South Platte River at South Platte Park Lessons Learned

2017 UDFCD Annual Seminar

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Topics

- Dam Impacts on South Platte River
- Natural Channel Design Concepts
  - Basic Geomorphology
- Improvements Made
- Challenges
  - Flows
  - Scheduling Work with Significant Revegetation Component
- Successes
  - Principle of restoration
  - Resiliency after full growing season
- Overall Takeaways

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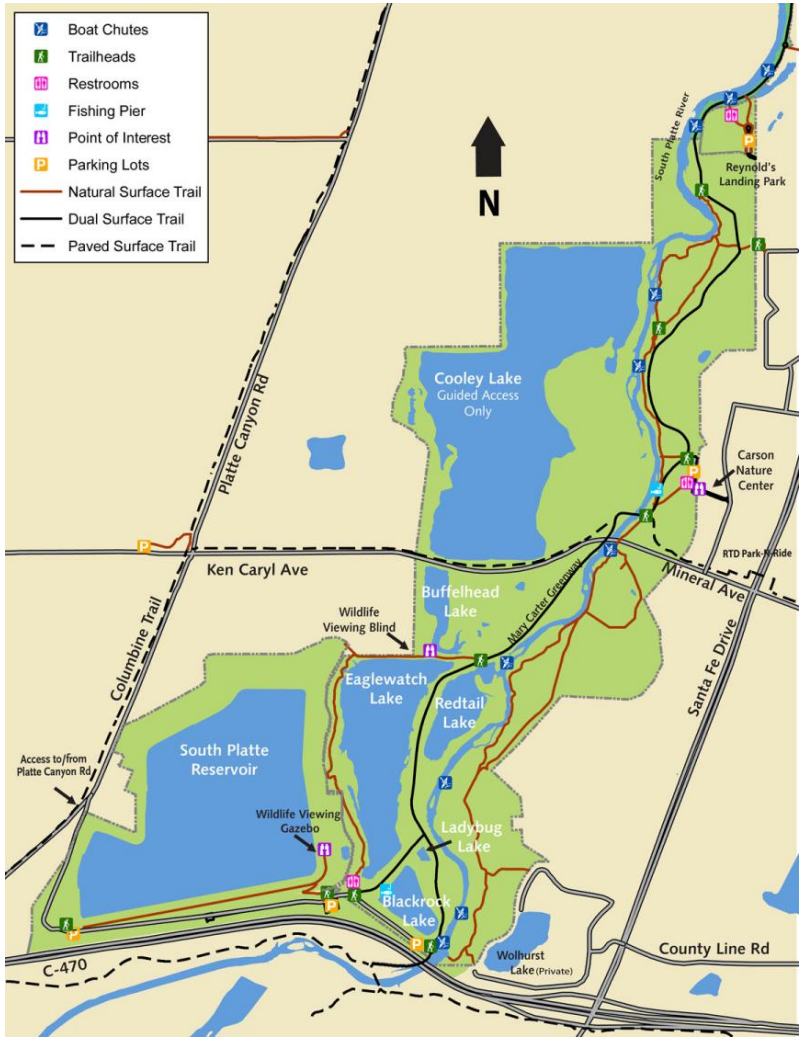
South Platte Park Project Location



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Primary Issues Addressed by Project

Reduced flows from Chatfield Dam

- Historic bankfull flow of 4,400 cfs created 120’ channel width
- Current bankfull flow of 650 cfs doesn’t fit with current flow regime
- Overly wide channel is not compatible with current flow regime
  - Proposed 40’ channel width bankfull channel

Channelization

- Sinuosity Reduced (1937-1955) ~ 1.4 to current ~1.1
  - Increase sinuosity by creating meandering low flow channel

Lack of instream aquatic habitat variety

- Very shallow low flow conditions (significant periods with flows < 10 cfs)
  - Construct low flow thalweg to optimize habitat during these periods

Bed and Bank instability

- Downcutting after construction of dam addressed with typical drop structures which impact aquatic passage
- Bank instability has been addressed through different forms of channel armoring
  - Constructed riffle/pool features where riffles provide grade control and mimic a natural stream system
  - Bank stabilization incorporated significant revegetation

