Monterey Peninsula Water Management District

Engineered Large Wood

A presentation to the

Carmel River Steelhead Association

- *Engineered logjams (ELJ) in the Pacific Northwest*
- *Large wood installation and management in the Carmel River*

Wednesday, February 10, 2010

by Larry Hampson, Senior Water Resources Engineer

Historical wood jams in large rivers

… today's forest trees do not compare with the first-growth giants that became snags in rivers, many of them three to six feet in diameter and imbedded in the channels to a depth of ten to fourteen feet."

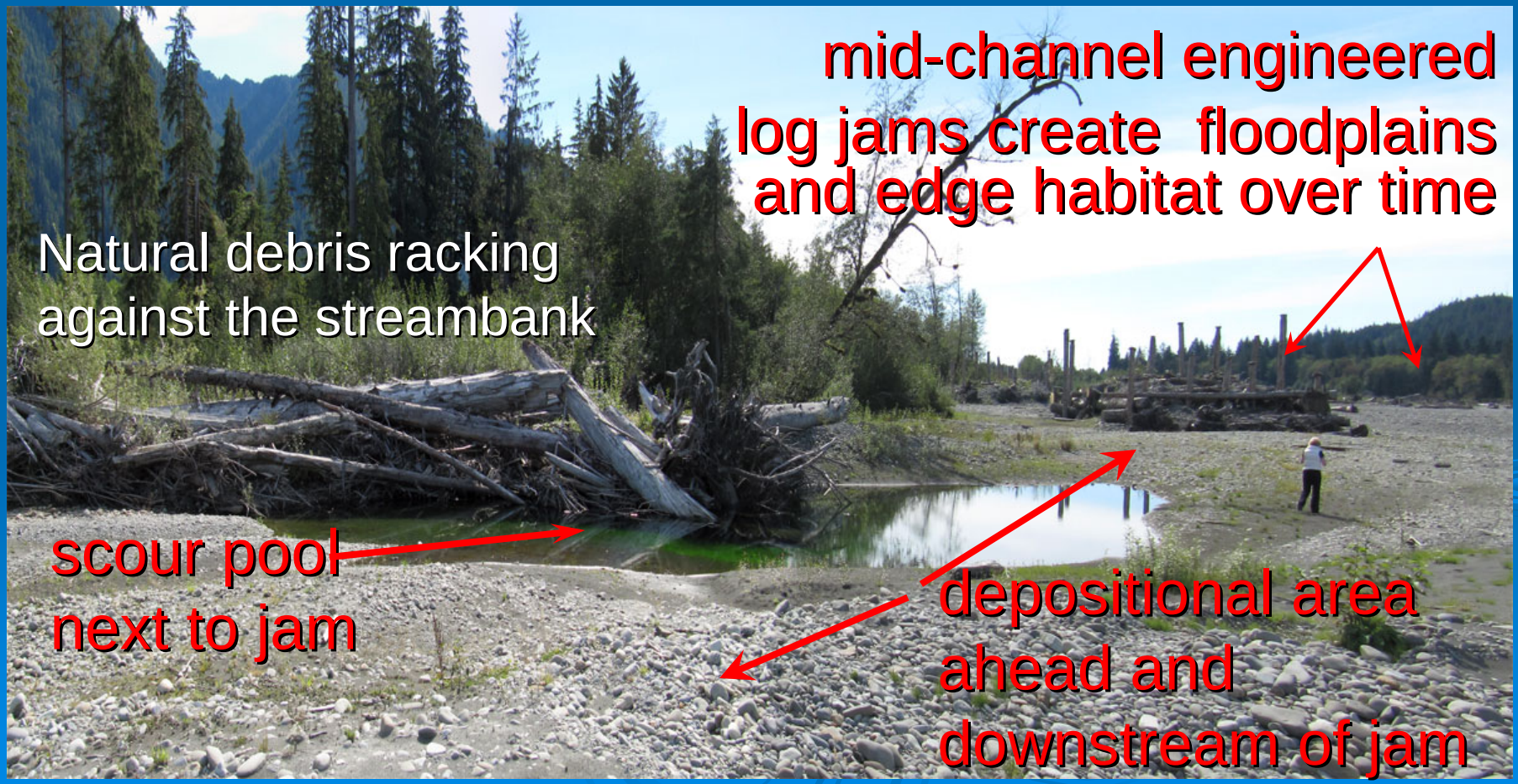
One of several log jams of the Great Red River raft (Vetch 1906).

