Designing After A Disaster

RIVER RESTORATION AND RIVER MANAGEMENT IN THE WAKE OF THE 2013 COLORADO FLOODS

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Introduction: Who We Are

River restoration, by PNW standards, is immature. We exist to “Raise the Bar” in Colorado

- Solve problems before they become problems
- Help run several of the state sponsored flood recovery programs: strategy, scoping, grant review, what projects to fund, are the projects technically sound?
- Review nearly all designs coming out of the programs
- Designed and built many of the “early out” projects
- Provide technical support to watershed coalitions

**The ability to talk about everything, and we speak solely for ourselves in this presentation**
Introduction: Floods and Recovery

Floods are not natural disasters, they are human disasters.
The Flood

- Up to 18 inches of rain over five days (Sept 9-Sept 15, 2013)
- Cold front stalled against the eastern face of the Front Range sucking moisture up from Mexico and dumping it on Colorado communities
- Federally declared disaster on Sept 24, 2013 for 18 counties
- Highest rainfall occurred between 6000’ and 8500’ in elevation—notably, this is the middle of the mountain range, i.e. the canyons (burn scars).
- Lost miles of transportation corridors, some communities were isolated for over 1 week
- ~$3-4B of damage in the state
- 10 fatalities
- 100s to 1000s of “environmental refugees” displaced for days, months, years, and permanently.

WA = 71,000 square miles
WA population = 7 Million people

OR = 98,000 square miles
OR population = 4 Million people

CO = 107,000 square miles
CO population = 5.4 Million people

Front Range population (approximate impacted population) = 4.7M people
Flood Impacted Area ~25,000 square miles
The Flood-Reframed

- Rivers quickly broke free of their anthropogenic confinements
- Creeks occupied and turned over nearly all valley/canyon bottoms
- High sediment loads, debris flows
- Erosion/avulsion dominant hazards
- Rapid progression through channel evolution
- Creation of “new” floodplains
- Creation of “new” side channels, off-channel, and backwater habitat.
- The most illustrative example of what “floodplains” are
- Riparian succession kick started
Emergency Response

• Quick movement to “put it back how it was”
• Big mobilization to “remove debris”
• Perception that removing sediment would fix the problems “just dredge the river”
• Blame placed on rivers and “freak” weather event (e.g. 1000 year rainfall!)
• Immediate and substantial work to reopen transportation corridors
Emergency Response—Reframed

- Emergency Response measures relayed a lack of understanding of the driving forces behind the hazards in the river systems: inundation flooding vs erosional hazards
- Massive loss of Large Woody Materials to landfills
- Tyranny of the single thread channel
- Immediate un-doing of all the free restoration work that was just done! Filling and clearing of the recently established side channels, cutoff chutes, point bars, pools, etc.
- Colorado Parks and Wildlife has published studies that suggest the flood itself had minimal negative impacts while the emergency response had significant negative impacts on native fish populations.
- Very little reflection upon the human relationship with the river.
Reflections on Emergency Response

- Emergency response is too late for river professionals to become involved.
- Reach out to your City/County/State Office of Emergency Management now.
- Reach out to your governors office now.
- Make sure everyone in both those offices knows what a “geomorphologist” and “hydrologist” does and has a list of them to call (USFS National Stream Center).
- Institute city/county/watershed LWM management plans to pull off the shelf when floods happen. Work with local Parks and Open Space and USFS staff to do this.
- The catchall term “debris” must be avoided at all costs.
- As a professional group we need to advocate to change the prevailing mindset that single thread, clean channels are the only ‘stable’ morphology.
- We MUST change our language surrounding recurrence intervals and flood statistics.
Hold Up

Response => Recovery =>
Response => Recovery =>
Response => Recovery =>

......
Master Planning

Response => Recovery => Resilience
Response => Recovery => Resilience
Response => Recovery => Resilience

Response = hours/days/weeks
Recovery = months/years
Resilience = decades
Rivers and Roads

Three Wins

AND

One loss
DR and EWP Pilot* Programs

DR Watershed Resilience Programs: $45-$85M (Housing and Urban Development)
- Planning-OR-Design and Construction
- ~150 projects
- Two years from date of obligation to close out

EWP Phase 2: $64M-$67M (Dept. of Ag)
- Design and Construction
- ~74 Projects
- 220 days (7.5 months) to contract and construct each project

*Pilot: creative implementation of federal $ to realize the state's vision, with the intent of setting a precedent for post-disaster river management and projects across the nation.
EWP and DR Pilot Programs

The largest investment in Colorado Rivers (ever)

Ever

So, do it right

No Pressure

(insert emoji of petrified face here)
DR and EWP Pilot Programs

- Successes
  - Established a clear vision for recovery
  - Shifted the status-quo for $150M in river work from top left to top right
  - Designed by inclusion AND exclusion
  - No design recurrence interval

- Challenges
  - Rules change every day
  - Timelines
  - Public perception
  - Watershed scale Instabilities
  - Sand, so much sand
  - No soil, no cohesive material on the ground
  - Groundwater
  - Permitting
DR and EWP Pilot Programs

• Successes
  • Established a clear vision for recovery
    • Strong State leadership
    • Colorado Water Plan
    • Technical experts willing to advocate
    • CHANGE IS NOT FAILURE

• Shifted the status-quo
  • Both a carrot and a hammer
  • CONTRACTS!
  • Guidance documents
  • Relentless expectations for performance

• Designed by inclusion AND exclusion
  • Start with the dream and move toward reality
  • Do not fear the blank canvas

• No design recurrence interval
  • To recognize the importance of designing for geomorphic function and hazards
DR and EWP Pilot Programs

- **Challenges**
  - Rules change every day
    - Have the right personalities on the job—see the adventure in the labyrinth.
    - Keep the focus on the big picture—listen to those who know what is important to the heart of the vision from a technical perspective, and know what is negotiable.

- **Timelines**
  - Cannot overstate the importance of good logistics management
  - TA team’s job is to think 4-6 months ahead and solve problems before they become problems
  - Packaging projects together
  - Stop complaining about timelines, start working

- **Public perception**
  - Role of Watershed Coalitions
  - Education
DR and EWP Pilot Programs

- Challenges
  - Watershed scale Instabilities
  - Sand, so much sand
  - No soil, no cohesive material on the ground
  - Groundwater
  - Bad initial cost estimates
  - Bad reach breaks
  - Bad/Poorly placed bridges and culverts
DR and EWP Pilot Programs

Challenges

- Floodplain permitting
  - If a floodplain remap is needed, after a flood, consider if a floodplain map is an appropriate tool to communicate flood risk
  - If a map revision is needed, do the restoration then remap, please do not remap and then do the work.

Lesson Learned: work out with local agencies and FEMA, before the flood, and a waiver that allows you to do actual good work in emergency situations.
Closing Thoughts

Relationship between Flood Recovery and River Restoration

How do we as a river discipline move forward, in a way that is relevant to rebounding from future flood events on a national scale?

What does resiliency and restoration mean in the face of climate change?

Value of passive recovery/passive restoration

Make decisions based on vision, not fear
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