

# **Forest Practice Rules Implementation and Effectiveness Monitoring**

## **FORPRIEM**

# **Watercourse Crossing Monitoring Results**

**CAL FIRE FORPRIEM Monitoring Program  
Pete Cafferata and Clay Brandow  
BOF Meeting — Sacramento, CA  
June 18, 2014**



# Outline

- I. Background Information
- II. Methods
- III. Watercourse Crossing Monitoring Results
  - a) THPs
  - b) NTMP-NTOs
- IV. QA/QC
- V. Changes Over Time
- VI. Summary

# I. Representative Sample

- THPs

- Randomly Selected

- Statewide

- Hillslope Monitoring Program (HMP) (1996 -- 2002)
      - Modified Completion Report (MCR) (2001-- 2004)
      - FORPRIEM (2008 -- present )

- NTMP – NTOs

- Randomly Selected

- FORPRIEM (2011 -- present)

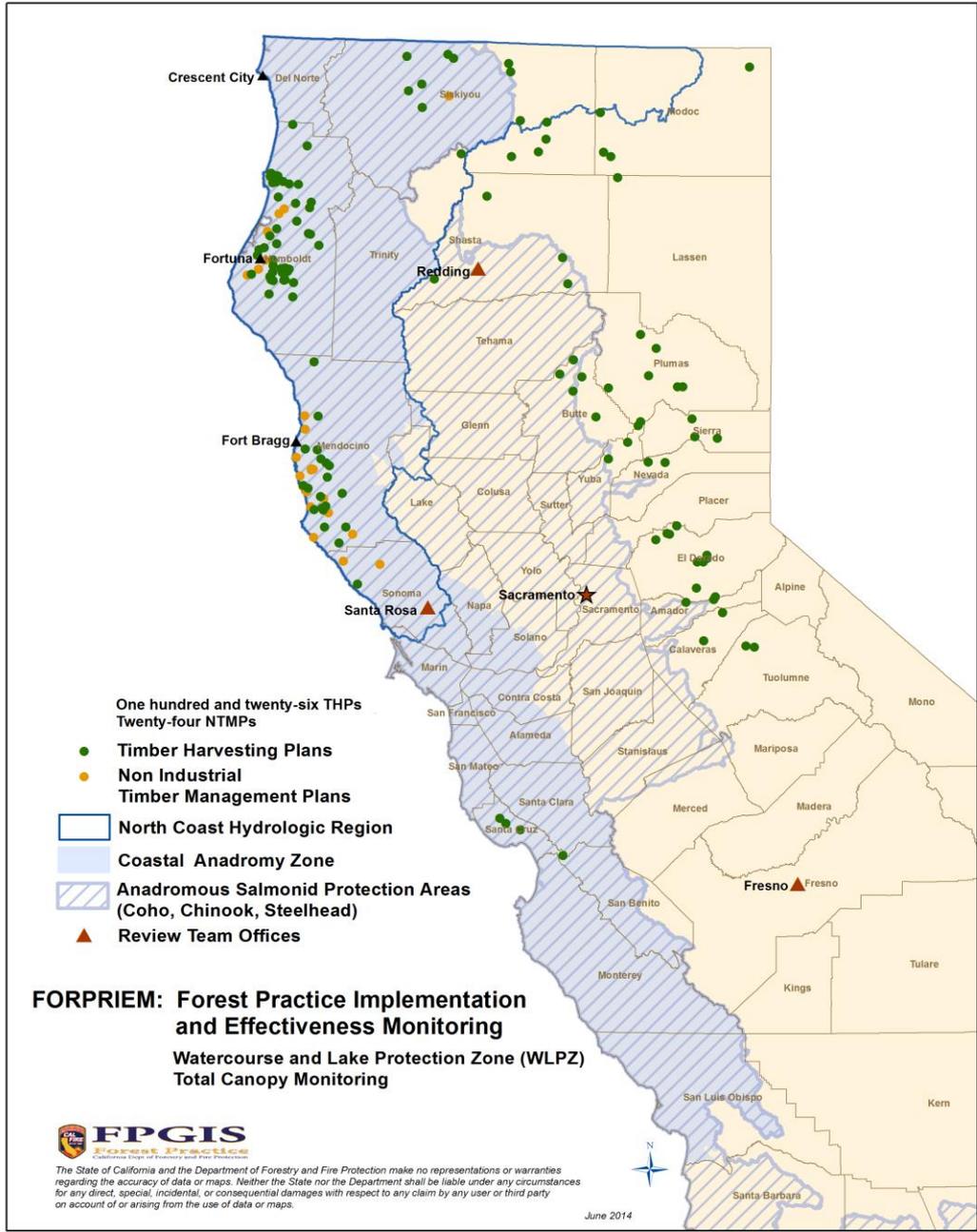
- North Coast Hydrologic Basin only (2011-12)
      - Statewide – 2013 to present

# 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

111 of 126 (88%) of the THPs had one or two crossings

21 of 24 (88%) of the NTMP-NTOs had one or two crossings



One hundred and twenty-six THPs  
Twenty-four NTMPs

- Timber Harvesting Plans
- Non Industrial Timber Management Plans
- North Coast Hydrologic Region
- Coastal Anadromy Zone
- Anadromous Salmonid Protection Areas (Coho, Chinook, Steelhead)
- ▲ Review Team Offices

**FORPRIEM: Forest Practice Implementation and Effectiveness Monitoring**  
Watercourse and Lake Protection Zone (WLPZ)  
Total Canopy Monitoring