Disconnected riparian habitat and active floodplain

- Created riparian flood terraces that are inundated above bankfull flow

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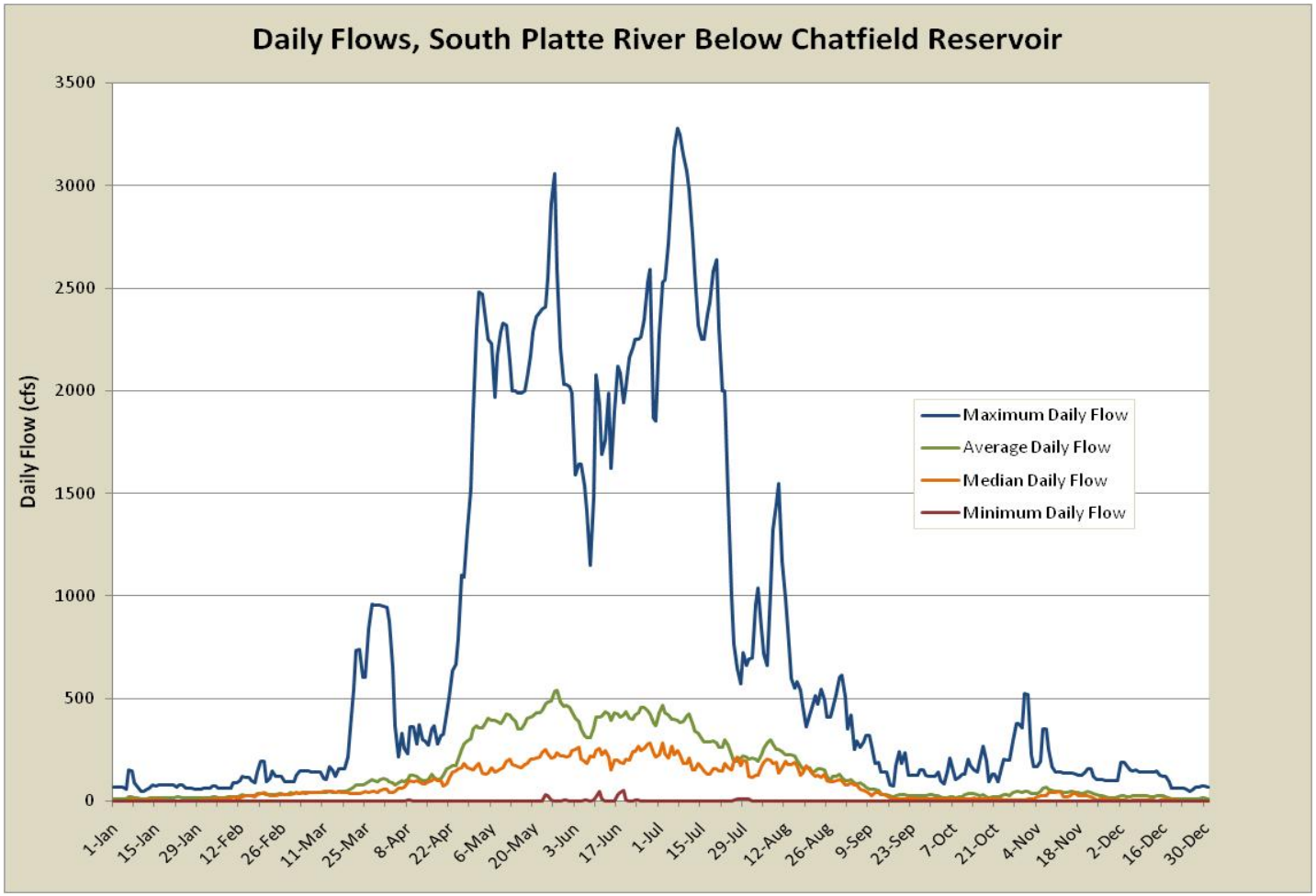
Current Flow Patterns with Chatfield Dam



Annual Flood:
650 cfs

Significant Periods of Extreme Low Flow (<10 cfs)