Wood in Streams

- For hundreds of years, wood has been removed for navigation and commercial purposes, flood control (sometimes mistakenly), to improve fish passage, and to improve substrate for fisheries
- Wood structures such as crib walls, weirs, pile dikes, and deflectors have been used in stream channels for centuries
- Wood has generally not been used for bank protection due to low specific gravity and perceived susceptibility to decay as compared with rock

Natural and man-made log jams Quinealt River, Washington

- primary goal: recreate old growth forests and processes within the meander belt



Scour from secondary current at downstream side of ELJ results in a cut bank with edge and pool habitat

ELJ – Quineault River

cable system for holding the structure together

five-foot diameter log

"Keypiece" log serves as nucleus to anchor smaller wood

Note badly crimped wire clips (damages galvanization).

Debris racking – traps logs, builds jam

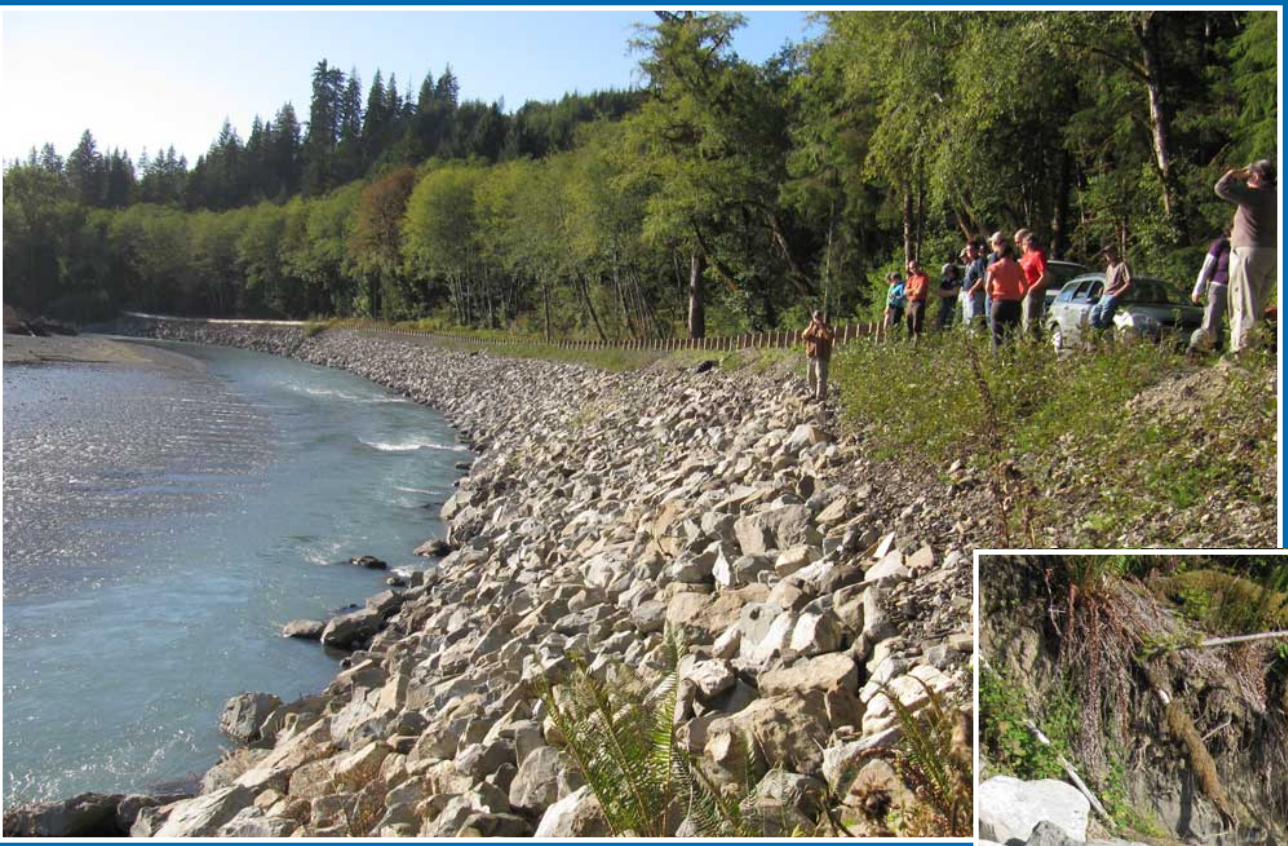
Debris racking close up

Multiple structures along the river guide flows of water, debris, and sediment

- Key pieces for debris racking and stability

- Work is carried out in the summer on floodplain areas (more cost effective)
- Installations are placed to anticipate meandering of river over 10-20 years

