Tongass National Forest Road-Stream Crossing Surveys: Methods, Assessment Status, and Data Stewardship

06/15/2012

Sheila Jacobson, Forest Fish Biologist

Why is passage important?

Culvert Gradient

Stream Channel Constriction

Perched Outlet

9/21/1999 16:02

Debris Blockage

Tongass Fish Passage

Inventory Methods

Passage Assessment

Biological Evaluation and Prioritization

Remediation Status

Data Management

Inventory Methods

Locate all fish
stream crossings

Obtain measurements for
passage assessment

Inventory Methods

RCS Data Element Categories

- General
- Spatial
- Road
- Drainage Structure
- Fish Passage

R-10
EFFECTIVE 07/02/1999
EXPIRATION 12/01/2000

Appendix A

ID 7709.58-99-2
Page 2 of 65

12.5 - <u>Condition Surveys</u>. Road condition surveys are methods of determining the status and from that information deriving the maintenance needs for roads. Condition surveys provide information for 1) identification of maintenance trends, 2) problems analysis, and 3) priority setting for work scheduling and funding.

The Road Condition Survey data is designed to function within ArcView with full integration of GIS spatial coverages. With the use of geographic information

Tongass National Forest

Assessment of Fish Passage at Road Crossings

Version: May 17, 2012

Approximately 60 measurements obtained….including:

- Fish Presence
- Culvert Dimensions and Type
- Culvert Inlet and Outlet Elevations
- Debris Blockage
- Culvert Bedload Size, Depth and Coverage
- Leap Pool Depth
- Downstream Control Elevation
- Ordinary High Water Width & Elevation
- Channel Bedwidth
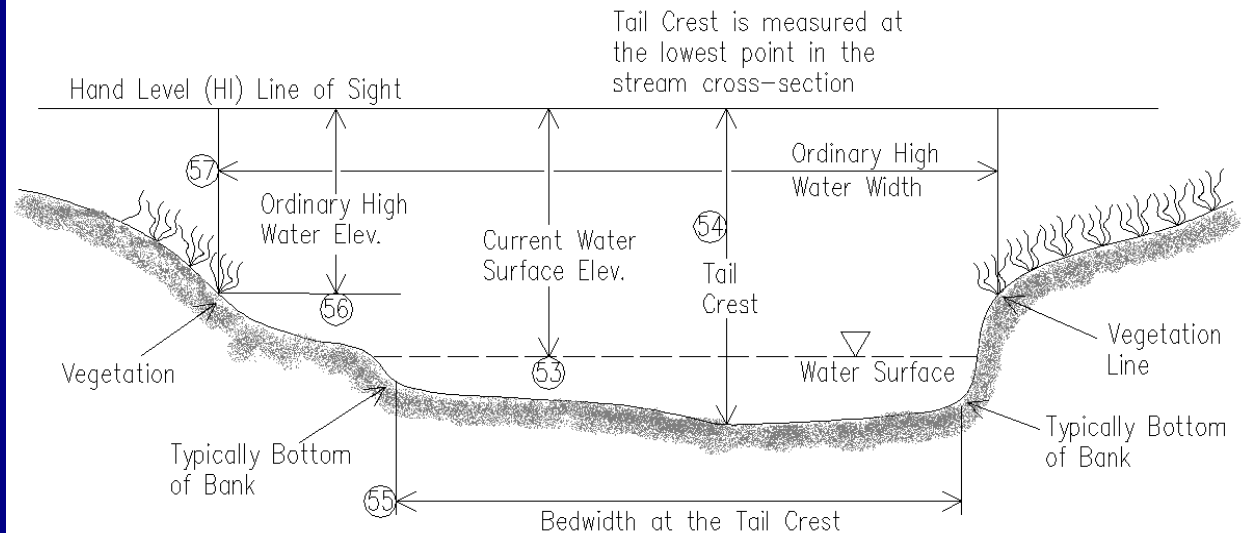- Outlet Condition
- Photo Documentation

Derived Values:
- Stream Constriction Ratio
- Culvert Outlet Perch
- Culvert Gradient
- Culvert Substrate Depth Ratio
- Stage-Discharge Rating Curve
- Mannings Roughness Coeff.
- Design Flow Velocity
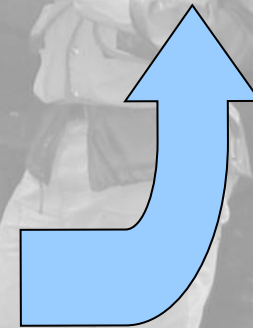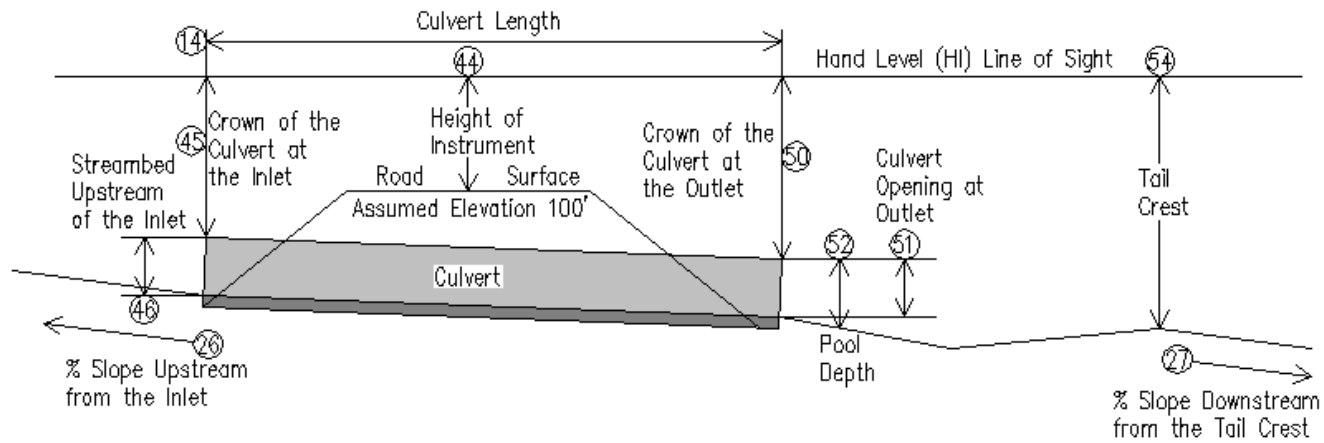
Typical Stream Profile and Road Cross-Section