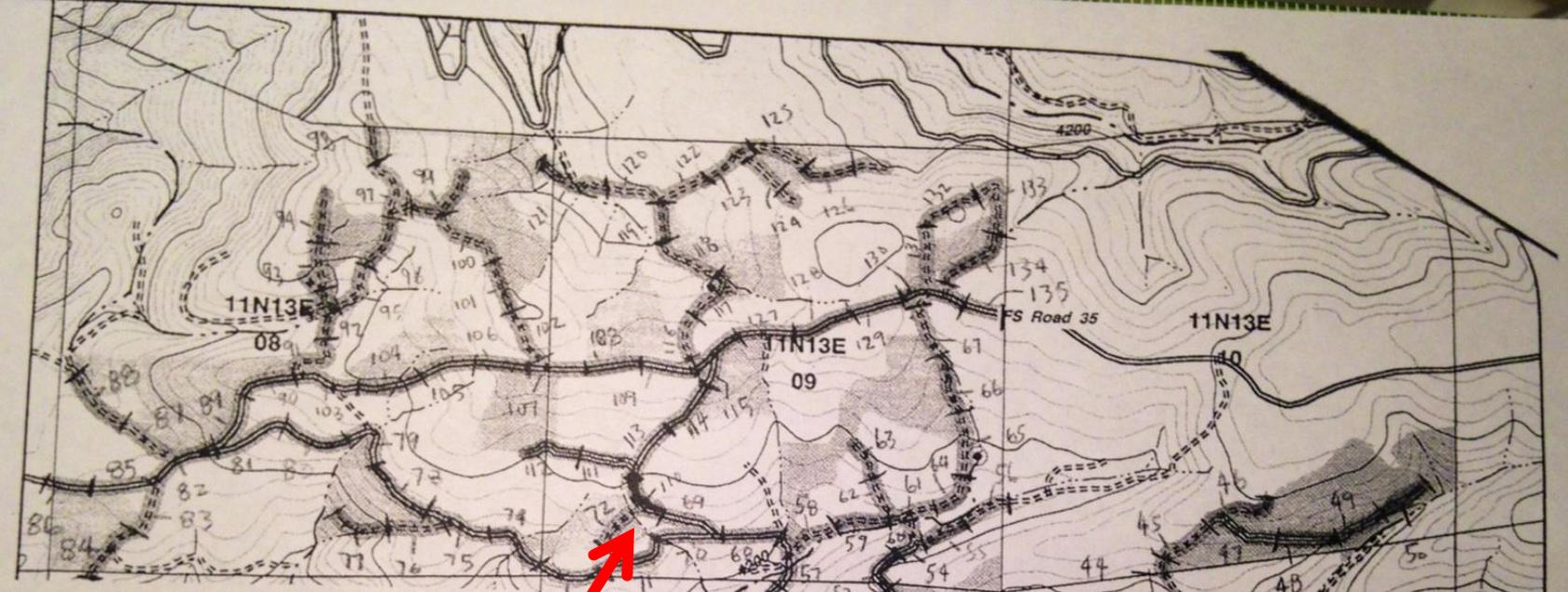


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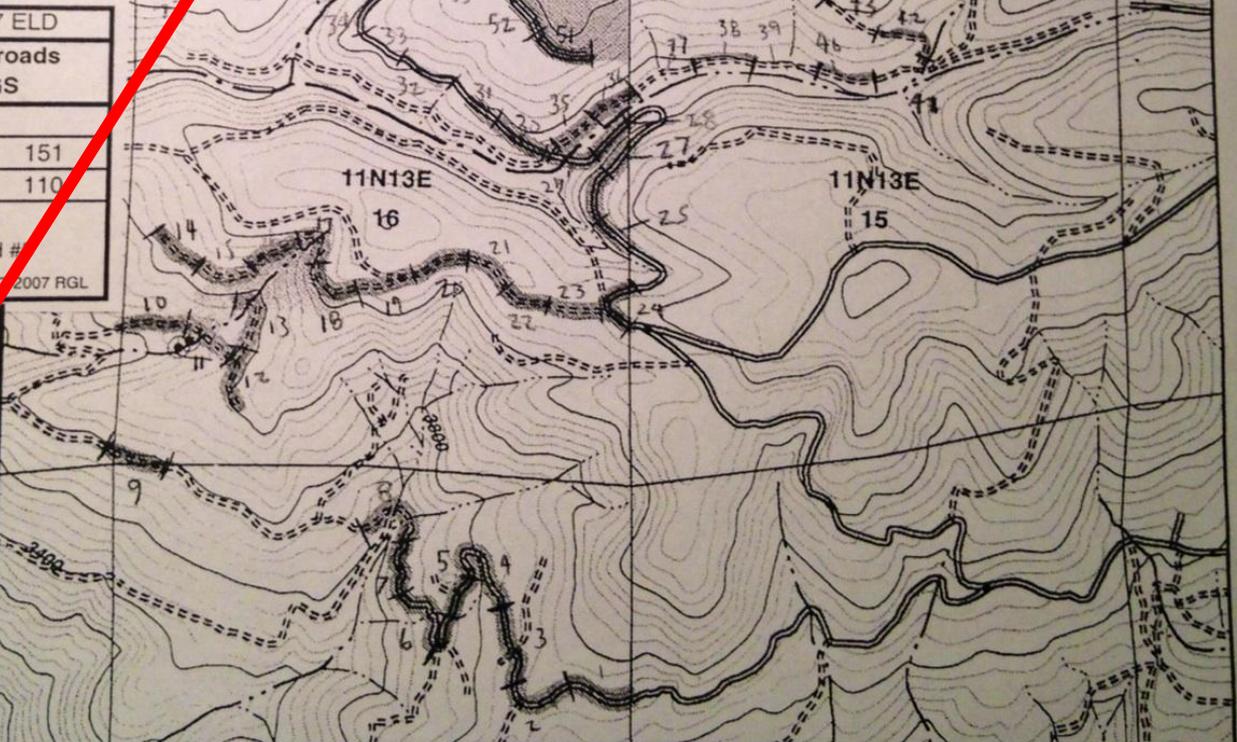
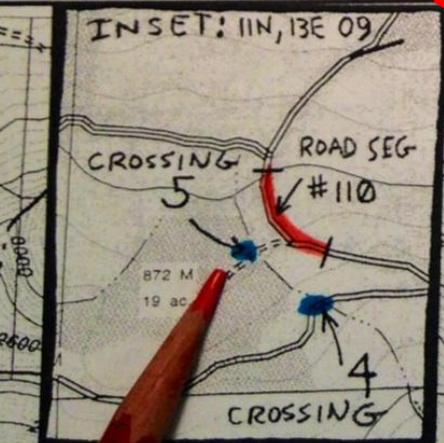
June 2014

## 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 nearest the randomly selected road segment,
    - Or alternatively picked at random independent of the random road segment selection.
  - 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 Crossings

## Methods

- Implementation of Forest Practice Rules (30 rule requirements related to crossings rated)
  - Departure from rule requirements (non-compliance)—D
  - Marginally Acceptable—MA
  - Acceptable—A
  - Exceeds Rule requirement—ER
  - Not Applicable—N/A
- Effectiveness Ratings (27 categories rated after at least one over-wintering period)
  - Not applicable—N/A
  - None/appropriate
  - Minor/moderate Problem Category
  - Major Problem Category (e.g., major scour at the outlet of a culvert)

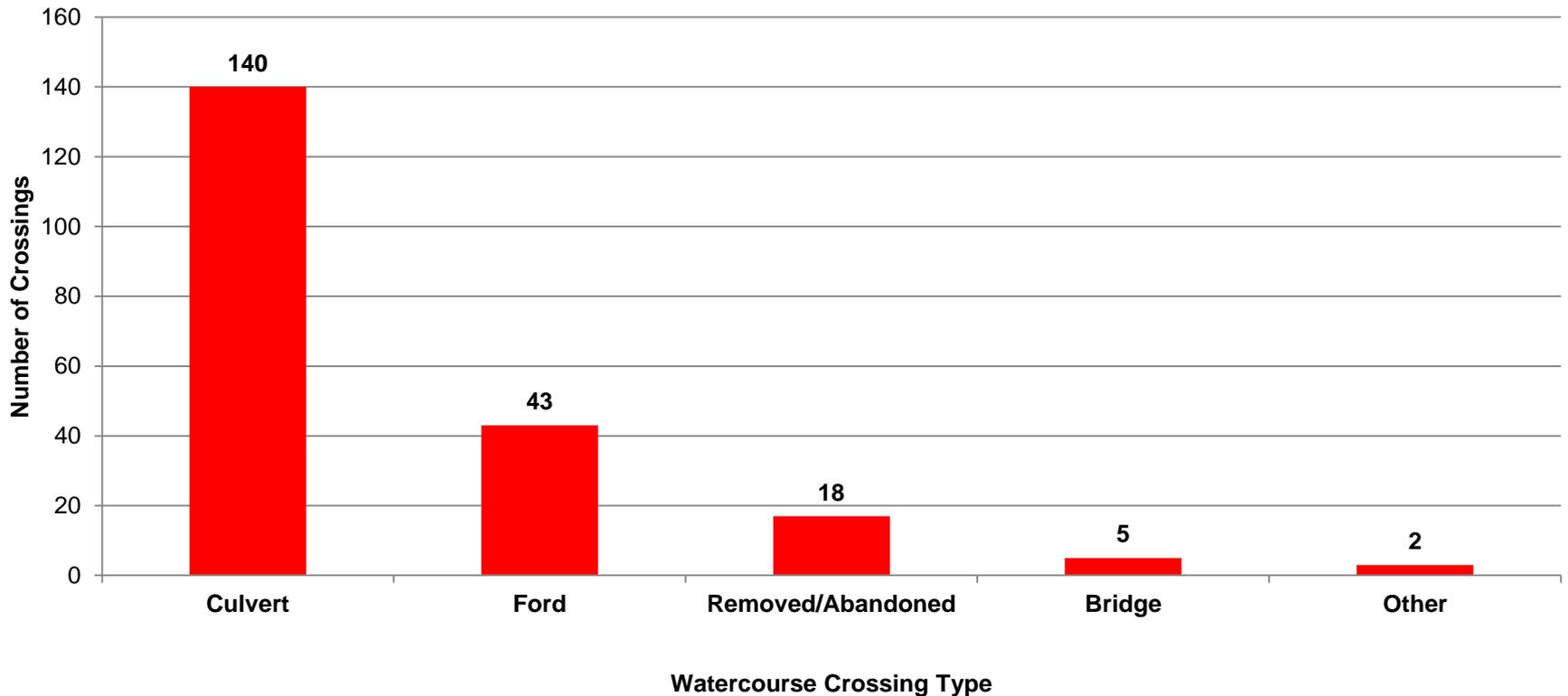
# **FORPRIEM Watercourse Crossing** **Sample Size (2008-2013)**

