Colorado’s Departments of Transportation and Natural Resources
New Partners in Stream Restoration and Floodplain Management

Kevin Houck, Colorado Water Conservation Board
Steven Humphrey, Muller Engineering / CDOT Flood Recovery Office
September 2013 Flood

- $480 million estimated damage to highway facilities
- $153 million estimated local highway costs
- 486 miles of State Highway closed
- 200+ Bridges and culverts damaged
- 140,000 cubic yards of debris removed
US 34 - Big Thompson Canyon
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US 34 - Big Thompson Canyon
SH 7 - St. Vrain Canyon
SH 119 - Boulder Canyon
US 34 – East of Greeley
Flood Debris
St. Malo – Woody Debris
CDOT and CWCB Partnership

- Partnership began in October/November of 2013 during the response phase
- The two organizations rarely worked together, but a new bond was formed during the flood
- Recognized the value of working together and establishing a team mentality
- Began establishing new efforts, assigning roles and moving forward
CDOT and CWCB Partnership

Collaborative Efforts:

- Hydrologic Evaluations
- Stream Restoration
- Re-construction efforts
- Private Access Bridges
- Floodplain Mapping
- Colorado Resilience Framework
Recognized an unmet need for design hydrology for the permanent repair projects

Identified seven flood affected watersheds that are critical to CDOT’s reconstruction efforts

- Big Thompson River
- Little Thompson River
- St. Vrain Creek
- Lefthand Creek
- Boulder Creek
- Coal Creek
- South Platte River
Flood Affected Watersheds
Phasing of the Studies

• CDOT’s critical permanent repair projects are largely within the canyons of these watersheds

• A phased approach was used to expedite the new hydrology for those CDOT roadways impacted most by the flood

  • Phase 1 - Generally from the headwaters of the watershed to the applicable canyon mouth. (Mountains)
  • Phase 2 - From the canyon mouth to downstream confluence. (Plains)
  • Phase 2a - Gauge Analysis of the South Platte River
CDOT and CWCB Hydrology Analysis
Little Thompson River
Peak Discharge Profile

![Graph showing peak discharge profile of the Little Thompson River with locations such as Weld County, Larimer County, Boulder County, and the Town of Milliken. Data points and lines represent different discharge estimates and models, including 100-yr (Effective FIS), 2013 Flood Estimates, 100-yr (Model), and 2013 Flood Model.](image-url)
Boulder Creek
Peak Discharge Profile

Note: FIS values derived from USACE, 1977 study, unless noted otherwise.
St. Vrain Creek
Peak Discharge Profile
South Platte River
Peak Discharge Profile
FEMA Best Available Data Memo

- Allows for and encourages the use of best available data
  - Which is defined as either the existing regulatory rates or the revised hydrology developed as part of this effort; whichever is more conservative
- Approved memos for both Phase 1 and Phase 2
US 36 - Stream Restoration during a Highway Reconstruction Project

- Led by CWCB and Crane & Associates
- CDOT
- Central Federal Lands

Two Watersheds:
- North St. Vrain Creek
- Little Thompson River
Damage Section

- Original Roadway Section
- Damaged Roadway Section
- Existing Grade
- Mass Failure
  - 100 Year Floodplain
  - 2 Year Floodplain
- Low Flow
- Top of Bedrock

(Colorado)
Typical Repair
Resilient Concept
Moving the Road on to Bedrock
Constructing the River and Road Together

- Moved the road over
- Moved the river back
- Provided room for the river and re-established the floodplain
- Reinforced the roadway embankment
- Root wads
Stream Restoration
Before
Stream Restoration
After
Protecting the River and the Road

BEFORE

AFTER
Private Access Evaluation
Floodplain Mapping

- SB245 requires CWCB to create new floodplain mapping for mainstem and tributary rivers affected by 2013 flood
- This mapping must include updated hydrology where applicable
- Erosion zones and debris flow zones also mapped, not regulatory
- 3-Year Program, $6.8 million of state funds

Floodplain Management

- Local communities are strongly encouraged to use new maps for landuse decisions, mandatory after placement on FEMA maps
- This is not mandatory for NFIP or State of Colorado rules
- This will become mandatory when data is placed on FEMA maps
Floodplain Mapping and Management
Colorado Resilience Framework

- **RESOURCE** for local governments, businesses, non-profits and individuals
- **SUPPORT AND CULTIVATE** a culture of resilience at the state and local level
- **EMPOWER** the whole community and tap into a sense of personal responsibility
- **INTEGRATE** resiliency into our everyday way of life

FINAL Report is available on the Colorado United Website
www.coloradounited.com
Colorado Resiliency Framework

- Sector Overview
- Shocks and Stresses
- Problem Statements
- Strategies and Goals
- Cross-Sector Integration
Colorado Resiliency Framework

Example Sector Overview

**Shocks**
- Damaged or destroyed infrastructure
- Inaccessible infrastructure

**Stresses**
- Increased demand
- Long term wear and tear on infrastructure
- Changing climate conditions

**Example Strategies**
- Evaluate Infrastructure risks to determine comprehensive approach to hazards
- Develop policies that a stakeholder / interagency approach should be taken for infrastructure design and construction projects to ensure that all interested parties are involved
CDOT & CWCB Working Together

• Colorado is more resilient because CDOT & CWCB are working together

• Moving forward from the September 2013 floods a new norm has been established and CDOT & CWCB will continue to support each other

• Do other State DOTs and Water Resource Agencies work closely together in day to day business?