Lower Teanaway River:
Reach & Site Assessment

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Yakima Basin Science and Management Conference
Central Washington University

Ellensburg, Washington
June 15, 2011

Paula Hammond
Secretary of Transportation

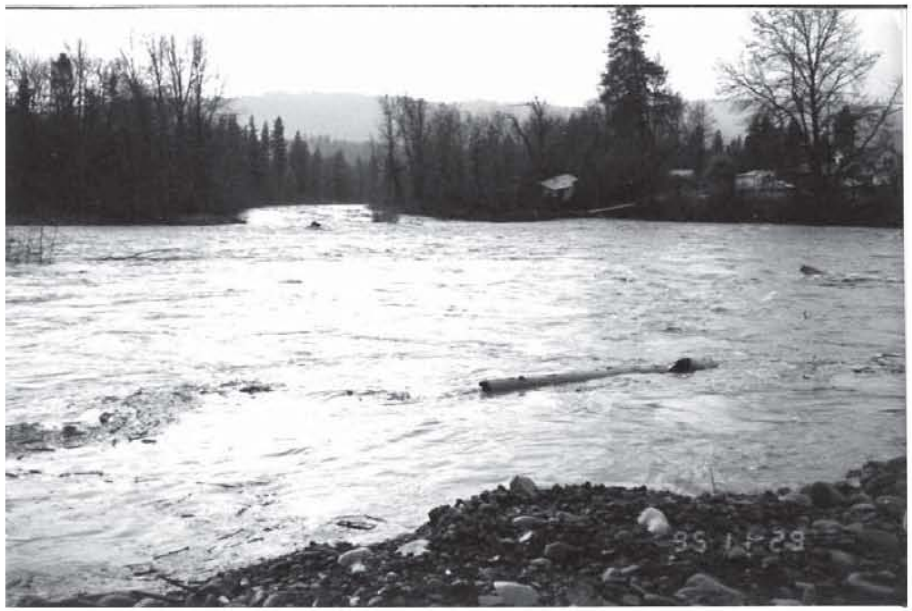
Steve Reinmuth
Chief of Staff

Washington State Department of Transportation

Emergency Repairs of Teanaway River Bridge

Teanaway River

1995 - 2009



SR 970 May 18, 2006

SR 970 May 18, 2008

SR 970 May 18, 2008

SR 970 April 23, 2009

Lower Teanaway River:

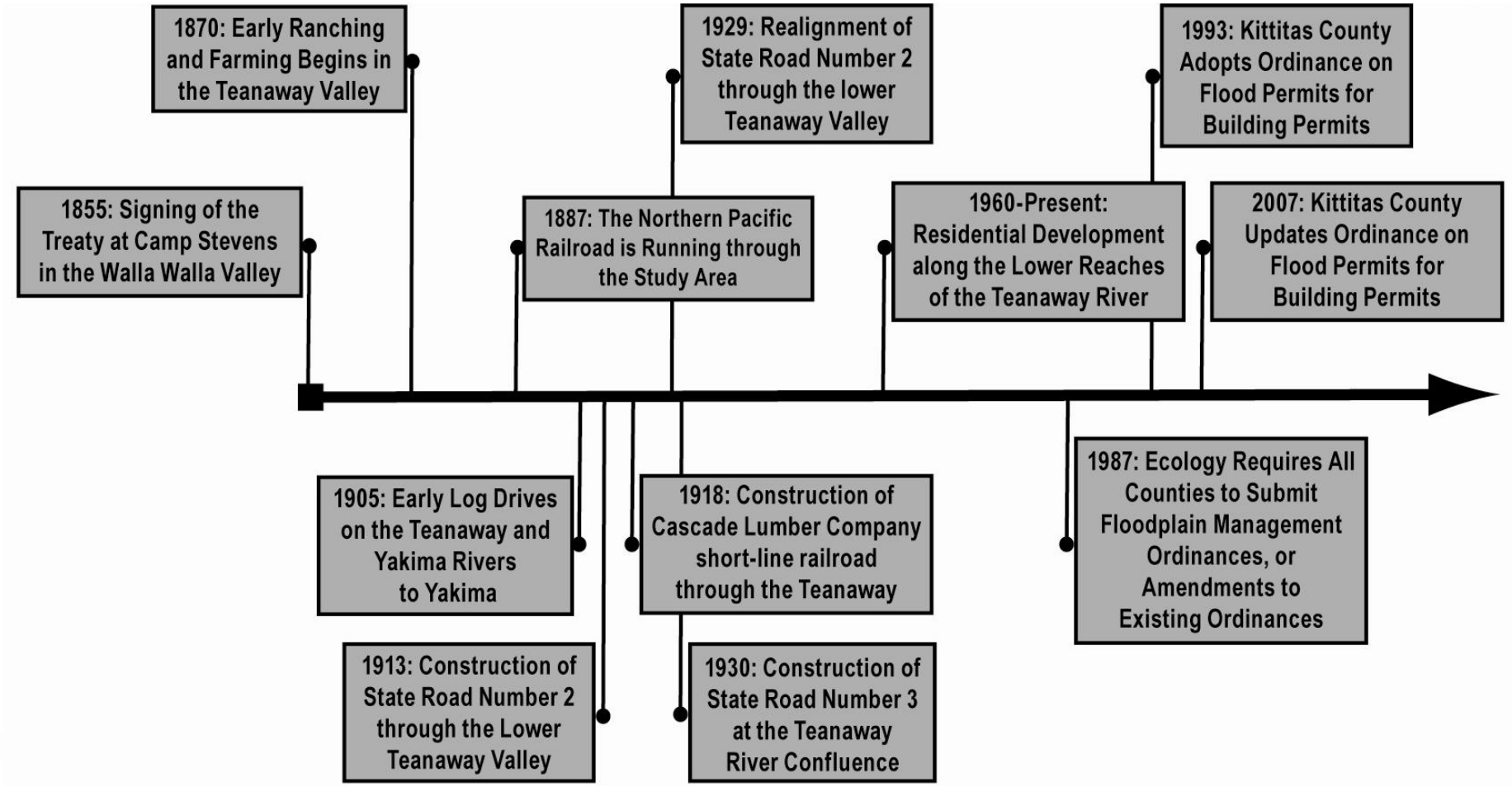
Reach and Site Assessment

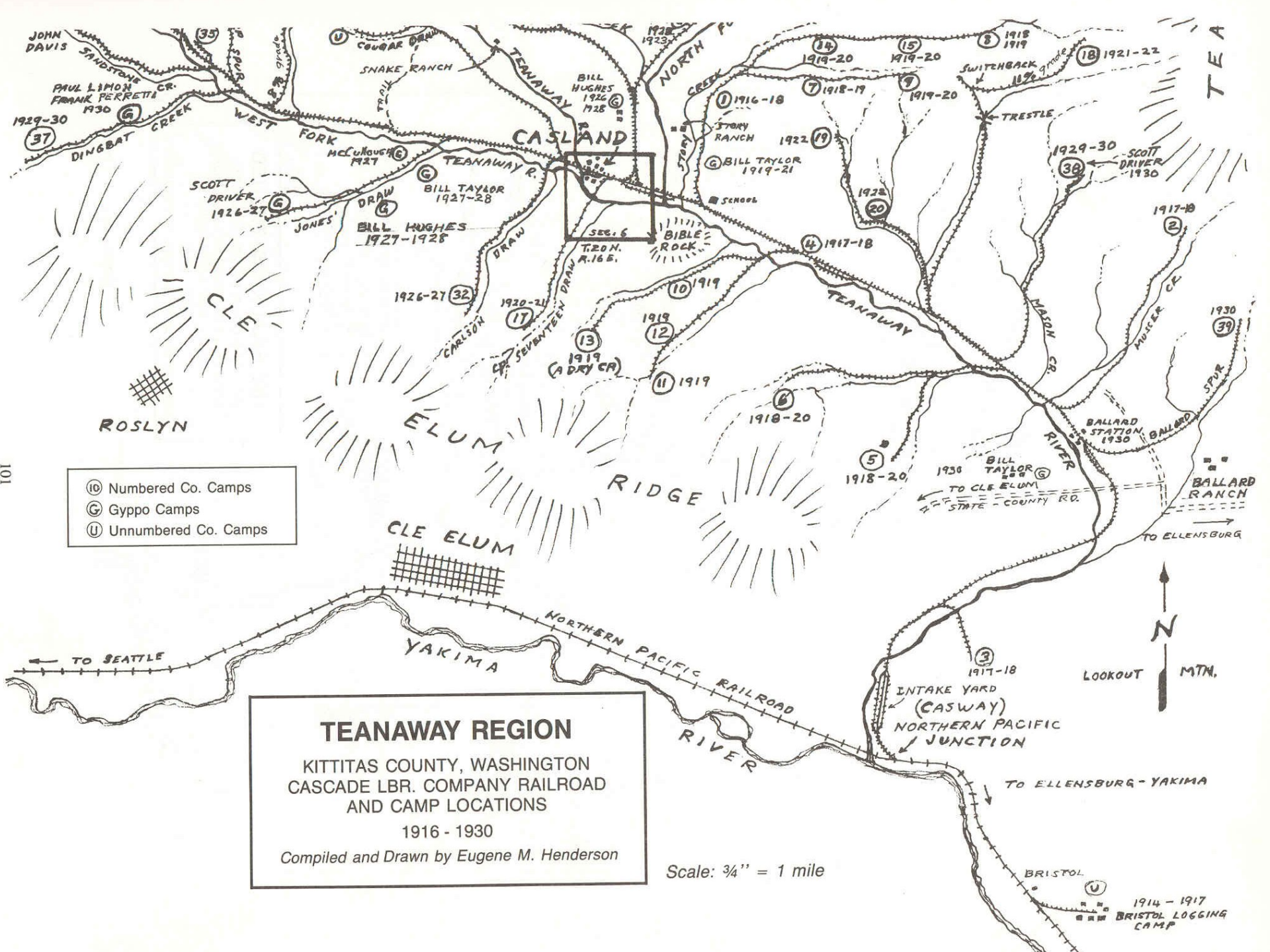
November 17, 2010

Ed Molash, Douglas Eitemiller, Jim Park, and Jason Smith
WSDOT Hydrology Program and SCR Environmental Office

