ENGINEERED LOG JAMS

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ELJS: OUTLINE

History
Definition
Types of ELJs
Opportunities in ELJ Design
Conclusion

History

- In Europe, North America, New Zealand, and Australia, there is a decrease in large wood in the present day compared to pre-colonization (Wohl et al 2016)
- Large wood has been removed directly to improve navigation and control flooding and indirectly by deforestation, reducing the amount of wood able to enter the system, and channelizing, which reduces the ability of a river to retain wood when it does enter the system (Wohl et al 2016)

Source: https://www.redriverhistorian.com/greatraft.html

Figure: *The Great Raft spanned the Red River, spanning several miles upstream to downstream, before it was removed by the Army Corps of Engineers to allow navigation from New Orleans upstream along the river in the mid-1800s (Lima et al 2019). It's an example of the removal of large wood for navigational purposes in America.*

WHAT IS AN ENGINEERED LOG JAM?

- "An ELJ is a human designed and constructed log structure that emulates the functions of historic naturally-occurring logjams to restore riverine geomorphic, hydraulic, and sediment transport processes" (Abbe et al 2018)

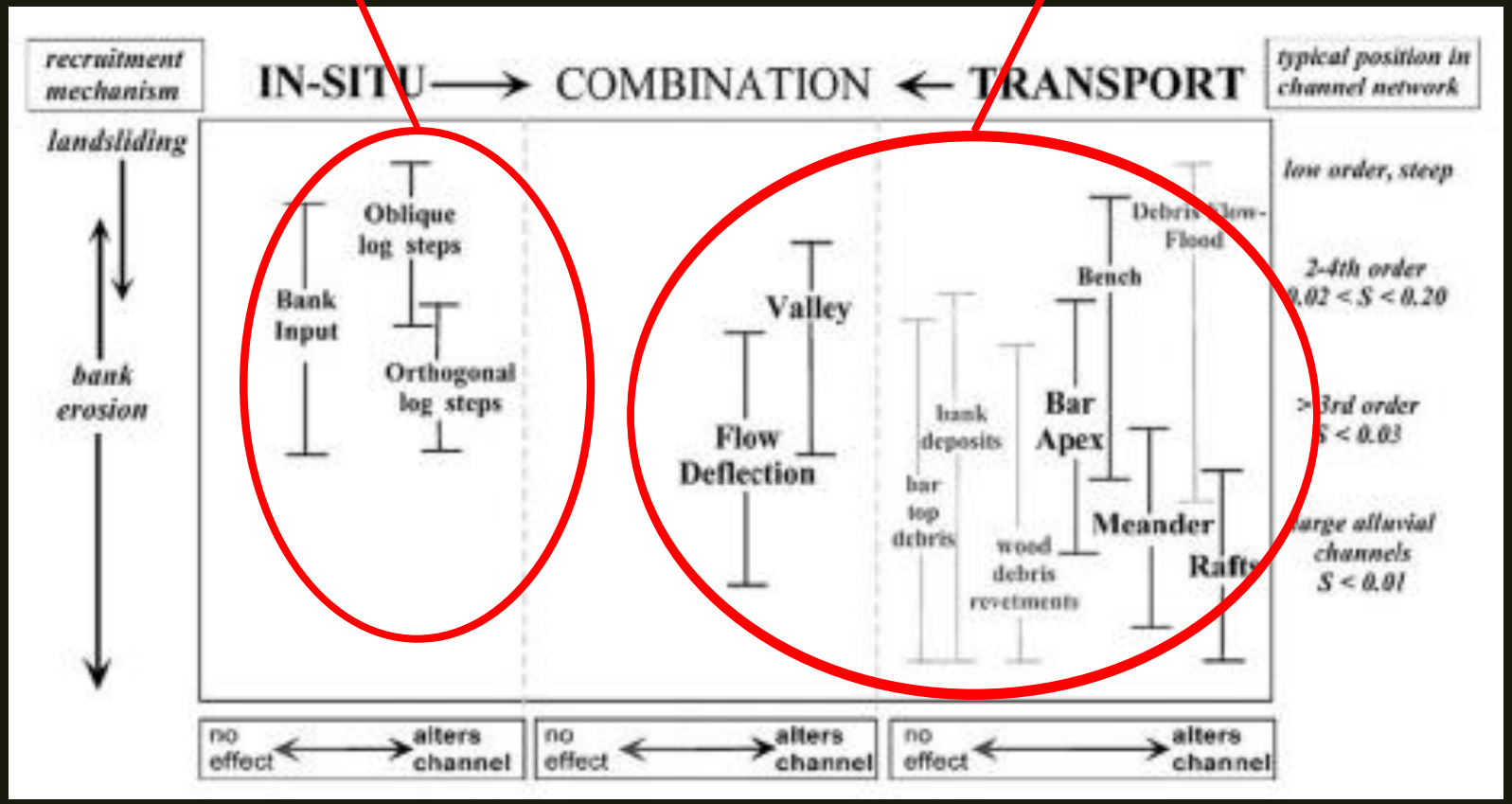
- Applications (Abbe et al 2018):
  - *Reducing Incising*
  - *Bank Protection*
  - *Restore physical processed*