Typical Tail Crest Cross-Section

# Corrugations are rusting out due to corrosion from saltwater

No.	Element	Abbrev.	Code	No.	Element	Abbrev.	Code
1	Road Number	RTE_NO	XXXXX	33	Silver Salmon Presence	SS	
2	Milepost	MP	0.000	34	Cutthrout Presence	CT	
3	Road System	SYS	XX	35	Dolly Varden Presence	DV	
4	Sampling Crew	CREW	XXXXX	36	Steelhead Presence	SH	
5	Date	DATE	XXXXX	37	Chum Salmon Presence	CS	
6	Feature	FEAT	CP2	38	King Salmon Presence	KS	
7	Descriptive Parameter	PRM	SC	39	Pink Salmon Presence	PS	B
8	Access and Travel Management	ATM		40	Sockeye Salmon Presence	RS	
9	Sign Condition	SGN_C		41	Sculpin Presence	SC	
10	Failure Mechanism	FAIL	MP	42	Stickleback Presence	SB	
11	Photograph	PIC	Y	44	Height of Instrument	HI	
12	Height of feature	HGT	60	45	Top of Culvert at Inlet	TC_I	
13	Width of feature	WID	60	46	Culvert Opening at Inlet	CO_I	
14	Length of feature	LEN	35	47	Culvert Bedload Coverage	BLD_C	
15	Entrance Type	ENT	PRO	48	Culvert Bedload Type	BLD_T	
16	Ditch Block	DB		49	Upstream Substrate Type	U_SB	
17	Catch Basin	CB		50	Top of Culvert at Outlet	TC_O	
18	Inlet Erosion	IE		51	Culvert Opening at Outlet	CO_O	
19	Outlet Erosion	OE		52	Depth 6" Downstream of Outlet	PD	
20	% Block	BLK	0	53	Water Surface Elevation	WSE	
21	% Structure Damage	SD		54	Tailcrest	TC	
22	Skew Angle	SKEW	0	55	OHW Mark at Outlet	OHW_O	
23	Road Grade	RD_G	0	56	Bed Width at Tailcrest	B_TC	
25	Bedwidth Upstream of Inlet	B_US	20	57	OHW Width at Tailcrest	OHW_W	
26	Upstream Gradient	U_GD	3	59	Special Site Condition	SSC	OT
27	Downstream Gradient	D_GD	3	60	Action Taken	A_TAK	N
28	Channel Type	CT	MM_ES	61	Action Required	A_REQ	X
29	Verified Aquatic Habitat Class	AHMU	1_1	62	Priority	PRI	C
30	Fish Habitat	HAB	B	63	Problem Corrected	COR	
32	Fish Sampling Method	SMP	VS	64	Notes	NOTES	

Miles of Road Surveyed
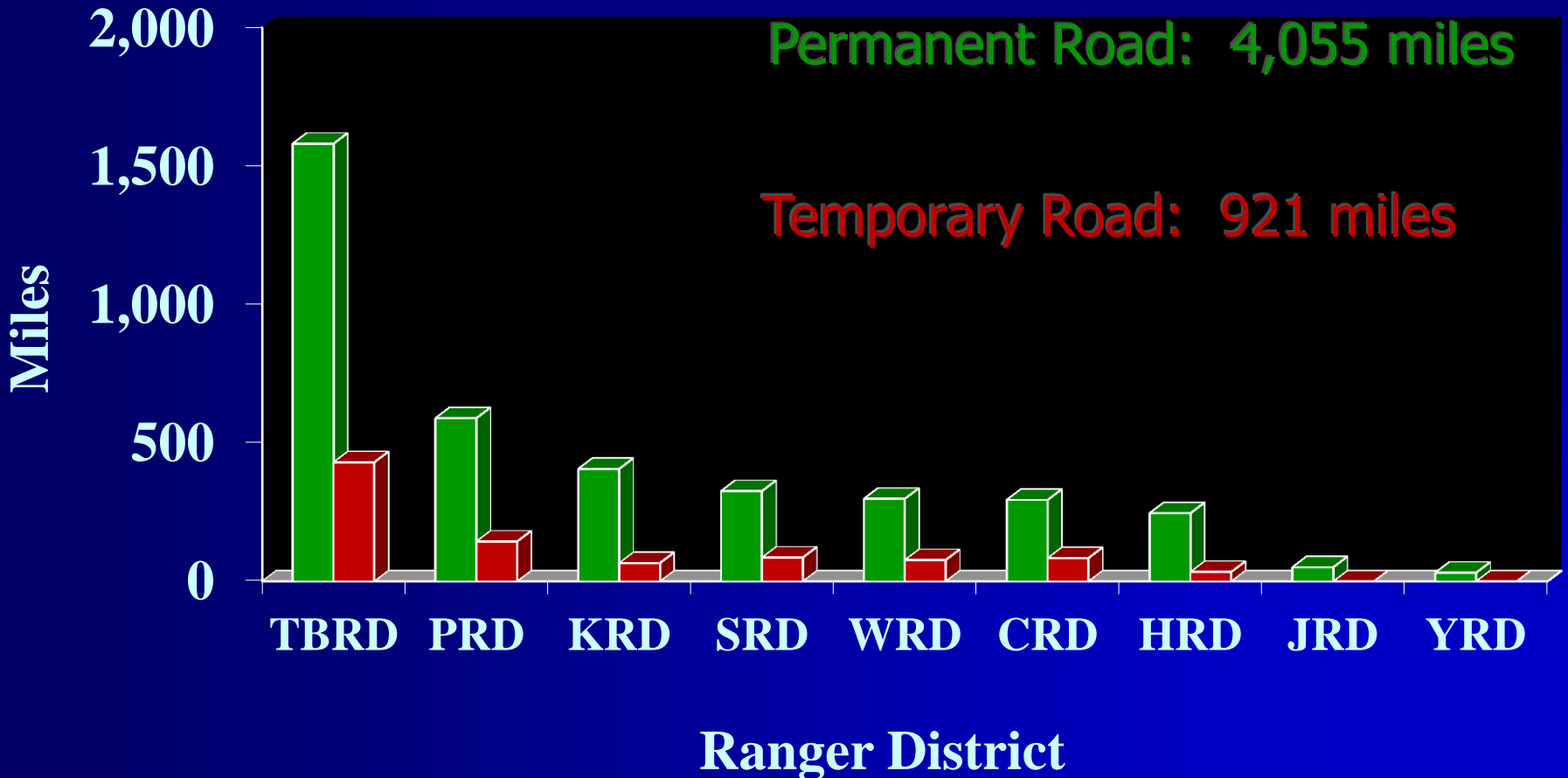
Fish Crossings Surveyed
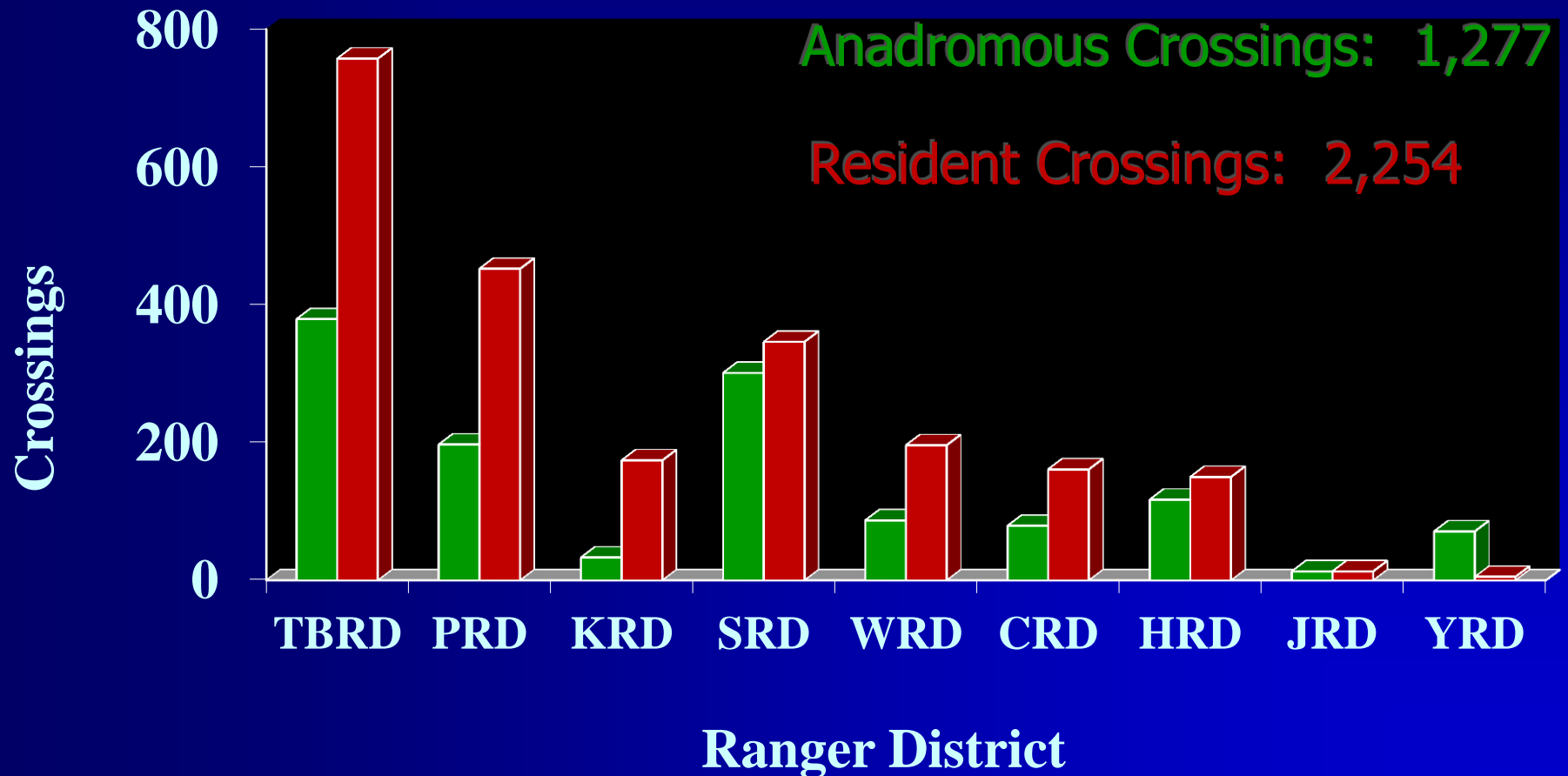
Tongass Fish Passage