Technical Support from
Stephanie McGuire, Tim Hillard, Elisabeth Lauver, VaLoy Briscoe, Kevin Fleming, and Michael Wandler
WSDOT Hydrology Program and SCR Environmental Office

Washington State
Department of Transportation


1870: Early Ranching and Farming Begins in the Teanaway Valley
1929: Realignment of State Road Number 2 through the lower Teanaway Valley
1993: Kittitas County Adopts Ordinance on Flood Permits for Building Permits
1855: Signing of the Treaty at Camp Stevens in the Walla Walla Valley
1887: The Northern Pacific Railroad is Running through the Study Area
1960-Present: Residential Development along the Lower Reaches of the Teanaway River
2007: Kittitas County Updates Ordinance on Flood Permits for Building Permits
1905: Early Log Drives on the Teanaway and Yakima Rivers to Yakima
1918: Construction of Cascade Lumber Company short-line railroad through the Teanaway
1987: Ecology Requires All Counties to Submit Floodplain Management Ordinances, or Amendments to Existing Ordinances
1913: Construction of State Road Number 2 through the Lower Teanaway Valley
1930: Construction of State Road Number 3 at the Teanaway River Confluence



TEANAWAY REGION

KITTITAS COUNTY, WASHINGTON
CASCADE LBR. COMPANY RAILROAD
AND CAMP LOCATIONS

1916 - 1930

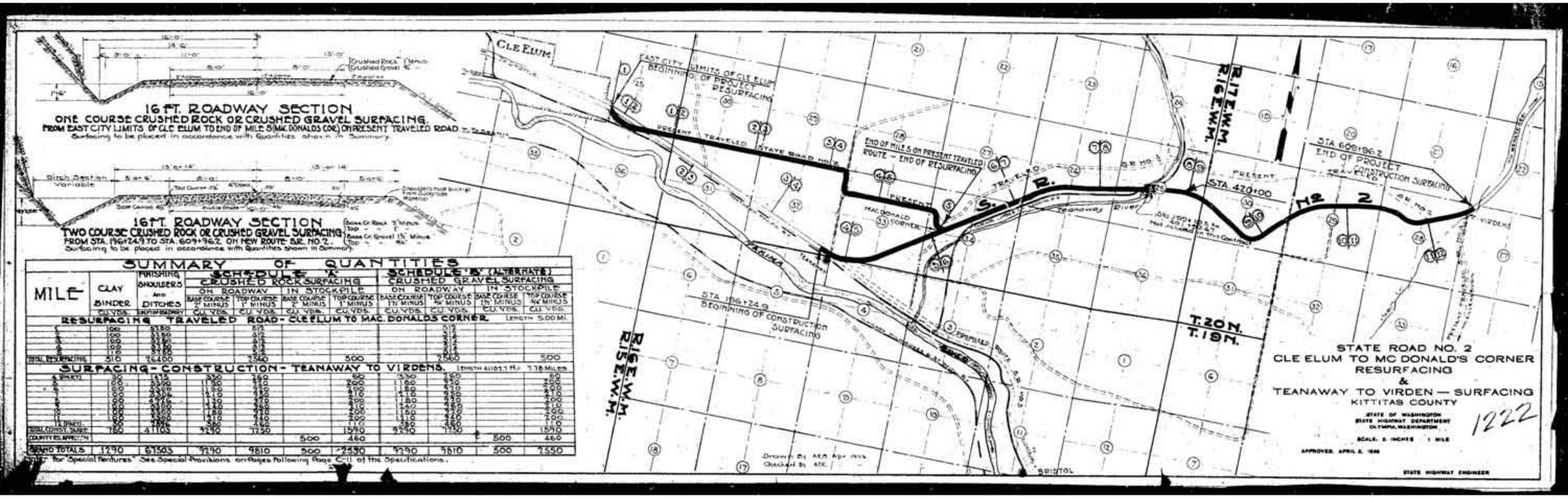
Compiled and Drawn by Eugene M. Henderson

Scale: ¾" = 1 mile

Log-drives on the Teanaway River transported logs out of the Teanaway to the Yakima River and then to the Cascade Limber Mill in Yakima

