 1,000.00					
52740 Routine Travel	$ 500.00				$ 750.00	
52750 Special Travel	$ 2,400.00					
52775 In County Hosting	$ 1,200.00		$ 357.25		$ 400.00	
52790 Administration	$ -					
Total Service & Supplies	**$ 1,301,526.00**		**$ 683,730.68**		**$ 682,932.03**	
Total Expenditures	**$ 1,361,526.00**		**$ 721,324.40**		**$ 728,097.03**	
Reserved Funding for Program Mgmnt	**$ 100,000.00**		**$ 100,000.00**		**$ 50,000.00**	
Uncommitted Funds	**$ 70,607.00**				**$ 100,916.85**	

** Note: Balance of $4,034 from Beckwourth Road Relocation reallocated to Uncommitted Funds.

2007-2008 Minority "B" Fund Budget

	06-07 Budget		06-07 Actual		07-08 Budget	
Beginning Fund Balance	$ 394,391.00		$ 394,391.00		$ 50,293.64	
Revenue						
46611 Revenue from Settlement	$ -		$ -		$ -	
43010 Interest	$ 1,500.00		$ 11,164.68		$ 300.00	
Total Assests	**$ 395,891.00**		**$ 405,555.68**		**$ 50,593.64**	
Expenditures - District Staff						
5100 Regular Wages	$ -		$ -		$ -	
51020 Other Wages	$ -		$ 2,992.16		$ 140.00	
51070 UI	$ -		$ 24.76		$ 13.00	
51080 Retirement	$ -		$ 355.04		$ 63.00	
51090 Group Insurance	$ -		$ 547.18		$ 110.00	
51100 OASDI	$ -		$ 498.32		$ 42.00	
51110 Workers Comp	$ -		$ 63.60		$ -	
51300 Per Diem	$ 7,200.00		$ 3,000.00		$ 4,500.00	
Total Salary & Benefits	**$ 7,200.00**		**$ 7,481.06**		**$ 4,868.00**	
Service & Supplies						
52020 Communications	$ 500.00		$ 475.25		$ 600.00	
52170 Miscellaneous	$ 100.00		$ -		$ -	
52180 Office Expense	$ 1,000.00		$ 341.79		$ 550.00	
52190 Professional Services/Projects	$ 380,790.16		$ 340,486.59		$ 37,875.01	
Plumas Geohydrology - LC Base Flow		$ 1,614.00		$ 957.60		$ 656.09
SV RCD - Capacity Building**		$ 3,573.00		$ 3,572.88		$ -
FR RCD - Capacity Building		$ 21,908.00		$ 21,908.00		$ -
Plumas Corp - Upland Vegetation		$ 40,604.16		$ 29,015.94		$ 11,588.22
Plumas Geohydrology - Forest Canopy		$ 13,345.00		$ 7,805.18		$ 5,540.15
CRM - Outreach & Awareness		$ 31,582.00		$ 12,558.30		$ 19,023.55
CRM - Proj Coord. & Development		$ 15,683.00		$ 15,682.74		$ -
Sierra Institute		$ -		$ 9,816.50		$ -
MWH Americas - FERC consultant		$ 20,000.00		$ 18,946.50		$ -
Tom Hunter - FERC consultant		$ 17,000.00		$ 1,129.69		$ -
Leah Wills - Consultant		$ 56,997.00		$ 50,803.88		$ -
Michael Jackson - Attorney		$ 38,089.00		$ 30,852.28		$ -
John Mills - Consultant		$ 71,600.00		$ 92,000.00		$ -
Advocation Inc.		$ 12,795.00		$ 11,617.63		$ 1,067.00
Maidu Cultural & Development Group		$ 36,000.00		$ 33,819.47		$ -
		$ 380,790.16		$ 340,486.59		$ 37,875.01
52370 Publications	$ 100.00		$ -		$ 150.00	
52420 Rents & Leases	$ 1,000.00		$ 1,000.00		$ -	
52440 Special Dept. Expenses	$ -		$ -		$ -	
52550 Auditor Fees	$ -		$ -		$ -	
52740 Routine Travel	$ 100.00		$ 386.25		$ 1,200.00	
52750 Special Travel	$ 5,000.00		$ 5,091.74		$ 5,000.00	
52775 In County Hosting	$ 100.00		$ -		$ 350.00	
Total Service & Supplies	**$ 388,690.16**		**$ 347,781.62**		**$ 45,725.01**	
Total Expenditures	**$ 395,890.16**		**$ 355,262.68**		**$ 50,593.01**	
Balance Available	**$ 0.84**		**$ 50,293.00**		**$ 0.63**	

**** Final report for Sierra Valley RCD included in 2006 Annual Report**

Part V

Watershed Forum Agendas and Meeting Minutes

PLUMAS WATERSHED FORUM
PLUMAS COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT

AGENDA FOR
TOUR OF OCTOBER 23, 2006
MEETING OF OCTOBER 24, 2006

ROBERT MEACHER, CHAIRMAN
NANCY L. DAFORNO, CLERK

www.countyofplumas.com

OCTOBER 23, 2006 - 10:00 A.M. - Public Works, 1834 E. Main Street, Quincy
Note: All members of the Board of Directors have been invited to attend the tour.

10:00 A.M. – Depart Quincy (Plumas County Public Works)

11:30 A.M. – Meet Jim Wilcox, Feather River CRM, at Red Clover Valley to view active restoration work

1:45 P.M. – Ferris Creek (off Last Chance Creek) View restoration work performed at Ferris Flat in 2003 and Ferris Creek in 2004; view work scheduled for 2007

2:30 P.M. – Jordan Flat – View restoration work done in 2005

3:00 P.M. – Begin return trip to Quincy

OCTOBER 24, 2006 - 9:00 A.M. - MINERAL BUILDING, FAIRGROUNDS, QUINCY

1. 9:00 A.M. **INTRODUCTIONS**

2. **PUBLIC COMMENT OPPORTUNITY**
   Any member of the public may address the Forum on matters which are within the jurisdiction of the Forum. If you are addressing the Forum regarding a matter listed on the agenda, you are requested to hold your comments until the Forum takes up that matter. Please limit your comments to three (3) minutes or less.

3. **PLUMAS WATERSHED FORUM**
   - **A.** Overview and Discussion of Tour Held October 23, 2006
   - **B.** Annual Report / IRWM Update
   - **C.** Budget Reports: 2005/2006 Expenditures and Proposed 2006/2007 Budget
   - **D.** Report by DWR on the Status of the Monterey EIR
   - **E.** Schedule Next Meeting of the Plumas Watershed Forum

ADJOURNMENT

REASONABLE ACCOMMODATIONS: In compliance with the Americans with Disabilities Act, if you need special assistance to participate in this meeting please contact the Clerk of the Board at (530) 283-6170. Notification 72 hours prior to the meeting will enable the County to make reasonable arrangements to ensure accessibility to this meeting

PLUMAS COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PLUMAS WATERSHED FORUM
COUNTY OF PLUMAS, STATE OF CALIFORNIA

MEETING OF THE PLUMAS WATERSHED FORUM
HELD IN QUINCY ON OCTOBER 24, 2006

1. INTRODUCTIONS

The Plumas Watershed Forum meeting convenes at 9:00 a.m. with Plumas County Flood Control and Water Conservation District board members Ole Olsen, Bill Powers, Rose Comstock, William Dennison and Robert Meacher present. Members from the Department of Water Resources include Dwight Russell. Members from the State Water Contractors include David Okita, Tim Quinn and Tom Hurlbutt.

2. PUBLIC COMMENT OPPORTUNITY

Forum Member Quinn, representing the Metropolitan Water District comments on a letter from the District Chair of the Board, Wes Bannister to Lester Snow of the Department of Water Resources regarding continued funding for the Plumas Watershed Forum. Mr. Quinn informs the Forum that the letter does not reflect the position of the Metropolitan Water District and that Mr. Bannister has resigned his position, effective November 01, 2006.

3. PLUMAS WATERSHED FORUM TOUR HELD OCTOBER 23, 2006

Overview and discussion of tour held October 23, 2006.

The tour of watershed restoration projects included Red Clover Valley, Ferris Creek and a low-water crossing on Last Chance Creek. All projects are in eastern Plumas County.

Forum Member Powers commends the CRM and the US Forest Service for working together and combing projects. This is a new attempt and the effort will make water projects more successful.

Forum Member Okita is impressed with the techniques being used, such as natural restoration, and states it is good to see projects moving forward.

Forum Member Quinn requests a briefing at the next Forum meeting on the broader scope of issues and projects in the Upper Feather River watershed.

ANNUAL REPORT/IRWM UPDATE

Brian Morris, General Manager of the Plumas County Flood Control and Water Conservation District, presents the draft annual report to the Forum.

Forum Member Quinn questions a discussion on page 6 regarding withdrawal of funding. Forum Member Russell clarifies that the discussion addresses the issue of the Forum funding a project where additional funding is anticipated or budgeted from another sponsor, but the additional funding does not actually materialize. The report will be revised to clarify that it is not referring to suspension of payments under the Monterey Settlement Agreement.

Mr. Morris states that because of the overlap in membership and programs between the Forum and the Integrated Regional Water Management Plan for the Upper Feather River watershed, an IRWM update has been included in the Forum's annual report. The IRWM Plan was adopted in 2005, and the participants have applied for a $10 million implementation grant, a portion of which would fund projects similar to the ones undertaken by the Forum.

BUDGET REPORTS

2005/2006 Expenditures

Review of expenditures for FY 2005-2006.

Forum Member Russell reminds the Forum that $4 million under the Monterey Agreement Settlement was appropriated to Water for California, a non-profit organization. Mr. Russell questions how the funding is being used. Mr. Russell further states that if the funding is not being used by Water for California, this is an opportunity to fund projects in Plumas County. Mr. Russell requests that a report on Water for California activities be included in the annual report. The Forum members concur and direct staff to contact Water for California.

2006/2007 Proposed Budget

Mr. Morris addresses the Forum with a report on the proposed budget for FY 2006-2007.

Discussion is held regarding the Lake Davis Water Treatment Facility. Forum Member Russell questions when construction will begin and if there is a plan to provide a backup water supply. Today, there is not a plan in place. Nancy Quan of DWR agrees to work with the Flood Control District to provide a plan.

Holly George, Cooperative Extension and a representative from the Sierra Institute are present and address the Forum regarding available funding for future projects. The Plumas Watershed Forum funding is interrupted until completion of the new Monterey Environmental Impact Report by the Department of Water Resources. Following discussion, motion is made by Forum Member Powers, seconded by Forum Member Comstock and unanimously carried directing staff to conduct an in-house assessment of all outstanding projects to determine available funding for reallocation.

The Forum directs staff to offer communication regarding funding for future projects but agrees to not advertise for solicitation of projects until determining availability of funding.

MONTEREY EIR

Report and update by Forum Member Russell and Nancy Quan of the Department of Water Resources on the new Monterey Environmental Impact Report (EIR). The administrative draft EIR (confidential document) is out and the comment period ends November 2006. The public draft will be available late spring 2007.

Following discussion, motion is made by Forum Member Quinn, seconded by Forum Member Powers and unanimously carried directing staff to send a letter to the Department of Water Resources Director requesting they meet the September 2007 deadline for adoption and certification of the new Monterey EIR.

NEXT MEETING OF WATERSHED FORUM

The next meeting of the Plumas Watershed Forum is scheduled for May 22, 2007, Quincy.

A conference call, to be determined, will be held for report by staff regarding revisions to the annual report, available funding for new project, and the final budget for FY 2006-2007.

ADJOURNMENT

The Forum adjourns at 11:35 a.m. to meet again on May 22, 2007.

PLUMAS WATERSHED FORUM

AGENDA FOR MEETING OF MAY 22, 2007
TO BE HELD AT 10:00 A.M.
IN THE BOARD OF SUPERVISORS CHAMBERS
COURTHOUSE, QUINCY, CALIFORNIA

ROBERT MEACHER, CHAIRMAN

www.countyofplumas.com

Note: Department of Water Resources and State Water Project Contractors may participate via teleconference.

AGENDA

1. 10:00 A.M. **Introductions**

2. **Public Comment Opportunity**
   Any member of the public may address the Forum on matters which are within the jurisdiction of the Forum. If you are addressing the Forum regarding a matter listed on the agenda, you are requested to hold your comments until the Forum takes up that matter. Please limit your comments to three (3) minutes or less.

3. **Lake Davis Pike Eradication**
   Staff report on status of eradication project and alternative water supply.

4. **06-07 Budget**
   Review budget, year-to-date expenditures, and projected carryover.

5. **Administrative Policy Implementation**
   Review the process and Forum funded staffing for project review, permitting, payments, and inspection.

6. **Administrative Staffing for Plumas Watershed Forum**
   Discuss status of Plumas County staffing for Forum administration, including coordination efforts with the Feather River CRM, watershed groups, and IRWM.

7. **Capacity Building Projects**
   Discuss status of multi-year capacity building project funding, reporting, and deliverables.

8. **2006 Annual Report**
   a. Review and approve revisions to 2006 Annual Report.
   b. Report on request for information from Water for California.

9. **Monterey EIR**
   a. Staff report on status of Monterey EIR.
   b. Letter to DWR regarding completion of EIR.

10. **Upper Feather River Watershed Integrated Regional Water Management (IRWM)**
    Provide update on IRWM implementation and coordination with the Forum.
    Discuss monitoring data coordination between IRWM and Forum.

11. **Program Review**
    Discussion and direction to staff regarding third-party review of Watershed Forum program.

12. **07-08 Budget**
    Discussion and direction to staff regarding program budget for 07-08.

13. **Schedule Next Meeting**
    Set annual meeting for October 23, 2007, or other date.

ADJOURNMENT

REASONABLE ACCOMMODATIONS: In compliance with the Americans with Disabilities Act, if you need special assistance to participate in this meeting please contact the Clerk of the Board at (530) 283-6170. Notification 72 hours prior to the meeting will enable the County to make reasonable arrangements to ensure accessibility to this meeting

PLUMAS COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
PLUMAS WATERSHED FORUM
COUNTY OF PLUMAS, STATE OF CALIFORNIA

MEETING OF THE PLUMAS WATERSHED FORUM
HELD IN QUINCY ON MAY 22, 2007

1. Introductions

The Plumas Watershed Forum meeting convenes at 10:00 a.m. with Plumas County Flood Control and Water Conservation District board members Ole Olsen, Rose Comstock, Sharon Thrall and Robert Meacher present. Members from the Department of Water Resources include Dwight Russell. Members from the State Water Contractors include David Okita, Tim Quinn and Tom Hurlbutt.

2. Lake Davis Pike Eradication

Brian Morris, General Manager of the Flood Control District, informs the Forum that the Department of Fish and Game is planning another chemical treatment of Lake Davis to attempt to eradicate pike. The pike project is scheduled for September or October, and DFG has made arrangement to assist the City of Portola and Grizzly Lake Resort Improvement District with well improvements as part of the project's mitigation package.

The Flood Control District has not taken water deliveries from Lake Davis since the first pike project in 1997, but a new water treatment plant will begin construction this summer. It is anticipated that Portola and GLRID will return to Lake Davis as a water supply sometime in mid-2008, once the treatment plant is completed.

3. 06-07 Budget

Mr. Morris presents a budget summary showing year-to-date expenses for program administration and projects, as well as the status of outstanding funding for approved projects. Approximately $1.7 million has been approved for Majority/A Fund projects, with $1.1 million expended and $600,000 pending. The bulk of the unexpended funds are for Feather River CRM projects in 2007 and 2008, as well as the Forest Service's Clark's Creek Aspen project. For the Minority/B Fund, $420,000 in funding was approved by the Technical Advisory Committee and the Forum, and approximately $120,000 remains to be spent for approved projects.

All Minority/B funds have been committed or will be spent by the end of the current fiscal year on June 30. Based on the Majority/A fund budget, Mr. Morris and Todd Hillaire of DWR agree that at least $70,607 in funds are uncommitted, with an additional $100,000 in reserves for program management in future years. Following the close of the fiscal year, a report will be prepared for the Forum meeting in October to provide the exact amount of Majority/A funds that are still available.

The Forum reviews the budget for the 2006-07 fiscal year, which is revised from the budget presented at the October meeting to reduce funding for salaries and benefits to a total of $60,000, as approved by the Forum in May 2006. In response to questions from Mr. Russell, Mr. Morris reports that the Flood Control District did not hire a full time natural resources analyst, but that Karen Oglesby has continued to assist with administration of the program.

4. Administrative Policy Implementation

Mr. Russell informs the Forum that a policy was developed by staff and approved by the Forum regarding administration of contracts with the individual project sponsors, and he requests that the Flood Control District update the Forum regarding implementation of the policy. Mr. Morris responds that he has been reviewing and approving invoices for the Forum program, although there have not been many invoices since October. A final invoice was received from the Feather River Resource Conservation District, and Mr. Morris reviewed the reports and photographs that were submitted to ensure the contract requirements had been satisfied.

5. Administrative Staffing for Plumas Watershed Forum

Mr. Morris reports that the Flood Control District's staffing has been in transition since the retirement of Tom Hunter, but the Board of Supervisors has approved a reorganization that will be effective with the new fiscal year on July 1. Mr. Morris, who was designated General Manager of the Flood Control District in October 2006, has submitted his resignation to the Plumas County Counsel and will be working full-time on water and natural resources issues.

The Flood Control District has also budgeted Forum funds and other monies to pay one-half the cost of a natural resources analyst position within the Plumas County Department of Public Works. The natural resources analyst will assist with administration of the Forum program and help manage other grant funds.

Any necessary engineering review of project plans or completed projects will be undertaken by the Department of Public Works. To review the projects scheduled to proceed during the 2007 construction season, Mr. Morris and the new Public Works Director, Bob Perreault, will both meet with the project sponsor as they determine the proper allocation of responsibilities for carrying out the Administrative Policy.

Mr. Russell questions how the Forum will coordinate with the Integrated Regional Water Management program, the Feather River Coordinated Resource Management Group, and other activities and groups in the Upper Feather River area. Mr. Meacher responds that between the members of the Board of Supervisors and the Flood Control District's staff and consultants, there is ongoing contact with all the other agencies and organizations in the region, and most meetings are attended by at least one representative of the Flood Control District. The Flood Control District holds regular meetings between its staff, consultants, a rotating group of board members, and the Feather River CRM staff to ensure coordination of activities.

Mr. Morris informs the Forum that the Upper Feather IRWM plan was prepared with assistance from Ecosystem Sciences Foundation and Mark Hill, who also prepared the Feather River Watershed Management Strategy on behalf of the Forum. As a result of that continuity, the IRWM plan is fully consistent with the Forum's objectives and methods. Also, the Feather River CRM and the Plumas National Forest, each of which have undertaken multiple projects funded by the Forum, are sponsoring the two largest projects in Plumas County's Prop. 50/IRWM implementation grant.

6. Capacity Building Projects

Mr. Morris reports that Forum funding for the Feather River Resource Conservation District and Sierra Valley Resource Conservation District came to an end in December of 2006, and that the progress reports included in the Annual Report reflect most of what the districts have done. A final report has been received from Feather River RCD, and a similar report from Sierra Valley RCD is forthcoming.

Mr. Russell states that the reason the Forum funded the "capacity building" efforts was to conduct education to broaden the base of potential project sponsors and to help new entities submit successful project proposals. If that goal has not been accomplished, there may be a need to keep looking at how that type of assistance can be provided.

Mr. Meacher states that a good example of how Minority/B funds were used was to obtain the $7 million Prop. 50 grant, which was pursued with Forum funds and additional Plumas County funds.

Mr. Russell requests that the next Annual Report include a full review of the Forum's capacity building projects.

7. 2006 Annual Report

Mr. Morris notes the edits that were requested at the Forum meeting in October, as well as the revised Majority/A fund budget. Upon a motion made by Mr. Russell, seconded by Ms. Comstock, and unanimously carried, the Forum approves the 2006 Annual Report and directs the report to be posted on the web page.

Mr. Morris reports that at the October meeting, Mr. Russell and Supervisor Dennison had requested that staff contact Water for California and obtain a report on that group's activities to include in the Annual Report. Mr. Morris states that he forwarded the request to one of the Water for California board members, but the response from the board of directors was that Water for California was not related to the Watershed Forum. If the Department of Water Resources or the State Water Contractors would like information from Water for California, they were asked to make a direct request to the organization.

Mr. Russell states that with the Minority/B fund depleted, Water for California might be a source of funding to continue the program. Mr. Morris reports that Plumas County will be making a direct request to Water for California for funding in the next fiscal year.

8. Monterey EIR

Nancy Quan reports that at the last EIR Committee meeting the plaintiffs and the Contractors agreed that a second administrative draft would be useful. There will be another EIR Committee meeting in July and the public review draft is currently anticipated to be released in August.

Mr. Morris reports that in October the Forum had requested a letter be sent to Lester Snow urging that the EIR be completed by September 2007, based on DWR's schedule at that time. Mr. Morris stated that he did not believe he had license to describe how that should be accomplished and that a letter simply asking DWR to finish the EIR would be relatively meaningless. Mr. Quinn stated that time has passed by and the letter is no longer relevant.

9. Upper Feather IRWM Program

Mr. Morris reports that Plumas County had received a $7 million IRWM implementation grant from DWR and was looking to begin work in July.

Katie Spanos asks about the relationship between the Forum and the IRWM program. Mr. Morris responds that the programs are parallel efforts with close coordination. Plumas County entered an MOU with the Plumas National Forest and the Sierra Valley Groundwater Management District to adopt the Upper Feather IRWM plan, and the MOU provides for a joint annual meeting and annual report with the Forum. In response to a question from Mr. Russell, Mr. Morris reports that Forum funds are not part of the matching funds for the IRWM grant.

Following discussion about the coordination of monitoring efforts in the Upper Feather region, Mr. Russell requests that the mid-term report include a review of monitoring activities and needs.

10. Program Review

Mr. Morris reports that there have been a number of discussions among staff about the desire of DWR and the Contractors to have a third-party program review and the desire of Plumas to use remaining Majority/A funds for actual projects.

Mr. Russell states that a program review is important for DWR and the Contractors to evaluate the program and decide whether to continue funding prior to completion of the Monterey EIR, which is one of DWR's options under the Settlement Agreement.

Following discussion, upon a motion made by Mr. Russell, seconded by Ms. Comstock, and unanimously carried, the Forum directs staff to prepare a scope of work for a program review, identify appropriate third parties to conduct the review, and proceed with the review.

Mr. Russell suggests that the Technical Advisory Committee should meet to complete the scope of work for the program review.

11. 07-08 Budget

Mr. Morris reminds the Forum that $100,000 was set aside in May 2006 for use in fiscal year 2007-08 and beyond. Mr. Morris suggests that the Forum allocate $50,000 per year for 2007-08 and 2008-09 for program administration, and that the program review be funded out of the $70,607 in uncommitted Majority/A funds. Following discussion, it is the consensus of the Forum to structure the budget as proposed by Mr. Morris and to anticipate the program review should cost at least $50,000.

Based of the scope of the program review and the budget, Mr. Okita suggests that the review can be accomplished in three to six months. Mr. Quinn states that the quicker the review is completed the better. Ms. Spanos states that six to nine months is a reasonable timeframe for the review. Mr. Russell suggests that the scope of work can be completed in 30 days, with a draft report by September or October.

12. Next Meeting

The next meeting is scheduled for October 23, 2007, at 10:00 a.m. Mr. Hillaire asks whether a field tour will be scheduled in conjunction with the annual meeting. Following discussion, it is the consensus of the Forum to plan for a tour in conjunction with the May 2008 meeting, which will allow viewing of the landscape and projects at a different time of the year than the 2005 and 2006 tours.

13. Adjournment

The Forum adjourns at 12:05 p.m. to meet again on October 23, 2007.

Part VI

Project Reports

Watershed Forum Completed Projects

Last Chance Creek Low Water Crossing
Sponsor: Plumas National Forest
Approved Funding: $35,000 (A funds)
Expended By 6/30/07: $35,000

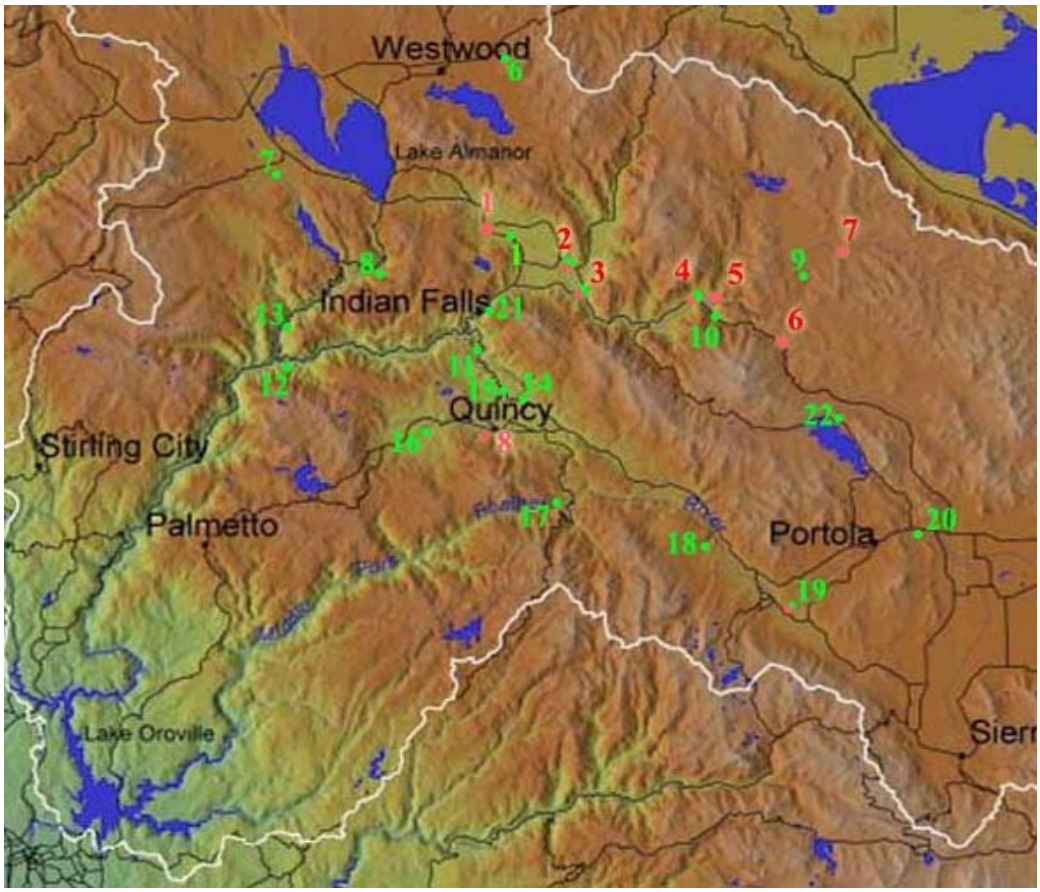
This project raised a primary road crossing Last Chance Creek to help raise and maintain the upstream water table at the level of the meadow. The project also included construction of a drop structure downstream of the road crossing to stabilize the river channel. Construction was completed in the fall of 2006. The project was jointly funded by the Forum ($35,000) and the Forest Service ($40,000).

Four Creeks Monitoring Project
Sponsor: Feather River CRM
Approved Funding: $25,000 (A funds)
Expended By 6/30/07: $25,000

The Feather River CRM maintains ten continuous recording stations along Last Chance Creek, Red Clover Creek, Indian Creek, Lights Creek, Wolf Creek, Spanish Creek, and Sulphur Creek, and the purpose of this project was to provide pre- and post-project flow and water quality conditions on a large, landscape scale. Funding was provided to support maintenance, calibration, and annual data analysis for the ten continuous recording stations.

Recording flow using a bridge crane from Deadfall Bridge on Lights Creek, Indian Valley

Continuous Recording Stations



1. Wolf Creek

2. Lights Creek

3. Indian Cr. @ Taylorsville

4. Indian Cr. @ Flournoy

5. Indian Cr. @ DWR Weir

6. Red Clover @ Notson

7. Last Chance

8. Spanish Cr.

19. Sulphur Cr.

The final Watershed Monitoring Report funded by the Forum was produced in the spring of 2007 and is included as Appendix D. The report is also available on the CRM website at:
http://www.feather-river-crm.org/monitoring/MonitoringReport06.pdf

As described in the report, the most important findings include:

- Big Flat peak flow attenuation and longer duration of baseflow
- Last Chance Watershed: decreasing number of days with temperature readings exceeding 75°F (lethal to coldwater fish habitat) below project areas

Dixie Creek Restoration Project
Sponsor: Feather River CRM
Approved Funding: $56,000 (A funds)
Expended By 6/30/07: $13,255
Expended By 10/1/07: $33,435 (with final invoice pending)

This project restored a reach of Dixie Creek in Dixie Valley, a major tributary to Red Clover Creek. A main systemic head cut that was moving upstream from Red Clover Valley since the 1950s was located within the project area. The landowner had attempted to halt the head cut in years past with rock treatments with little success. This project was the first phase of stabilization, including restoration of 2,000 feet of functional channel/meadow, prevention of additional loss of functional meadow upstream, and the establishment of a demonstration project for adjacent landowners.

The Dixie Creek project employed the pond and plug technique (as described in the Ferris Field project, above), anchored by a moderate rock gradient at a natural valley constriction at the downstream end. Construction was completed in September 2007.

Ferris Fields Restoration Project
Sponsor: Feather River CRM
Approved Funding: $86,000 (A funds)
Expended By 6/30/07: $7,896
Expended By 10/1/07: $86,000

This project was intended to provide important hydrologic and biologic connection between previously restored reaches of Last Chance Creek. Previous restoration eliminated approximately 2,200 feet of channel length on Last Chance Creek at the downstream end of Ferris Fields, as well as 2,500 feet of gully on Ferris Creek above the confluence with Last Chance Creek, which is within the area of the current project. The current project restored a 4,500-foot reach of Last Chance Creek that was determined to be a lower priority during the CALFED-funded Last Chance Creek Restoration Project implemented from 2002 to 2004. Construction was completed in August 2007.

The project used the pond and plug technique, which has been used in numerous areas throughout the Feather River watershed, and has been proven to perform well, while requiring minimal long-term maintenance. The technique involves obliterating a gully by replacing it with a series of earthen plugs and ponds. The excavation of the ponds provides the fill material for the plugs. The stream flow that was within the gully is redirected into an existing, remnant channel at the elevation of the meadow, resulting in a defined, continuous channel throughout the length of the project. To minimize the footprint of the project, the fill material from any pond is moved less than 300 feet to a plug. The primary function of the ponds is to provide the fill material for the gully plugs. An ancillary benefit of the ponds is wildlife habitat enhancement. In dry years in these project areas, pond water may be the only surface water available.

The Ferris Fields project also included 2.5 miles of fence repair and replacement around the Ferris Fields pasture to control the movement of cattle. Fence materials were provided by the Plumas National Forest Range Program with assistance from the Plumas County RAC. Also, the Plumas National Forest fisheries program supported revegetation.

Ramelli Ditch Replacement Project
Sponsor: Plumas National Forest
Approved Funding: $85,000 (A funds)
Expended By 6/30/07: $0 *(Note: Project completed but not invoiced in 06-07)*

The purpose of the Ramelli Ditch project was to ensure a safe and reliable supply of irrigation water to a downstream water user by placing a 12-inch pipe into an existing 1.5 mile historic

irrigation ditch. The goal of this improvement was to prevent ditch failure and sedimentation into Grizzly Creek in the event of a blowout. Benefits include the reduction of seepage, thereby decreasing water use; increased water yield; downstream sediment reduction; rangeland improvement; wildlife habitat enhancement; and scenic enrichment for forest visitors and travelers using the adjoining Highway 70 rest area.

With the water delivery system now secure, the Natural Resource Conservation Service and the permittee will develop an all encompassing ranch plan. The ranch plan will include irrigation management with lateral irrigation pipe lines, permanent fences to control livestock use on the meadows, duck ponds, and off-site livestock watering troughs. These potential projects will be analyzed in the Plumas National Forests' 2008 Range Management NEPA process.

Matching funds for the project included $119,000 in U.S. Forest Service Centennial Funds and $40,000 in Forest Service fire recovery funds.

Last Chance Base Flow Monitoring
Sponsor: Plumas Geo-Hydrology
Approved Funding: $23,000 (B funds)
Expended By 6/30/07: $22,333
Expended By 10/1/07: $22,974

This project was intended to develop better methods of measuring how much base flow can be attributed to meadow recharge compared to upland recharge, particularly in relation to stream restoration projects. To overcome the limitations inherent in physical stream flow measurements, this project utilizes environmental tracers to help eliminate problems with probabilistic data noise inherent in physical flow measurements in differentiating between stream water and groundwater. The method is being tested in three different stream reach settings with varying complexities and varying levels of surface-to-groundwater interaction.

The final report is attached as Appendix B.

Feather River RCD Capacity Building
Sponsor: Feather River Resource Conservation District
Approved Funding: $47,750 (B funds)
Expended By 6/30/07: $47,750

The Feather River RCD expended the remainder of contract funds and submitted a final report in January 2007. The Feather River RCD maintained an exhibit at the 2006 Plumas-Sierra County Fair to display current and past projects and to conduct public education and outreach. The RCD also funded projects for three private landowners following public notice and submission and review of nine project proposals. The projects that were funded included a fuel reduction and star thistle eradication project ($1,125), a riparian fencing and streambank habitat improvement project ($7,500), and a tree and underbrush thinning and burning project ($5,235). The Forum

funding also supported the RCD staff in soliciting and reviewing project proposals, developing and administering contracts, and preparing articles for the Plumas County newspapers.

Upland Vegetation Management
Sponsor: Plumas Corporation
Approved Funding: $30,000 (B funds)
Expended By 6/30/07: $18,412
Expended By 10/1/07: $30,000

Plumas Corporation undertook this project to improve the capabilities of the upland vegetation to contribute to watershed health and viability. The two aspects covered by this portion of Plumas Corporation activities are the Quincy Library Group, a citizens group working directly with the U.S. Forest Service to carry out the *Herger-Feinstein Quincy Library Group Forest Recovery Act of 1998* (HFQLG), as well as the Plumas County Fire Safe Council, whose activities are administered by Plumas Corporation.

Plumas Corporation worked directly with Quincy Library Group members and the three local national forests (Lassen, Plumas and Tahoe) to implement the HFQLG project and its work program, extending until 2012. Plumas Corporation assists on the Upland Vegetation component of HFQLG, which is the forestry program. Hazardous fuels treatment was completed on over 30,000 acres in the HFQLG area in federal fiscal year 2006. Also, Plumas Corporation became a member of the California Climate Registry in December of 2006 and is focusing on assisting the Air Resources Board in developing protocols for forestry, meadow, and stream restoration which will help the implementation of the new California greenhouse gas programs on both public and private lands.

The Plumas County Fire Safe Council continued to carry out projects throughout the county in the wildland-urban interface (WUI). Plumas Corporation administers the projects and receives

contract administration expense reimbursement. Forum funds assisted in overall project planning and development. All projects are described at the website www.plumasfiresafe.org.

Four Creeks Project Development
Sponsor: Feather River CRM
Approved Funding: $50,000 (B funds)
Expended By 6/30/07: $50,000

The purpose of this project was to provide funding to develop plans for a number of restoration projects to the point where the projects themselves could be proposed for funding. Project development work that was completed included cross sectional surveys and conceptual project designs for Spanish Creek at Spanish Ranch, Silver Creek, Long Valley Creek, and two Sulphur Creek sites (Rapp/Guidici and Boulder Creek). Technical Advisory Committee meetings were held at each site to review the conceptual designs. Consultation was conducted with the California Department of Fish and Game for the projects on Spanish Creek and Long Valley Creek. Communication and coordination with landowners was ongoing throughout the project development process. Landowners attended the pre-funding Forum tour on Silver Creek, and the Last Chance site was reviewed with the landowner.

As a result of the development work, the Spanish Creek and Silver Creek projects were proposed for implementation funding from the Forum, and the Forum awarded funding in May 2006. The Last Chance project was included as part of Plumas County's Prop. 50 grant application, and funding was awarded in 2007. The Sulphur Creek projects have been awarded funding by the Plumas County RAC.

Watershed Forum Ongoing Projects

Hosselkus II Restoration Project
Sponsor: Feather River CRM
Approved Funding: $80,000 (A funds)
Expended By 6/30/07: $79,280

The construction contract for this pond and plug creek restoration project was awarded to Hat Creek Construction, and construction was completed in October 2006. Re-vegetation of the project site was initiated by working with the landowner in November and December.