- **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

# **III. FORPRIEM THP Watercourse Crossing Results**

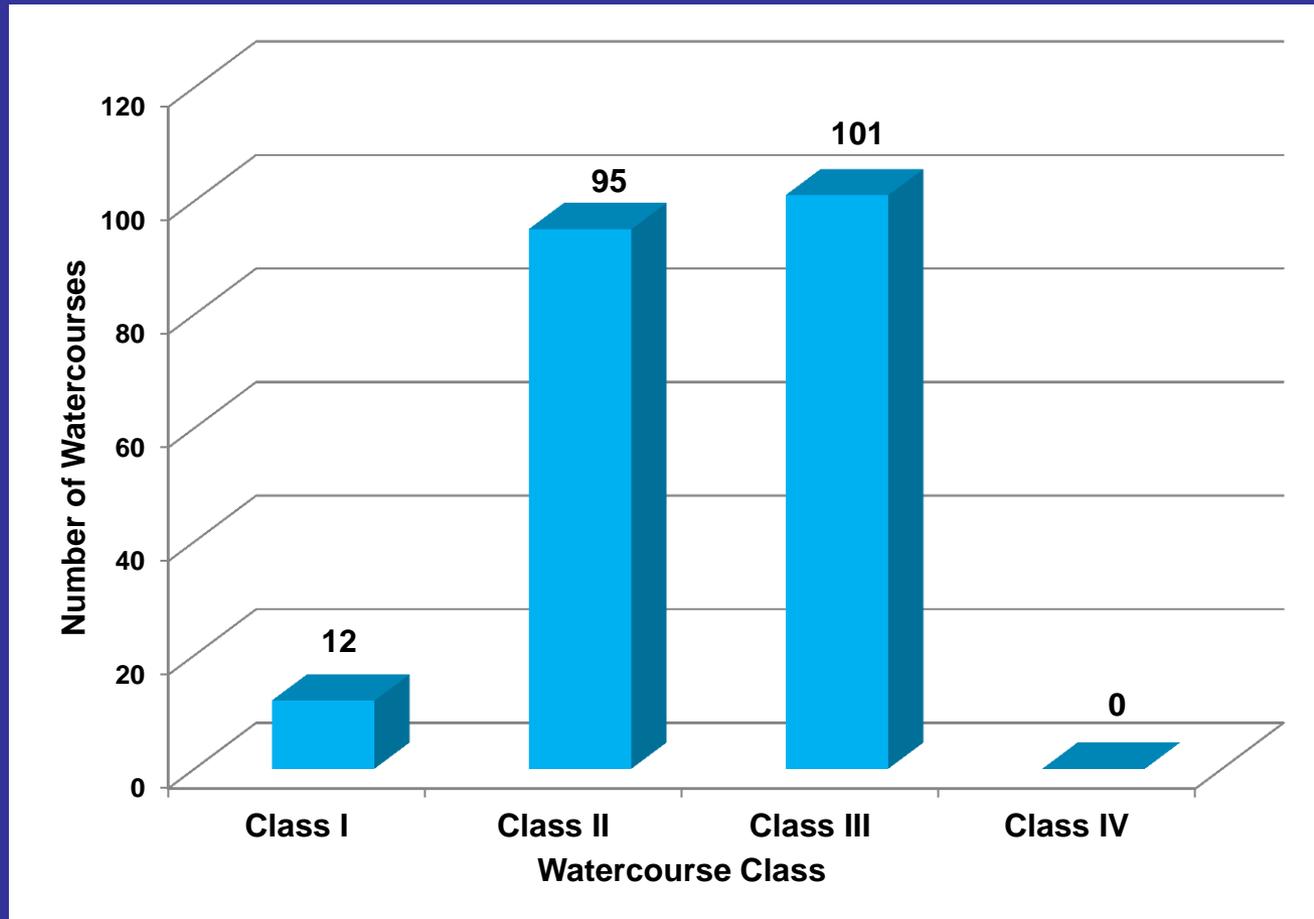
# FORPRIEM THP Results

## Watercourse Crossings: Crossing Types



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

# THP Watercourse Class Distribution

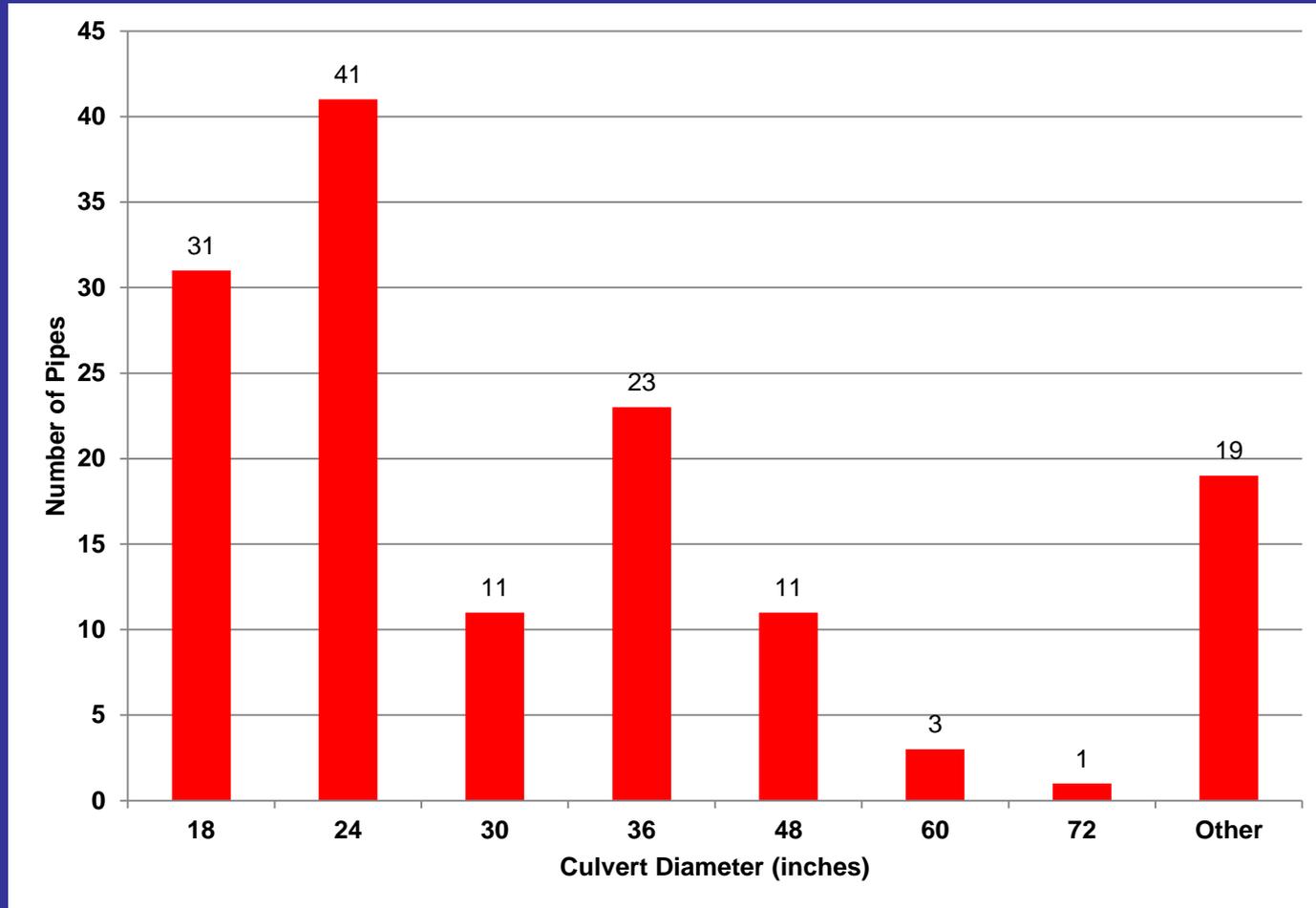


~5% Class I, 46% Class II, and 49% Class III