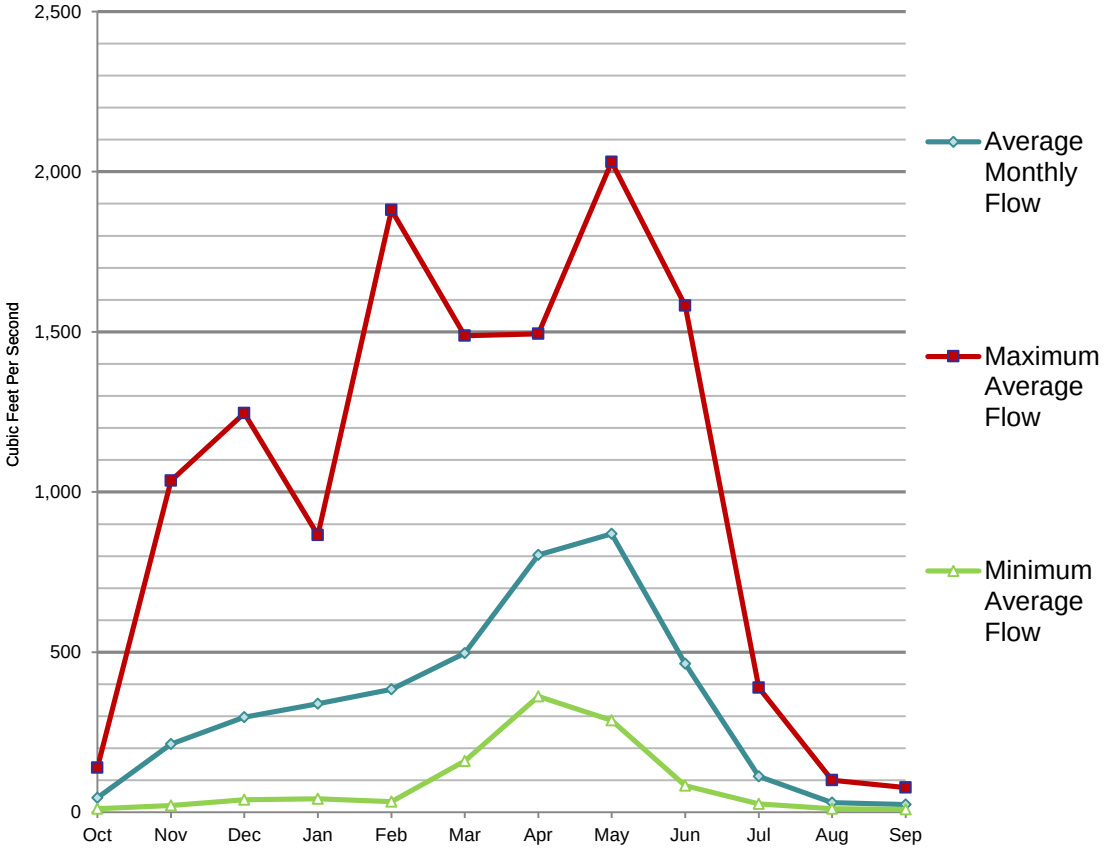
State Road #3

Plan Sheet circa 1927



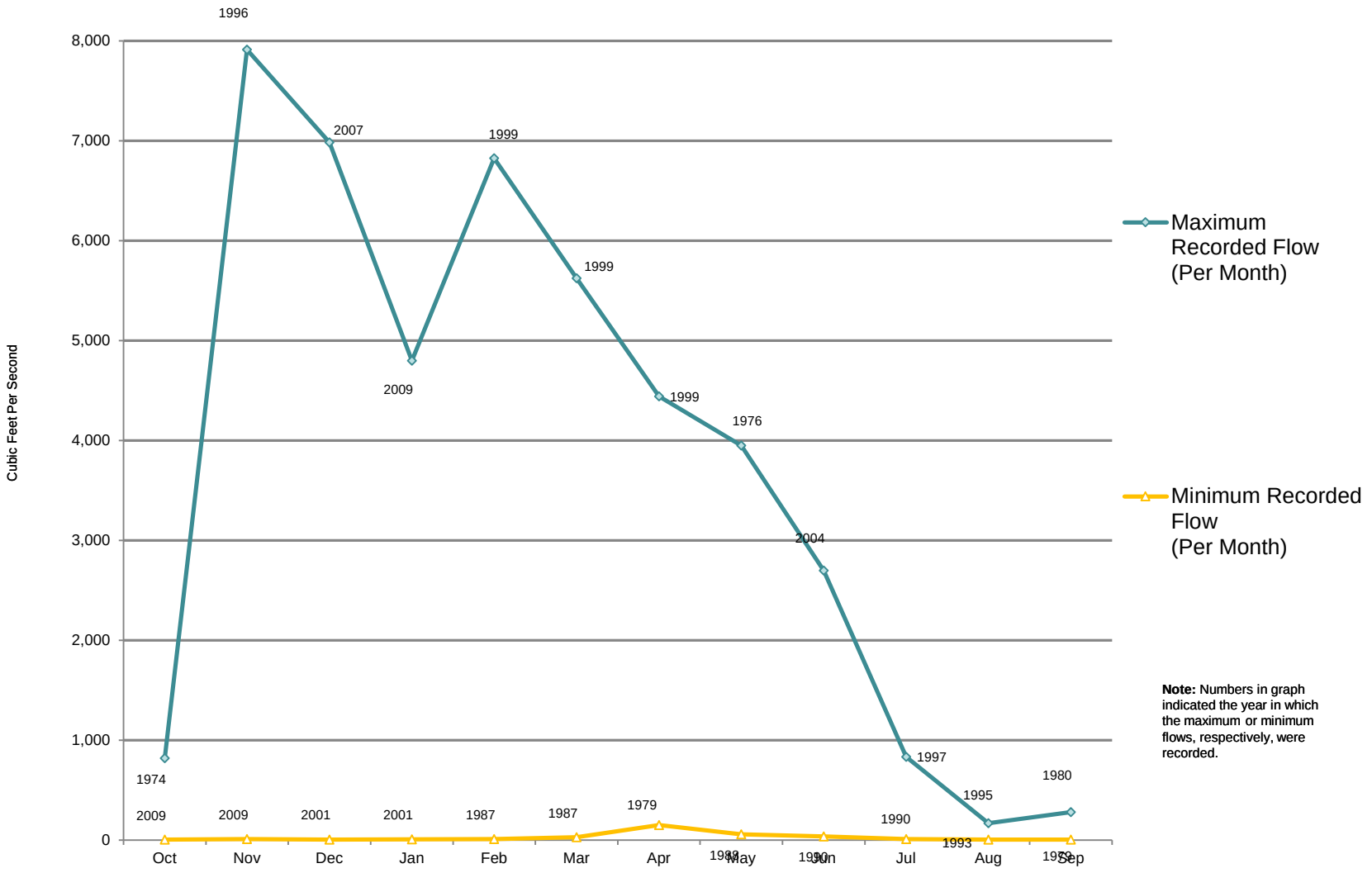
Teanaway River Flow Data

Monthly Averages from October 1, 1970 to September 30, 2010

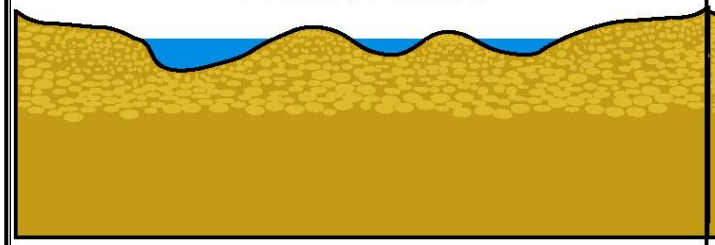
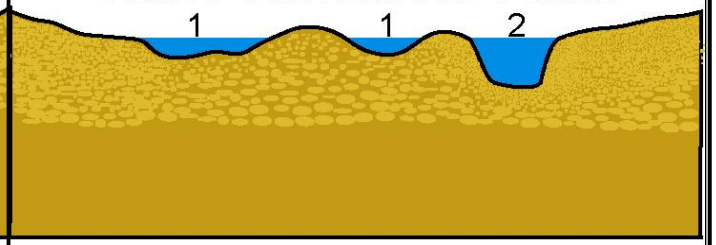


Teanaway River Extreme Flows

Includes Statistics from October 1, 1970 to September 30, 2010



Note: Numbers in graph indicated the year in which the maximum or minimum flows, respectively, were recorded.

Geomorphic Pattern (Functional Sector) Braided Pattern		Geomorphic Pattern (Functional Sector) Braided[1]-Anastomosed[2] Pattern
		
Ecological Response		Ecological Response
River Bed	Unstable	Unstable[1]-Moderately Stable[2]
Lateral Wandering	Fast	Fast[1]-Moderate[2]
Biotic Connection to the Alluvial Aquifer	Very Low (Aggrading) High (Degrading)	Very Low[1]-Moderate[2](Aggrading) *Anastomosed Pattern occurs only with aggradation
Habitat Diversity of the Floodplain	Moderate	Very High
Developmental Stages of the Ecosystem	Juvenile-Adolescent	Juvenile[1-2]-Mature[2]
Expected Biomass of the Floodplain	Moderate	High

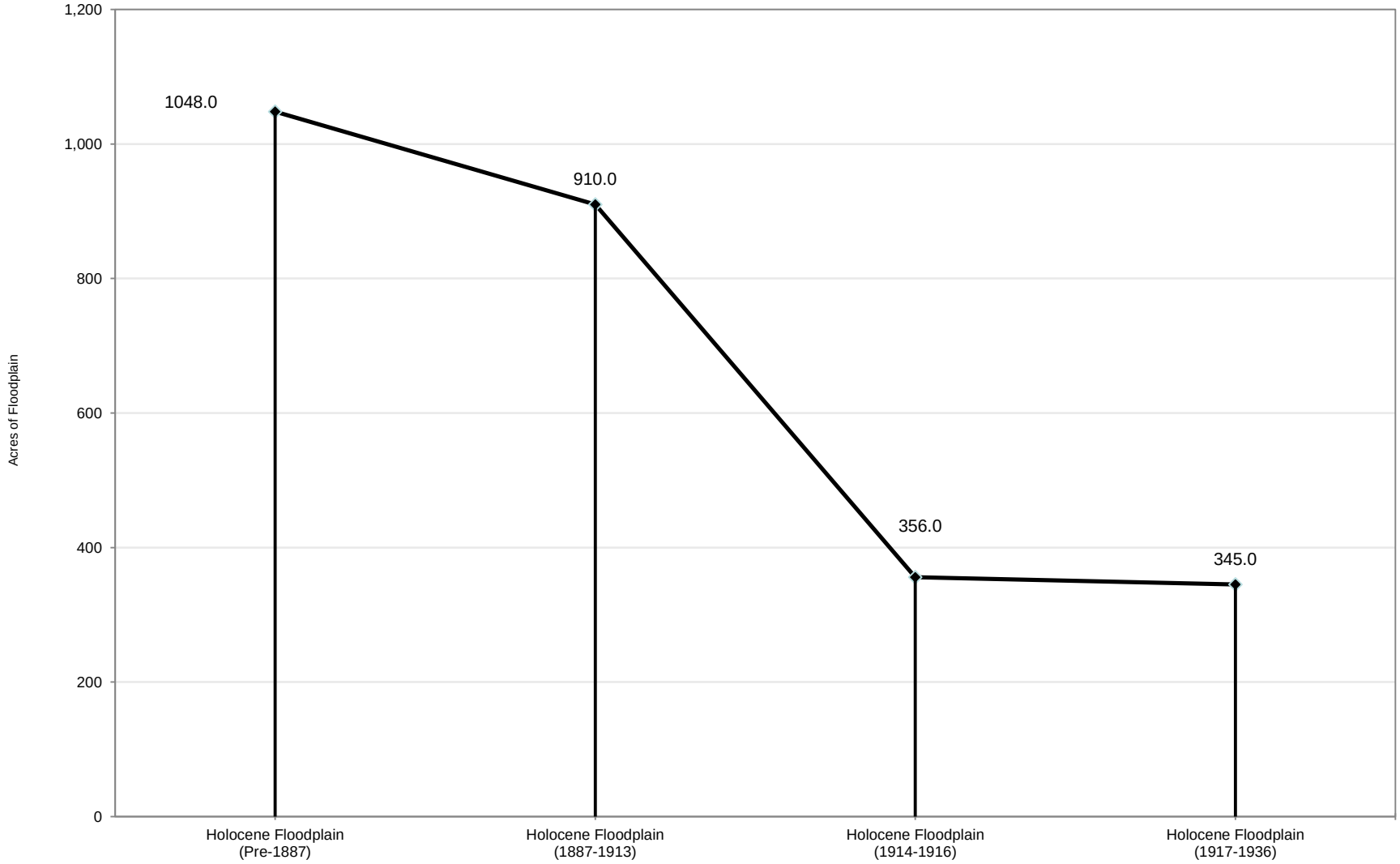
Modified from Amoros et al., 1987.

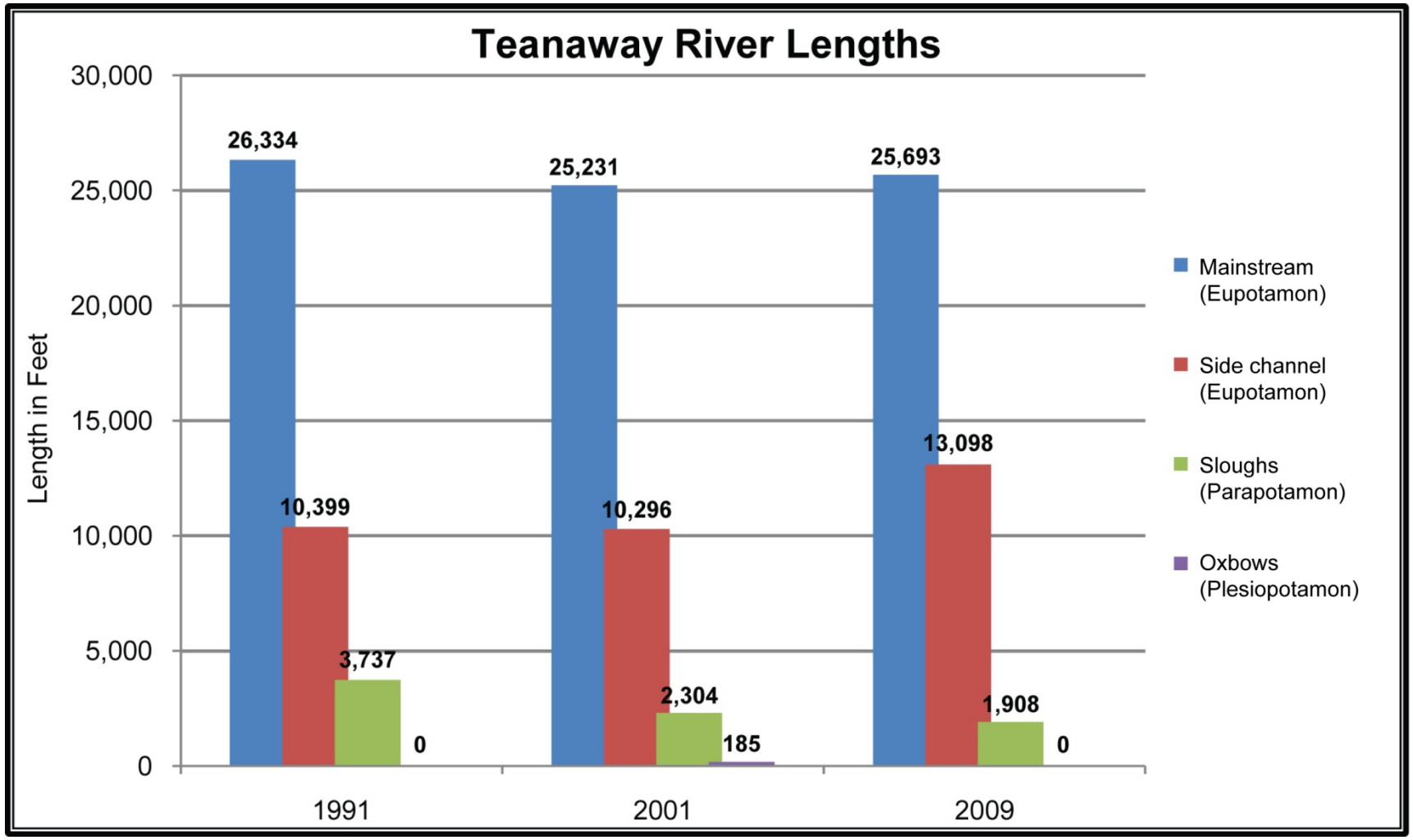
A comparison of the braided and braided-anastomosed function sectors and the associated ecological response associated with each; modified from Amoros et al., 1987 (Eitemiller, Arango, Clark, Uebelacker, 2002).