Activity has continued in the 2007 work season with further re-vegetation work by volunteers, planting drier plug sites with pine saplings donated by the Forest Service, installing HOBO temperature loggers above and below the confluence of Hosselkus Creek and Indian Creek, and monitoring groundwater levels.

Feather River College Riparian Protection Project
Sponsor: Feather River College
Approved Funding: $92,453 (A funds)
Expended By 6/30/07: $90,231

This project was designed to improve the native pasture and wetlands on the Feather River College campus and better manage livestock with the goals of improving water quality in Spanish Creek and its riparian habitat and to offer educational opportunities to students and the community.

Primary work on this project was completed in the summer of 2005 with fencing to exclude livestock from riparian areas and the installation of heated and unheated off-stream water sources. The college also expanded and began the use of new dry-lots. The Natural Resource Conservation Services completed a pasture condition report in May of 2006, and water quality monitoring continued. The college also began using the new livestock facilities in conjunction with three new agriculture courses to demonstrate wetlands management, livestock management, and grazing practices.

Feather River College continues to see improvement to its pasture and wetlands. The evaluation of the water quality data collected to date has shown no significant environmental concerns from the college's operations. A new Feather River College grazing plan restricts livestock grazing in the college's fenced-out areas. The grazing restrictions have allowed a significant spread of healthy native vegetation, which serves as a natural "plant" water filtration system. The grazing management plan was based on a pasture condition report developed by Allen Bower, a Range Management Specialist with the Natural Resource Conservation Service.

Effective runoff drainage systems, primarily involving the "plant" filtration of livestock manure, were established in the riparian areas. Runoff has also been reduced at other campus locations, such as the fish hatchery, positively impacting the campus watershed in general. The college

reports that the primary goal of improving the quality of water draining from the college's facility into Spanish Creek has been accomplished, and the water quality data that has been collected has been offered to the Feather River CRM and the Upper Feather IRWM program for review and possible integration with other databases.

The riparian protection project has been incorporated into the college's environmental studies and agriculture curriculums to demonstrate various best management practices. The monitoring of water and wildlife will be an ongoing, permanent practice, including specific monitoring through 2010 that was included in the Forum funding agreement.

Sierra Valley Aquifer Testing
Sponsor: Sierra Valley Groundwater Management District
Approved Funding: $30,000 (A funds)
Expended By 6/30/07: $10,724

This project consisted of three aquifer tests to be conducted in the southwestern part of Sierra Valley near Sattley, east of Beckwourth, and north of Loyalton The three aquifer tests, along with about ten additional aquifer tests performed at different times since 1982, were to be used to determine aquifer characteristics and predict the effects of continued groundwater pumping on groundwater levels in certain areas. Where well interference is a significant problem, possible mitigating measures include development of well spacing criteria for new wells.

Ken Schmidt, the contract geohydrologist for the Sierra Valley Groundwater Management District, has reviewed aquifer test results and pump tests collected by his staff, prepared plots of well locations, drawdown, and recovery data, and prepared a report which is attached as Appendix C.

Red Clover Monitoring Project
Sponsor: Plumas Geo-Hydrology
Approved Funding: $28,000 (A funds)
Expended By 6/30/07: $20,099
Expended By 10/1/07: $22,417

This is a monitoring project with the objective of assessing baseflow augmentation due to stream restoration in a meadow that is affected by an adjacent ground water discharge area. The project focuses on Red Clover Valley, which has been the site of a number of past restoration projects, including an expansive Cal-FED funded project that was completed in the fall of 2006.

In March 2006, the contract with Plumas Geo-Hydrology was extended to include additional field data collection in the summer and fall of 2006. The final report is forthcoming.

Clark's Creek Aspen Enhancement and Ecosystem Restoration Project
Sponsor: Plumas National Forest
Approved Funding: $84,500 (A funds)
Expended By 6/30/07: $24,269
Expended By 10/1/07: $39,790

This project will restore the functioning condition of aspen stands within the Clarks Creek watershed, a tributary to Last Chance Creek. The project focuses on the release and regeneration of aspen communities from conifer suppression and encroachment. Conifers to be removed are within the existing aspen stand and include those trees actively suppressing aspen community productivity and function on 150 acres of land. Coniferous trees bordering aspen stands will also be removed to encourage the extension of the aspen community and improve the health of the existing stand. Timber removal activities will be accomplished through a combination of mechanical and manual thinning methods. Measures to protect stream channels and riparian zones will be incorporated. An additional focus of this project is to protect sprouts from excessive browsing. To limit extensive browsing of sprouts, Forest Service specialists and the allotment permittee will design and implement strategic grazing plans. Under these adaptive plans, existing levels of grazing within the project area could continue, but season or duration of use may be altered. When season or duration of use is inflexible, where intensive use has been previously documented, or where retaining any induced sprouting is absolutely critical, temporary exclusion fencing would be constructed. Traditional fencing (such as wire, or log fence) will be utilized when essential protection is required. Nontraditional fencing (strategic jackstraw barriers or guardian log placement) will be used when traditional fence construction is impractical or when high maintenance cost is anticipated.

Following initial wildlife, botany, and archeology work in the summer of 2006, NEPA review and sale planning proceeded during the summer of 2007. A final decision to approve the Environmental Assessment is expected in October 2007.

Meadow Valley – Silver Creek Restoration Project
Sponsor: Feather River CRM
Approved Funding: $51,000 (A funds)
Expended By 6/30/07: $1,040

This project is the result of a Forum-funded project development grant. The project will restore Silver Creek in Meadow Valley, a major tributary of Spanish Creek. The entire Meadow Valley stream system has degraded, including that portion of Silver Creek located in the valley. The planned treatments include affecting 250 feet of stream channel upstream of the main treatment section with three large, log jams designed to capture bedload; treating 50 feet of channel bank with boulder vanes, sloped bank and transplanted vegetation at the one bridge within the project reach; treating 60 feet of stream length with a fourth log jam within the actively eroding channel section to capture bedload and maintain channel grade; stabilizing 170 feet of channel bank with boulders placed under exposed tree roots and with transplanted vegetation; treating 320 feet of meander bend streambank with reshaped bank, boulder vanes and transplanted vegetation; treating 550 feet of stream channel with raised riffles and improved scour holes to reconnect the

inset channel with a mid-terrace (floodplain) and dissipate energy; and sloping back 110 feet of channel bank and vegetation with transplanted material.

Contracts were awarded in the summer of 2007 to complete the environmental surveys and reports required for the project, including botany, wildlife, and archeology. Construction is scheduled for 2008.

Meadow Valley – Spanish Creek Restoration Project
Sponsor: Feather River CRM
Approved Funding: $147,000 (A funds)
Expended By 6/30/07: $1,346

This project is the result of a Forum-funded project development grant. The project will restore Spanish Creek in Meadow Valley at Spanish Ranch. Spanish Creek in Meadow Valley has been historically manipulated and channelized, and it has subsequently degraded. Spanish Ranch Road (County Road 413) forces Spanish Creek to flow under a 43-foot wide bridge, which reduces the stream channel-floodplain width by 90 percent. The constriction is an effective barrier to high flows, causing it to slow and a large backwater area to form. Bedload material quickly deposits within this backwater area, creating large gravel bars that force flows against the opposite, eroding channel banks. The long-term result is the loss of property and a migration of the stream channel around the bridge. The planned treatments include inserting 12 culverts into the south approach to the bridge to alleviate pressure on the bridge, spread flood flows out onto 100 feet of floodplain, alleviate the backwater effect, and reduce upstream bank erosion and the potential for the stream to end-run the bridge. The project will treat 200 feet of eroding outcurve channel bank with boulder vanes, sloped bank, and transplanted vegetation. It will also remove 1,200 cubic yards of gravel berms used to further constrict and direct stream flows within a 2,300-foot long section of channel-floodplain upstream of the bridge, opening the section up for improved overbank flows and reducing concentration of flows against the entrenchment banks.

Contracts were awarded in the summer of 2007 to complete the environmental surveys and reports required for the project, including botany, wildlife, and archeology. Construction is scheduled for 2008.

Little Last Chance Restoration Project
Sponsor: Feather River CRM
Approved Funding: $115,000 (A funds)
Expended By 6/30/07: $14,331
Expended By 10/1/07: $15,943

This project is the result of a Forum-funded project development grant to complete initial survey work. The project area consists of two treatment reaches: North Creek and the East Creek. The entire project area is located on an alluvial fan. The Forum funding will complete design work

on the entire North and East Creek reaches and complete approximately 20 percent of the highest priority riffle augmentation construction.

The restoration concept for North Creek and East Creek is riffle augmentation. Both channels have been highly manipulated because of the fan location and intensive livestock and hay production. Rather than a network of often changing, shallow channels across the valley, flow has been restricted into these two main channels. A combination of concentration of flow, highway culverts, loss of sediment supply, and intensive agricultural use have contributed to the development of the degradation of the channels to an existing depth of three to nine feet. Irrigation diversion ditches and a grade control dam have helped reduce the rate of down-cutting, but the depth of the gully now captures enough flood flows to thwart most in-gully attempts at control. Two diversion structures are no longer operable, and most of the rest are at risk of failure. Because the channel bottom has not yet reached a resistant layer, without treatment, incision cycles are expected to continue moving upstream, resulting in a deeper and wider gully, making irrigation structure maintenance more difficult and expensive. Riffle augmentation is proposed for 58 locations on North Creek and 48 locations on East Creek and would result in flows slightly over 200 cfs in each channel spilling onto the floodplain. The project also includes management changes, primarily through fencing.

NEPA review was completed in the summer of 2007, as well as pre-project monitoring including vegetation transects, soil moisture readings, installing HOBO temperature loggers above and below the project, and other pre-project preparation. A construction contract has been awarded, and construction is scheduled for late in the 2007 season.

Lake Davis Water Treatment Facility
Sponsor: U.S. Army Corps of Engineers
Approved Funding: $488,260 (A funds)

This project involves the construction of a new 1.5 million-gallon-per-day water treatment facility at Lake Davis to serve the City of Portola and the Grizzly Lake Resort Improvement District. The original water treatment facility was taken out of service in 1997 when the Department of Fish and Game poisoned Lake Davis in an attempt to eradicate northern pike. Once the lake was recertified as a municipal water source and the City of Portola agreed to return to the lake as its water supply, it was determined that the old water treatment facility was obsolete and needed to be completely replaced.

A new water treatment plant has been designed and, with the U.S. Army Corps of Engineers serving as the lead agency, bids were solicited in August 2007. Unfortunately, the low bid on the project was substantially higher than the engineer's estimate, and Plumas County and the City of Portola have been attempting to identify additional funding to pay for the project. If funding is found, construction of the new facility will begin in the spring of 2008.

Forest Canopy Interception Study
Sponsor: Plumas Geo-Hydrology
Approved Funding: $21,000 (B funds)
Expended By 6/30/07: $15,460
Expended By 10/1/07: $17,082

This project is a field study assessing the utility of environmental isotopes in water to determine the effect of forest canopy density on soil moisture abundance and baseflow. The project includes verification and refinement of the results of a 1997 preliminary throughfall field study, using comparatively simple field technology; examining evaporation loss during forest canopy interception and infiltration through forest litter and soil using the naturally occurring environmental isotopes deuterium and oxygen-18 in water; and examining the extent to which the isotope signatures induced by evaporation in the forest canopy and in soil waters can be recognized in baseflow.

Prior progress on this project included preparation and setup of throughfall collection stations, collection of throughfall samples, collection of surface water samples, data entry and analysis, photography of canopy densities, isotope sampling and soil core sampling, and laboratory analysis. Work continued through the summer of 2007 pixel analysis of canopy pictures and further data collection and analysis. The final report is forthcoming.

Feather River Watershed Public Awareness Campaign
Sponsor: Feather River CRM
Approved Funding: $33,668 (B funds)
Expended By 6/30/07: $14,644
Expended By 10/1/07: $17,880

The *Feather River Watershed Public Awareness Campaign* is a concerted effort to bring water quality and watershed-related information into the homes and minds of residents of the Feather River watershed. By engaging landowners, educators, students and community members in multiple formats for learning about watershed issues, improved understanding and increased participation in stewardship activities will result over time.

The CRM's Watershed Map was completed and presented to the Plumas County Board of Supervisors in October 2007. The map presents the Feather River watershed, as well as the relation of the Feather River to the Sacramento River watershed and the rest of California. The map is a large-format document, and copies may be obtained from the Feather River CRM.

Other outreach and education activities have included completing a sediment and erosion control brochure for small-scale construction sites; sponsoring a storm drain stenciling watershed stewardship event in Quincy to celebrate Watershed Awareness Month in May; and publishing a watershed awareness opinion article in the Plumas County newspapers.

Appendix A

RFP for Program Review

Plumas County Flood Control & Water Conservation District

Request for Proposals
for
Program Review of the
Plumas Watershed Forum

Project Budget: Not to exceed $75,000.

Introduction

The Plumas Watershed Forum ("Forum") was formed in 2003 as part of a Settlement Agreement stemming from litigation involving California's State Water Project. The Plumas County Flood Control District is one of the long-term contractors receiving water from the State Water Project, and Plumas County and the Upper Feather River watershed are the source of water for Lake Oroville, the primary storage facility for the State Water Project. The Forum's purpose is to implement watershed management and restoration activities for the mutual benefit of Plumas County and the State Water Project.

As provided in the Settlement Agreement, the Forum is composed of three voting members:

- Plumas County Flood Control & Water Conservation District
  (governed by the Plumas County Board of Supervisors)
- California Department of Water Resources
- State Water Project Contractors
  (the State Water Project contractors other than Plumas)

The Settlement Agreement provided for payments to the Forum and Plumas totaling $1 million per year from 2003 through 2006, with an additional four years of payments upon completion of milestones in unrelated areas of the Settlement Agreement. The other milestones have not yet been achieved, but the Settlement Agreement provides that the parties may continue funding for the Forum depending on the success of the watershed work, among other things.

Additional information about the Settlement Agreement and the Forum is available at:
http://www.countyofplumas.com/publicworks/watershed/index.htm
http://www.des.water.ca.gov/mitigation_restoration_branch/rpmi_section/projects/index.cfm

To assist the parties in determining whether to continue funding, the Forum has directed that a program review be conducted by an independent evaluator. This Request for Proposals seeks proposals from persons interested in conducting the program review set forth in the attached Scope of Work.

The deadline for submission of proposals is **4:00 p.m. PDT on Friday, November 16.**

Proposals will be evaluated as described below, and a contract will be negotiated with the highest

ranked respondent.

All questions regarding this RFP should be e-mailed to brianmorris@countyofplumas.com by November 2, 2007. A written response to the questions and any amendment or addendum to the RFP will be available no later than November 5, 2007, and will be sent to all persons who have requested this RFP.

Proposal Content and Format

A qualifying proposal will include the following:

1. Biographical Information

    a. Name, mailing address, telephone number, and e-mail address of the primary contact.
    b. Business name, address, and owner's name, if different than above.
    c. Brief history of personal or company experience. Testimonials from previous clients may be included.
    d. Credentials and background for key managers or employees to be assigned to this contract.
    e. Description of experience in providing similar services and a list of relevant references.
    f. Hourly rates by staff position and description of tasks typically carried out by each position

2. Service Plan

    a. Description of anticipated staffing to complete the Scope of Work.
    b. Description of approach to the Scope of Work.
    c. Estimated schedule and timeline for completion of the project, assuming:
        i. contract award by December 1, 2007
        ii. submission of draft report by March 28, 2008, with two-week review period
        iii. submission of final report no later than April 30, 2008

General Conditions and Provisions

1. Services shall be provided in accordance with all applicable laws and regulations and professional standards of practice.

2. Services shall be provided as an independent contractor and not as an employee or agent of the Flood Control District or Forum.

3. Contractors shall be required to maintain worker's compensation and general and professional liability insurance coverage, with limits of the liability coverage equal to or greater than $1 million dollars per occurrence/$1 million aggregate.

4. Any questions related to this RFP are to be directed to the contact person identified above. Do not contact other Flood Control District or Plumas County personnel regarding this project or the selection procedures during the RFP process.

5. All work performed for the Flood Control District, including all documents associated with the work, shall become the exclusive property of the Flood Control District.

6. The Flood Control District reserves the right to:

A. Reject any or all submittals.
B. Request clarification of any submitted information.
C. Waive any informalities or irregularities in any qualification statement.
D. Not enter into any agreement.
E. Not select any service provider.
F. Cancel this process at any time.
G. Amend this process at any time.
H. Interview prospective contractors prior to award.
I. Negotiate all final terms and conditions of any agreements entered into.
J. Issue similar RFPs in the future.
K. Request additional information during this process.

7. Respondents may not alter submittals after the deadline for submission. The Flood Control District reserves the right to make corrections or amendments to documents due to clerical errors identified in submittals by the Flood Control District or the respondent.

8. All costs arising from preparation of a proposal to respond to this RFP and participation in the selection process shall be borne by respondent without reimbursement by the Flood Control District.

9. Respondents assume the risk of the method of submitting their proposals. The Flood Control District assumes no responsibility for delays caused by delivery service. Postmarking by the due date will not substitute for actual receipt.

Proposal Submission

Respondents must submit **three copies** of their proposal to:

Plumas County Flood Control District
c/o Clerk of the Board
520 Main Street, Room 309
Quincy, CA 95971

Attn: Watershed Forum RFP

Proposals must be received by **4:00 p.m. PDT on Friday, November 16.**

Evaluation of Proposals

Proposals will be evaluated by the Flood Control District and the Forum's Core Technical Advisory Committee. Proposals will be ranked based upon their adherence to RFP requirements and the following criteria:

1. Respondent's specialized experience, performance record, qualifications, and technical competence as related to review of the Forum program.

2. Respondent's demonstration of a clear understanding of the services to be provided as evidenced in the proposal, including a general description of the approach for evaluating the different types of projects or activities (for example, appropriate metrics or significance criteria).

3. Respondent's commitment and ability to successfully complete the project and meet staffing requirements.

4. Billing rates.

5. Respondent's ability to provide the required services promptly.

6. Respondent's reputation as determined by references and documented past performance history.

Selection

The Flood Control District reserves the right to be the sole judge of acceptability of any proposal. Selection will be based on programmatic and qualitative service measures as described in the evaluation criteria.

After selection, negotiations will be entered into with the selected respondent. If negotiations are unsuccessful in achieving a contract to perform the scope of work, the Flood Control District reserves the right to enter into negotiations with the next highest scoring respondent until a successful contract is negotiated.

Contract negotiation may result in clarification or expansion of the scope of work.

Plumas Watershed Forum
Scope of Work for Program Assessment

Members of the Plumas Watershed Forum (Forum) have agreed to conduct a program assessment for evaluating all expenditures of settlement funds to meet the Monterey Settlement Agreement's goals, the Forum's Bylaws and Policies, and the Feather River Watershed Management Strategy. This objective assessment will be performed by an independent consultant.

The assessment is intended to qualitatively assess the objectives and results of proposal solicitation, project implementation, management, funding, monitoring data, project management, reporting, etc. in terms of satisfying the specific goals of the Monterey Settlement Agreement for Watershed Programs. These specific goals are:

1. Improve retention (storage) of water for augmented base flow in streams;
2. Improve water quality (reduced sedimentation), and streambank protection;
3. Improve upland vegetation management; and
4. Improve groundwater retention/storage in major aquifers.

The Feather River Watershed Management Strategy was developed by the Forum to further refine and guide the priorities for watershed management and restoration actions for funding projects.

The Monterey Settlement Agreement requires that a majority of all funds paid to Plumas be applied to Watershed Programs (so called "Majority" or "A" funds). The settlement parties agreed that $500,001 dollars out of each $1 million payment would be deposited into this fund. The assessment should evaluate how well the Monterey Settlement Agreement's specific goals were met with regard to the priorities set forth in the Feather River Watershed Management Strategy.

The Monterey Settlement Agreement allows the remaining funds (so called "Minority" or "B" funds) to be spent for other purposes of the Flood Control District at the discretion of Plumas but with due consideration for the needs of the Forum. The assessment should:

- Evaluate the extent to which the expenditure of Minority/B funds advanced the goals of the Forum.
- Review the expenditure of funds through the Forum/Technical Advisory Committee (TAC) process for direct benefit of the Forum, as well as independent expenditures by Plumas to indirectly advance the goals of the Forum.
- Review the success of "capacity building" efforts and judge whether additional assistance could be beneficial.
- Provide a complete inventory of all uses of Minority/B funds, regardless of any relation to the Forum goals.

The success of the program should also be evaluated in terms of how well the Forum and TAC spent A and B funds to meet items 6 through 8 of the Forum's bylaws as listed below:

6 **Project Selection:** The Forum shall be guided in its selection of projects by the following principles:
   - **a** Funding criteria emphasizing matching or supplemental funding.
   - **b** Selection criteria linked to a strategic plan.
   - **c** Project criteria emphasizing certain landscapes and types of work.
   - **d** Probability of meeting performance criteria.
   - **e** Probability of increasing public education and awareness.

7 **Settlement Principles:** The Forum shall be guided by the Settlement text entitled "Watershed Forum and Programs" (pp18 –20), to which reference shall be made in the event of an inability to reach consensus on any particular issue.

8 **Planning:** The Forum shall focus on both short-range and long-range planning in order to optimize expected benefits to the Plumas Watershed.

The assessment should also evaluate the effectiveness with which the following reporting requirements from the Bylaws were met:

9 **Financial Reporting:** The Forum shall, at its annual October meeting, review the prior fiscal year's income and expenditures prepared by the Plumas County Auditor-Controller for the Plumas Flood Control and Water Conservation District, which District shall hold, utilize and carry forward funds as set forth in the Settlement text.

10 **Annual Progress Reports:** The Forum shall direct Plumas' preparation of an annual progress report in layperson's language, with Technical Committee review, and with technical appendices as necessary, in order to assist public education and awareness. The report should be finalized by the annual October meeting.

The assessment should evaluate all project proposals, funded projects, and designated funding for administrative and other activities. A list of funded projects is included at the end of the Scope of Work. Beyond the listed projects, the balance of the $4 million in funding has been used primarily for staffing, program administration, and separate purposes of the Plumas County Flood Control District (mainly professional services from outside consultants).

To assist with the State Water Project Contractors' decision as to whether to voluntarily continue to fund the Forum pending completion of the new Monterey Plus Environmental Impact Report, the assessment should attempt to answer the following

questions, either qualitatively or quantitatively, to the extent that time, data, and budget constraints will allow:

1. How do the Forum's actions in general benefit the State Water Project?

2. How do the meadow restoration projects benefit the State Water Project?

3. Of the projects that have been completed, can the benefits that are observed or calculated be extrapolated to a larger scale?

4. If additional restoration work is conducted, what are the predicted benefits to the State Water Project?

5. How should future project funding actions proceed in regards to achieving quantifiable benefits to the State Water Project? What recommended actions and funding should be implemented to qualify such benefits (i.e., long-term monitoring)?

As a final element, the assessment should include a summary overview of other activities in the Upper Feather River region and their relation to the Watershed Forum program and objectives.

Implementation

Flood Control District staff will work closely with the reviewers to facilitate the Program Review, including collection of documents, information, and project reports and contact with project sponsors. The reviewers should expect to make direct contact with project sponsors to ask project-specific questions or to schedule meetings, interviews, or site visits.

Meetings with project sponsors are expected, including on-site project review.

The Forum partners anticipate the periodic submission of written products (review of methodologies, draft sections of the final report, etc.) with conference calls with Forum staff and the reviewers approximately every two weeks to review progress and the reviewers' approach to the project. Among other things, this interaction is expected to refine significance criteria and yardsticks for evaluating the different types of projects, as well as to ensure the Program Review is answering the questions outlined in this Scope of Work.

Review of raw data will vary depending on the nature of each project and availability of data. In finalizing the contract and final list of tasks to be performed under this Scope of Work, Forum staff will consult with the reviewers to determine whether raw data will be reviewed for a particular project or whether a review of the project's final report will be sufficient, giving consideration to other tasks to be completed and budget limitations.

The Program Review will be completed upon the Forum's acceptance of the final report.

In the event the Forum members would like a presentation of the final report, representatives of the reviewers should be available to attend the Forum's spring meeting in Quincy (tentatively scheduled for May 22, 2008). This item would be negotiated as an add-on to the contract following submission of the final report.

Plumas Watershed Forum - Funded Projects

A Fund

Project	Sponsor	Funding	Approved
Sulfur Creek Data Collection	U.C. Cooperative Extension	$ 3,000.00	
Charles Creek	Feather River CRM	$ 35,000.00	8/31/2004
SVGMD Monitoring Wells	Sierra Valley Groundwater Management District	$ 120,984.24	8/31/2004
Rogers Creek Road Relocation	Plumas National Forest	$ 63,500.00	10/26/2004
Charles Creek and Hosselkus Creek	Feather River CRM	$ 115,000.00	10/26/2004
Feather River College	Feather River CRM	$ 92,453.00	5/23/2005
Sierra Valley Aquifer Testing	Sierra Valley Groundwater Management District	$ 30,000.00	5/23/2005
Red Clover Monitoring	Plumas Geohydrology	$ 25,000.00	5/23/2005
Clark's Creek - Aspen Restoration	Plumas National Forest	$ 84,500.00	5/23/2005
Four Creeks	Feather River CRM	$ 25,000.00	5/23/2005
Jordan Flat	Feather River CRM	$ 64,000.00	5/23/2005
Silver Creek - Burney's	Feather River CRM	$ 51,000.00	5/23/2006
Spanish Creek - Kellet's	Feather River CRM	$ 147,000.00	5/23/2006
Ramelli Ditch	Plumas National Forest	$ 85,000.00	5/23/2006
Little Last Chance Creek	Feather River CRM	$ 115,000.00	5/23/2006
Dixie Creek	Feather River CRM	$ 56,000.00	5/23/2006
Red Clover Monitoring	Plumas Geohydrology	$ 3,000.00	5/23/2006
Ferris Fields	Feather River CRM	$ 86,000.00	5/23/2006
Lake Davis Water Treatment Plant	Plumas County Flood Control District	$ 488,260.00	
Project Total		$ 1,689,697.24	

B Fund

Isotope Monitoring	Plumas Geohydrology	$ 23,000.00	10/26/2004
Project Coordination and Monitoring	Feather River CRM	$ 70,000.00	10/26/2004
Sierra Valley RCD Capacity Building	Sierra Valley Resource Conservation District	*below*	10/26/2004
Feather River RCD Capacity Building	Feather River Resource Conservation District	*below*	10/26/2004
QLG and Forest Watershed	Plumas Corporation	$ 50,000.00	10/26/2004
Sierra Valley RCD Capacity Building	Sierra Valley Resource Conservation District	$ 50,000.00	5/23/2005
Feather River RCD Capacity Building	Feather River Resource Conservation District	$ 47,750.00	5/23/2005
Forest Canopy Interception Study	Plumas Geohydrology	$ 21,000.00	5/23/2005
Upland Vegetation Management	Plumas Corporation	$ 75,000.00	5/23/2005
Feather River CRM Outreach	Feather River CRM	$ 33,668.00	5/23/2005
Four Creeks - Development	Feather River CRM	$ 50,000.00	5/23/2005
Project Total		$ 420,418.00	

Appendix B

Baseflow Monitoring in the Last Chance Watershed

Plumas Geo-Hydrology
LAND AND WATER RESOURCES
P.O. Box 1922, Portola, CA 96122
tel. (530) 836-2208, fax (530) 836-0959

Baseflow Monitoring in the Last Chance Watershed: Big Flat Meadow and Rowland-Charles Reach of Last Chance Creek

September 22, 2007

Technical Summary Report

prepared for

Plumas County Flood Control and Water Conservation District

by Burkhard Bohm, Hydrogeologist, CA Lic. No. 337

Table of contents

Executive summary

Project description

1. The objective is to examine how to quantify baseflow augmentation after stream restoration, by comparing pre- and post-restoration baseflow environmental isotope signatures.
2. Data were collected from two sites in the Last Chance watershed: Big Flat on Cottonwood Creek and the Rowland-Charles Reach of Last Chance Creek. Samples were collected from streams, wells and springs for analysis of the isotopes deuterium and oxygen-18, major ion chemistry, together with field EC, temperature, stream stage and well water level data.
3. Environmental tracer data proved useful in clarifying stream-to-ground water interactions and suggest a way to quantifying baseflow augmentation.

Summary of findings:

Big Flat on Cottonwood Creek

1. The tracer data confirm that the Big Flat floodplain aquifer is recharged by infiltration in the upper meadow channel, which then discharges back into the lower meadow channel.
2. Isotope and streamflow data indicate that in a period of four weeks in February 2005 the floodplain aquifer was recharged with 55 ac-ft, raising the ground water table by about 3 ft. This water is slowly discharged back into the channel in the following three months.
3. Flow and water chemistry data also indicate that after mid-March the floodplain aquifer and downstream channel received inflow from the underlying bedrock aquifer from upland ground water recharge, further augmenting Cottonwood Creek flow.
4. In this hydrologic setting ephemeral channel flow depends mostly on upstream channel inflow, leading to floodplain aquifer recharge, which is returned into the channel by mid-summer.

Rowland-Charles Reach of Last Chance Creek

1. These data show the significance of upland ground water recharge for maintaining flow in a small intermittent stream channel.
    a. The floodplain aquifer receives year round ground water inflow from the eastern and western upland bedrock regions, sufficient to raise the ground water table by 4 to 7 ft in winter and spring, leading to ephemeral stream flow.
    b. After April ground water discharge from the western uplands diminishes, making floodplain ground water levels subside and depriving the channel of its water source. The channel is dry by mid June.
2. In this hydrologic setting ephemeral channel flow depends almost entirely on upland ground water recharge.

Implications for stream restoration projects

Although this project did not have the benefit of pre- and post-restoration project data, it provided valuable insights into the utility of isotope data to examine baseflow augmentation in two different ephemeral floodplain settings:

1. Increased floodplain aquifer storage due to meadow restoration can be measured by comparing pre- and post-restoration baseflow isotope characteristics, under one or both of the following conditions:
    a. Stream water isotope signatures change from winter into spring and summer.
    b. Ambient floodplain aquifer water isotope signatures uniquely differ from stream water.
2. Increased floodplain ground water storage can be measured in at least two ways:
    a. Comparison of up- and downstream tracer compositions, for pre- and post-project data.
    b. Comparing pre- and post-restoration aquifer composition as a function of ground water level changes.

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Introduction

This report is an analysis of the isotope and other environmental tracer data collected between fall 2004 and fall 2005 from ground and stream waters in the Last Chance Creek subwatershed of the Feather River basin. This work is the subject of the Last Chance Baseflow Monitoring Project. The main objective was to explore alternative methods to assess the impacts of stream channel restoration on baseflow. This report is an attempt to provide a comprehensive analysis of the findings made in this project, aimed at providing a more complete picture of the hydrologic situation in two limited reaches in the Last Chance watershed.

Background

Baseflow augmentation is one long range benefit believed to be derived from watershed restoration. From a conceptual hydrological standpoint this argument has a great deal of validity. However, baseflow augmentation is difficult to measure, particularly in small, ungaged watersheds. Hydrograph separation based on physical stream flow is of limited use in small watersheds since physical stream flow measurements are of limited resolution. This leads to significant uncertainty whether flow increases are due to restoration or natural annual variability of ground water influx (for example in an unusually wet year or period of years). The issue is further complicated by the probabilistic nature of stream flow data.

It is quite possible that late year stream flow is less affected by spring flood flow temporarily stored in the floodplain, but maybe more so by ground water discharged from the upgradient reaches. In other words, conceptually, late year channel flows in an upper watershed meadow can be made up of several components, listed in decreasing order of importance:

1. Channel flow from the reaches upstream of the meadow. i.e. baseflow released from upstream alluvial areas and/or adjacent uplands.
2. Baseflow originating from the upland areas directly adjacent to the meadow, entering the floodplain deposits from the bedrock underlying and adjacent to the meadow.
3. Baseflow released from the floodplain aquifer of the meadow.

Among these three components the third makes up the smallest portion and is therefore the most difficult one to identify. However, it is the portion most affected by channel degradation and is thus of greatest interest in stream channel and meadow restoration projects.

In the opinion of this author the benefit of baseflow augmentation due to meadow restoration is very difficult (if not impossible) to quantify by means of physical streamflow measurements (the problem is explained in more detail in Attachment B, using the example of Big Flat meadow).

Project purpose and scope

To date very little, if any information is available about how ground water and stream water interact in the hydrologic settings of the Last Chance watershed. While the effect of baseflow augmentation is readily visible in many restoration projects, it is typically quantified in terms of water table rise and ecological parameters. Measuring benefits in terms of water yield for sustaining ecosystems in the late season have so far been limited by our limited understanding of stream-ground water interactions. Under these conditions it is difficult to design effective monitoring programs to measure yield due to baseflow augmentation.

The goal of this project is to explore alternative methods to quantify baseflow augmentation due to stream and meadow restoration projects. The intent is to identify hydrograph components (i.e. surface flows, shallow meadow aquifer, upland subsurface flows) by their environmental isotope signatures. Then compare pre-restoration with post-restoration baseflow signature characteristics to discern the baseflow augmentation due to restoration.

This project utilizes naturally-occurring isotopes of hydrogen and oxygen (deuterium and oxygen-18) together with selected major dissolved ions in stream and ground water to help overcome limitations inherent in physical flow measurements.

The Big Flat project had no pre-restoration isotopic data to be compared with post-project data since restoration has already been implemented. The initial concept for the Rowland-Charles Reach of LCC was for pre-project data to be collected for later comparison. However, this research project did not commence until after restoration was completed in the fall of 2004. Therefore at neither site was it possible to compare pre- and post-restoration conditions.

This required a change in sampling strategy where isotope data collected above and below each project were characterized, allowing analysis of the effects of channel and meadow restoration in-between.

Although this was the second choice strategy, the data has significantly improved our understanding of environmental tracer patterns under conditions of stream-ground water interactions in these landscape settings, which is a prerequisite for efficiently assessing the success of restoration enhancing ground water storage.

It is anticipated that the greatest benefit of this project will be in being able to devise better monitoring programs for upcoming restoration projects. One particular project that may benefit from what was learned from this project will be the Red Clover Restoration project near McReynolds Creek, completed in summer 2006.

Acknowledgments

This project was funded by the Plumas Watershed Forum and administered by the Plumas County Flood Control District. Thanks go to Tom Hunter and the Forum members for taking an interest in this problem and approving the proposal that is the basis of this project. Most importantly, both Jim Wilcox and Leslie Mink deserve most credit for taking upon themselves the formidable challenges of winter data collection, having to travel long hours to remote sites by snowmobile. Thanks also go to Terry Benoit and Jim Wilcox for many helpful discussions and review of the initial draft.

Project locations

Two separate hydrologic sites were monitored in the Last Chance Creek (LCC) watershed:

1. Big Flat Meadow, on Cottonwood Creek, a tributary to LCC. This is located on Plumas National Forest (USFS) land, Beckwourth Ranger District (Section 36 of T.27N.,R.13E. and Section 1 of T. 26N., R 13E.).
2. The Upper Last Chance Creek Project: this area includes two sub-reaches (Rowland-Charles Reach and the Charles Bird Reach), about 3500 ft apart. Channels in Rowland-Charles Reach were restored in the Fall of 2004 (Section 7 of T25N-R16E). The Charles-Bird Reach (Sections 1 and 6 of T25N-R15E) is slated for future restoration and is currently being used as a control reach. The project is located on Nature Conservancy Land:

These project areas are shown on the two location maps in Figures 1 and 2.

The two sites markedly differ in their hydrologic features. Both sites are located within areas subject to ongoing restoration efforts.

Data collection

Samples were collected from streams, wells, springs and precipitation for analysis of the isotopes deuterium and oxygen-18, major ion chemistry. EC, temperature, stream stage and well water level data were collected in the field. Adequate sample representation was assured by sampling only well mixed channel reaches. Ground water samples were collected by bailer from monitoring wells installed with _ inch galvanized steel pipe (‘drive probes’), stainless steel well points, _ inch PVC casing, or 4 inch PVC sewer pipe. These improvised monitoring wells were originally intended only for measuring depth to ground water.

For the small diameter wells a bailer was made from 3/8 inch copper pipe. Isotope samples were collected in 40 ml glass vials with screw caps and Teflon liners. Chemistry samples were collected in 250 ml plastic bottles. Well water levels were measured with an electric well sounder.