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Problem

Channel was Overly Wide For Current Flows

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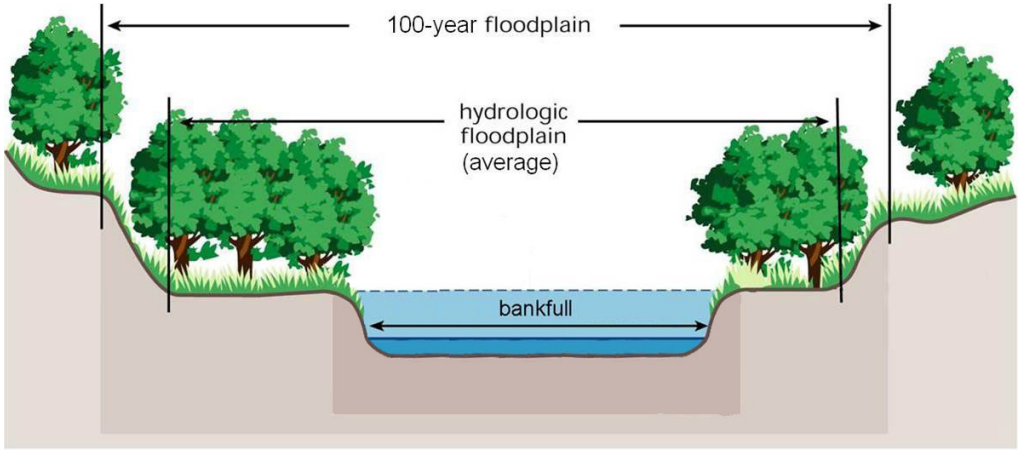
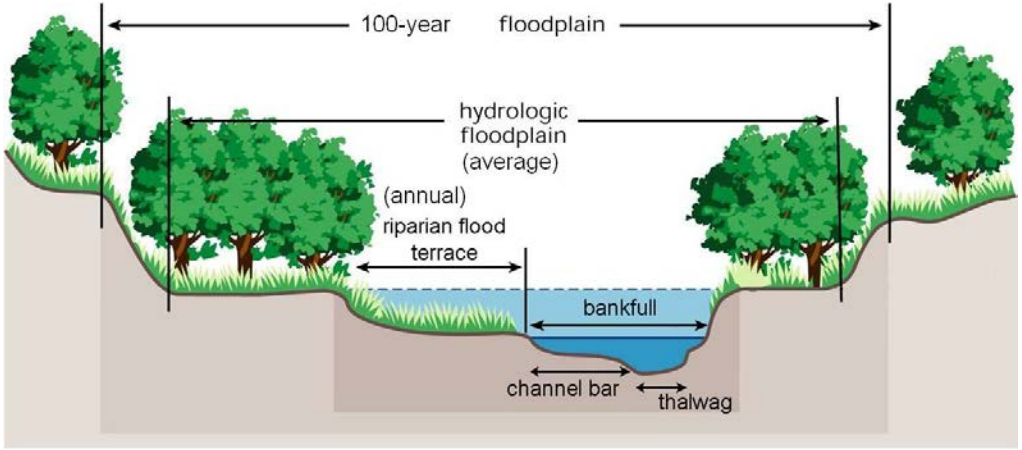
Design Concepts

- Establish bankfull channel width
- Create vegetated flood terraces
- Construct riffle-pool bedform
- Minimize aquatic organism barriers
- Stabilize banks