Where roads meet rivers



Looking downstream (left)

Looking upstream (below)

Olympic National Park

State of Washington road protection Hoh River

- $11 million installation along 2,500 lineal feet of Hoh River

Rootball deflectors – Hoh River

Anchoring system Hoh River

- chains are connected to logs, rootballs and “H” piles (up to 55 feet deep in volcanic substrate)

Training the Hoh River

Engineered Logjam (ELJ) in the Center of the active channel, Hoh River, Washington

Jimmiecomelately Creek and Estuary restoration in Puget Sound

- 1,800 returning adults within five years after restoration
- Total length of stream available for spawning = two miles

Chum (dog) salmon

Comparison of Hoh and Carmel Rivers

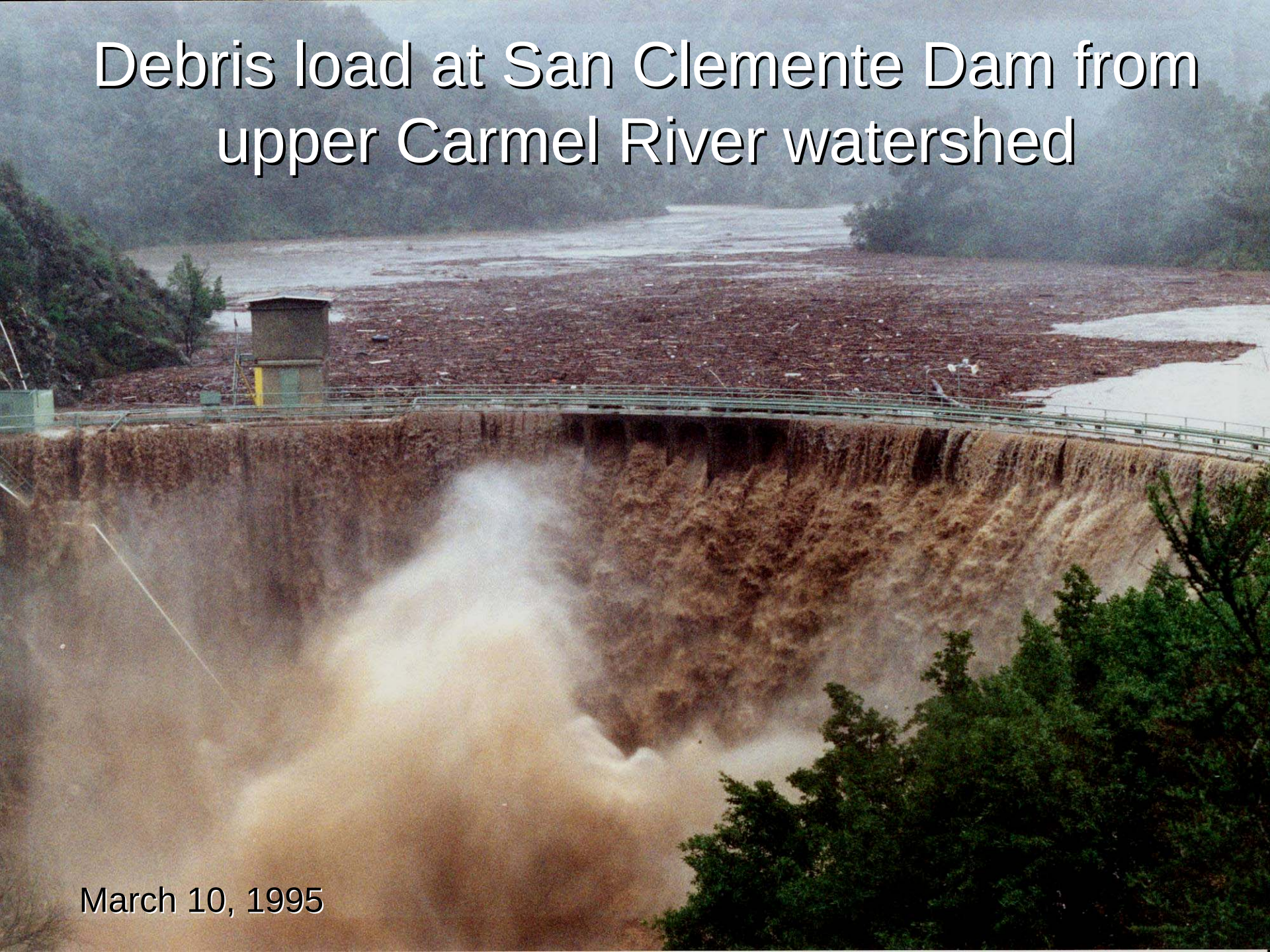
- Hoh River watershed area = 300 sq. mi.
- 58,000 to 60,000 cfs peak in October 2003
- Flow is over unconsolidated glacial deposits
- Meander belt of up to 0.5 mile
- One bridge (Hwy 101)
- National Forest/Park

