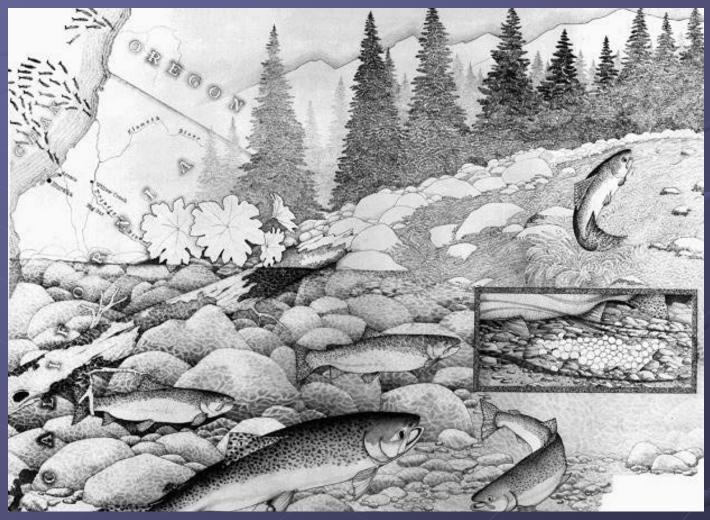


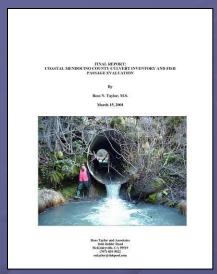
# Five Counties Salmonid Conservation Program



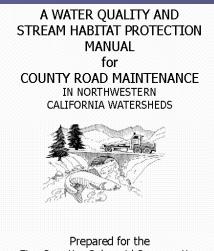
Roads Webinar, May 21st, 2012



### Watershed Planning Tools



Migration
Barrier
Inventories
&
Prioritization



Five Counties Salmonid Conservation Program

**Roads Manual** 



Five Counties Salmonid Conservation Program P.O. Box 2819 Waterola, Co. 5019

Road Design Guidelines for Low Impact to Hydrology

I. General

Purpose and Intent. Provide Low Impact to Hydrology (LITH) Design Guidelines that can be considered for adoption as County Road Design Standards where appropriate. In addition, LITH design Standards where the control of the County County of the County of the County County of the County County of the County of

The 1998 University of California Cooperative Estension's "Effects of County Lund Use Regulations and Menagement on Anaderous Sadmonda and Their Habitats: Humbold, Del Norte, Mendocino, Sishiyou and Trinity Counties," included the following in Recommendation 50th to the county.

"... Fish-friendly alternatives to generic CalTrans and ASHTO road standards should be developed."

During the UCCE measurement process, it was determined that the road design standards for the counties were based on convent of intology designs into diction. Indeed eithings in the control were resulted in the control of intology designs into diction. Indeed eithings make it is resulted to one result in downcuting and enlargement of dinthes, acceleration of cutberly encount and/or plagging, and devenion across a road. An additional road design to societamentate outslope road segments, was recognized as desirable. The design, however, would have to meet anticy, speed and thoughpuble design.

The U.S. Forest Service, the National Pack Service, the USDA Natural Resource Conservation. Service, Cultiform Department of Foresty and Fee Potenties, and surprised forest somewhole Service. Sufficient Department of Foresty and Fee Potenties, and surprised commonly referred to an "Low Impact to Mydrodege" (LTIF). The goal of the LTIF design spreach is to make the less disruptive to natural watersheld runoff processes. This is generally accomplished by "outspings rooks" in lice of fensionising inboard offices and installing "rolling dips" in lice of

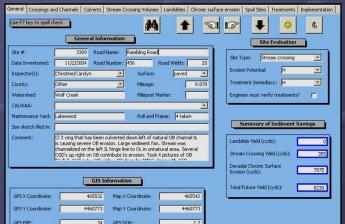
\* Howard Dashiell, CA Registered Civil Engineer (principal author) and Mark Lancaster, CA Registered Professional Forester