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

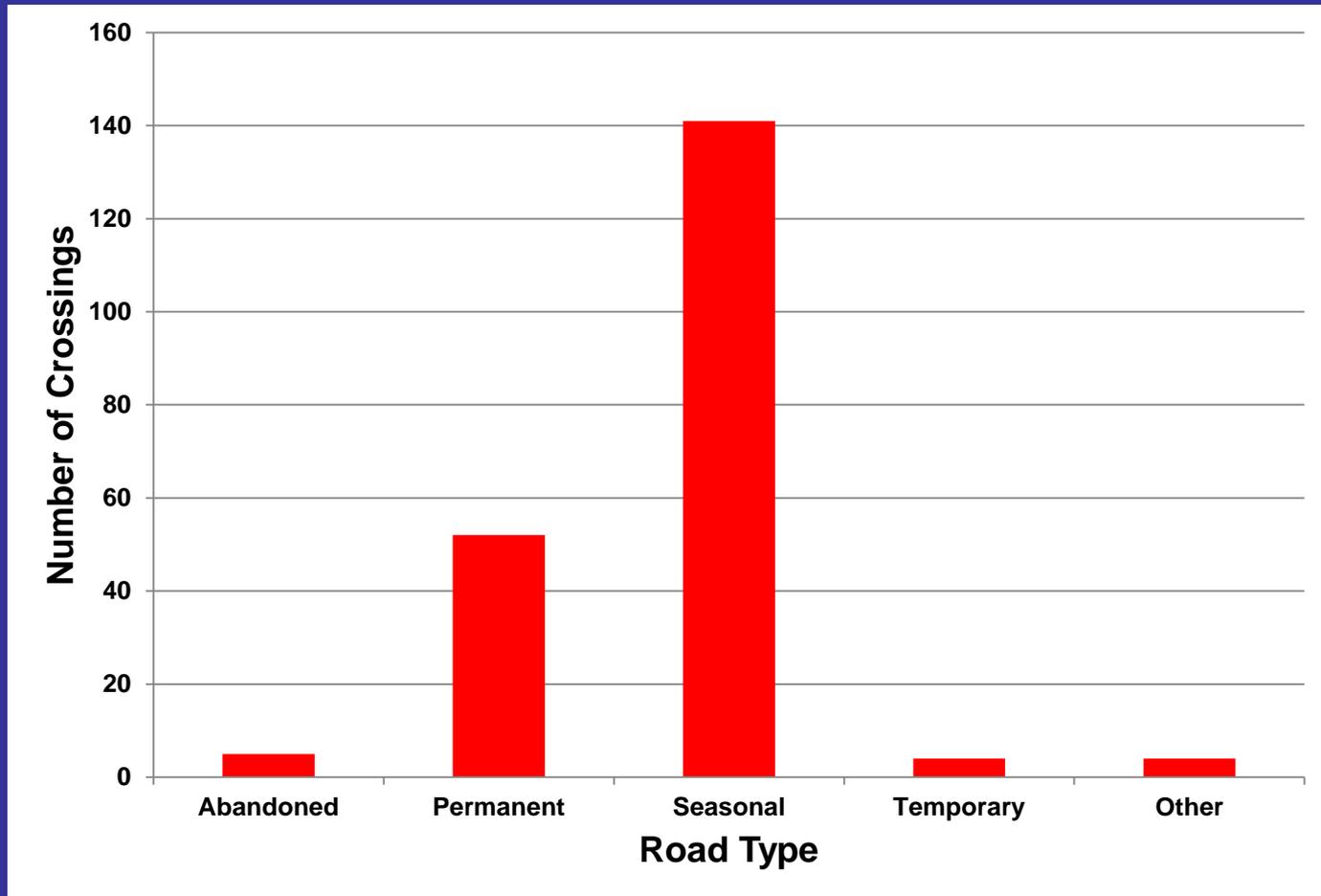
36 inch Steel Culvert  
THP 1-09-026 HUM



THP 1-06-107 MEN  
30 inch Plastic Pipe Outlet

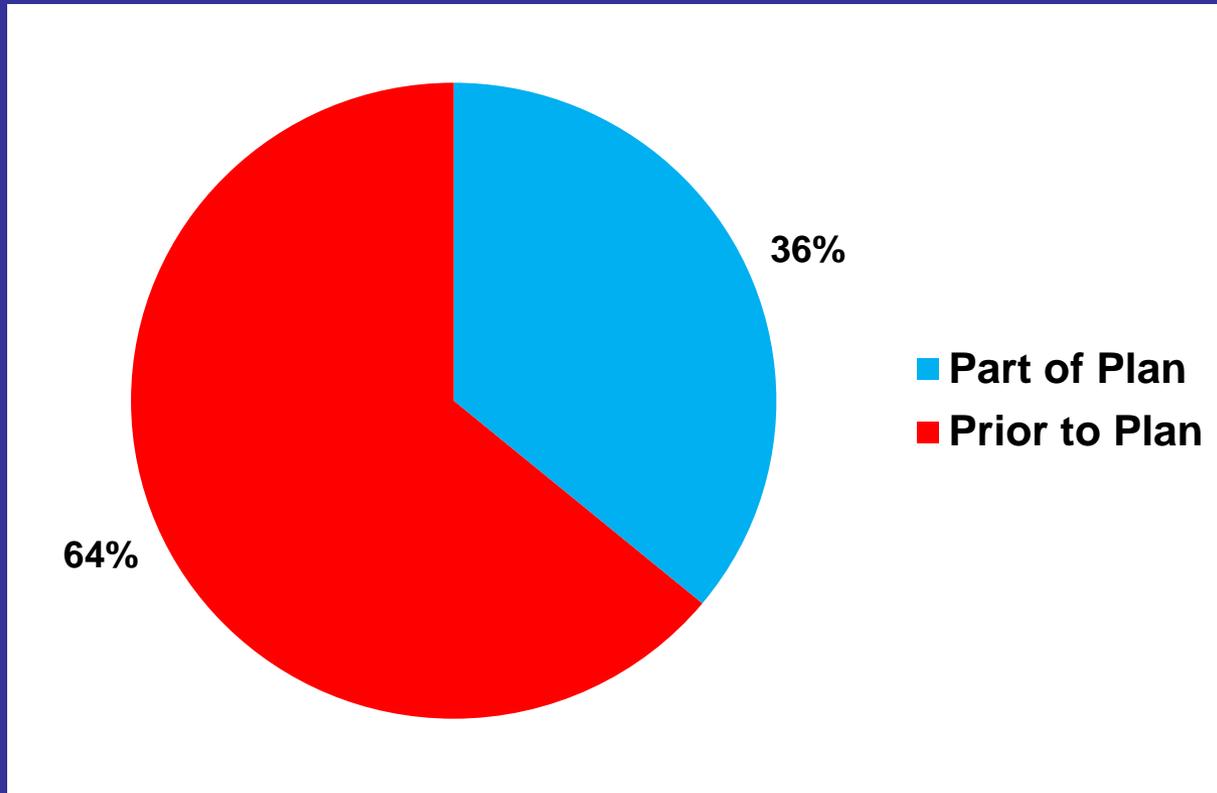


# Road Type Associated with THP Watercourse Crossings



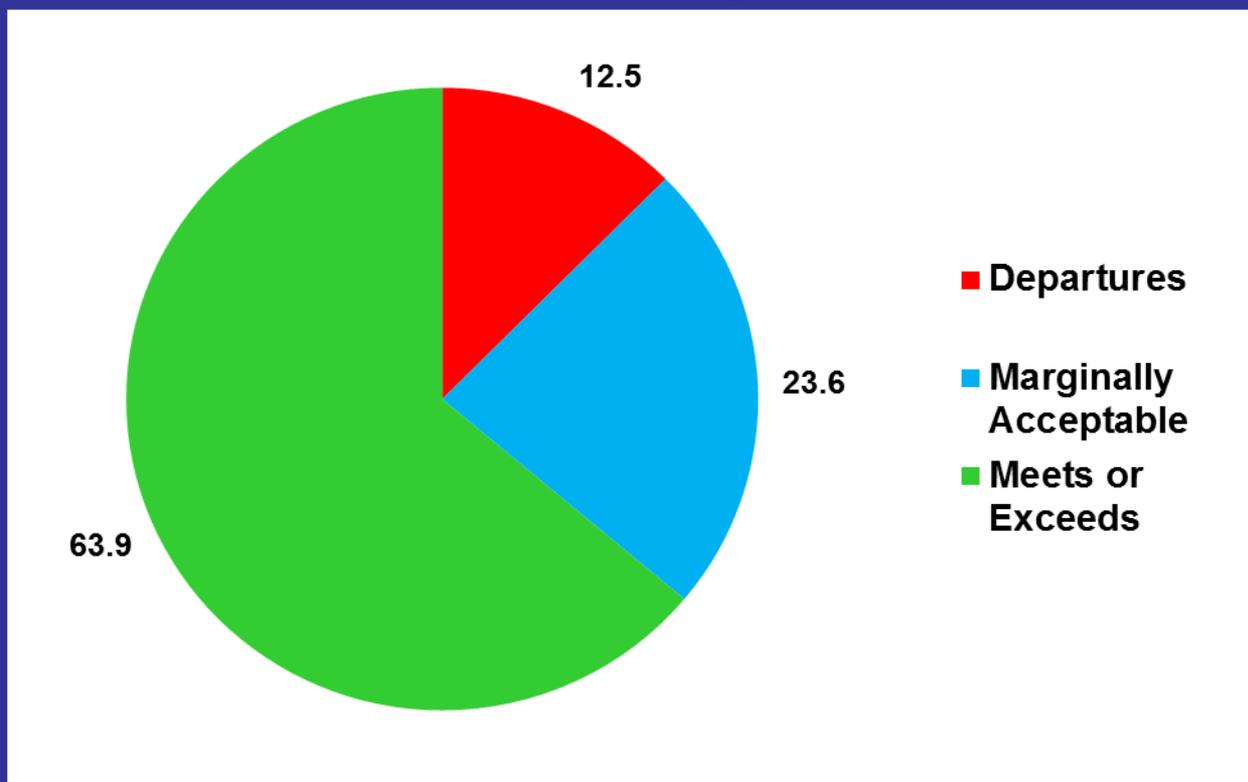
68% of the watercourse crossings were associated with seasonal roads

