Upper Elk River
Sediment Total Maximum Daily Load

Elk River Forum
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Eureka, CA

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North Coast Regional Water Quality Control Board

CALIFORNIA
Water Boards

Presentation Overview

- Water Quality Standards and Scope of TMDL
- Status of Upper Elk Sediment TMDL
- Watershed Overview
- Details of Upper Elk Technical TMDL to address management-related hillslope and instream sediment loading
- TMDL Implementation Strategy

Water Quality Standards

- Beneficial Uses
- Water quality objectives to protect uses
- Antidegradation to maintain and protect existing uses and high quality water
- Program of implementation

TMDL

- Comprehensive Analysis
- Improved program of implementation and monitoring

Water Quality Objectives

Suspended Material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Settleable Material	Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.
Suspended Sediment Load	The suspended sediment load and suspended sediment discharge rate of surface water shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
Turbidity	Turbidity shall not be increased more than 20 percent above naturally occurring background levels. Allowable zones of dilution within which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof.

Nuisance (Defined in CWC § 13050)

Anything which meets all of the following requirements:

(1) Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property.

(2) Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.

(3) Occurs during, or as a result of, the treatment or disposal of waste.

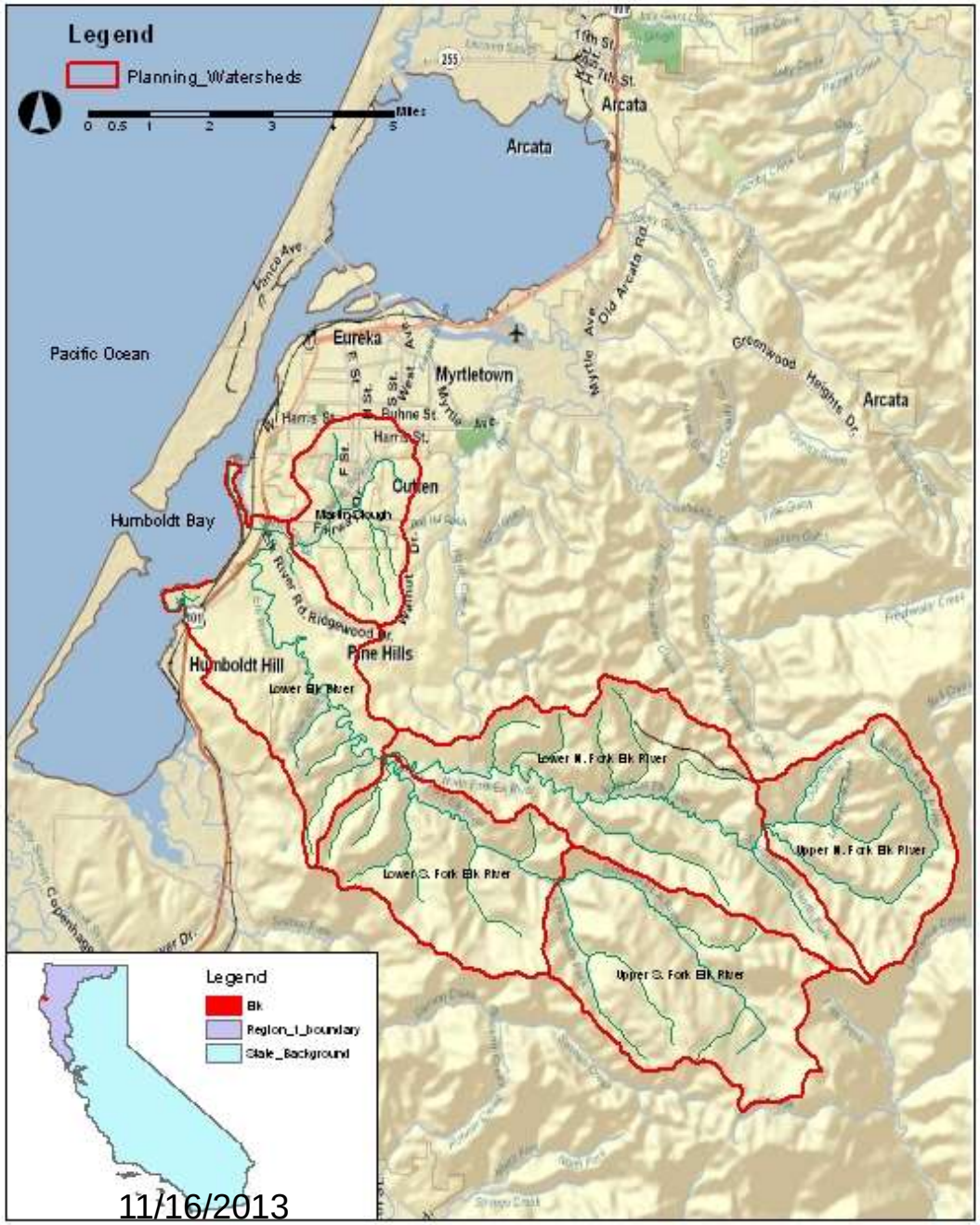
Elk River TMDL

Comprehensive Peer Reviewed Assessment:

- Identifies impaired reaches (Geographic scope)
- Characterizes the water quality impairments (Problem Statement)
- Quantifies the magnitude and timing of sediment discharges to Elk River (Sediment Source Analysis)
- Develops measures of progress toward attainment of water quality standards (Numeric Targets)
- Describes the sediment loading capacity of the river to ensure water quality standards are met (TMDL, Loading Capacity, MOS)

Implementation and Monitoring Being Developed

- Develops a watershed recovery and TMDL attainment strategy (Program of Implementation)
- Describes monitoring and adaptive management