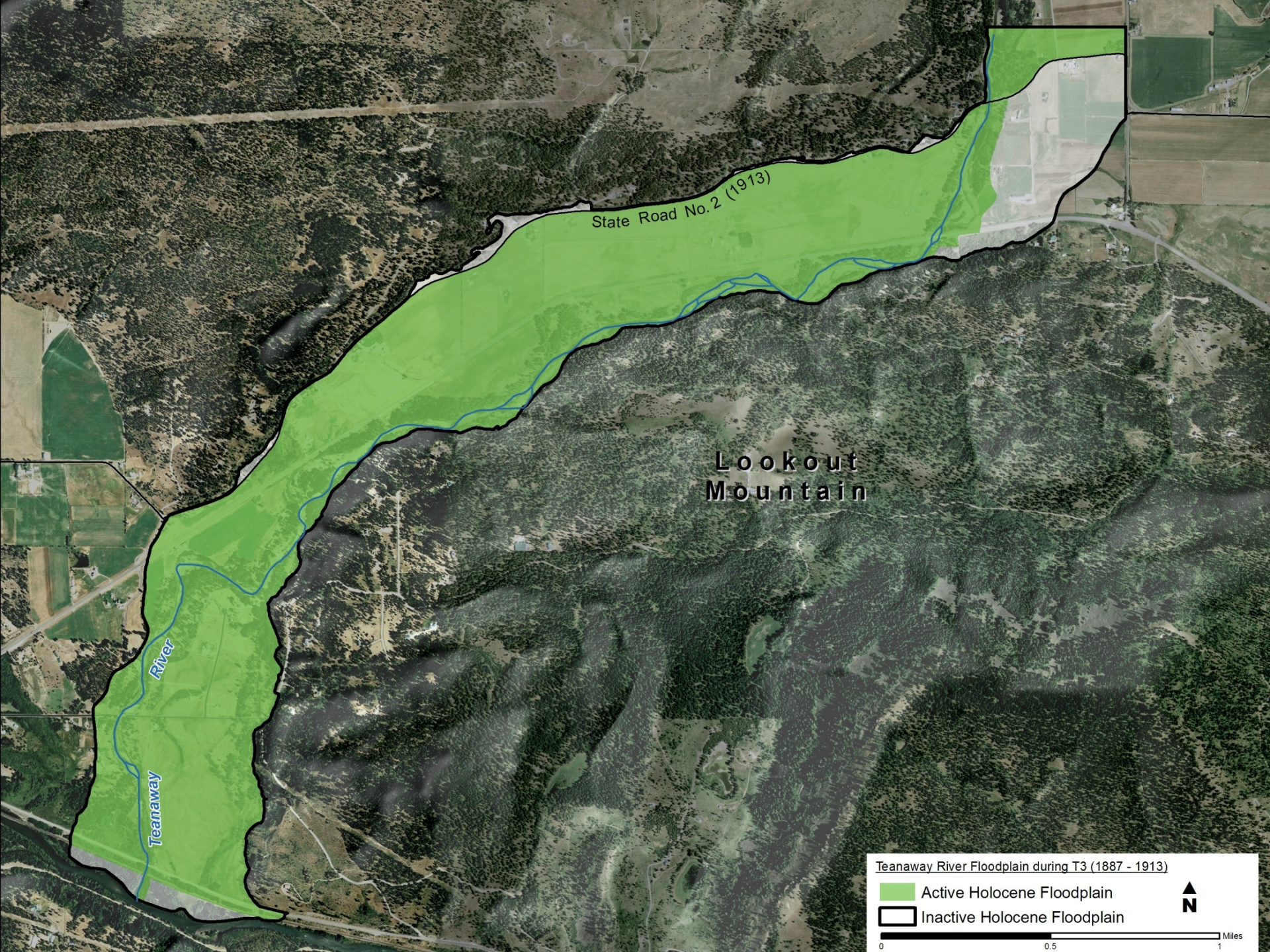
Types of functional sets associated with alluvial floodplains; modified from Ward and Stanford, 1995 (Eitemiller, Arango, Clark, Uebelacker, 2002).

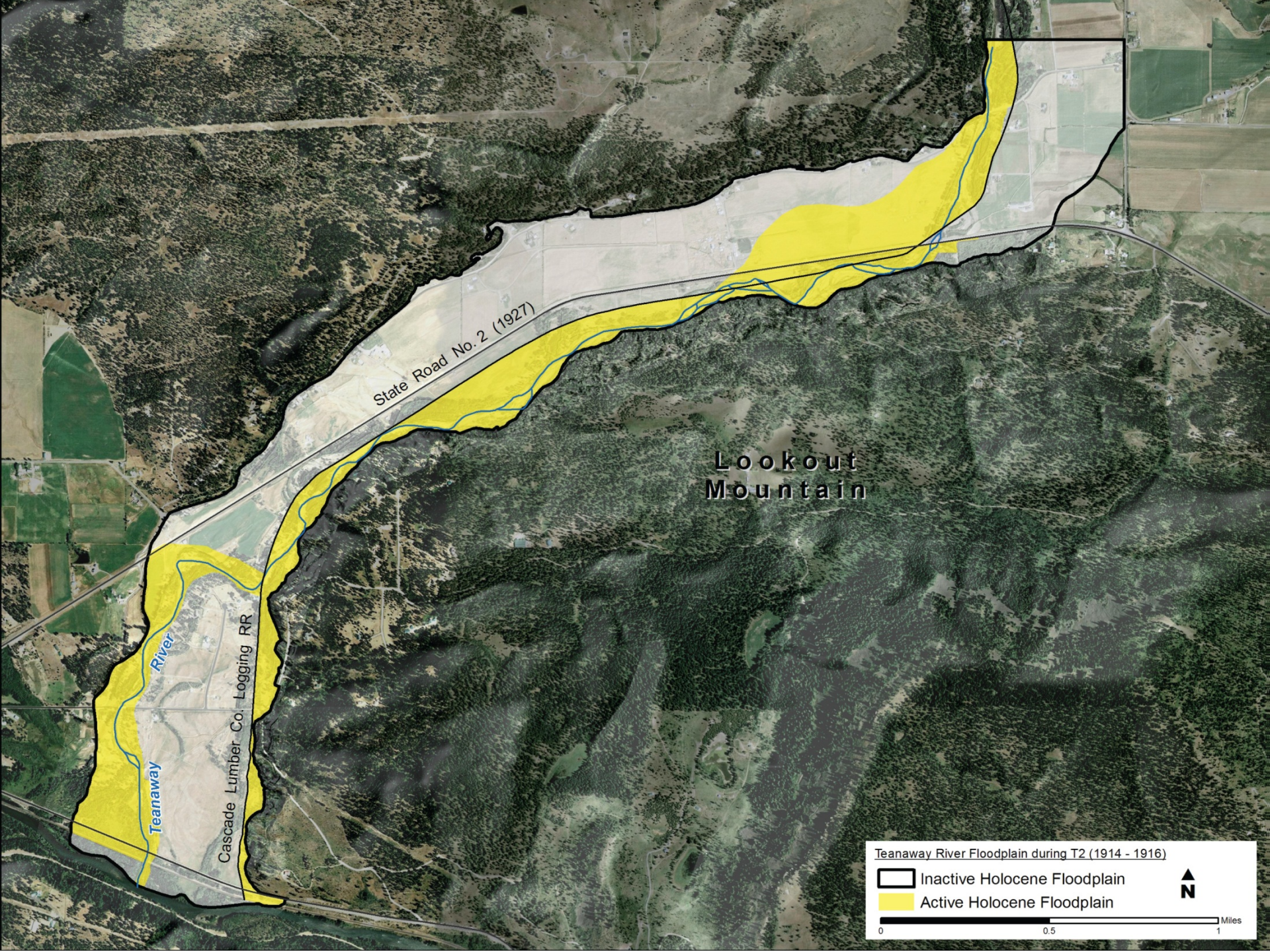
Teanaway River Holocene Floodplain Change