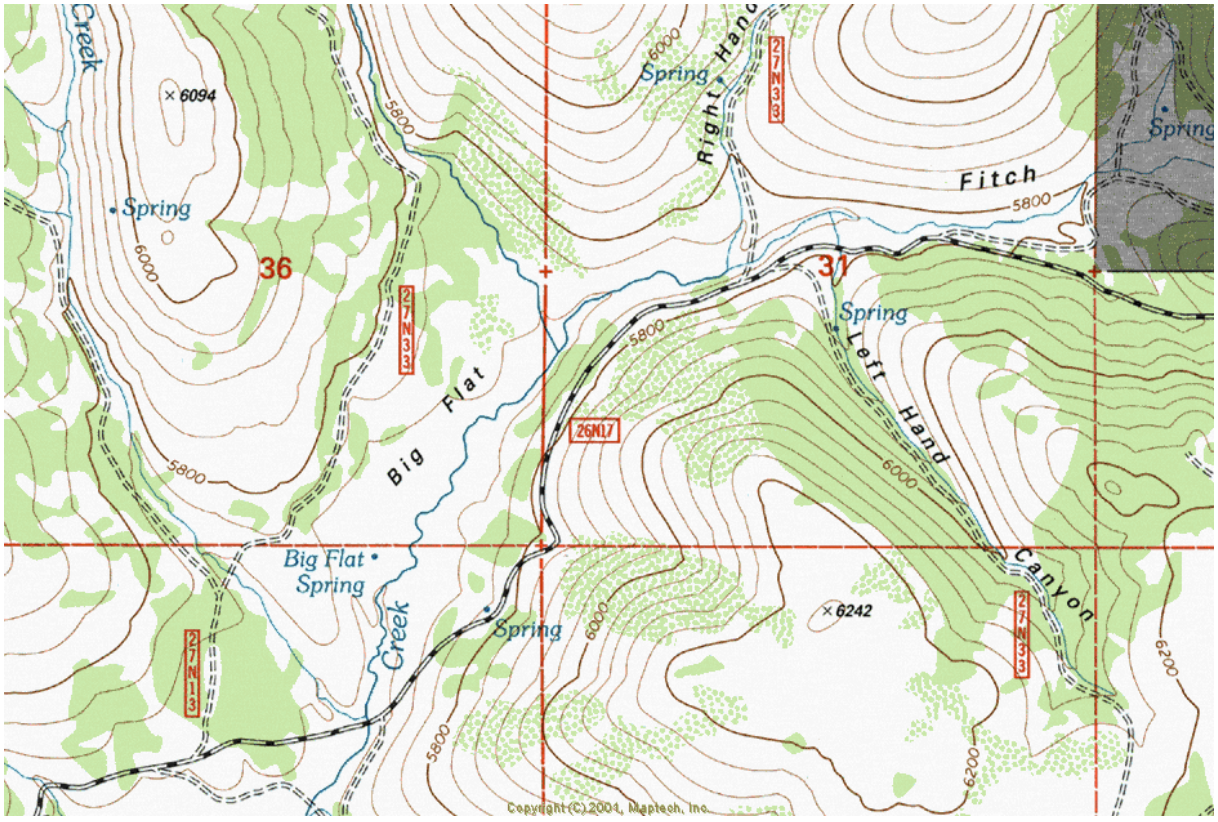

Figure 1: Location map, Big Flat Meadow on Cottonwood Creek

Sample schedules

Both project sites have been subject to intense data collection before the advent of this project, and will continue in the future - by Plumas Corporation, UC Davis and Stanford University. Fall, summer and spring field data collection was conducted mostly by the author of this report. Winter data collection was "piggybacked" onto the ongoing monitoring, via snowmobile, of the Last Chance Creek Watershed Project conducted by Plumas Corporation.

Data were collected in about 30 day intervals beginning in November 2004, continuing through winter and into early summer 2005:

1. At the Last Chance Creek site 54 isotope samples were collected in 10 sample runs between December 16, 2004 and June 16, 2005, after which streamflow ceased.
2. At the Big Flat site a total of 72 isotope samples were collected in 12 sample runs, beginning in November 2004 and ending on November 27, 2005.

Isotope analysis was conducted by UC Davis Isotope Labs. A select number of samples were also analyzed for major ion chemistry by Sierra Environmental Monitoring Lab in Reno, Nevada.

Graphic presentation of isotope concentrations

The non-technical reader may notice that isotope concentrations are displayed as negative values. These are units of “per mil deviation from the SMOW standard”, where ‘SMOW’ stands for ‘standard mean ocean water’. In other words isotope concentrations of oxygen-18 and deuterium in water are expressed in comparison with ocean water (SMOW). The values are negative since on land meteoric waters are typically depleted with these isotopes, when compared to ocean water. It should be kept in mind that the more isotope concentration a sample contains, the less negative its isotope value is, and vice versa.

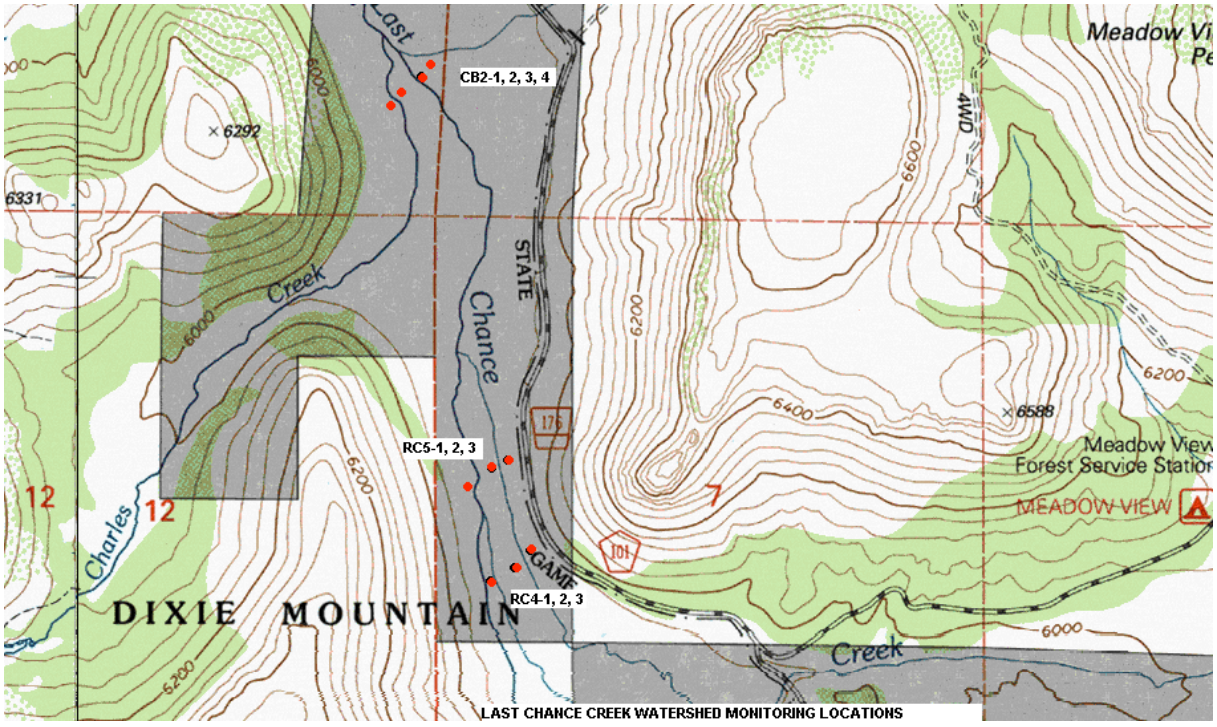

Figure 2: Location map, Rowland-Charles Reach of Last Chance Creek

Big Flat Meadow on Cottonwood Creek

The 47 acre Big Flat Meadow is located on a SSW flowing reach of Cottonwood Creek. The general slope of the meadow increases in the lower 1/3 of the meadow, where a small spring emerges. Cottonwood Creek flows into LCC about two miles further south. The NNE extent of the meadow is about 3500 ft, and meadow width is up to about 700 ft. A topographic map is shown in Figure 1.

The hydrologic features were summarized by Sagraves (1996, p. 13). Flow conditions in Cottonwood Creek follow a well defined seasonal pattern. Snowmelt runoff makes up the bulk portion of runoff, between late January and May or June. Peak runoff levels are in March and April. Typically flows end by midsummer (June-July).

This area encompasses the Big Flat Restoration Project, completed in 1995. Originally equipped with at least 20 monitoring wells and two stream gauging stations Big Flat has been subject to ongoing data collection since the mid 1990's (Sagraves, 1996; 1998, 2006). Stream flow monitoring began in 1994, the summer before the stream channel was restored. With at least nine monitoring wells and two recording gauging stations data collection will continue into the foreseeable future (Jim Wilcox, pers. com.).

Several types of low cost monitoring wells were originally installed to test their efficacy, resulting in numerous installations of limited utility due to improvised and poor construction methods (dictated by budget limitations). Many of these monitoring wells were affected by sedimentation or damaged by animals. Difficult winter site access and logistics posed a further constraint on data collection and most of these monitoring wells were monitored in irregular intervals. Only in three monitoring wells was it possible to collect a more continuous data record, covering up to 12 months. A six-inch well, is located in the upper meadow. Since no drillers log is available, nothing is known about its construction details, though a sounding indicates that this well is more than 100 ft deep.

The layout of the pertinent monitoring wells sampled are shown on a schematic sketch map in Figure 3, conveniently simplified for the Summary reader's overview.

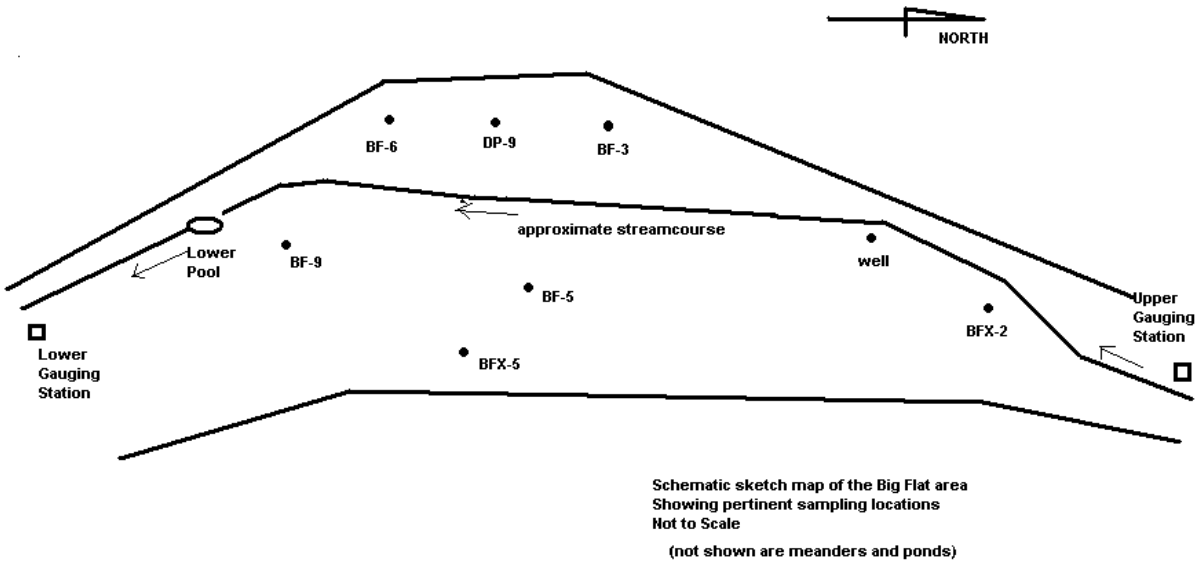

Figure 3: Big Flat Meadow, schematic sketch map of pertinent monitoring well locations at Big Flat.

Floodplain aquifer responses to stream flow

The isotope data in stream water show wide variations between summer and winter. Ground waters follow these changes but with smaller ranges, suggesting displacement by channel infiltration.

Figure 4 and Figure 5 are Deuterium and O-18. Shown here are:

a. Stream water Deuterium and O-18 changes at the upstream (green), and downstream (red) gauges.
b. Upper and lower floodplain aquifer Deuterium and O-18 changes (light and dark blue).
c. Bedrock aquifer composition in East Spring (black), located about 1000 ft east of the lower stream gauge, next to Fitch Canyon Road (Figure 1). (It was not possible to obtain a bedrock aquifer sample from the six-inch well in the upper meadow).
d. The local meteoric water line (LMWL) serves as a reference line. It is a regression of snow isotope data collected nearby. Stream waters plot away from the LMWL due to changes in snow melt composition before and during infiltration.

Figure 4: Isotope changes in Big Flat stream flow

1. Cottonwood Creek is an intermittent stream. It began flowing upstream in late January 2005, about four weeks before it started flowing downstream in late February. Streamflow ended in mid-June 2005 (though samples were obtained in mid-December from a pool in the lower meadow).
2. Stream water compositions changed significantly at both gauges. On Figure 4 the data plots resemble loops, with the lower end in late February (close to bedrock aquifer composition) and the upper end in June.
3. After June 2005 stream water data were affected by evaporation when flow diminished to stagnant puddles.

In summary, beginning in early winter stream water changed from a composition somewhere in the upper right diagram toward a composition resembling that of ground water in bedrock aquifer (lower left plot). Then throughout the remaining winter and into the summer it shifted back to the upper right, attaining its final "summer" composition.

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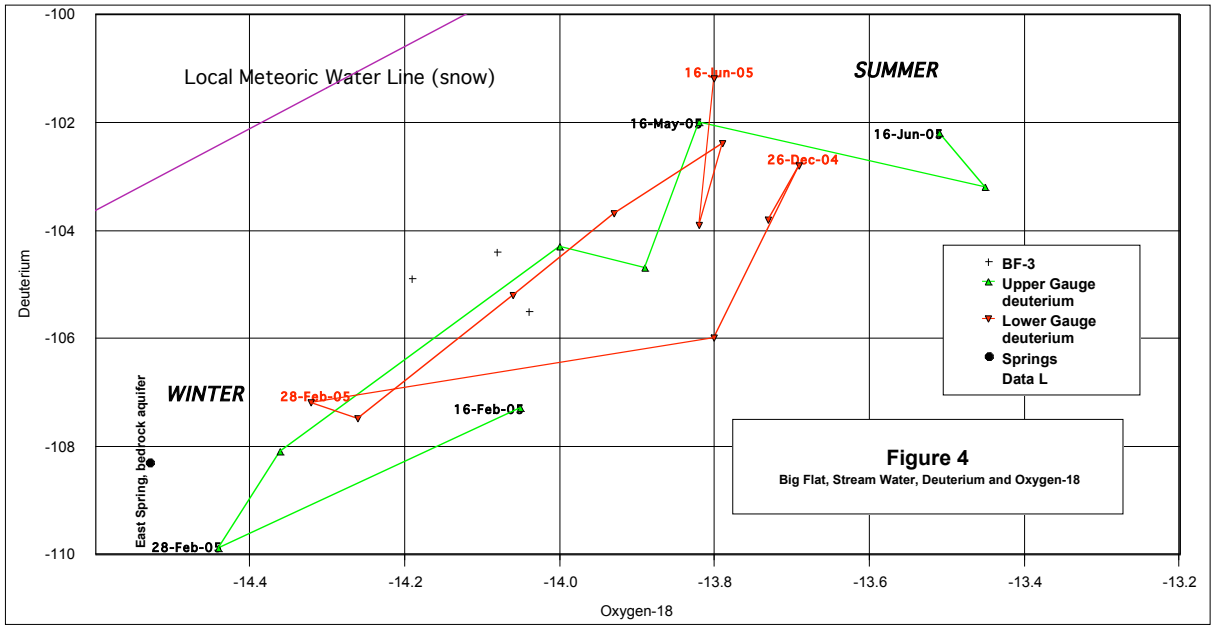

Figure 4
Big Flat, Stream Water, Deuterium and Oxygen-18

Figure 5: Changes in floodplain aquifer composition

1. Upper and lower floodplain aquifer compositions are represented by data from two monitoring wells, BFX-2 and BF-9, which are about 1800 ft apart. BFX-2, in the upper floodplain, is about 750 feet down gradient from the upper stream gauging station. BF-9, in the lower floodplain, is about 900 ft upgradient from the lower gauge (see Figure 3).
2. The floodplain ground water isotope data trend between summer stream water (upper right) and bedrock aquifer composition (lower left). The patterns resemble those observed in the stream waters, however the range (variability) is much narrower.
3. The changes in floodplain aquifer are significant, indicating mixing between two source waters.

a. Since ground water patterns mimic stream water changes. Since it range is exceeded by that of channel water it is concluded that stream water infiltrated into the floodplain aquifer - not vice versa. This supports what has been hypothesized before.

b. Inundation by a water resembling winter stream water composition is more complete in the upper than the lower floodplain aquifer. This suggests that most infiltration occurred in the upper channel, while some ground water was discharged back into the downstream channel.

The data indicate that inundation by stream water is a gradual process that continued as long as Cottonwood Creek was flowing.

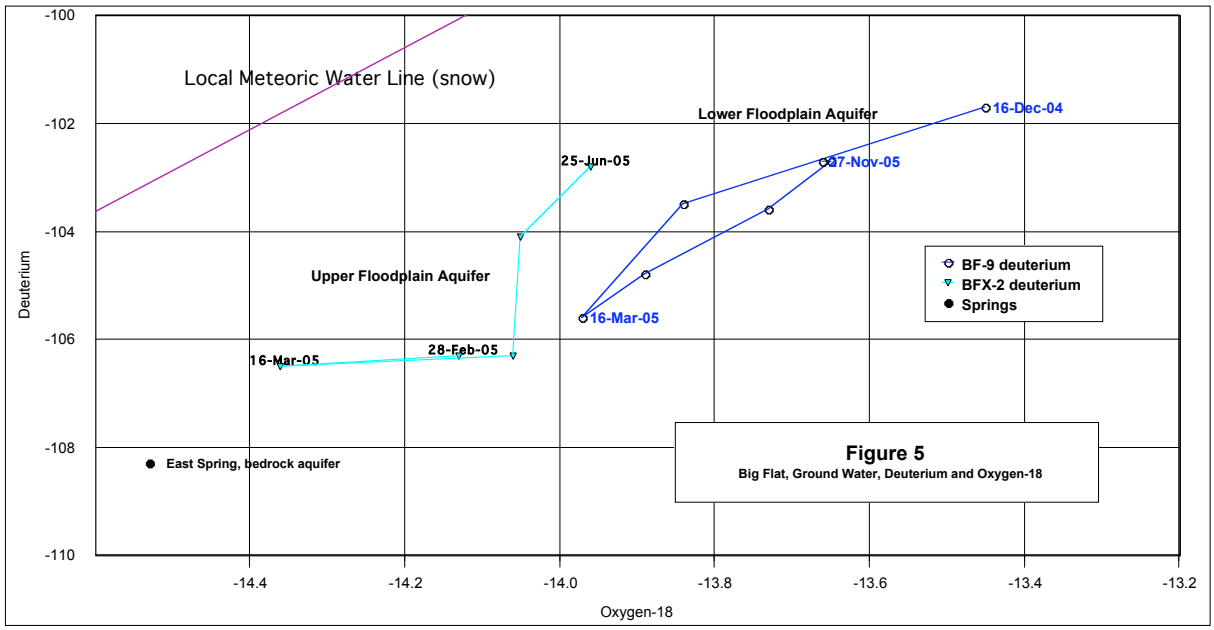

Figure 5
Big Flat, Ground Water, Deuterium and Oxygen-18

Ground water levels and channel flow responses

The following discussion ill show that the isotope data support the conclusions derived from monitoring well water levels and stream flow data. For brevity only deuterium will be used, since a similar analysis using oxygen-18 yields the same results.

Our understanding of the interaction between floodplain aquifer and streamflow is enhanced by comparing isotope composition changes with ground water levels and stream hydrographs. These data are combined in Figure 6 and Figure 7:

1. Time is plotted on the horizontal axis - spanning almost 12 months. The reader should be aware that the straight lines connecting points are only connecting momentary sampling events. They are only approximations of a continuum.
2. The upper portions of the diagrams show ground water levels measured in monitoring wells BFX-2 and BF-9 (light and dark blue).
3. The lower portion shows the deuterium isotope changes in stream water and floodplain aquifer (BFX-2 and BF-9, shown in light and dark blue). Also shown is ground water deuterium measured in East Spring.
4. Also shown is the difference in channel flow between upstream and downstream gauges (thick blue line - downstream minus upstream flow as measured by the continuous flow recorders). Whenever this thick blue line is greater than zero more water flowed out of the meadow than what flowed in, and vice versa:
   a. Before the first week of March outflow was less than inflow (below zero line), i.e. when the floodplain aquifer was recharged by upstream channel infiltration. An exception occurred in the second week of January when the lower gauge recorded flow, while no flow occurred upstream.
   b. Beginning in the third week of March outflow increased and eventually became larger than inflow, i.e. the meadow discharged water.
   c. The significance of the two peaks in the second segment will be discussed later.

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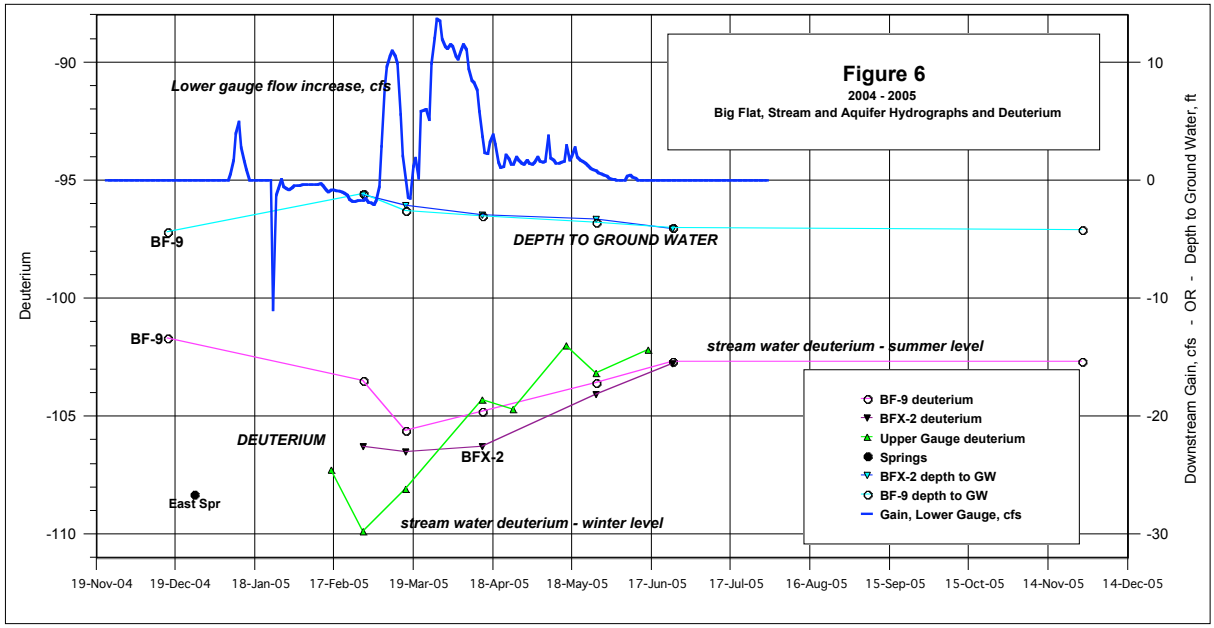

Figure 6: streamflow and ground water levels

1. Ground water levels in the floodplain aquifer rose from about 3 ft below grade in December to near-ground-level in late February. Thereafter ground water levels declined until about mid-June, and then remained about 3 ft below ground level. This is observed in both BF-9 and BFX-2.
2. Rising monitoring well water levels correlate with the period when inflow was larger than outflow. On the other hand, declining monitoring well water levels correspond to the time when more water flowed out of the meadow channel.
3. These changes are expected during streambed infiltration into the floodplain aquifer. Once the aquifer was fully recharged ground water began to be discharged. When monitoring well water levels declined more water flowed out of the meadow than what flowed in.

Evidently meadow recharge began in the second half of January, continuing until about mid-March, when outflow became larger than inflow. This situation continued until the fourth week in May, when upstream flow had diminished to a mere trickle of less than 0.05 cfs, while downstream flow continued at about .2 cfs. By mid-June streamflow had ceased at both stations, though ponding water could still be found throughout the entire channel.

Clearly, beginning in late January the floodplain (meadow) aquifer was recharged by channel infiltration, which was completed in four weeks, i.e. by late February. After that the infiltrated water was discharging into the lower channel while being continuously recharged upstream. Concurrently, ground water levels rose to a maximum in late February and then declined to a minimum in mid-June, and remained at that level until the end of the year. In other words after mid-June the meadow generated no more baseflow.

Figure 6; Streamflow and floodplain aquifer isotope changes

1. Shown in the lower half are the deuterium changes for the 12 month period:
   a. Monitoring wells BF-9 and BFX-2 (purple and black).
   b. Stream water at the upper gauging station (green).
2. Changes are significant. For this discussion two sources are postulated, based on deuterium levels;
   a. “stream water” with deuterium at about -102.

b. “ground water” with deuterium at about -110.

3. When the stream began flowing at the upper gauge in mid-February stream water composition resembled “ground water” (green line). Thereafter it changed until it gradually resembled “stream water” in late May, until it ceased to flow in mid-June. - These changes turned out to be useful to identify the effect of channel infiltration.

4. Isotope composition of the floodplain aquifer (monitoring wells BF-9 and BFX-2) mimicked the changes in stream water composition. These changes are seen as evidence of channel infiltration into the floodplain aquifer:

   a. During the preceding fall (and summer), i.e. before the advent of channel flow, the floodplain aquifer was filled with ground water resembling “stream water” (see BF-9 data), presumably derived from the previous summer’s stream flow.
   b. Sometime before mid-February the upper channel started flowing and stream water resembling ground water began infiltrating into the floodplain aquifer, changing floodplain aquifer composition between ground water (East Spring) and stream water (summer).
   c. Assuming simple mixing, the deuterium composition suggests that by late February stream water component in the floodplain aquifer constituted about 20%. This had increased to about 60% in mid-March. By mid-April upper and lower floodplain aquifer composition were practically the same as in the channel. In other words previous year’s water near these monitoring wells had been completely replaced by renewed channel infiltration.

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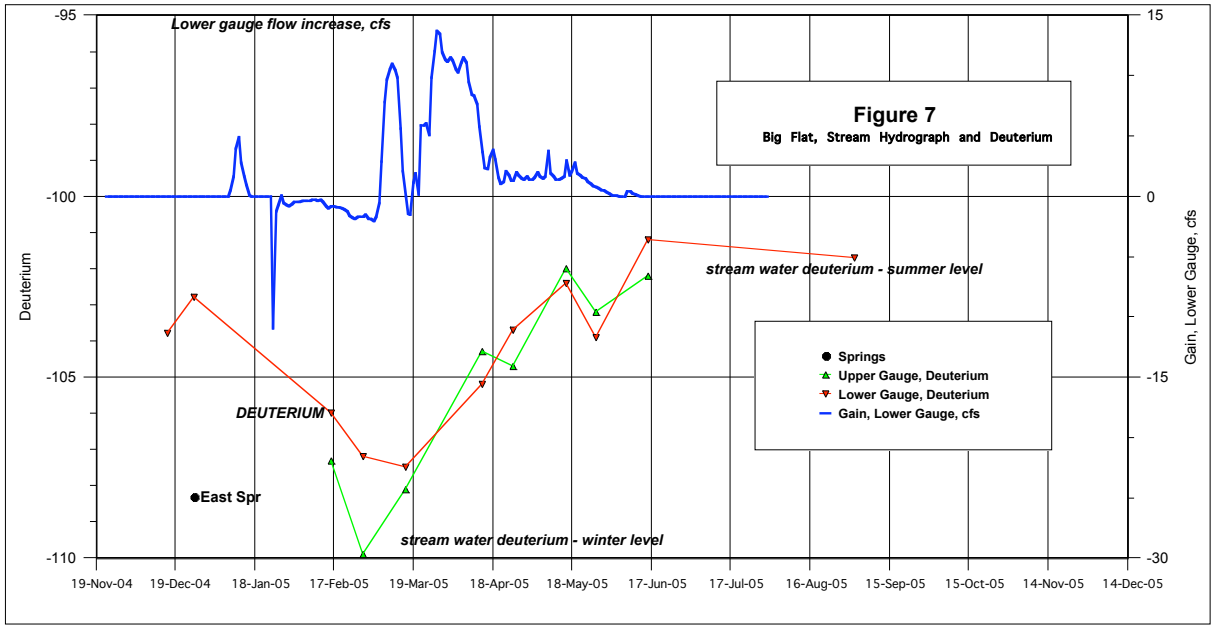


Figure 7: Changes in up- and downstream channel water composition

In Figure 7 up- and downstream composition changes over time are plotted in green and red. Since the late 2004 downstream data record is spotty it was augmented with data from an in-stream pool (’lower pool’) near BF-9. Also included are the downstream net flow gains (thick blue line).

Observations:

1. Although the lower gauge deuterium mimics upper gauge deuterium, there are also some significant differences:
   a. In January and February, downstream deuterium is still much higher than upstream.
   b. In late March the two trends eventually ‘merged’. Thereafter both trends increase at similar rates until about mid-June. After that flow diminishes to mere stagnant puddles.
2. The difference between the green and red lines in February and March are an indication that by

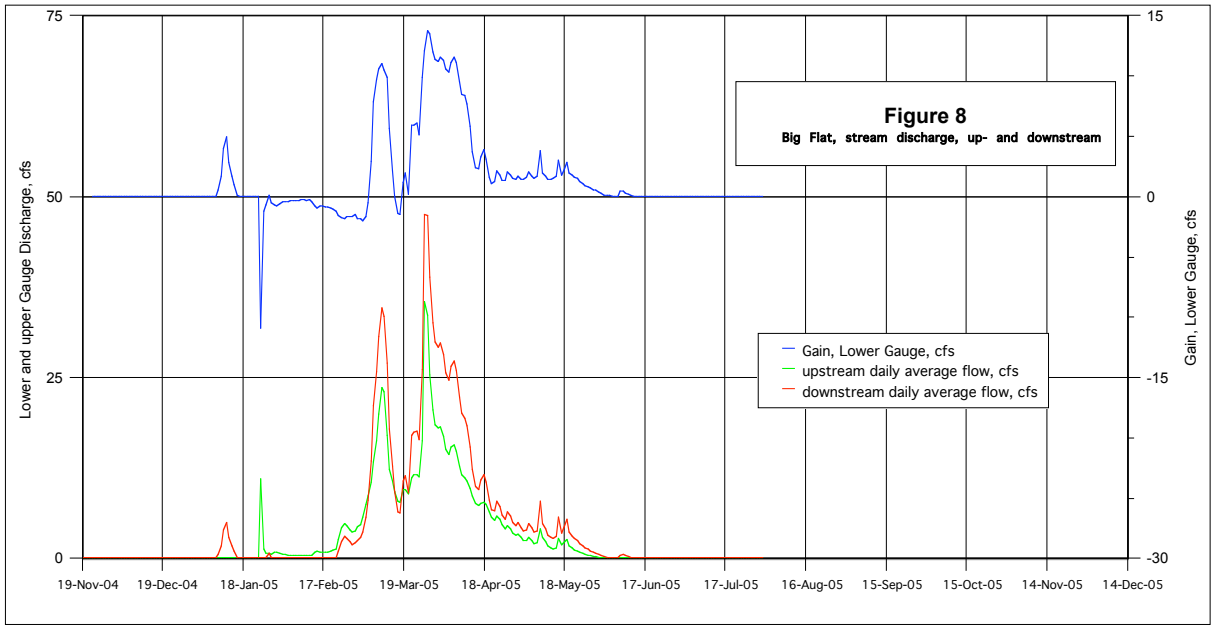
that time channel infiltration was not yet complete in the lower meadow aquifer. - *This feature provides a potential means to assess the efficiency of meadow aquifer recharge due to channel restoration (to be discussed later).*

In summary, these data suggest that floodplain aquifer composition changes largely follow stream channel water composition, which suggests that exchange of water between stream and aquifer is fairly efficient. Probably this is facilitated by floodplain aquifer water flowing downstream in the permeable floodplain sediments, after being recharged in the upper channel and discharged in the lower channel, making room for further upstream channel infiltration.

Stream discharge data

The following comparison of up- and downstream flow data shows that after the Big Flat floodplain aquifer had been recharged by channel infiltration, ground water discharge from upland bedrock aquifer recharge also plays an important role in determining Cottonwood Creek streamflow patterns.

Big Flat stream flow records were summarized by Tim Sagraves in several March 2006 e-mail memos to Plumas Corporation (Leslie Mink, pers. communication, May 2006). The implications from these data could not be ignored and were thus integrated into this report. The 2005 streamflow data are plotted in Figure 8, showing upstream and downstream flows (green and red). Also shown are the differences between downstream and upstream flows, shown in blue (plotted at larger scale).



According to the 2005 flow records, Cottonwood Creek began flowing by January 25. Significant flow was first recorded at the lower gauge by February 21. In that period inflow into Big Flat was about 55 acre-ft, before the lower channel started flowing. It is hereby implied that water flowing into Big Flat while no water flowed out of Big Flat, was water that infiltrated from the channel into the floodplain aquifer. Assuming a floodplain aquifer area of 47 acres, and specific yields between 22% and 40% (Heath, 1986, page 8), the resulting rise in floodplain aquifer ground water table would have been 3 and 5.5 ft. This water table rise compares well with rises observed in monitoring wells BF-9 and BFX-2. In other words the floodplain aquifer was recharged in that four-week period.

The records also show that after March 6 outflow from Big Flat was greater than inflow. The creek continued flowing until mid summer. By mid June flow in the upper reach had dried up, while in the lower reach flow had diminished to a trickle. When comparing the entire up- and downstream flow records, the total over 12 months flowing into and out of the meadow was 1617 and 2306 ac-ft. Clearly the areas above the x-axis (zero) are larger than those below, because more water flowed out than flowed into the meadow. It can be argued that this is water discharged from the meadow aquifer. Assuming an area of 47 acres for the Big Flat meadow, and a specific yield between 22 and 40% for the floodplain aquifer, the

required corresponding ground water table declines of 35 to 66 ft would be unrealistically high, suggesting that most of the increased downstream discharge can not be attributed to water released from storage in the floodplain aquifer.

Instead the difference of 634 ac-ft (2306-1617-55 = 634 ac-ft) came from elsewhere. It can be argued that in this case most of the additional water discharged into Cottonwood Creek below Big Flat originated from the surrounding and underlying bedrock aquifer. Under this scenario the upland contribution to total annual stream discharge of the Big Flat reach of Cottonwood Creek was almost 40%.

Snowmelt beginning in February leads to upland ground water recharge and rising ground water tables. Onset of rising ground water tables in bedrock aquifers at this time of the year is a common observation. It is only to be expected that this will lead to increased discharge into the floodplain aquifer from the surrounding and underlying bedrock aquifers. The few Big Flat monitoring wells flowing artesian may be an indication that this is happening.

Evidence of deep ground water entering the meadow aquifer in select zones is found n the major cation and anion data. While stream waters' EC values are on average 70 to 100 uMhos/cm, EC in most monitoring wells is in the same range. However, in a few monitoring EC is much higher, and their wide ranges are indicative of subsurface mixing (between 290 and 560 uMhos/cm, depending on season). With calcium and alkalinity about four times as high as in stream water these monitoring wells are most likely affected by influx of deep ground water.

But why is this inflow not visible in the isotope data? Most likely winter stream channel isotope signature is determined by the same kind of ground water discharge in reaches above Big Flat, since similar gains in channel flow are to be expected upstream. In other words ground water discharge from bedrock into the floodplain aquifer and subsequently into the stream channel has the same isotope composition as the stream water entering Big Flat at the upstream gauge.

> *In summary a comparison of the 2004-2005 upstream and downstream Cottonwood Creek data at Big Flat Meadow indicate that downstream channel flow was not only augmented by aquifer floodplain storage but also by inflow from the underlying bedrock aquifer. This is supported by ground water chemistry patterns. For certain, this feature deserves further examination, since it implies the significance of upland ground water recharge affecting streamflow.*

Synopsis of the Big Flat data record

The preceding discussion demonstrated that the stream water composition entering Big Flat undergoes significant seasonal changes. It thereby affects not only the lower gauging station, but also the floodplain aquifer. To understand the cause of these changes it is important to realize that Big Flat is only one short reach of about 0.65 miles on a stream which is about 20 miles long. In other words streamflow at the upper gauge in Big Flat is the result of ground water discharge in the stream reaches above (‘upstream baseflow’).