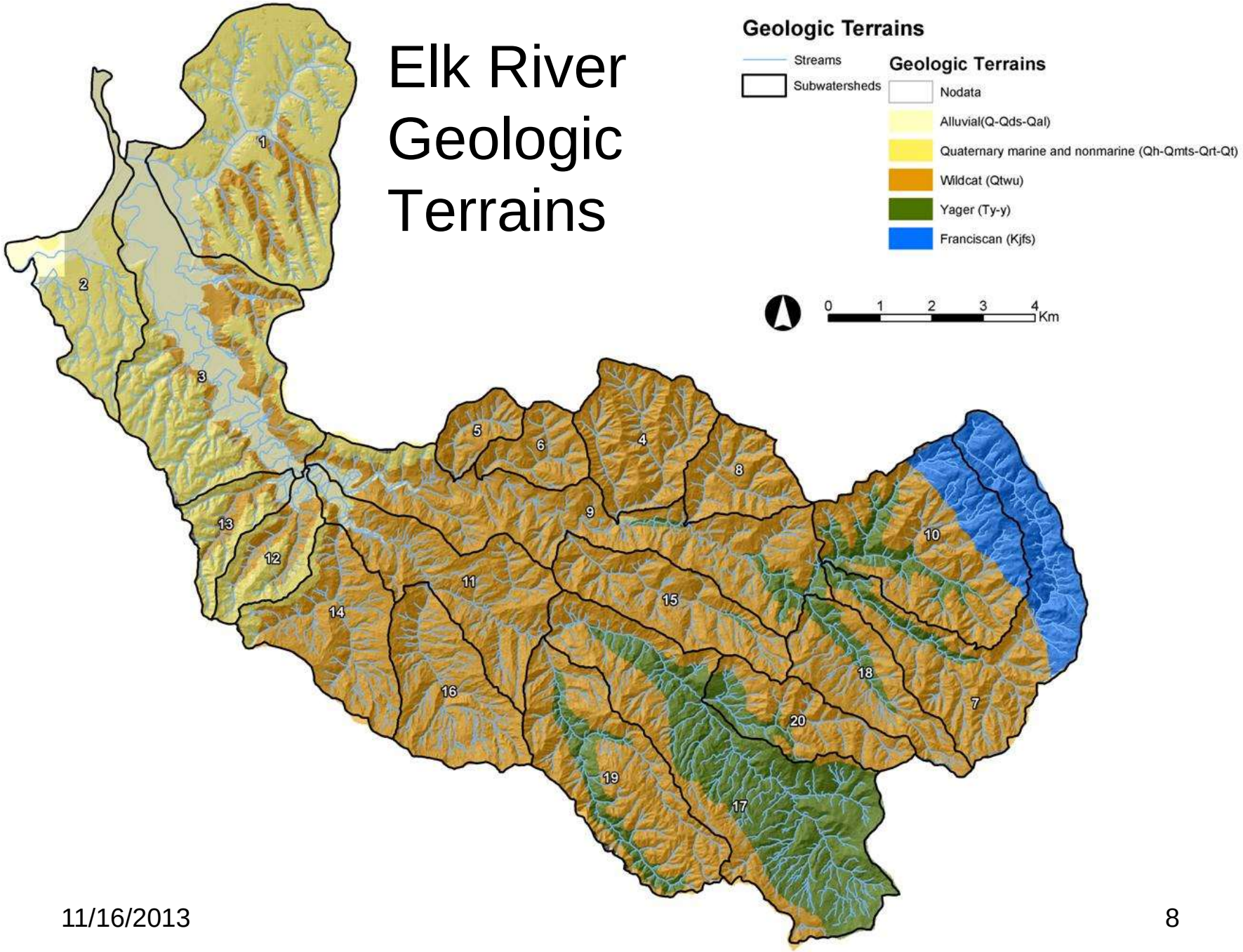


Elk River Watershed

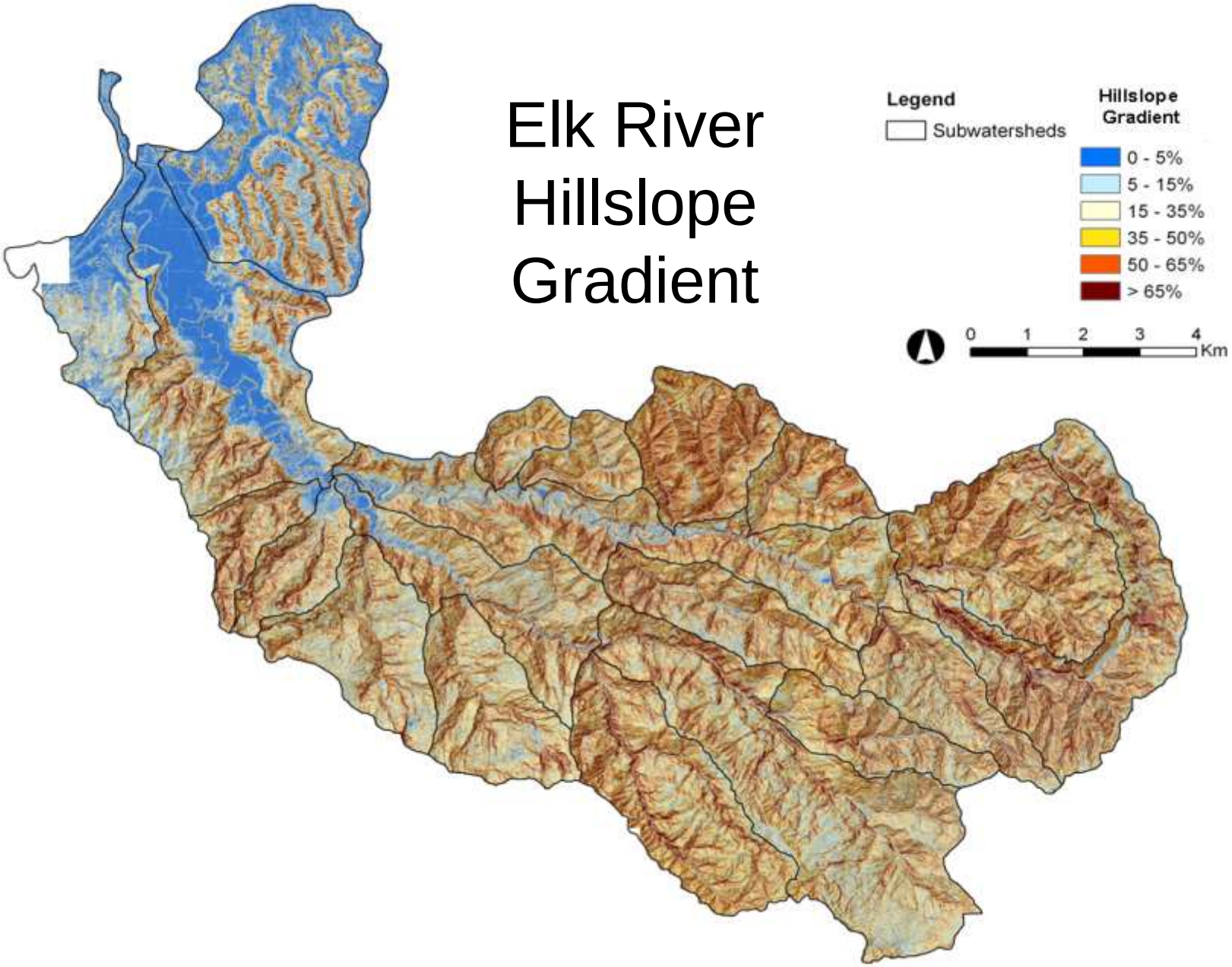
58.3 square miles

- North Fork Elk River (22.5mi^2)
- South Fork Elk River (19.5 mi^2)
- Lower Elk River (10.4 mi^2)
- Martin Slough (5.9 mi^2)