- Carmel River watershed = 255 sq. mi.
- 16,000 cfs peak in March 1995
- Flow is over unconsolidated alluvial deposits
- Historic meander belt of up to 0.5 mile
- 19 bridges
- >400 property owners

Channel Maintenance in the Carmel River at Farm Center ca 1940s

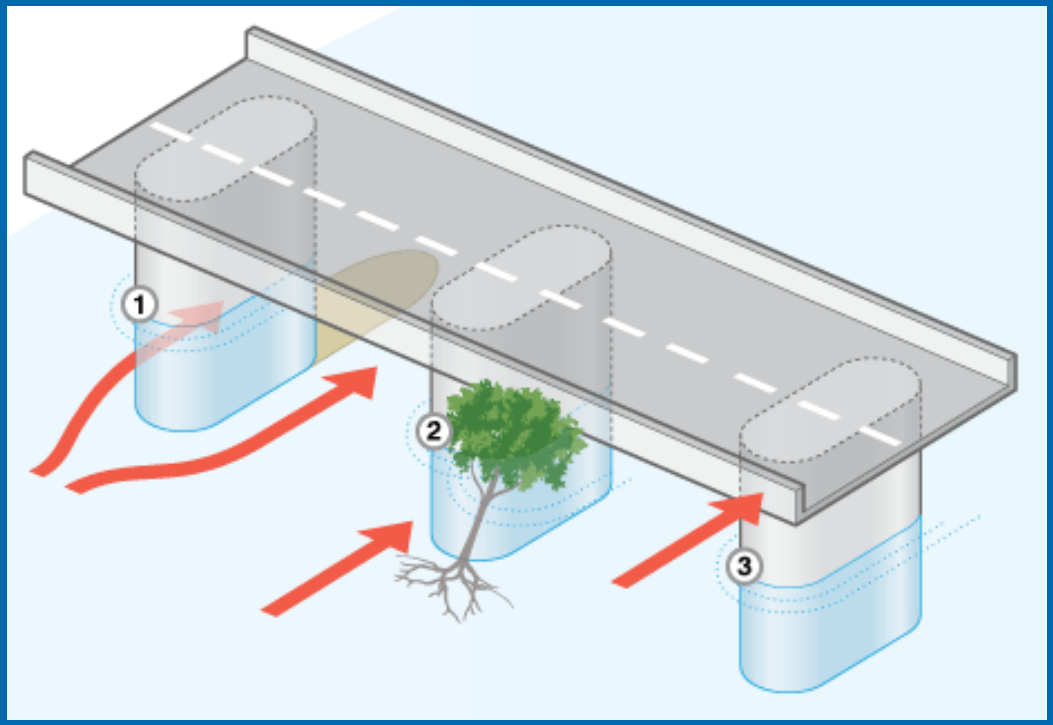
The photographer wrote on the back: “Sand bars can build up in the river channel, divide the flow and divert it on new courses unless a clearance project is maintained from year to year.”