# 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%

**Crossing with Sediment/Debris Blocking >30% of Inlet/Outlet  
THP 1-05-246 HUM, Crossing No. 1**



# Road Approaches to Watercourse Crossings – Cutoff Drainage Structure Function

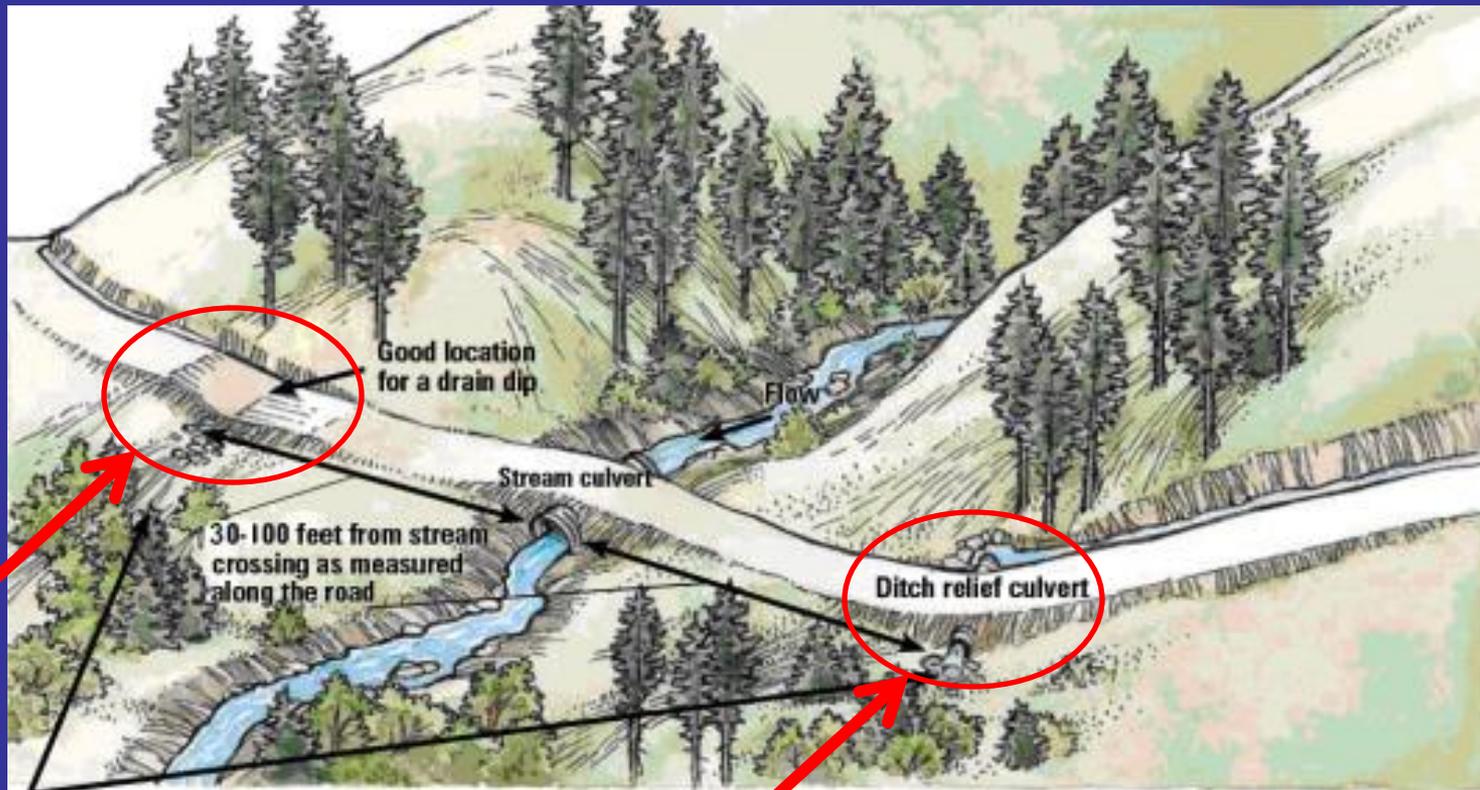


Figure 2, TRA #5

# 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%

**Abandoned Crossing** with >1 cubic yard of sediment entering the channel;  
THP 1-08-176 MEN; Crossing No. 2  
Two of the abandoned/removed crossings had major slope failure problems.



Fill Failure  
Reached the  
Channel

# **FORPRIEM NTMP-NTO Watercourse Crossing Results**

# FORPRIEM NTMP-NTO Preliminary Results

## Watercourse Crossings

- 39 randomly selected watercourse crossings in the monitoring sample.