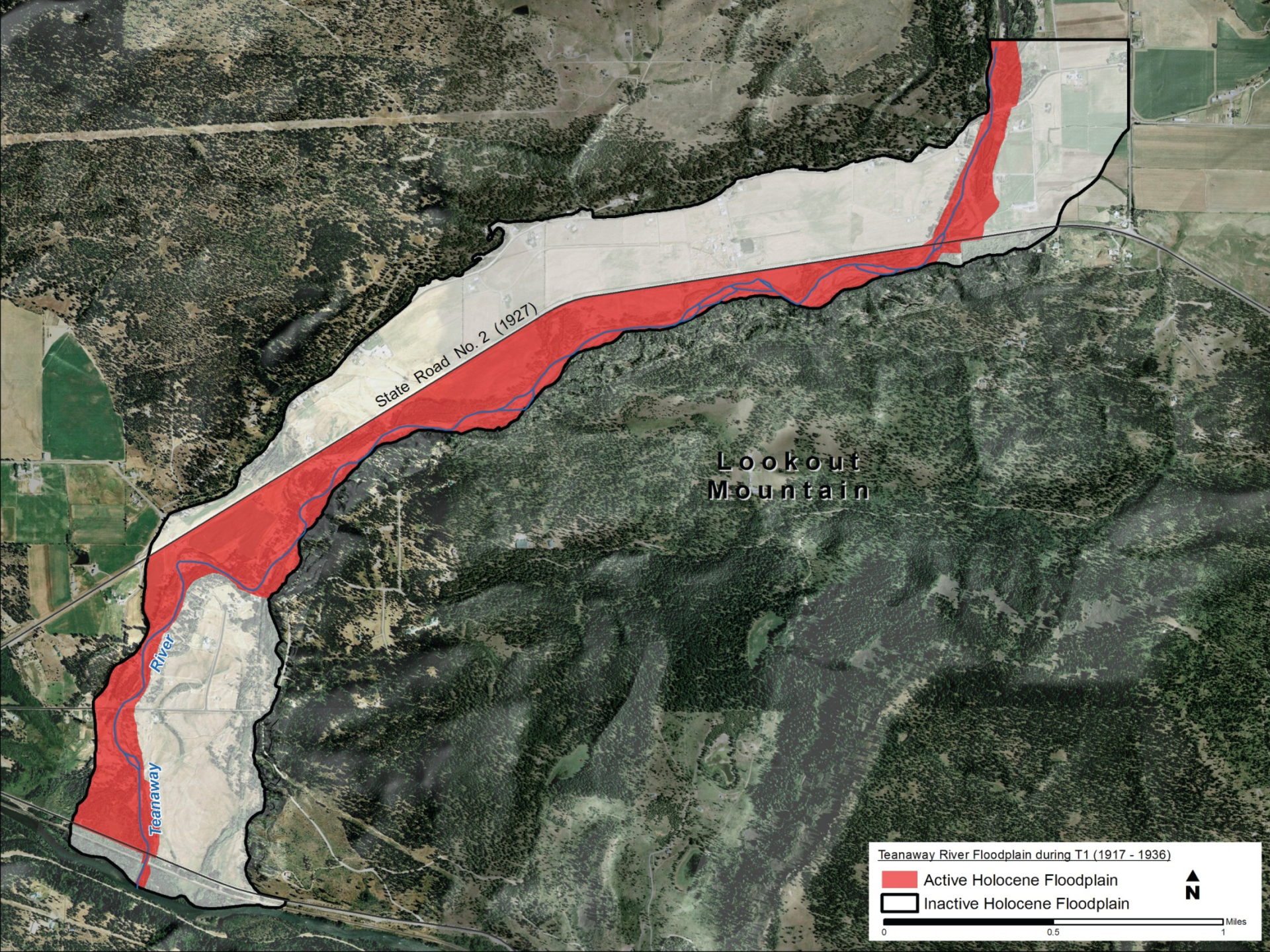
1887 - 1936



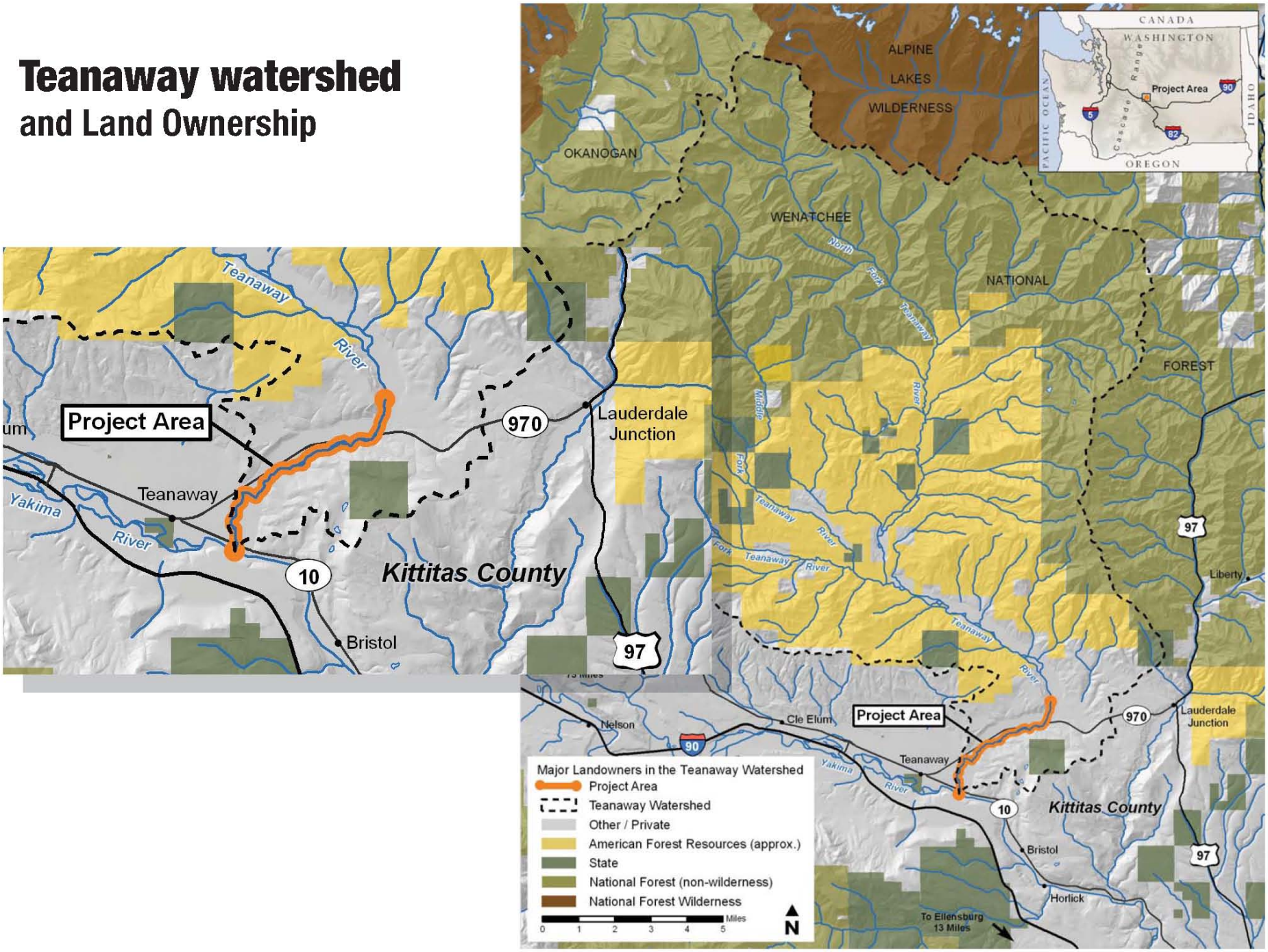

Teanaway River Lengths
Length in Feet
30,000
25,000
20,000
15,000
10,000
5,000
0
26,334
10,399
3,737
0
25,231
10,296
2,304
185
25,693
13,098
1,908
0
1991
2001
2009
Mainstream (Eupotamon)
Side channel (Eupotamon)
Sloughs (Parapotamon)
Oxbows (Plesiopotamon)

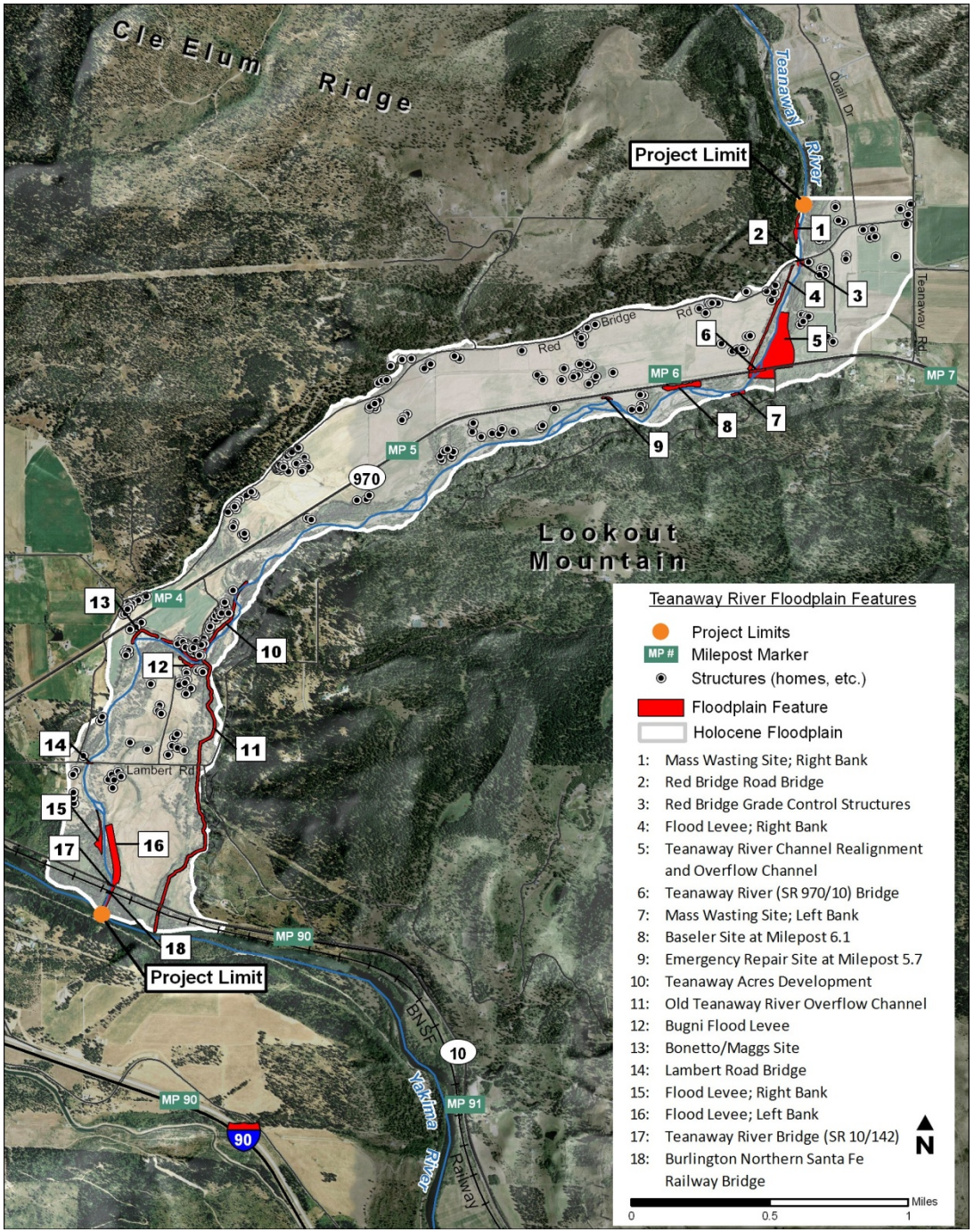

State Road No. 2 (1913)
Lookout Mountain
Teanaway River
Teanaway River Floodplain during T3 (1887 - 1913)
Active Holocene Floodplain
Inactive Holocene Floodplain
N
0
0.5
1
Miles