Inventory Methods

Passage Assessment

Southeast Alaska
Fish Passage Design Fish:
55 mm coho salmon

Resident Dolly Varden char and cutthroat trout

Fish Passage Assessment Process

BLACK: measurements required for passage determination are not available.

Coarse Sieve
Thresholds For:
➤ **Culvert Gradient**
➤ **Stream Constriction Ratio**
➤ **Debris Blockage**
➤ **Outlet Perch**

GREEN: conditions assumed adequate for fish passage

GRAY: additional analysis required to assess fish passage

RED: conditions assumed <u>not</u> adequate for fish passage

Computer Aided Analysis of Hydraulic Conditions

Juvenile Salmonid Fish Passage Assessment Matrix

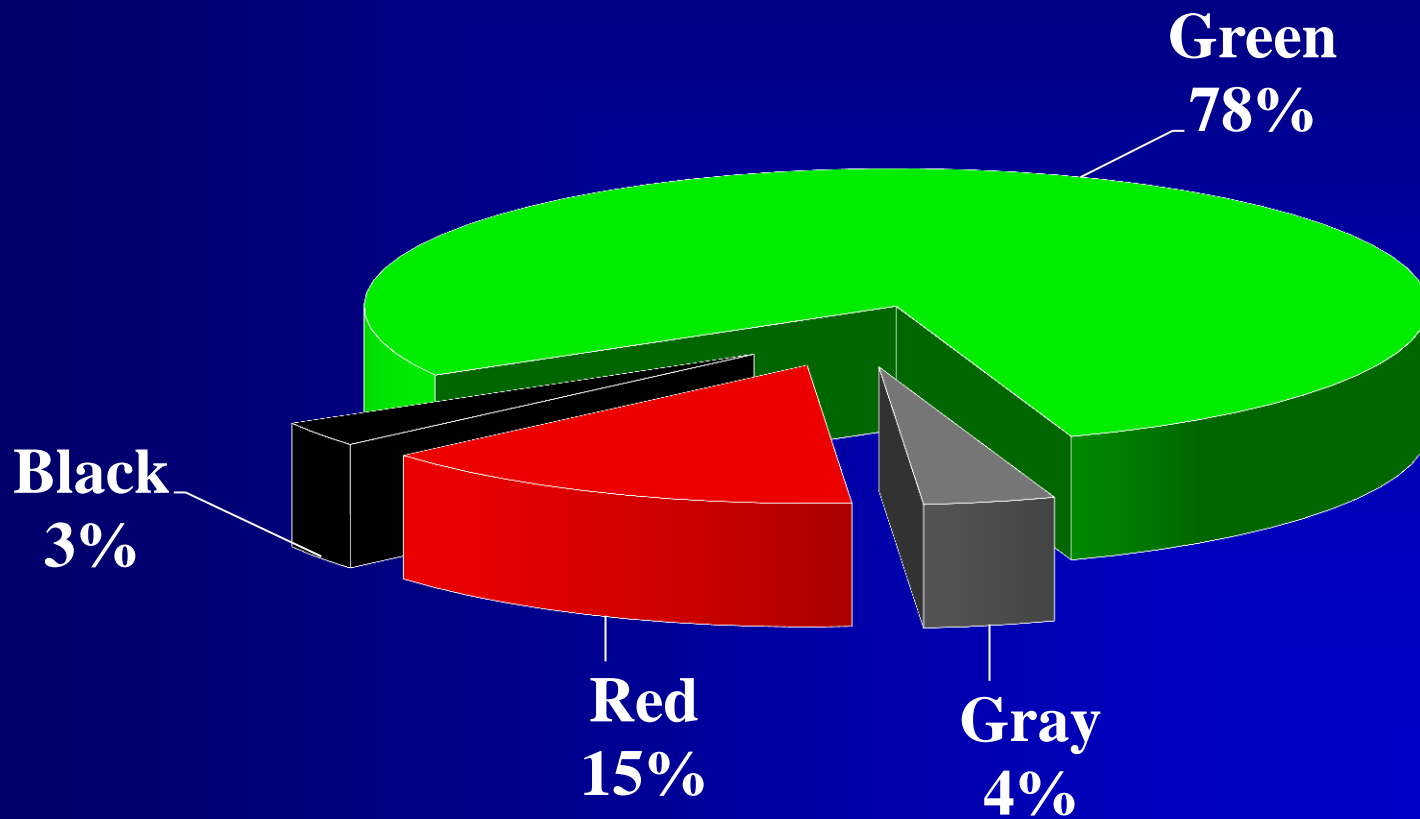|	Group	Green Conditions assumed adequate to pass juvenile fish	Gray Conditions require additional analysis	Red Conditions assumed inadequate to pass juvenile fish
1	Bottomless pipe arch or embedded[1] pipe arch or embedded CMP.	Culvert span to bed width ratio >= 0.75 and no blockage or backwatered [3] and no blockage.	Culvert span to bed width ratio of 0.5 to 0.75 OR blockage >0% but <=10%.	Culvert span to bed width ratio <0.5 or blockage >10%
2	Non-embedded pipe arches and culvert span <= 144" or non-embedded CMP and culvert span > 48" and <=144".	Culvert gradient <0.5% and no perch [2] and no blockage and culvert span to bed width ratio > 0.75 or backwatered and no blockage.	Culvert gradient between 0.5% - 2.0% or perch >0.0' but <=4" or blockage >0% but <=10% or culvert span to bed width ratio between 0.5 to 0.75.	Culvert gradient >2.0% or >4" perch or blockage >10% or culvert span to bed width ratio <0.5.
3	Non-embedded CMP and <= 48" span.	Culvert gradient <0.5% and no perch and no blockage and culvert span to bed width ratio > 0.75 or backwatered and no blockage	Culvert gradient between 0.5% - 1.0% or perch >0.0' but <=4" or blockage >0% but <=10% or culvert span to bed width ratio between 0.5 to 0.75.	Culvert gradient >1.0% or >4" perch or blockage >10% or culvert span to bed width ratio <0.5.
4	Non-embedded culvert and culvert span >144"	Culvert gradient <1.0% and no perch and no blockage and culvert span to bank full ratio > 0.75 or backwatered and no blockage.	Culvert gradient between 1.0% - 2.0% or perch >0.0' but <=4" or blockage >0% but <=10% or culvert span to bed width ratio between 0.5 to 0.75.	Culvert gradient >2.0% or >4" perch or blockage >10% or culvert span to bed width ratio <0.5.
5	Box culverts, tidally influenced culverts, culverts with non-standard configurations or materials or baffled culverts.	Fully backwatered	All	Perch >4"
6	Bridges or fords or removed structures	No road fill caused blockage	Not Applicable	Road fill causing blockage. Water piping through road fill
7	Multiple structure installations	Multiple structures are assessed as other similar structures with the exception that constriction is calculated by dividing the stream bedwidth by the sum of all the structure widths. The structure with the best passage performance is used to determine the passage capability of the entire array.		

