

# FORPRIEM

## Forest Practice Rules Implementation and Effectiveness Monitoring FINAL REPORT

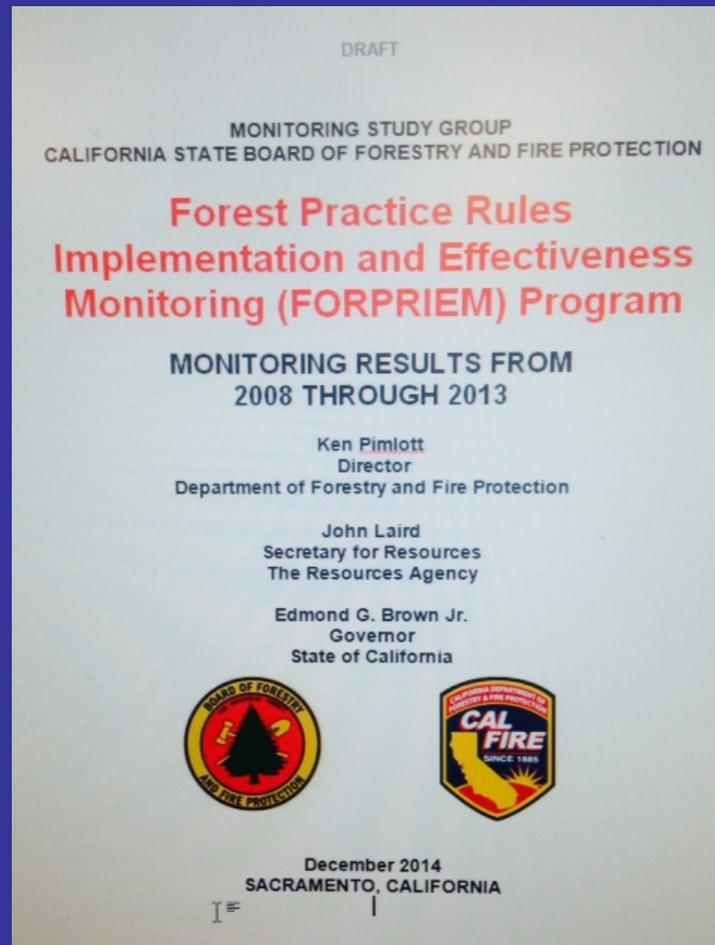
**CAL FIRE FORPRIEM Monitoring Preliminary Results**  
**Clay Brandow**  
**MSG Meeting — Howard Forest, CA**  
**December 18, 2014**



# Outline

- I. Organization of the Report
- II. Background Information
- III. WLPZ Total Canopy
- IV. Water Course Crossings
- V. Roads
- VI. Summary

# I. Organization of the Report



<b>Abstract.....</b>	<b>ii</b>
<b>Monitoring Study Group (MSG).....</b>	<b>ii</b>
<b>Executive Summary.....</b>	<b>iii</b>
<b>Acknowledgements.....</b>	<b>vi</b>
<b>Table of Contents.....</b>	<b>viii</b>
<b>List of Figures.....</b>	<b>x</b>
<b>List of Tables.....</b>	<b>xiv</b>
<b>List of Abbreviations.....</b>	<b>xv</b>
<b>Introduction.....</b>	<b>1</b>
<b>Background Information.....</b>	<b>1</b>
<b>Literature Review.....</b>	<b>3</b>

**FORPRIEM Study Design.....9**

**Overview.....9**

**Random Selection of Plans.....9**

**Data Collection.....11**

**Implementation and Effectiveness Evaluations.....11**

**Quality Assurance/Quality Control (QA/QC).....12**

**Distribution of FORPRIEM THPs and Comparison to  
Previous Monitoring Programs.....13**

**Random Site Selection within Randomly Selected  
THPs and NTMP-NTOs.....18**

## **WPLZ Canopy, Groundcover, and Erosion Monitoring....19**

I. Methods.....	19
II. THP WLPZ Results.....	24
III. NTMP-NTO WLZP Results.....	34
IV. WLPZ QA/QC.....	38
V. Discussion.....	40

## **Road Monitoring.....42**

I. Methods.....	42
II. THP Road Results.....	47
III. NTMP-NTO Road Results.....	61
IV. Road QA/QC.....	68
V. Discussion.....	71

## **Watercourse Crossing Monitoring.....74**

I. Methods.....	74
II. THP Watercourse Crossing Results.....	81
III. NTMP-NTO Watercourse Crossing Results.....	90
IV. Watercourse Crossing QA/QC.....	98
V. Discussion.....	99

<b>Conclusions.....</b>	<b>103</b>
<b>Recommendations.....</b>	<b>109</b>
<b>Literature Cited.....</b>	<b>111</b>
<b>Glossary.....</b>	<b>118</b>
<b>Appendix—</b>	
<b>FORPRIEM Monitoring Procedures     and Methods.....</b>	<b>122</b>

## II. Background Information

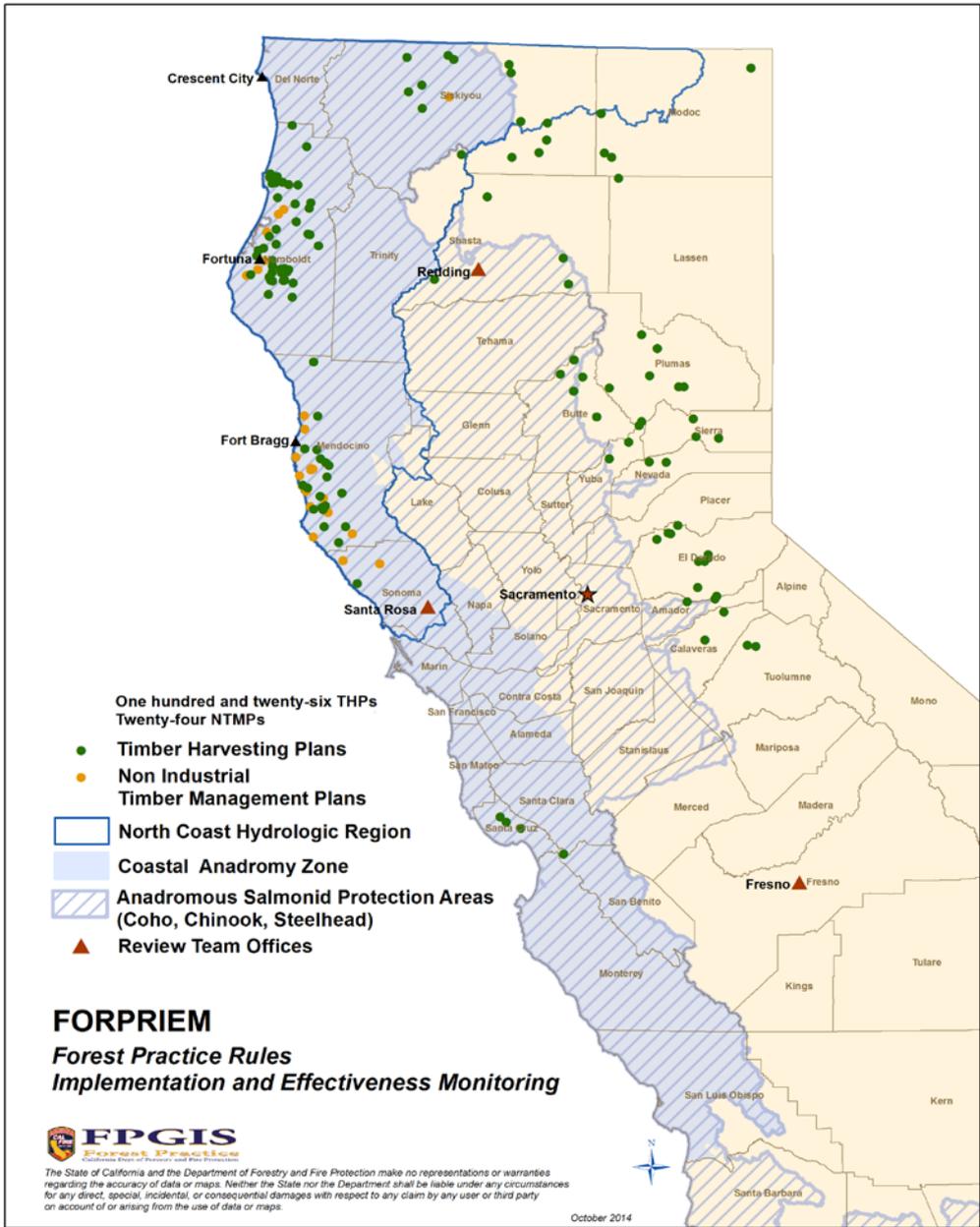


# Representative Sample

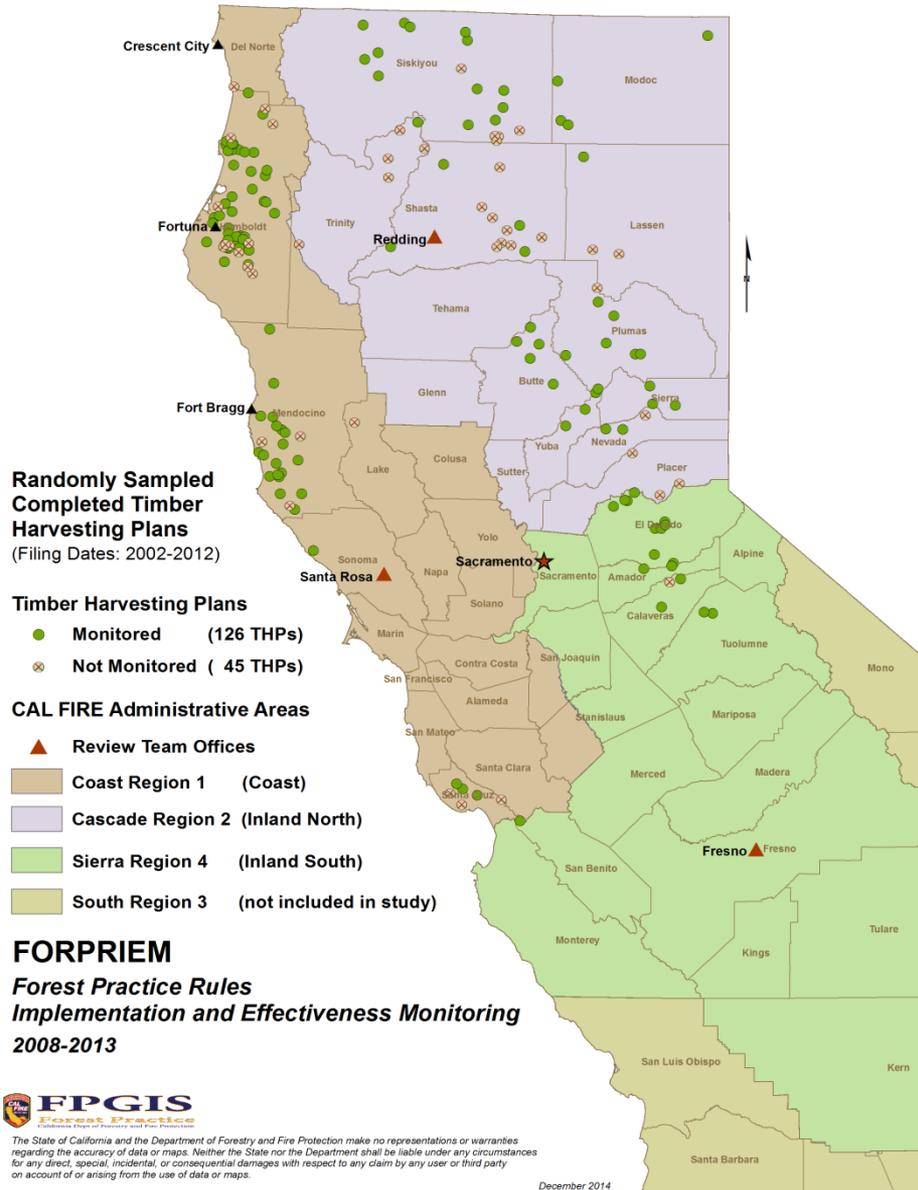
- **THPs Randomly Selected**
  - Statewide
  - HMP (1996 -- 2002)
  - MCR (2001-- 2004)
  - FORPRIEM (2008 -- present)
    - 10% sample
- **NTMP – NTOs Randomly Selected**
  - FORPRIEM (2011-- present)
    - North Coast Hydrologic Basin only (2011-12)
      - 20% sample
    - Statewide - 2013 to present

# FORPRIEM Plans Sampled

- THPs 126
  - Coast District 66
  - Northern District 43
  - Southern District 17
  
- NTMP/NTOs 24
  - Coast District 22
  - Northern District 1
  - Southern District 1







**Randomly Sampled Completed Timber Harvesting Plans**  
(Filing Dates: 2002-2012)

- Timber Harvesting Plans**
- Monitored (126 THPs)
  - ⊗ Not Monitored (45 THPs)

- CAL FIRE Administrative Areas**
- ▲ Review Team Offices
  - Coast Region 1 (Coast)
  - Cascade Region 2 (Inland North)
  - Sierra Region 4 (Inland South)
  - South Region 3 (not included in study)

**FORPRIEM**  
*Forest Practice Rules Implementation and Effectiveness Monitoring 2008-2013*



The State of California and the Department of Forestry and Fire Protection make no representations or warranties regarding the accuracy of data or maps. Neither the State nor the Department shall be liable under any circumstances for any direct, special, incidental, or consequential damages with respect to any claim by any user or third party on account of or arising from the use of data or maps.

# III. WLPZ Total Canopy



Example of a Coast Region Class II WLPZ in the FORPRIEM THP sample. Total canopy was 82% (THP 01-05-246 HUM).

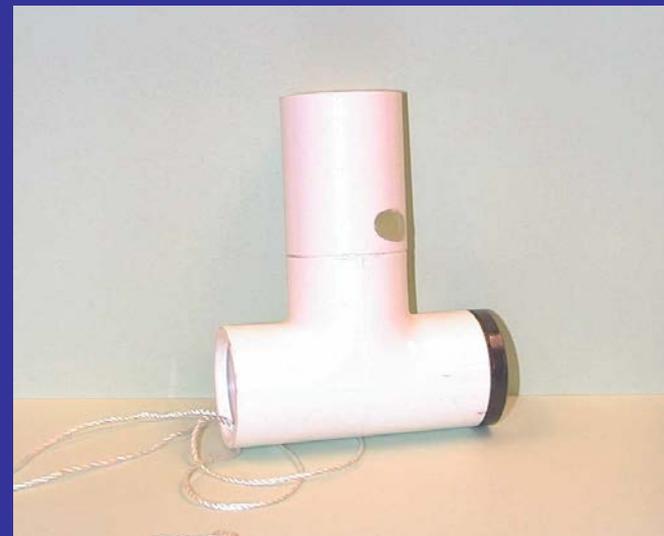
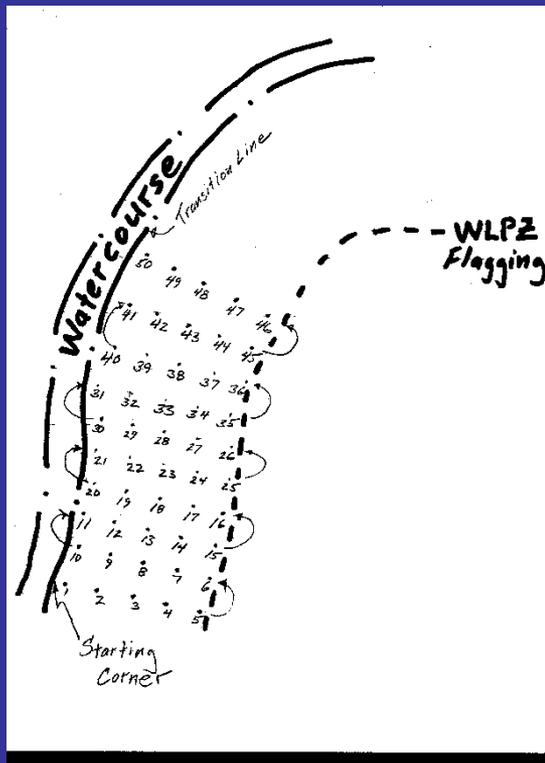
# FORPRIEM WLPZ Segments

- 103 THP WLPZs
  - 23 Class I watercourses
  - 80 Class II watercourses
  
- 20 NTMP-NTO WLPZs
  - 4 Class I watercourses
  - 16 Class II watercourses

~80% of the plans evaluated had a Class I or II watercourse available to measure total canopy

# FORPRIEM WLPZ Total Canopy

- Randomly located 200-foot WLPZ segments for Class I and II watercourses.
- A 50-point systematic grid pattern and a sighting tube are used for measurement.