The data indicate that streamflow composition entering the meadow is a continuum between 2 mixing end members, the relative significance of which changes with time. Another possibility are changing contributions from at least two upstream ‘sub watersheds’.

It is, however, conspicuous that the early stage stream water is apparently like typical bedrock ground water. This gradually changes in the subsequent three months until it resembles a second source. Similar observation have been made in the hydrologic literature, where the initial pulse of streamflow is deep ground water, and the later stream water is derived from shallow ground water (‘hyporheic zone’ - defined as a subsurface volume of sediment and porous space adjacent to a stream through which stream water readily exchanges). Hereby it should be noted that the term ‘surface water’ compared to ‘ground water’ has little meaning in this context, since in this hydrologic setting essentially all stream water is derived from ground water (see for example Winter et al., 1998).

These stream flow source patterns should be further investigated since they may tell a great deal about how these headwaters watersheds function. Hopefully it may also provide a means of understanding how a watershed responds to changing land use patterns. Clearly, these data support what has been hypothesized before, i.e. a floodplain aquifer does get recharged not only during flood events inundating the floodplain, but also from channel infiltration.

The observations made herein also show that the benefits of channel restoration on floodplain aquifer storage using pre- and post-project environmental tracer data maybe a feasible option. By comparing pre-project with post-project data it is possible that the upstream to downstream difference in isotope

composition can be used as a measure of increased floodplain aquifer storage due to channel restoration. In a setting similar as in Big Flat the difference between upstream and downstream isotope trends in the winter would be increased from pre- to post-project data, if ground water storage was increased due to restoration.

An unexpected feature so far evident only in the Cottonwood Creek discharge data, is that beginning in mid-March the downstream channel and the floodplain aquifer receive ground water from the underlying bedrock aquifer, as a result of upland ground water recharge.

Rowland-Charles Reach of Last Chance Creek

This portion of the project encompasses Rowland-Charles and Charles-Bird Reaches of Last Chance Creek (LCC). For the purpose of this project this is referred to as the 'Rowland-Charles Reach of LCC'. This ephemeral reach of Last Chance Creek is north-south oriented, as shown on the topographic map in Figure 2. The valley width here is less than _ mile in the south, and about _ mile in the north.

A systematic sketch map of monitoring wells and stream gauging stations is included in Figure 9.

Based on the monitoring well installation data depth to bedrock is no more than 9 ft and 13 ft in the southern and northern central valley sediments. In the Rowland-Charles Reach, LCC had developed two parallel degraded (down cut) channels, less than 1000 ft apart, at about 5800 ft elevation. The valley here is probably defined by a NS trending fault, with a 6600 ft high ridge in the east. Springs discharging at the contact between granite and volcanics at about 6200 ft elevation suggest that this is probably an important ground water recharge area, supplying baseflow to LCC from the east, evident in the valley with low elevation springs and what appears to be phreatophyte vegetation on the eastern floodplain fans.

Ground water data were collected in three of four monitoring well transects, installed in the summer 2001. Each transect in the Rowland-Charles Reach (RC4 and RC5) consists of 3 monitoring wells (1/2 inch perforated steel pipe) placed in lines perpendicular to the stream channels with one monitoring well located west and two east of the restored LCC stream channel.

The Charles-Bird Reach has two transects (CB2 and CB3) consisting of 4 monitoring wells each. These transects are located approximately 0.4 miles downstream (north) of the Rowland-Charles Reach, one above and one below the confluence of Charles Creek with LCC. Only the monitoring wells in transect CB2 were monitored. The valley here begins to trend NW, and the active floodplain maintains its width due to a prominent alluvial fan entering from the northeast. This reach likely receives baseflow from the 6200 ft ridge to the east and the small drainage to the northeast.

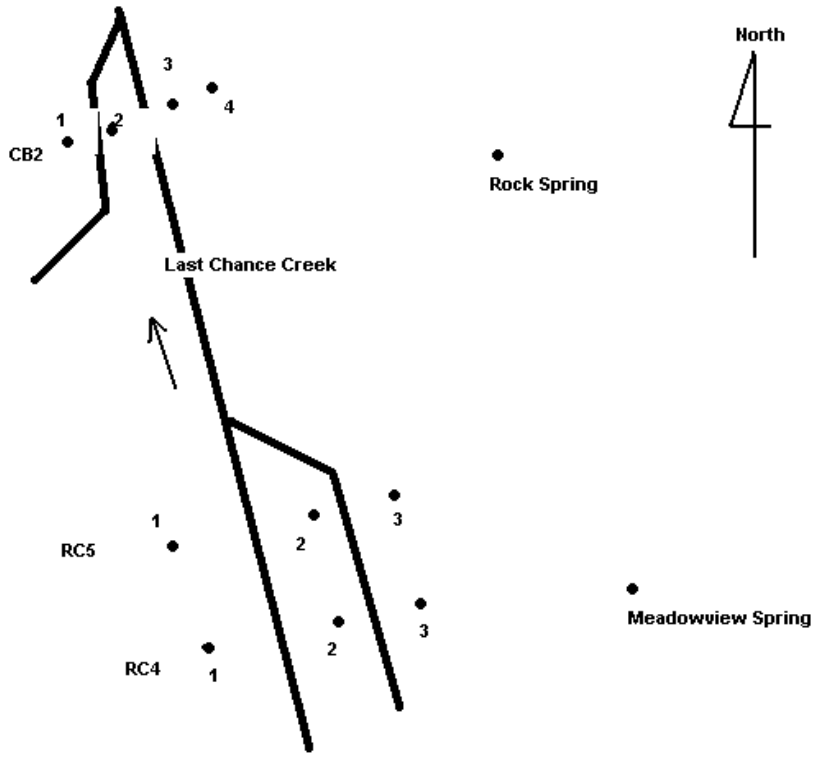


Figure 9: Schematic site map, Rowland-Charles reach, Last Chance Creek. Staff gauges were installed at profiles RC4 (upper) and CB2 (lower).

Stream stage data were collected at RC4 in the south (upstream) and at CB2 in the north (downstream) about 1.5 miles apart. Two springs, Meadowview and Rock Spring, located on the lower eastern valley

slope were also sampled.

Channel restoration conducted in summer 2004 encompassed only the RC4 and RC5 monitoring well transects.

Rowland-Charles Reach is a stream-floodplain-aquifer system that differs from that seen in Big Flat, although both Cottonwood Creek and the Rowland-Charles Reach of last Chance creek are ephemeral:

1. Rowland-Charles Reach floodplain aquifer is wider than that of Big Flat Meadow (2000 ft versus 500 ft).
2. Rowland-Charles Reach floodplain aquifer depth is one-third that of Big Flat Meadow (9 and 35 ft).

General comments

Due to the significant logistic challenges and poor monitoring well construction features the data record from this reach sometimes contains frustrating gaps. Nevertheless, these data permit a number of interesting observations that lead to some very useful conclusions.

The following analysis examines correlations between deuterium, stream stages, and ground water levels. For brevity the discussion is limited to deuterium only, since comparison with oxygen-18 data yields similar results.

> *The discussion will show that in the summer and fall the floodplain aquifer received ground water flow from the east. This had changed by April when the western floodplain aquifer became inundated by recharge from the west raising the ground water table. As expected, the stream water composition followed ground water composition until mid-May, after which ground water levels declined and channel flow ceased altogether.*

Deuterium, stream stage and ground water levels

Figure 10: Deuterium changes correlating with ground water levels.

Deuterium is plotted on the horizontal axis and depth to ground water on the vertical axis. Also shown are stream stages at the upper and lower gauges (green and red).

Observations:

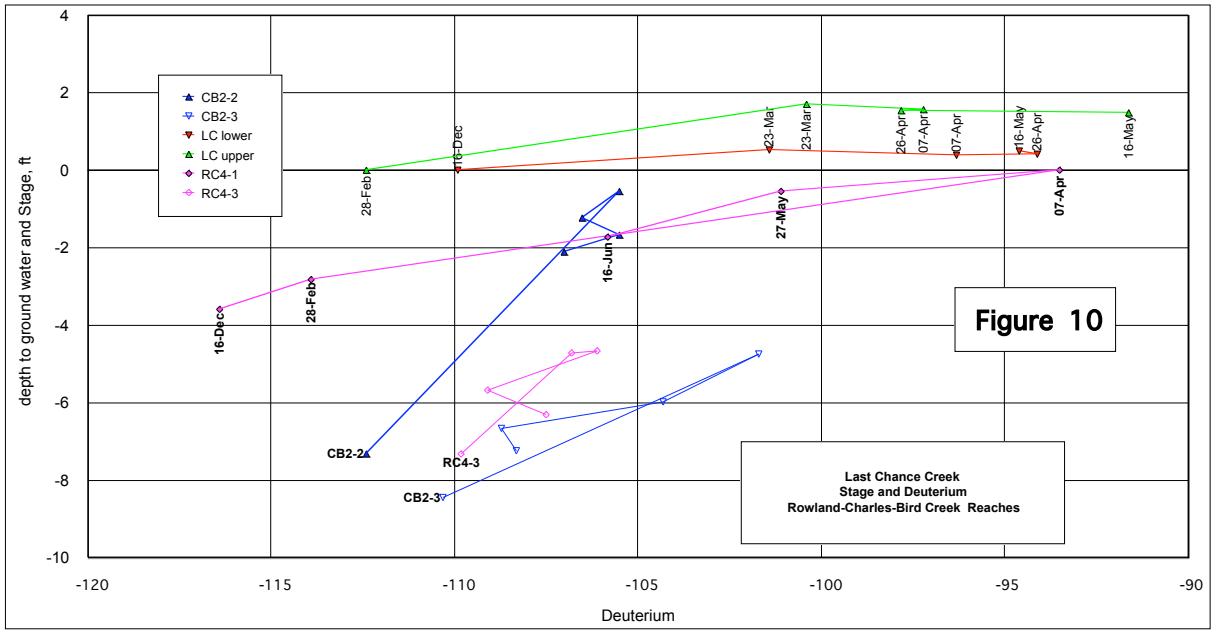
1. Deuterium changes in the stream channel, depending on stage and season (red and green), follow an increasing trend from late February (left) until flow ceased in late May (right).
2. Ground water deuterium levels are lowest when the ground water table is low, and vice versa. Plotted here are the data from four selected monitoring wells (blue and purple).
3. Deuterium in the monitoring wells increased until early April, together with ground water levels. Both declined thereafter, back to levels similar as in the preceding December.

> *Evidently the floodplain aquifer experienced influx of water, from a source with different isotope composition, leading to rising ground water levels. The following discussion will demonstrate that the source of recharge was ground water influx from he underlying and surrounding bedrock aquifer, eventually discharging into the channel.*

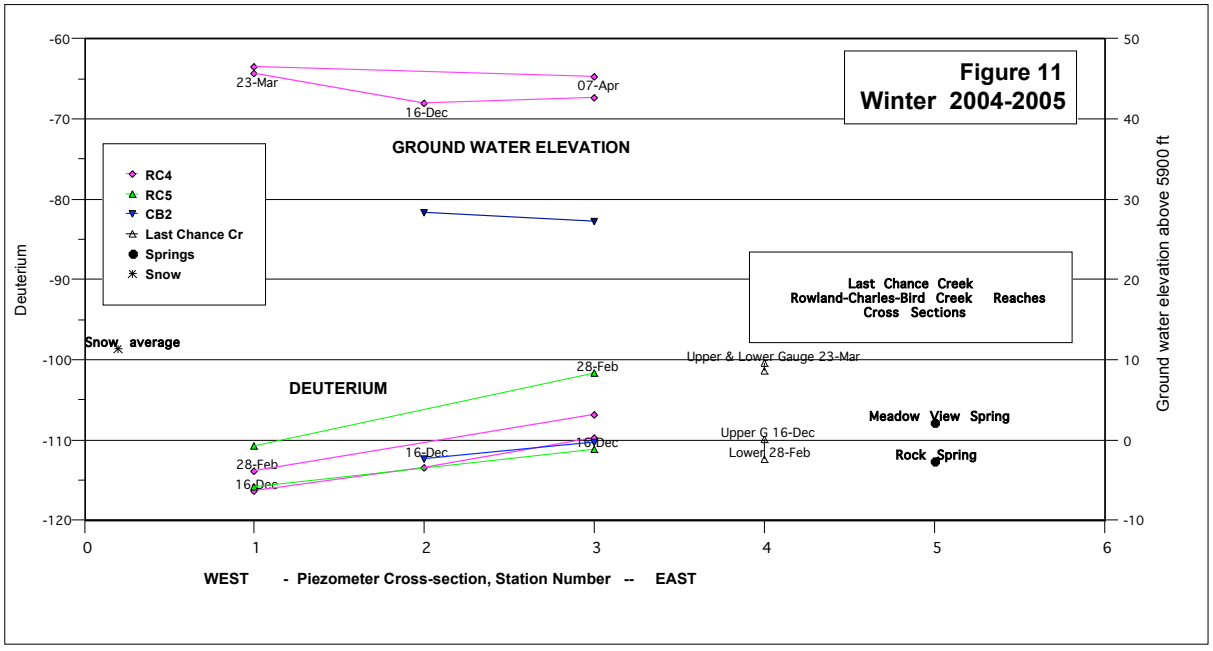
Winter and spring interactions between channel and floodplain aquifer.

In Figure 11 deuterium levels are shown for selected monitoring wells for the winter of 2004-2005. The same are shown in Figure 12 for the Spring and Summer of 2005.

The diagrams are approximations of cross sections across the floodplain, as if looking north, with the monitoring well locations from left to right (west to east). Locations 1, 2 and 3 pertain to each monitoring well number, while their location on the diagram is only a schematic plot, not to scale, on the horizontal axis. Deuterium concentrations and ground water table elevations are plotted on the left and right vertical axes, respectively.



Shown on the far right are the spring water concentrations, the springs being located on the eastern valley slope. Also shown are the concentrations measured at the stream gauge locations, for selected sampling dates. To avoid an unnecessarily cluttered plotting pattern the gauging station data were plotted at location 4, i.e. to the right of the monitoring well location points. In actuality the channel monitoring sites are located somewhere between monitoring well locations 1 and 2.



Data included in these two diagrams were selected to be able to demonstrate the nature of surface-to-ground water interactions in this floodplain. Here, again, as in the Big Flat data analysis, deuterium levels are compared to discern similarities and thereby determine water sources. Though not included here, the oxygen-18 data yield similar results.

The reader should be cautioned to not confuse deuterium levels in the lower diagrams with water levels. While the same colors are used, the ground water elevations are shown in the upper diagram. A survey was conducted by Jim Wilcox to obtain absolute (relative) top-of-casing elevations before the monitoring

wells were destroyed.

Figure 11: Deuterium and ground water levels, winter of 2004-2005.

1. Winter floodplain aquifer water levels and 'deuterium profiles' are 'tilted' to the west. Deuterium in all monitoring wells increased from December until February due to ground water influx.
2. Ground water deuterium levels are higher in the east than in the west. Eastern monitoring wells resemble the spring waters to the east, as expected. In the west (locations 1 and 2) deuterium is still much lower (no ground water data is available from the bedrock slope in the west).
3. Streamflow was first observed in December though it did not become significant until mid-March. Early channel flow deuterium resembles the eastern springs, indicating early ground water discharge from the east initiating channel flow.
4. By March channel flow deuterium was significantly higher than in the springs, probably due to early channel flow arriving from upstream reaches in the south.
5. Channel deuterium levels increased over time, with upper and lower gauging station deuterium levels practically the same every time they were sampled. The streamflow composition increased from December until late March due t a combination of ground water discharge from the east and channel inflow from the south.

Figure 12: Deuterium and ground water levels, spring and summer 2005.

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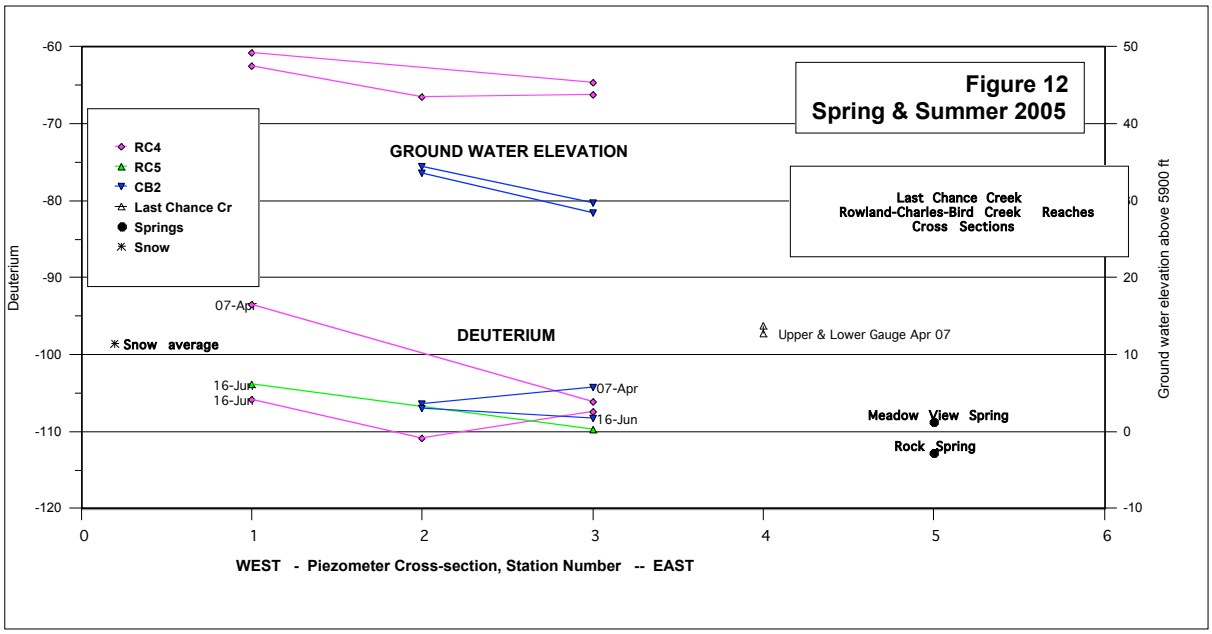

1. In April floodplain aquifer deuterium began to increase in the west, eventually to levels far above those observed in the east.
2. From this point on stream water composition followed the upward trend in the west, indicating channel flow was maintained by ground water discharge from the west.
3. Increased ground water discharge from the west is supported by increasing easterly ground water flow gradients in this period.

Synopsis of the Rowland-Charles Reach data record

Based on these data channel flow in this ephemeral reach of Last Chance Creek is maintained by ground water discharge from the underlying floodplain aquifer, and to a lesser degree by upstream channel inflow. Since the valley floor at less than 6000 ft is surrounded by mountains in the east and west, ranging to more than 8000 ft elevation significant ground water flow into the valley and the floodplain aquifer is to be expected. The springs flowing year-round are evidence for that.

The deuterium data from ground and stream water support this. Ground water flow entering the valley from the east and emerging in the eastern springs dominates the floodplain aquifer in the summer and fall. This ground water flow from the east increases in early winter (December) which leads to the first flows in the previously dry stream channel.

In the spring recharge from the western bedrock aquifer had increased, leading to an accelerated rise in the floodplain ground water table, thereby increasingly dominating stream water composition. Channel flow ceased soon after ground water levels started to decline, depriving the ephemeral stream of its water source.

The most important conclusion: in this channel ephemeral stream flow patterns are determined by upland recharge discharging into the channel via a limited volume floodplain aquifer.

Assessing baseflow augmentation with environmental tracers

How can environmental tracers be applied to assess baseflow augmentation? The objective of this project are:

a. To collect environmental tracer data to further our understanding of the stream-to-ground water interaction in two stream reaches in the Last Chance Watershed.
b. To use that information to identify how tracers can be used to evaluate the effect of meadow restoration projects on baseflow.

Data collected indeed enhanced our understanding of how stream water isotope data change both during channel infiltration and ground water discharge into the channel.

Isotope time series

In Big Flat Meadow pre- and post-project ground water table data suggest that the meadow restoration project has resulted in elevating the ground water table. Less clear is to what extent the project has enhanced the differential between maximum and minimum seasonal ground water level changes. An increase of these changes is desirable since the magnitude of this change determines how much water is stored in and drained from the floodplain aquifer.

In the preceding discussion it was postulated that the difference between up- and downstream isotope composition is an indication of stream water infiltrating and discharging back into the stream (see vertical distance between red and green curves in Figure 6 and Figure 7). Unfortunately no pre-project isotope data are available for comparison. However, it is conceivable that a stream flowing in a degraded channel at a level 7 to 10 ft below the restored channel depth has little potential to infiltrate into the surrounding floodplain aquifer. In other words floodplain aquifer storage would be almost nil, and the downstream water composition would be almost identical to upstream water composition.

To demonstrate this effect, aquifer mixing composition changes were simulated using a spreadsheet. It was hereby assumed that the average daily channel infiltration volume is about 3% of the original floodplain aquifer storage volume (based on actual stream flow data collected in Big Flat). The results of this simulation are plotted in Figure 13.

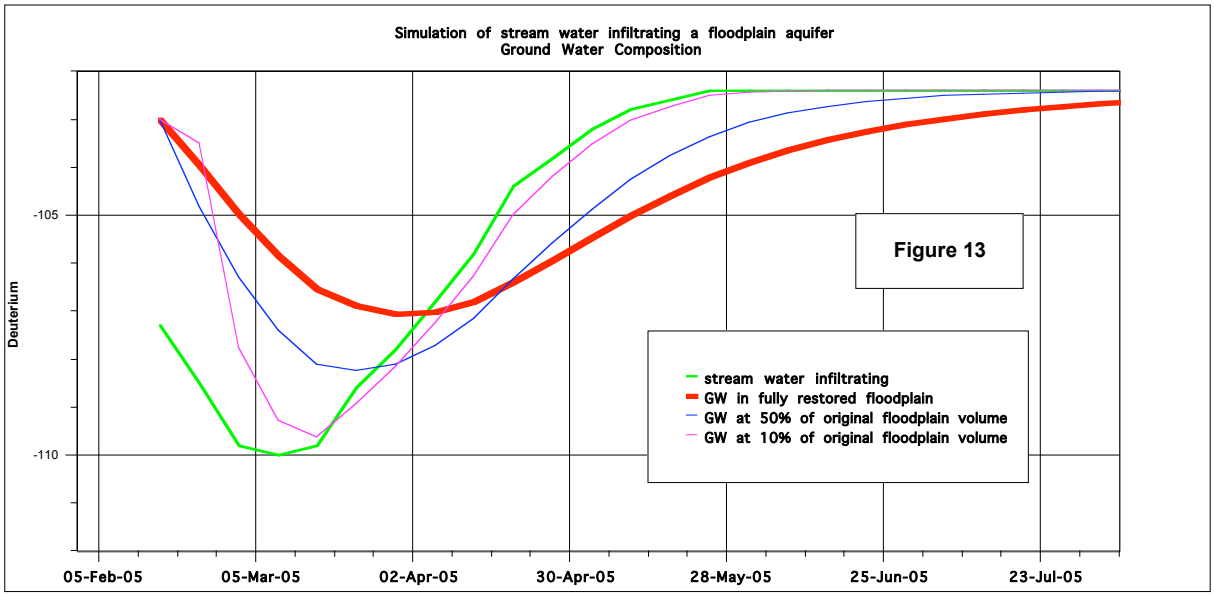

Figure 13

The stream water composition, sampled at the upstream gauge is plotted in green. Ground water composition in a fully restored aquifer is plotted in red. Correspondingly, ground water composition under increasingly degraded floodplain condition are plotted in blue and purple.

The initial stream and ground water composition were those from Big Flat. Surprisingly, the data for the restored floodplian simulation mimic the original data patterns reasonably well (compare Figure 6 and Figure 13).

As expected under most degraded conditions the ground water composition would be almost identical to the inflowing stream water composition. This thinking can be taken one step further by modeling up- and downstream channel composition to estimate the impact of restoration. To go even further, the actual baseflow enhancement volume can be estimated with a digital model, whereby the tracer data can serve as a verification tool.

It is hereby postulated that the differences between upstream and downstream composition can be seen as a measure of how efficient the system is at accommodating channel infiltration, and how efficient it is at releasing it. Presumably the vertical distance of these two trends is dependent on how long it takes to completely replace the floodplain aquifer water with channel water. In other words, the farther apart the two curves the more storage occurs, and vice versa.

Aquifer composition and ground water levels

When an unconfined aquifer receives influx of water of a different composition, a correlation between depth to ground water and mixing composition is to be expected. Given the limited thickness of most mountain meadow floodplain aquifers complete mixing is likely. This is demonstrated in Figure 10 where tracer composition plots as a function of depth (linear correlation). Since restoration is expected to result in increased floodplain storage capacity, restoration should result not only in higher ground water levels, but also in changing tracer concentrations. In Figure 10 this would result in a shift to the right and reduced slopes in post restoration data .

Summary

Baseflow augmentation due to meadow restoration can be measured by comparing pre- and post-restoration baseflow isotope characteristics. However, the hydrologic setting has to meet at least one or both of two conditions:

a. Stream water isotope signatures changes from winter into spring and summer.
b. Ambient floodplain aquifer water isotope signatures differ uniquely from that of stream water.

Under ideal conditions the tracer patterns observed in this project may very well lend themselves as a tool to estimate the degree of baseflow augmentation. More so they may serve as verification tools for hydrologic models.

By comparing such data from the pre- and post-restoration phases one may be able to determine ground water storage efficiency. Determining the vertical separation between the curves and the time it takes to close the ‘gap’ between the two curves may be a measure of restoration efficiency.

Recommendations

Apart from the logistic challenges posed by this project, obtaining good isotope tracer data can be a comparatively low cost effort. From that standpoint this project has yielded a lot of information. Several recommendations are made:

1. Based on what was learned in this project other restoration projects should be sought out for similar data collection, maybe in more ideal hydrologic settings. A more continuous data record would be beneficial, ideally in weekly intervals. For that purpose projects closer by would be beneficial to better handle site access and inclement weather conditions.
2. To obtain a more continuous sampling and data record one may want to seek out (if not develop) automated sampling equipment. Crest gauges installed not only on streams but also in wells may provide a useful way of obtaining a more complete range of ground water fluctuations.
3. One my even seek out funding for modeling projects in ideal setting to further our understanding of isotope tracer patterns in these settings.
4. The significance of upland ground water recharge on streamflow patterns was one unexpected realization growing out of this data analysis. This feature should be further examined.

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Attachment A: Big Flat hydrology synopsis

The difficult task of physically measuring baseflow augmentation can be demonstrated in Big Flat. Before restoration Big Flat meadow had a deeply incised, degraded channel which was restored in the mid 1990's with a "plug-and-pond" system. With an area about 47 acres in size during a flood event that covers the floodplain for example with 12 inches of water, the meadow would store 47 acre-feet of surface water. Usually most of this is released back into the stream channel within a few hours, while some of this water infiltrates into the floodplain aquifer.

Data from Big Flat indicate that ground water table fluctuations can be between 3 and 5 ft within a given year (Sagraves, 1998). Assuming a specific yield of 12% (e.g. Fetter, 1988, p. 74) for the meadow floodplain deposits, Big Flat Meadow can store and release between 17 and 28 acre-ft of ground water per year. This water is slowly released back into the stream channel in the following 6 to 9 months.

Recent data from Big Flat Meadow also suggest the beneficial impact of recent stream channel restoration. When compared to the pre-project water table, this impact has reportedly resulted in an average of 1.5 ft post-restoration increased ground water table rise (Sagraves, 1998). Again, using a specific yield of 0.12, increased bank storage due to channel restoration has increased by 8.5 ac-ft per year, or 30%.

It is difficult to convincingly measure baseflow augmentation since base flow released from the meadow is only a small fraction of flow measured in the stream channel below Big Flat Meadow. Assuming 8.5 acre-feet of baseflow is released from the meadow due to baseflow augmentation over a period of 6 to 9 months, this results in an average flow of about 0.02 cfs. When compared to between 0.1 to 1 cfs of channel flow late in the year (Sagraves 1998) it is doubtful that this small amount can be convincingly distinguished from channel flow entering the meadow by using only physical streamflow measurements, given the probabilistic nature of these data.

This problem is further complicated by not knowing how much ground water enters the meadow aquifers from the surrounding bedrock, and which is also discharged into the channel. Using only physical stream flow measurements this is next to impossible to separate from the hydrograph data.

The foregoing discussion demonstrates that it is quite possible that late year stream flow is less affected by spring flood flow temporarily stored in the floodplain, but maybe more so by ground water discharged from the reaches upgradient of the Big Flat meadow.

Attachment B: Calculations

Estimating mixing fractions of stream water in the alluvial aquifer

Using a simple mixing equation the fraction of stream channel infiltration (leakage) into the alluvial aquifer can be approximated. The mixing equation is:

$$ECa = ECU \times Vu - ECc \times (1 - Vu)$$

EC stands for environmental tracer concentration, V for volume fraction (smaller than 1.0) and the subscripts a, u and c stand for floodplain aquifer mixture, upstream channel water and late summer floodplain aquifer composition. The fraction of upstream channel water in the floodplain aquifer during the winter can be estimated by rearranging the above equation:

$$Vg = (ECa - ECc)/(ECg - Ec)$$

The fraction of upstream channel water in the floodplain aquifer can then be estimated by $Vc = (1 - Vg)$.

Appendix C

Sierra Valley Aquifer Tests Report

RESULTS OF THE FALL 2005 AQUIFER TESTS IN SIERRA VALLEY

Draft Report-For Review Purpose Only

prepared for
Sierra Valley Groundwater Management Division
Sierraville, California

by
Kenneth D. Schmidt and Associates
Groundwater Quality Consultants
Fresno, California

January 2006

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RESULTS OF THE FALL 2005 AQUIFER TESTS IN SIERRA VALLEY

INTRODUCTION

Knowledge of aquifer characteristics is important for estimating drawdowns due to pumping of wells, estimating groundwater flows, and for other purposes. Aquifer tests have been conducted in the Vinton, Chilcoot, Loyalton, Sierra Brooks, River View Estates, and Grizzly Ranch areas. Prior to formation of the District, aquifer tests were conducted on three irrigation wells, and the results were presented by the California Department of Water Resources (1980) in the report "Sierra Valley Groundwater Study". The other aquifer tests referenced have primarily been conducted as part of hydrogeologic studies for new developments in or near the District. No such test had been conducted in the area southeast of Beckwourth or farther east prior to the Fall 2005 tests. Two sites in this area were selected for these tests. The first was at the Goodwin Ranch, located about a mile southeast of the Beckwourth Airport. The second was at the Green Gulch Ranch, located about four miles farther east. Appendix A contains completion reports (where available) for wells used for the aquifer tests.

GOODWIN RANCH PUMP TEST

Figure 1 shows the locations of the wells that were used for this test. Well T23N/R15E-29N3 was the pumped well. This well is

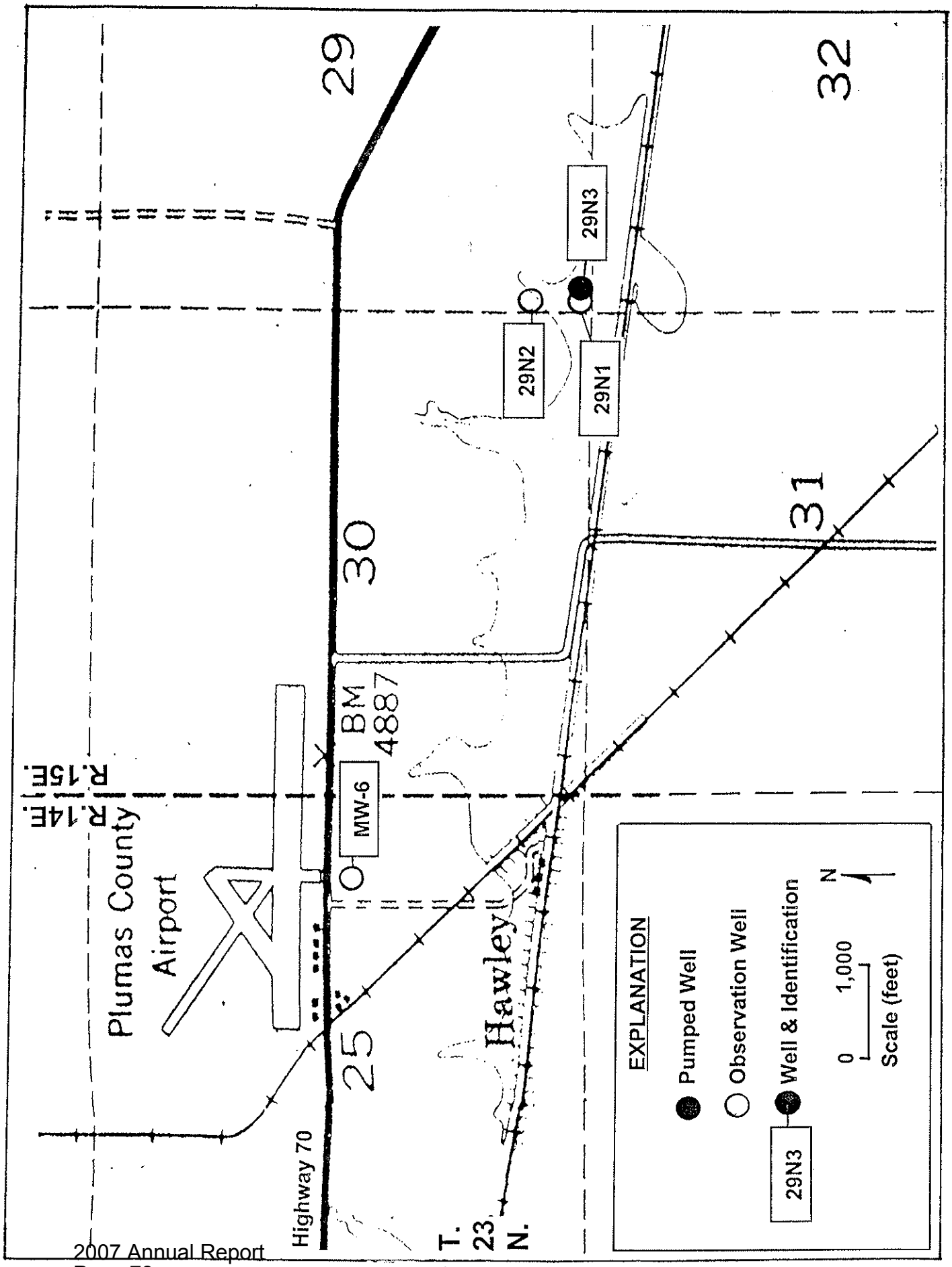

FIGURE 1- LOCATION OF WELLS USED IN GOODWIN RANCH TEST

indicated to be 500 feet deep and the perforated interval is unknown. Four observation wells were used for these test. Unused Well 29N2 is 298 feet deep and the casing is perforated from the land surface to 298 feet in depth. This well is located 260 feet from the pumped well. Unused Well 29N1 is 696 feet deep and is located 700 feet from the pumped well. The perforated interval is unknown. Sierra Valley GMD cluster monitor well MW-6 was also used for observation purposes. This site has a shallow well perforated from 115 to 130 feet in depth, and a deep well perforated from 310 to 340 feet in depth. MW-6 is located 7,100 feet from the pumped well. The aquifer test site is indicated to be north of where a regional confining clay layer is present. Measurements for this test are provided in Appendix B.

Drawdown Measurements

Pumped Well

The existing totalizing flowmeter in Well 29N3 was used to measure pumpage during the test. The pump in the well was turned off at 10:25 AM on September 22, 2005 prior to the test. Some antecedent water-level measurements were then made. Pumping began at 10:30 AM on September 23 and continued until 10:30 AM on September 24, 2005. A total of 1,874,300 gallons was pumped from the well during the test and the average pumping rate was 1,300 gpm. The static level in Well 29N3 prior to pumping was 52.1 feet below

the measuring point. After about one hour of pumping, the pumping level was about 160.1 foot, after about nine hours of pumping, the pumping level was 162.8 feet. Below that depth, the water level could not be measured. The drawdown was 110.7 feet and the specific capacity was 11.8 gpm per foot after about nine hours of pumping. Transmissivity could not be determined from the drawdown measurements in the pumped well.