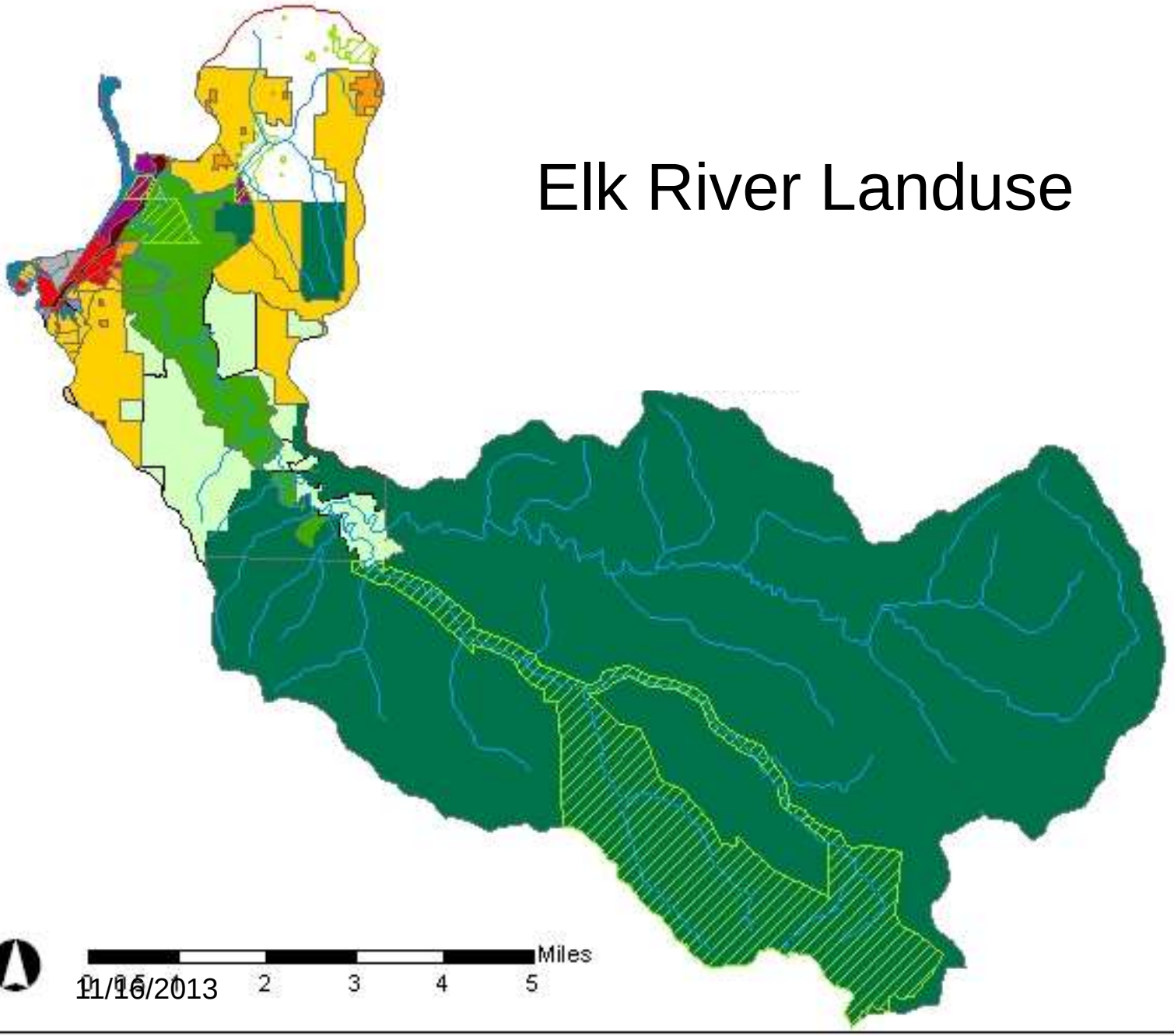
Elk River Geologic Terrains

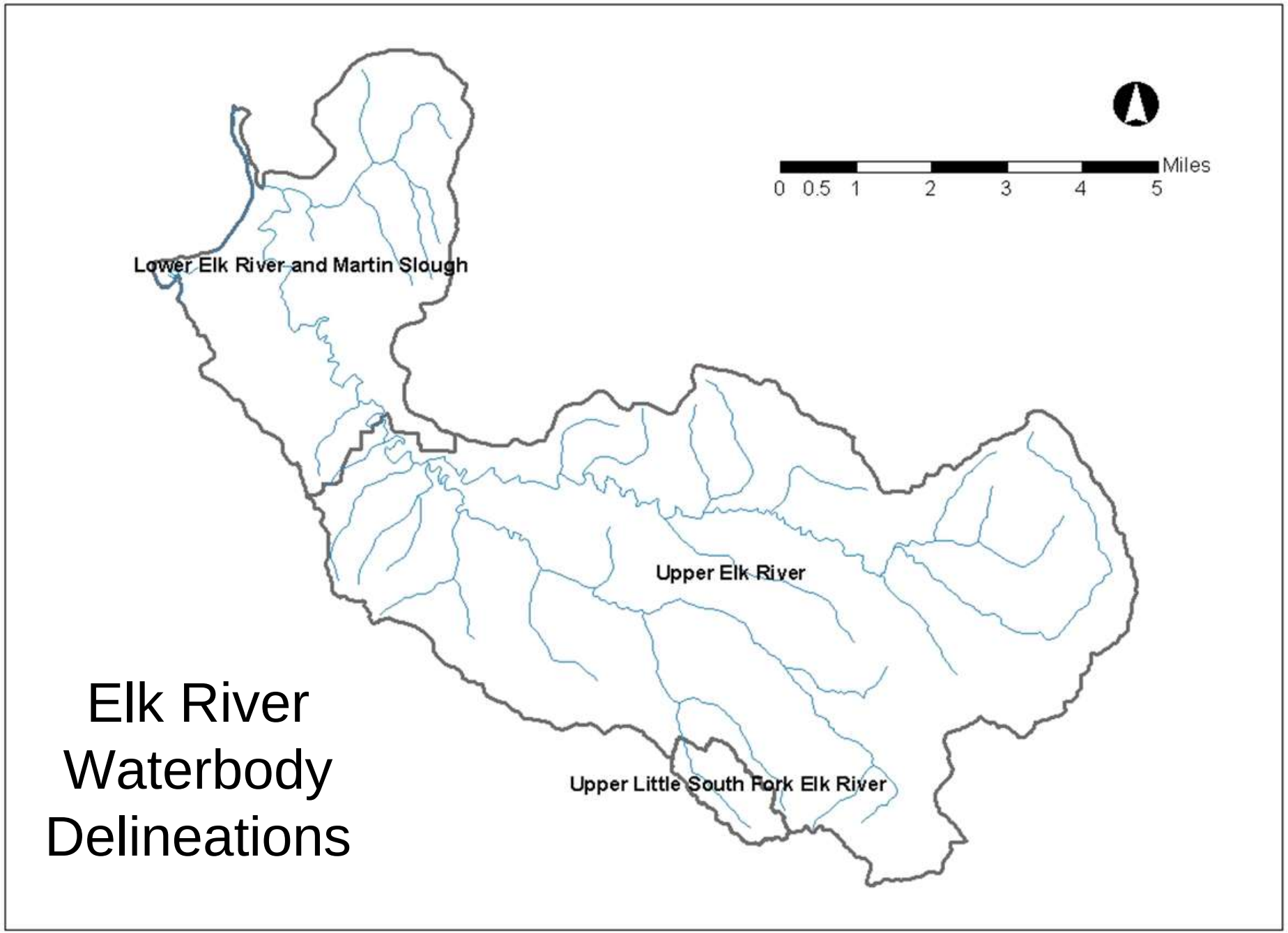


Elk River Hillslope Gradient



Elk River Landuse





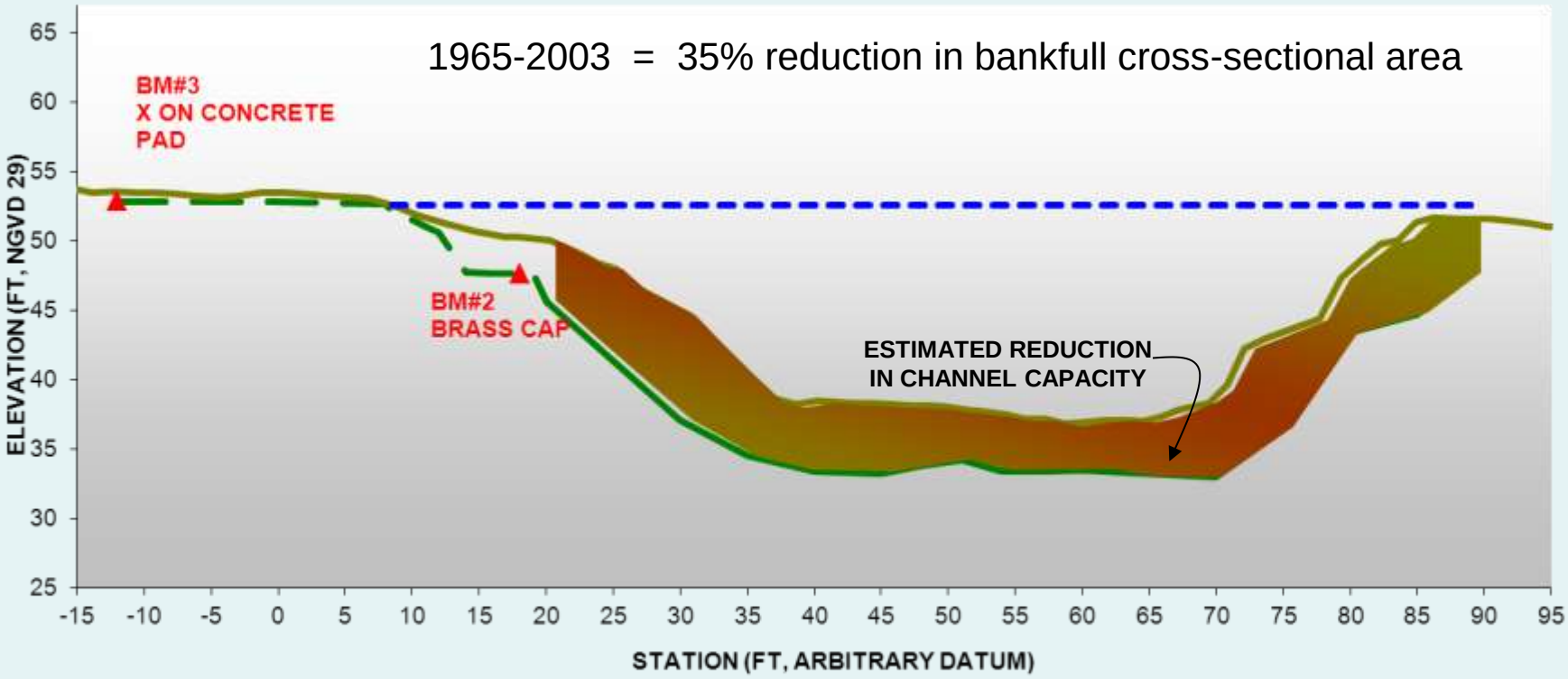
Elk River Waterbody Delineations

Fine Sediment Impairments

- Deposition of settleable material impacts beneficial uses and causes flooding
  - Altered channel and floodplain morphology
  - Diminished streamflow conveyance capacity
  - Diminished pool size
  - Reduced substrate grain size
  - Cross-sectional areas continue to decrease
- Elevated turbidity and suspended sediment concentrations impact fisheries, water supplies
- Loss of property uses (access, structures, water systems)

Comparison with Historic Conditions

USGS gaged Upper Mainstem Elk (1958-1967)
PL reoccupied site beginning in 1998



K Wrigley, 2008

Nuisance Flooding Conditions

Photo by N Sievert, 2003

Photo part of RWB files, 2003

(California Water Code section 13050)

Cumulative Effects

Photo by N Sievert, 2005

Photo by A White, 2008

Background on Elk

- High levels of harvesting, roading