Sighting Tube



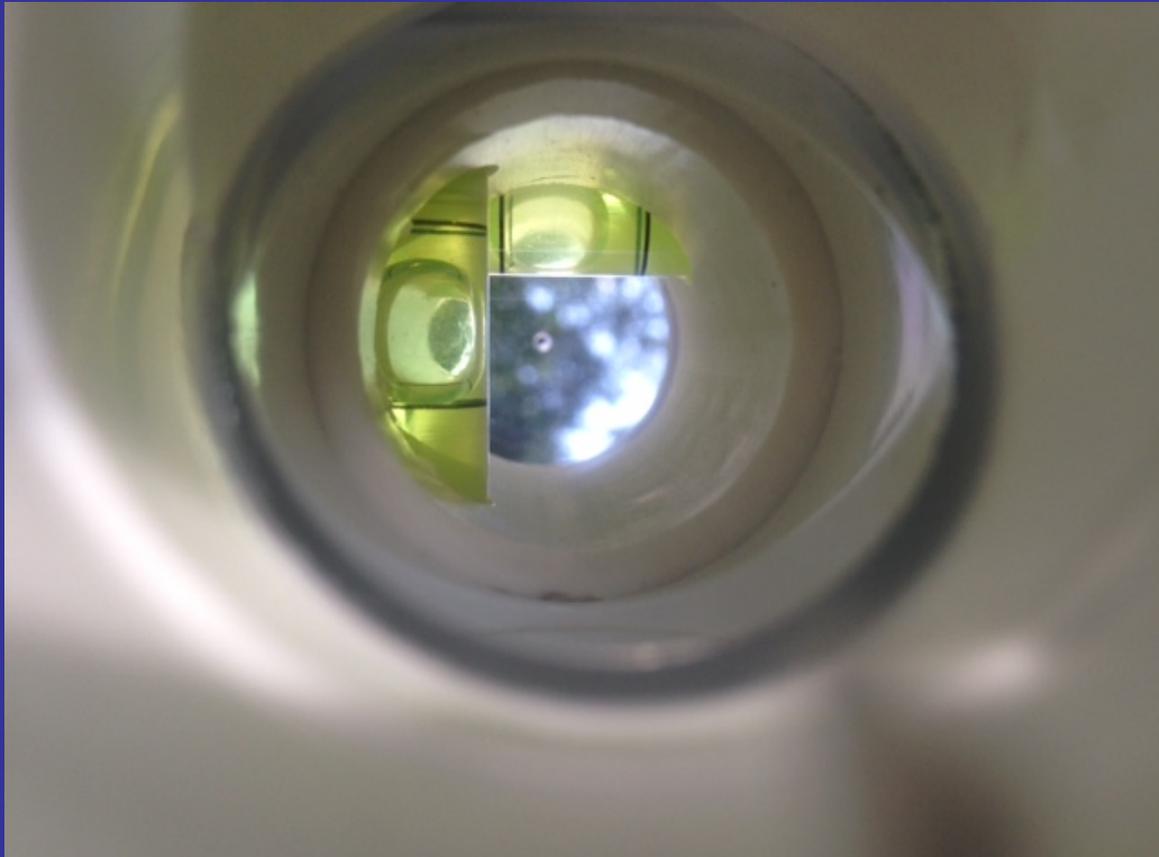
1-97NTMP-018  
MEN, NTO #6  
Aug 16, 2011  
Mill Creek NTMP

**Ken Margiott, CAL FIRE,  
measuring total canopy for  
FORPRIEM (92%). WLPZ  
harvesting had occurred as  
part of the NTMP NTO.**



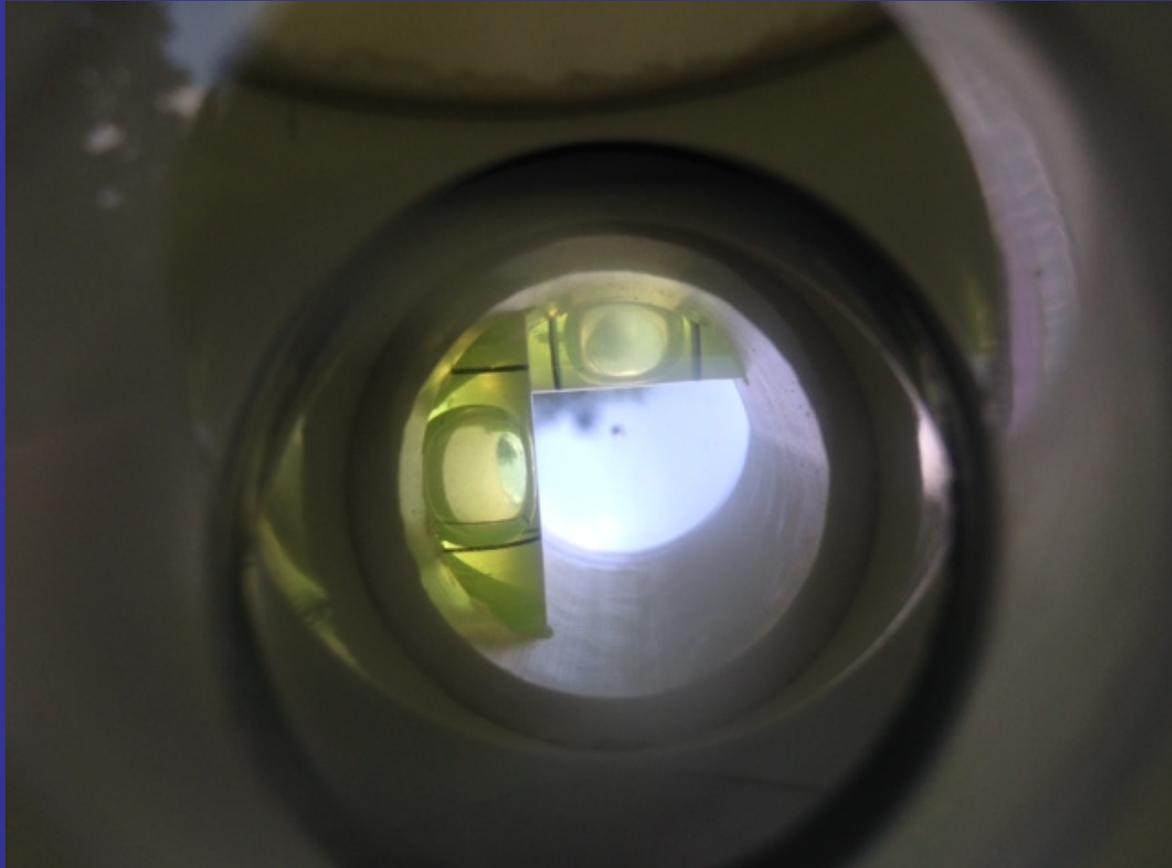
## Sighting Tube Use

Get in position. Make sure of your footing. Bring the tube up to your eye. Center the two leveling bubbles. Move your head slightly so the you eye centers the dot in the circle.



## Sighting Tube Hit

Repeat 50 times within the WLPZ sample segment on a specified grid using pacing.



## Sighting Tube Miss

Continue to repeat 50 times within the WLPZ sample segment on a specified grid using pacing.

# **FORPRIEM THP Preliminary Results**

## **WLPZ Total Canopy**

- **Out of the 126 THPs in the sample:**
  - **103 THPs had WLPZs.**
    - **53 had no harvesting this entry in the WLPZ sample segment.**
    - **50 had harvesting with this entry in the WLPZ sample segment.**
  - **26 of the THPs had no WLPZs to sample.**

# THP WLPZ Total Canopy Overall

**81.5%**

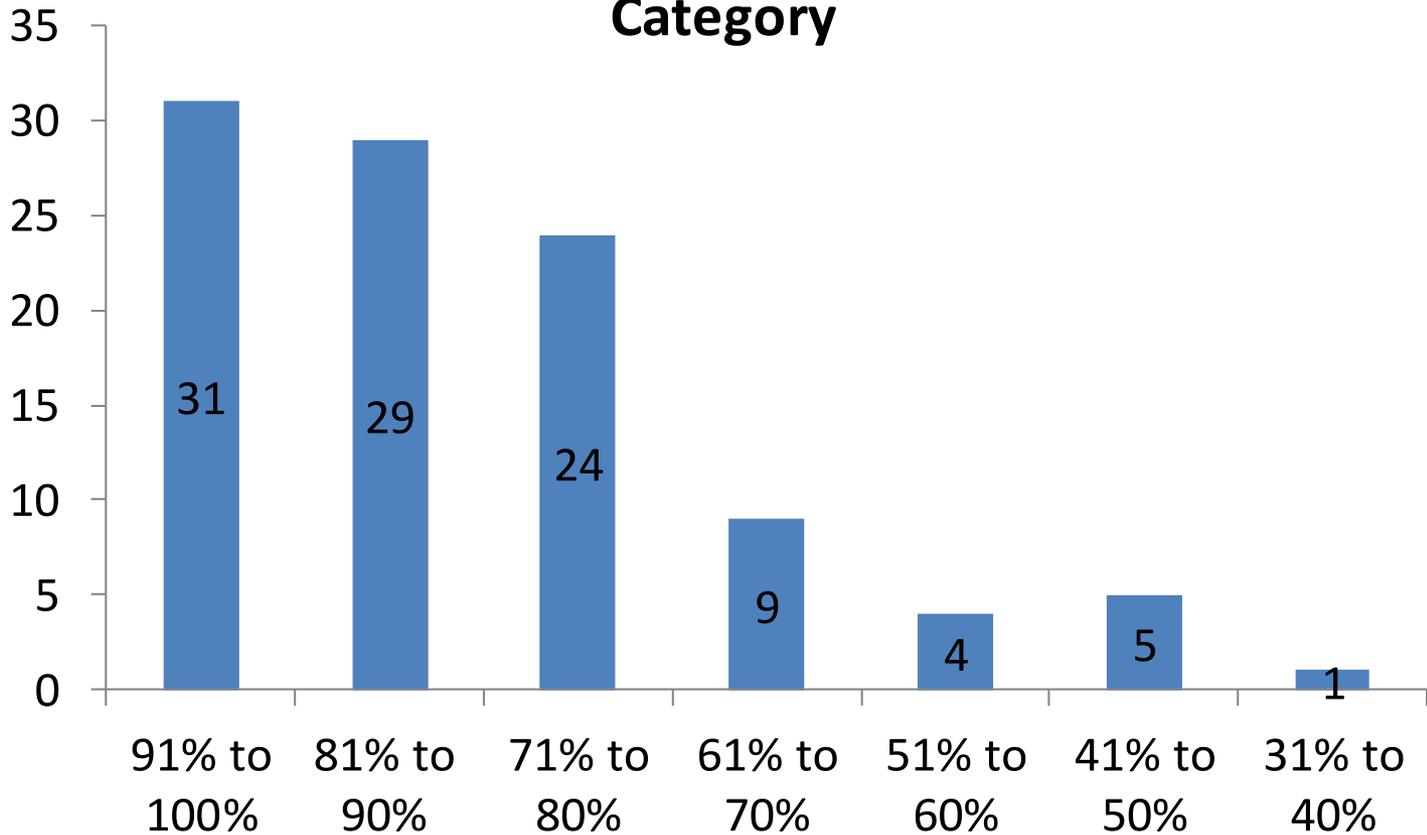
s.d. = 15.15

n = 103

**Median = 84%**

# THPs

**103 THP- WPLZ Segments by Percent Total Canopy Category**



**THP  
WLPZ Total  
Canopy  
Class I**

**81%**

s.d. = 17.9

n = 23

**Median = 82%**

**THP  
WLPZ Total  
Canopy  
Class II**

**82%**

s.d. = 14.4

n = 80

**Median = 85%**

**THP**  
**WLPZ Total**  
**Canopy**  
**No Harvest**

**80%**

s.d. = 18.16

n = 52

**Median = 87%**

**THP**  
**WLPZ Total**  
**Canopy**  
**Harvest**

**82%**

s.d. = 10.41

n = 51

**Median = 82%**

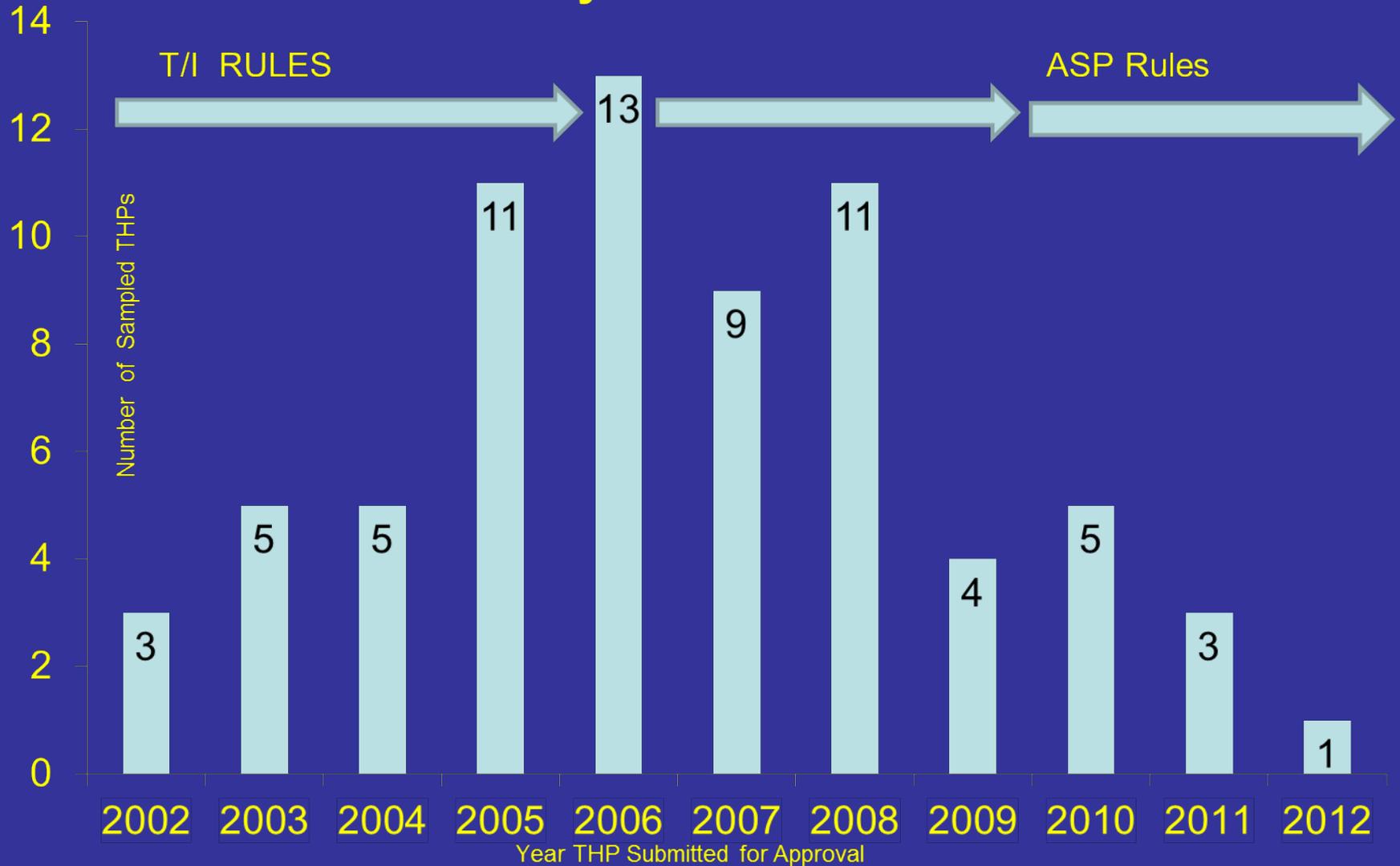
# Forest Practice Rules (FPRs)

- July 1, 2000 to December 31, 2009 Interim Threatened or Impaired (T/I) Watershed Rules in effect.
- Anadromous Salmonid Protection (ASP) Rules in effect since January 1, 2010.