Desired Natural River Ecosystem



EXISTING



PROPOSED

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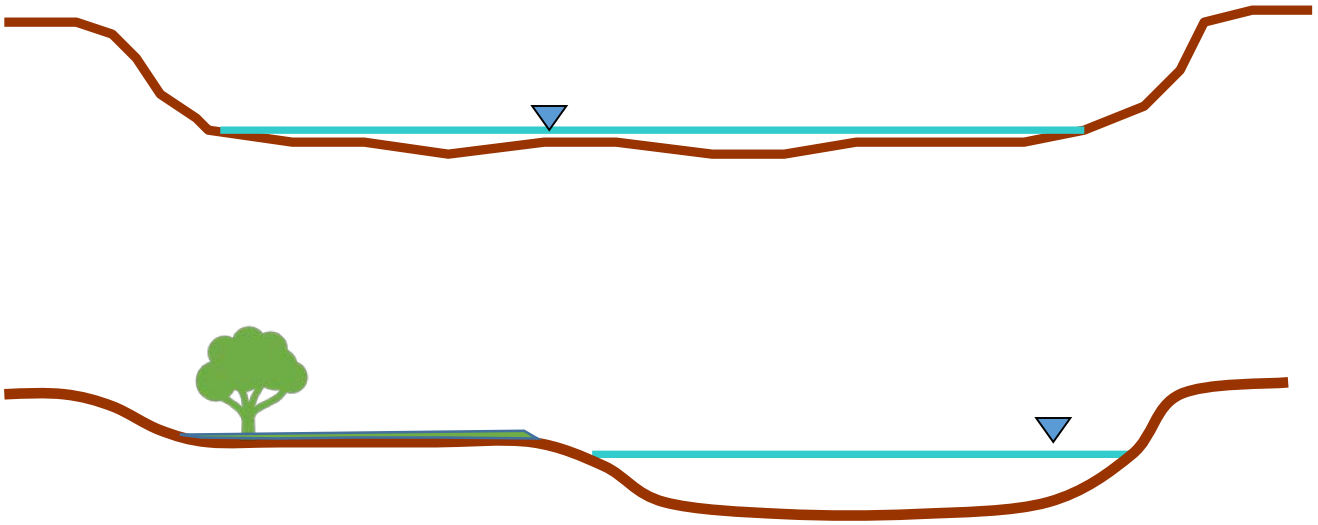
Channel Width and Disconnected Floodplain

Reshape Channel to Create Riparian Terraces



Creating and Bankfull Channel and Riparian Terrace

Terrace Seeded and Prepared for Blanket

Planting Pockets Excavated

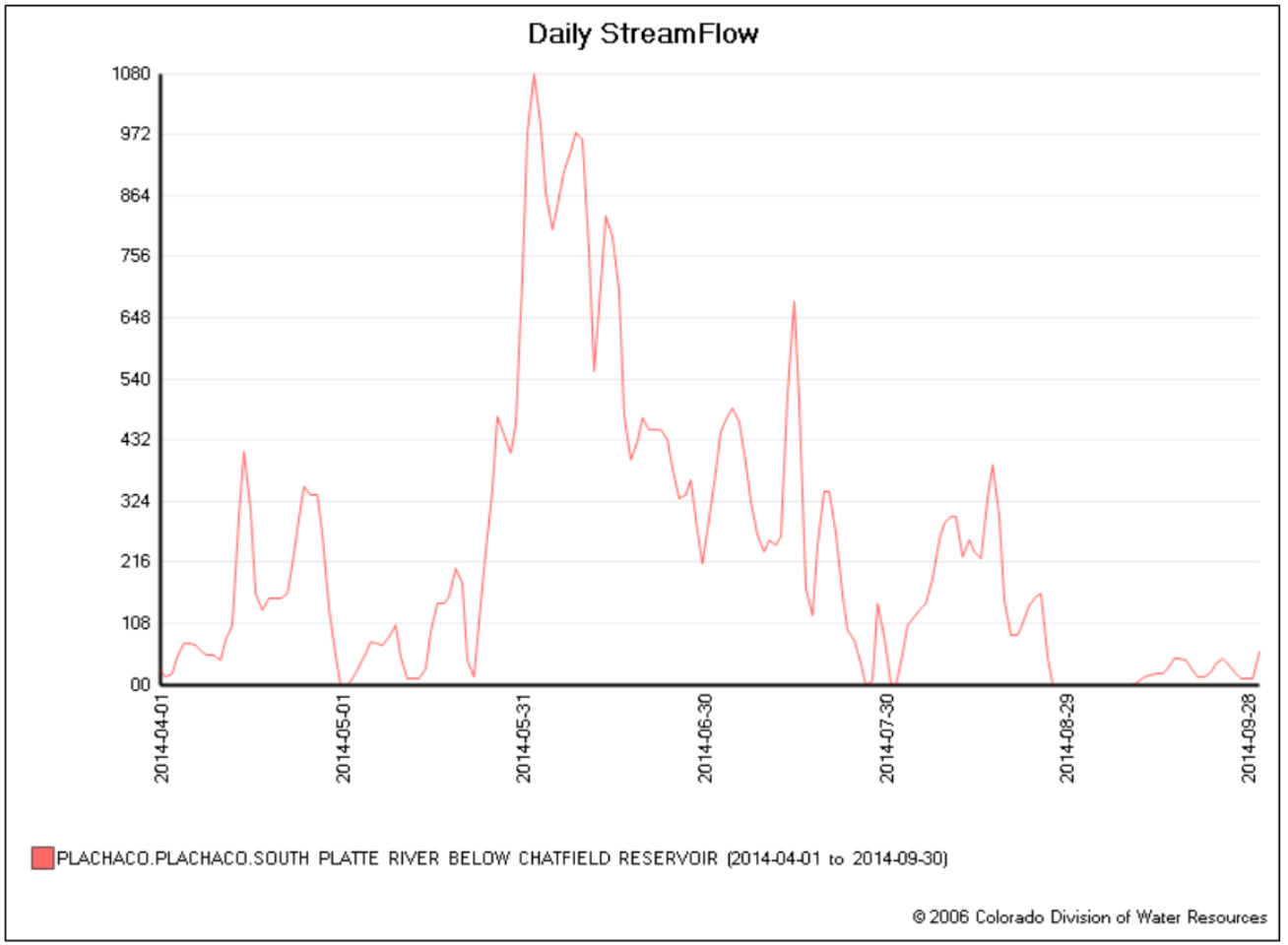
Erosion Control Fabric and Walking Access