5C Read Design Guidelines for Low Impact to Hydrology

Page 1 of 9

LITH Standards





Addressing Road-Related
Sedimentation

5 Counties Salmonid
Conservation Program

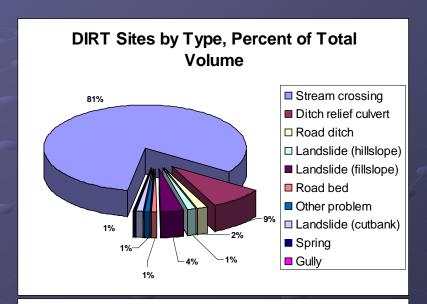
FUNDED BY
California Department of Fish & Game
Fisheries Restoration Grant Program

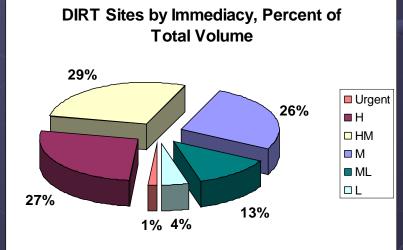
**DIRT Inventories & Prioritization** 

Workshops & Training Tools

# County Road Direct Inventory of Roads and Treatments (DIRT) Sediment Source Inventory

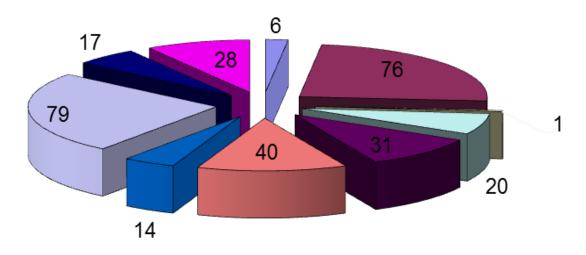
	Volume Yd <sup>3</sup>	Sites
Stream crossing	2,958,981	6299
Ditch relief culvert	315,775	2454
Road ditch	61,378	381
Landslide (hillslope)	44,385	24
Landslide (fillslope)	134,563	76
Road bed	31,593	217
Other problem	33,282	89
Landslide (cutbank)	36,490	32
Spring	7,249	80
Gully	2,511	9
Total	3,626,205	9,661





#### County Road Sediment Treatments

Figure 2. 2008-2010 Road Drainange Treatments 5C Counties



- New Culverts
- ■Enmergency Overflow Culverts
- Critical Dips at Steam Crossings
- ■Outsloped Road
- Road Surfacing

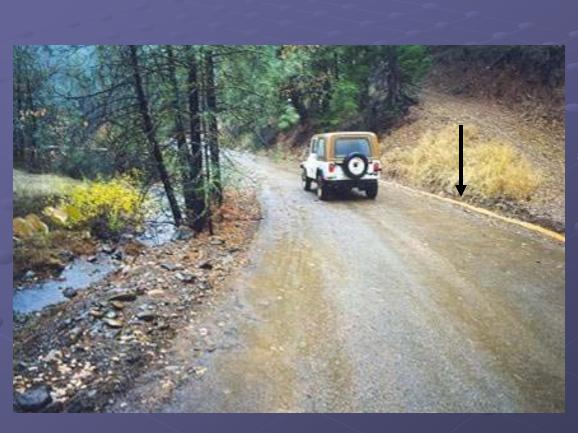
- Upgraded/Replaced Culverts
- □ Ditch Relief Culverts
- Other Stream Uprades
- ■Rolling Dips
- Excavtions (berms, slides, spoils)

### Ditch And Hillslope Delivery



Ditch Activated Erosion Include: Bank Sluff, Bank Slumps, Bank Slides, Bank Surface Erosion, Ditch Downcutting, Ditch Enlargement, Ditch Diversion and Road Cutting

# Ditch And Hillslope Delivery





#### Disconnecting Ditches and Hillslopes

Restore More Natural Slope Runoff Processes With Eliminating the Ditch By Outsloping Where Feasible