- Violations of FPRs/BP
- Stressing storms
- Channel filling, degradation of water supplies, flooding
- 303(d) listed
- Need for coordinated and comprehensive evaluation of harvesting impacts, flooding, and recovery and monitoring strategy

Current RWB Implementation Program in Upper Elk

- Inventory, prioritize, treat & monitor existing sediment sources
- Avoid creation of new sediment sources; limit overall areas of landuse disturbance as a means of controlling harvest-related landslides and peakflow increases from canopy removal
- Monitor landslide occurrence and instream sediment loads

Upper Elk River Source Analysis

- Timing and magnitude of natural and management-related hillslope sediment sources
- Sub-basin analyses based on site specific data
- Reference and managed study sub-basins for generalized loadings where no site specific data available
- Time periods analyzed: 1955-1966, 1967-1974, 1975-1987, 1988-1997, 1998-2000, and 2001-2003, 2004-2011

Upper Elk River Source Analysis

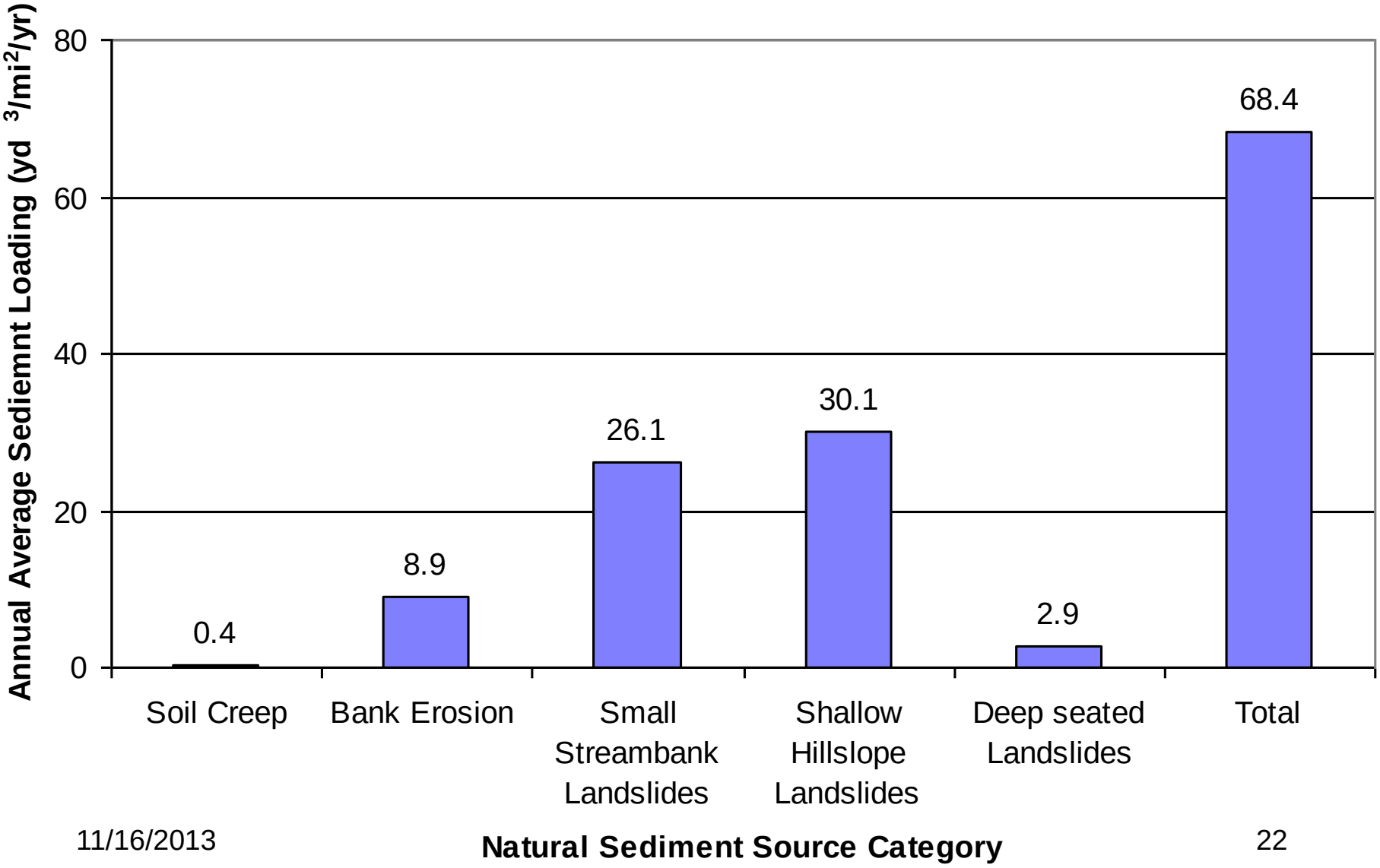
Data sources:

- Humboldt Redwood Company
- Pacific Lumber Company
- Green Diamond Resource Company
- Bureau of Land Management
- Pacific Watershed Associates
- Stillwater Sciences
- North Coast Regional Water Board
- Redwood Sciences Laboratory
- California Geologic Survey
- Salmon Forever
- Humboldt State University

Upper Elk Source Analysis: Natural

	Sediment Source	Data Sources Relied Upon / Approach
Natural	Soil Creep	Literature
	Bank Erosion	Field surveys; natural drainage density estimate
	Small Streambank Landslides	Field surveys; natural drainage density estimate
	Shallow Hillslope Landslides	Areas not harvested in past 15 years
	Deep seated Landslides	CGS mapped active features; Palco WA rates

Upper Elk Natural Sources Summary



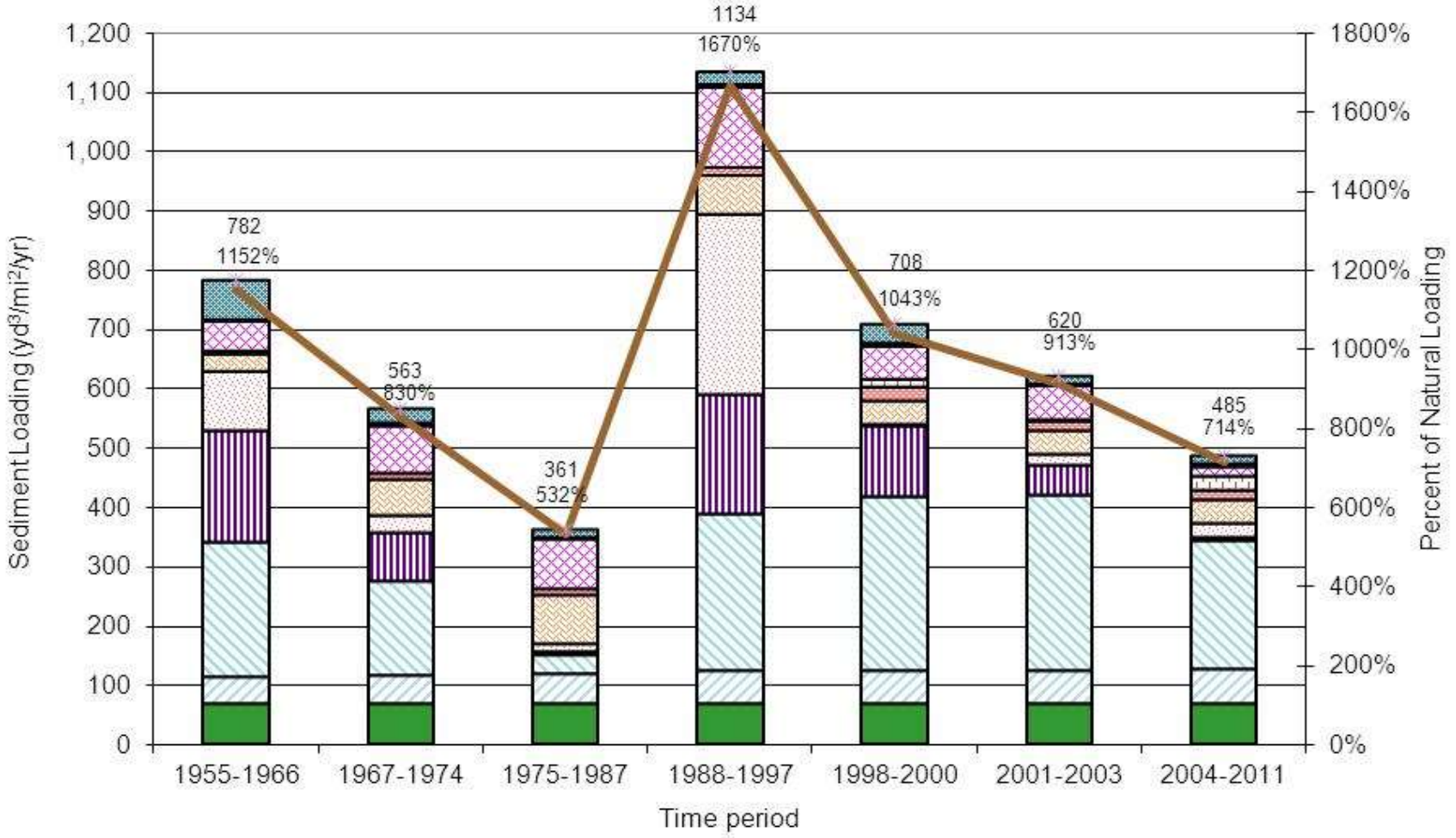
Upper Elk Source Analysis: Management

	Sediment Source	Data Sources Relied Upon / Approach
Management	Low Order Channel Incision	Field-based estimates of managed and natural drainage density; assumed 75% occurred in 1950's and 5% in each subsequent decade
	Management-Related Soil Creep	Soil creep to management-induce channel network
	Management-Related Bank Erosion	Field surveys in managed study sub-basins; managed drainage density estimate; subtracted natural loading
	Management-Related Open Slope Shallow Landslides	Sub-basin specific landslide inventory data from Palco WA and 2005 ROWD; non-road-related slides, includes some skid-related slides
	Road-related Landslides	Sub-basin specific landslide inventory data from Palco WA and 2005 ROWD

