Stormwater Capture and Recharge to Enhance Riparian Habitat

Michael Milczarek, Cyrus Miller, Karen Riggs, Brooke Bushman, Robert Rice, Lindsey Bunting, and Laurel Lacher

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Stormwater Capture and Recharge

• Highly disturbed watersheds
• Stormwater capture/detention:
  - Reduce flooding/peak flows
  - Increase groundwater recharge
  - Support riparian habitat (via groundwater storage)
  - Sediment reduction/improve water quality
• Design issues/questions:
  - Scale
  - Hydrogeology
  - Design parameters and longevity?
Stream Flow Disturbance

- Changes in upstream watershed characteristics
- Channel degradation
- Reduced groundwater availability/quality
Watershed Scale Characteristics
Hydrogeologic Conditions

• Not all locations are created equal
  – Infiltration rates/permeability/lithology
  – Depth to groundwater/gradients
  – Distance from riparian area
Case Study - San Pedro River

- Groundwater mining affecting flows in the San Pedro River
- Interagency/public/private partnership to protect river
- CONCEPT: Flood control basins to capture stormwater and recharge groundwater by river
  - Groundwater modeling to identify best places to help base flow
  - Surface water modeling to estimate surface water flow and urban enhanced runoff
  - GIS screening and field investigations
  - Detention/recharge basin(s) design
- Pilot project at flood control basin designed to protect school
Surface Water Modeling

- How much stormwater runoff, how much UER?
- AGWA/KINEROS
  - Highly detailed watershed model
  - Model individual events from 57 year precipitation record
  - Use of regression relationships for other watersheds
- Model runs to predict stormwater runoff and infiltration:
  - pre-urbanized vs urbanized conditions,
  - w/ and w/o detention basins
  - high and low permeability basins
Palominas Watershed

- 4820 acres ($\approx 7.5$ sq miles)
- 8% impervious surface
### Predicted Runoff and Infiltration – Palominas Wash

<table>
<thead>
<tr>
<th>Percent Impervious Surface Area</th>
<th>Average Annual Precipitation</th>
<th>Average Annual Runoff into Channels</th>
<th>Average Annual Channel Infiltration</th>
<th>Average Annual Channel Recharge</th>
<th>Average Annual Inflow to Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00%</td>
<td>37.34 cm</td>
<td>294 acre-feet</td>
<td>90.7 acre-feet</td>
<td>35.4 acre-feet</td>
<td>203 acre-feet</td>
</tr>
<tr>
<td>8.00%</td>
<td>37.34 cm</td>
<td>530 acre-feet</td>
<td>178 acre-feet</td>
<td>69.6 acre-feet</td>
<td>351 acre-feet</td>
</tr>
</tbody>
</table>

Predicted UER = 148 afa
Palominas Detention/Recharge Basin Design
Average Precipitation (7/23/14 – 6/30/15)

Odile
Basins 1-3 Water Depth (7/23/14 – 6/30/15)
Depth to Groundwater (7/23/14 – 6/30/15)

![Graph showing groundwater depth](image)

- **Odile**

Legend:
- Baseline Well
- East Well
- Central Well
- West Well
- USGS Firehouse Well
- USGS San Pedro
Palominas Recharge Facility Works! But.....

- Odile stormwater runoff:
  - Models predicted about 270 acre-feet of runoff
  - Palominas (San Pedro River) USGS gauge:
    - Contributing watershed 100X Palominas watershed
    - Approximately 35,000 acre-feet
    - So, flow should have been 270 to 350 acre-feet
- Monitoring data indicated 13 acre-feet (5% of predictions)
- Where did the runoff go??!!!
  - Watershed surface conditions
  - High permability areas
  - Low intensity precipitation, Only one year of data
What we know and what we don’t

• Small is good….
  – High capture efficiency – more is better
  – Generally limited to upper parts of watershed
  – Shallow groundwater conditions facilitate riparian recovery
  – Enhances vegetation and likely increases mountain front recharge

• Larger watershed capture and recharge facilities
  – How big to design? - need modeling AND monitoring
  – Need to find appropriate hydrogeology
  – Design for sediment control
  – Need to monitor – BEFORE and AFTER
Thank you!

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Mike@gsanalysis.com