Minor Challenge: High Flows in 2014

Phase 1 Terraces had been established for a full season

Phase 2 and 3 Not Yet Constructed

Flows were above Bankfull for about 2 weeks



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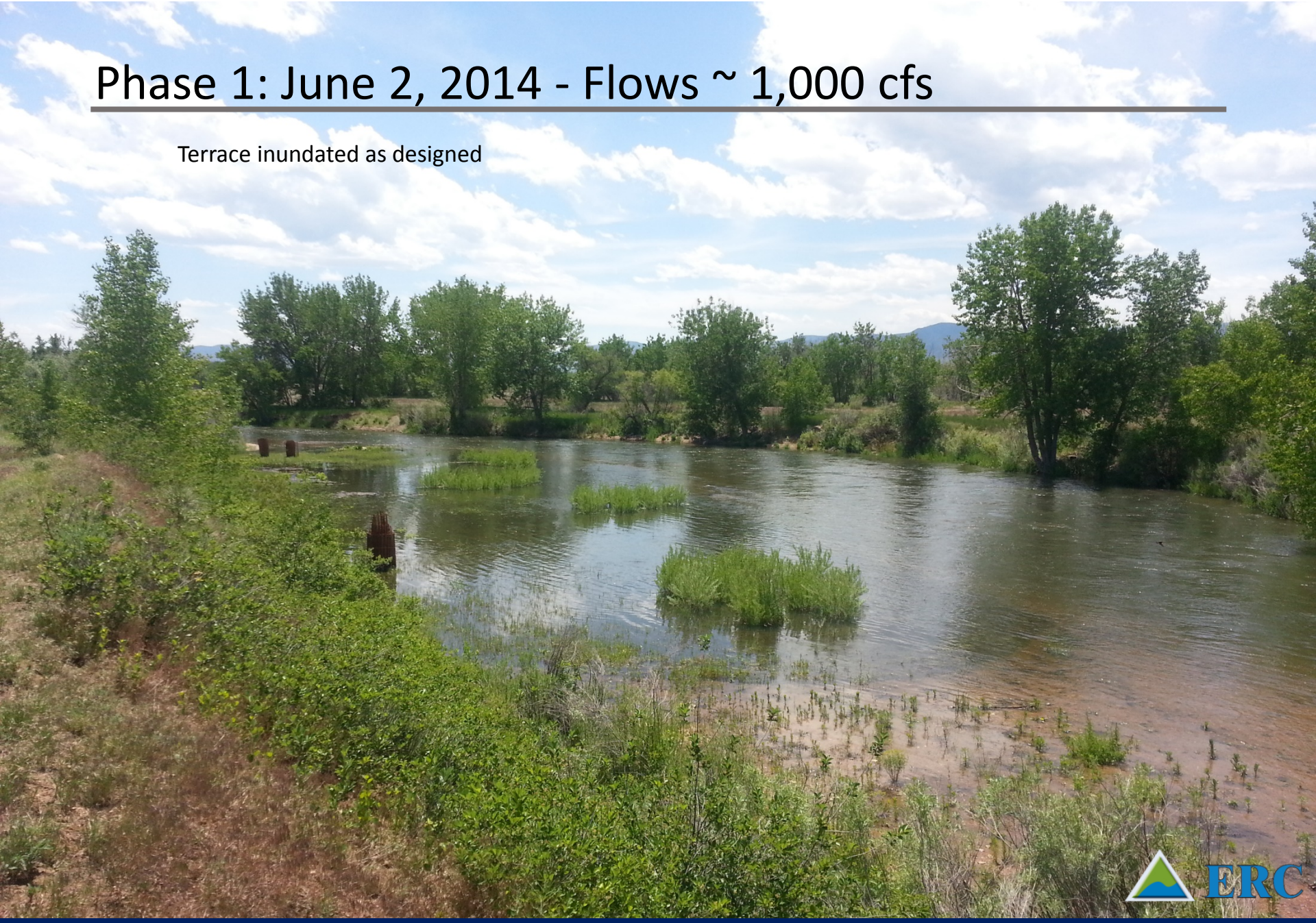
Phase 1: June 2, 2014 - Flows ~ 1,000 cfs