Impacts lateral stream movement

TYPES OF ELJS

Higher up in a stream network, ELJs have less form as naturally they're often from landslides/debris flows

Larger flows downstream require additional anchoring as trees naturally are typically not in the channel due to having to withstand high flow events

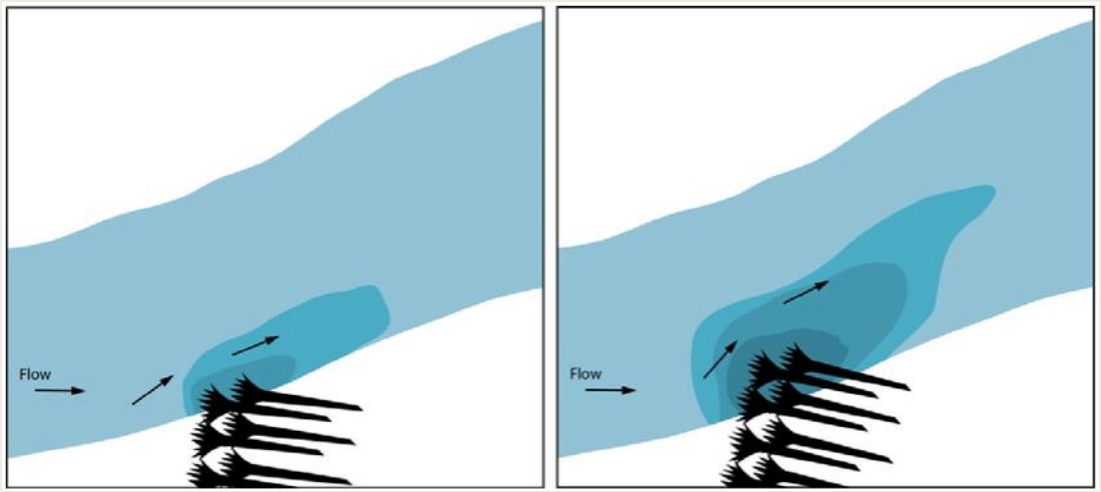


SOURCE: Abbe and Montgomery, 2003

The form and function of an ELJ depends on such factors as stream power (impacted by the order) and how sediment is added to the system