State Road No. 2 (1927)
Lookout Mountain
Cascade Lumber Co. Logging RR
Teanaway River
Teanaway River Floodplain during T2 (1914 - 1916)
Inactive Holocene Floodplain
Active Holocene Floodplain
N
Miles
0
0.5
1

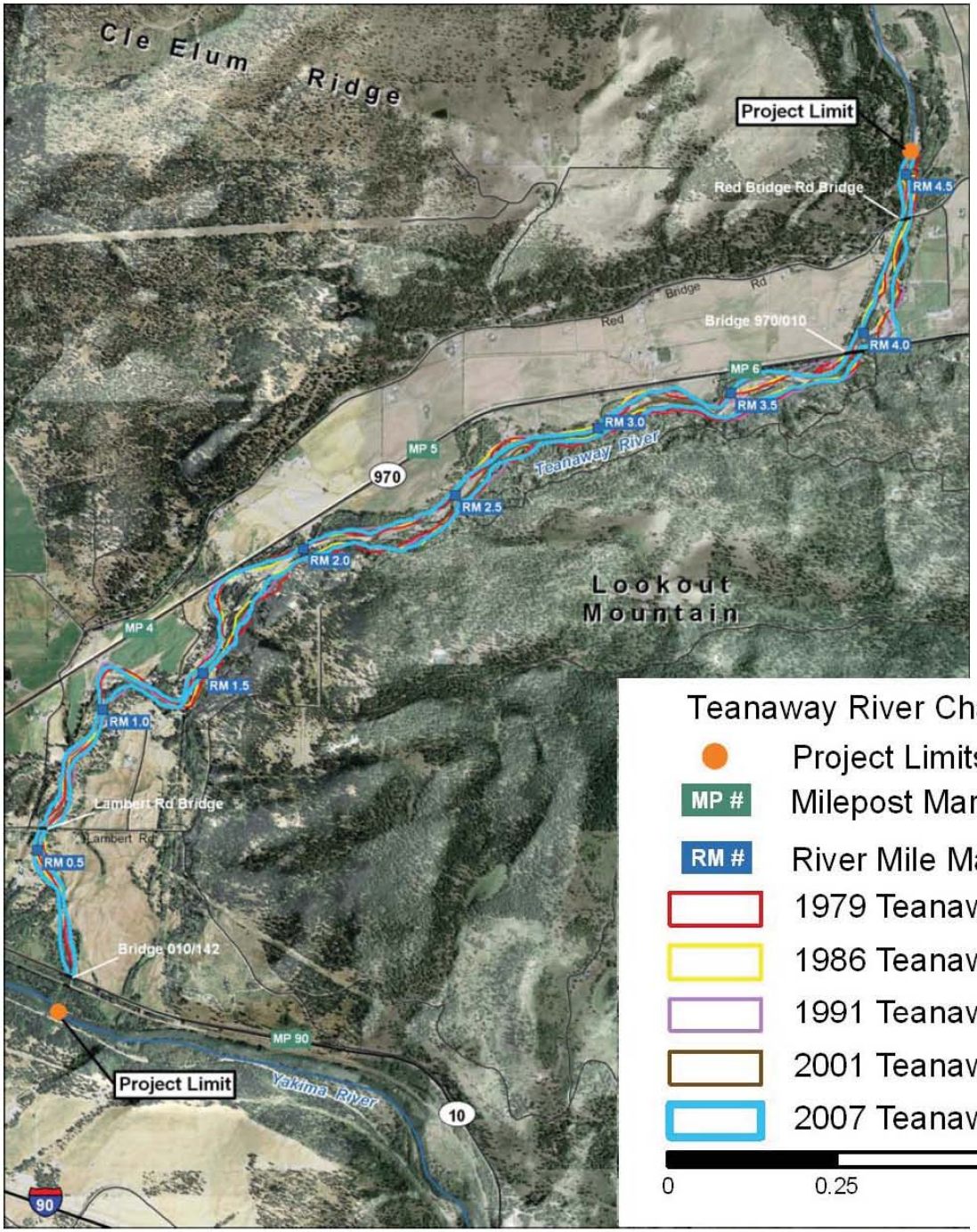

State Road No. 2 (1927)
Lookout Mountain
Teanaway River
Teanaway River Floodplain during T1 (1917 - 1936)
Active Holocene Floodplain
Inactive Holocene Floodplain
N
Miles
0
0.5
1

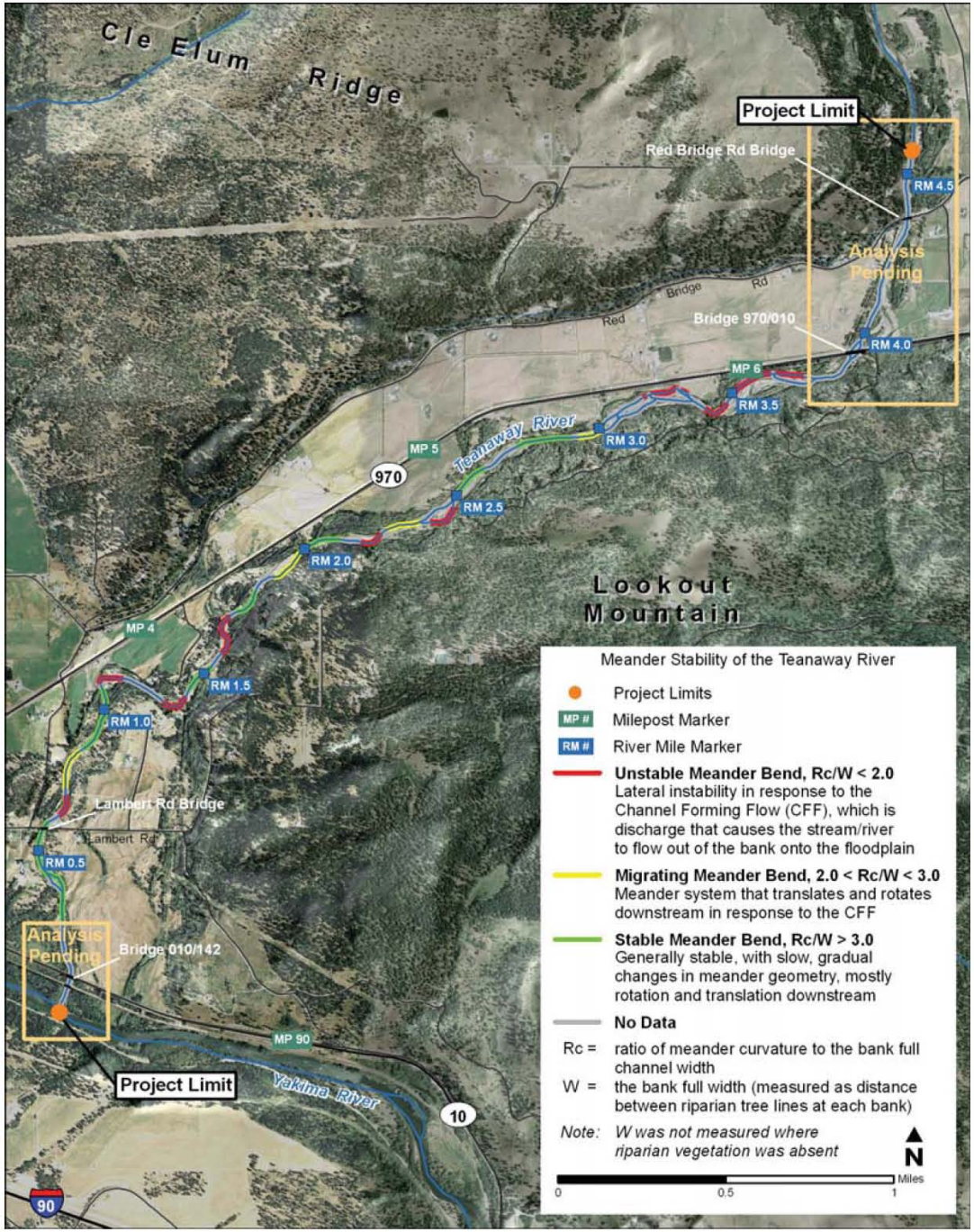
Teanaway watershed
and Land Ownership




Cle Elum Ridge
Lookout Mountain
Project Limit
Project Limit
Teanaway River
Quail Dr
Teanaway Rd
Red Bridge Rd
MP 4
MP 5
MP 6
MP 7
MP 90
MP 90
MP 91
970
90
10
Lambert Rd
BNSF Railway
Yakima River
Teanaway River Floodplain Features
Project Limits
MP # Milepost Marker
Structures (homes, etc.)
Floodplain Feature
Holocene Floodplain
1: Mass Wasting Site; Right Bank
2: Red Bridge Road Bridge
3: Red Bridge Grade Control Structures
4: Flood Levee; Right Bank
5: Teanaway River Channel Realignment and Overflow Channel
6: Teanaway River (SR 970/10) Bridge
7: Mass Wasting Site; Left Bank
8: Baseler Site at Milepost 6.1
9: Emergency Repair Site at Milepost 5.7
10: Teanaway Acres Development
11: Old Teanaway River Overflow Channel
12: Bugni Flood Levee
13: Bonetto/Maggs Site
14: Lambert Road Bridge
15: Flood Levee; Right Bank
16: Flood Levee; Left Bank
17: Teanaway River Bridge (SR 10/142)
18: Burlington Northern Santa Fe Railway Bridge
N
Miles
0
0.5
1