Terrace inundated as designed



Phase 1: August 1, 2014

Terrace was healthy after short duration flooding

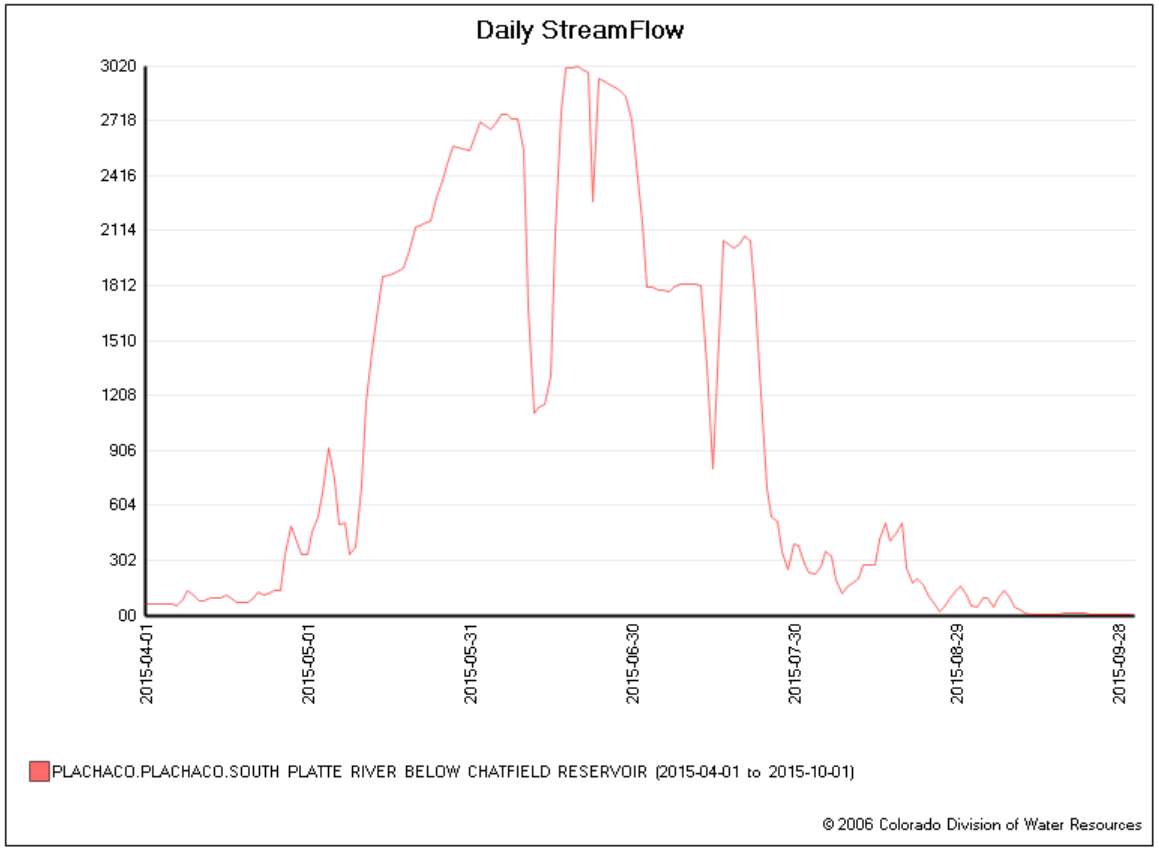
Major Challenge: High flows in 2015

Peak Flows over 3,000 cfs

Flows over 1,000 for 2.5 months

Phase 1 Terraces had been established

Phase 2 and 3 Terraces had only been seeded and covered with blanket for weeks



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Phase 1: September 4, 2015

Terrace acted as a depositional bar for sediment.
Grasses and shrub pockets remained
Channel shape was retained

Phase 1: March 16, 2017

Grasses didn't fully recover after event
Channel shape and terrace were maintained