Debris load at San Clemente Dam from upper Carmel River watershed



March 10, 1995

Large wood vs. bridges



1. Fast-flowing floodwater scours away the riverbed downstream of the piers on which a bridge rests
2. The torrent of water also puts immense force on the bridge, made worse if debris piles up creating a dam effect
3. The pressure is greatly increased if the floodwater reaches the deck, or top, of the bridge

Highway 1 Bridge over the Carmel River
Above - March 10, 1995
Below - March 12, 1995

Highway 1 Bridge hit by 120-foot tree – likely a cottonwood from near the Crossroads Center

Debris racking at Rancho San Carlos Road Bridge

Debris racking at Via Mallorca Road Carmel River (click for movie)

Rosie's Bridge – left abutment sustains damage in 1995

Boronda Road Bridge

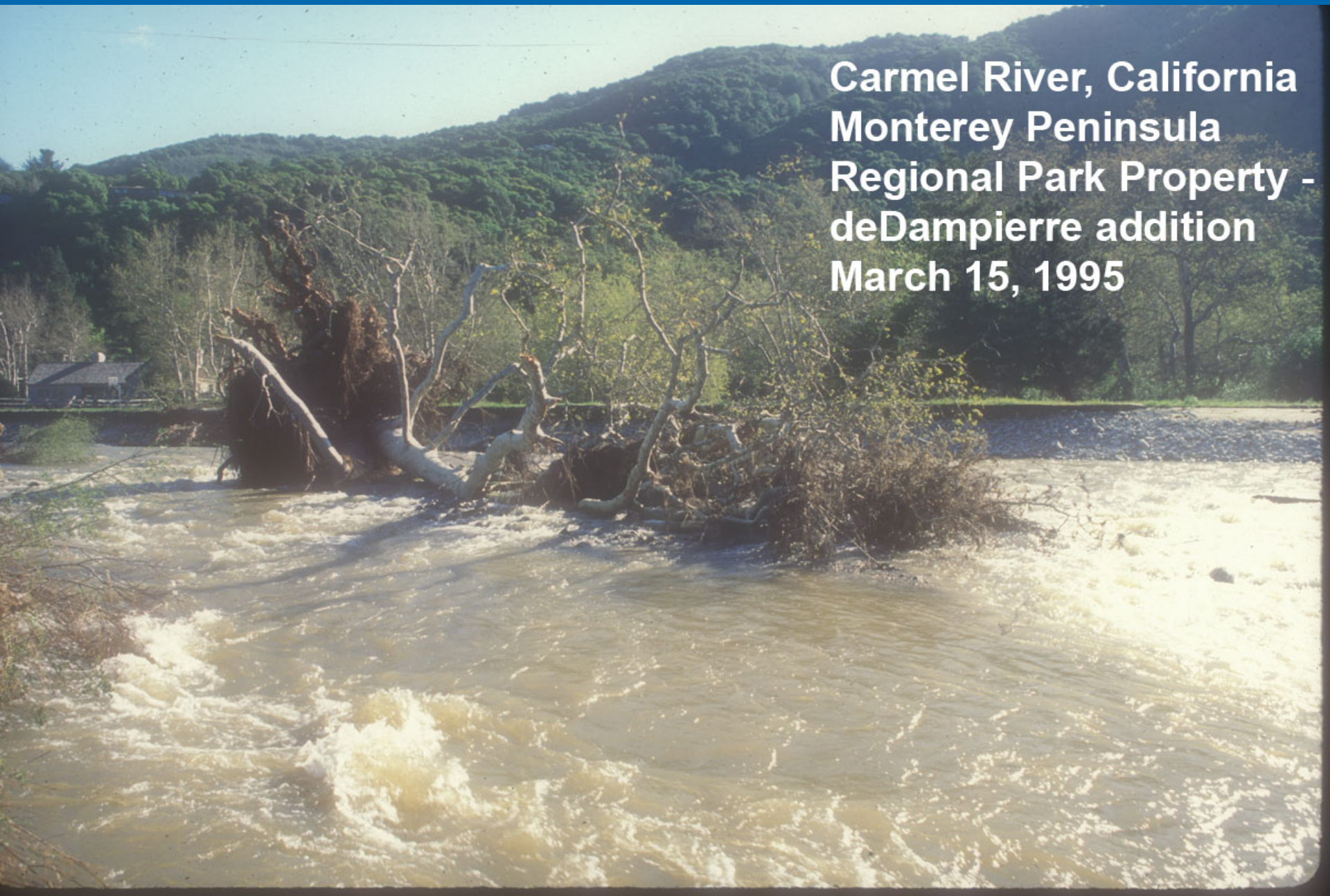
March 10, 1995

May 2002

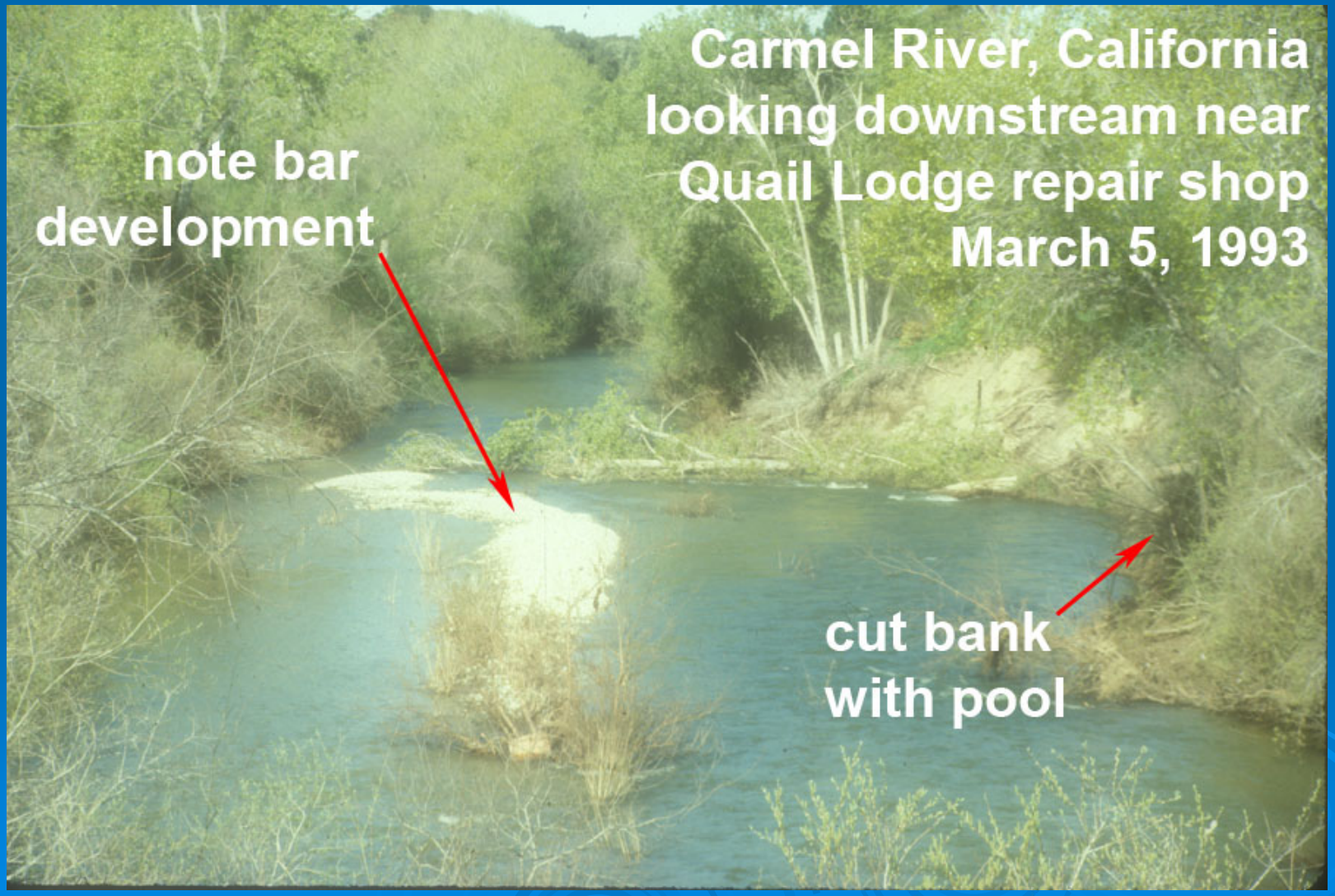
Stonepine Bridge (upper left)
Ward's Bridge (lower right)