Chart Area

Juvenile Fish Passage
Permanent Roads
Anadromous Fish Crossings
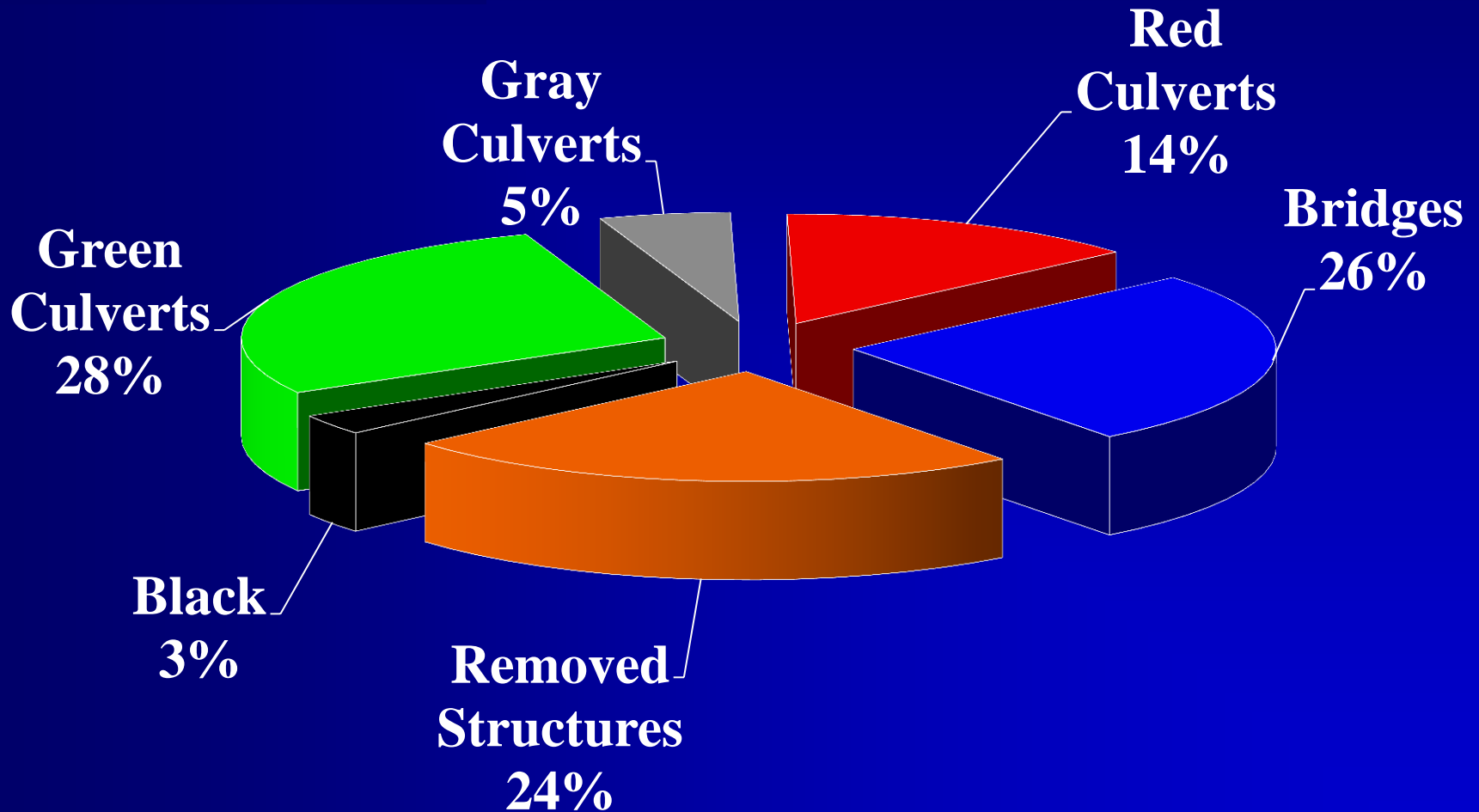n = 1,193 crossings

Green 78%
Black 3%
Red 15%
Gray 4%

1998-2014

Juvenile Fish Passage
Permanent Roads
Anadromous Fish Crossings

Gray Culverts 5%

Red Culverts 14%

Bridges 26%

Green Culverts 28%

Black 3%

Removed Structures 24%

1998-2014

Juvenile Fish Passage
Permanent Roads
Resident Fish Crossings
n = 2,085 crossings
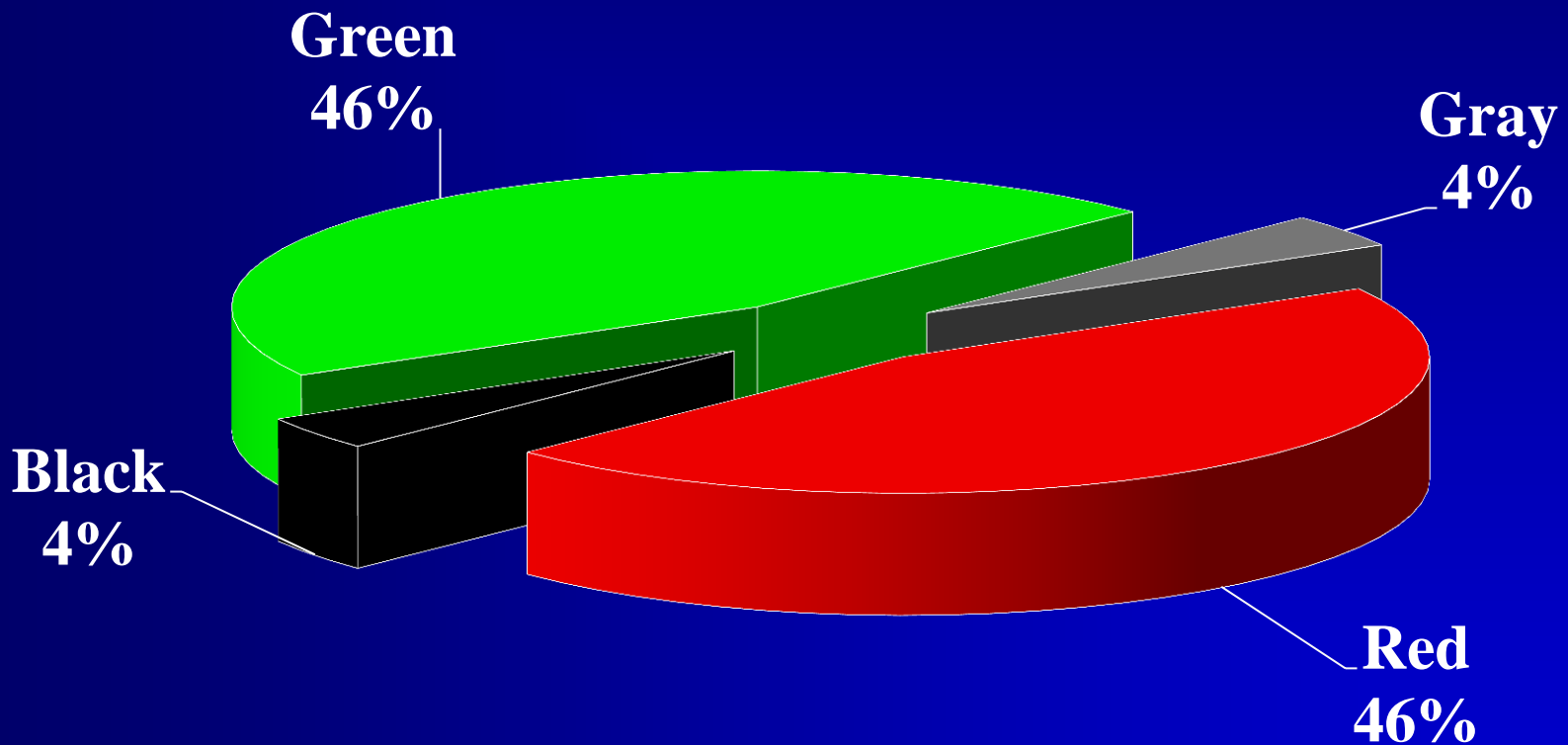
Green 46%