# Sampled ASP Area THP-WLPZs (70)

## Distribution by Submission-Year



**THP  
WLPZ Total  
Canopy  
ASP Rule  
Area**

**86%**

s.d. = 12.580

n = 70

**Median = 88%**

**THP  
WLPZ Total  
Canopy  
Non-ASP  
Rule Area**

**73%**

s.d. = 15.83

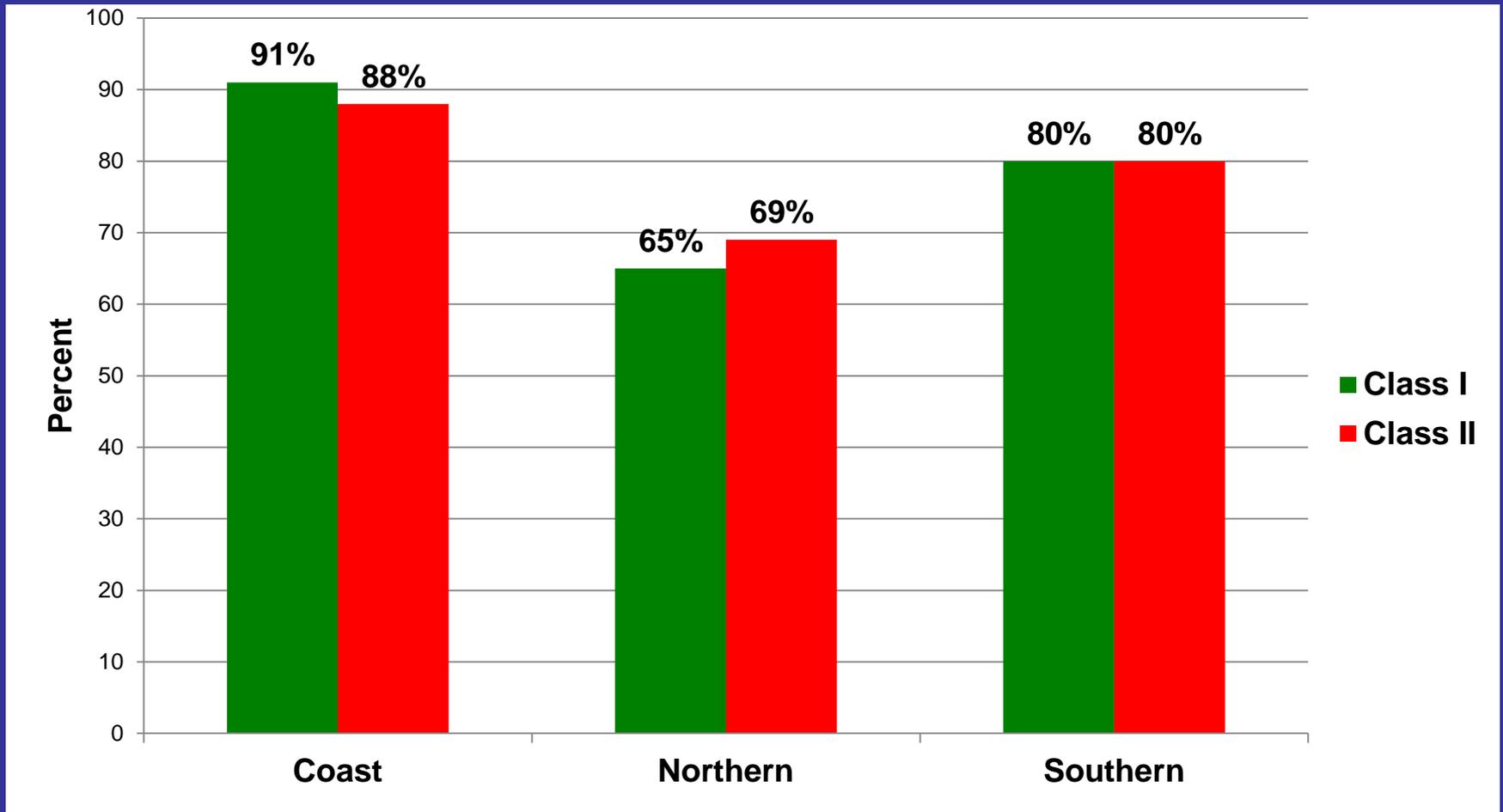
n = 33

**Median = 72%**

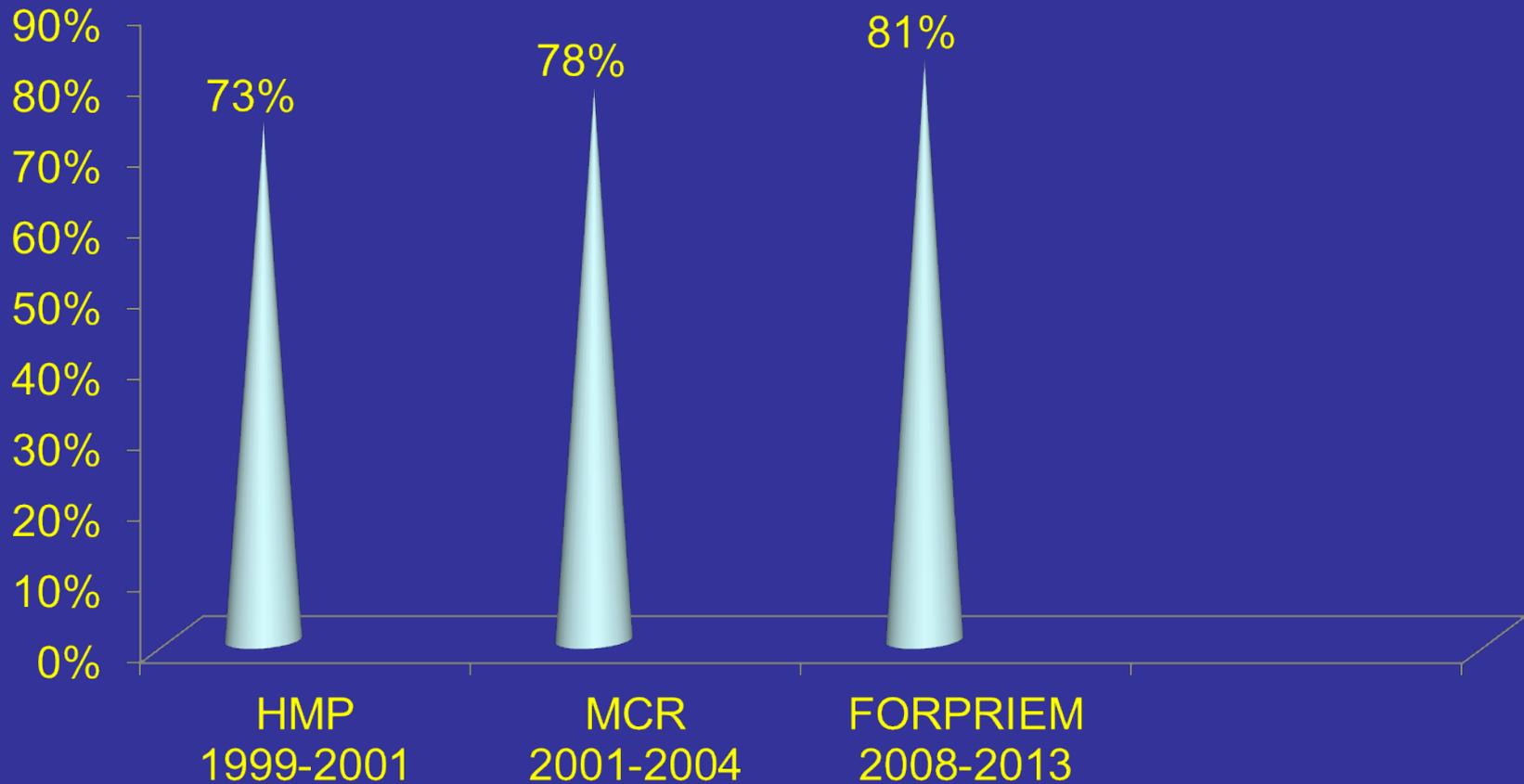
	<b>THP</b> <b>WLPZ Total Canopy</b> <b>ASP Rule Area</b>	<b>THP</b> <b>WLPZ Total Canopy</b> <b><u>Non</u>-ASP Rule Area</b>
<b>Overall</b>	<b>86%</b> n = 70 <b>Median = 88%</b>	<b>73%</b> n = 33 <b>Median = 72 %</b>
<b>Class I</b>	<b>88%</b> n = 15 <b>Median = 88 %</b>	<b>67%</b> n = 8 <b>Median = 69 %</b>
<b>Class II</b>	<b>85%</b> n = 55 <b>Median = 90 %</b>	<b>73%</b> n = 25 <b>Median = 74 %</b>
<b>No-Harvest</b>	<b>86%</b> n = 38 <b>Median = 90 %</b>	<b>67%</b> n = 14 <b>Median = 69 %</b>
<b>Harvest</b>	<b>87%</b> n = 32 <b>Median = 86 %</b>	<b>75%</b> n = 19 <b>Median = 78 %</b>

# FORPRIEM THP

## WLPZ Total Canopy by District



# Possible Trend in Class I WLPZ Total Canopy



# **FORPRIEM NTMP-NTO Preliminary Results**

## **WLPZ Total Canopy**

- **Out of the 24 NTMP/NTOs in the sample:**
  - **20 NTOs had WLPZs.**
    - **12 had no harvesting this entry in the WLPZ sample segment.**
    - **8 had harvesting with this entry in the WLPZ sample segment.**
  - **4 of the NTOs had no WLPZs to sample.**

**NTMP/NTO  
WLPZ Total Canopy  
ASP Rule Area**

**91.3%**

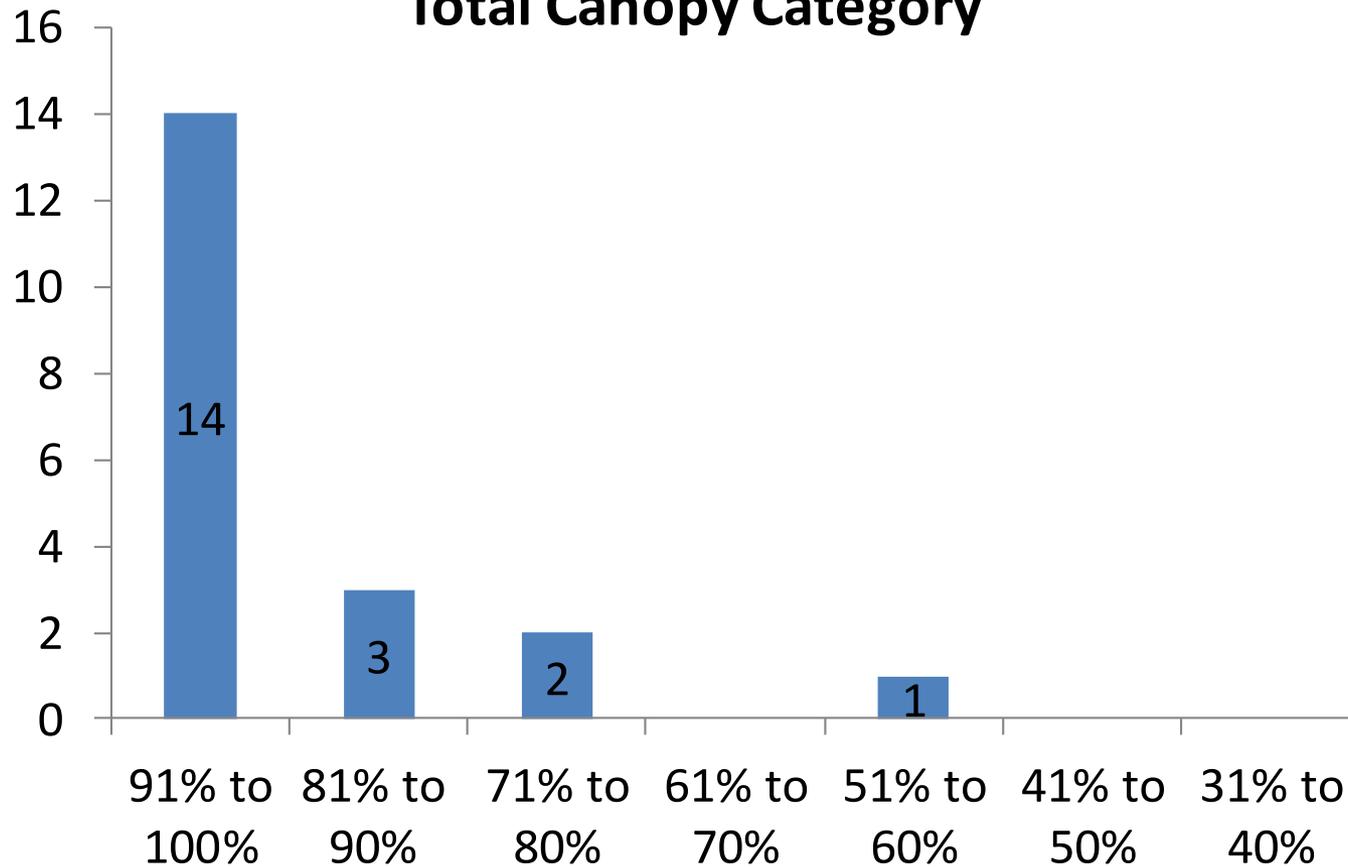
s.d. = 11.02

n = 20

**Median = 93%**

# NTMP/NTOs

**20 NTMP/NTOs - WLPZ Segments by Percent  
Total Canopy Category**



NTO/NTMP  
WLPZ Total  
Canopy  
ASP Rule  
Area

**91%**

s.d. = 11.02

n = 20

**Median = 93%**

THP  
WLPZ Total  
Canopy  
ASP Rule  
Area

**86%**

s.d. = 12.58

n = 70

**Median = 88%**

	<u>NTMP / NTO</u> WLPZ Total Canopy ASP Rule Area	<u>THP</u> WLPZ Total Canopy ASP Rule Area
<b>Class I</b>	<b>93%</b> n = 4 <b>Median = 95%</b>	<b>88%</b> n = 15 <b>Median = 90%</b>
<b>Class II</b>	<b>91%</b> n = 16 <b>Median = 92 %</b>	<b>86%</b> n = 55 <b>Median = 90%</b>
<b>No- Harvest</b>	<b>90%</b> n = 12 <b>Median = 93%</b>	<b>86%</b> n = 38 <b>Median = 90%</b>
<b>Harvest</b>	<b>94%</b> n = 8 <b>Median = 94%</b>	<b>87%</b> n = 32 <b>Median = 86%</b>

## WLPZ Erosion

- Out of the 103 THP WLPZ sample segments, 12 had some type(s) erosion, mostly not related to the current entry.
- Only 1% of the THP WLPZs had erosion (rilling) related to the current entry.
- None of the 20 NTMP/NTOs sample segments had erosion features recorded.

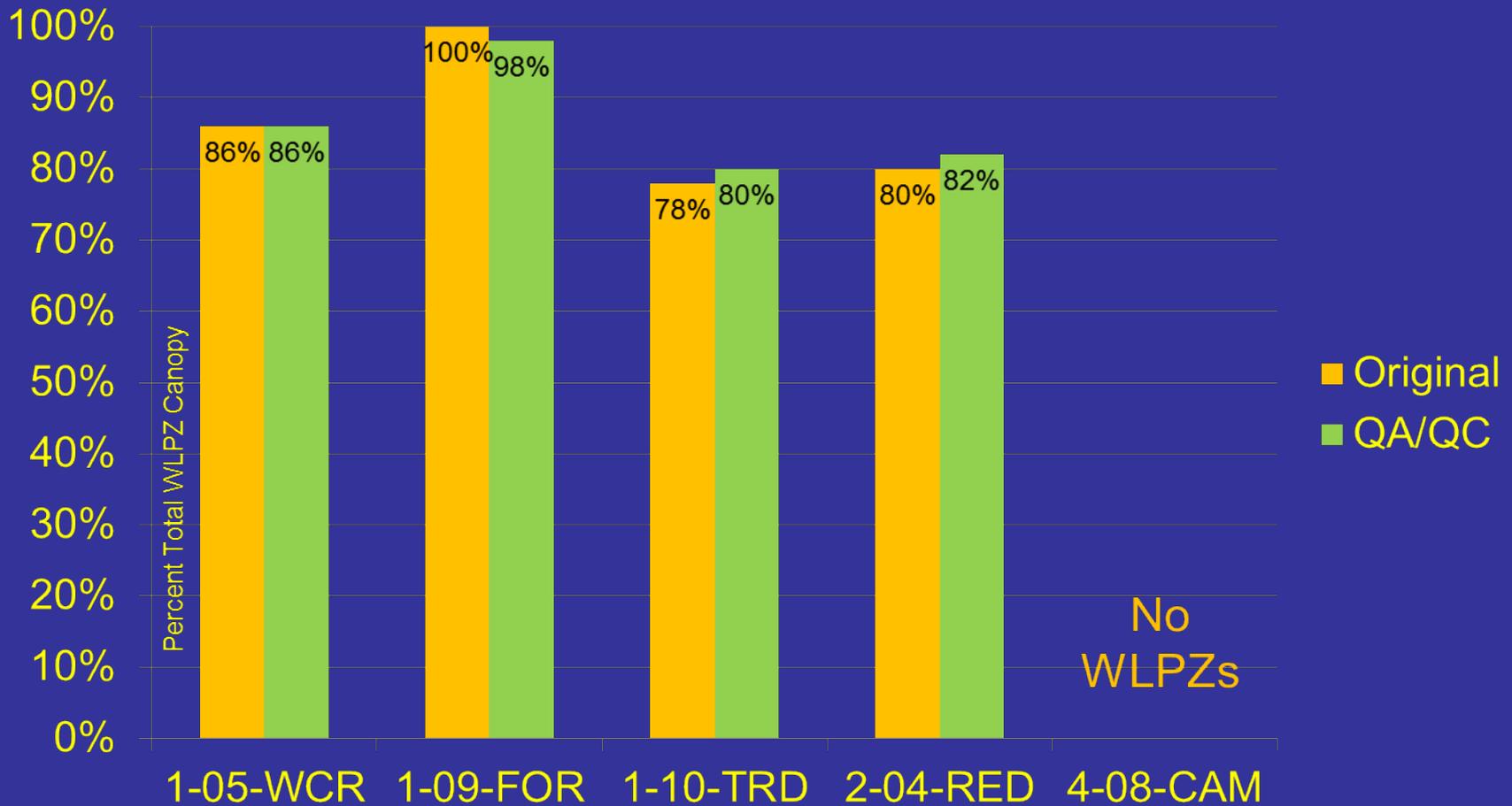


## QA/QC

Five FORPRIEM - THP reports were randomly selected last year and re-monitored. Four of the five had monitored WLPZ segments. Re-monitoring produced the same percent total canopy results, plus or minus 2%.

# QA/QC -- THP WLPZs

## Percent Total Canopy



# V. Roads

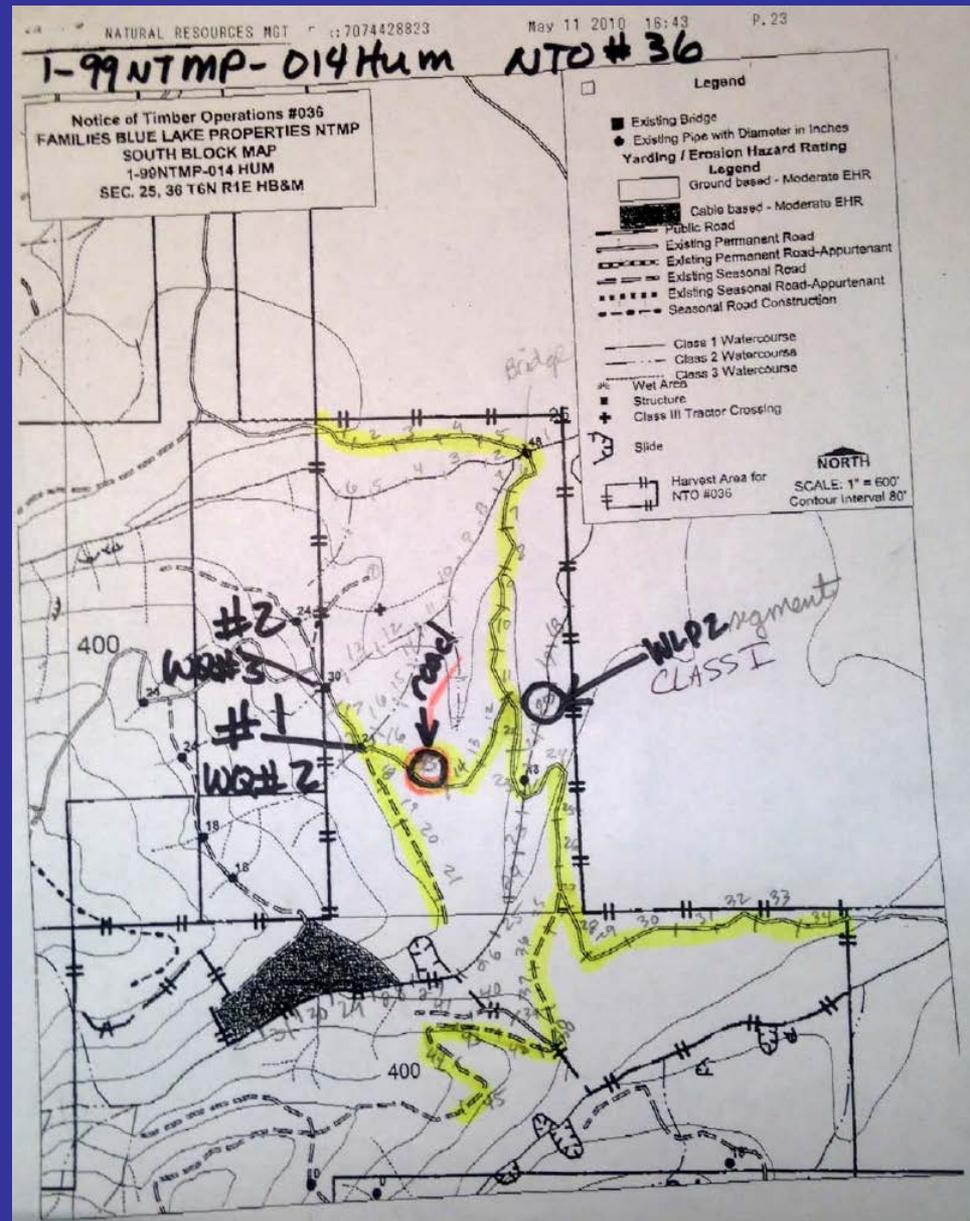


Clay Brandow recording road rule implementation and effectiveness data along a randomly located 660-foot road segment included in the FORPRIEM THP sample.