Observation Wells

Figure 2 shows drawdown measurements for Well 29N2. Depth to water in this well was 53.1 feet prior to pumping and 78.2 feet near the end of the pumping period. The drawdown was thus 25.1 feet. A transmissivity of 23,000 gpd per foot and storage coefficient of 0.002 were indicated by these measurements. Because of its shallow depth, this well is indicated to tap only part of the aquifer tapped by the pumped well. This is the reason why a higher transmissivity value was obtained from measurements on this observation well, compared to the pumped well (discussed later).

Figure 3 shows drawdown measurements for Well 29N1. Depth to water in this well prior to pumping was 50.1 feet. Near the end of the pumping period, depth to water was 65.8 feet. The drawdown was thus 15.7 feet. A transmissivity of 26,000 gpd per foot and storage coefficient of 0.01 were indicated by these measurement.

Depth to water in MW-6S was 38.50 feet prior to pumping and

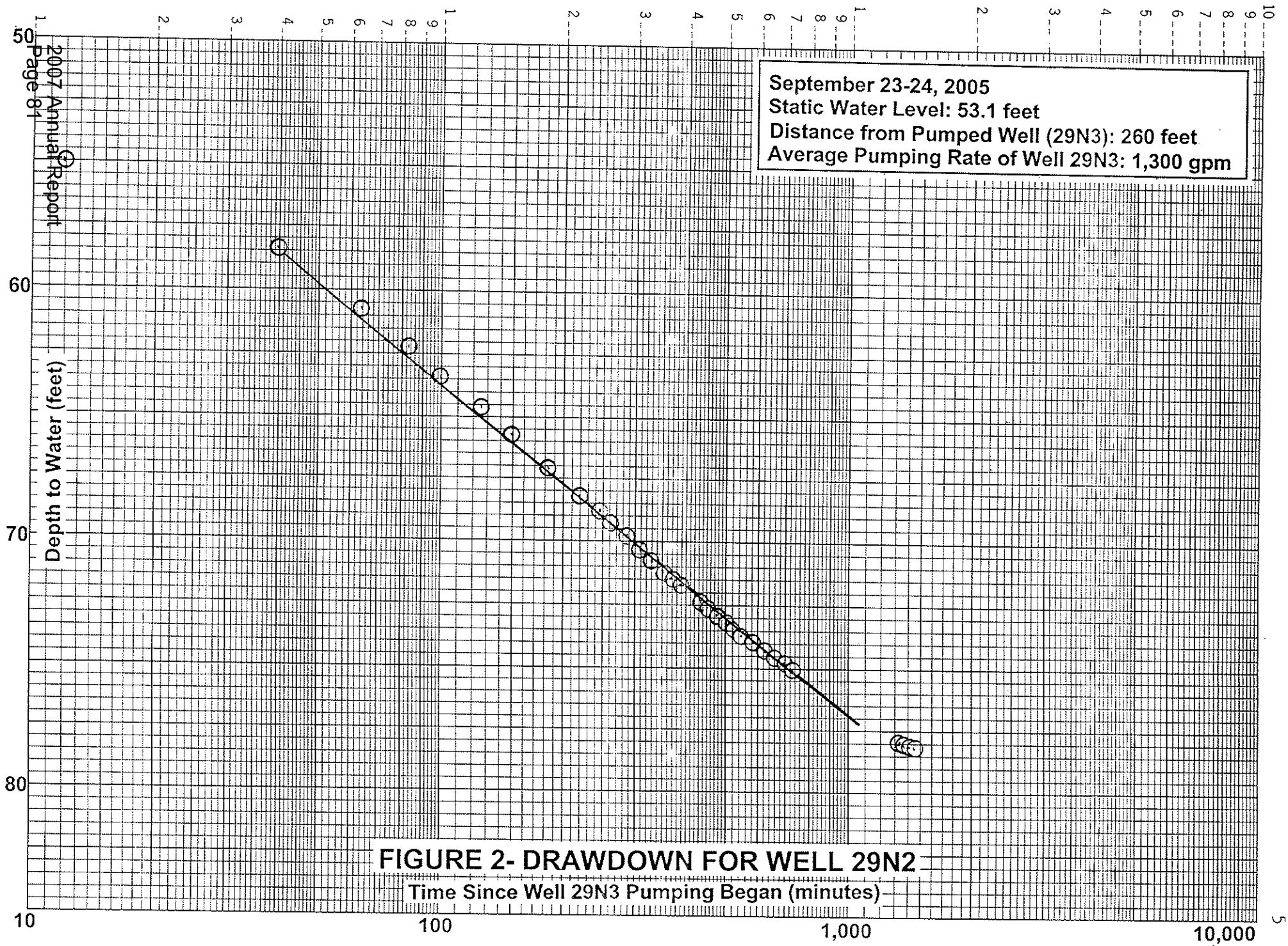

FIGURE 2- DRAWDOWN FOR WELL 29N2

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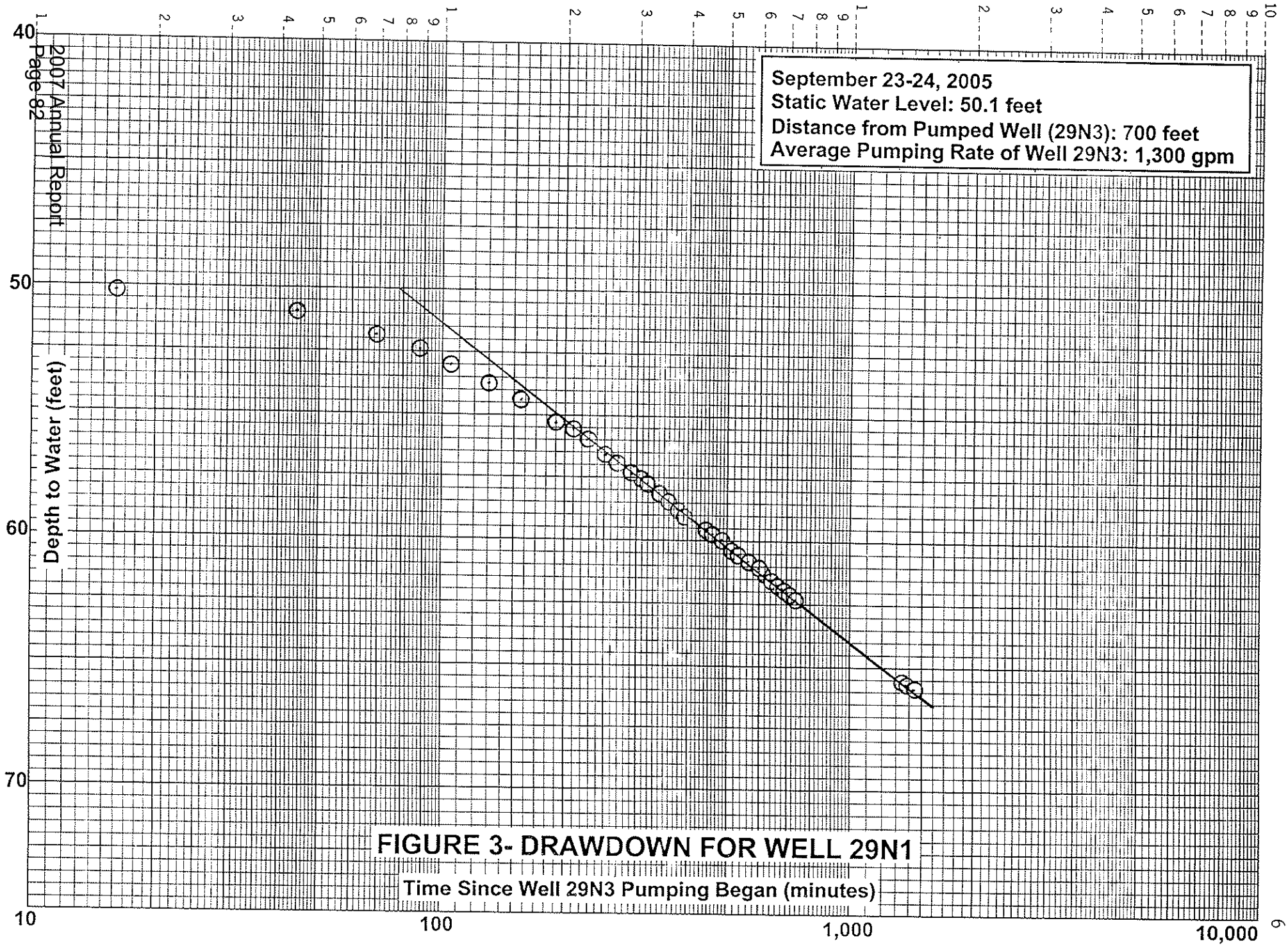

FIGURE 3- DRAWDOWN FOR WELL 29N1

38.59 feet at the end of the pumping period. The apparent drawdown was 0.09 foot. Recovery measurements (discussed later) indicate that this water-level decline was not due to pumping of Well 29N3. This is because the water level in MW-6S continued to decline after pumping of Well 29N3 stopped. Depth to water in MW-6D was 32.93 feet prior to pumping and 33.01 feet at the end of the pumping period. The apparent drawdown was thus 0.08 foot. Recovery measurements indicate that about one-third of this water-level decline was due to pumping of Well 29N3, as there was a water-level recovery of about 0.03 foot after pumping stopped.

Recovery Measurements

Pumped Well

After 24 hours of recovery, depth to water in Well 29N3 was 52.0 feet, or 0.2 foot above the static level prior to pumping. Figure 4 shows corrected recovery measurements for the pumped well. A transmissivity of 13,600 gpd per foot was indicated by these measurements, in excellent agreement with the value from the drawdown measurements.

Observation Wells

Afer 24 hours of recover, depth to water in Well 29N2 was 52.9 feet, or 0.2 foot above the static level prior to pumping. Figure 5 shows corrected recovery measurements for Well 29N2. A transmis-

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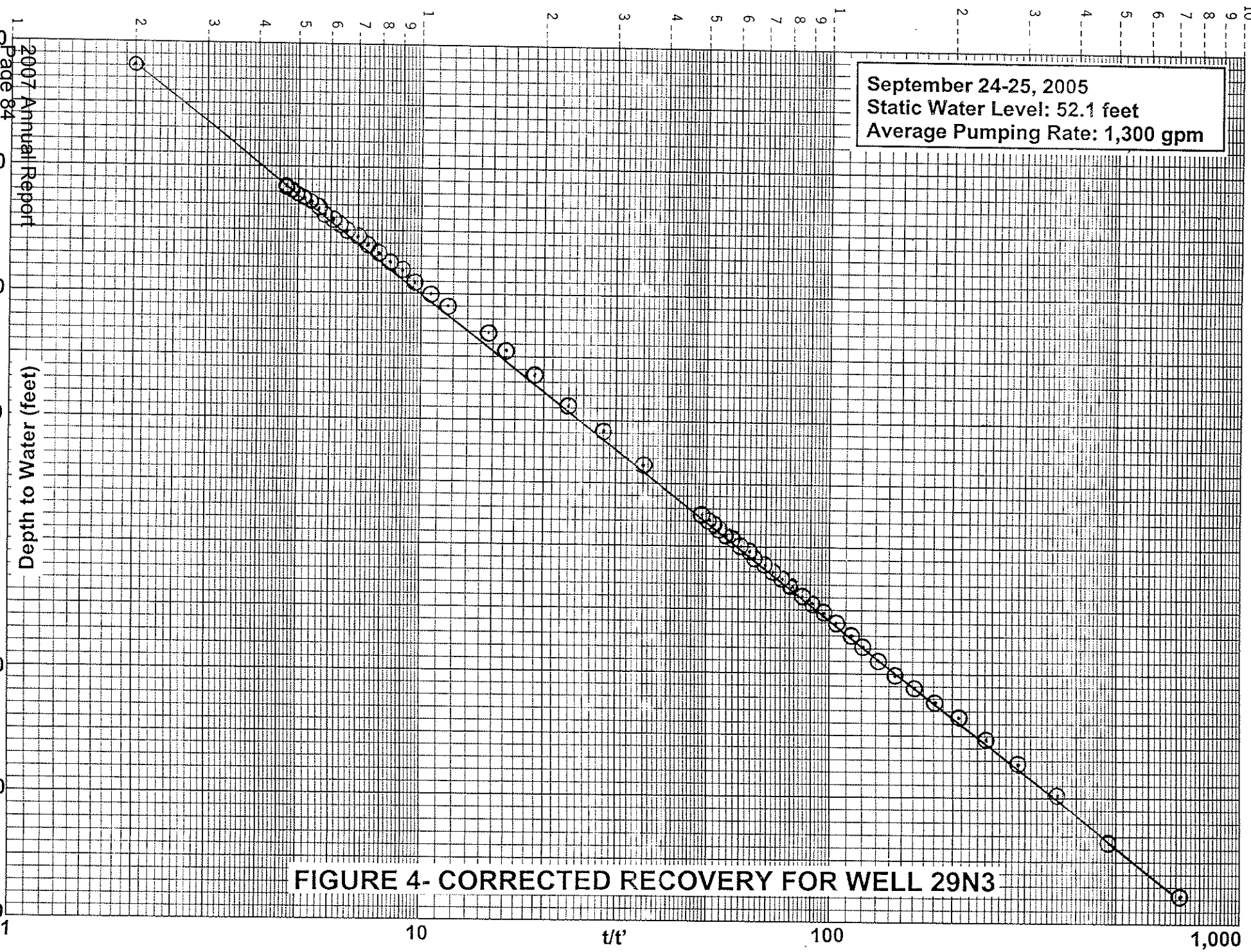

FIGURE 4- CORRECTED RECOVERY FOR WELL 29N3

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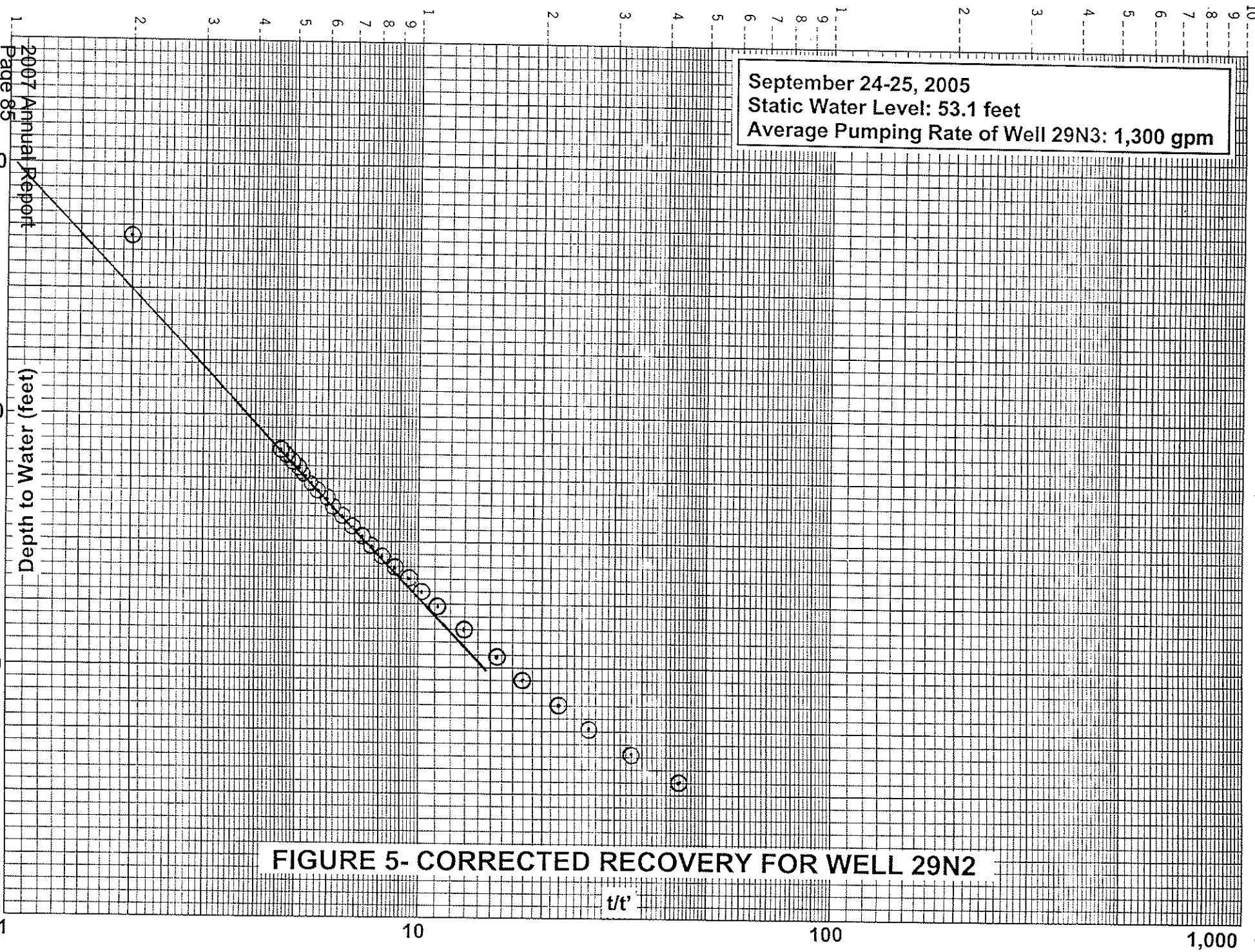

FIGURE 5- CORRECTED RECOVERY FOR WELL 29N2

sivity of 20,000 gpd per foot was indicated by these measurements. After 24 hours of recovery, depth to water in Well 29N1 was 49.9 feet, or 0.2 foot above the static level prior to pumping. Figure 6 shows corrected recovery for Well 29N1. A transmissivity of 24,000 gpd per foot was indicated by these measurements.

After 24 hours of recovery, depth to water in MW-6S was 38.9 feet, or 0.4 foot below the static level prior to pumping. Measurements for this well indicate that there was an antecedent water-level decline in this well, and this trend continued throughout the test. Pumping of Well 29N3 did not influence the water level in MW-6S.

After 24 hours of recovery depth to water in MW-6D was 32.98 feet, or 0.05 foot below the static level prior to pumping. The water level in this well apparently responded only slightly due to pumping of Well 29N3, as discussed previously.

GREEN GULCH RANCH PUMP TEST

Figure 7 shows the locations of wells used for the Green Gulch Ranch pump test. Well T23N/R15E-26R1 was pumped for the test. This well taps the lower aquifer and is perforated from 440 to 763 feet in depth. The pumping rate was measured with the existing flowmeter in the well. Three other irrigation wells were used as observation wells for the test. Well 26G1 is perforated from 500 to 780 feet in depth and was located about 4,600 feet from the

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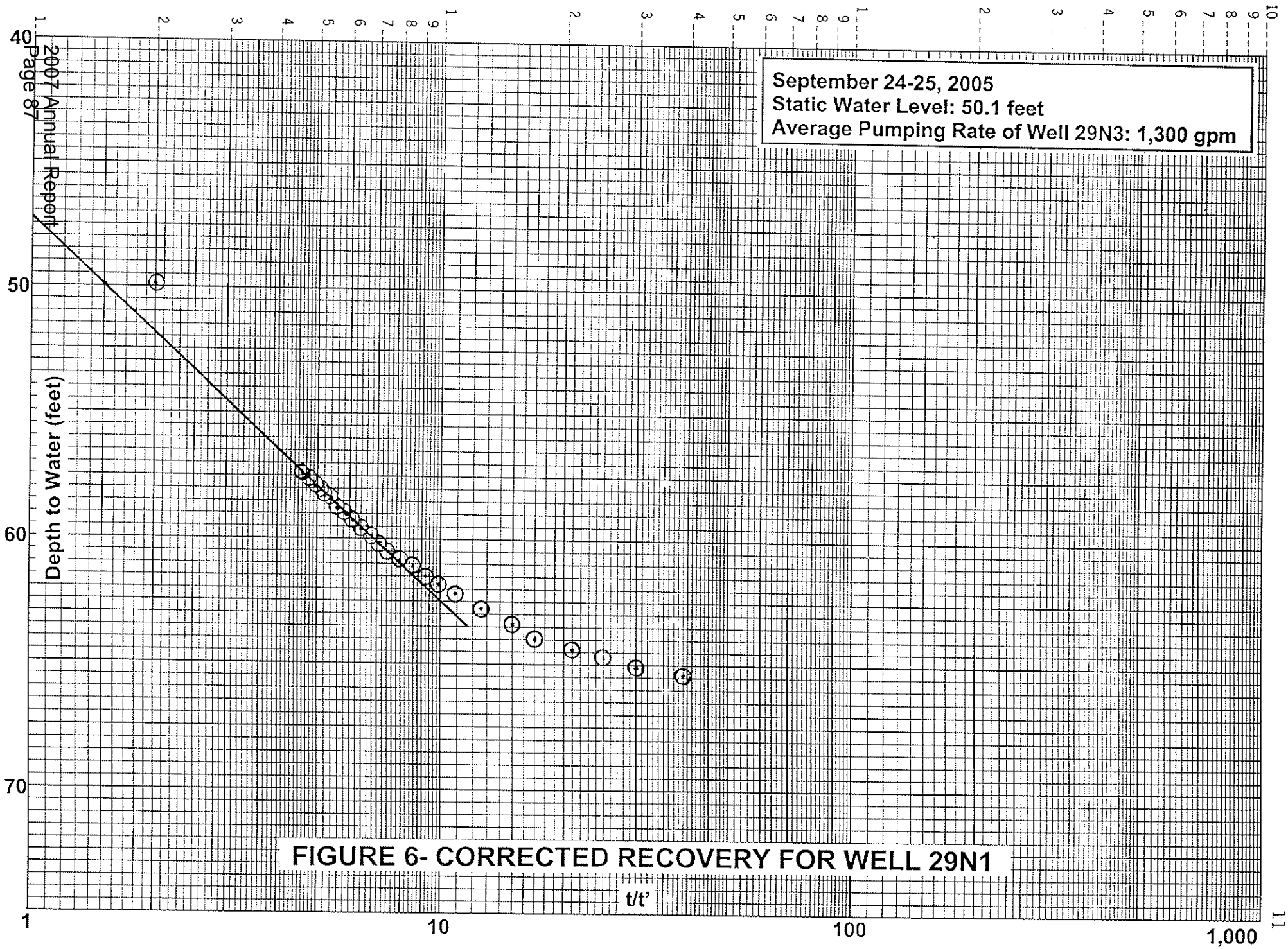


FIGURE 6- CORRECTED RECOVERY FOR WELL 29N1

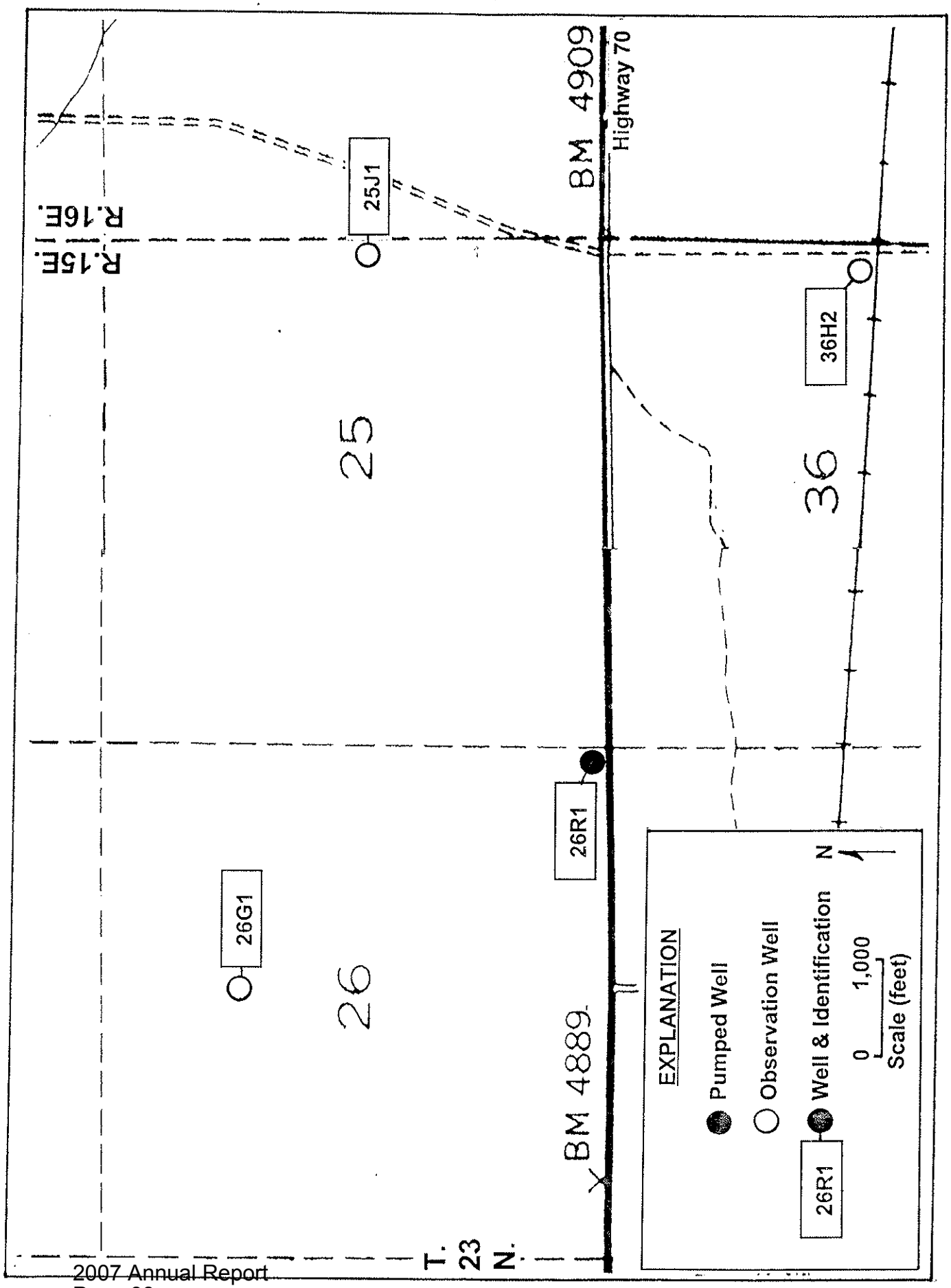


FIGURE 7- LOCATION OF WELLS USED IN GREEN GULCH RANCH TEST

pumped well. Well 25J1 is perforated from 312 to 784 feet in depth and is located about 5,500 feet from the pumped well. Well 36H2 is perforated from 636 to 688 feet in depth and is located about 6,200 feet from the pumped well. Measurements for the pump test are provided in Appendix C.

Drawdown Measurements

Pumped Well

Well 26R1 was not pumped for at least four days prior to the test. Pumping began at 8:00 AM on September 26, 2005 and continued until 8:00 AM on September 27. A total of 1,963,300 gallons was pumped and the average pumping rate was 1,365 gpm. The static water level prior to pumping was 112.5 feet below the measuring point. After about 12 hours of pumping, the pumping level was 319.8 feet. No further measurements of the pumping level could be made. After 12 hours of pumping, the drawdown was 207.3 feet, and the specific capacity was 6.6 gpm per foot. Drawdown measurements in the pumped well could not be used to determine aquifer transmissivity.

Observation Wells

Depth to water in Well 25J1 was 120.2 feet prior to pumping of Well 26R1 and was 118.1 feet at the end of pumping. Recovery measurements indicated that the water level in this well did not

respond to pumping of Well 26R1. Depth to water in Well 26G1 was 107.5 feet about four and a half hours after pumping of Well 26R1 began and was 106.9 feet at the end of the pumping period. Recovery measurements indicated that the water level in this well also was not affected by pumping of Well 26R1. Depth to water in Well 36H2 was 111.4 feet prior to pumping of Well 26R1 and 110.8 feet at the end of pumping. Recovery measurements indicate that the water-level in this well did not respond to pumping of Well 26R1.

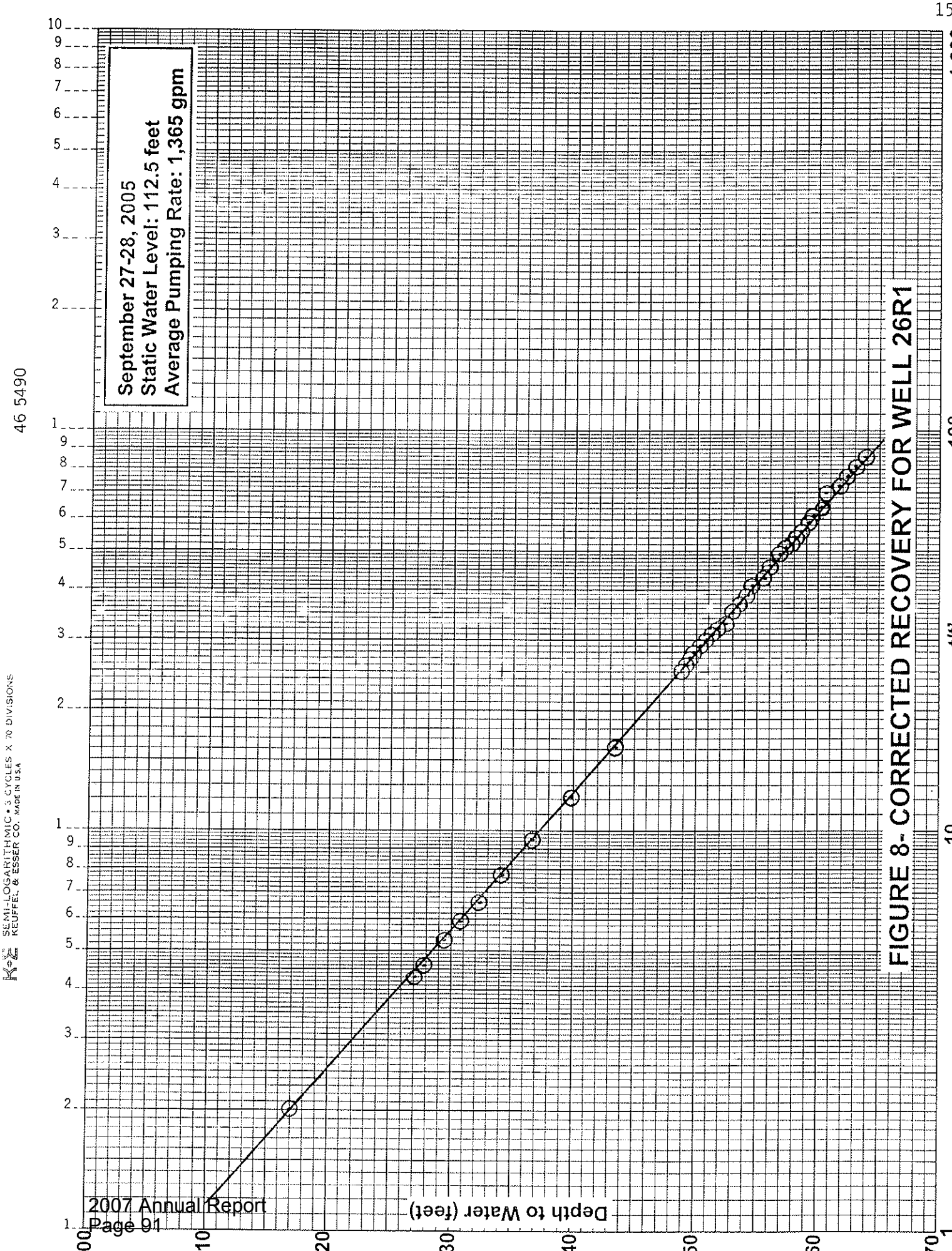
Recovery Measurements

Pumped Well

After 24 hours of recovery, depth to water was 117.0 feet, or 4.5 feet below the static level prior to pumping. Figure 8 provides corrected recovery measurements for the pumped well. A transmissivity of 12,400 gpd per foot was indicated by these measurements, in good agreement with the specific capacity value for the test.

Observation Wells

Depth to water in Well 25J1 was 117.7 feet about seven hours after pumping stopped, or about 0.4 foot shallower than prior to when pumping stopped. Depth to water in Well 25G1 was 106.8 feet about 24 hours after pumping stopped, or 0.1 foot shallower than prior to when stopped. Depth to water in Well 36H2 was 110.2 feet


September 27-28, 2005
Static Water Level: 112.5 feet
Average Pumping Rate: 1,365 gpm
FIGURE 8- CORRECTED RECOVERY FOR WELL 26R1
Depth to Water (feet)
t/t'
1,000
100
10
1
100
110
120
130
140
150
160
170
46 5490
SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN USA

about 24 hours after pumping stopped, or 0.6 foot shallower than prior to when pumping stopped. The water levels in each of the observation wells thus didn't respond to pumping of Well 26R1, but rather indicated a water-level recovery, following the cessation of summer pumping.

SUMMARY AND CONCLUSIONS

Two aquifer tests were conducted in Sierra Valley in Fall 2005. At the Goodwin Ranch site, the best value for transmissivity was from corrected recovery measurements for the pumped well, or 13,600 gpd per foot. A storage coefficient of 0.002 was determined from measurements in an observation well within 300 feet of the pumped well. At the Green Gulch Ranch site, the best value for the transmissivity was also from corrected recovery measurements from the pumped well, or 12,400 gpd per foot. The results of these tests provide valuable information on aquifer characteristics in Sierra Valley.

Appendix D

2006 Watershed Monitoring Report

Feather River Coordinated Resource Management Watershed Monitoring Program

Funded by Plumas Watershed Forum

2006 Report

Recording flow using a bridge crane from Deadfall Bridge on Lights Creek, Indian Valley

Prepared by Plumas Corporation
Quincy, CA
Spring 2007

Introduction

The Feather River Coordinated Resource Management (FR-CRM) group, a proactive consortium of 21 public agencies, private sector groups, and local landowners, was formed in 1985 in response to widespread erosion and channel degradation in the Feather River watershed. 140 years of intense human use, including mining, grazing, timber harvesting, wildlife, railroad and road construction, have all contributed to a watershed-wide stream channel entrenchment process. FR-CRM has been monitoring the Feather River watershed since 1999 in an effort to establish baseline data for assessing long-term trends in watershed condition, and the potentially significant effects of restoration projects on watershed function. Most of the monitoring effort is concentrated in the Indian Creek watershed because of its highly degraded upper watershed condition, and high potential for benefit from restoration with many square miles of alluvial valleys. Site location follows a nested approach.

Program Background

Background information such as an overview of the watershed, monitoring program objectives, and protocols can be found in the three previous FR-CRM Watershed Monitoring Reports from 2001, 2004, and 2005. The last two reports (2004 and 2005) can be found on the FR-CRM website at www.feather-river-crm.org. The monitoring stations were installed in 1999 and data has been collected from 2000-2006.

Initial funding for FR-CRM's monitoring program was provided by a federal Clean Water Act grant (Aug 1998 to Dec 2000). Subsequent funding sources were: the California Surface Water Ambient Monitoring Program (SWAMP) from Oct 2000 to Dec 2003 and the Plumas Watershed Forum (2004 to 2006). The primary goal of the monitoring program funded by the Forum was to continue operation of the ten continuous recording stations, with the addition of some project sites that have watershed-level significance. Physical and biological surveys of the 20 Monitoring Reaches were not included in this effort. Those sites will likely be re-surveyed as more funding becomes available, due to geomorphic changes caused by the extended high stream flows of 2005-06.

Monitoring Program Description

As the fourth FR-CRM Watershed Monitoring Report, this report documents on-going monitoring data from the 2006 water year (October 1, 2005-September 30, 2006). The 2006 water year saw the highest flows since the start of FR-CRM's watershed monitoring program. FR-CRM completed a significant amount of sampling in 2006 before the monitoring program ran out of funding. Since this report is minimally funded, data was collected and analyzed for priority sites with respect to monitoring program continuity. Some of the continuous recording stations require maintenance following the extended high stream flows of 2005-06 and others are reaching their life expectancy. Funding from UC Davis Indian Creek modeling project will help pay for their maintenance/replacement in 2007.