Upper Elk Source Analysis: Management

	Sediment Source	Data Sources Relied Upon / Approach
Management	Management-Related Streamside Landslides	Field surveys in managed sub-basins in Freshwater Creek; applied to natural drainage density estimate assuming bank erosion captured features in management-induced network; subtracted natural loading
	Management-Related Discharge Sites	Sub-basin specific site inventories from Palco WA, HRC CAO reports, GDRC WDR reports, BLM reports
	Post-Treatment Discharge Sites	Compiled monitoring results from BLM, HRC, and GDRC from sites treated in Elk River.
	Skid Trails	Compiled findings from Elk River skid-related inventories on BLM and HRC lands to estimate loading from skid sites not included in Management Discharge Site inventories
	Road surface erosion	Sub-basin road densities & surface condition based on Palco and HRC WA and ROWD; unit loading based upon Palco ROWD
	Harvest surface erosion	Estimated harvest history in clear-cut equivalents based upon CDF, Palco WA, and Palco ROWD; unit loading based upon Palco WA

Upper Elk Management Sources Summary



TMDL to Attain WQ Standards

TMDL = Loading Capacity

= Natural Background

+ Waste Load Allocation

+ Load Allocation

+ Margin of Safety

Sediment Loading Capacity

Results

$$\frac{SSL_{Objective}}{SSL_{Background}} x\ 100 = \%\ Natural\ SSL\ to\ attain\ turbidity\ objective$$

2004	123%
2005	126%
2006	115%
2007	132%
Mean	**124%**

Loading Capacity = 120% of Natural loading,
with a Margin of Safety

TMDL *= Loading Capacity*

= ∑(Natural Background + Waste Load Allocation + Load Allocation + MOS)

= (0 WLA) + Load Allocations + MOS

= 1.2 x Natural Background

= 1.2 x (68 $yd^3/mi^2/yr$)

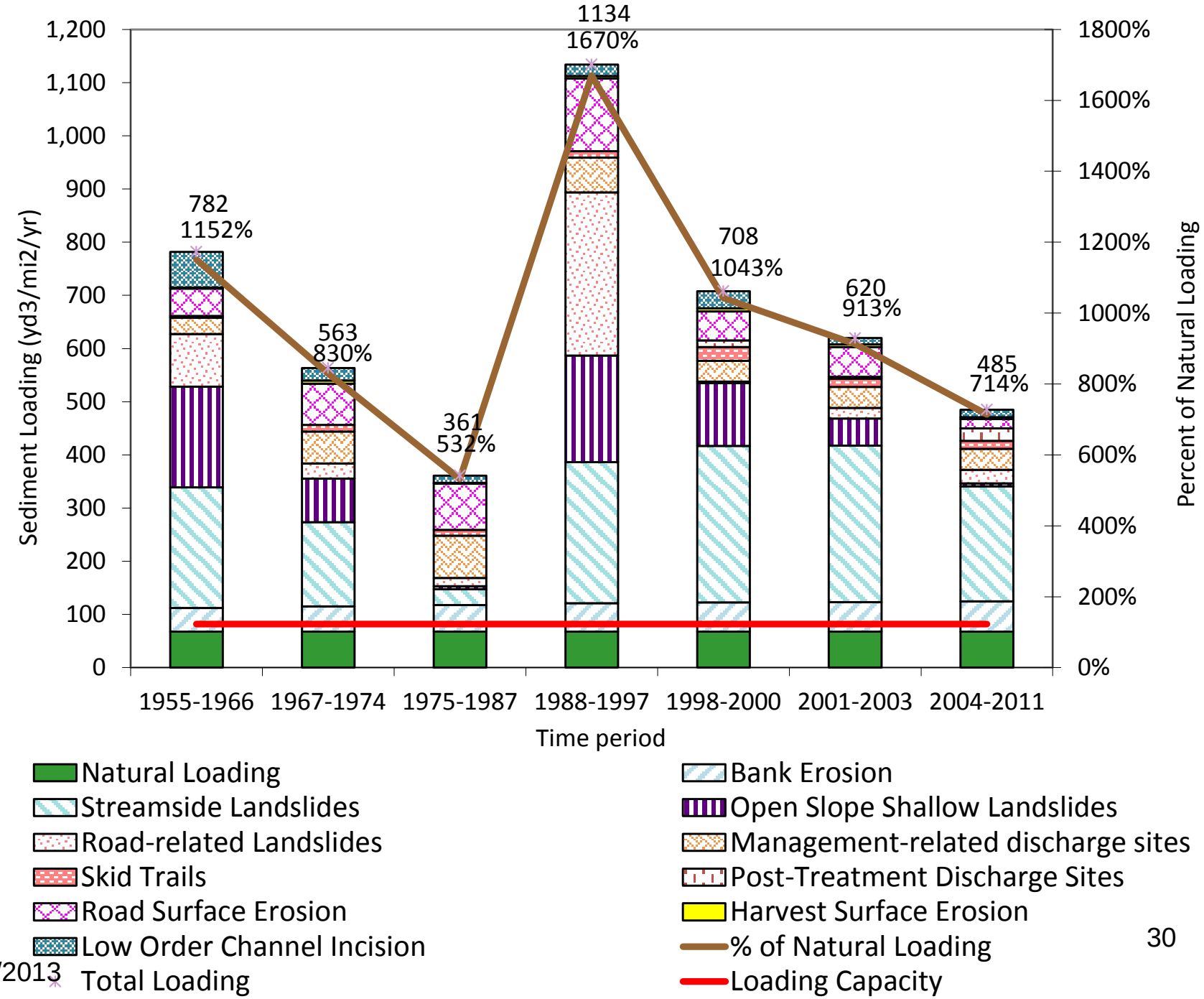
= 82 $yd^3/mi^2/yr$

Load Allocation = *Loading Capacity – Natural Background*

= *82 $yd^3/mi^2/yr$ - 68 $yd^3/mi^2/yr$*

= 14 $yd^3/mi^2/yr$

= *Upslope Loading - Instream Loading*


1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
Sediment Loading (yd3/mi2/yr)
1800%
1600%
1400%
1200%
1000%
800%
600%
400%
200%
0%
Percent of Natural Loading
782
1152%
563
830%
361
532%
1134
1670%
708
1043%
620
913%
485
714%
1955-1966
1967-1974
1975-1987
1988-1997
1998-2000
2001-2003
2004-2011
Time period
Natural Loading
Bank Erosion
Streamside Landslides
Open Slope Shallow Landslides
Road-related Landslides
Management-related discharge sites
Skid Trails
Post-Treatment Discharge Sites
Road Surface Erosion
Harvest Surface Erosion
Low Order Channel Incision
% of Natural Loading
Total Loading
Loading Capacity

Management-Related Sediment Source Category	Allocation ($yd^3/mi^2/yr$)	2004-2011 Loading ($yd^3/mi^2/yr$)	Percent Reduction from 2011 Loading	Schedule to Achieve Allocations
Total Management-Related Upslope Sediment Loading	14	417	97%	20 years

Instream Loading = (Volume management-related deposits) ÷ (upstream area) ÷ (10 year time frame for restoration)

Reach description (downstream to upstream)	**Estimated Volume Stored within Reach (yd^3)**	**Upstream drainage area (mi^2)**	**Volume per Unit Area (yd^3/mi^2)**	**Instream Loading ($yd^3/mi^2/yr$)**
Upper Mainstem: Shaw Gulch to confluence	260,000	45	5,777	578
Lower North Fork: confluence to Browns Gulch	280,000	22	12,727	1,273
Lower South Fork: confluence to Toms Gulch	100,000	19	5,263	526
Total Middle Reach	**640,000**	**45**	**14,222**	**1,422**