No major effectiveness problems

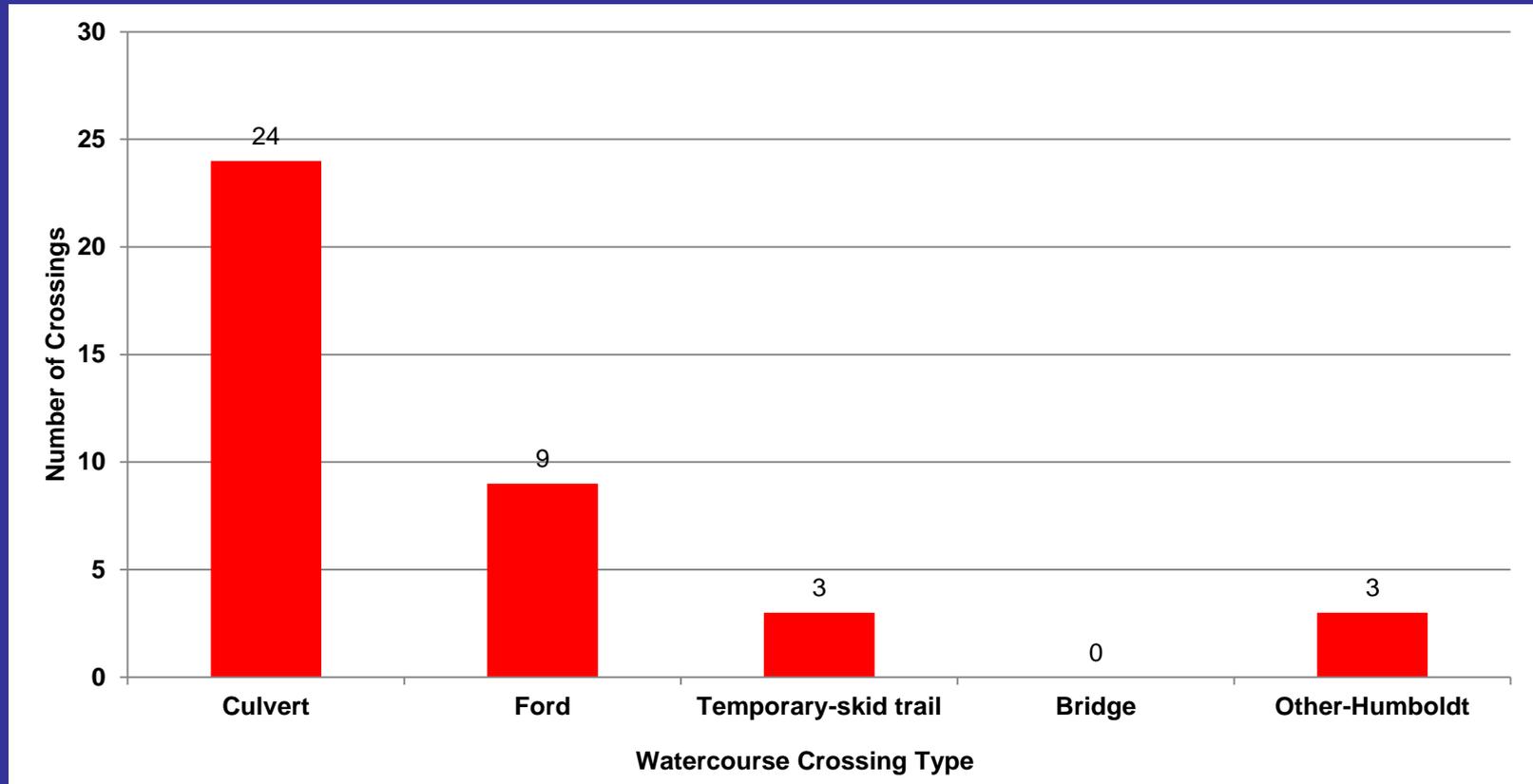
1-97NTMP-018  
MEN; NTO #6

August 16,  
2011

Mill Creek  
NTMP

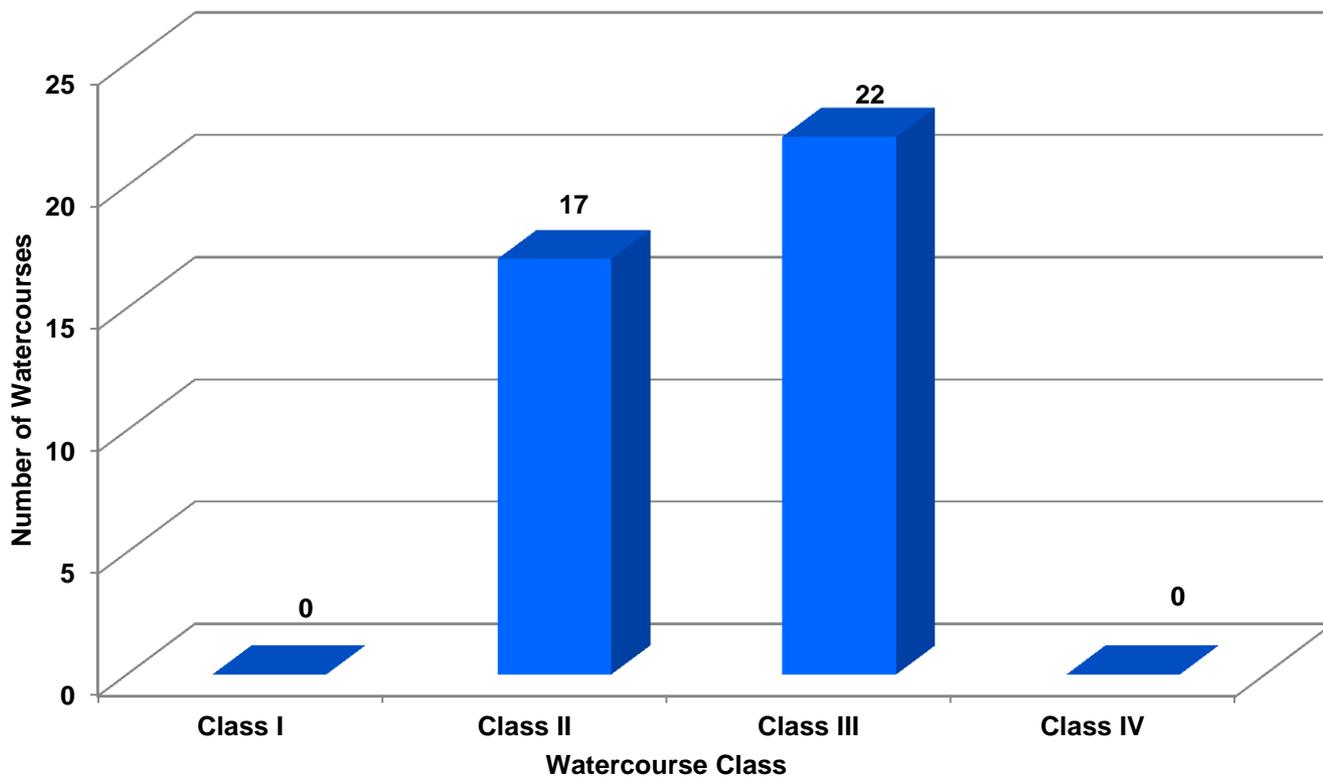
# FORPRIEM NTMP-NTO Preliminary Results

## Watercourse Crossings: Crossing Types



39 Crossings Evaluated: 62% culverts; 23% fords

# NTMP-NTO Watercourse Class Distribution





1-97NTMP-038 MEN;  
NTO # 6

October 11, 2011

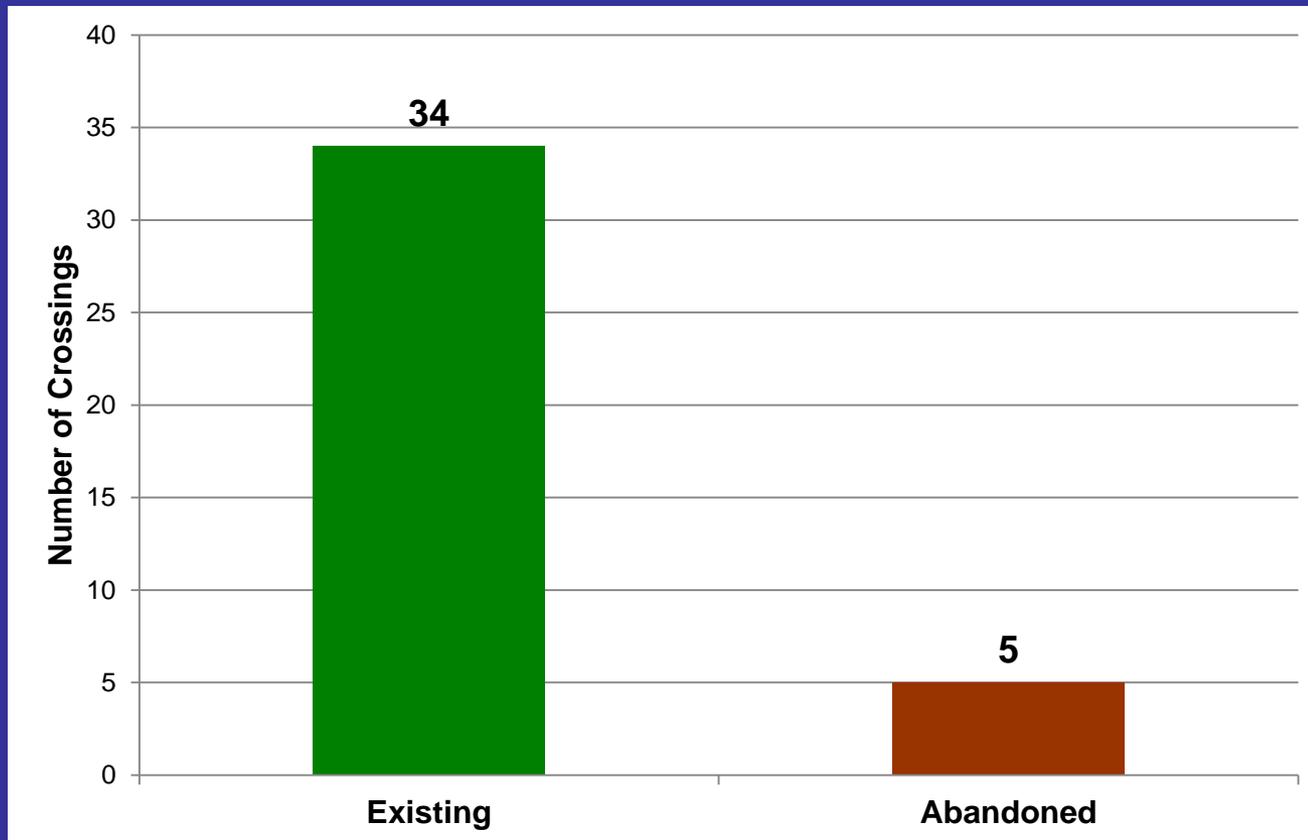
Watercourse Crossing  
#1

Class III, 18 in Culvert



# FORPRIEM NTMP NTO Preliminary Results

## Watercourse Crossings: Current Status

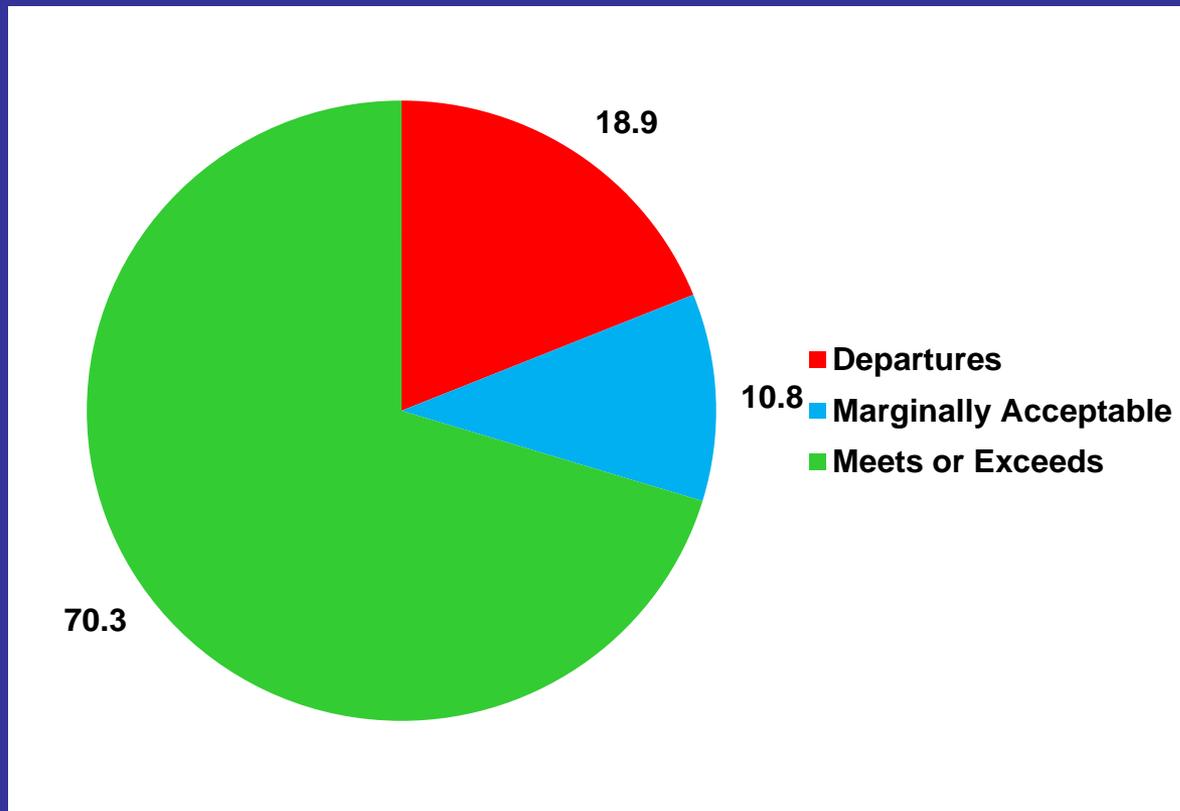


87% Existing Crossings; ~60% Built Prior to NTMP-NTO

# 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

# FORPRIEM Watercourse Crossings

## NTMP-NTO Culvert Effectiveness Categories

Category	Appropriate/ None	Minor Problem	Major Problem	% with Major Problems
Alignment	23	1	0	0
Crushing	23	1	0	0
Corrosion	16	0	0	0
<b>Diversion Potential</b>	21	1	2	8.3
Gradient	21	3	0	0
Pipe Length	21	3	0	0
Plugging	19	4	1	4.2
Scour at Inlet	19	4	1	4.2
Scour at Outlet	14	9	1	4.2

24 culverts rated  
for effectiveness



**1-97NTMP-018 MEN;  
NTO #6  
August 16, 2011  
Mill Creek NTMP**

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

**Major  
problems:**

- Significant  
scour at the  
outlet**
- Diversion  
