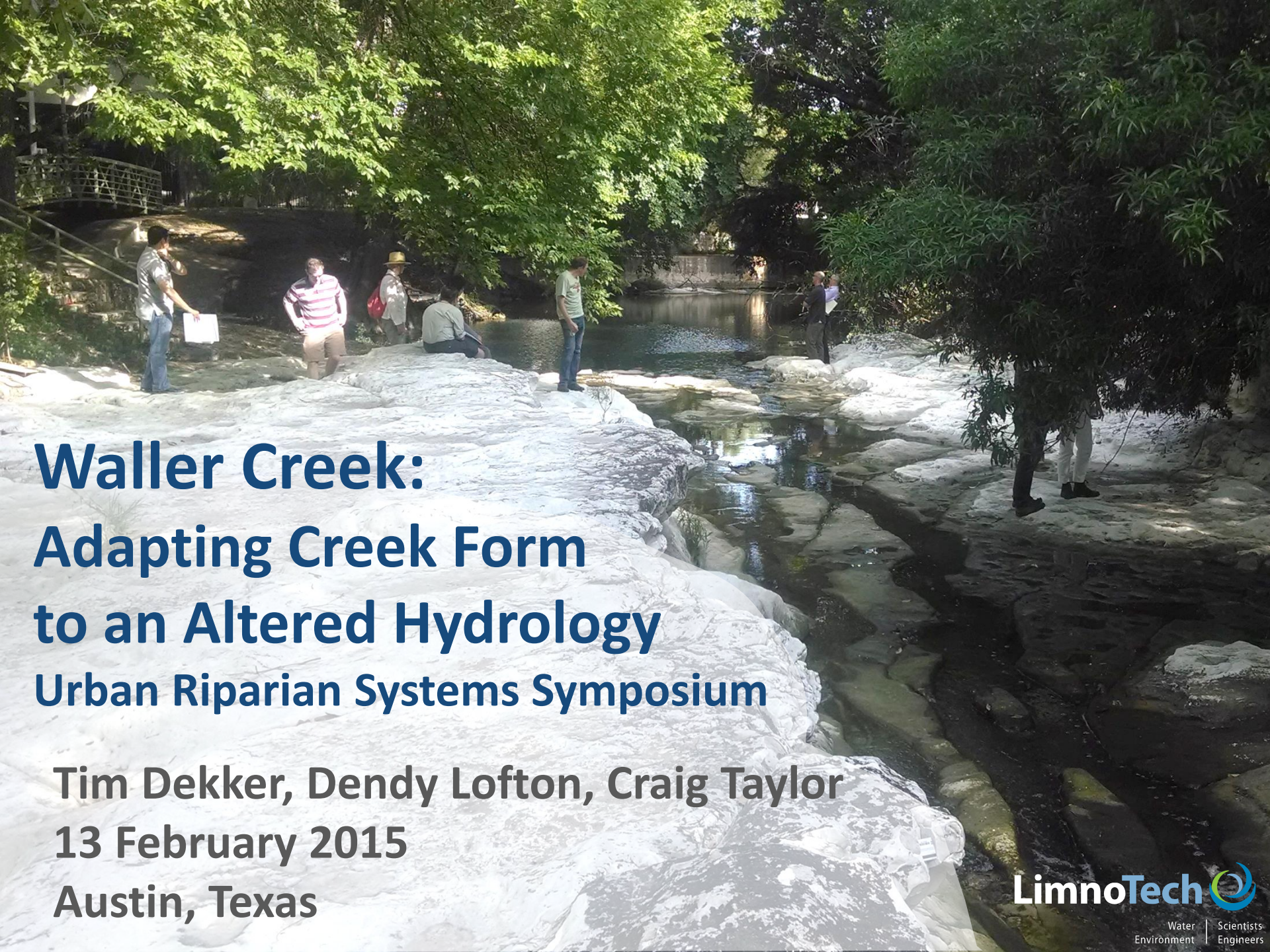


Waller Creek:
Adapting Creek Form to an Altered Hydrology
Urban Riparian Systems Symposium