Four main subwatersheds of the Feather River are covered under this monitoring program:

- Indian Creek
- Spanish Creek (Indian + Spanish = East Branch North Fork Feather River)
- Middle Fork Feather River
- North Fork Feather River

Most important findings in this monitoring report:

- Big Flat peak flow attenuation and longer duration of baseflow
- Last Chance Watershed: decreasing number of days with temperature readings exceeding 75°F (lethal to coldwater fish habitat) below project areas

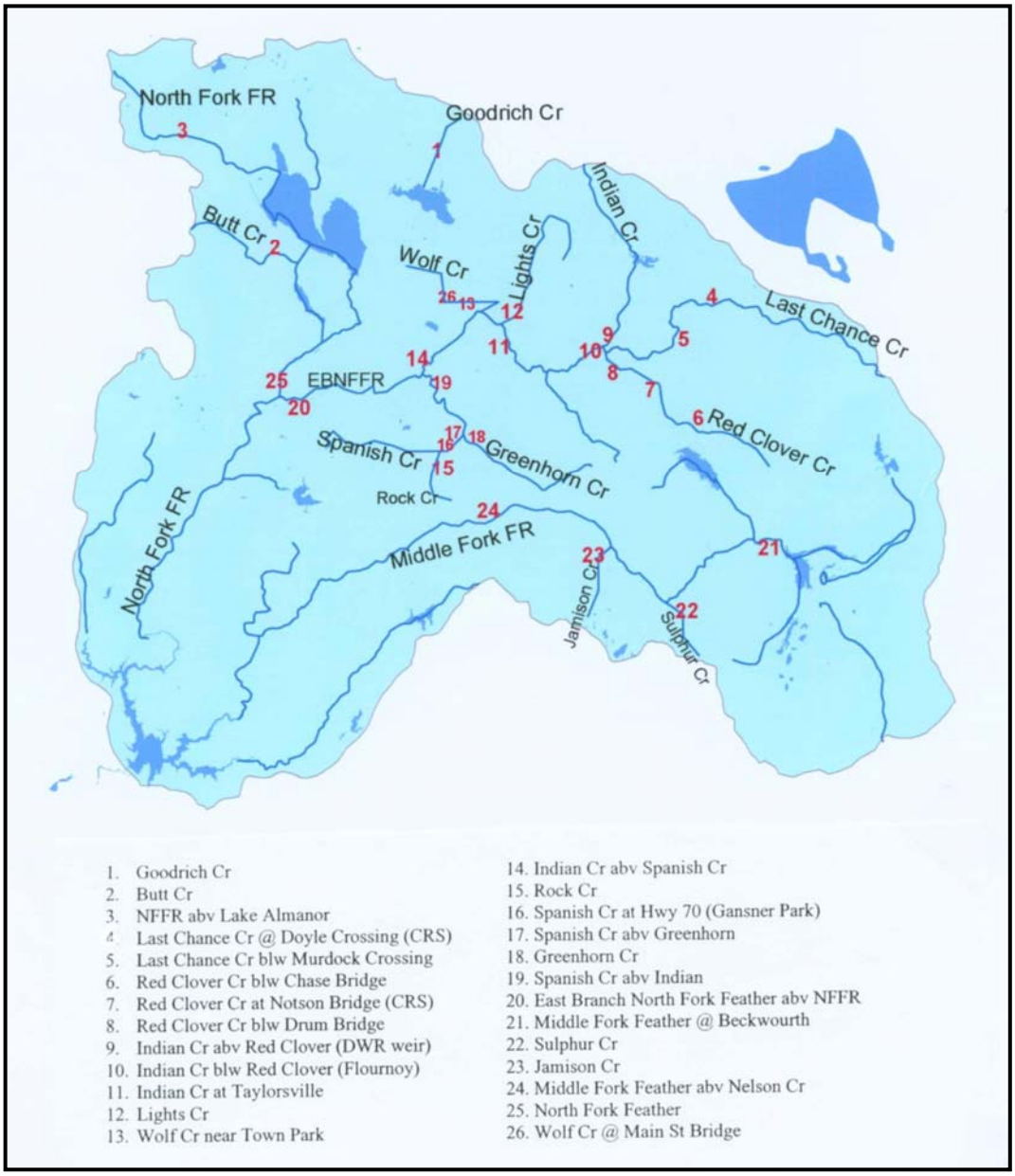


Figure 1. Feather River CRM Watershed Monitoring Locations – all "types"

Table 1. Feather River Watershed Monitoring Sites and Parameters Recorded

Map #	Monitoring Site by Subwatershed	Monitoring Type
	North Fork Feather River (NFFR) watershed	
3	NFFR @ Domingo Springs (abv Lake Almanor)	MR[∞]
25	NFFR @ acw[†] East Branch NFFR	MR
	Butt Cr (abv 307 Br)	MR
	Goodrich Cr	MR (discontinued)
	East Branch mouth (acw NFFR)	MR
19	Spanish mouth (acw Indian)	MR
17	Spanish Cr acw Greenhorn	MR
18	Greenhorn Cr mouth	MR
16	Spanish @ Gansner Park (Hwy 70)	CRS[‡]
15	Rock Cr mouth	MR
14	Indian Cr blw Indian Falls (acw Spanish Cr)	DWR
13	Wolf Cr @ Town Park	MR
26	Wolf Cr @ Main St Bridge	CRS
12	Lights Cr @ Deadfall Br	MR & CRS
11	Indian Cr @ Taylorsville	MR & CRS & DWR weather
10	Indian Cr @ Flournoy (bcw[§] Red Clover)	MR & CRS
9	Indian Cr @ DWR weir (acw Red Clover)	MR & CRS
6	Red Clover @ Chase Bridge	MR
	Thompson Valley (TVL)	DWR weather
8	Red Clover Cr @ Drum Bridge	MR
7	Red Clover @ Notson Bridge	CRS
5	Last Chance (LC) Cr @ Murdock	MR
4	Last Chance (LC) Cr @ Doyle Crossing	CRS & DWR weather
	McClellan Cr	DWR
	Cottonwood Cr	CRS
	Little Stoney Cr	DWR
	Willow Cr	DWR
	LC @ Alkali Flat low water crossing	DWR
	Ferris Cr	DWR
	LC @ Bird-Jordan Neck	staff gage & DWR
	Jordan Peak (JDP)	DWR weather
	Middle Fork Feather River (MFFR) watershed	
24	MFFR abv Nelson Cr	MR
	MFFR @ Sloat	staff gage
23	Jamison Cr @ 23N37 Br	MR
22	Sulphur Cr @ Clio	MR & CRS & volunteer weather station
	Boulder Cr	staff gage
	Barry Cr	staff gage
	Sulphur @ Lower Loop Bridge	staff gage
	Sulphur @ Upper Loop Bridge	staff gage
21	MFFR blw A23 Br (Beckwourth)	MR
	MFFR near Portola (MFP)	DWR flow

[∞] Monitoring Reaches (MR) are included in the above schema to give the reader an idea of the breadth of the overall watershed monitoring program. Monitoring Reaches have been surveyed three times for geomorphic, habitat, chemical, and biological characteristics. Long term monitoring of these sites is expected to give watershed managers a better understanding of processes and long term trends in these subwatersheds. The types of data collected at Monitoring Reach sites can be found in the SWAMP final report, with details on protocols in Appendix A.

[†] "acw" means "above confluence with"

[‡] Only operation and maintenance of the Continuous Recording Stations (CRS) sites are funded by the Plumas Watershed Forum.

[§] "bcw" means "below confluence with"

Data Collected at the Continuous Recording Stations (CRS):

- Stage (calibrated to flow)
- Water Temperature
- Air Temperature
- Turbidity (NTU's) (Spanish Creek at Gansner and Indian Creek at Taylorsville only)

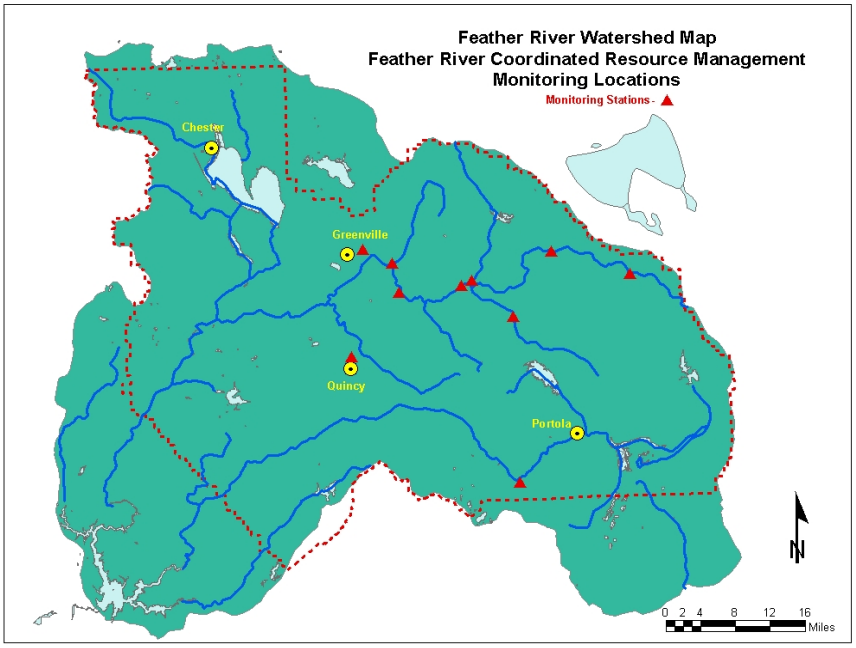


Figure 2. Location of Continuous Recording Stations (CRS)

Much of CRM's restoration efforts are concentrated on restoring the function of the watershed to store winter and spring precipitation, and release it later in the year. Continuously recorded flow data (via stage height) can help track this function of the floodplains within the Feather River watershed. Water temperature is another parameter monitored at the Continuous Recording Stations, which is biologically important due to its effect on native aquatic species. Stream flow stage, air and water temperature are read every 15 minutes by Campbell CR10X data loggers at the following monitoring sites: Red Clover Creek on Notson Bridge; Last Chance Creek at Doyle Crossing, and Million Dollar Bridge; Cottonwood Creek above and below Big Flat (not on map); Indian Creek at the DWR weir (abv Red Clover), at the Flournoy Bridge (blw Red Clover), and at the Taylorsville Bridge; Lights Creek at Deadfall Bridge; Wolf Creek at the Main Street Bridge in Greenville; Spanish Creek near Highway 70 at the Gansner Park Bridge in Quincy; and on Sulphur Creek at the Highway 89 Bridge.

The stage, air and water temperature readings are stored as hourly averages and then summarized into daily files at the end of each water year. To continuously record turbidity, Analite 195 laser sensors (a nephelometric (NTU) probe) were installed on Indian Creek (at Taylorsville Br) and Spanish Creek (at Gansner Park) in 2001. The data loggers are capable of storing up to six months of data. FRCRM staff and contract technicians download data bi-monthly to ensure reliable station operation. Because of periodic channel shifts at most of the stations monthly calibration measurements are required. Rating tables are reviewed and/or updated annually.

DWR Weather Stations

The California Department of Water Resources recently installed weather stations and one flow station in the Feather River watershed to assist in managing the water resources. In 2006, a new flow station was installed on Middle Fork Feather River near Portola (MFP) along with a DWR weather station in Thompson Valley (TVL) in the Red Clover watershed. These stations, and the two DWR weather stations installed in the Last Chance watershed in 2000 (Doyle Crossing) and 2004 (Jordan Peak), are accessible on the California Data Exchange Center (CDEC) website at www.cdec.water.ca.gov. The Taylorsville DWR weather station should soon become web (CDEC) accessible. Stream discharge and stage height are recorded at the DWR flow stations, while the DWR weather stations record rainfall, temperature, relative humidity, wind speed, wind direction, and atmospheric pressure.

Overall Findings

FR-CRM is currently collecting data. The 2006 Water Year experienced the highest annual precipitation in the last decade with 154% of historic average annual precipitation for the Feather River Basin (see Table 1). Four moderate flood events induced during the 2006 Water Year - New Years, February 27, March 25 and April 16 – are examined closely in this monitoring report.

Table 2. Precipitation averages

Water Year (10/1-9/30)	Percent of Historic Average annual precip for all Feather River Basin from CDEC*	Water Year (7/1-6/30)	Total annual precip (inches) at Indian Cr in Genesee (Wilcox data)
		1996	54.55
		1997	58.9
1998	144%	1998	60.70
1999	99%	1999	47.8
2000	101%	2000	43.65
2001	56%	2001	23.6
2002	77%	2002	33.6
2003	111%	2003	49.6
2004	83%	2004	42.8
2005	109%	2005	45.6
2006	154%	2006	68.2
			48.1 = Avg

* calculated by averaging the percent average of all reporting stations in the watershed. For 2004 there were 6/10 stations with averages (Sierraville, Vinton, Portola, Chester, Strawberry Valley, Brush Cr). For 2005, 9/10 stations were reporting (all of the above, plus Greenville, Quincy, and DeSabla). For 2006 data, 10 out of 10 stations were reporting.

I. Last Chance Creek watershed

The Last Chance watershed was designated as one of the two demonstration watersheds in the Feather River basin by FR-CRM 10 years ago. Spanish Creek was chosen as the other demonstration watershed due to its proximity to educational institutions and landowner interest. Direct management and land use change in Last Chance watershed is minimal and there is not as much urban interference in watershed function as in the Spanish Creek watershed.

Last Chance Creek

Completed in 2005, the Last Chance Creek project restored nine miles of stream in eastern Plumas County (see Table 3 for list of projects). Two weather stations in the Last Chance watershed are at Doyle Crossing and Jordan Peak and real-time data is available on the CDEC website. The Doyle Crossing continuous recording stream flow station is 4 miles downstream of the Big Flat project site on Cottonwood Creek and captures the discharge from most of the upper Last Chance watershed.

Table 3. Completion of Project work at Last Chance Creek

Year	Reach Name	Miles of Channel	Affected Acreage
1995	Big Flat on Cottonwood Cr	0.78	47
2001	Stone Dairy	0.43	20
2002	Meadowview & Artray	1.6	300
2003-4	Ferris Field I, Alkali Flat, Bird, Bird-Jordan, Ferris Cr, Jordan Flat I	4.1	800
2004	Above Charles	0.38	80
	Big Flat Modification	0.57	34
2005	Jordan Flat Supplemental	0.34	50
	Dooley Cr	1	80

Peak Flow Attenuation at Big Flat – Cottonwood Creek

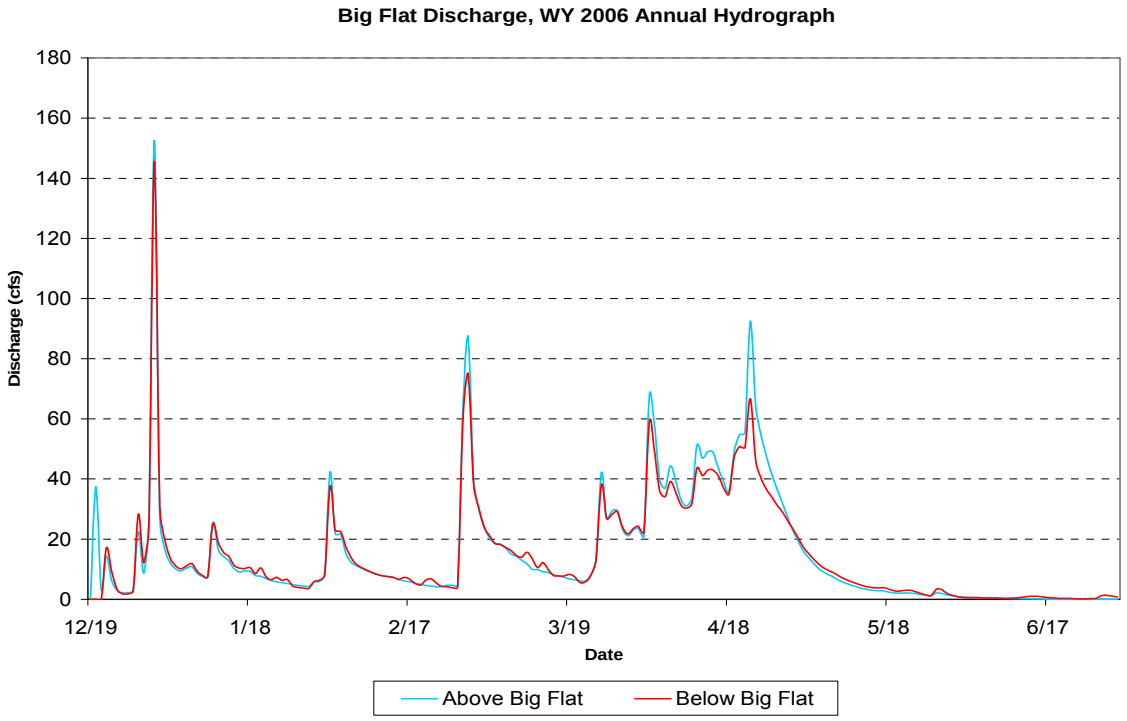


Figure 3. Annual Hydrograph recorded above and below Big Flat project area

Big Flat on Cottonwood Creek was the first pond-and-plug project implemented by FR-CRM in 1995. In the summer of 2004, a modification of 0.57 miles of channel was completed. Two winters after the completion of the channel modification, the above normal precipitation year of 2006 produced some significant results from the two continuous flow recorders installed above and below the project area. The gage readings above and below the project area show a marked flood attenuation because one would expect to see high flows at the downstream station, but the graph shows higher peaks at the upstream station (see Figure 3). The annual hydrograph shows a 15-20% reduction in flood peaks. The gage readings also show a sustained baseflow on the recession limb of the spring runoff during the 2006 water year (see Figure 3). Figure 4 more clearly illustrates the spring recession limb of daily average discharge recorded above and below the Big Flat project area. The 2006 water year shows the meadow absorbing peak flows and releasing the flows later in the year.

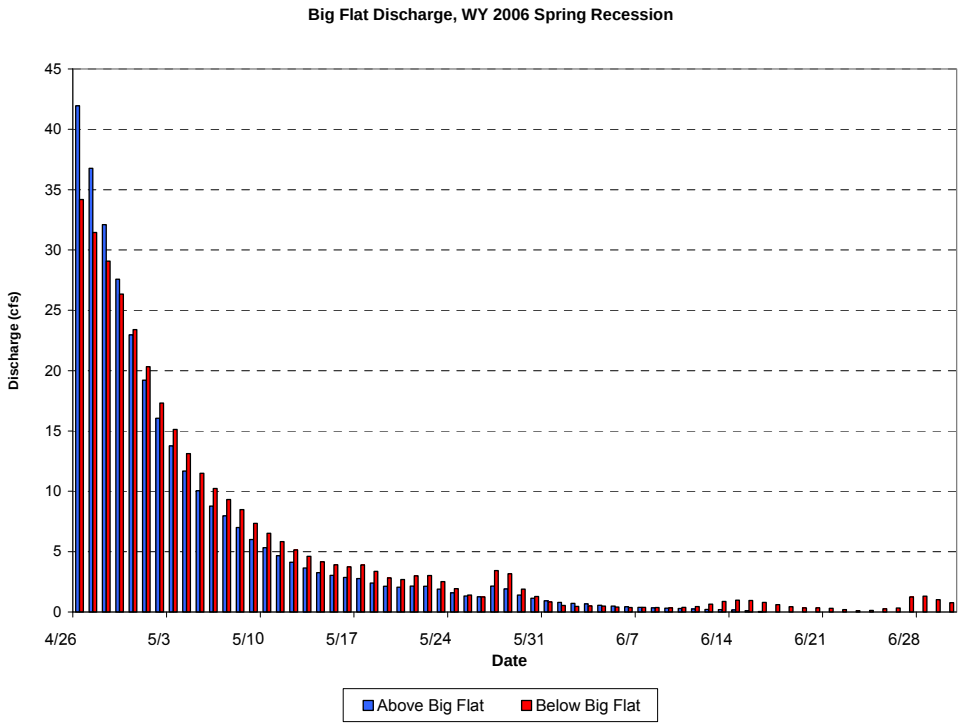


Figure 4. Discharge readings above and below Big Flat project during the Spring recession limb

The hydrograph of a late winter storm (2/28-3/22/06) during the 2006 water year takes a closer look at peak flow attenuation with a 15-20% reduction in peak discharge (see Figure 5). Figure 5 also illustrates an extended duration of surface water in Cottonwood Creek that has been recorded following the Big Flat modification of 2004.

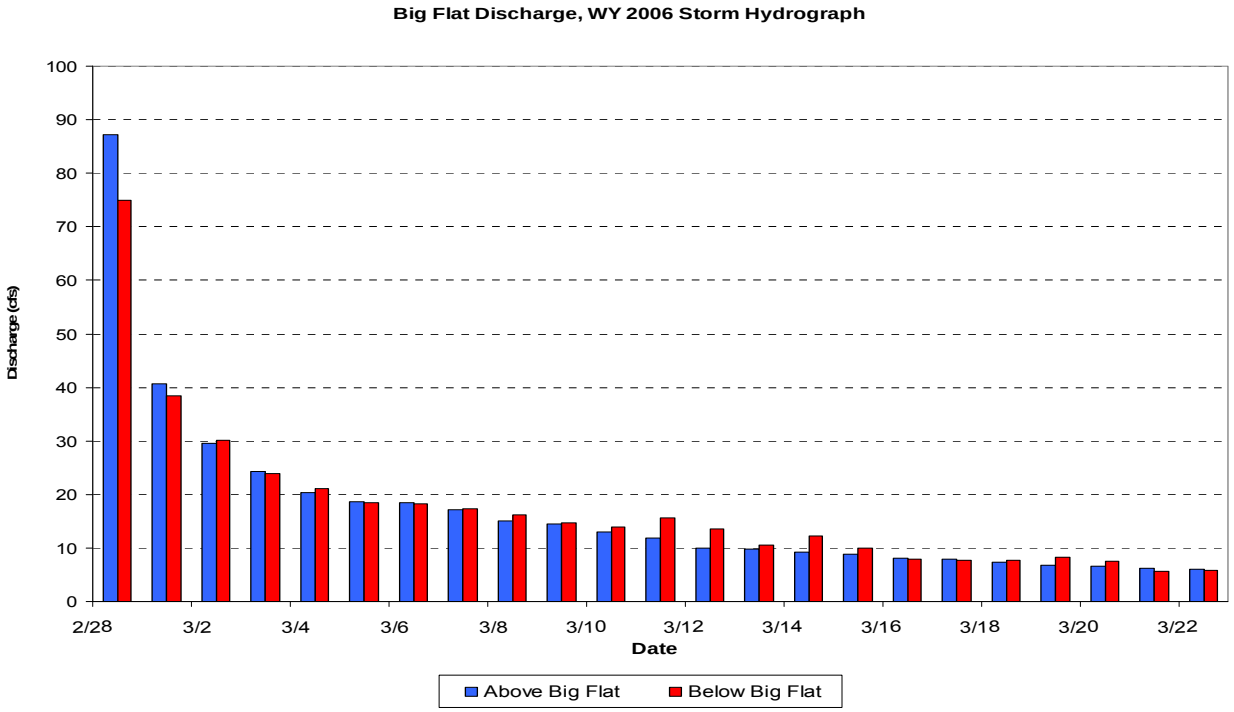


Figure 5. Storm hydrograph (2/28-3/22/06) showing discharge above and below Big Flat

Figure 6 takes a closer look at the hydrologic response of Big Flat on Cottonwood Creek to the peak flow event for WY2006 - the New Year's Flood (12/20/06-12/31/06). The graph shows a 2 day delay from when the discharge peaked above vs. below the project area. The peak flow/increased discharge appears to be attenuated and absorbed by the Big Flat meadow and gradually released back into Cottonwood Creek, sustaining a higher base flow for an extra 3 days.

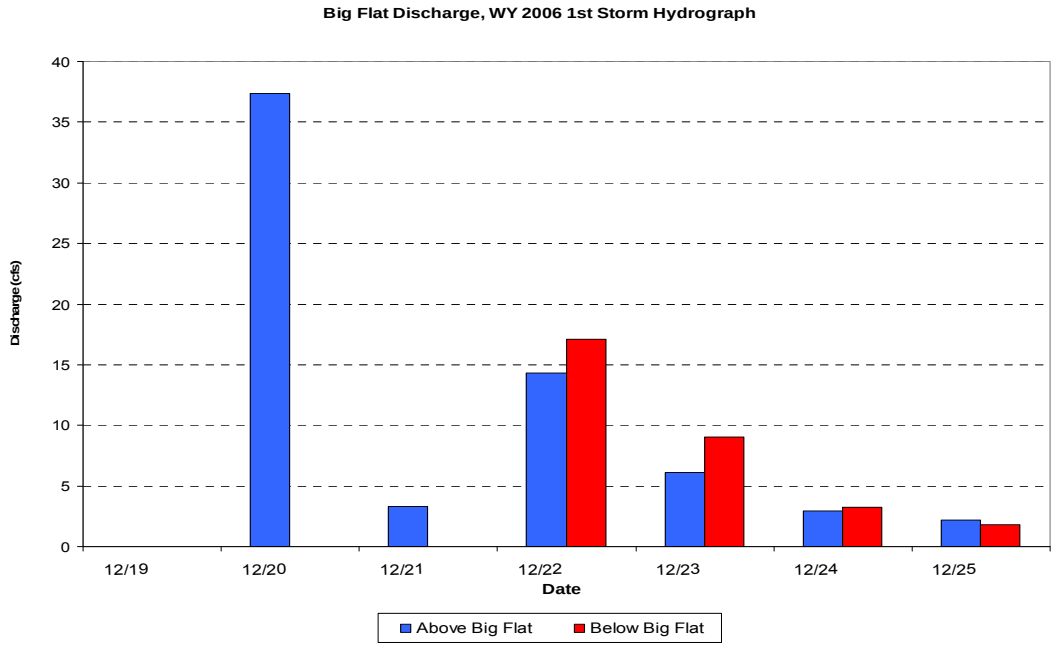


Figure 6. Close-up look at hydrologic response of Big Flat to New Year's Storm 12/20-12/25/05

Last Chance vs. Red Clover:

The annual hydrographs of these watersheds are compared to see if there is a discernable difference between the hydrologic response of Last Chance with more restored meadows and stream channel versus Red Clover with little restored floodplain area during the 2006 Water Year. Dr. Levant Kavvas (UC Davis) completed a flow model of the Last Chance watershed in 2005. The Doyle Crossing gage on Last Chance Creek measures flow from 64,000 acres of the Last Chance watershed, while Red Clover at Notson Bridge measures 69,190 acres of watershed flow. A comparison of the 2006 annual hydrographs of the Last Chance and Red Clover watersheds showed that the two watersheds have a similar response to precipitation events during the big water year. During the 2006 water year, 28.88 inches of precipitation was recorded at Doyle Crossing on the Last Chance watershed.

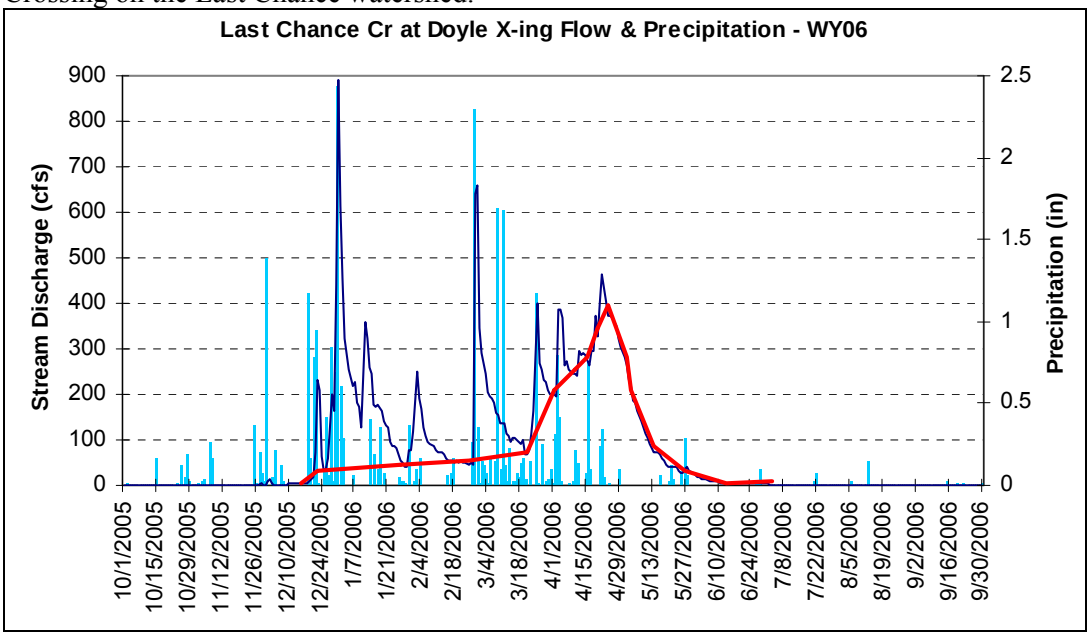


Figure 7. WY 2006 annual hydrograph & precipitation for Last Chance Creek at Doyle Crossing

The red lines in Figures 7 and 8 follow the rising limb and falling limb of base flow in Last Chance and Red Clover creeks over the 2006 Water Year. Both watersheds took a similar amount of time (130 days for Last Chance and 128 days for Red Clover) to reach the height of wetness for the 2006 water year (see Figure 7 & 8). The receding limb of the yearly hydrographs show a similar drainage response following the bulk of precipitation for WY2006 with drainage durations of 74 days for Red Clover Creek and 60 days for Last Chance Creek.

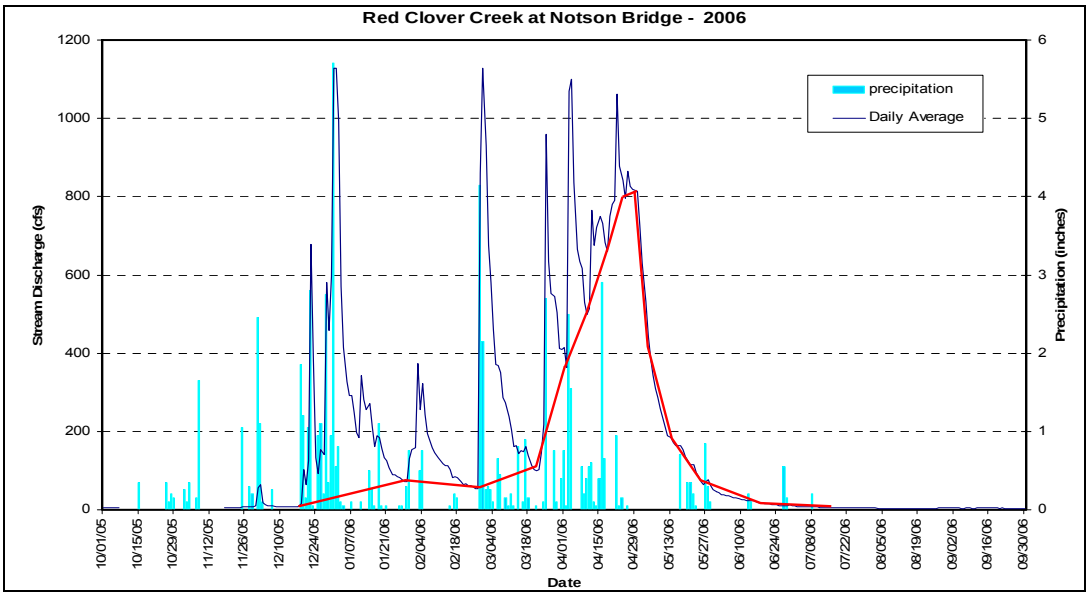


Figure 8. WY2006 annual hydrograph & precipitation for Red Clover Creek at Notson Bridge

Figures 7 and 8 also show that in dry and wet antecedent moisture conditions, the discharge of Red Clover watershed at Notson Bridge is a little less than 2 times that of Last Chance watershed at Doyle Crossing, though they exhibit similar hydrologic responses to storm events and their watershed size is almost the same. This is expected due to the greater amount of precipitation falling in the Red Clover watershed in comparison to the drier Last Chance watershed. Because of the larger volume of water, however, one would also expect that the response time of Red Clover watershed would be slower, but this is only slightly noticeable. Maybe with more of Red Clover creek restored in 2006, the next water year may show a greater difference in response time.

Unfortunately, during the New Year's Storm (12/30/05), the discharge of Red Clover at Notson Bridge exceeded the rating curve (stage height to discharge). The maximum rated discharge of Red Clover at Notson Bridge is 1129 cfs. Therefore, a comparison of the hourly hydrograph (12/30/05-1/9/06) for the New Year's Storm from the monitoring stations on Red Clover at Notson Bridge and Last Chance at Doyle Crossing does not yield definitive data. The following hourly storm hydrograph from the two monitoring stations on Last Chance and Red Clover does suggest a steeper recession limb of the peak flow on Red Clover, though the data is not conclusive.

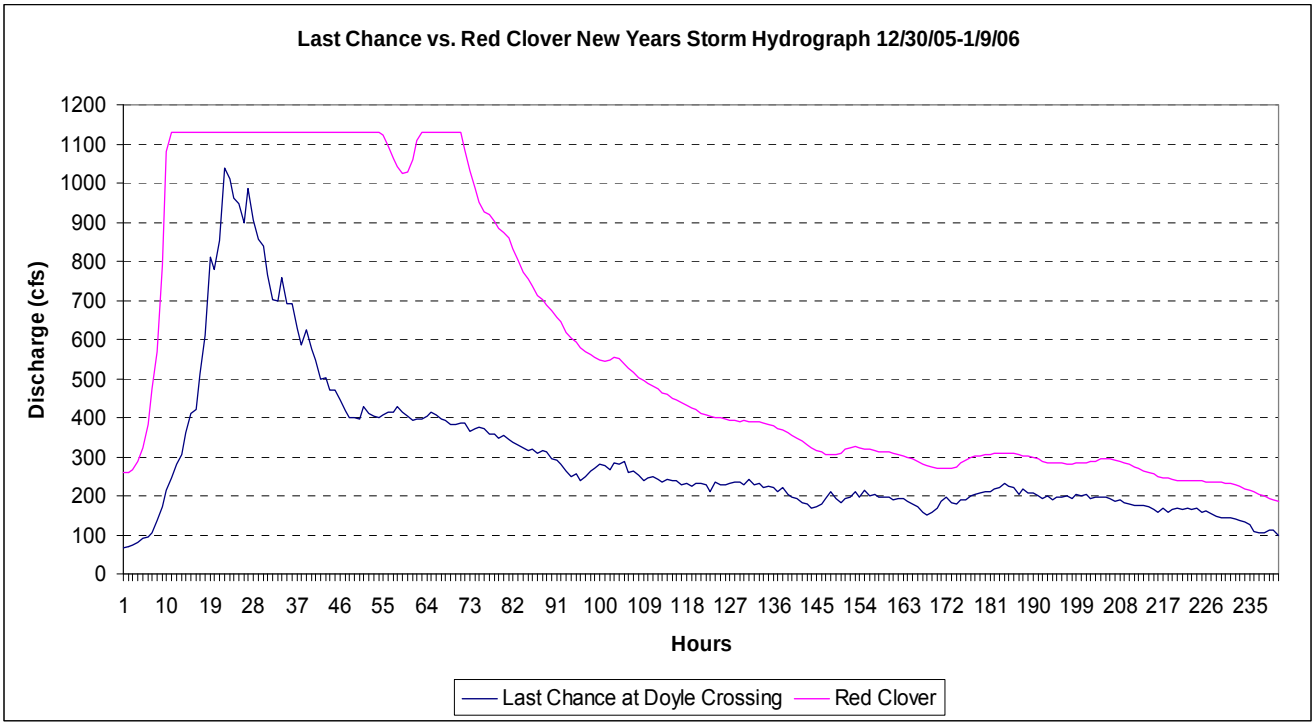


Figure 9. New Years Storm hydrograph for Last Chance & Red Clover Creeks

Last Chance Creek flow in wetter vs. drier water years:

Comparing precipitation and discharge at Doyle Crossing on Last Chance Creek, Figure 10 shows the different flow responses to rainfall in a drier (2005) vs. wetter (2006) water year. During the above normal precipitation water year of 2006, peak flow appeared at the end of December, whereas the peak flow during the drier 2005 water year did not appear until the end of March. Peak watershed wetness was achieved earlier in the 2006 water year.