# FORPRIEM Road Segments

- 1) Using the Plan Map divide the roads into 660-foot (1/8-mile) segments.
- 2) Number the segments.
- 3) Randomly select one road segment per Plan for monitoring using a random number generator or random number table.
- 4) Monitor the road segment once for Implementation and once for Effectiveness.

Note: Implementation and Effectiveness Monitoring may be done on the same site visit, if the road segment has overwintered at least one-year.



# FORPRIEM Road Segments

- 125 THP Road Segments
  - 125 with Implementation Monitoring
  - 122 with Implementation & Effectiveness Monitoring
- 24 NTMP-NTO Road Segments
  - 24 with Implementation Monitoring
  - 23 with Implementation & Effectiveness Monitoring



## FORPRIEM Road Monitoring Tools

- Pocket Tape Measure (lengths, widths & depths)
- String Box (distances)
- Clinometer (gradients)

## Three (3) Key Terms

- Road Sample Segment  
(660 feet or 1/8 mile.)
- Waterbreak Interval  
(Distance between waterbreaks.)
- Road Sample Increment  
(10-feet or 66 per segment.)



Three (3) Key Road FPRs  
rated for Implementation:

- Waterbreak Construction.
- Discharge into Cover.
- Waterbreak Spacing.

**ROAD IMPLEMENTATION FORM**

THP No. 1 - 04 - XXX

Observer(s) C Brandow  
P. Cafferata  
J. Munn

Date 2-29-07 Page 2 of 6

Appendix A-3

Distance from the Starting Point in 10-Foot Increments

Revised 9/14/07

	000	010	020	030	040	050	060	070	080	090	100	110	120	130	140	150	160	170	180	190	200	210	220
	010	020	030	040	050	060	070	080	090	100	110	120	130	140	150	160	170	180	190	200	210	220	
Road Construction CF=Cut & Fill, TC=Thru-Cut TF=Thru-Fill FB= Full Bench Cut		TF					TF	CF															CF
Watercourse Xing B, C, P-A, OBA, F, A, O				C																			
Road Surface OS=Out-Sloped IS=In-Sloped FL= Flat CR=Crowned		FL					FL	OS															OS
Outside Berm																							
Inside Ditch & Ditch Relief Culvert, Dip or Other			C			D																	
Rate Maintenance of Inside Ditch & Ditch Relief: (Circle E, A, MA or D)		E A MA D																					
Waterbreaks WB, RD, NL					NL				RD														RD
Percent Road Gradient between Waterbreaks			-3%			+5%							+3%										
Percent Side Slope between Waterbreaks			6%			10%							25%										+4%
Rate Waterbreaks constructed with a depth ≥6" into firm roadbed: (circle E, A, MA or D)		E A MA D																					
Rate Waterbreaks discharge into cover and not onto erodible fills: (circle E, A, MA or D)		E A MA D																					
Other implementation problems explained in comments section.					X																		

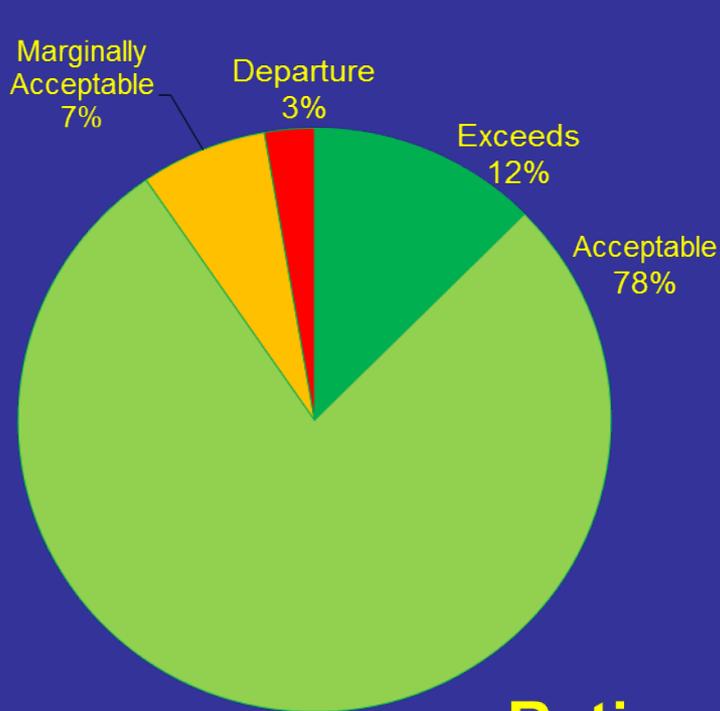
\* E (Exceeds Rule), A (Acceptable), MA (Marginally Acceptable), D (Departure)

**660' Road Segment**

# Waterbreak Construction

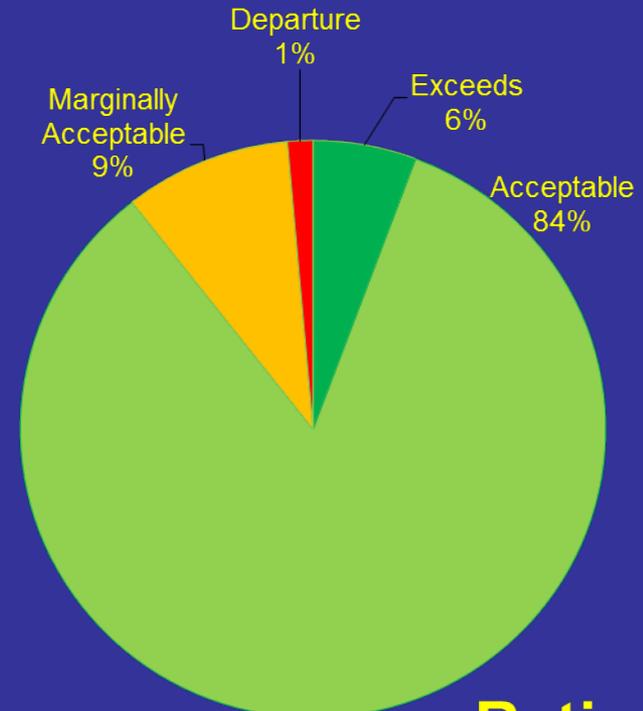
14 CCR section 914.6, 934.6, 954.6 (g)

## THPs



**Ratings**

## NTMP – NT0s

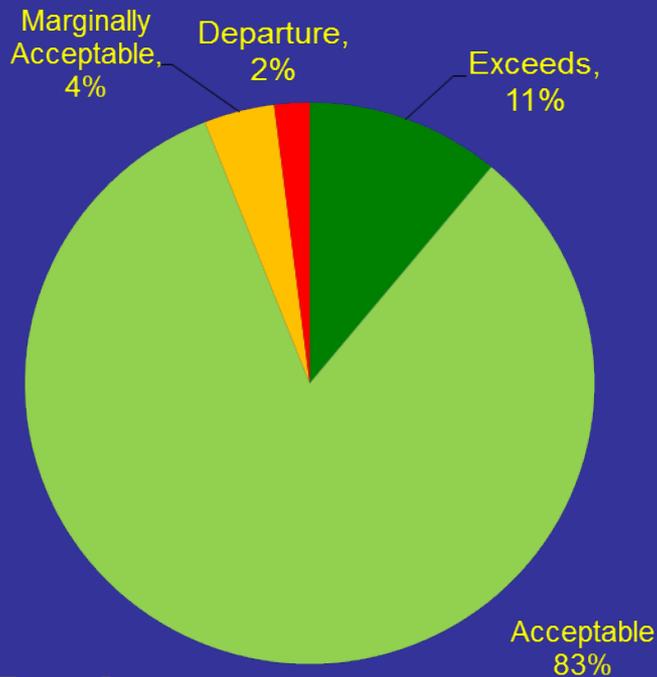


**Ratings**

# Waterbreak Discharge into Cover

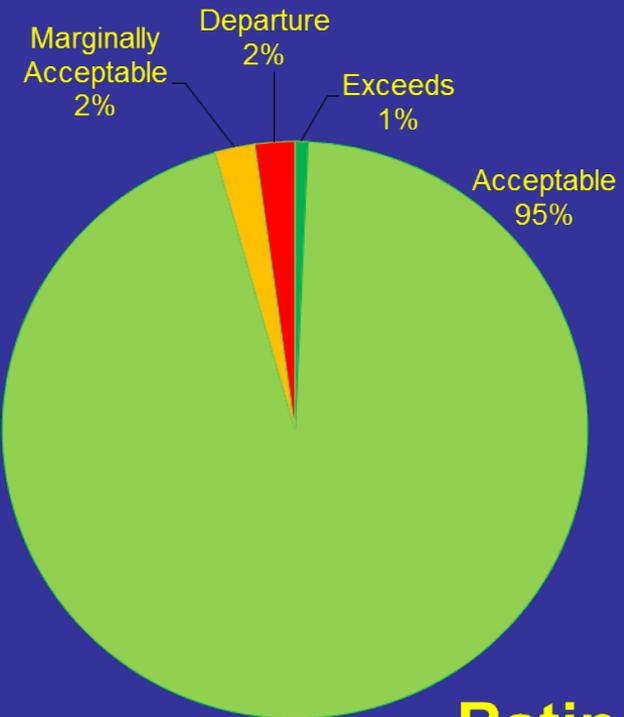
14CCR section 914.6, 934.6, 954.6 (f)

## THPs



**Ratings**

## NTMP – NT0s



**Ratings**

# Waterbreak Spacing

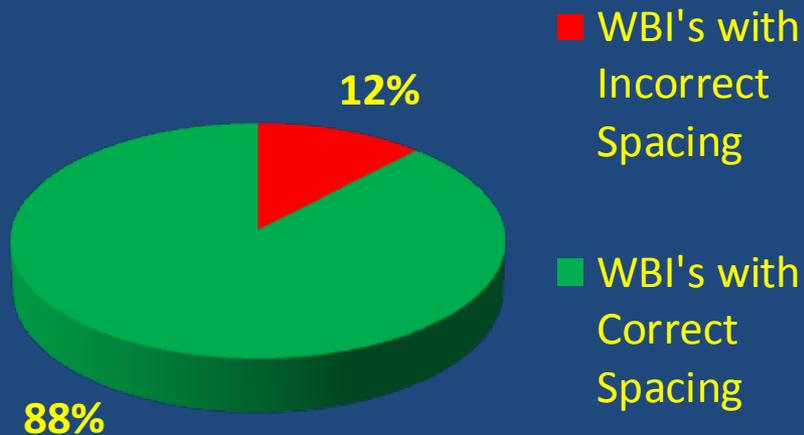
- Roads gradients in the sample were in the “10% or less” OR “11-25%”
- Estimated (Erosion) Hazard Ratings (EHRs) were mostly in the moderate category with a few highs and few lows and one extreme.

Estimated Hazard Rating	MAXIMUM DISTANCE BETWEEN			
	U.S. Equivalent Measure Road or Trail Gradient (in percent)			
	10 or less	11-25	26-50	>50
	Feet	Feet	Feet	Feet
Extreme	100	75	50	50
High	150	100	75	50
Moderate	200	150	100	75
Low	300	200	150	100

# Waterbreak Spacing

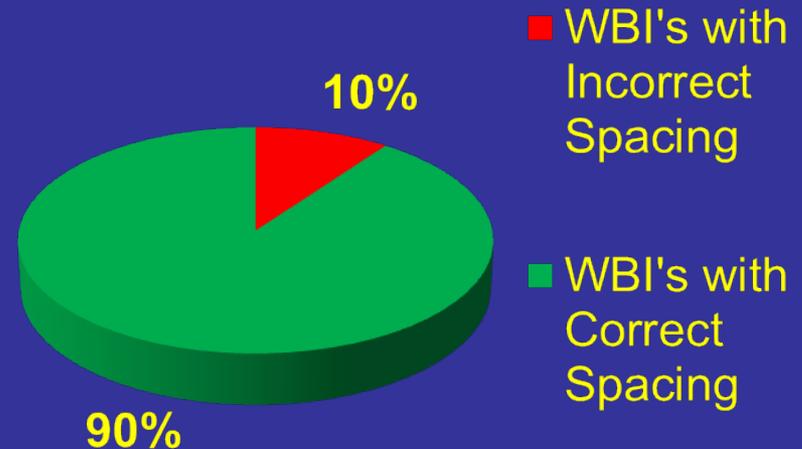
## THPs

Waterbreak Intervals (WBIs)



## NTMP - NTOs

Waterbreak Intervals (WBIs)



**Nine times out of ten,  
waterbreak spacing  
is correct.**

# Effectiveness Road Erosion & Sediment Transport

**Source**

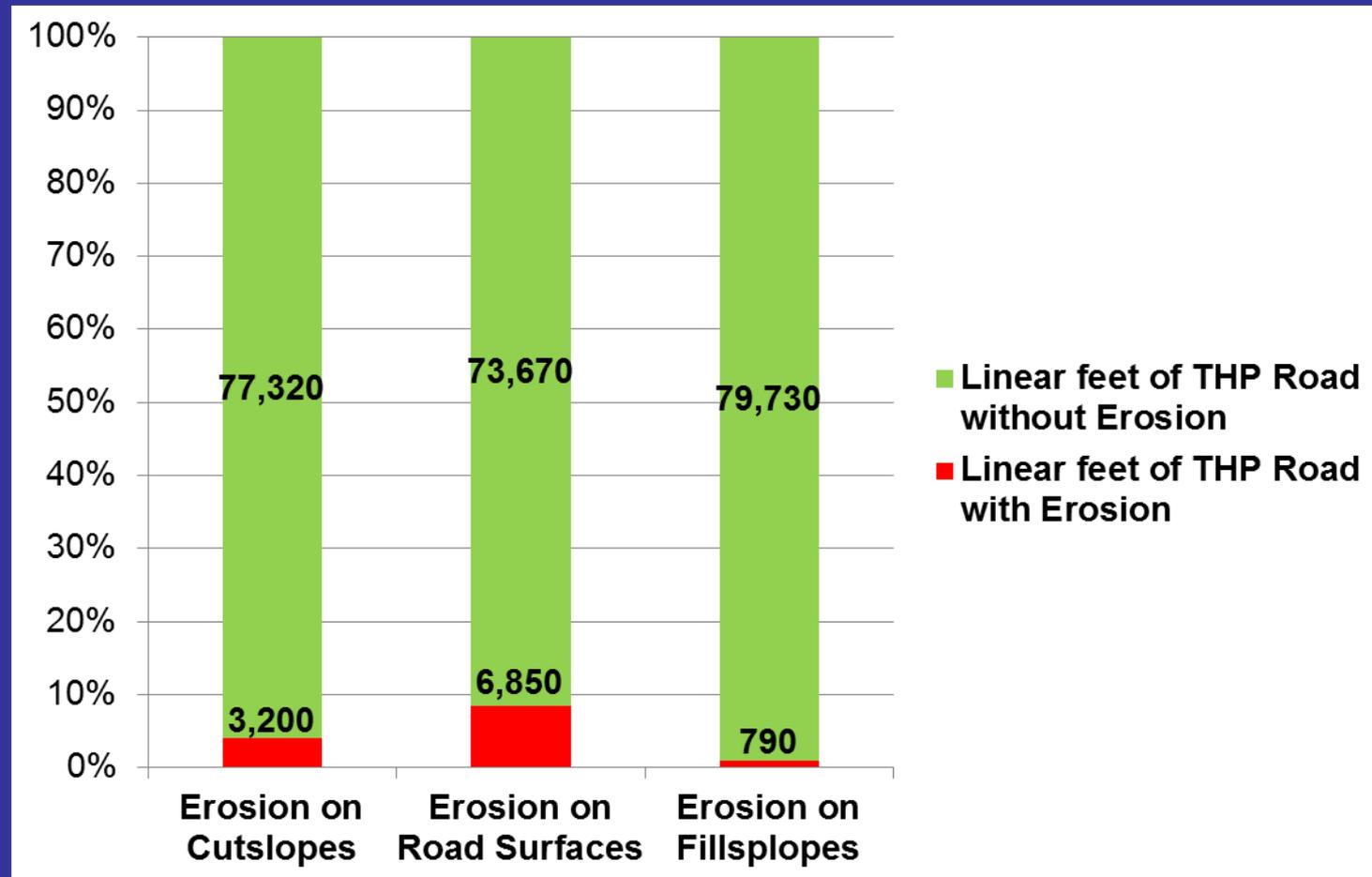


**Deposition**



THP 2-04-193 SHA on August 16, 2013

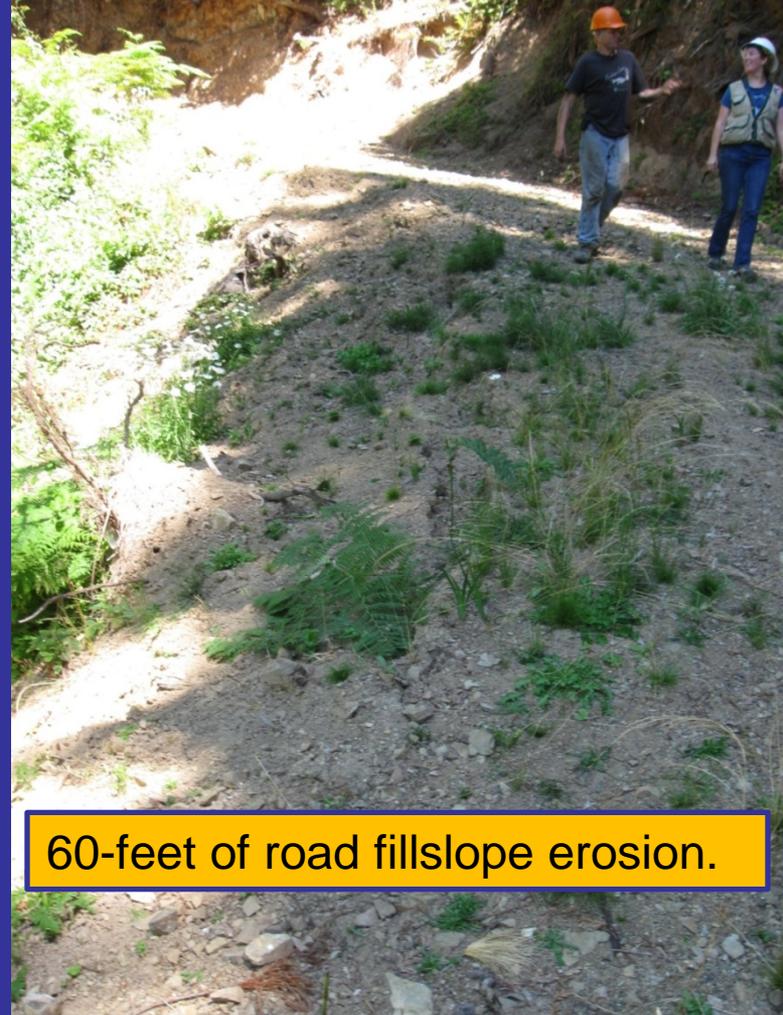
# FORPRIEM THP Road Effectiveness: Erosion Data