Reduces Diversion
Potential of
Stream/Storm Runoff

Reduces Routine Maintenance and Cutbank Erosion

Public Road Options For Outsloping More Limited Than Private Roads

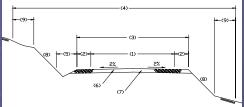














#### Five Counties Salmonid Conservation Program

F.O. Box 2019
Theoretic, CA 16019
GSR 413+1515 Bet 5-PAX 5538 413+1515 Bet 5-PAX 5538 413+1515

#### Road Design Guidelines for Low Impact to Hydrology

#### I. Gener

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\*... Fish-friendly alternatives to generic CulTraza and ASHTO road standards should be developed.\*

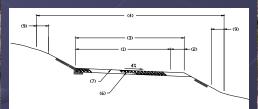
During the UCCB assessment process, it was determined that the road design standards for the creation were based on convened or inclope duringer into disthes. Inhose of disthes, in some instances on they or steep gradient and/or in credible soils can result in downsetting and enlargement of disthes, acceleration of cuttent results under plagging, and downson across a road. An additional road draign to accommodate outslope road regenerat, was recognized as desirable. The draign, however, would have to meet addity, openful and top-graphs design.

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Howard Dashiell, CA Registered Civil Engineer (principal author) and Mark Lawarder, CA Registered Professional Former

5C Read Design Guidelines for Low Impact to Hydrology

Page 1 of 9



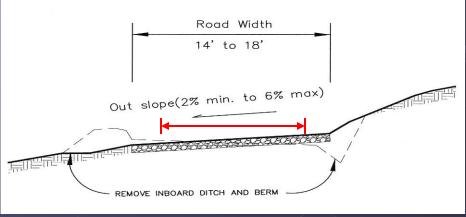
















### Low Impact To Hydrology Road Designs



In some instances even paved roads can be outsloped



## Disconnecting Ditches and Hillslopes Ditch Relief Culverts











# Disconnecting Ditches and Hillslopes Ditch Relief Culverts & Class III Culverts





- Disconnect Excessive Ditch Flow
- Reconnect Streams to Natural Channels





- Properly Size
- No Shot Gun Placements
- Place at Proper Angle
- Plastic vs. Metal Culverts
- Critical Dips
- Downspouts and Energy Dissipaters







#### Shot Gu Placements

- Place at Proper Angle
- Properly Size
- Plastic vs. Metal Culverts?
- Critical Dips
- Downspouts and Energy Dissipaters





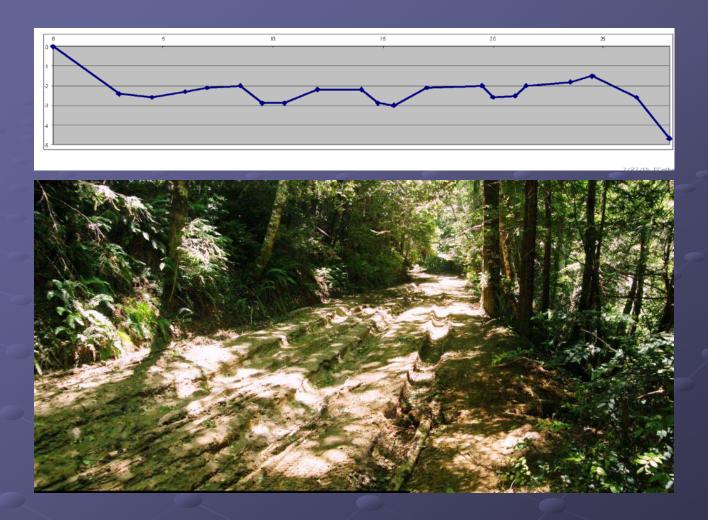






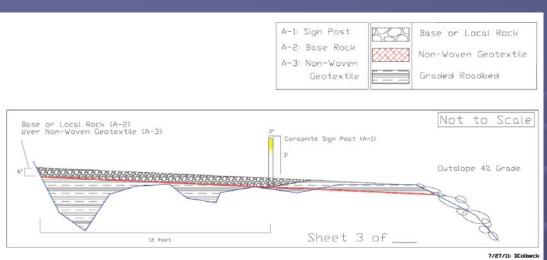


## Ditches and Through Cuts



In Board Ditches Combined with Out Board Berms Trap Water in the Road

## Through Cut Treatments







Fill the In Board Ditch, Outslope the Road, Remove the Berm, Breach the Berm, Add Geo Fabric & Rock Surface