Natural Recruitment along Carmel River

Large floods recruit very large trees



Large wood recruitment is associated with channel avulsion



Historic response to large wood recruitment

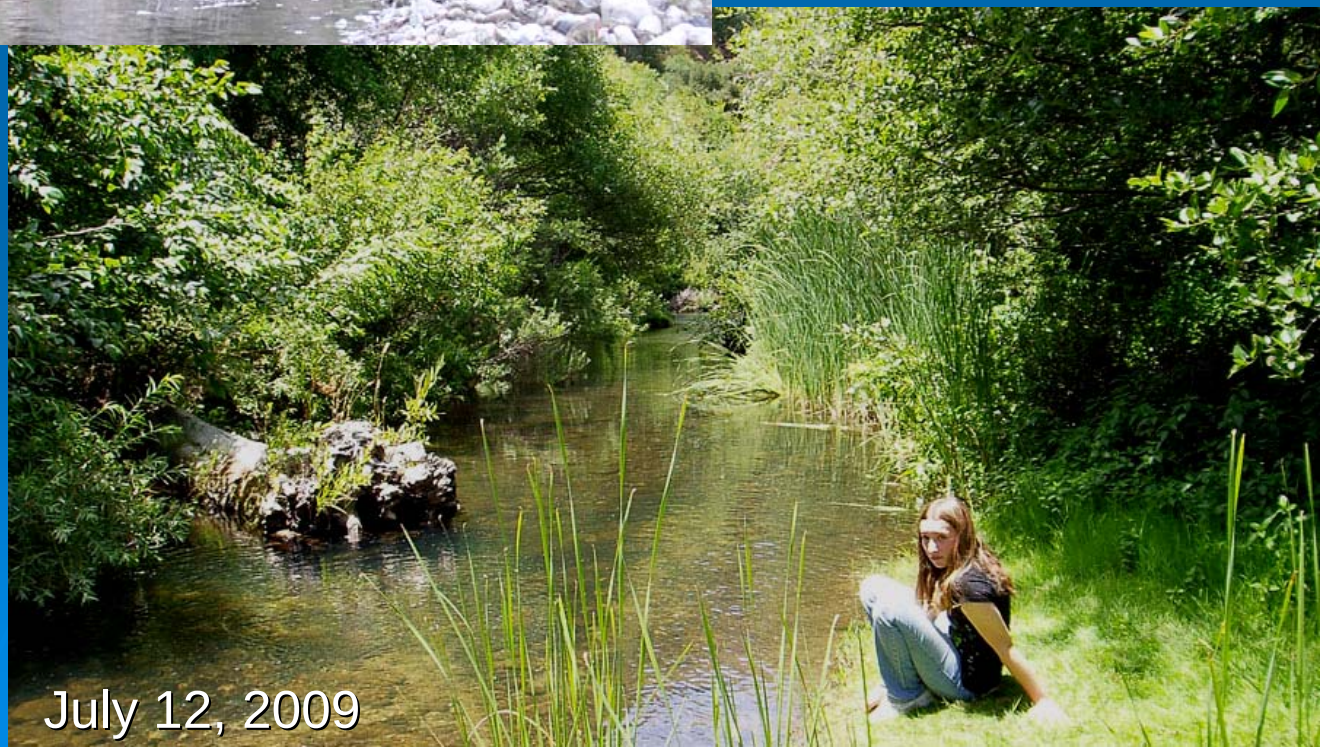
Logs donated to instream habitat project at deDampierre ball fields

UC SANTA CRUZ

BIG CREEK

deDampierre ballfields rootwad and log placement

deDampierre ballfields finished project



All Saints Restoration Project digger log installation

Carmel River Lagoon south arm

Above – 5/18/2009

Right – 6/11/2009

Some common riparian forest tree ages

- Sycamore: avg. 200-300 (up to 500 years)
- Red Willow – short-lived (up to 50 years?)
- Black Cottonwood – up to 400 years
- White Alder – rarely over 50 years

- Portion of a Sycamore found cut near a home in the Carmel River floodplain

Key concepts for future management

- Re-introducing large wood in stream corridors altered by development is at an experimental stage
- Wood should be viewed as another material in the toolbox to control the flow of sediment, change stream dynamics, and improve habitat conditions
- Successful installation requires a multi-disciplinary approach involving engineers, biologists, fluvial experts and river managers.
- We need to know if these installations are working

Conclusion

- Is the “whole valley approach” used in the Hoh River valley feasible or appropriate for the Carmel River?
- How long should large wood projects be designed for?
- How should natural large wood be managed?