# FORPRIEM Monitoring Mill Creek NTMP-NTO (1-97NTMP-018 MEN) with North Coast Water Board Staff August 16, 2011.

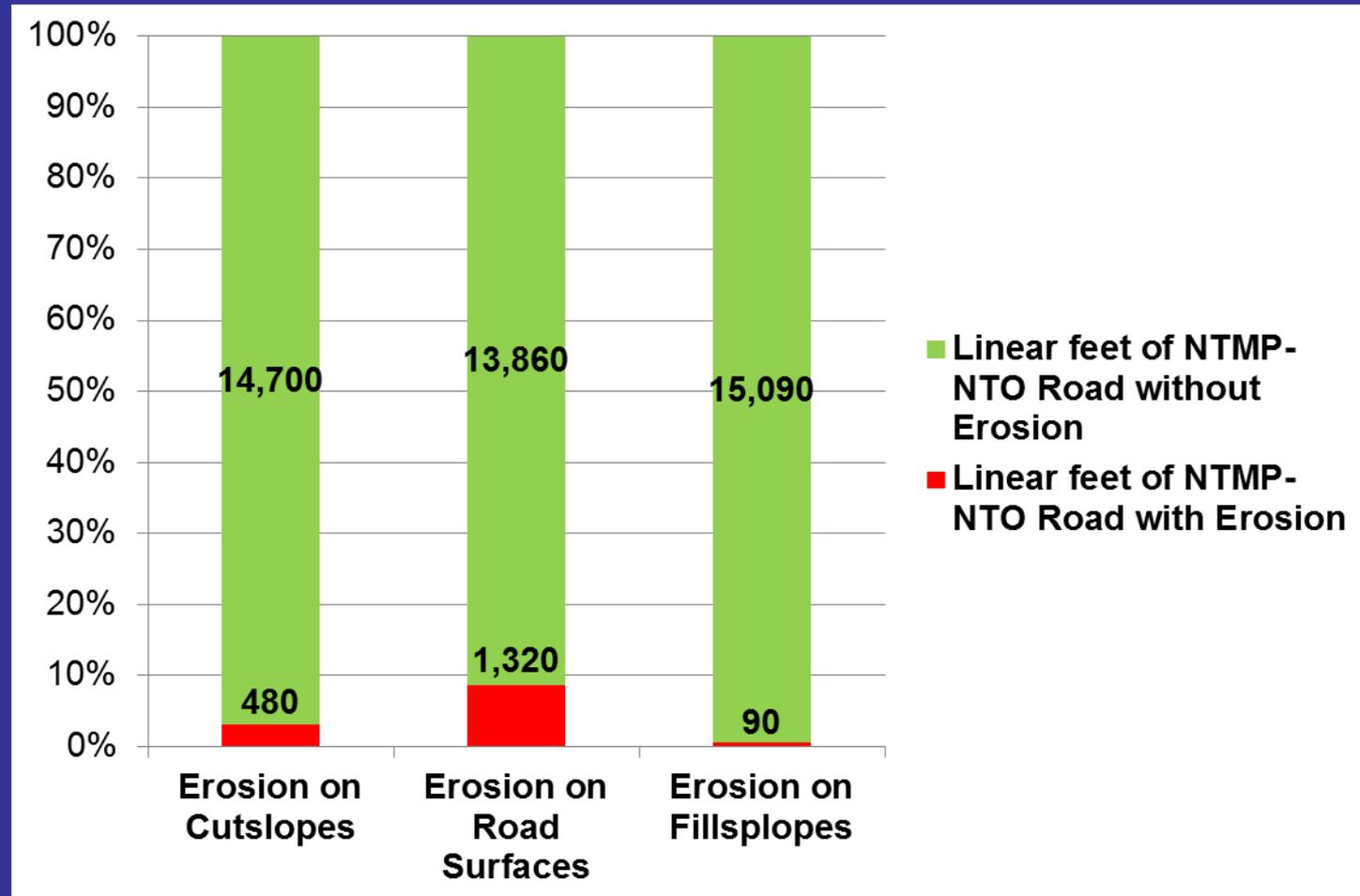


Tension Cracks on road fill surface.

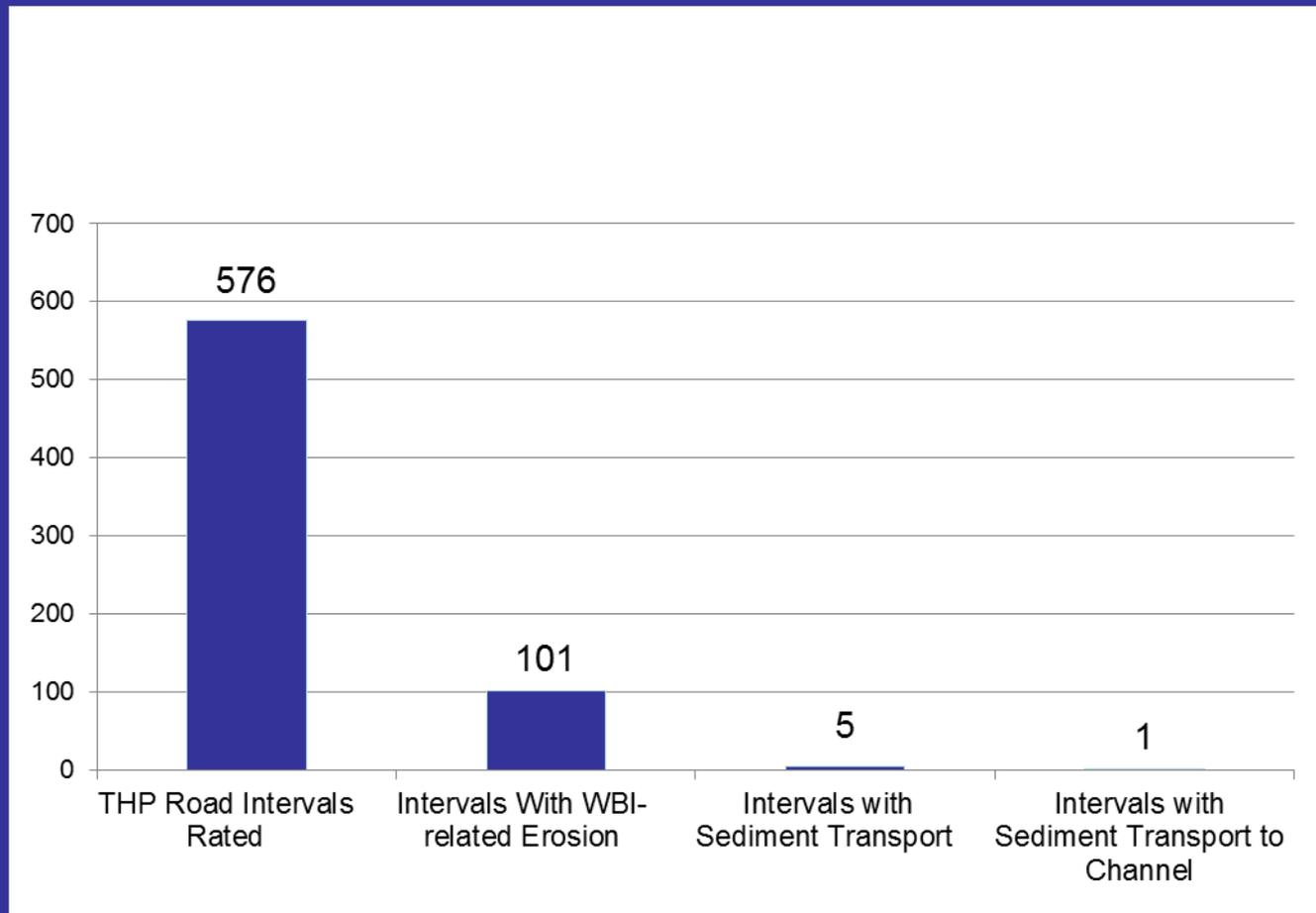


60-feet of road fillslope erosion.

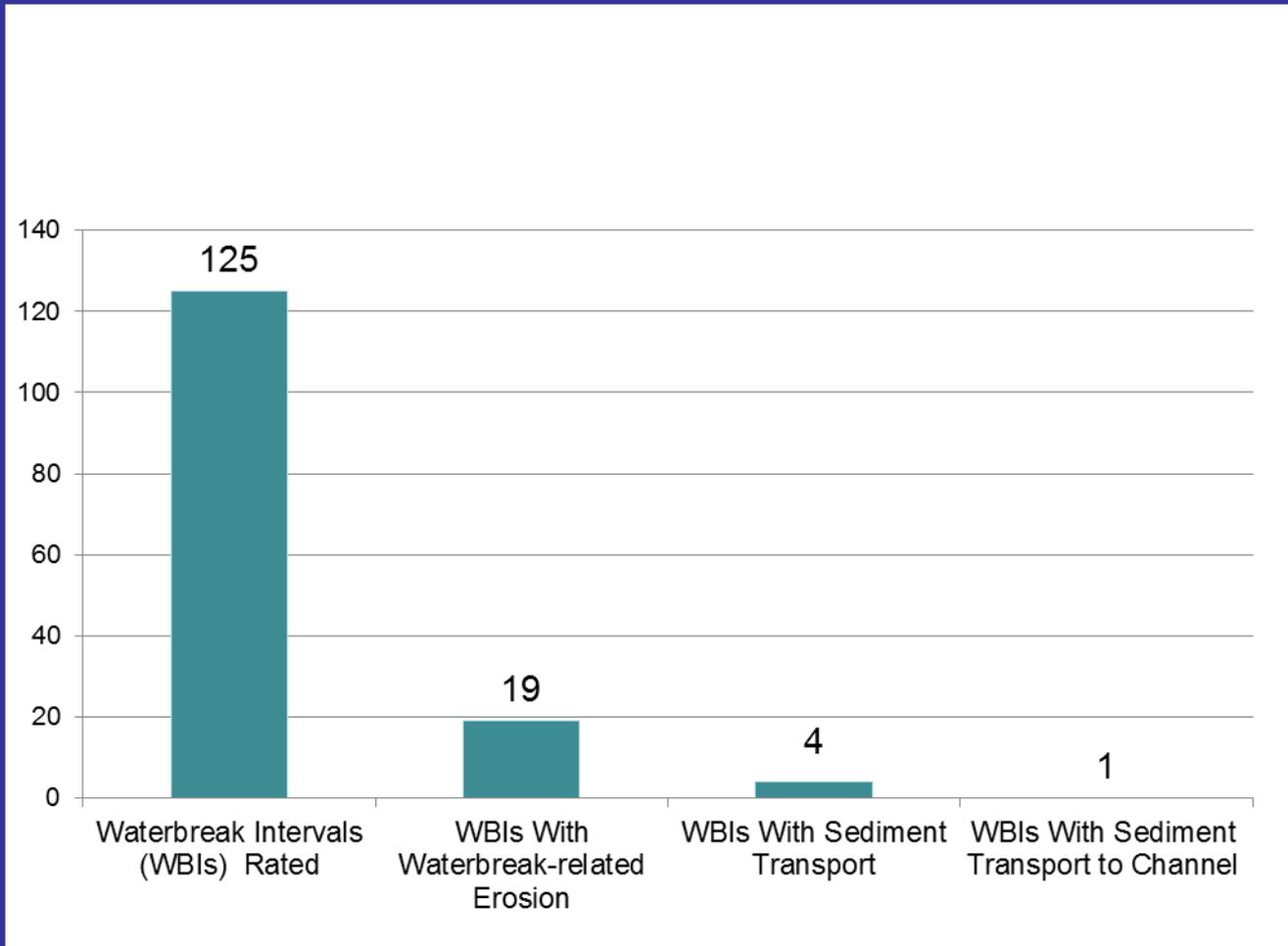
# FORPRIEM NTMP-NTO Road Effectiveness: Erosion Data



# THP Intervals Monitored for Effectiveness



# NTMP - NTO Intervals Monitored for Effectiveness

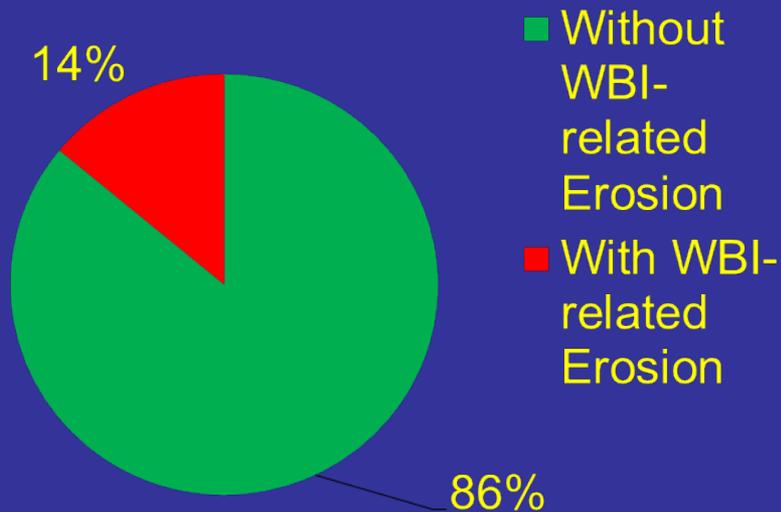


# THP Waterbreak Spacing

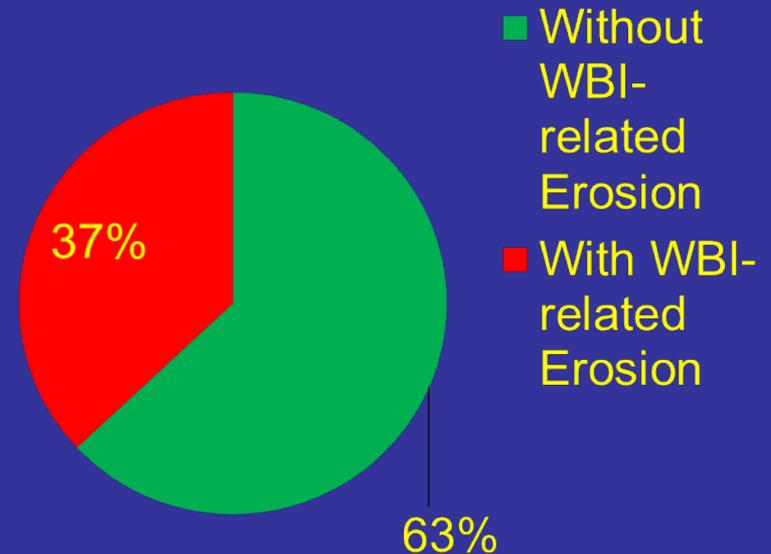
14CCR section 914.6, 934.6, 954.6 (c)