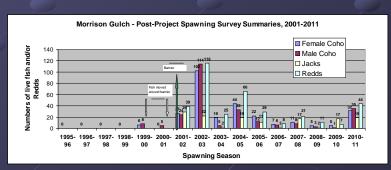
#### Fish Passage Improvement

- 70 Projects\* since5C inception
  - 147 miles of habitat\*
  - \$16 Million\*
  - 15+ Designs
  - 24+ remaining priority sites

\* 60 County Projects







#### Migration Barrier Modification Approaches



**Retrofitted Bottom** 





Metal Arch W/Embedded Weirs





Concrete Vortex Weir



# Migration Barrier Modification Approaches



Metal Arch W/Concrete Headwalls



Concrete Arch



Post Stressed Concrete Bridge







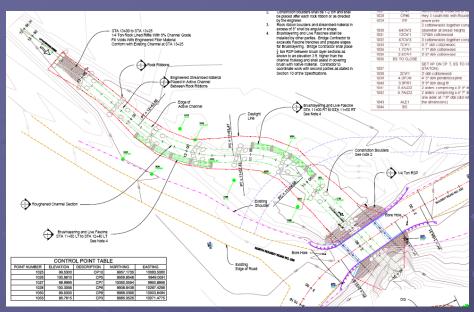
# Little Browns Creek Migration Barrier Removal Project- "Hollywood Production"

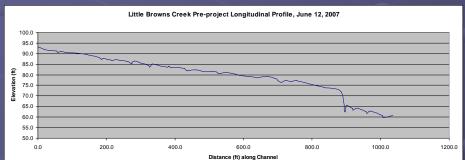


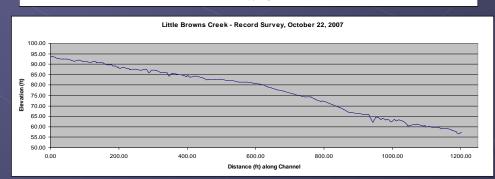


- Three 48" culverts; ~50 feet long@ 3-4% slope
- 8-foot jump at culvert outlet
- ~1,400 cyds aggraded sediment upstream
- Severe headcutting from 1 mile downstream to outlet
   & outboard fill face erosion

### Little Browns Creek Project Design







Watershed Area= mi<sup>2</sup>
Channel Gradient= 6%
24 Hour Rainfall Intensity=
2.26"/Hr
Q<sub>100</sub> Flow= 743 Ft<sup>3</sup>/Sec (cfs)
Depth of Q100= 46"
Velocity at Q100= 7 Ft/Sec
Bank Full Channel Width\*= 20'
Excavation Volume Removed=
1,400 yd3

#### Permitting:

- CDFG 1602 StreamAlteration Agreement
- 401 Water Quality Certification
- Nationwide 27

NEPA Categorical
Exclusion/Browns EIS
CEQA Categorical

Exemption 15333

### Little Browns Creek Bridge Construction



Foundation Pilings









Poured In Place Concrete Bridge

# Roughened Channel









# Roughened Channel









### Bio-Engineered Stream Banks









Brush Mattress & Fascine

# Large Wood Placement







# Large Wood, Bio-Engineered Stream Banks and Jetting Soils In Place











## December 2007 Flows



## February 2008 Flows



#### Funding:

- State Coastal Conservancy
- NOAA Open Rivers Initiative
- Partners for Fish & Wildlife (USFWS)
- Trinity River Basin Fish & Wildlife Restoration Program