Targets: Translate Allocations and Objectives to Inform Implementation and Compliance

- Hillslope Targets
  - Address factors influencing sediment source categories
  - Provide basis for conditions in future permits
  - Progress informed by monitoring program
- Instream Targets to support beneficial uses and prevention of nuisance
  - COLD, SPAWN, MIGR, MUN
  - Bankfull conveyance capacity
  - Progress informed by monitoring program

Management-Related Sediment Source Category	Target
Headward Incision in Low Order Channels	Zero increase in existing drainage network
Bank Erosion and Streamside Landslides	Decreasing trend in length of unstable channel
	Harvest-related peak flow increases in Class II and III watercourse catchment areas do not exceed 10% in 10 years
	All road segments are hydrologically disconnected from watercourses
Open Slope Shallow Landslides	Decrease in management-related open-slope landslide delivery in conformance with load allocation

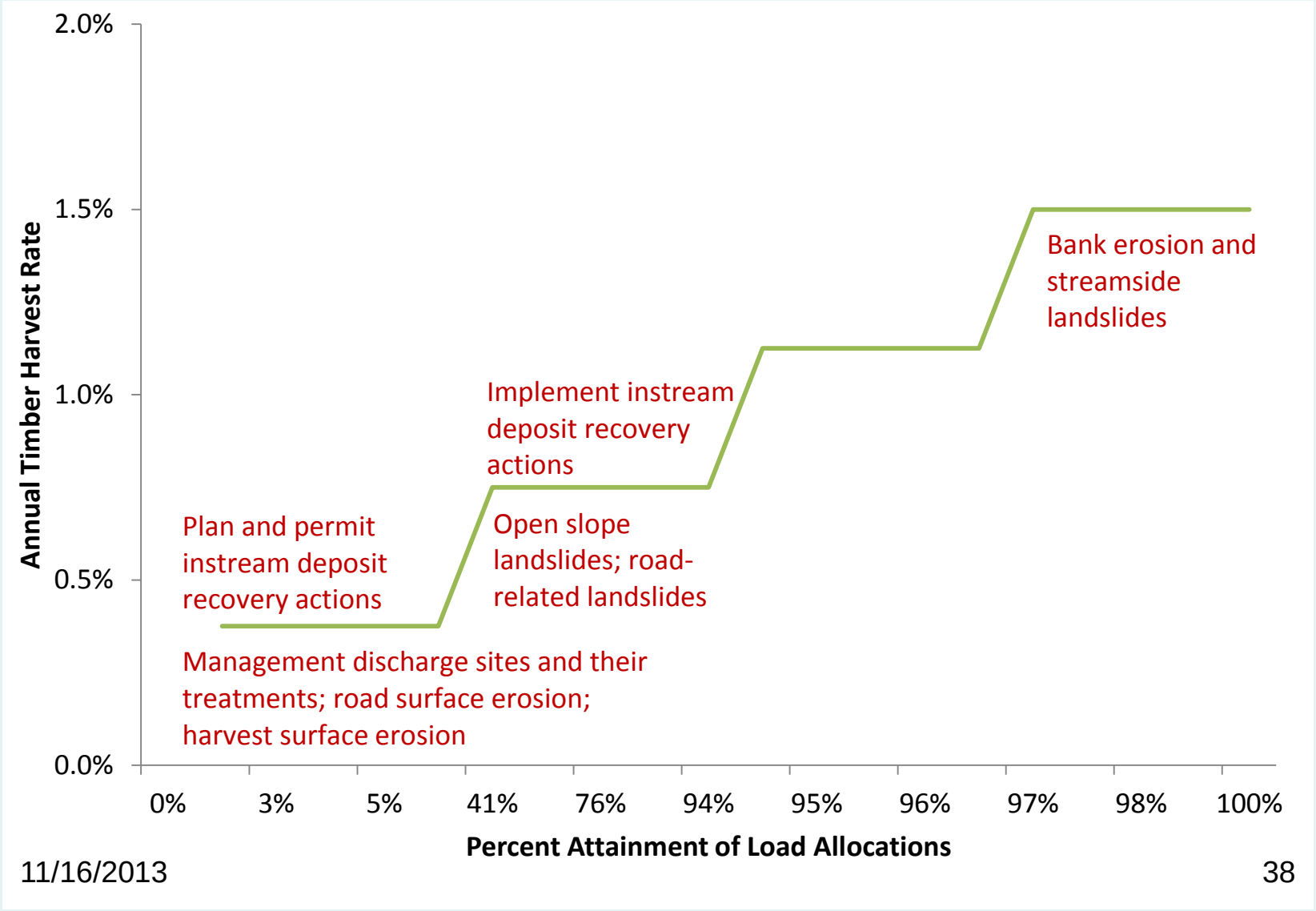
Management-Related Sediment Source Category	Target
Road Related Landslides	Improving trend in stability of roads in conformance with load allocation
Deep Seated Landslides	Zero increase in discharge from deep seated landslide due to management-related activities
Road Surface Erosion	Decrease road surface erosion to load allocation
Management Discharge Sites and Skid Trails	No new management discharge sites created
	Treatment of all controllable management discharge sites

Watershed Indicator	Targets
Riparian Areas	Improving trend in quality of riparian stands capable of providing: 1) delivery of wood and complexity to the channel for sediment metering, stabilization, and to provide habitat elements, 2) slope stability to minimize sediment delivery associated with landslide features, and 3) ground cover to ensure sediment control.
Cumulative Watershed Effects	The maximum timber harvest rate is ~1.5% of a Class I subbasin area and ~1.5% of ownership.

Program of Implementation

- Revise Waste Discharge Requirements (WDRs) to conform with load allocations
- Control strategy to attain hillslope load allocations for all management-related sediment sources
- Identify and implement feasible recovery actions to remediate instream deposits
- Target for cumulative watershed effects ties voluntary remediation of instream deposits to hillslope activities

Adaptive Implementation for 20-Year Recovery Conceptual Model



External Scientific Peer Review of Upper Elk River TMDL Staff Report

- Cal/EPA coordinates Peer Review Program through the University of California
- Four reviewers with expertise in fisheries, water quality, hydrology and geomorphology, and slope stability
- Technical TMDL submitted in March 4, 2013; comments received April 26, 2013
- Reviewers evaluated if the assertions, findings, and conclusions were based upon sound scientific knowledge, methods, and practices

Peer reviewer comments

- Sound scientific basis for:
  - Water quality impairments
  - Reference subbasin in natural loading estimates
  - Management-related loading estimates
  - Loading Capacity
  - Load allocation strategy for hillslope and instream loading
  - Hillslope targets
  - LIDAR DEM and landslide hazard modeling and mapping strategy
  - Adaptive implementation
- Suggested greater detail on:
  - Instream conditions, provide individual cross section data
  - Implementation and monitoring plans
- Concerns/Recommendations:
  - Lower harvest rate may be needed to attain allocations
  - Channel conveyance target may not reflect unimpaired conditions
  - Habitat enhancement actions may be warranted for salmonids

Upper Elk River WDR Development

Objective: Update and consolidate the regulatory structure in place for timber operations and associated activities (including restoration) in the Upper Elk River watershed to be consistent with the load allocations and targets presented in the Upper Elk River TMDL.