Teanaway Channel Migration





Teanaway River Meander
Stability Analysis

Meander Stability of the Teanaway River

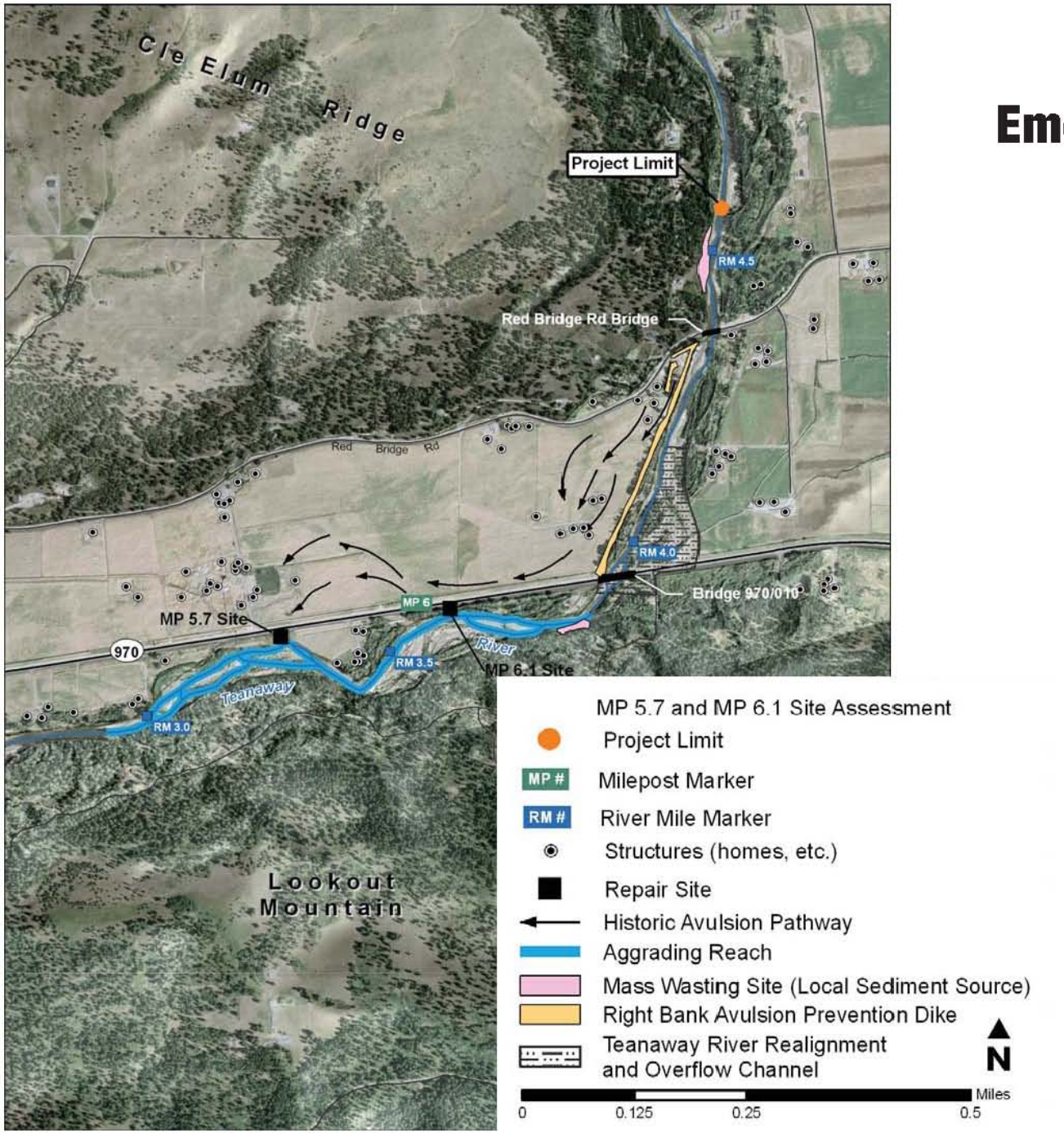
- Project Limits
- MP # Milepost Marker
- RM # River Mile Marker
- **Unstable Meander Bend, Rc/W < 2.0**
  Lateral instability in response to the Channel Forming Flow (CFF), which is discharge that causes the stream/river to flow out of the bank onto the floodplain
- **Migrating Meander Bend, 2.0 < Rc/W < 3.0**
  Meander system that translates and rotates downstream in response to the CFF
- **Stable Meander Bend, Rc/W > 3.0**
  Generally stable, with slow, gradual changes in meander geometry, mostly rotation and translation downstream
- **No Data**

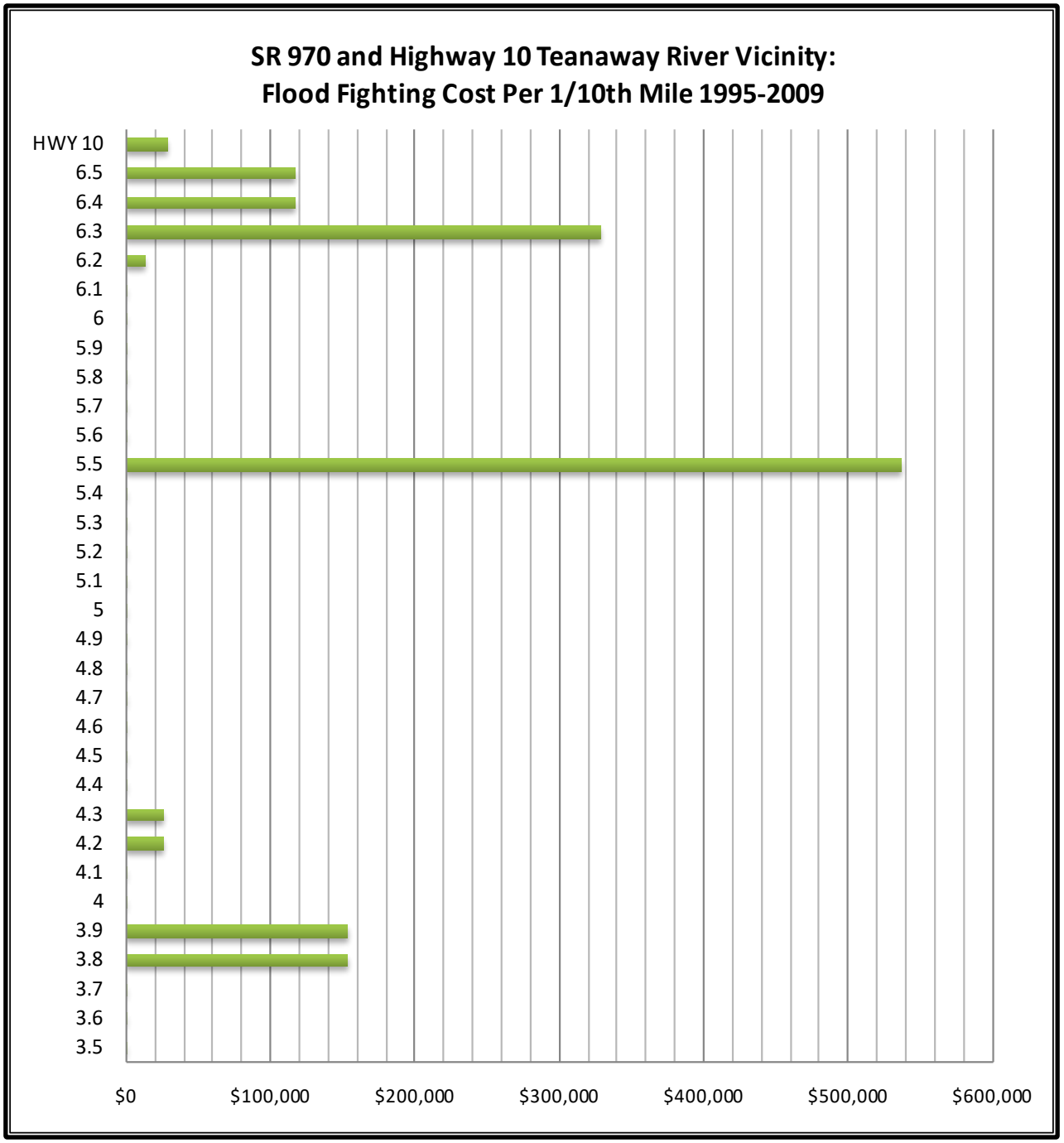
Rc = ratio of meander curvature to the bank full channel width

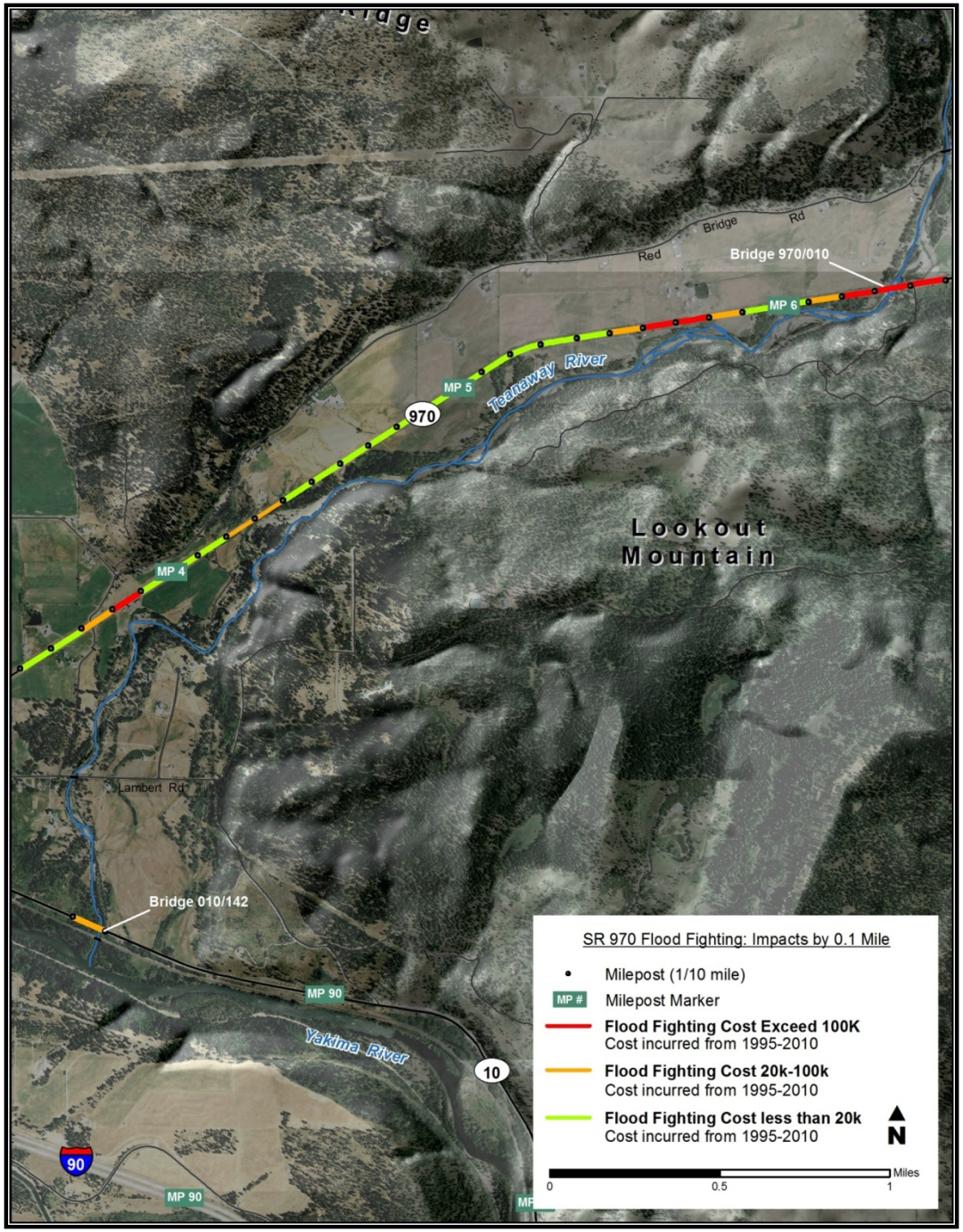
W = the bank full width (measured as distance between riparian tree lines at each bank)