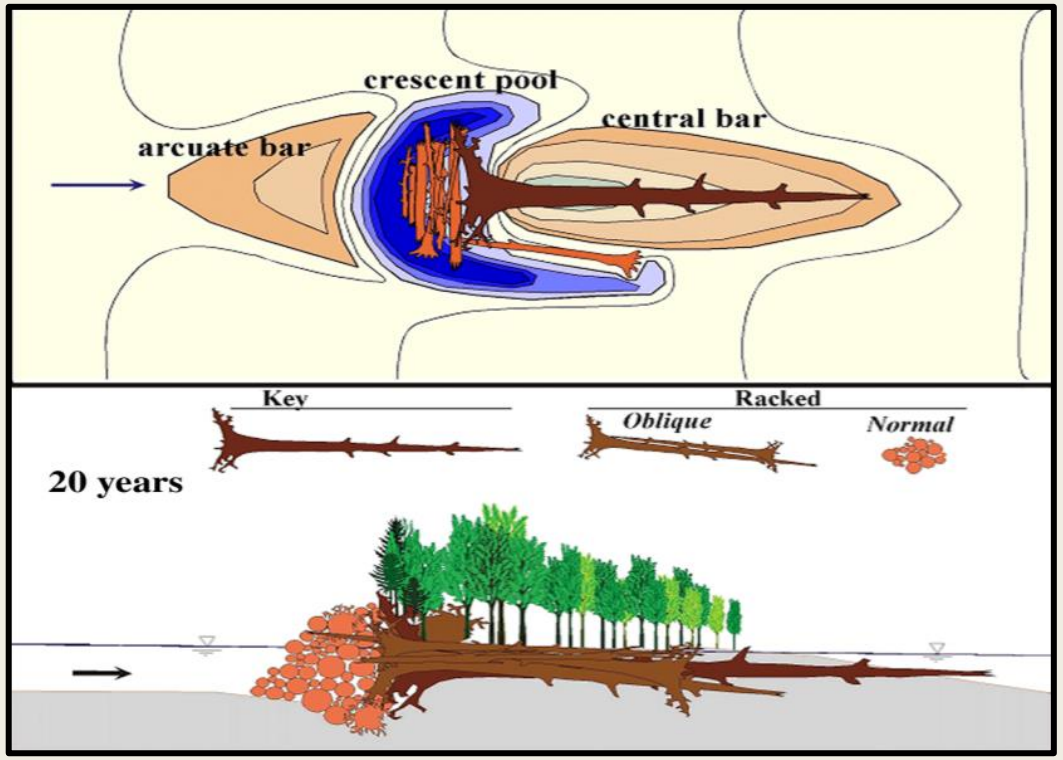
TYPES OF ELJS: EXAMPLES

A flow deflection ELJ



Source: Brooks and Daley 2013

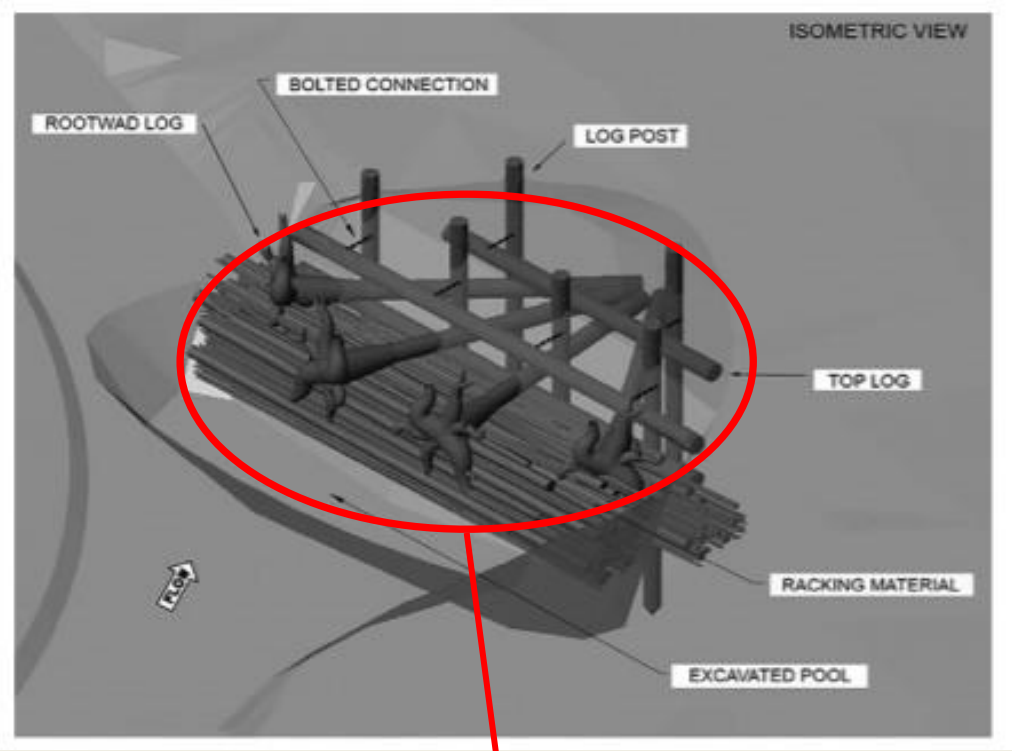
A bar apex ELJ



Source: Fetherston et al 2012

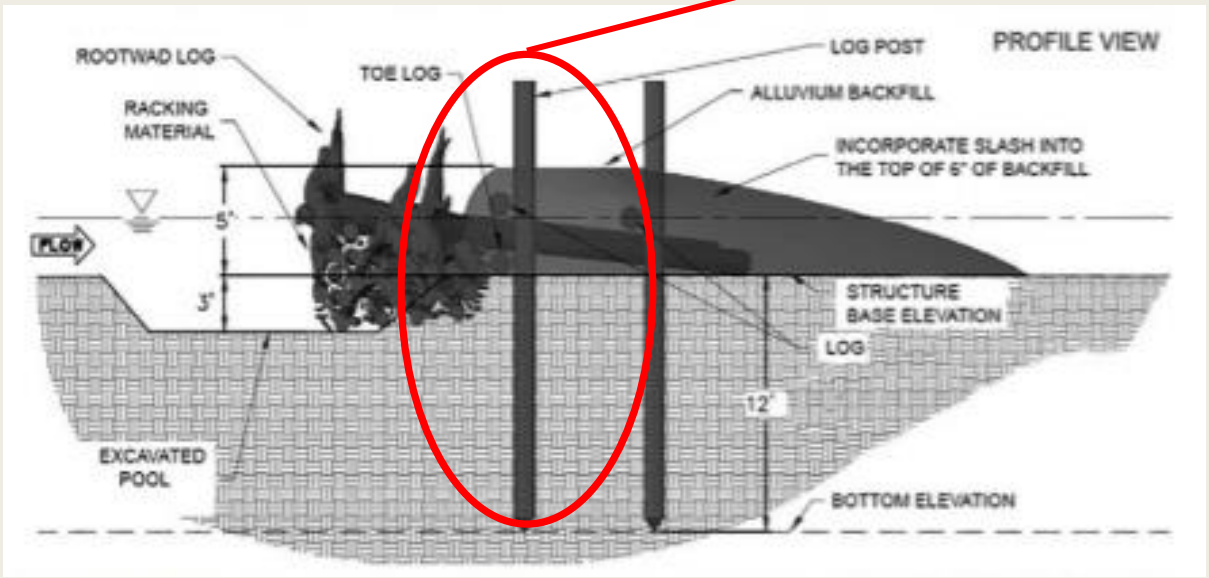
ELJ DESIGN EXAMPLE: Lehmi River

Size: mid-range, withstand flows up to the 100yr event, ~3200cfs



Structure is rootwads stabilized by cross-logs and bolted in place. Aggregate at downstream end for additional stability/ability for vegetation to be established

