Listen to the Science

• The South Boulder Creek Watershed
• Climate change predictions for hydrology
• The Gross Reservoir Expansion project
• The Phase 1 Flood Mitigation project
The South Boulder Creek Watershed

- Watershed is 132 sq. miles
- The creek runs 22 miles in the foothills, 10 miles on the plains
- Much of its flow comes from the Colorado River basin
Predicted Stream flow and Temperature Changes in the Upper Colorado River Basin

- Warming leads to
  - reduced snowpack
  - higher evaporation
  - dryer soil
  - Shift in peak runoff by 1-2 months

- Result is reduced annual streamflow, and lower flow during growing season

Calculated from RCP 8.5 from CMIP5 simulations. From Overpeck and Udall, PNAS, June 2, 2020
The Gross Reservoir Enlargement Project

- Owned/operated by Denver Water
- Fed by trans-basin diversion through Moffat Tunnel from tributaries of the Colorado River
- Denver Water typically diverts half the tributary flows, but is allowed to divert all flow if minimum flows not specified
Gross Reservoir Enlargement

- Additional storage and resiliency needed by Denver Water

- Increases dam height by 131 ft, would double the area

- When full, nearly triples the existing capacity, by 77,000 af
Filling Gross Reservoir

• Gross Reservoir is supplied by the tributaries of the CO River
• The CO River is managed by a Compact created in 1922
• Upper Basin states must supply 7.5 maf/year on average to avoid curtailments in usage
• Flows have decreased 30% since the Compact was created
• Climate change predicts CO River flows will continue to decrease
Colorado River Use Reductions

- Lake Mead and Lake Powell are at 28% of their capacities, the lowest water levels since they were constructed
- June 14: USBR Commissioner said usage must be curtailed by 15-30% (2-4 maf) starting in 2023 or they will specify reductions
- States missed the August 15 deadline to develop plans
Will Gross Reservoir Fill?

- Denver Water used the 1950’s drought for low inflows
- Modeling showed the reservoir would be about 1/3 full

- Due to climate change and possible curtailments placed on Denver Water, how often will it fill?
The Phase 1 Flood Mitigation Project

- The SBC watershed is at high risk for flooding due to the large mountain watershed
- Flood mitigation project being implemented by the City of Boulder
- Designed to hold a 100-year flood coming out of the main stem of SBC
The 100-year Flood Design Benefits

- The Phase 1 Mitigation goal is to eliminate flooding in the West Valley area (near Foothills Parkway)
## Major Floods in South Boulder Creek

<table>
<thead>
<tr>
<th>Date</th>
<th>Flow at Eldorado Springs (cfs)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 29, 1894</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>June 3, 1895</td>
<td>1,130</td>
<td></td>
</tr>
<tr>
<td>May 9, 1900</td>
<td>1,100</td>
<td></td>
</tr>
<tr>
<td>June 20, 1909</td>
<td>1,340</td>
<td></td>
</tr>
<tr>
<td>May 24, 1914</td>
<td>1,240</td>
<td></td>
</tr>
<tr>
<td>June 6, 1921</td>
<td>1,440</td>
<td></td>
</tr>
<tr>
<td>★ Sept 2, 1938</td>
<td>7,390</td>
<td>• A 100-year flood means a 1% chance of a flow of that amount in any year</td>
</tr>
<tr>
<td>June 21, 1947</td>
<td>1,290</td>
<td></td>
</tr>
<tr>
<td>June 6, 1949</td>
<td>1,430</td>
<td></td>
</tr>
<tr>
<td>★ June 18, 1951</td>
<td>2,370</td>
<td>• There have been three 100-year floods in the past 84 years</td>
</tr>
<tr>
<td>June 4, 1952</td>
<td>1,080</td>
<td></td>
</tr>
<tr>
<td>May 4-8, 1969</td>
<td>1,690 (on May 7)</td>
<td></td>
</tr>
<tr>
<td>★ Sept 9-15, 2013</td>
<td>2,120 (&gt;5,600 at Hwy 93)</td>
<td></td>
</tr>
</tbody>
</table>
Climate Change and Flooding

- Flooding events are projected to increase in both frequency and amount.
- As the atmosphere warms the amount of water it can hold increases, by 7% per degree C (~ 4%/°F).
- Today’s 100-yr flood will be more likely (an 80-yr, 50-yr, etc, event).

Sept 11, 2013 water vapor and circulation pattern

Atmospheric river of water vapor, February 2019
Is a 100-year flood design adequate?

• The City evaluated designs for a 100-yr and 500-yr floods.

• A 500-yr flood was modeled with the 100-yr design in place.

• Results show the 500-yr event will flood nearly the same areas as a 100-yr event would now.

• Limited protection from a flood larger than a 100-yr event.

• In light of climate change and increased flooding, is the 100-year design the right choice?
Summary and Conclusions

• Climate change studies indicate that both droughts and floods will occur more frequently and at higher intensity.

• The Gross Reservoir Expansion and the Phase 1 Flood Mitigation projects in the South Boulder Creek watershed are examples of not listening to the science.