Note: W was not measured where riparian vegetation was absent

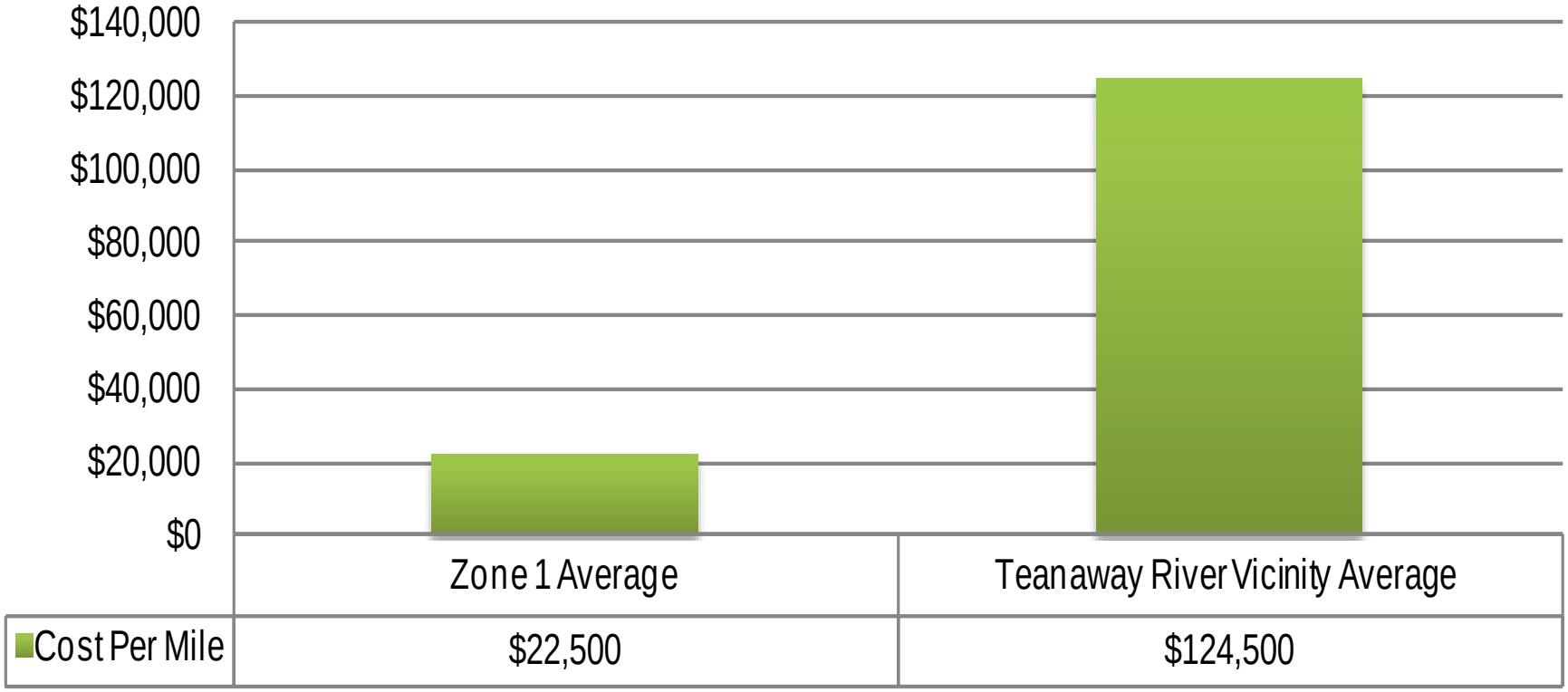
Emergency Sites

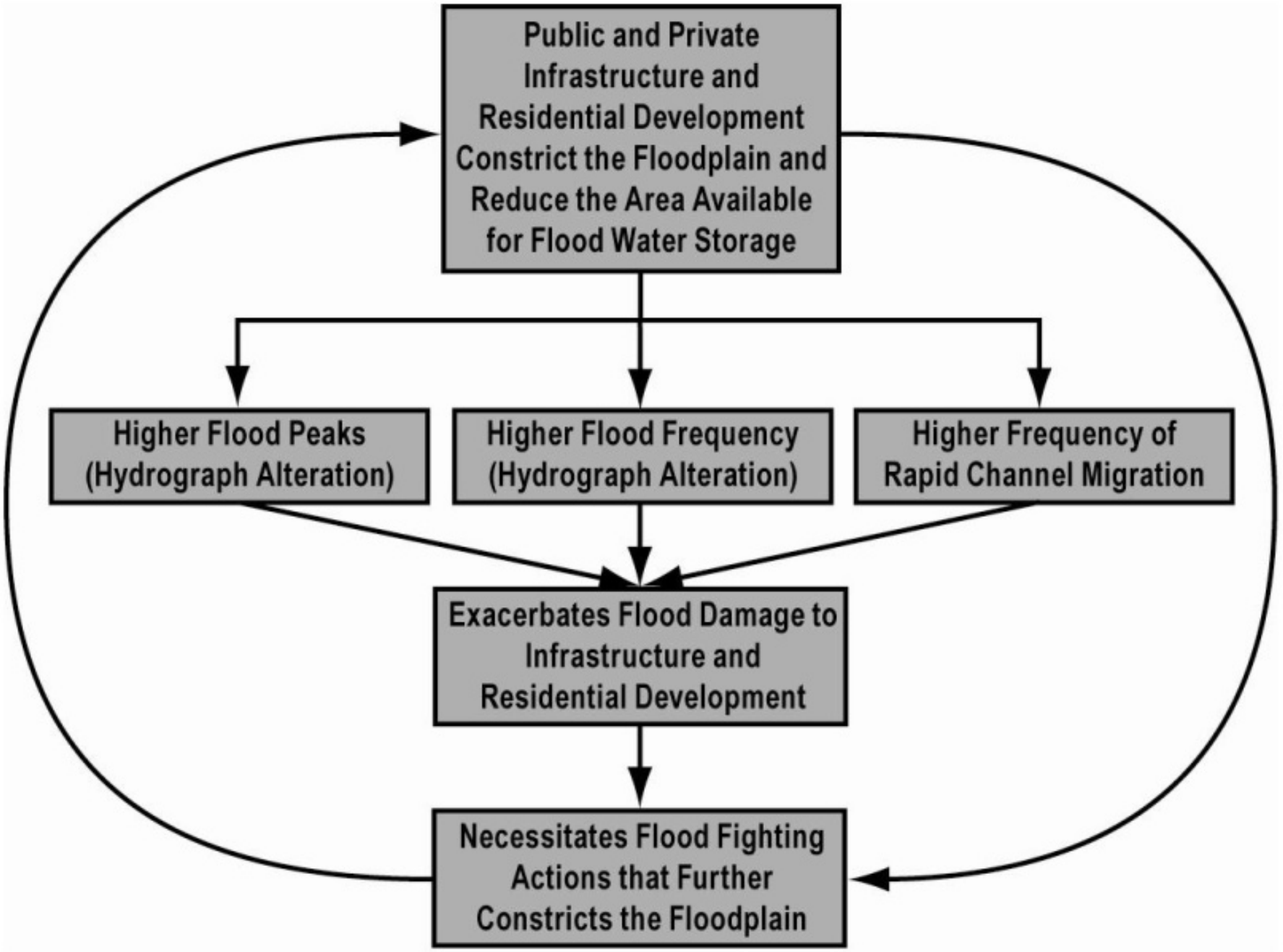



SR 970 and Highway 10 Teanaway River Vicinity:
Flood Fighting Cost Per 1/10th Mile 1995-2009
HWY 10
6.5
6.4
6.3
6.2
6.1
6
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
5.1
5
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
$0
$100,000
$200,000
$300,000
$400,000
$500,000
$600,000


Red Bridge Rd
Bridge 970/010
MP 6
MP 5
Teanaway River
970
MP 4
Lookout Mountain
Lambert Rd
Bridge 010/142
MP 90
Yakima River
10
90
MP 90
SR 970 Flood Fighting: Impacts by 0.1 Mile
Milepost (1/10 mile)
MP #
Milepost Marker
Flood Fighting Cost Exceed 100K
Cost incurred from 1995-2010
Flood Fighting Cost 20k-100k
Cost incurred from 1995-2010
Flood Fighting Cost less than 20k
Cost incurred from 1995-2010
N
Miles
0
0.5
1

Average Operational Cost Per Mile: Teanaway River Vicinity SR970




Public and Private Infrastructure and Residential Development Constrict the Floodplain and Reduce the Area Available for Flood Water Storage
Higher Flood Peaks (Hydrograph Alteration)
Higher Flood Frequency (Hydrograph Alteration)
Higher Frequency of Rapid Channel Migration
Exacerbates Flood Damage to Infrastructure and Residential Development
Necessitates Flood Fighting Actions that Further Constricts the Floodplain


Teanaway River
Milepost 5.7 January 2009
Questions?