Desired Outcome: Adopt, by single action of the Regional Water Board, the Upper Elk TMDL and TMDL implementation plan through a watershed WDR for all timberlands within the Upper Elk, including BLM, Green Diamond, HRC and non-industrial timberlandowners.

TMDL & WDR Next Steps

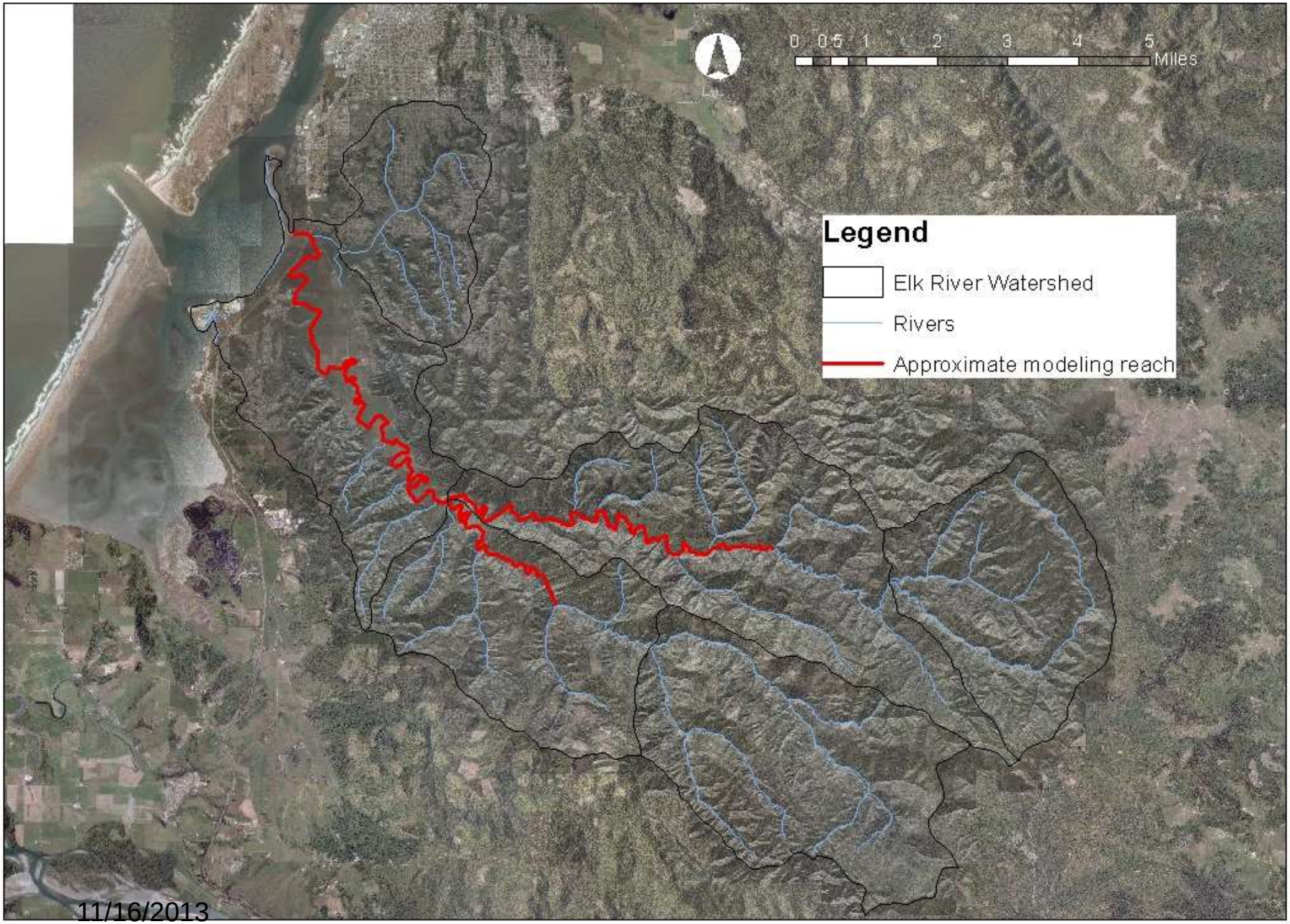
- Coming months
  - Continue stakeholder outreach
  - Describe and resolve key technical issues
  - Continue to refine scope and content of WDR
- Spring 2014
  - Release Public Review Drafts of TMDL Staff Report, WDR, and Adopting Resolution
  - Workshop
- Summer 2014
  - Receive and respond to public comments
  - Revise drafts
- Winter 2014/2015
  - Adopting hearing for proposed TMDL Staff Report, WDR, and Adopting Resolution

Instream Deposits:
Elk River Recovery Assessment

- TMDL and WDR: appropriate tools for new activities, source control
- Stored material remains an enormous water quality problem
- Restoration is necessary to remedy channel storage
- 2004 RWB Resolution:
  - Restoration actions need to be based upon a scientifically defensible feasibility study
  - Need for lead entity for funding and permitting
- Restoration actions need to be scientifically-based, have a high likelihood of success, and avoid unintended consequences.
- Elk River Recovery Assessment is the tool to identify restoration actions to ameliorate pre-HRC problem

Elk River Recovery Assessment

- Over a 18.5 mile reach (top of Middle Reach Elk River downstream to Humboldt Bay):
  - Document existing channel morphology and sediment conditions
  - Develop, calibrate, and validate hydrodynamic and sediment transport model
- Assess the system trajectory:
  - Existing sediment loads,
  - Reduced sediment loads,
  - A suite of broad recovery actions and reduced sediment loads
- Prioritize a suite of direct recovery actions
- Develop scientifically defensible, peer reviewed restoration plan to recover beneficial uses and abate nuisance flooding conditions in middle reach of Elk River.


0 0.5 1 2 3 4 5
Miles
Legend
Elk River Watershed
Rivers
Approximate modeling reach

11/16/2013

Project Team

- CalTrout
- Northern Hydrology and Engineering
- Stillwater Sciences

Current Project Partners

- Humboldt Redwood Company
- State of California Coastal Conservancy
- Redwood Community Action Agency
- Bureau of Land Management
- Salmon Forever
- Elk River residents

Elk River Recovery Assessment: Funding

- Recovery Assessment exceeds funding typically awarded through planning grants
- Water Code Section 13443 allows RWB to apply to State Board Cleanup and Abatement Account (CAA) to assist in responding to a water quality problem posing public health threat
- 2009-2010 HRC paid $330,000 into CAA as a result of civil liability penalties accrued by Pacific Lumber Company
- 2013 State Board approved $475,030 from CAA for Recovery Assessment
- Cost shares from Coastal Conservancy, HRC, and RCAA
- Contract request package currently under review

Staff Contacts

Upper Elk River TMDL

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Track Elk River TMDL development, and download documents for review and comment:

http://www.waterboards.ca.gov/northcoast/progams/tmdl/elk

Sign-up for announcements pertaining to Elk TMDL:

http://www.waterboards.ca.gov/resources/email_subscriptions/reg1_subscribe.shtml