## & Erosion

### Waterbreak Intervals with Correct Spacing



### Waterbreak Intervals with Incorrect Spacing

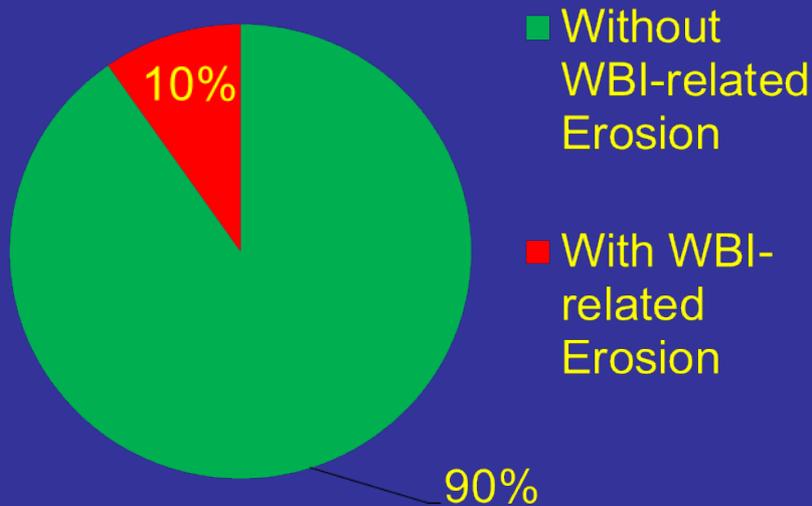


# NTMP -NTO Waterbreak Spacing

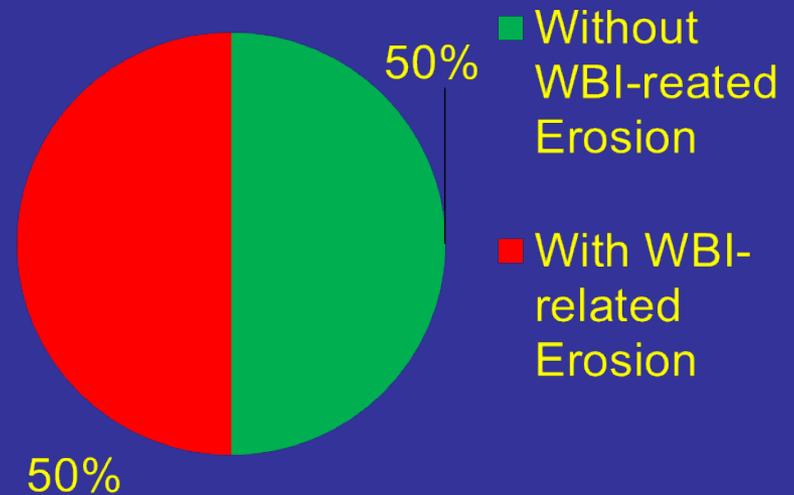
14CCR section 914.6, 934.6, 954.6 (c)

## & Erosion

**Waterbreak Intervals with  
Correct Spacing**



**Waterbreak Intervals with  
Incorrect Spacing**



# THP

## Road Sediment Transport

<b>THP</b>	<b>Waterbreak Spacing</b>	<b>Waterbreak Construction</b>	<b>Discharge into Cover</b>	<b>Evidence of Discharge to Channel</b>	<b>Notes</b>
<b>THP 1-02-236 HUM</b>	Major Departure	N/A	N/A	None Reported. Upper-slope road.	Mass wasting. Slide occurred just below the road: 300' long x 120' wide x 20' deep.
<b>THP 1-05-134 MEN</b>	Acceptable	Exceeds	Acceptable	No	Waterbreak outlet at natural grade but dozer carried soil beyond road surface.
<b>THP 1-07-131 HUM</b>	Acceptable	Acceptable	Acceptable	No	Rills on road. Sediment plume beyond end of WB. Does not reach watercourse.
<b>THP 1-08-014 HUM</b>	Acceptable	Marginally Acceptable	Marginally Acceptable	Yes	Ruts on road surface in thru-cut. Road surface sediment transported to Class II watercourse.
<b>THP 4-04-033 ELD</b>	Major Departure	Acceptable	Marginally Acceptable	No	Gully erosion on road surface.

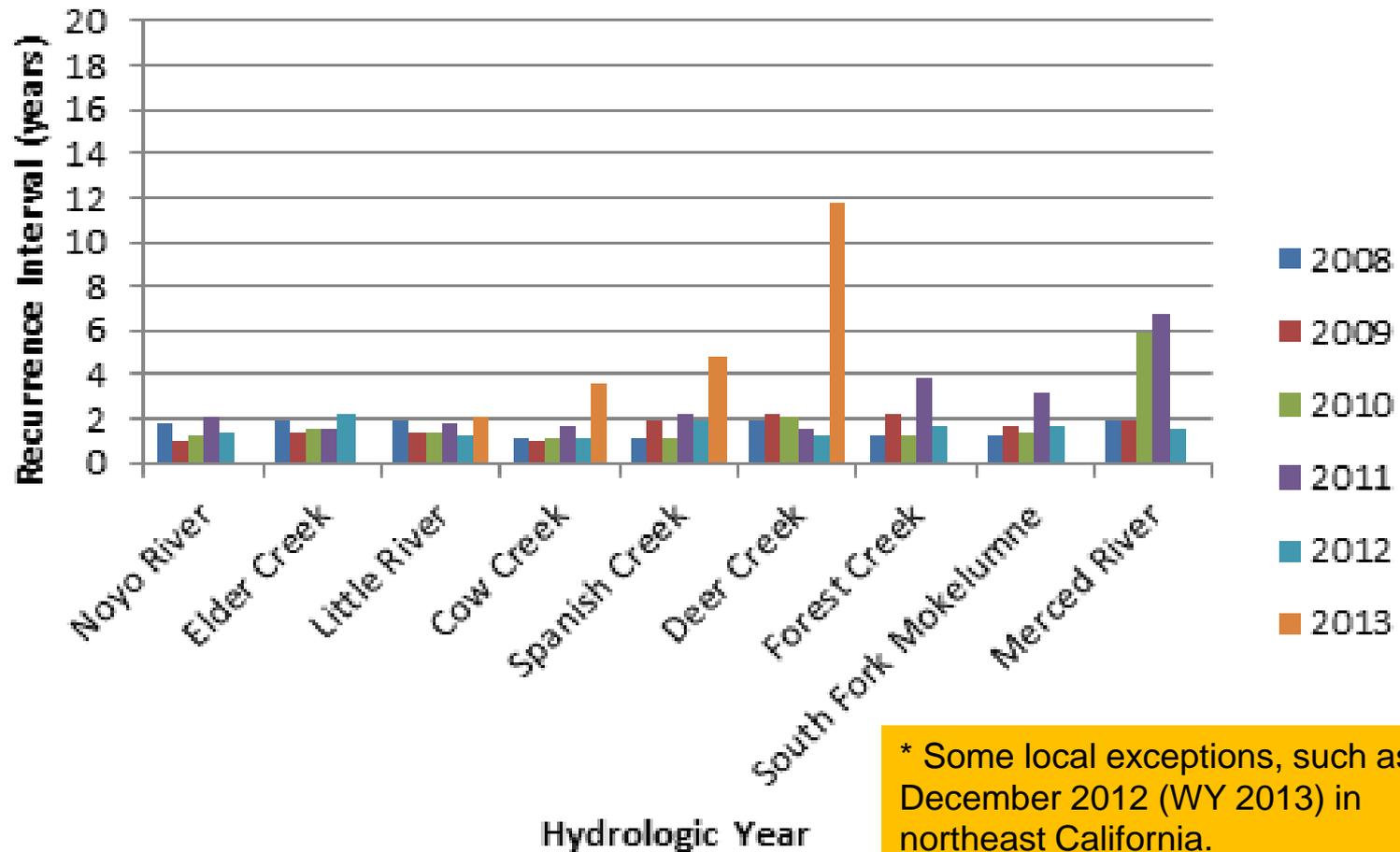
# NTMP - NTO

## Road Sediment Transport

<b>NTMP - NTOs</b>	<b>Waterbreak Spacing</b>	<b>Waterbreak Construction</b>	<b>Discharge into Cover</b>	<b>Evidence of Discharge to Channel</b>	<b>Notes</b>
2-00NTMP-007-5	Acceptable	Acceptable	Acceptable	No	Rilling on road surface.
1-07NTMP-015-1	Departure	Exceeds	Departure	No	Gully on fillslope.
1-06NTMP-026-3	Acceptable	Acceptable	Acceptable	No	Minor surface erosion into grass cover.
1-97NTMP-001-14	N/A	N/A	N/A	Yes	Sinkhole over failed culvert.

## Caveat:

The FORPRIEM monitoring period (2008-13) produced few intense storms with high flows\*.





## Slide on a Santa Cruz County Road.

**Note:** Public Roads were not in the sample population. All logging roads sampled were from Plans completed from 2008 thru 2013.

**FORPRIEM sample includes a wide variety of logging roads.**





## QA/QC

- Field training initial/continuing by Unit.
- Regular communication with Inspectors.



## QA/QC

Five THP – FORPRIEM Reports were randomly selected last year and re-monitored. All five had monitored Road segments. Re-monitoring produced consistent results. Some variation occurred where subjectivity was required.

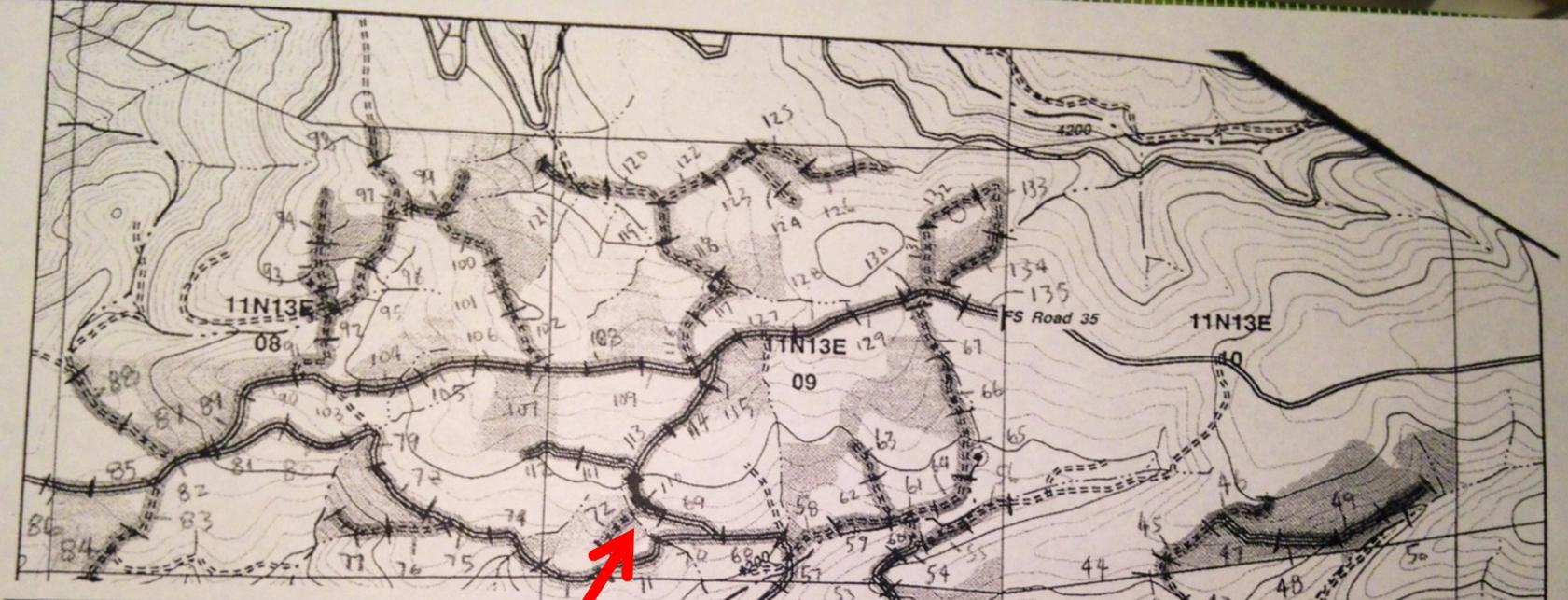
# IV. Water Course Crossings



Clay Brandow and Gabe Schultz of CAL FIRE completing a QA/QC evaluation on a large culvert in the upper Sacramento River canyon during August 2013.

# II. FORPRIEM Watercourse Crossings Methods

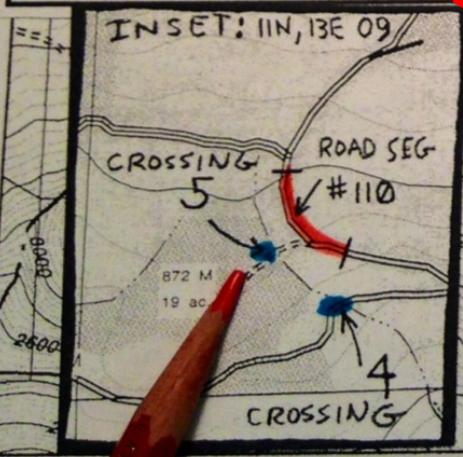
- 2 Watercourse Crossings selected per Plan (if available) by the CAL FIRE Forest Practice Inspector.
  - Randomly selected by either:
    - The 2 on the randomly selected road segment,
    - The 2 nearest the randomly selected road segment, or
    - Crossings on nearby tractor roads (if no other crossings are available).
  - Rated for Forest Practice Rule (FPR) Implementation.
  - Rated for FPR effectiveness after overwintering.
    - Effectiveness rating system has remained generally similar for HMP, MCR, and FORPRIEM.



FORPRIEM THP 4-03-077 ELD  
 ROAD SAMPLING MAP- Appurt roads  
 WATERCOURSE CROSSINGS

TOTAL RANDOM SEGMENTS	151
RANDOM NUMBER SELECTION	110

Road Segment Location 11N,13E,S9  
 Crossings nearest road segment are #4 and #5  
 Crossings: See Inset 11:2007 RGL

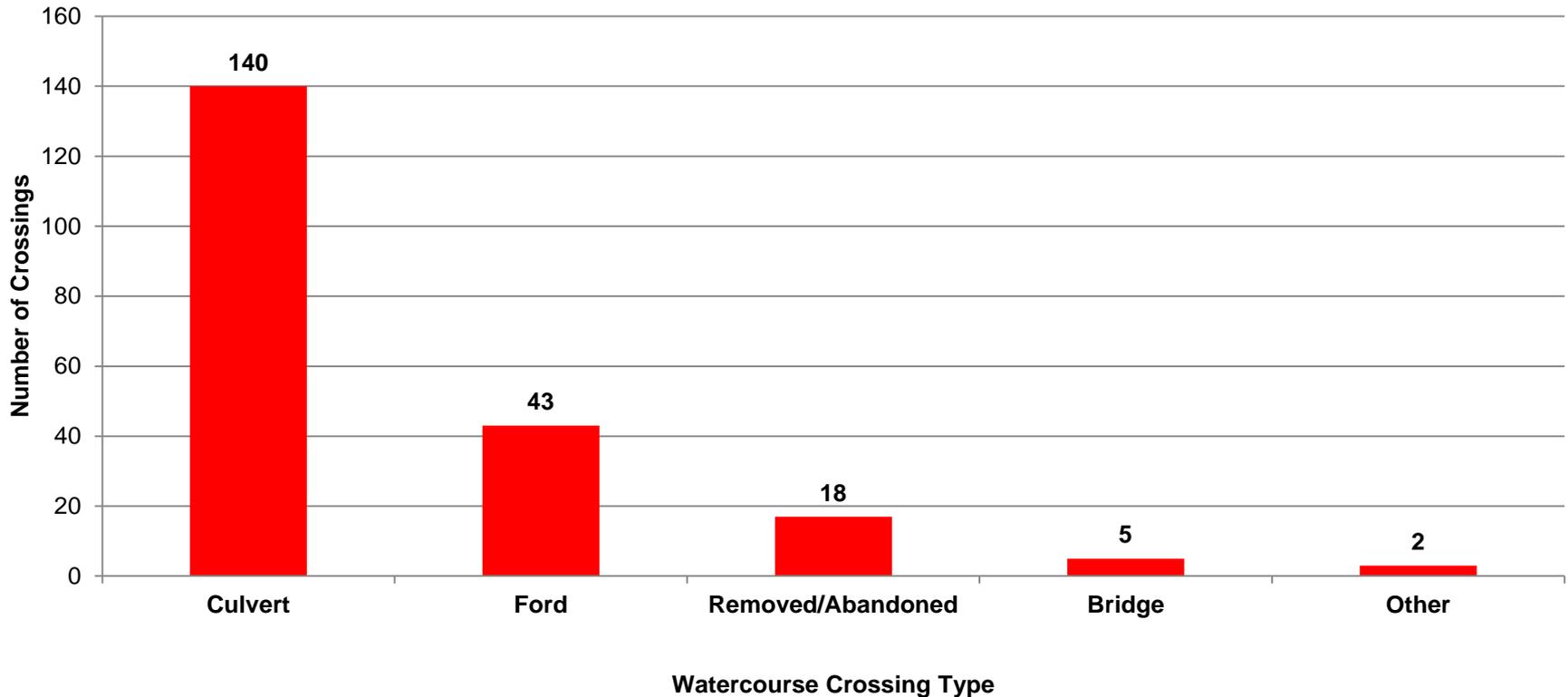


# **FORPRIEM Watercourse Crossing** **Sample Size (2008-2013)**

- **208 THP Watercourse Crossings**
  - 208 with Implementation Monitoring
  - 194 with Effectiveness Monitoring
  
- **39 NTMP-NTO Watercourse Crossings**
  - 37 with Implementation Monitoring
  - 39 with Effectiveness Monitoring