Gray 4%

Black 4%

Red 46%

1998-2014

Juvenile Fish Passage
Permanent Roads
Resident Fish Crossings

Gray Culverts 5%
Red Culverts 44%
Green Culverts 18%
Black 4%
Removed Structures 21%
Bridges 8%
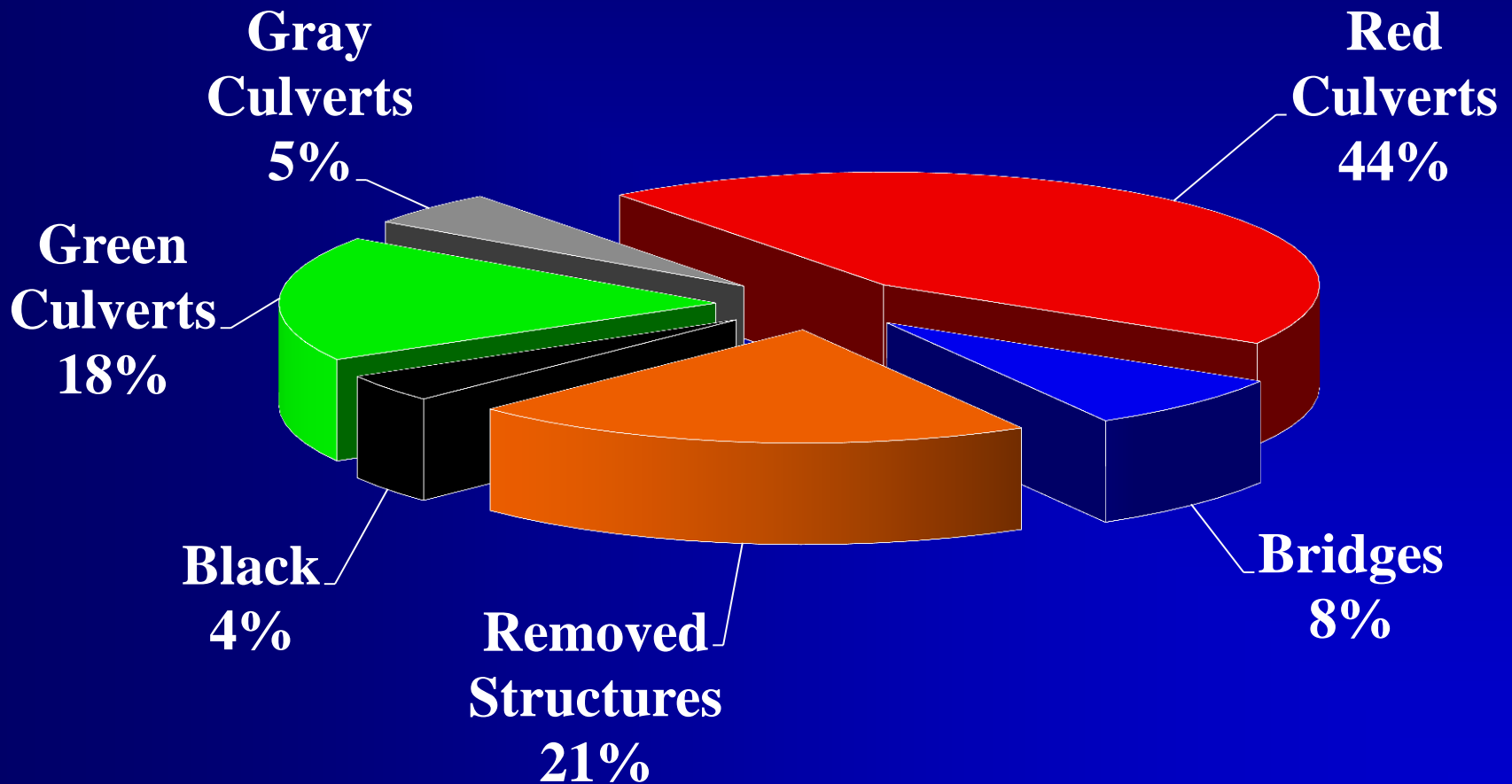
1998-2014