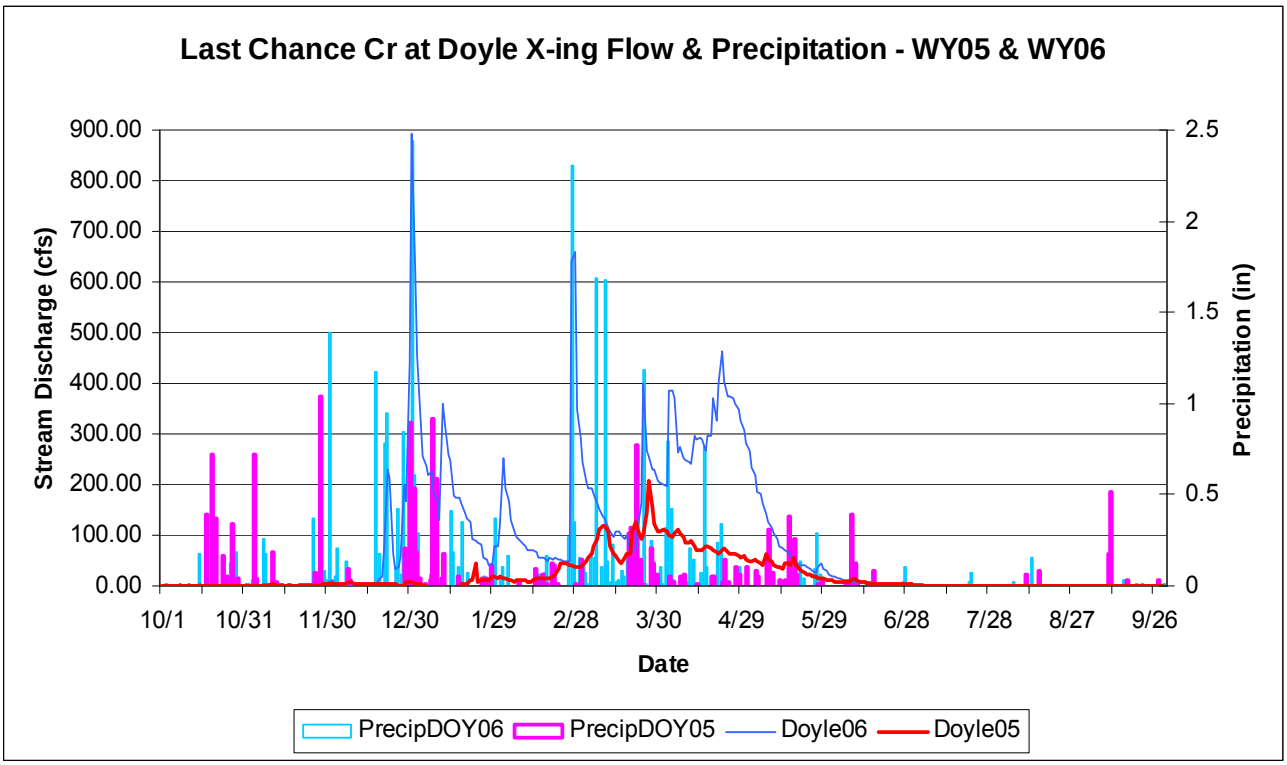


Figure 10. Rainfall and flow at Doyle Crossing on Last Chance Creek in WY 2005 and WY 2006.

Temperature in Last Chance Watershed above and below project sites:

The following graphs show temperature readings 2 years after project completion above and below four project sites (constructed 2003-4) in the Last Chance Watershed: Bird, Jordan Flat, Alkali Flat and Ferris Creek. Bird, Jordan Flat and Alkali Flat are all reaches of Last Chance Creek, with Ferris Creek as a tributary. Jordan Flat had some supplemental project work done in 2005.

Looking at one-time Maximum Daily Water Temperature (°F) readings in WY2006, temperatures at Alkali Flat show a decrease of 8°F and samples from Bird show a 2°F temperature decrease from the top to the bottom of the project area (see Figure 11). The slight increase in temperature at Jordan Flat may be due to a spring that enters Last Chance Creek at the top of the Jordan reach.

Maximum Weekly Water Temperatures (°F) decreased in WY 2006 at Jordan Flat and Alkali Flat project sites by 1°F and 6°F respectively (see Figure 12). Maximum daily and weekly water temperatures recorded above and below Ferris Creek remained stable with undetectable change (Figures 11 & 12).

Figure 13 shows that aside from the Jordan Flat project, which received modification work in the summer of 2005, two years after project completion on Bird, Alkali Flat and Ferris Creek, diurnal water temperature fluctuations decrease dramatically from above the project site to below the project site. Results show diurnal fluctuations of water temperature decrease 13°F through Alkali Flat, 2°F through the Ferris Creek project site, and 3°F through the Bird project in the Last Chance watershed (Figure 13).

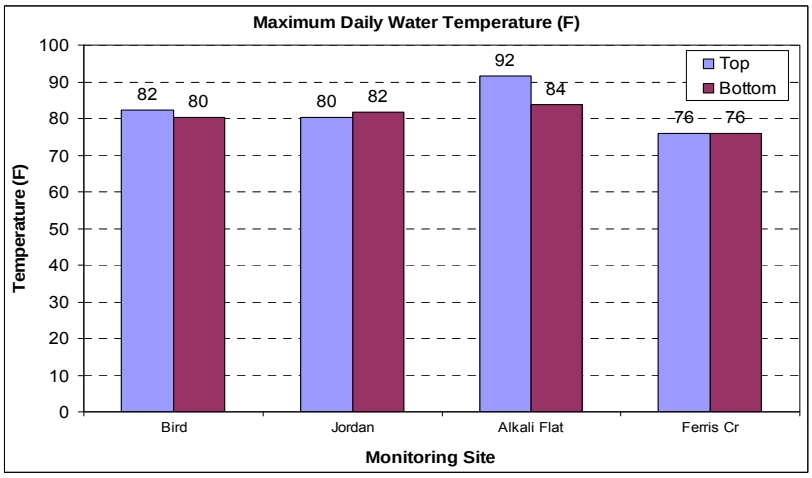


Figure 11. Maximum Daily Water Temperature above & below Last Chance projects

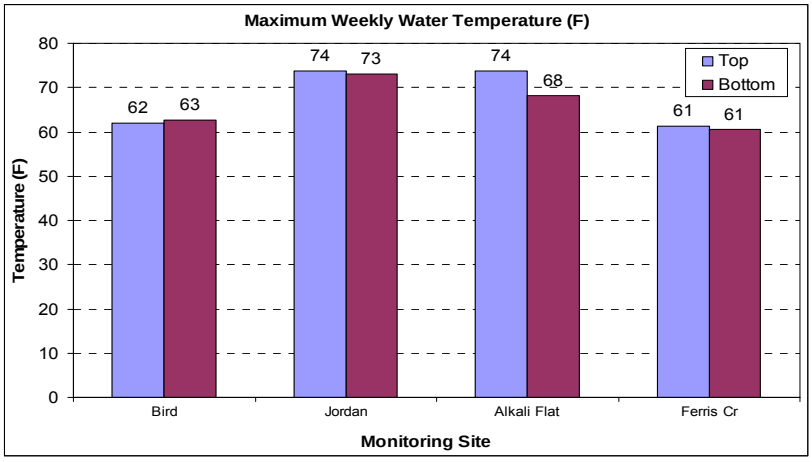


Figure 12. Maximum Weekly Water Temperature abv & blw Last Chance projects

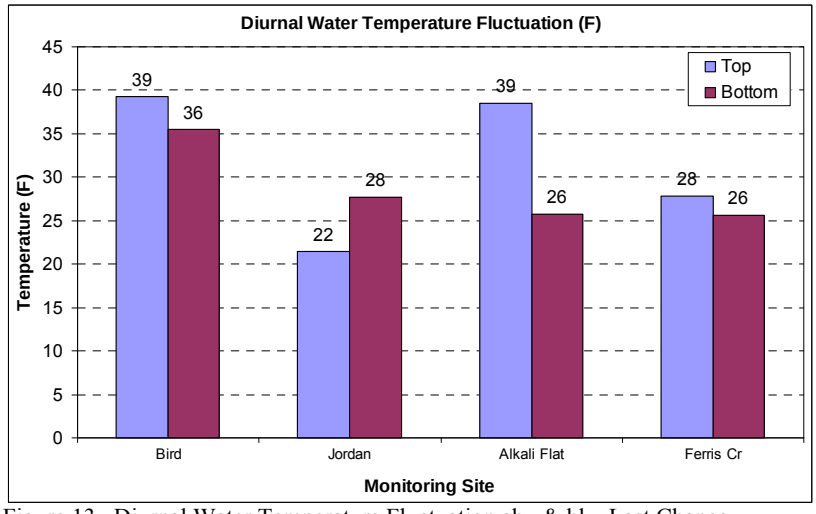


Figure 13. Diurnal Water Temperature Fluctuation abv & blw Last Chance projects

Figure 14 illustrates the dramatic reduction of weekly average water temperature readings that exceed 70°F (considered harmful to coldwater trout fisheries) in water that flows through the Alkali Flat project area. Above the project area, 11 readings of weekly average temperature above 70°F were recorded, whereas none were recorded in the stream channel as it flows out of the project area. Having experienced the most recent project construction, Jordan Flat does not exhibit a change in the number of weekly average temperature readings exceeding 70°F. The spring entering Last Chance at the top of the Jordan reach may also be cooling the flow entering the project area.

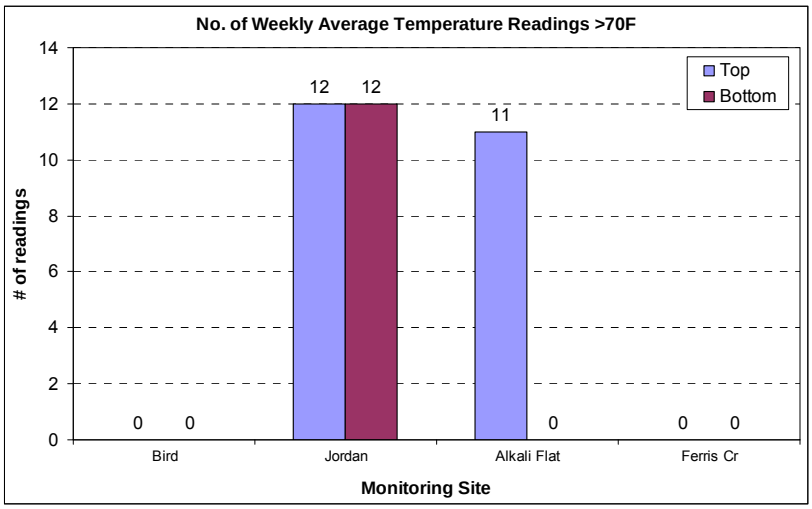


Figure 14. Number of Weekly Average Temperature Readings >70F abv & blw Last Chance projects

Figures 14 and 15 show that no weekly average temperature readings at the Bird or Ferris Creek project areas exceeded 66°F, and thereby are not considered impaired cold water fish habitat. Just one year after supplemental meadow restoration work on Jordan Flat, there are 11 fewer weekly average water temperature readings exceeding 66°F below the project area than were measured above (49 vs. 38 readings). As Figure 14 illustrates, Figure 15 also shows a dramatic reduction in weekly average water temperature readings exceeding 66°F through the Alkali Flat project area with 44 readings above vs. 10 below.

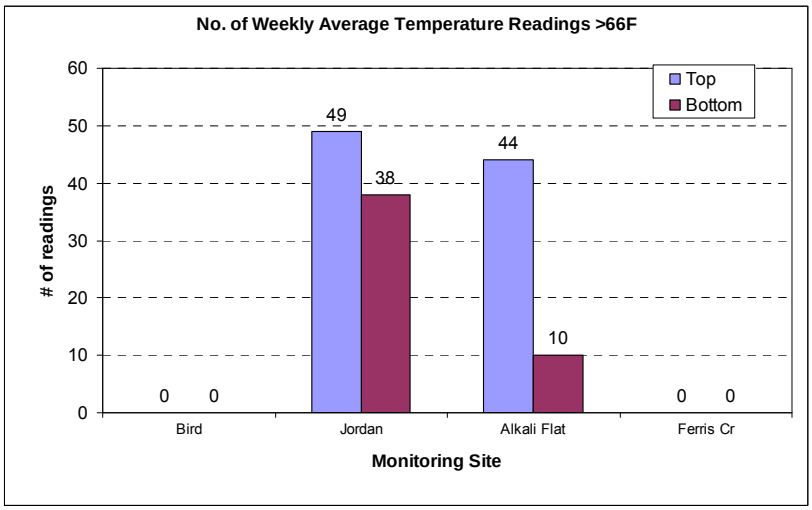


Figure 15. Number of Weekly Average Temperature Readings >66F abv & blw Last Chance projects

Figure 16 illustrates a reduction at all four project sites on Last Chance Creek in hourly temperature readings exceeding 75°F below vs. above the project area. The most dramatic reduction in the number of hourly temperature readings was recorded at Alkali Flat with 291 readings above the project area compared with 16 below. Hourly temperature readings exceeding 75°F are considered lethal to coldwater fish populations, and all of the project sites record a reduction in such readings through the project areas.

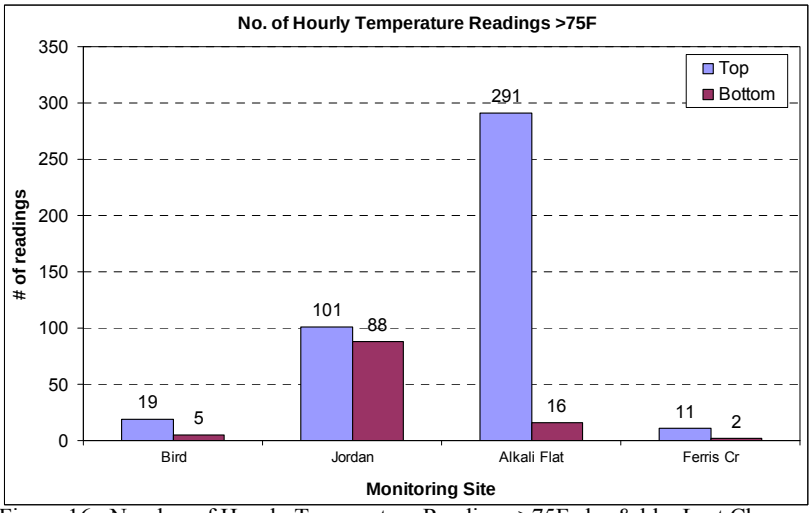


Figure 16. Number of Hourly Temperature Readings >75F abv & blw Last Chance projects

Watershed Temperature

The Central Valley Regional Water Quality Control Board has identified water temperature as a concern in the Feather River. A variety of water temperature parameters were used to compare between sites, and between years at each site to track trends in different water temperature parameters. Water temperature parameters were analyzed for six continuous recording stations with usable low flow data (all of which are in the Indian Creek subwatershed). The temperature sensor at Wolf Creek has been buried by sediment in 2005 & 2006, thus the data are inaccurate and not included in these analyses.

Maximum daily water temperature

Figure 17 graphs the highest 1 hour-long temperature that was recorded during the annual sampling period, which is a function of air temperature, volume of water, and surface interval for insolation. While the station on Indian Creek above the confluence with Red Clover maintains a fairly low daily maximum temperature from 2000-06, the maximum daily water temperature at Red Clover creek at Notson Bridge increased by about 10 degrees Fahrenheit in 2006. A warming influence of Red Clover Creek on Indian Creek is apparent with the higher maximum daily water temperatures on Indian Creek below the confluence with Red Clover (Flournoy) vs. above the confluence (DWR weir) in 2000-06 (except for 2002).

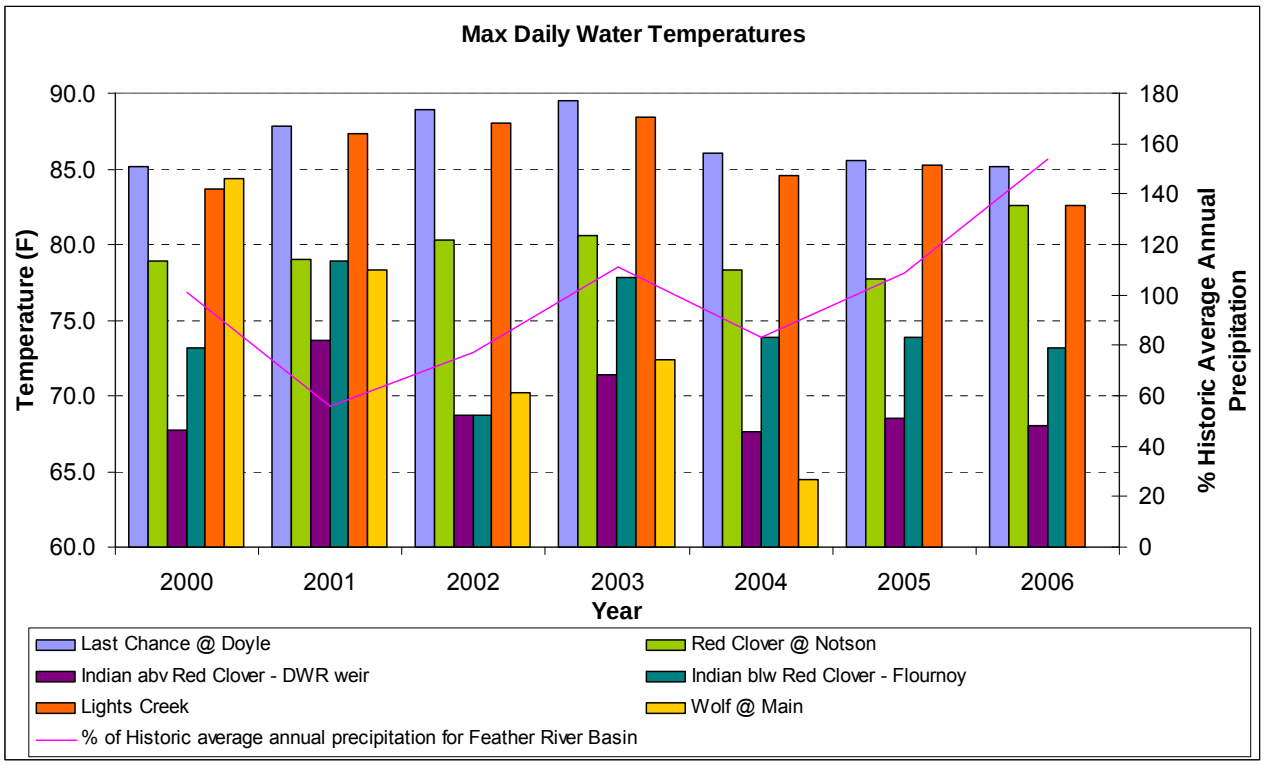


Figure 17. Maximum Daily Water Temperatures recorded 2000-06

Despite the warmer max water temperature on Red Clover Creek in 2006, no extra warming influence is noticeable on Indian Creek, based on temperature readings at Flournoy in 2005 vs. 2006. Wolf Creek portrays a fairly steady decrease in maximum daily water temperatures from 2000-04 (inaccurate data in '05-'06 due to buried sensor). Increase in riparian vegetation from drought years and CRM's restoration projects above the gage in 1992 (Wolf Creek, Phase 3), and 2002 (Anson bank) may be contributing factors to the maximum daily temperature decrease. Beaver dams on the reach have also increased water depth throughout. The maximum water temperature recorded on Last Chance Creek at Doyle Crossing has also been declining since 2003, despite the 8 miles of untreated stream channel above the gage where insolation can occur.

Maximum weekly average water temperature

The graph of maximum weekly average water temperatures (Figure 18) shows that Lights and Last Chance Creeks are consistently the two warmest channels, based on the highest of the running seven-day averages calculated throughout the sampling period from 2000-06. During the high precipitation water year of 2006, Red Clover Creek at Notson Bridge exhibited a dramatically higher maximum weekly average water temperature,

but it does not appear to have had an extra warming influence on Indian Creek above the normal temperature increase with the confluence of Red Clover.

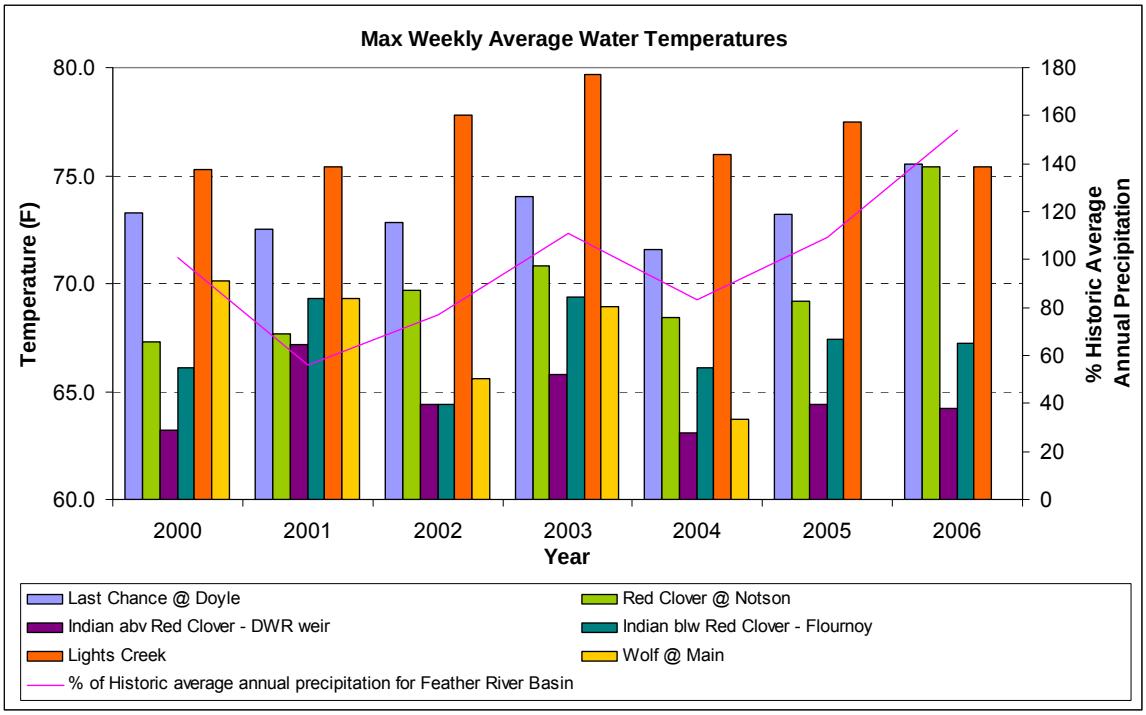


Figure 18. Maximum Weekly Average Water Temperatures 2000-06 at Continuous Recording Stations

Weekly Average Water Temperatures >66°F

Figure 19 displays the number of running seven day averages that were greater than 66 degrees Fahrenheit. This water temperature parameter is of biological importance since water that has an average temperature greater than 66°F for seven days is considered not conducive to a coldwater fishery. Lights Creek and Last Chance Creek consistently have the highest number of weekly average water temperatures greater than 66°F. There appears to be an inverse relationship between the number of weekly average water temperature exceedences and percent historical average annual precipitation on Lights Creek. In other words, wetter precipitation years have fewer periods of weekly average temperatures exceeding 66°F and drier precipitation years have an increased number of such periods.

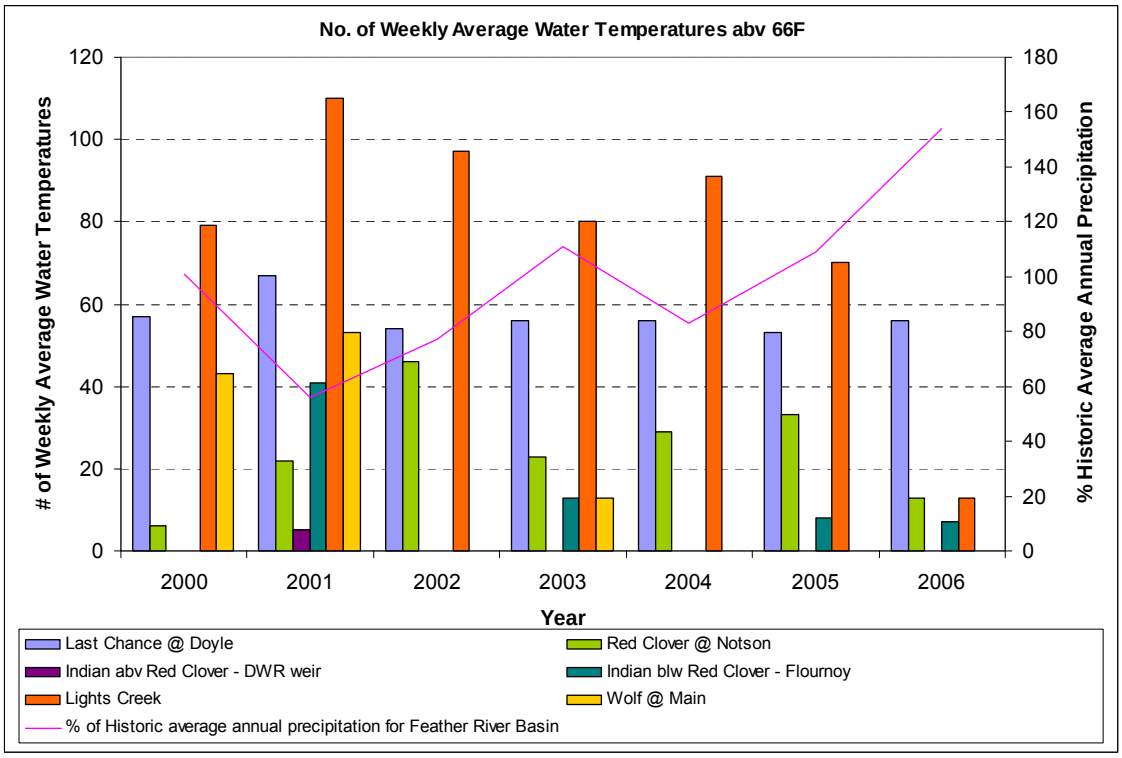


Figure 19. Number of Weekly Average Water Temperatures above 66F from 2000-06

Daily Maximum Water Temperature >75°F

Figure 20 displays the number of days that had an absolute 1-hour long temperature greater than 75°F among the six continuous recording stations with usable low flow data from 2000-06. A reading greater than 75°F can be lethal to coldwater fisheries, even if it is just a short-term maximum temperature reading. Based on the above two figures indicating the impairment of waters for trout fisheries, Last Chance and Lights Creeks appear to be the most impaired creeks monitored over the last 6 years. However, on Last Chance Creek, there is a significant downward trend in the number of days with maximum water temperatures above 75°F from 2001-06. The dramatic decline in number of days with maximum water temperature above 75°F is apparent in spite of the 8 mile distance (where insolation can occur) from the end of the project work on Last Chance Creek and the monitoring station at Doyle Crossing. On Red Clover Creek at Notson Bridge, the number of days with max water temperatures above 75°F has also been declining since 2002, though not as steadily as Last Chance Creek.

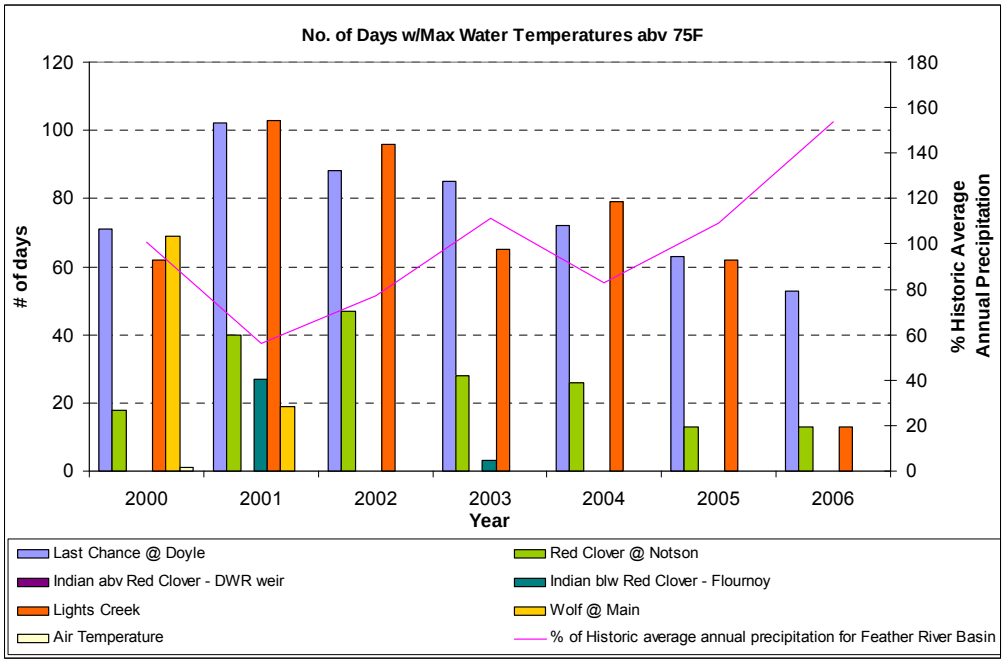


Figure 20. Number of days with maximum water temperature above 75F recorded from 2000-06

Maximum summer diurnal water temperature fluctuation

Figure 21 displays the greatest fluctuation in temperature in a 24-hour period during the sampling period. Since this parameter is heavily dependent on the volume of water and elevation, a comparison between years at the same site is most appropriate. Last Chance at Doyle Crossing exhibits a significant downward trend in diurnal fluctuation of maximum summer water temperature from 2004-06. Over the entire six year record, Wolf Creek portrays the most obvious decreasing trend in maximum water temperature diurnal fluctuation during the summer. Such a change could be due to a combination of factors such as increased riparian vegetation, CRM's restoration projects upstream of the gage, and beaver dams increasing water depth.

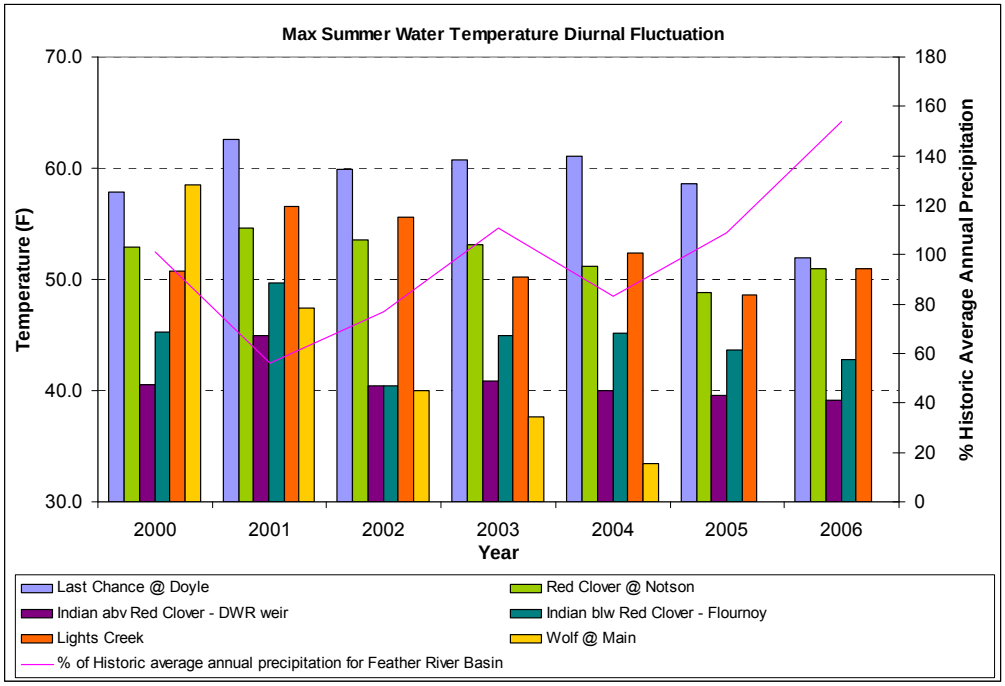


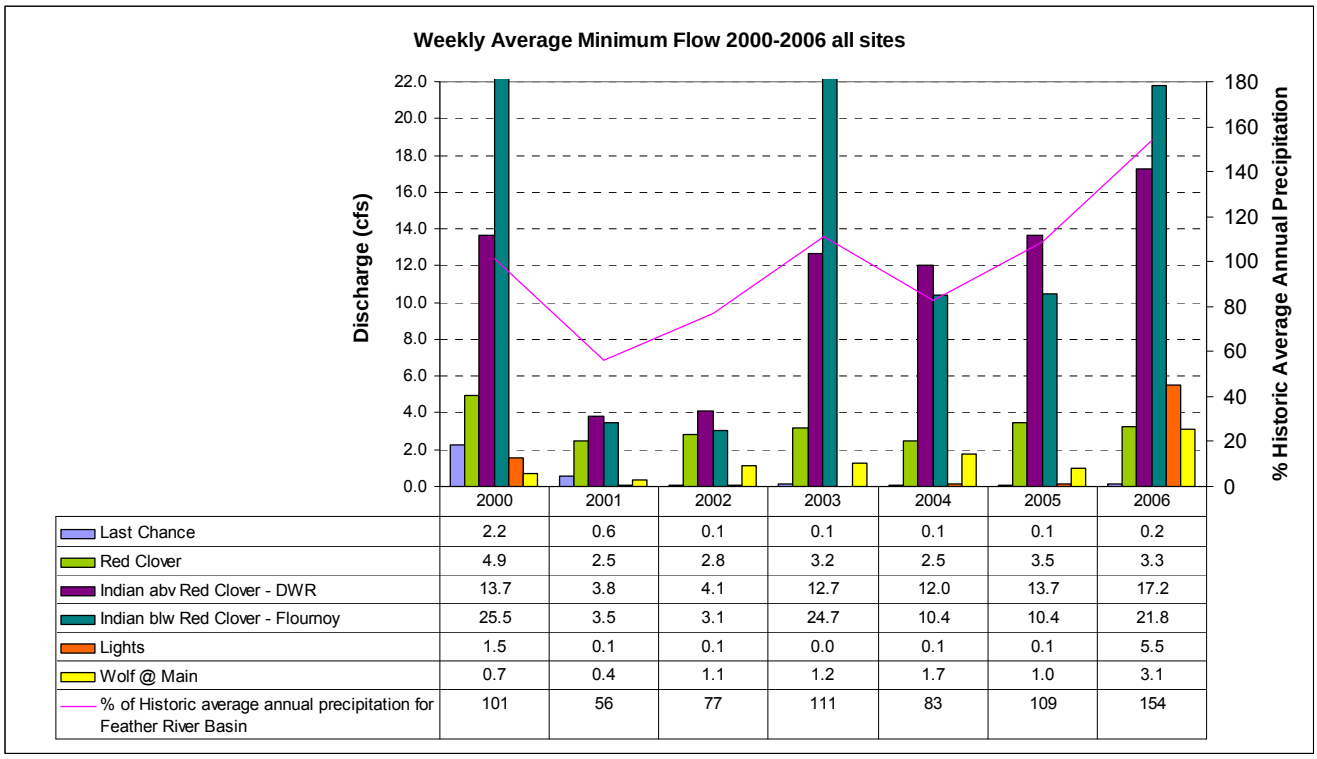
Figure 21. Maximum summer water temperature diurnal fluctuation recorded from 2000-06

Temperature Impairment in the watershed

Last Chance Creek at Doyle Crossing continues to be the most heavily temperature impaired channel, followed by Red Clover and Lights Creeks. Locally high temperature readings at Doyle Crossing on Last Chance Creek can be attributed to enhanced solar collection from water sheeting over bedrock and a 400-foot long open pool above the recording station. Nevertheless, the previous two graphs (figure 20 & 21) exhibit downward trends in daily maximum water temperatures and diurnal fluctuations during the summer on Last Chance Creek at Doyle Crossing. The temperature impairment of Red Clover and Lights Creeks are assumed to be from channel degradation.