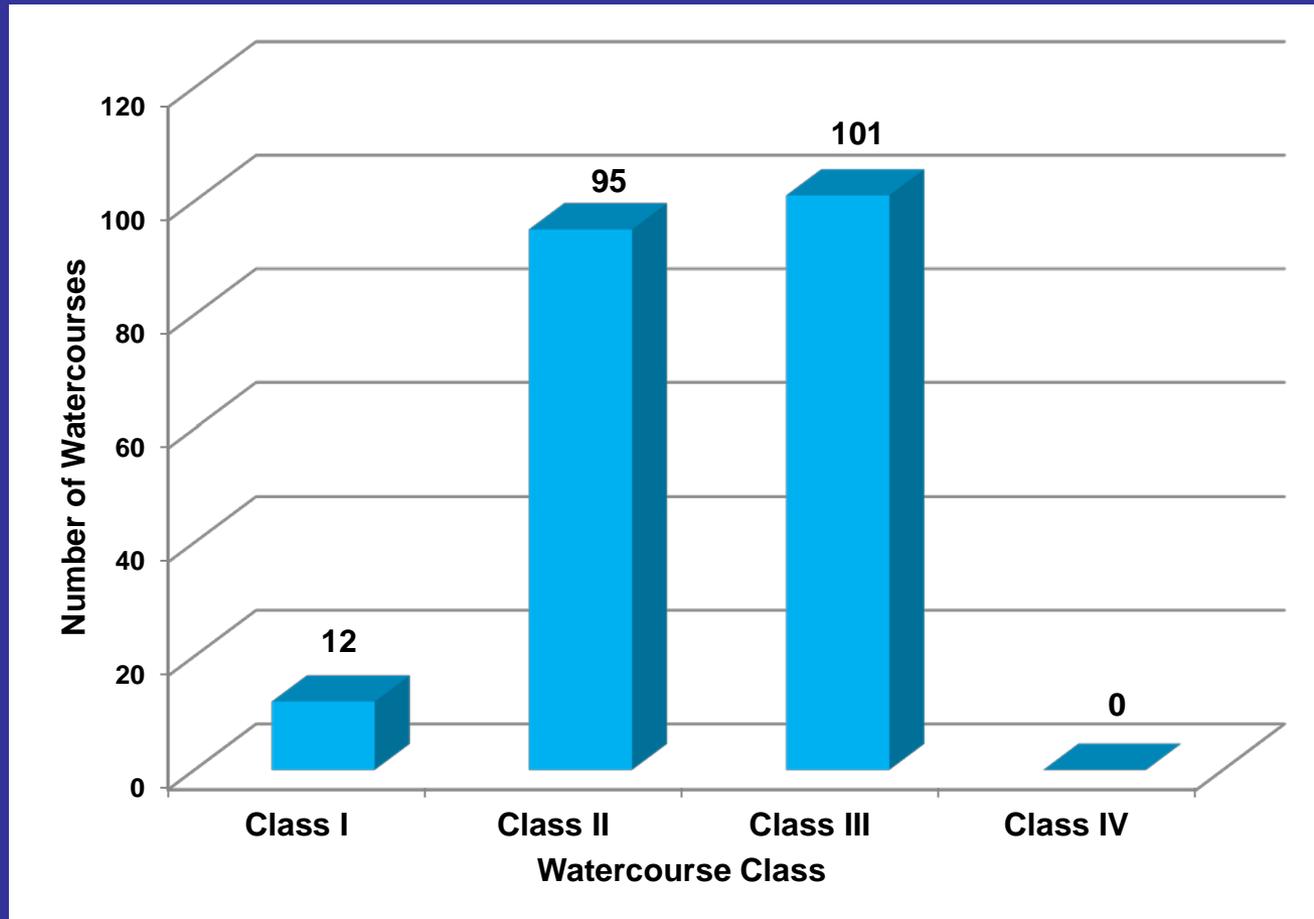
# FORPRIEM THP Results

## Watercourse Crossings: Crossing Types



208 Crossings Evaluated: 67% culverts; 21% fords, 2% bridges, 9% removed/abandoned, 1% other

# THP Watercourse Class Distribution

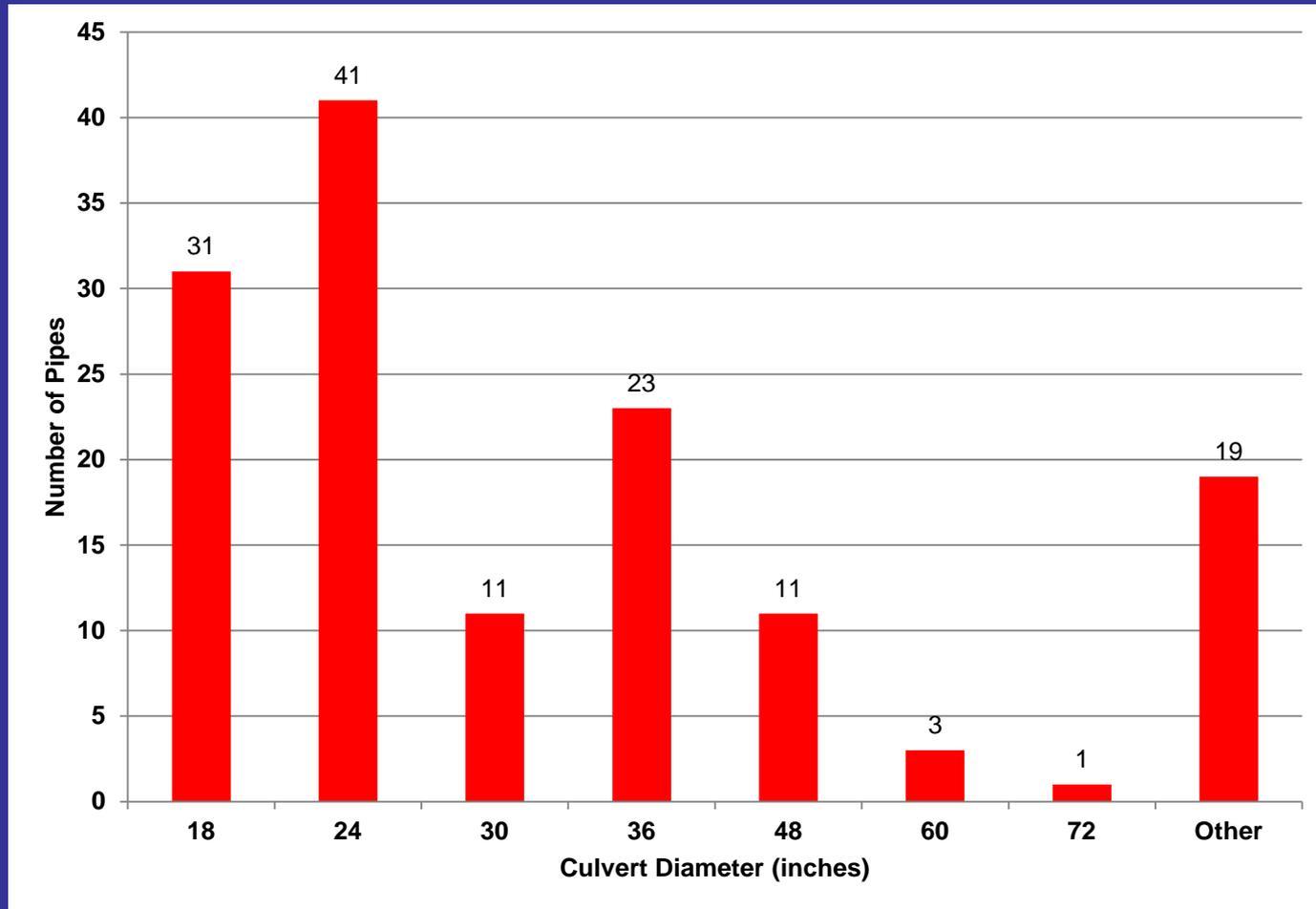


~5% Class I, 46% Class II, and 49% Class III

18 Inch Steel Culvert  
2-04-193 SHA

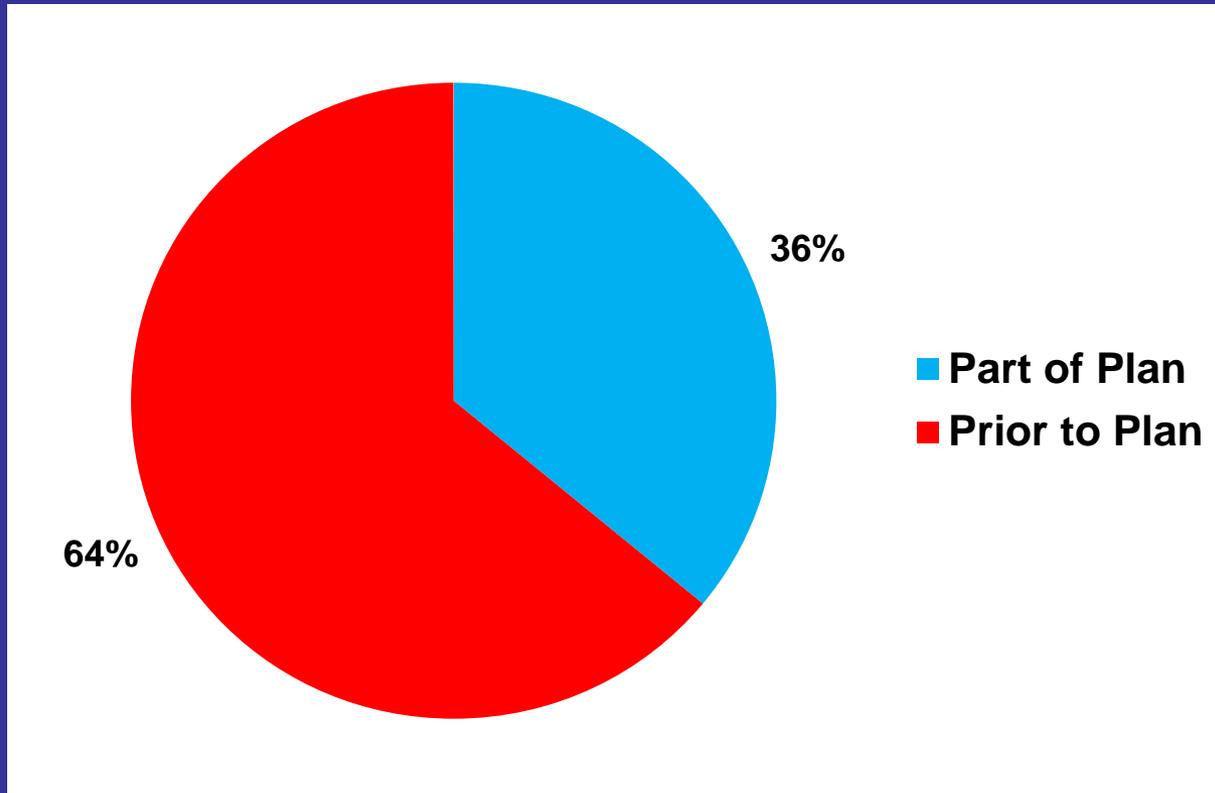


# THP Culvert Diameter Distribution



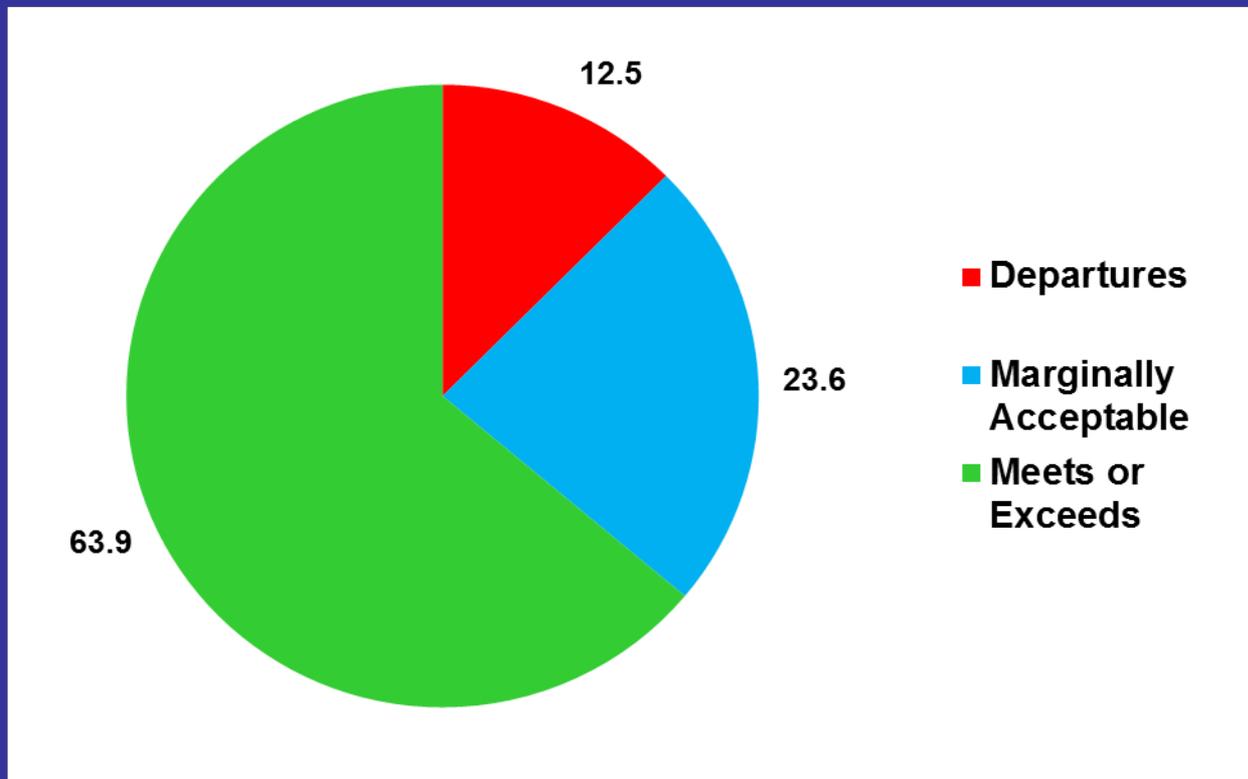
Approximately 50% of the culverts were 18 in or 24 in diameter pipes

# Date of Installation for THP Watercourse Crossings



# FORPRIEM THP Crossing FPR Implementation

64% of the Crossings had all the Crossing Rules rated as Meeting/Exceeding Rule Requirements; 12.5% had one or more Rule Departures



Compares to 17% Departures with MCR and 19.5% Major Departures for HMP.  
MCR: 64% all acceptable; 19% marginal only; 17% one or more Rule departures

# Examples of FORPRIEM THP Crossing FPR Implementation Ratings

Forest Practice Rule No.	Brief Description	Total Observations (w/out NA)	Departure (%)	Departure + Marginally Acceptable (%)
923.3(f)	Crossing/fills built or maintained to prevent <b>diversion</b>	196	5.1	12.8
923.4(d)	Crossing open to <b>unrestricted passage of water</b>	198	3.0	8.1
923.4(l)	Drainage structure & trash rack maintained/repared to prevent blockage	64	7.8	21.9
923.3(a)	Permanent crossings shown on THP map (+pipe diameter(s) if appropriate)	166	3.6	4.8

# FORPRIEM Watercourse Crossings

## THP Culvert Effectiveness Categories

Category	Appropriate/ None	Minor Problem	Major Problem	% with Major Problems
Alignment	125	5	2	1.5
Crushing	125	7	0	0
Corrosion	120	6	0	0
<b>Diversion Potential</b>	106	18	8	6.1
Gradient	128	3	1	0.8
Pipe Length	125	5	2	1.4
<b>Plugging</b>	120	8	4	3.0
Scour at Inlet	114	18	0	0
Scour at Outlet	107	22	3	2.3

132 culverts rated for effectiveness

Diversion Potential--HMP: 9.0%; MCR 10.6%  
 Plugging—HMP: 8.6%; MCR 5.5%

# Road Approaches to Watercourse Crossings – Cutoff Drainage Structure Function

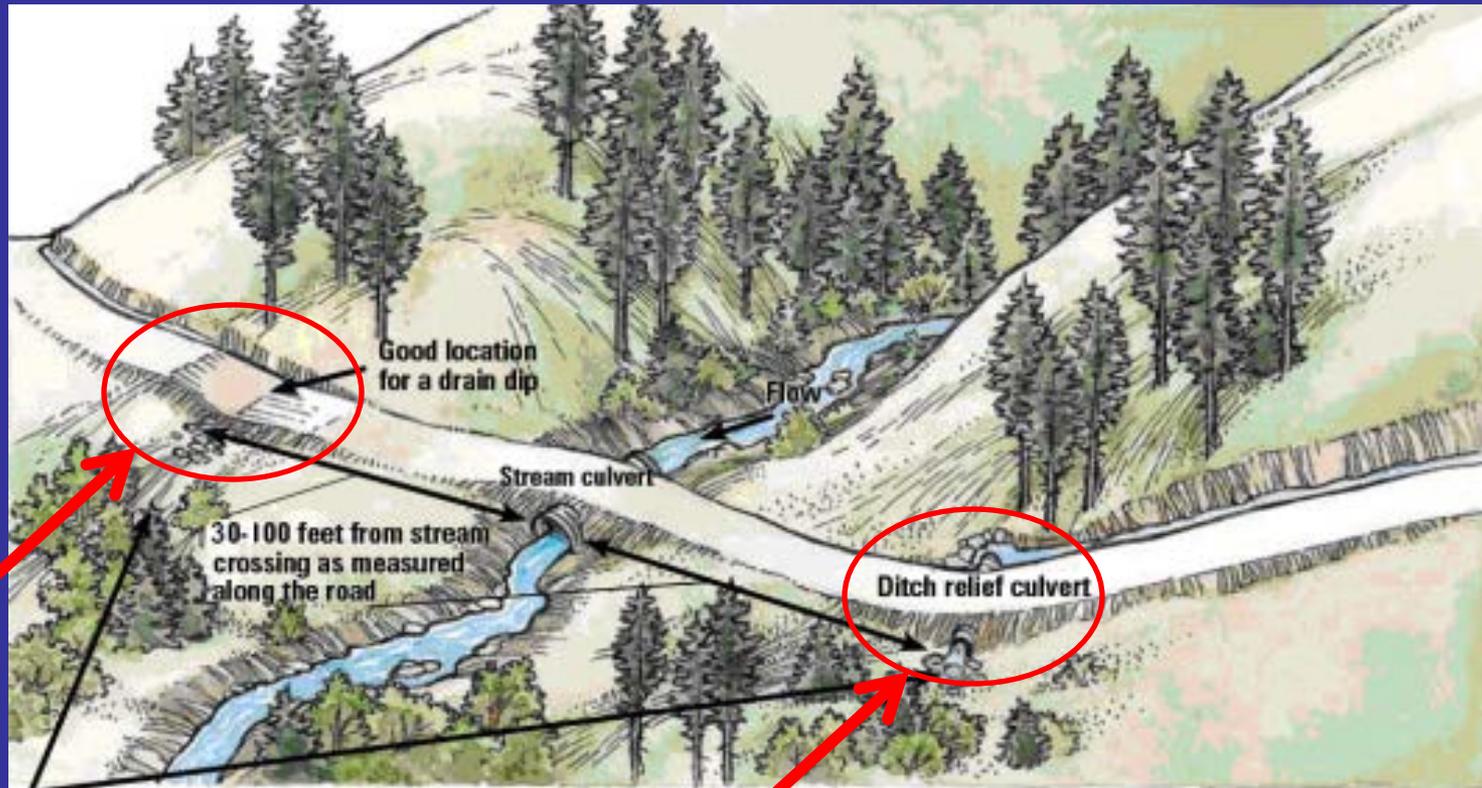


Figure 2, TRA #5

# FORPRIEM Watercourse Crossings

## THP Road Surface Approach/Fill Slope Effectiveness Categories

Category	Appropriate / None	Minor Problem	Major Problem	% with Major/Total Problems
<b>Cutoff Drainage Structure</b>	160	26	8	5% / 21%
Road Surface Gullies	190	9	0	0% / 5%
Inside Ditch	69	12	0	0% / 17%
Ponding	172	21	0	0% / 12%
Rutting	190	11	2	1% / 7%
Fill Slope Failure	178	5	2	1% / 4%
Fill Slope Gullies	179	9	0	0% / 5%
Fill Slope Cracks	179	3	2	1% / 3%

# FORPRIEM NTMP-NTO Preliminary Results

## Watercourse Crossings

- 39 randomly selected watercourse crossings in the monitoring sample.