Total Cost- \$600,000\*

# Little Browns Creek Long Term Channel & Biological Monitoring







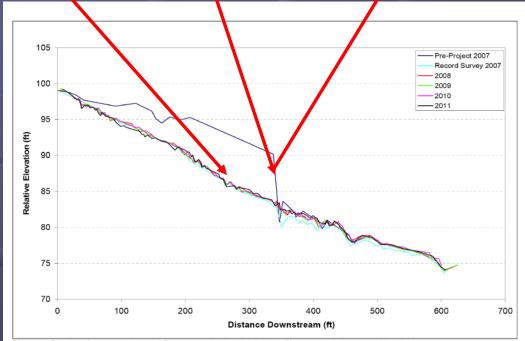
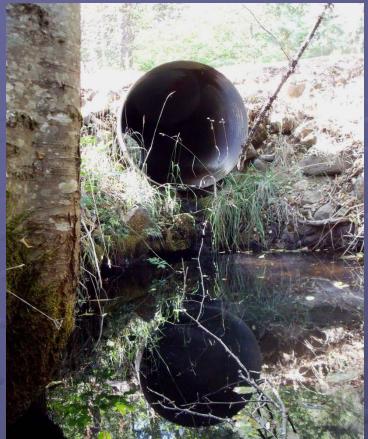


Figure 1. Overlay of the pre-project and five post-project longitudinal profiles surveyed between 2007 and 2011.

#### Finley Gulch- "Home Movie"

By RPF Productions

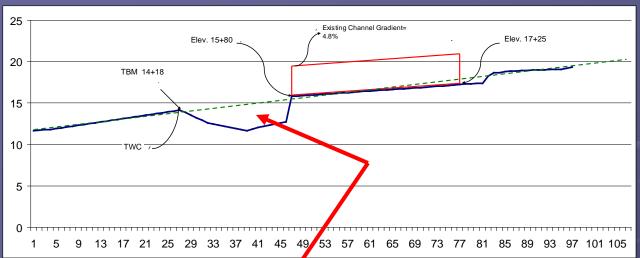
Before

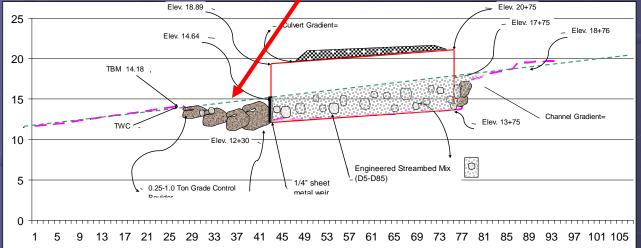


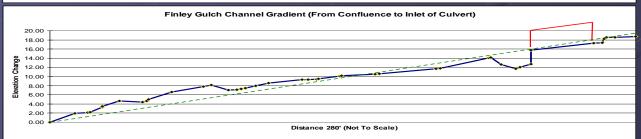


- 280 Acre Watershed- Small Stream With Colder Water Than Little Browns Creek
- Perennial Cold Water Pools Upstream of Crossing- Fed By Subsurface Springs. Stream Was Not On Anybody's List As Fish Stream
- Excellent Outlet Pool & Monitoring Found ~50 YoY & 1+ Steelhead in Spring and 2-4 "Really Big and Happy" 1+ Steelhead in Pool in the Fall
- Before the Project- 42" CMP Culvert With 18" Jump; After 84" Culvert Embedded 33" With 5" Jump Left As Experiment To Look At Ways To Retain An Outlet Pool

#### Finley Gulch "Home Movie"







Watershed Area= 0.45 mi<sup>2</sup>
Channel Gradient= 6.5%
24 Hour Rainfall Intensity= 2.26"/Hr
Q<sub>100</sub> Flow= 113 Ft<sup>3</sup>/Sec (cfs) W/C
Depth of Q<sub>100</sub>= 46"
Velocity at Q<sub>100</sub>= 7 Ft/Sec
Headwall/Depth Ratio= 1.1:1
Bank Full Channel Width\*= 6'

Passage Flows:

Anadromous Adult Salmonids = 3.0 to 26.4 cfs
Resident Trout/2+ Juveniles = 2.0 to 16.0 cfs
1+/Young-of-Year Juveniles = 1.0 to 5.3 cfs

Adult Passage Criteria:

Prolonged Swim Speed =

8.0 Ft/Sec.

Burst Speed =

16.0 Ft/Sec.

Minimum Passage Donth —

Minimum Passage Depth = 0.5'

## Finley Gulch



Fish Relocated Upstream But the Outlet Pool Was Not Drained Until Streambed Mix Time



The New Channel Included An Embedded Bottom Culvert
That Spanned the Active Channel Width of <6'

#### Finley Gulch Installing Streambed Mix



Determine The Proper (D<sub>5</sub>-D<sub>84)</sub> Streambed Mix And Install Using Compaction and Jetting to Seal Fines Within the Larger Gravel/Cobble/Boulder Matrix

# Finely Gulch Water Quality Protection

































# Bank Stabilization & Bio-Engineering



















# Climate Change Considerations On Road Maintenance and Upgrades









# Climate Change Considerations On Road Maintenance and Upgrades

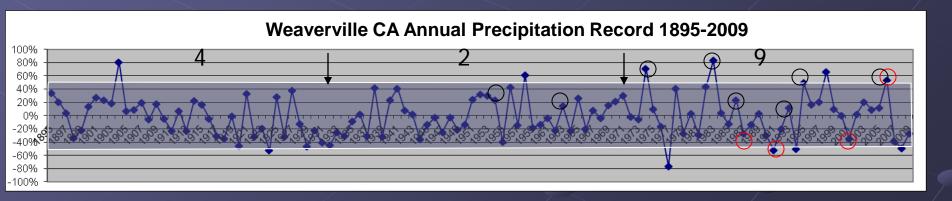
Changes in precipitation patterns are expected to increase the chances of both drought and flood conditions in many areas... greater rates of evaporation due to warming surface temperatures, is projected to lead to decreased soil moisture and drought in many regions...anthropogenic climate change will likely lead to a more vigorous hydrologic cycle with... greater probability for intense precipitation and

flooding in many regions. http://www.britannica.com/EBchecked/topic/235402/globalwarming/274848/Precipitation-patterns

"Our analysis further demonstrates that existing precautionary allowances for climate change used for flood management may not be sufficiently robust in NE England and east Scotland. These findings imply that for certain types of flood mechanism, adaptation decisions might have to be taken in advance of formally detected

changes in flood risk." Detecting changes in seasonal precipitation extremes using regional climate model projections: Implications for managing

fluvial flood risk. H. J. Fowler and R. L. Wilby



**Highways and Climate Change** 

FHWA > HEP > Highways & Climate Change > Resources > Regional Climate Change Effects

# Regional Climate Change Effects: Useful Information for Transportation agencies

#### Increases in intense

precipitation events

- Increases in weather-related delays and traffic disruptions
- Increased flooding of evacuation routes
- Increases in flooding of roadways and tunnels
- •Increases in road washout, landslides, and mudslides that damage roadways
- Drainage systems likely to be overloaded more frequently and severely, causing backups and street flooding
- Areas where flooding is already common will face more frequent and severe problems
- •If soil moisture levels become too high, structural integrity of roads, bridges, and tunnels (especially where they are already under stress) could be compromised
- Standing water may have adverse effects on road base
- •Increased peak streamflow could affect scour rates and influence the size requirement for bridges and culverts

#### **Highways and Climate Change**

<u>FHWA</u> > <u>HEP</u> > <u>Highways & Climate Change</u> > Resources > Regional Climate Change Effects

Increases in drought conditions

Changes in seasonal precipitation and stream flow patterns

- Increased susceptibility to wildfires, causing road closures due to fire threat or reduced visibility
- •Increased risk of mudslides in areas deforested by wildfires
- Benefits for safety and reduced interruptions if frozen precipitation shifts to rainfall
- Increased risk of floods, landslides, gradual failures and damage to roads if precipitation changes from snow to rain in winter and spring thaws
- Increased variation in wet/dry spells and decrease in available moisture may cause road foundations to degrade
- Degradation, failure, and replacement of road structures due to increases in ground and foundation movement, shrinkage and changes in groundwater
- •Increased maintenance and replacement costs of road infrastructure