Weekly Average Minimum Flow

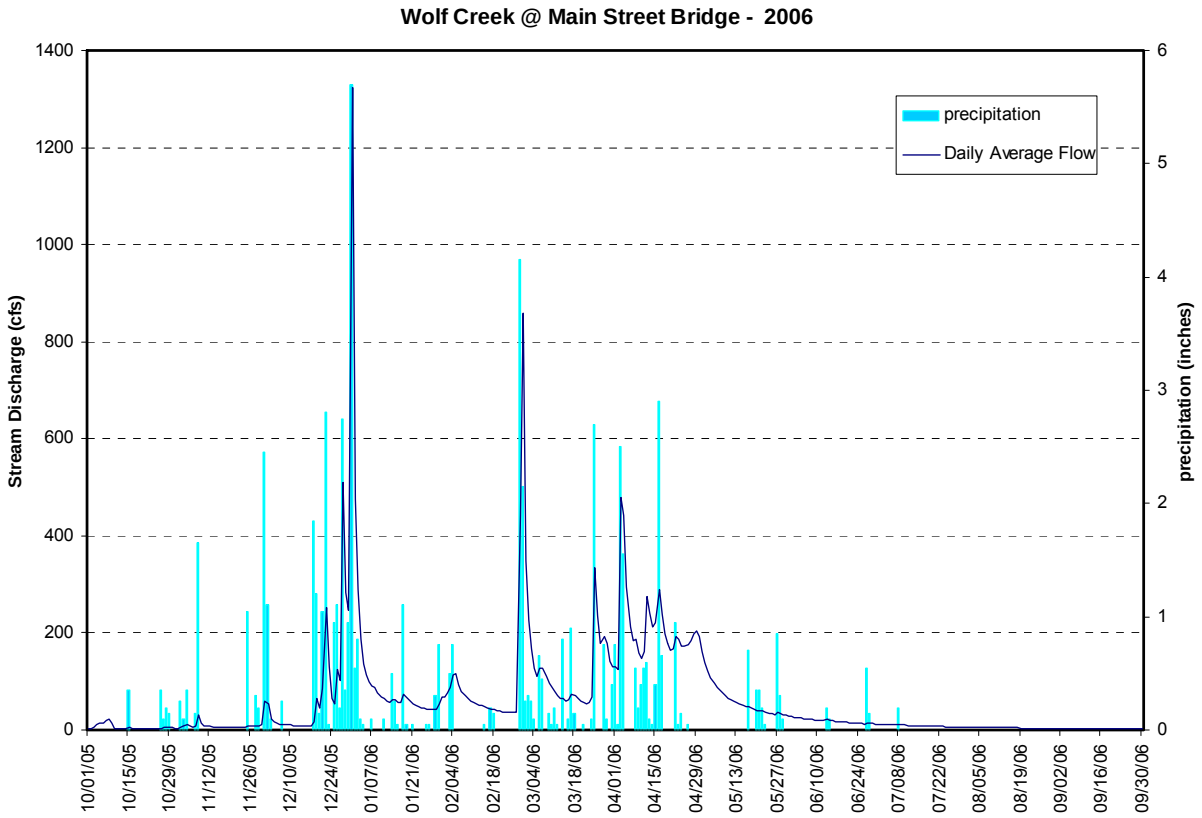
Figure 22 shows minimum weekly average flows (discharge in cfs) across the six continuous recording sites in the Indian Creek watershed from 2000-06. During the 2006 water year, the weekly average minimum flow recorded on Indian Creek below Red Clover at Flournoy Bridge (21.8 cfs) was over twice the minimum weekly average discharge (cfs) recorded in the 2005 Water Year (10.4 cfs). As precipitation levels increased from 2004-2006 water years, minimum flows on Indian Creek above Red Clover (DWR weir station) have followed a dramatic upward trend from 12 cfs in WY2004 to 17.2 cfs in WY2006, although this is a regulated system. Minimum weekly average flow on Red Clover at Notson Bridge stayed fairly stable through precipitation changes over the monitoring years, though Lights Creek and Wolf Creek exhibited higher weekly average minimum flows than in the past six years.

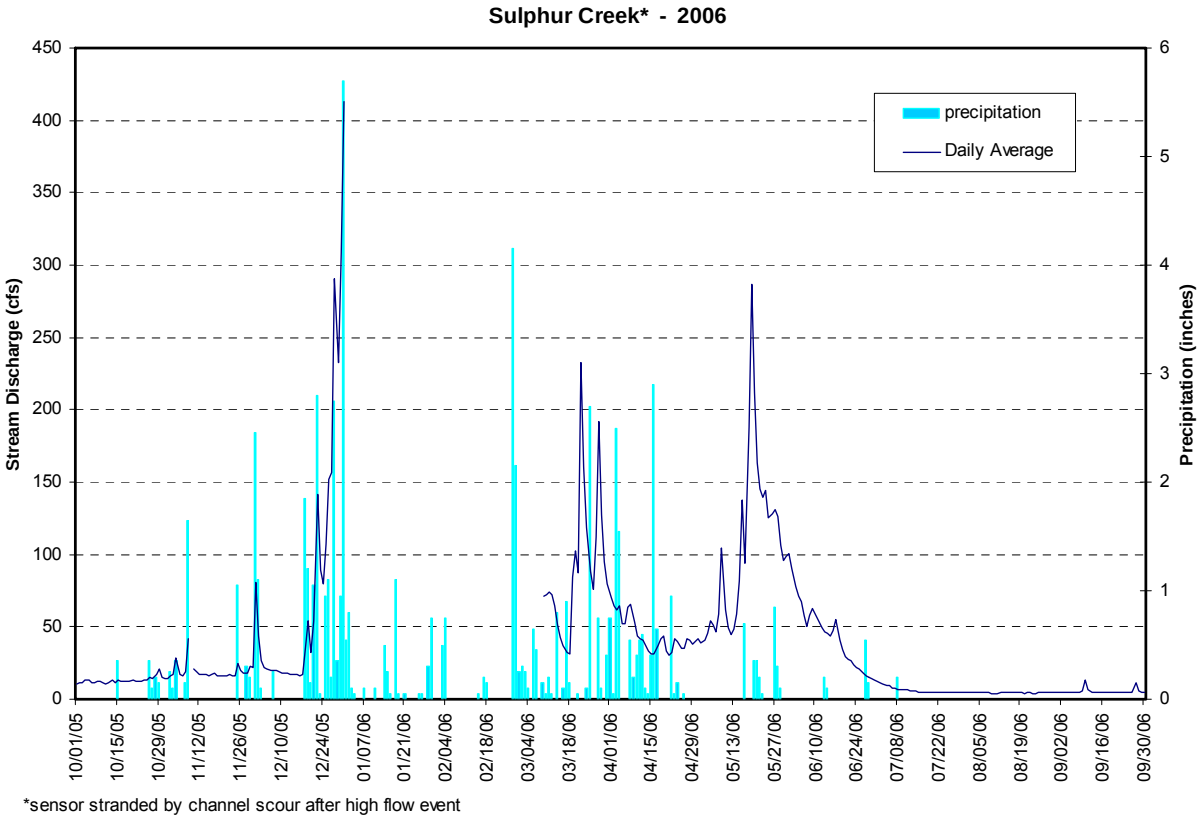


	2000	2001	2002	2003	2004	2005	2006
Last Chance	2.2	0.6	0.1	0.1	0.1	0.1	0.2
Red Clover	4.9	2.5	2.8	3.2	2.5	3.5	3.3
Indian abv Red Clover - DWR	13.7	3.8	4.1	12.7	12.0	13.7	17.2
Indian blw Red Clover - Flournoy	25.5	3.5	3.1	24.7	10.4	10.4	21.8
Lights	1.5	0.1	0.1	0.0	0.1	0.1	5.5
Wolf @ Main	0.7	0.4	1.1	1.2	1.7	1.0	3.1
% of Historic average annual precipitation for Feather River Basin	101	56	77	111	83	109	154

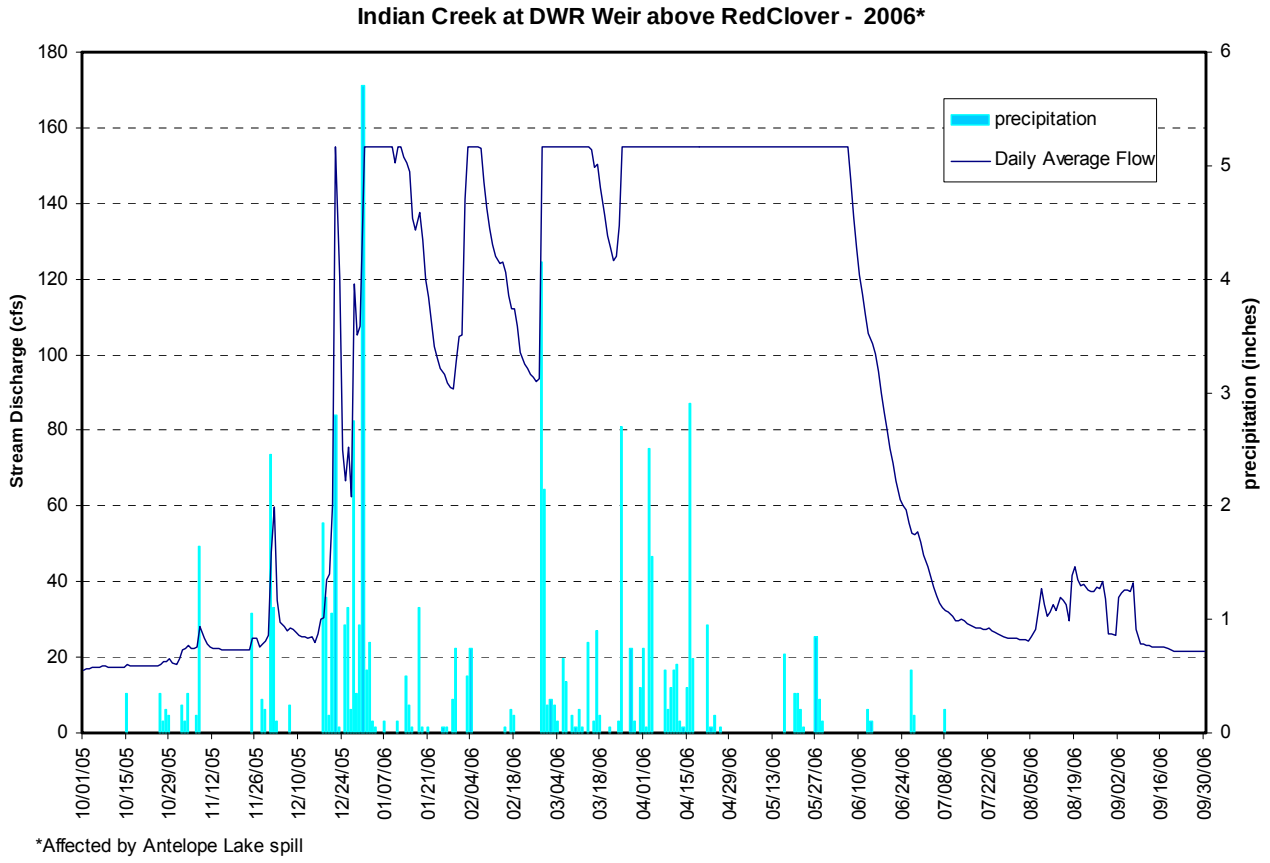
Figure 22. Weekly Average Minimum Flow from 2000-06 across CRS sites in Indian Creek Watershed

Appendix A. Annual hydrographs for continuous recording stations WY2006 (with precipitation at Genesee)

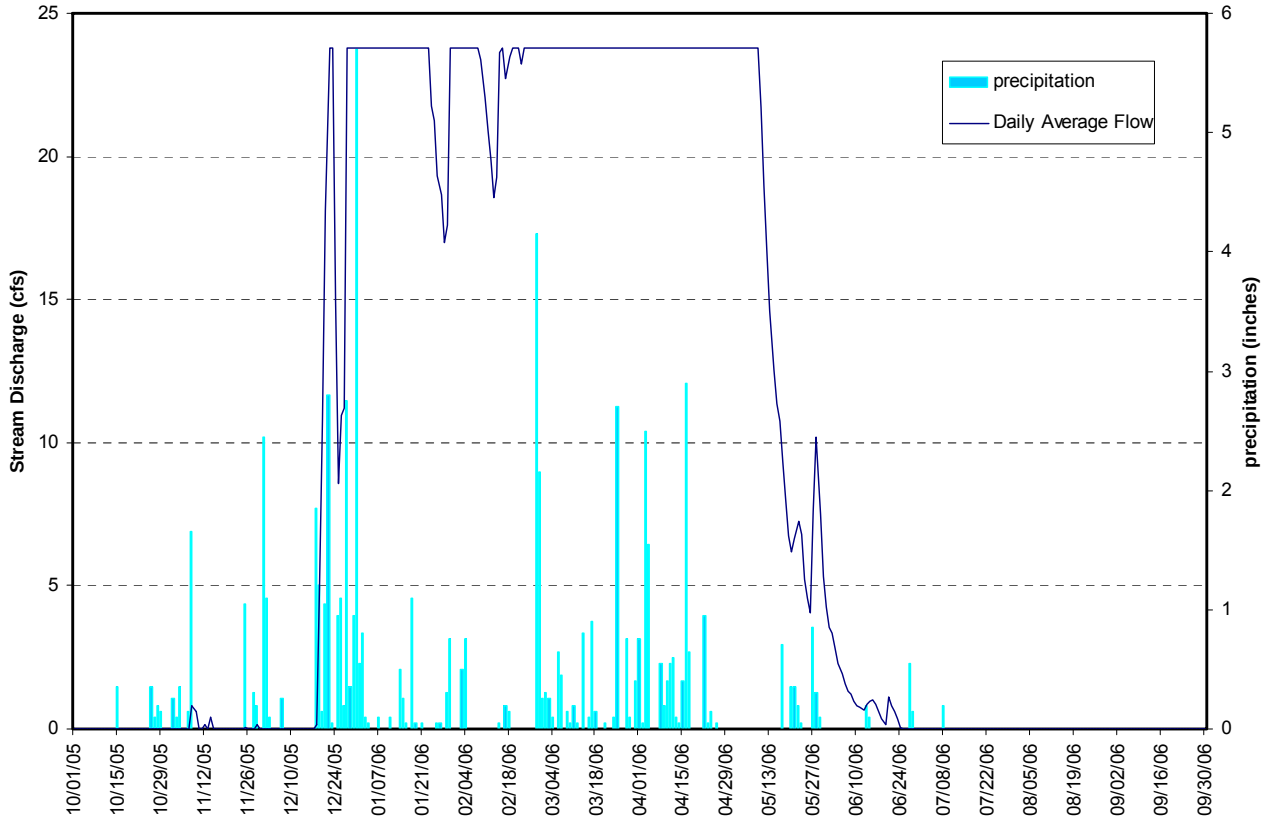


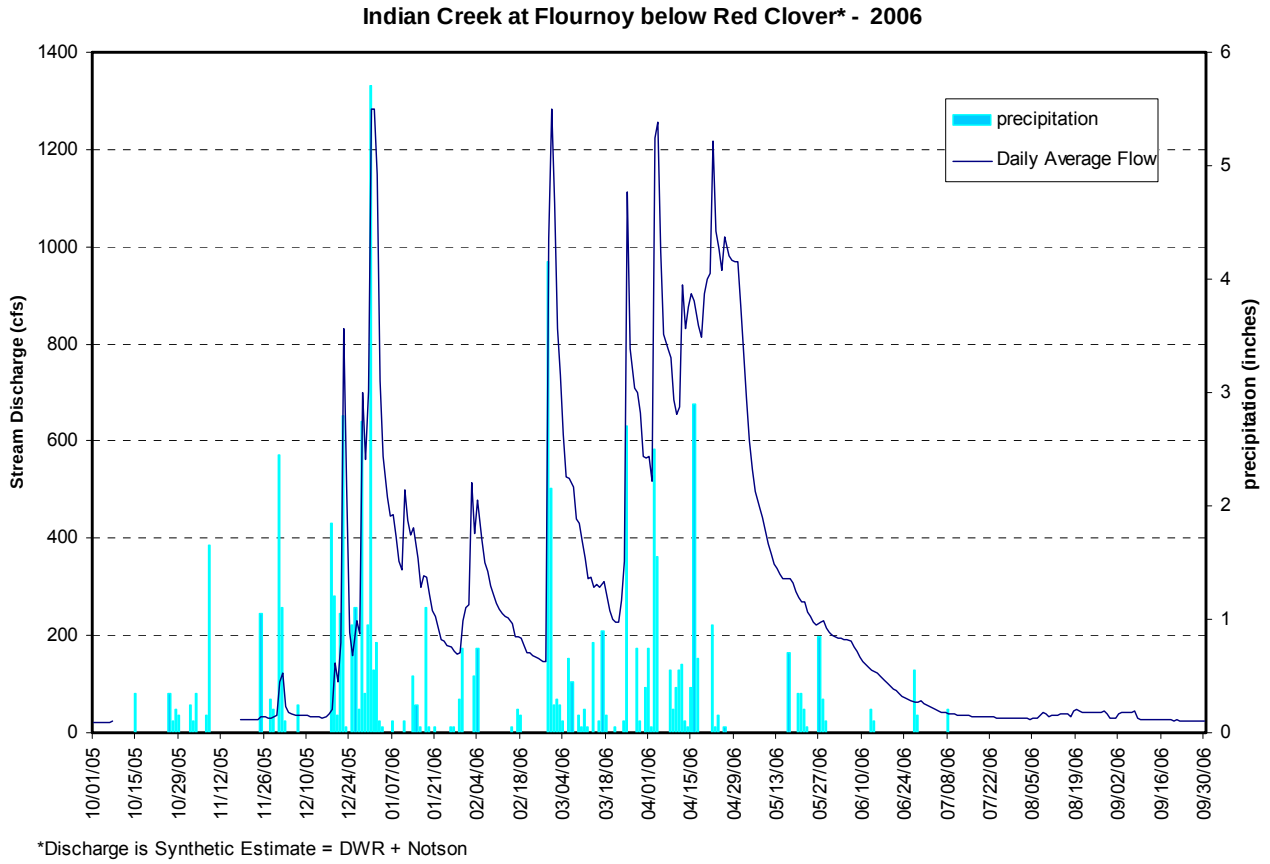


*sensor stranded by channel scour after high flow event

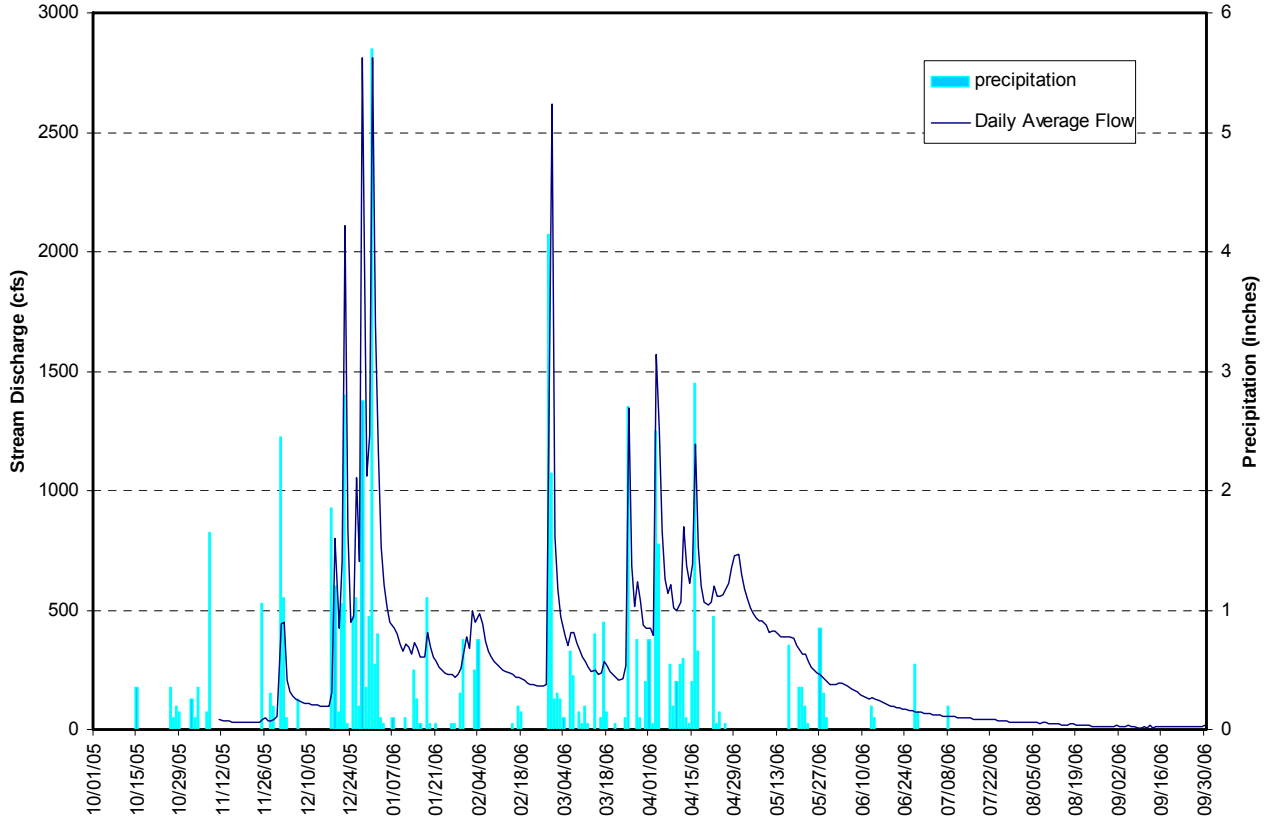


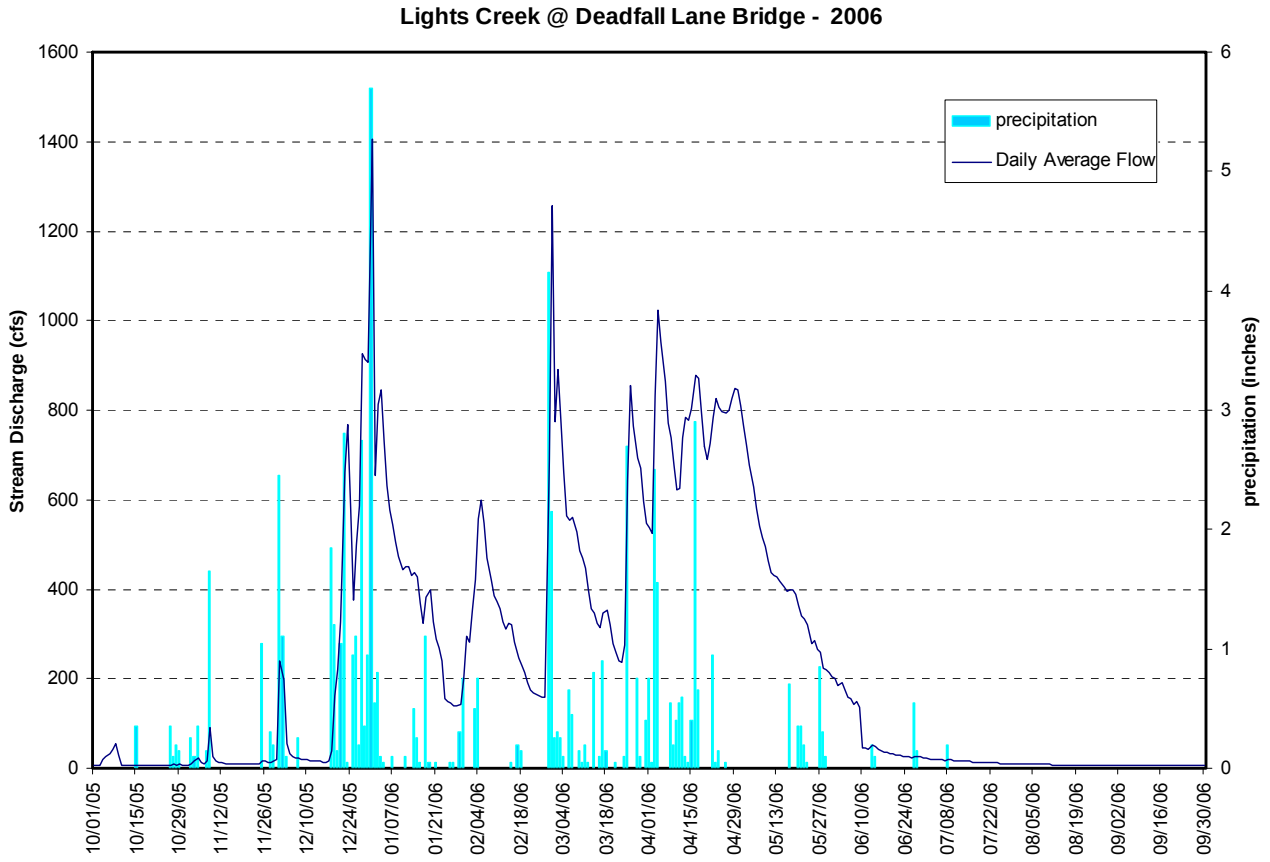
*Affected by Antelope Lake spill





*Discharge is Synthetic Estimate = DWR + Notson




Lights Creek @ Deadfall Lane Bridge - 2006
Stream Discharge (cfs)
precipitation (inches)
precipitation
Daily Average Flow
0
200
400
600
800
1000
1200
1400
1600
0
1
2
3
4
5
6
10/01/05
10/15/05
10/29/05
11/12/05
11/26/05
12/10/05
12/24/05
01/07/06
01/21/06
02/04/06
02/18/06
03/04/06
03/18/06
04/01/06
04/15/06
04/29/06
05/13/06
05/27/06
06/10/06
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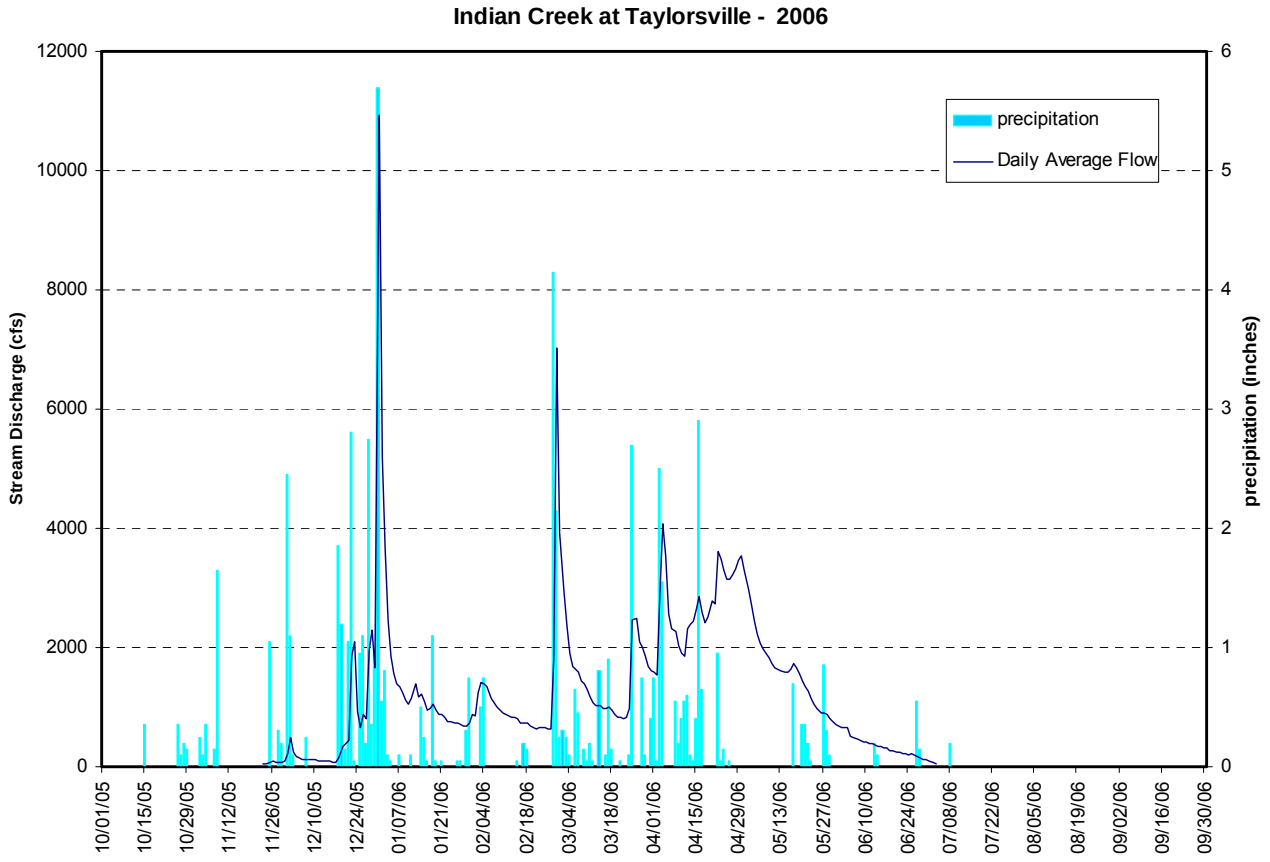
08/19/06
09/02/06
09/16/06
09/30/06


Indian Creek at Taylorsville - 2006
Stream Discharge (cfs)
precipitation (inches)
precipitation
Daily Average Flow
0
2000
4000
6000
8000
10000
12000
0
1
2
3
4
5
6
10/01/05
10/15/05
10/29/05
11/12/05
11/26/05
12/10/05
12/24/05
01/07/06
01/21/06
02/04/06
02/18/06
03/04/06
03/18/06
04/01/06
04/15/06
04/29/06
05/13/06
05/27/06
06/10/06
06/24/06
07/08/06
07/22/06
08/05/06
08/19/06
09/02/06
09/16/06
09/30/06

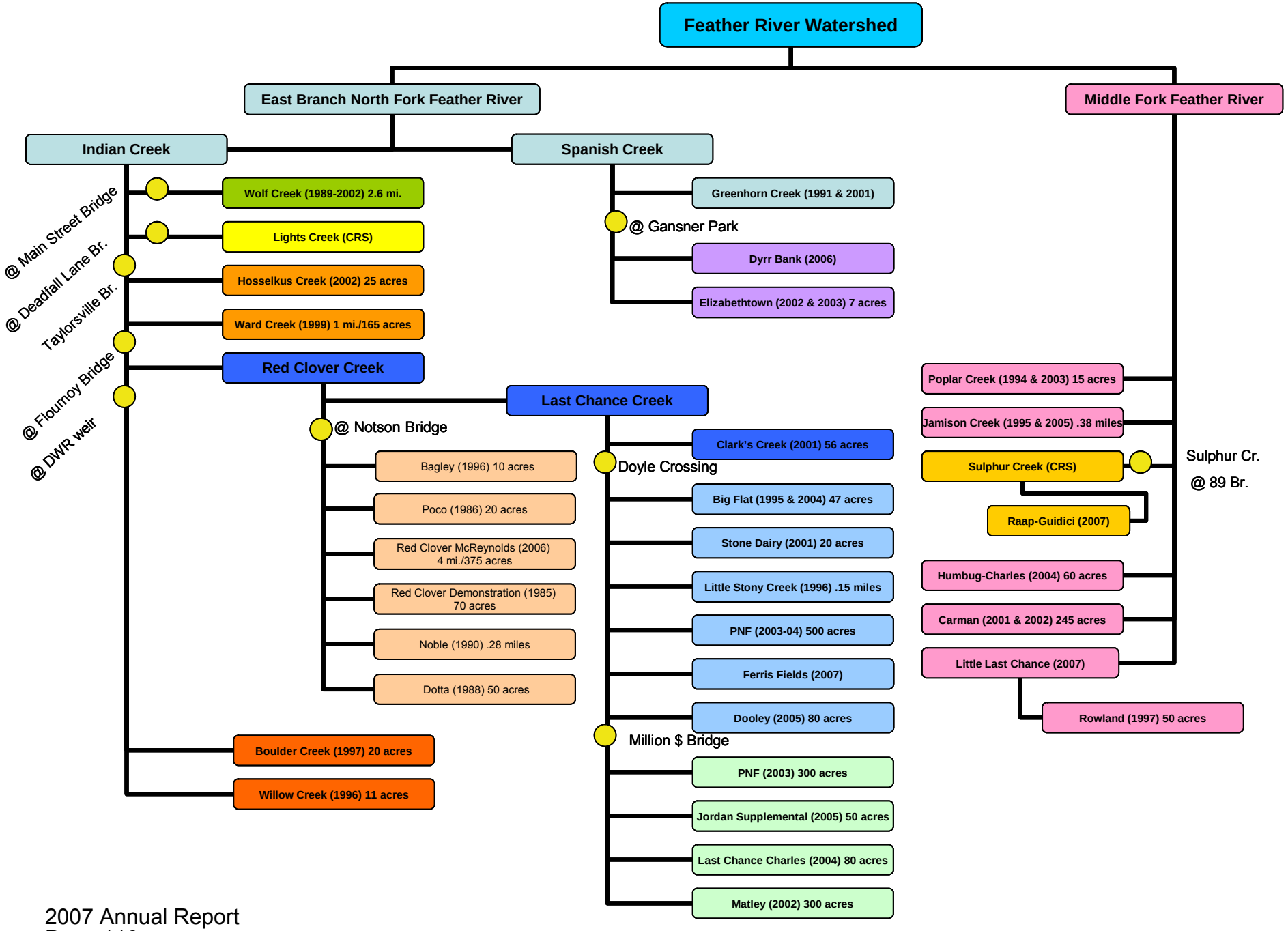
Conclusion:

The 2006 Water Year was an interesting water year for the Feather River Watershed Monitoring Program, due to the series of high flow events and associated hydrologic effects on meadow restoration project areas in the watershed. Many project areas are exhibiting watershed benefits of water temperature and peak flow reduction (i.e. Cottonwood Creek-Big Flat and Alkali Flat). As FR-CRM continues to collect data at the continuous recording stations, the value of the monitoring program is growing. With some necessary maintenance at the continuous recording stations, stronger results from meadow restoration are foreseen in the watershed monitoring program.

Maintenance:

The continuous recording stations (CRS) with performance issues include Wolf Creek @ Main Street Bridge, Lights Creek, Indian Creek @ Taylorsville, and Sulphur Creek @ Hwy 89. The transducer box at Wolf Creek has been continuously buried by sediment for the past 3 Water Years, therefore the water temperature data is unreliable. Due to the apparent instability of the bedload moving through the reach above and below the Main Street bridge in Greenville, FR-CRM has been discussing the potential to install a new station further downstream. The proposed new location is directly upstream of the bridge on Hot Springs Road on the east side of Hwy 89, providing access to the Greenville ball field. The location is directly downstream of FR-CRM's Wolf Creek Phase 2 project, and there is a nice gage pool provided by an old alder tree that creates a nice scour hole and would help disguise the transducer box. Another benefit of the location is that the bridge does not receive as much daily traffic as the Main Street bridge, so installing an air temperature sensor may be another possibility (since the air temperature sensor was bent & broken by passers-by at the other location). In conclusion, the current location of the water level and temperature transducer on Wolf Creek is very dynamic and the ball field bridge further downstream seems more stable with boulders directing the flow to the center of the channel.

The transducers on Lights Creek and on Indian Creek at Taylorsville go dry when both creeks drop to summer baseflow. The transducer box at Lights Creek, currently anchored on a large boulder, needs to be lowered deeper into the creek. The staff gage should also be relocated to accommodate lower stage readings. In Taylorsville, when Plumas County Department of Public Works finishes replacing the guard rails on the bridge spanning Indian Creek at the Rodeo grounds, the transducer box needs to be moved toward the center of the channel, since the left channel has become blocked with sediment and willows. This will require running a conduit along the new guard rail and down one of the center bridge abutments. The staff gage should also be relocated so that local citizen monitors can easily read the water level.


Feather River Watershed
East Branch North Fork Feather River
Middle Fork Feather River
Indian Creek
Spanish Creek
@ Main Street Bridge
@ Deadfall Lane Br.
Taylorsville Br.
@ Floumoy Bridge
@ DWR weir
Wolf Creek (1989-2002) 2.6 mi.
Lights Creek (CRS)
Hosselkus Creek (2002) 25 acres
Ward Creek (1999) 1 mi./165 acres
Red Clover Creek
Boulder Creek (1997) 20 acres
Willow Creek (1996) 11 acres
Greenhorn Creek (1991 & 2001)
@ Gansner Park
Dyrr Bank (2006)
Elizabethtown (2002 & 2003) 7 acres
@ Notson Bridge
Bagley (1996) 10 acres
Poco (1986) 20 acres
Red Clover McReynolds (2006) 4 mi./375 acres
Red Clover Demonstration (1985) 70 acres
Noble (1990) .28 miles
Dotta (1988) 50 acres
Last Chance Creek
Doyle Crossing
Clark's Creek (2001) 56 acres
Big Flat (1995 & 2004) 47 acres
Stone Dairy (2001) 20 acres
Little Stony Creek (1996) .15 miles
PNF (2003-04) 500 acres
Ferris Fields (2007)
Dooley (2005) 80 acres
Million $ Bridge
PNF (2003) 300 acres
Jordan Supplemental (2005) 50 acres
Last Chance Charles (2004) 80 acres
Matley (2002) 300 acres
Poplar Creek (1994 & 2003) 15 acres
Jamison Creek (1995 & 2005) .38 miles
Sulphur Creek (CRS)
Raap-Guidici (2007)
Humbug-Charles (2004) 60 acres
Carman (2001 & 2002) 245 acres
Little Last Chance (2007)
Rowland (1997) 50 acres
Sulphur Cr.
@ 89 Br.