No major effectiveness problems

1-97NTMP-018  
MEN; NTO #6

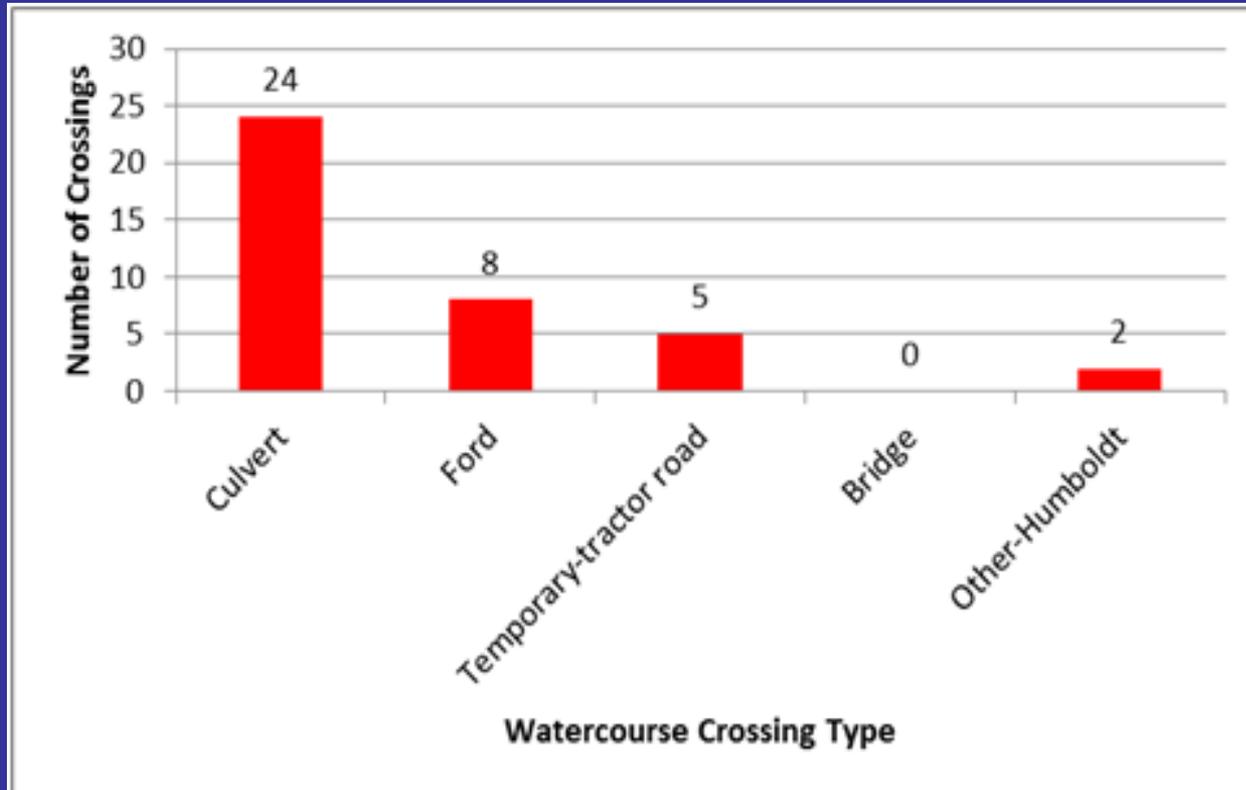
August 16,  
2011

Mill Creek  
NTMP

Crossing No. 1

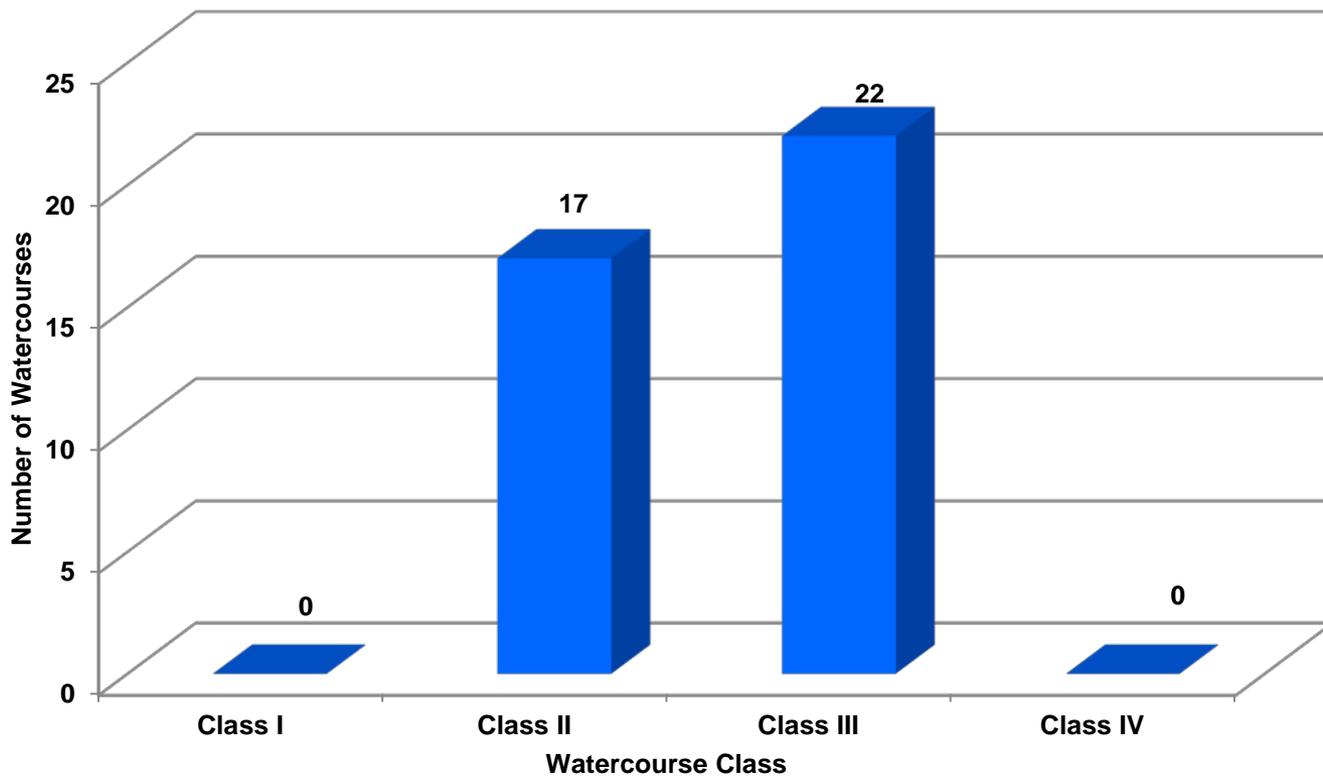
# FORPRIEM NTMP-NTO Preliminary Results

## Watercourse Crossings: Crossing Types



39 Crossings Evaluated: 62% culverts; 23% fords

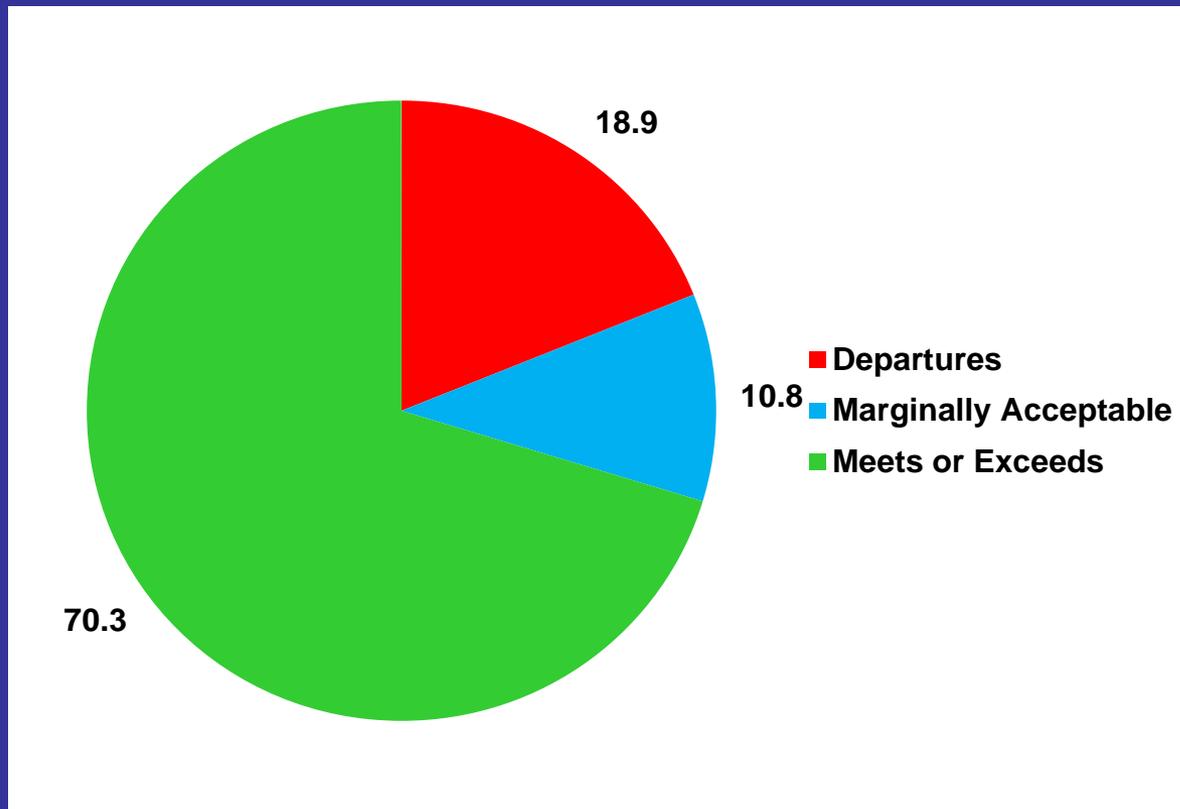
# NTMP-NTO Watercourse Class Distribution



# FORPRIEM Watercourse Crossings

## NTMP-NTO Forest Practice Rule Implementation Categories

70% of the Crossings had all the Crossing Rules rated as Meeting/Exceeding Rule Requirements; 18.9% had one or more Rule Departures



Compares to 17% Departures with MCR and 19.5% for HMP



**1-97NTMP-018 MEN;  
NTO #6**

**August 16, 2011  
Mill Creek NTMP**

**Crossing No. 2**

**Random  
crossing “D” –  
36 inch CMP**

**Major  
problems:**

**- Significant  
scour at the  
outlet**

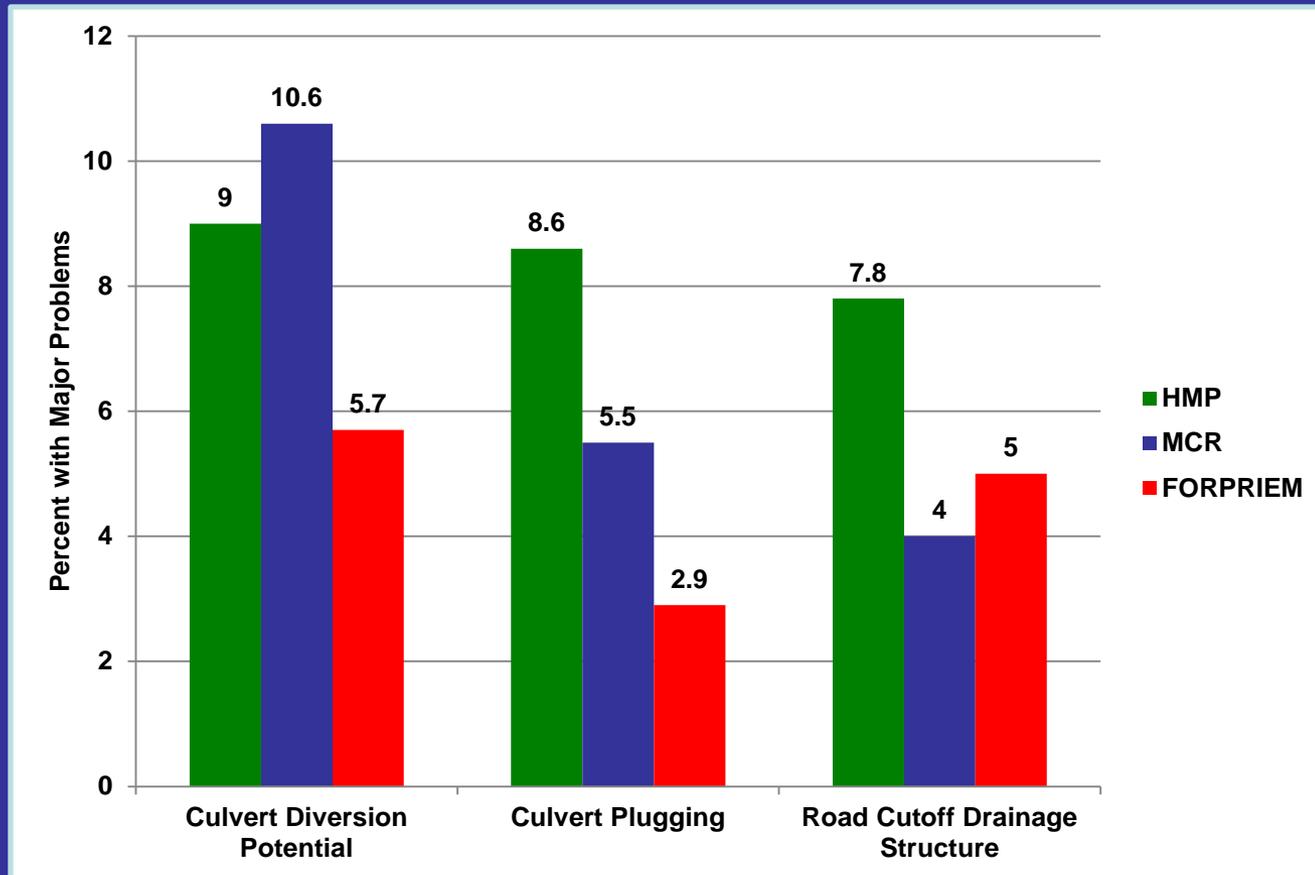
**- Diversion  
potential**

# Summary

- Frequent THP Effectiveness Problems (Major – 13%):
  - Diversion Potential - 6%
  - Plugging - 3%
  - Cut-off Drainage Structure - 5%
- Frequent NTMP-NTO Effectiveness Problems (Major – 10%):
  - Diversion Potential – 8%
  - Plugging – 4%
  - Scour at the Outlet – 4%
  - Scour at the Inlet – 4%
  - Cut-off Drainage Structure - 3%
  - Gullyng – 3%
  - Rutting – 3%

**NTMP-NTO crossings appear to have roughly the same rate of effectiveness problems as THPs (but small sample size).**

# Changes Over Time for Three Selected THP Major Effectiveness Categories



Diversion potential and culvert plugging appear to be improving over time for THPs.

# IV. Summary



Overall, the study found that the rate of compliance with FPRs designed to protect water quality and aquatic habitat is generally high, and that they are effective in preventing erosion, sedimentation, and sediment transport to channels when properly implemented.

## Summary (WLPZs)

- **Generally, the Forest Practice Rules (FPRs) appear to be working to retain high levels of post-harvest WLPZ canopy and prevent erosion in the WLPZ.**
- **THP – WLPZ percent total canopy for Class I watercourses appears to be improving over time based on comparing results from three studies conducted between 1999 and the present.**
- **WLPZ percent total canopy is higher on average inside the Anadromous Salmonid Protection Rule (ASP) areas than outside these areas.**

## Summary (Roads)

- **Generally, the Forest Practice Rules (FPRs), where properly implemented, appear to be working to limit Road-related erosion and prevent sediment transport.**
- **Compliance with the Waterbreak Construction Rule (914.6 (g)) is very good: THPs 97% and NTMP - NT0s 99%.**
- **Compliance with the Discharge into Cover Rule (914.6 (f)) is very good: THPs 98% and NTMP - NT0s 98%.**
- **Compliance with the Waterbreak Spacing Rule (914.6 (c)) is good: THPs 88% and NTMP - NT0s 90%.**

## Summary (Roads continued)

- **Waterbreak intervals with correct spacing (914.6(c)) have a much lower incidence of WBI-related erosion than waterbreak intervals with incorrect spacing.**
  - **For THPs: 14% vs. 37%**
  - **For NTMP – NTOs: 10% vs. 50%**
- **Incidences of forensically observed sediment transport were very low during this monitoring period (2008-2013).**

# Summary (Watercourse Crossings)

- THP watercourse crossing and road approach implementation and effectiveness appear to be improving over time.
- NTMP-NTO watercourse crossings are generally comparable to THPs from a water quality standpoint.
- Crossing diversion potential and cutoff drainage structure function on road approaches remain high priority items for training efforts.
- Further improvement is needed, and education and enforcement will continue to be emphasized with the implementation of the Road Rules, 2013 rule package.



## FOR FUTURE MONITORING:

Recommend posting short training videos on the web that Inspectors can review before right before doing the monitoring. These sort videos may also be of interest to sister agencies, industry and the public.