Stability provided by posts anchored to 12 ft below the bed



Example/Image source: Abbe et al 2018

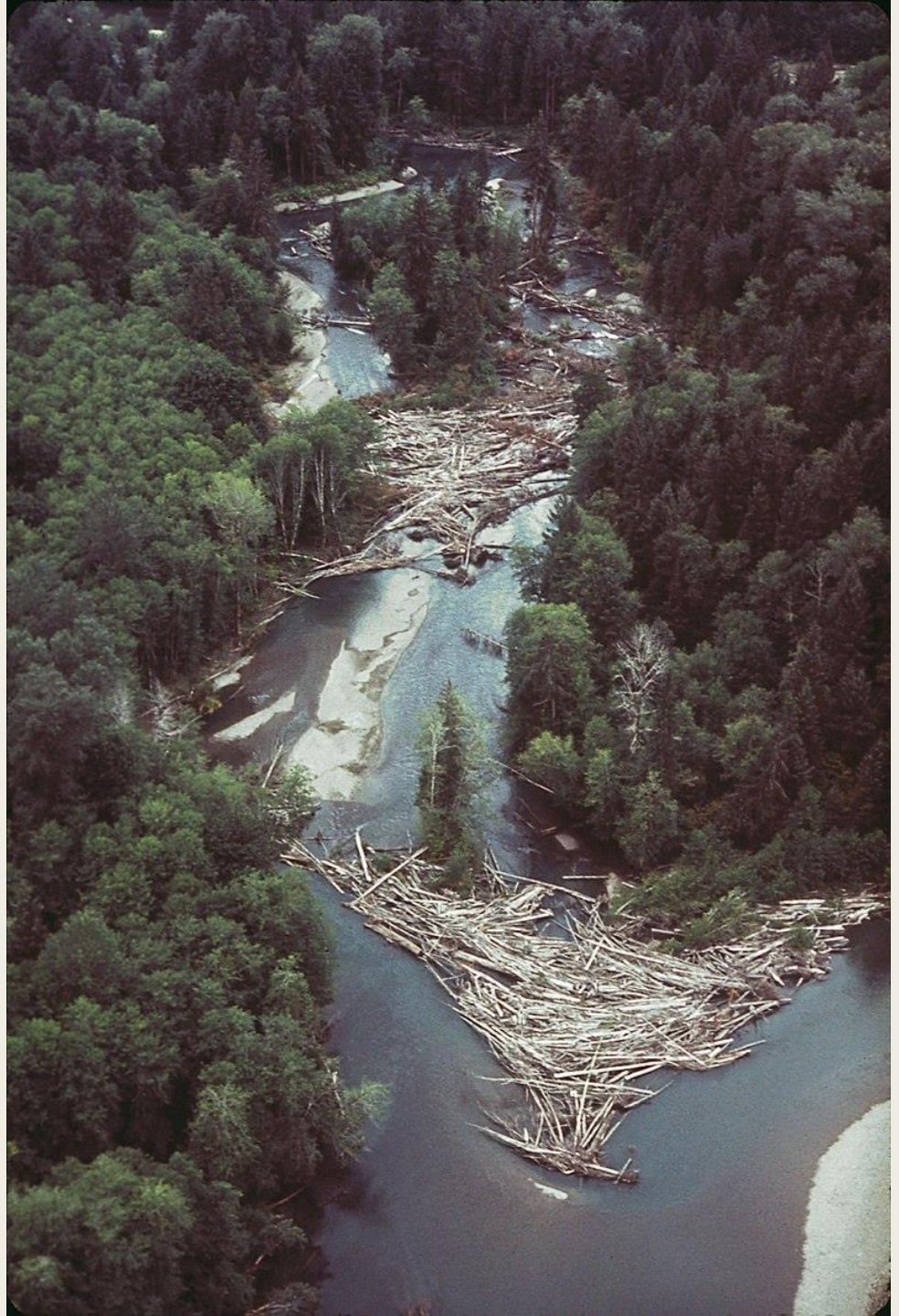
ELJ OPPORTUNITIES

- As ELJs incorporate biology, there are some uncertainties in terms of creating a stable engineering design
- The balasting/stabilization can be calculated akin to any structural design
- Planting trees/vegetation can be more uncertain and some trial and error might be required, or additional research into what plants are suitable for that area

SOURCE: http://oregonewrg.org/october-2019-presentation-sandy-river-logjams/

CONCLUSION

- ELJs are a way of stabilizing channels, increase channel complexity, and restore riverine functions
- Often requires large amounts of permitting due to adding large wood, which is seen as a potential hazard to downstream infrastructure



Source: https://en.wikipedia.org/wiki/Log_jam#/media/File:LOG_JAM_ON_THE_QUINAULT_RIVER_LEFT_BY_BUREAU_OF_INDIAN_AFFAIRS_LOGGING_OPERATION_-_NARA_-_545148_(restored).jpg

SOURCES

(In order of appearance)

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