Phase 2: September 4, 2015

All fabric and soil eroded from some terraces

Phase 2: Fall 2015

Phase 2: Fall 2015

Fabric, seed and soil completely washed out during extended high flow event

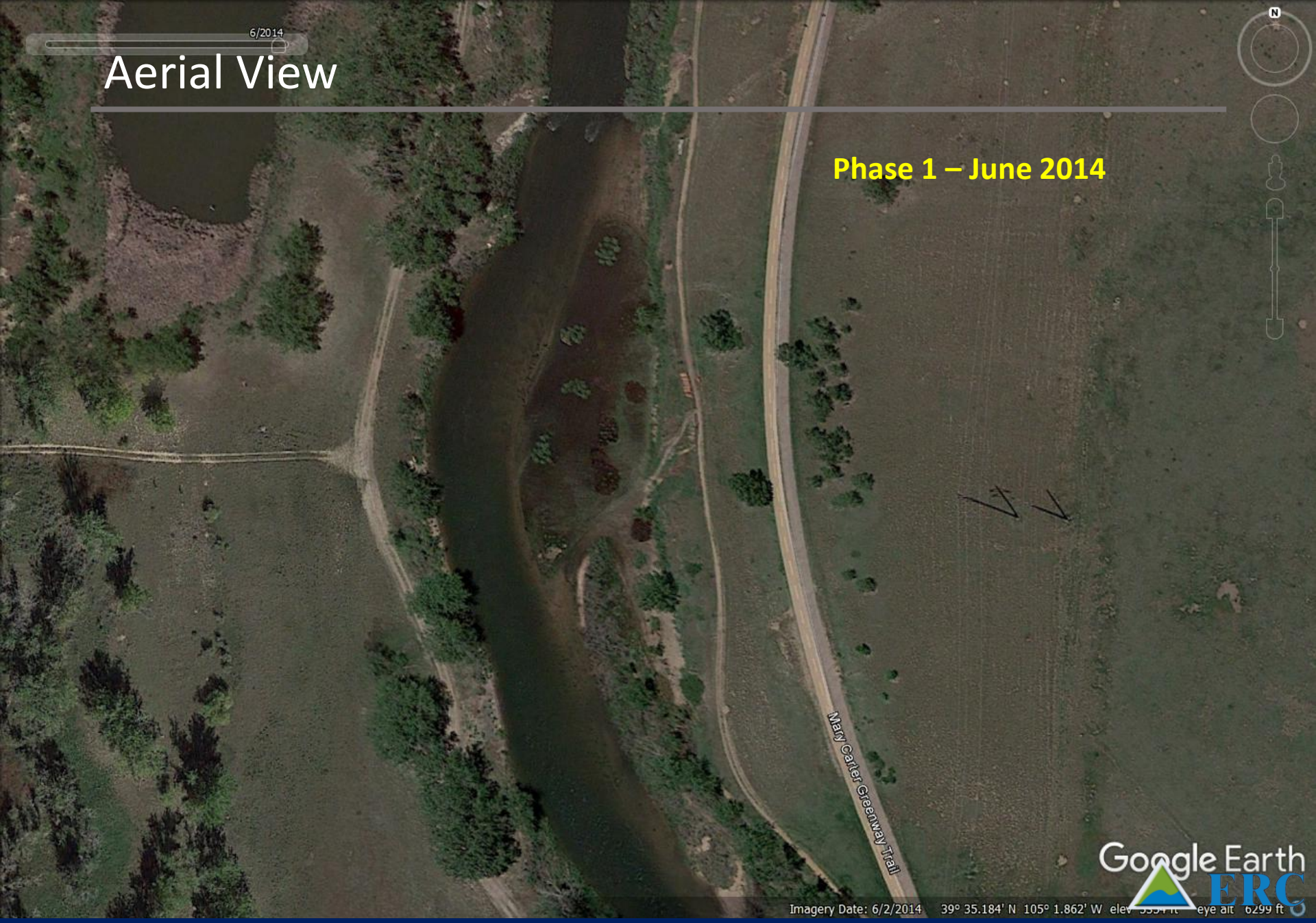
Phase 2: Fall 2015

Loss of riparian vegetation occurred and bars became cobble bars rather than riparian terraces
Channel shape and bar shape was resilient

Aerial View


10/2013
Phase 1 – November 2013
Maty Carter Greenway Trail
Google Earth
Imagery Date: 10/6/2013 39° 35.184' N 105° 1.862' W elev 5354 ft eye alt 6299 ft

Aerial View


6/2014
Phase 1 – June 2014
Mary Carter Greenway Trail
Google Earth
Imagery Date: 6/2/2014 39° 35.184' N 105° 1.862' W

Aerial View


10/2014
Phase 1 – November 2014
Mary Carter Greenway Trail
Google Earth
Imagery Date: 10/6/2014 39° 35.184' N 105° 1.862' W

Aerial View


10/2015
1937
2016
Phase 1 – November 2015
Mary Carter Greenway Trail
Google Earth
Imagery Date: 10/9/2015 39° 35.184' N 105° 1.862' W

Aerial View


10/2015
Phase 2 – November 2015
E Trail
1937
Imagery Date: 10/9/2015 39° 34.346' N 105° 2.385' W
Google Earth
ERC

Lessons Learned

- Challenges
  - Success of vegetated terraces is highly dependent on subsequent flow conditions
  - Given persistent high flows, soil on terraces is not stable without developed vegetation, even with stout erosion fabric
  - Revegetation work that is completed in spring with revegetation as one of the last pieces to be completed is most susceptible to damage
  - Revegetation in the fall allows time for grass and other planted material roots to establish, but is likely to require supplemental watering
- Successes
  - Natural channel form was stable both from a cross sectional and profile standpoint and provides a good alternative to more traditional, structural restoration
  - Once developed, vegetated terraces are stable even under extremely high flow conditions

Risks to Consider and Ways to Minimize Them

- Exposed soil will erode in flood events
  - Timing of work with soils near typical flood levels should likely occur so that grasses can establish over the winter/spring prior to expected peak flows
  - Tight window on fall seeding with potential need for supplemental watering
- Erosion control fabric has some benefits, but likely has weaknesses
  - Quality control is important as construction defects (particularly at edges and overlap areas) allow for system wide unraveling
- Plantings are susceptible
  - Want larger plant material to have time to root prior to flooding
  - Possible staggering of planting to minimize cost exposure
    - Seeding in fall of year zero followed by additional plantings after peak runoff in year 1
    - If project allows, staggering revegetation over several years can reduce risk of loss

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