Juvenile Fish Passage
Temporary Roads
Anadromous Fish Crossings
n = 88 crossings

Green
92%

Black
3%

Red
5%

Gray
0%
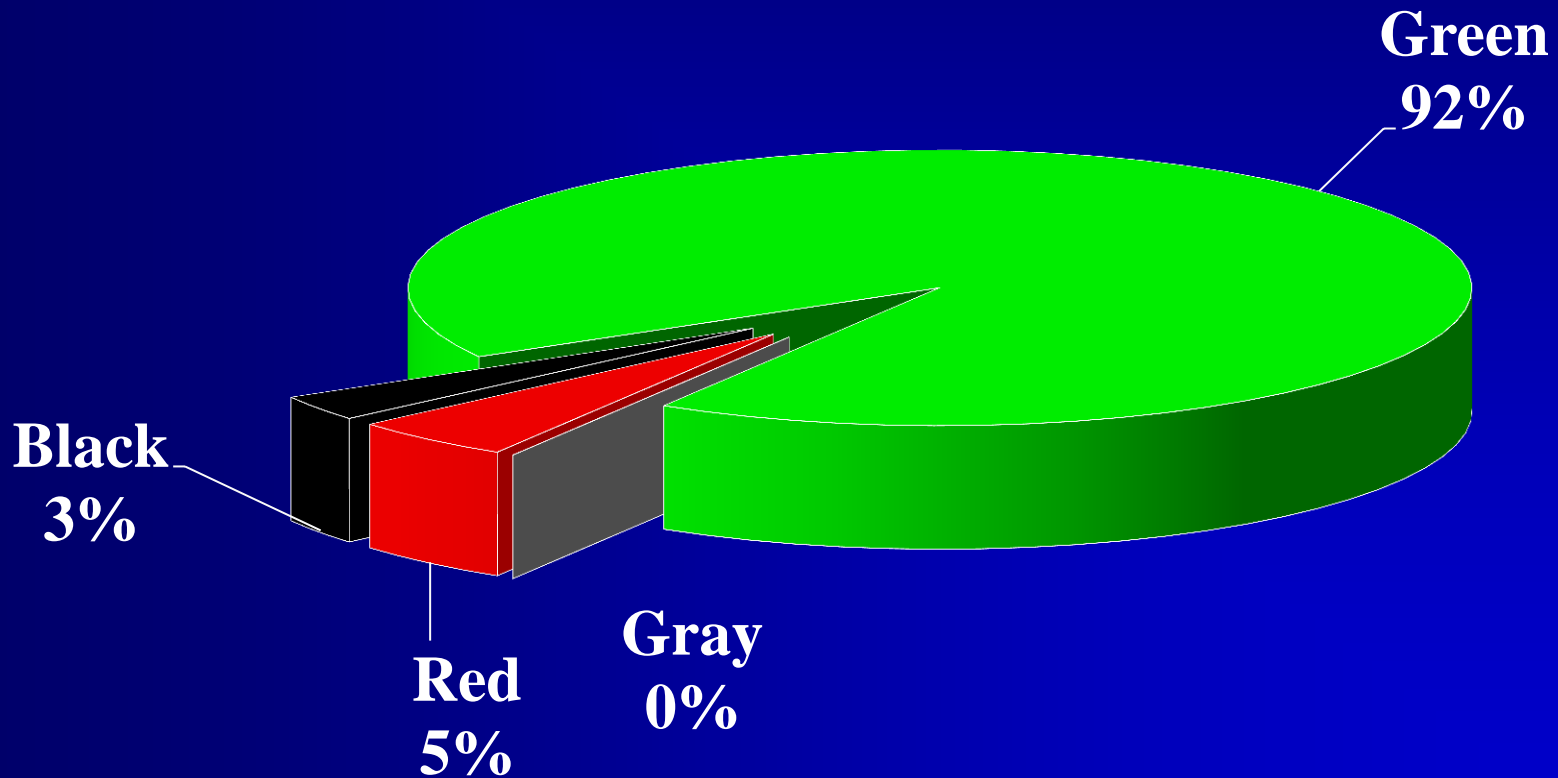
1998-2014

Juvenile Fish Passage
Temporary Roads
Resident Fish Crossings
n = 164 crossings
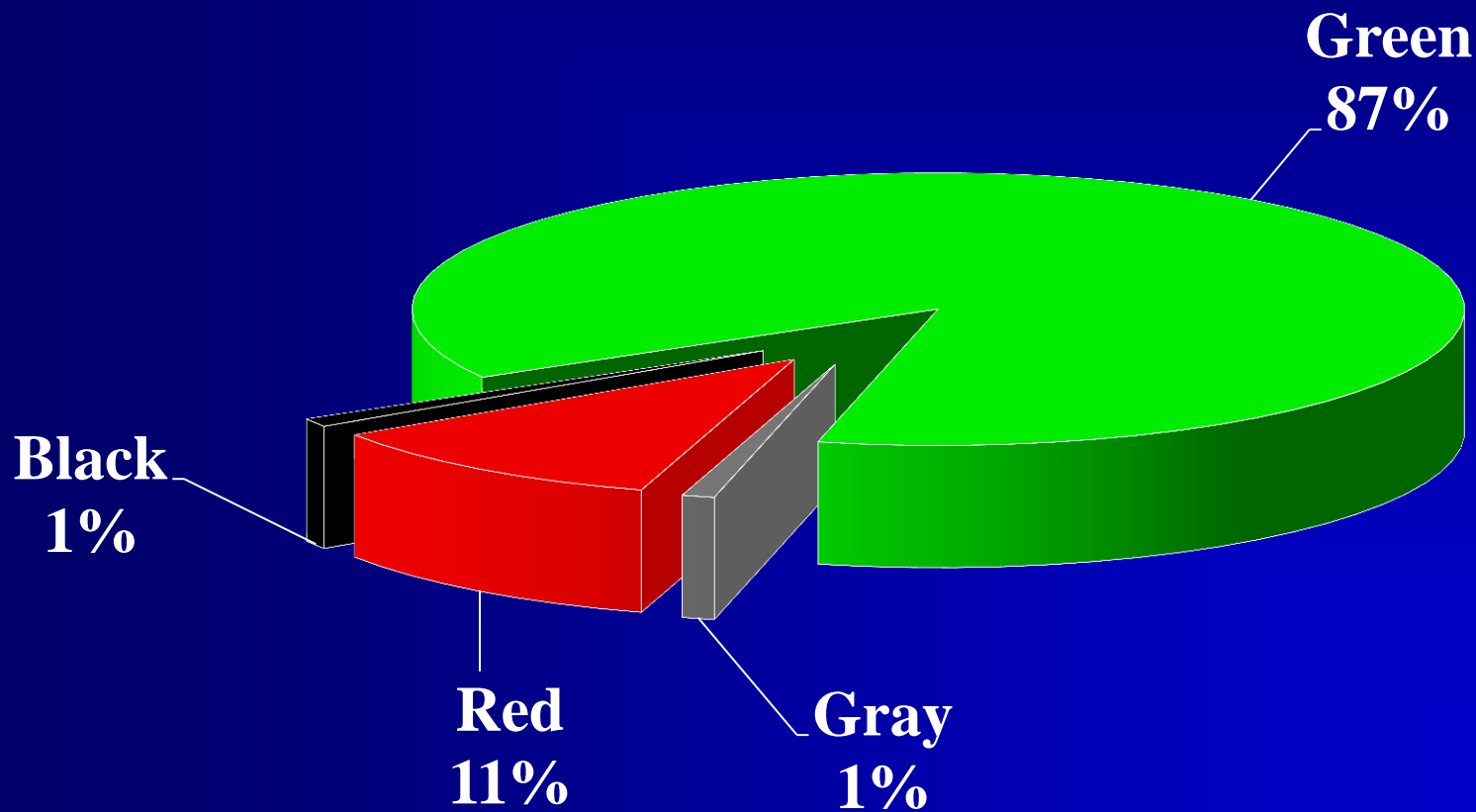
Green
87%

Black
1%

Red
11%

Gray
1%

1998-2014

Tongass Fish Passage

Inventory Methods

Passage Assessment

Biological Evaluation and Prioritization

Assessment of Habitat Upstream of RED culverts

Objective of Surveys :
Determine the quantity and quality of the fish habitat located upstream of crossings not meeting passage standards….. A.K.A. RED Crossings

1,642 surveys completed over ~ 5 year period. Surveys continue on a project scale.

TONGASS NATIONAL FOREST UPSTREAM FISH HABITAT ASSESSMENT PROTOCOL

A STREAM HABITAT SURVEY FOR PRIORITIZATION OF FISH PASSAGE REMEDIATION AT ROAD CROSSINGS

Tongass National Forest

Revised May 19, 2004

Upstream Habitat Assessment

HABITAT ASSESSMENT DATA CARD

[1]District:	[2]Rd. System:	[3]Road #:	[4]M.P.: __ __ . __ __	[5]Page of

[6]Date: / /	[7]Surveyor(s):	[8]Gear:	[9]Class: _	[10]Stage: L M H

[11]Reason for the transition from Class I to II or for end of fish habitat.   Gradient   Barrier   Insufficient Stream Energy   Other:

[12]Reach	[13]Class	[16]P.G.	[15]Rmrks	[16]Start (meters)		[17]End (meters)	XING GPS Acc:	[18]Distance End of stream section (meters)									
								50	100	150	200	250	300	350	400	450	500
							[19]acc										
							[20]grad										
							[21]bdw										
							[22]bfw										
							[23]incs										
							[24]cntrl										
							[25]fish										
							[26]pool										

Comments (Include 100m DS observations: Class, P.G., barrier, fish species?):