potential**

# NTMP 1-98NTMP-008 MEN

## Crossing No. 2 -- Humboldt Crossing



Crossing Inlet



Crossing Outlet

# FORPRIEM Watercourse Crossings NTMP Road Surface Approach / Fill Slope Effectiveness Categories

Category	Appropriate/ None	Minor Problem	Major Problem	% with Major/Total Problems
<b>Cutoff Drainage Structure</b>	31	7	1	3% / 21%
Road Surface Gullies	37	1	1	3% / 5%
Inside Ditch	12	3	0	0% / 25%
Ponding	30	4	0	0% / 12%
Rutting	31	4	1	3% / 14%
Fill Slope Failure	37	2	0	0% / 5%
Fill Slope Gullies	34	4	0	0% / 11%
Fill Slope Cracks	39	0	0	0% / 0%

# Summary

- **Frequent THP Effectiveness Problems (Major – 13.4%):**
  - Diversion Potential - 6%
  - Plugging - 3%
  - Cut-off Drainage Structure - 5%
- **Frequent NTMP-NTO Effectiveness Problems (Major – 10.3%):**
  - 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).**

# **IV. FORPRIEM Watercourse Crossing QA/QC**

# FORPRIEM Watercourse Crossing QA-QC

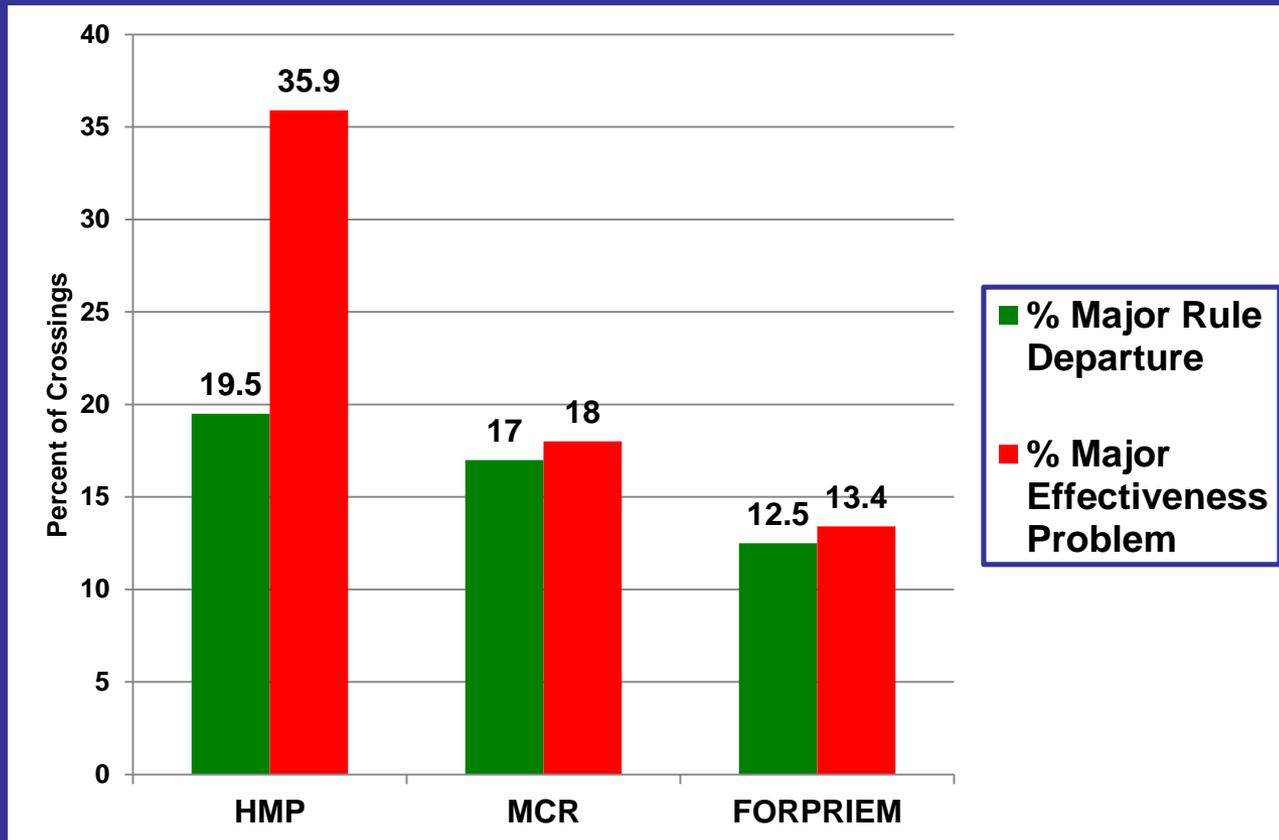
- 5 THPs reevaluated in 2013;  
4 THPs with 2 culvert crossings  
(8 crossings evaluated twice).
- Good agreement on watercourse  
type, culvert size, watercourse  
class.
- Small sample size, but more poor  
implementation and effectiveness  
“grades” with original inspection.
- Crossing evaluations are less  
repeatable/more subjective than  
canopy measurements.

