Stormwater Monitoring in the Cherry Creek Basin, Colorado

NWQMC 9th National Monitoring Conference
Cincinnati, OH
April 29, 2014
Cherry Creek Watershed
Reservoir and Stream Sampling Sites
Pollution Reduction Facilities
Current Monitoring Program

- Reservoir monitoring monthly (including winter) and bi-monthly from May through September
  - Photic zone nutrients at all sites and nutrient profile at one site; chl a, phyto, zoops, temp, DO, pH, cond, ORP
  - Continuous temperature profile

- Baseflow sampling monthly

- Stormflow sampling up to 2 events per month; April through September

- Watershed Sampling twice/year
June 6, 2012
Storm Event

Severe Storms, Tornadoes Left Denver Ankle Deep in Hail Thursday

June 06, 2012; 6:07 PM

Severe weather slammed Denver and Colorado Springs on Wednesday evening and night, spawning tornadoes and causing deep hail to pile up. A total of seven tornadoes were reported along the Front Range of the Colorado Rockies.

A weak tornado touched down north of the Denver International Airport during the evening. Many other unconfirmed tornadoes touched down south and east of the city.

2.72” rain in approx. 5 hours
June 6, 2012
Cottonwood Creek CT-P1

Peak Flow 92 cfs

2.72” Rain

CT-P1 Stream Flow (cfs)
Precipitation (in)
June 6, 2012
Cottonwood Creek CT-P1
June 6, 2012
Cottonwood Creek CT-P2
June 6, 2012
Cottonwood Creek CT-1

June 7, 2012
Gage Height (ft)
Reservoir and Stream Sampling Sites
June 6, 2012
Cherry Creek CC-10

Peak Flow 220 cfs

2.72” Rain
June 6, 2012
Cherry Creek CC-10
September 2013


http://coflood2013.colostate.edu/images/CO_08_15Sep2013_Web.png

http://coflood2013.colostate.edu/images/CO_08_15Sep2013_Web.png

Preliminary Precipitation Accumulation for Colorado (inches)
8 - 15 September 2013

5.37” rain in approx. 5 days
Boulder area saw closer to 16” rain in same timeframe
September 2013
Cottonwood Creek CT-P1

Peak Flow 92 cfs
2.72” Rain

Peak Flow 120 cfs
5.37” Rain
ISCO is GONE!
September 2013
Cottonwood Creek CT-P2
September 2013
Cottonwood Creek CT-1

[Graph showing gage height (ft) from Tue 10 to Mon 16]
September 2013
Cottonwood Creek CT-2
September 2013
Cherry Creek CC-10

Peak Flow 345 cfs
Peak Flow 220 cfs
2.72” Rain
5.37” Rain
September 2013
Cherry Creek Ecopark
September 2013
Cherry Creek CC-10
PRF Efficiency
Baseflow Conditions

![Graph showing PRF Efficiency under baseflow conditions with TP, TN, and TSS concentrations for CT-P1, CT-P2, CT-1, and CT-2.]
PRF Efficiency

“Typical” Stormflow Conditions

![Graph showing PRF Efficiency]
PRF Efficiency
June 2012 Storm Event

![Graph showing PRF Efficiency with concentration levels for TP (ug/L), TN (ug/L), and TSS (mg/L) at different locations: CT-P1, CT-P2, CT-1, and CT-2. The graph compares PRF and WWTP treatment efficiencies.]
PRF Efficiency
September 2013 Storm Event

![Graph showing concentration changes in PT, TN, TSS](image)
Cherry Creek Monitoring
Baseflow Conditions

![Graph showing concentrations of TP, TN, and TSS at Ecopark and CC-10]
Cherry Creek Monitoring
“Typical” Stormflow Conditions

Graph showing concentrations of TP (µg/L), TN (µg/L), and TSS (mg/L) at Ecopark and CC-10.
Cherry Creek Monitoring
September 2013 Storm Event

<table>
<thead>
<tr>
<th></th>
<th>TP (μg/L)</th>
<th>TN (μg/L)</th>
<th>TSS (mg/L)</th>
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<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
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<td></td>
<td></td>
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<tr>
<td>2500</td>
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<td>3000</td>
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<tr>
<td>3500</td>
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Concentration

Ecopark | CC-10
Nutrient Concentration Based on Storm Magnitude

<table>
<thead>
<tr>
<th></th>
<th>Total Phosphorus</th>
<th>Total Nitrogen</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>CT-2</td>
<td>CC-10</td>
</tr>
<tr>
<td>small (&lt;0.4&quot;)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>moderate (0.4&quot;-1.5&quot;)</td>
<td>500</td>
<td>1000</td>
</tr>
<tr>
<td>large (&gt;1.5&quot;)</td>
<td>1500</td>
<td>2000</td>
</tr>
</tbody>
</table>

Concentration (µg/L)
Historical Phosphorus Baseflow CT-2
Historical Phosphorus Storm CT-2

Dashed Line = 170 µg/L

Stream Reclamation Project Completed
Historical Phosphorus Baseflow CC-10

Dashed Line = 170 µg/L
Historical Phosphorus Storm CC-10

Dashed Line is the Interim TP value for Warm Water Streams 170 µg/L
Conclusions

- Nothing too surprising...nutrient concentrations followed typical patterns based on size of storm event
- Overall PRF efficiency was good, even during large storm events
- Difference in nutrient concentrations between the two sites may be natural, but PRFs may also play a part
Acknowledgements

- Cherry Creek Basin Water Quality Authority
Thank You!!

Natalie Love
(303) 264-1070
nlove@geiconsultants.com