Length of Fish Habitat Upstream of Red Crossings

n=1,579

Mean = 418 meters
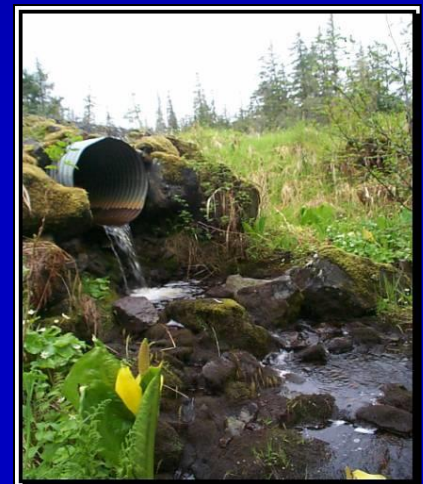
Median = 220 meters
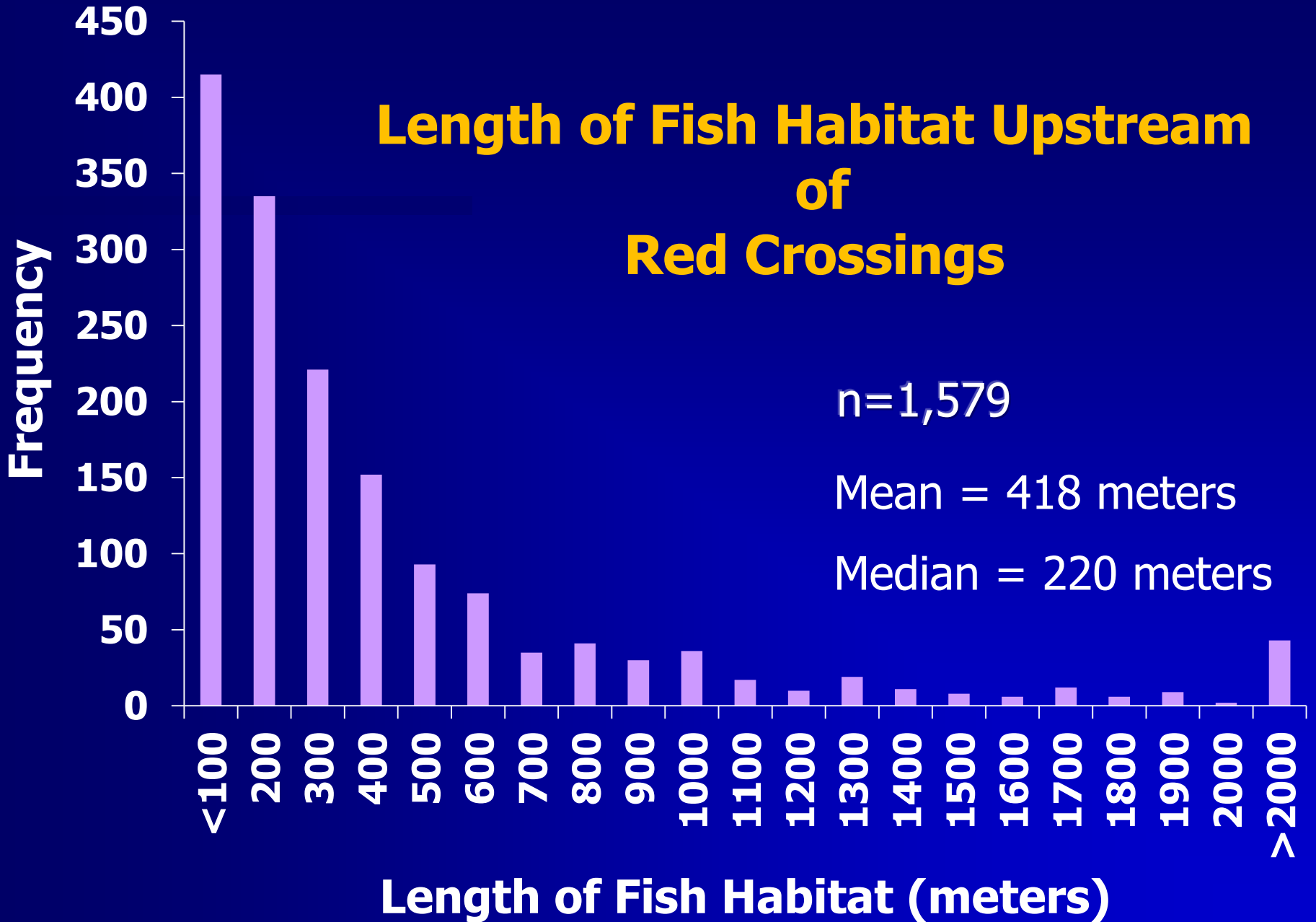
Tongass Fish Passage