Criteria	First Visit	QA/QC Visit
# of Major Effectiveness Problems	3	1
# of Minor Effectiveness Problems	13	6
# of crossings with Major Problems	2	1
# of crossings with Minor Problems	6	3
# of crossings with FPR Departures or Marginally Acceptable Ratings	3	2

**FORPRIEM  
QA/QC  
THP 2-04-193  
SHA; Upper  
Sacramento  
River Canyon  
August 16,  
2013**

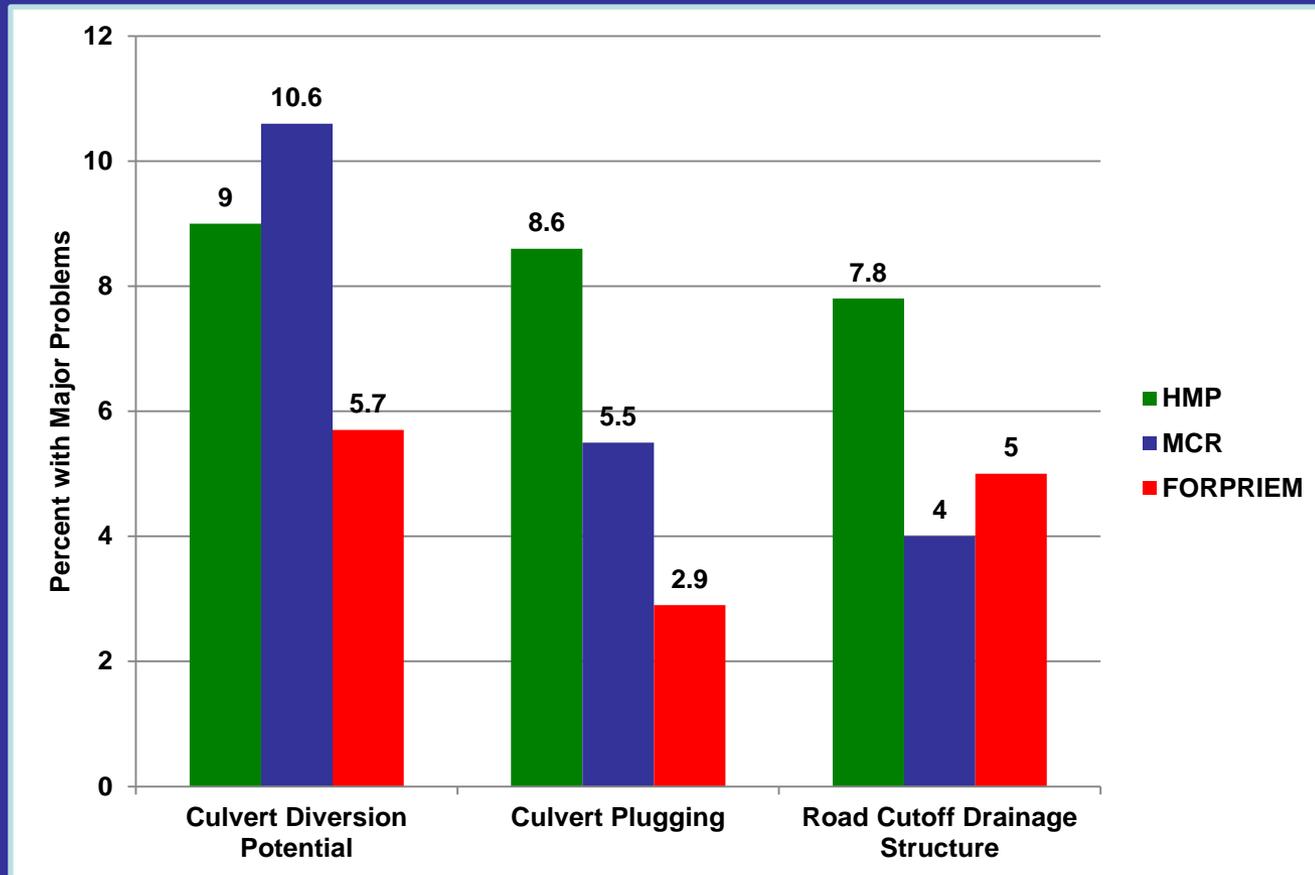


# V. Changes Over Time for THP Major FPR Departures and Effectiveness Problems



**Note:** HMP data were collected by contractors (i.e., R.J. Poff and Associates), not CAL FIRE Forest Practice Inspectors; 33 categories rated (not 27); and the January 1997 flood event occurred during the study.

# Changes Over Time for Three Selected THP Major Effectiveness Categories



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

# Watercourse Training Efforts

- 2004 Watercourse Crossing Design Guidance Document (California Forestry Report No. 1).
- New revised document expected by mid-August, 2014.

State of California  
The Resources Agency  
Department of Forestry & Fire Protection



## Designing Watercourse Crossings for Passage of 100-year Flood Flows, Wood, and Sediment

California Forestry  
Report No. 1

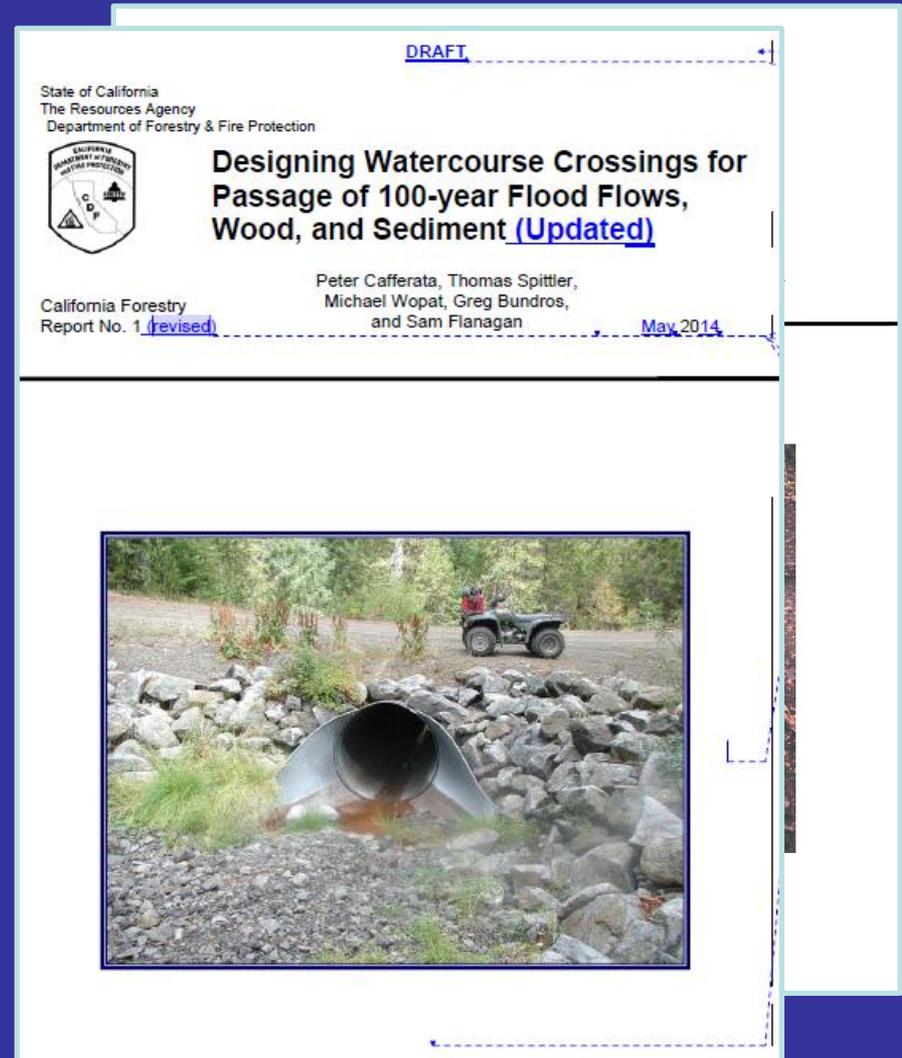
Peter Cafferata, Thomas Spittler,  
Michael Wopat, Greg Bundros,  
and Sam Flanagan

February 2004



# Watercourse Training Efforts

- 2004 Watercourse Crossing Design Guidance Document (California Forestry Report No. 1).
- New revised document expected by September 2014.



# Watercourse Training Efforts

- 2006-2008  
Watercourse  
Crossing Training  
Workshops  
(7 sessions)



# Watercourse Training Efforts

- 7 UCCE road workshops and a road webinar series with Dr. Richard Harris



# Watercourse Training Efforts

- Funding for revised version of “Handbook for Forest and Ranch Roads” (Weaver and Hagans 1994).
- New revised edition expected to be available in July 2014.

## HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

A Guide for planning, designing, constructing, reconstructing, upgrading, maintaining and closing wildland roads

PREPARED BY:  
WILLIAM WEAVER, PhD  
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ARCATA, CA

FOR:  
THE MENDOCINO COUNTY RESOURCE CONSERVATION DISTRICT

IN COOPERATION WITH:  
CALIFORNIA WATER RESOURCES CONTROL BOARD AND  
CALIFORNIA DEPT OF FORESTRY AND FIRE PROTECTION

JANUARY 2014

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# VI. Summary

1. THP watercourse crossing and road approach implementation and effectiveness appear to be improving over time.
2. NTMP-NTO watercourse crossings are generally comparable to THPs from a water quality standpoint.
3. Further training will occur with the Road Rules, 2013 training sessions to be held in August and September of 2014.
4. Crossing diversion potential and cutoff drainage structure function on road approaches remain high priority items for training efforts.
5. Further improvement is needed, and education and enforcement will continue to be emphasized with the implementation of the Road Rules, 2013 rule package.