Inventory

Passage Analysis

Biological Evaluation and Prioritization

Remediation Status

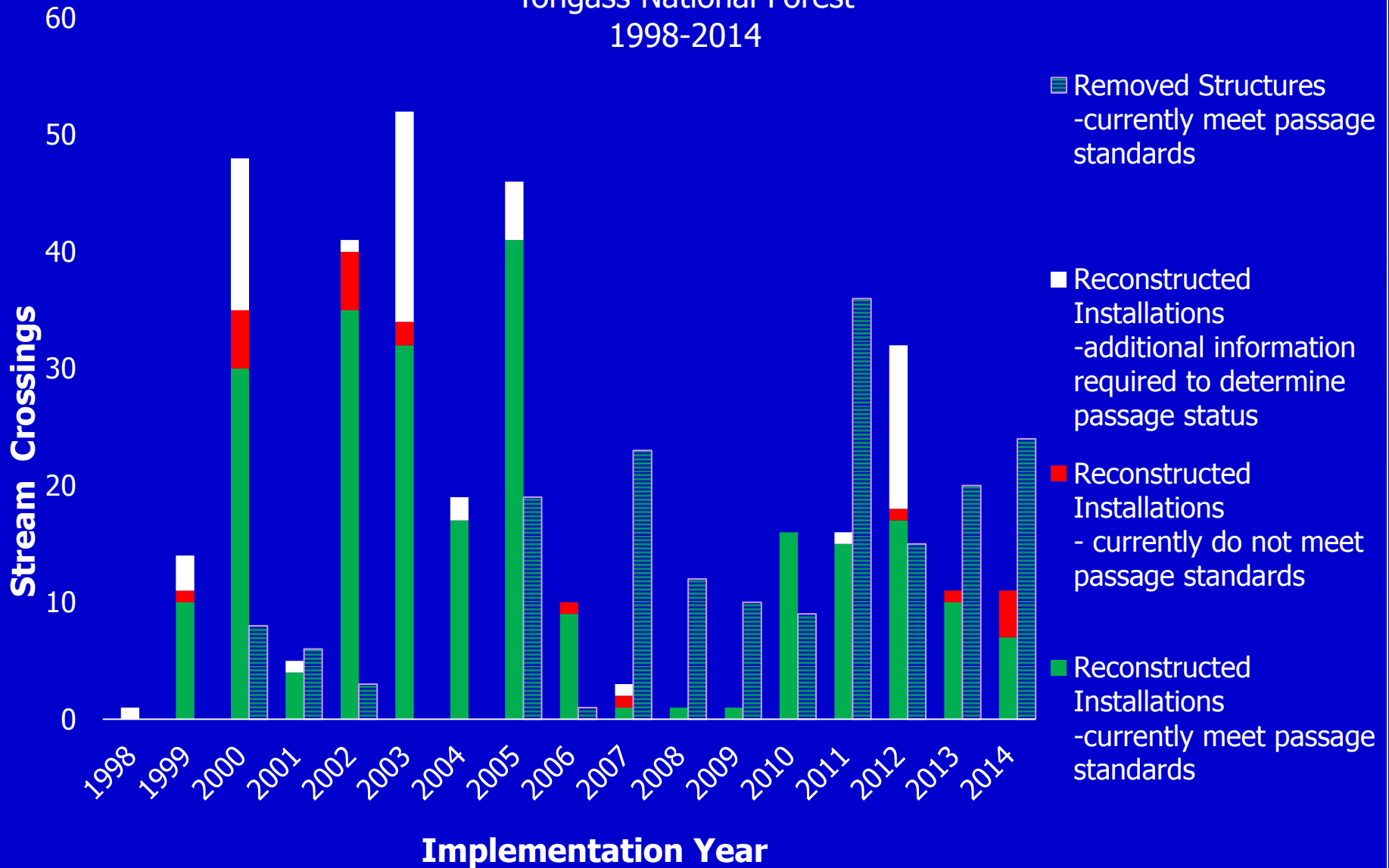Remediation

Redesign and Reinstall

Retrofit

Remove

Mitigate

Aquatic Organism Passage Remediation
Tongass National Forest
1998-2014

Tongass Fish Passage
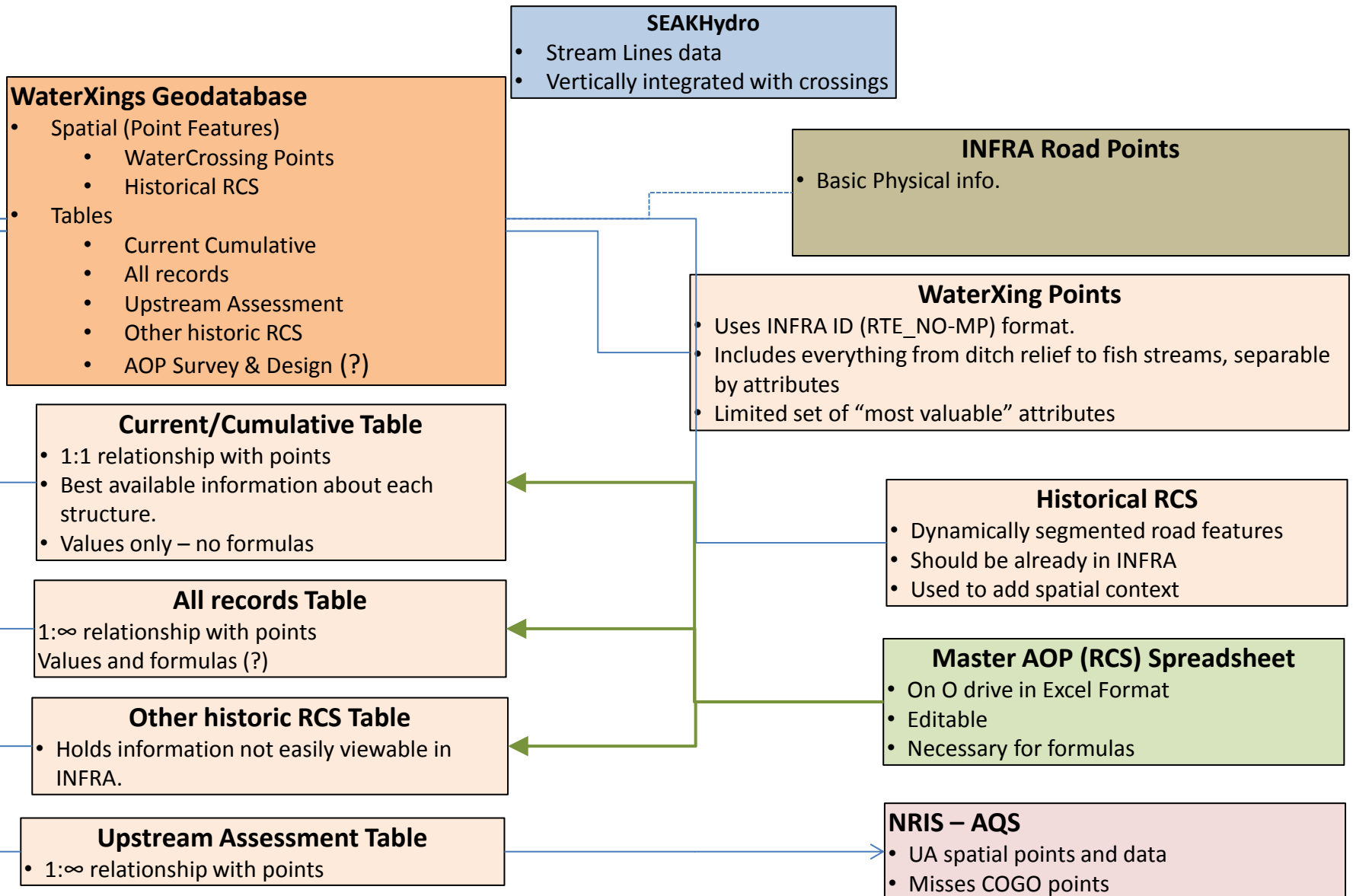
Inventory Methods

Passage Assessment

Biological Evaluation and Prioritization

Remediation Status

Data Management

WaterXings: Data management of current and historic road-crossing information for the Tongass National Forest

SEAKHydro
- Stream Lines data
- Vertically integrated with crossings

WaterXings Geodatabase
- Spatial (Point Features)
    - WaterCrossing Points
    - Historical RCS
- Tables
    - Current Cumulative
    - All records
    - Upstream Assessment
    - Other historic RCS
    - AOP Survey & Design **(?)**

INFRA Road Points
- Basic Physical info.

WaterXing Points
- Uses INFRA ID (RTE_NO-MP) format.
- Includes everything from ditch relief to fish streams, separable by attributes
- Limited set of "most valuable" attributes

Current/Cumulative Table
- 1:1 relationship with points
- Best available information about each structure.
- Values only – no formulas

Historical RCS
- Dynamically segmented road features
- Should be already in INFRA
- Used to add spatial context

All records Table
1:∞ relationship with points
Values and formulas (?)

Master AOP (RCS) Spreadsheet
- On O drive in Excel Format
- Editable
- Necessary for formulas

Other historic RCS Table
- Holds information not easily viewable in INFRA.

Upstream Assessment Table
- 1:∞ relationship with points

NRIS – AQS
- UA spatial points and data
- Misses COGO points

NATIONAL INVENTORY AND ASSESSMENT PROCEDURE—For Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings

Based on several other fish passage evaluation procedures including: Taylor and Love (2001), USDA Forest Service Region 10 (2001) and USDA Region 6.

Diffs from R10 Protocol:
- Complete tailwater x-section
- Fill volume estimate
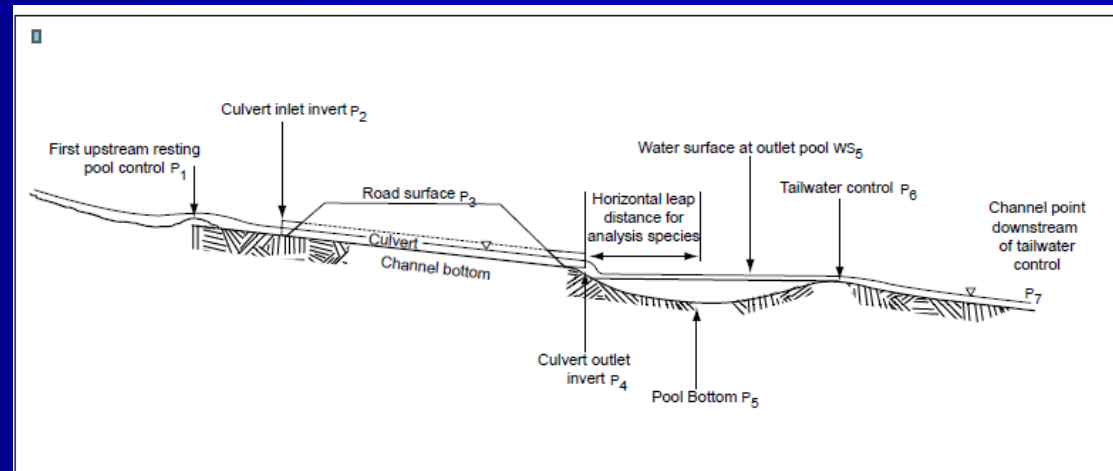- 5 bankfull measurements
- Other optional additions

Figure E-12. Long profile survey points.

Questions?