Tim Dekker, Dendy Lofton, Craig Taylor

13 February 2015

Austin, Texas

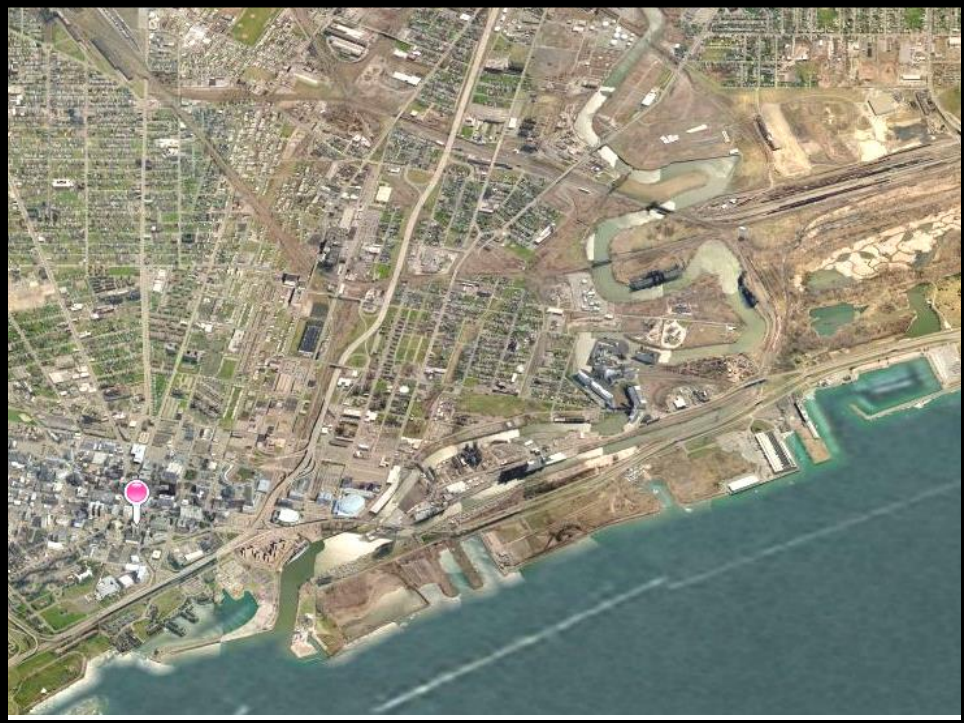
LimnoTech

Water Environment | Scientists Engineers

Waller Creek Urban Hydrology

- Urban hydrology is commonly affected by excessive imperviousness, intense runoff, functionally compromised creeks and rivers
- Ecological restoration requires careful attention to hydrologic underpinnings: functional lift
- This is typically challenging in developed urban systems – never enough land area to redo the hydrology
- Austin's Waller Creek is a very unusual exception to the above: comprehensive solution that definitely manages the flood water, but more importantly creates the physical space for a new urban hydrology and ecology



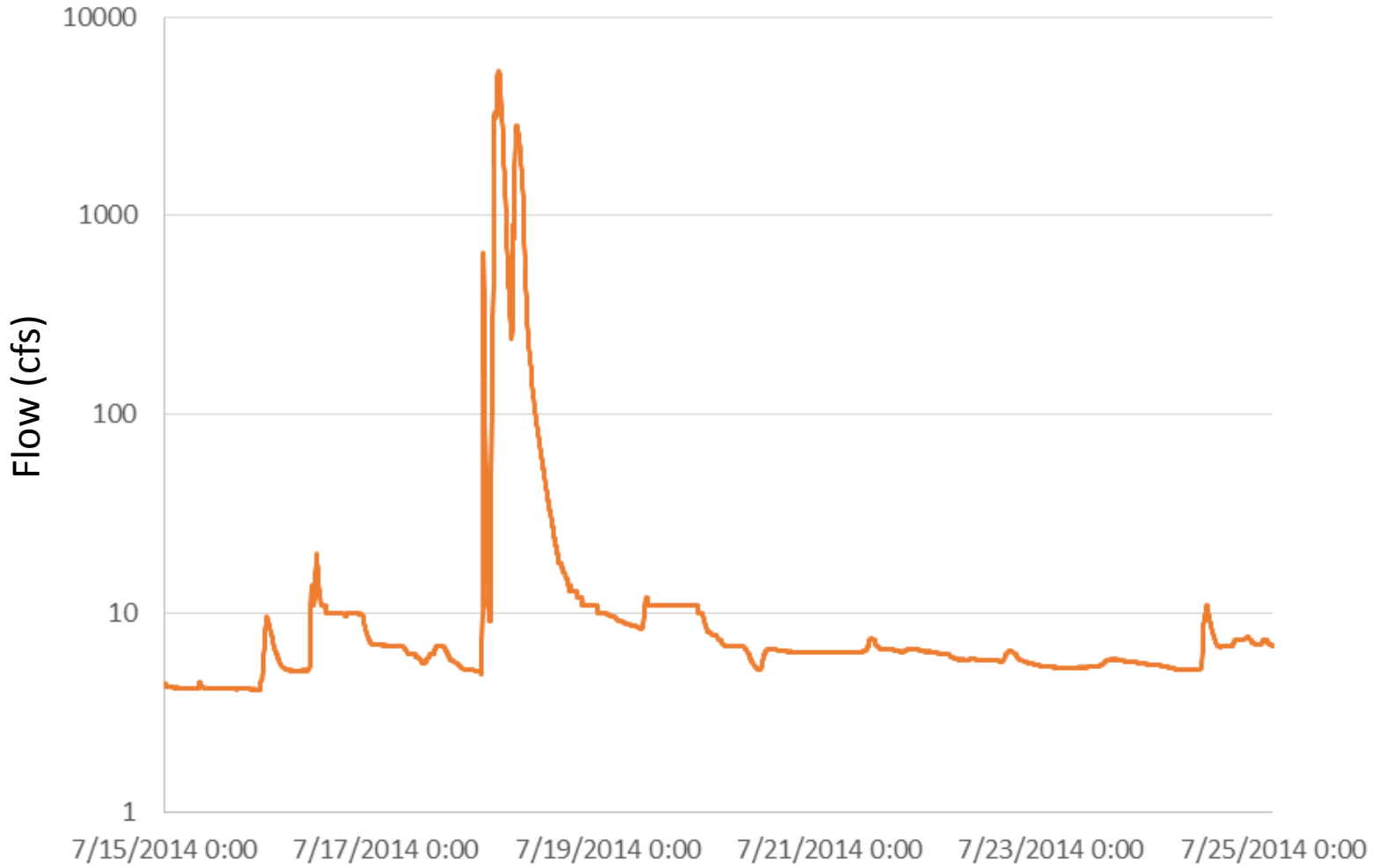



Functional Lift

USFWS: http://www.fws.gov/chesapeakebay/newsletter/Fall11/Pyramid/Pyramid.html

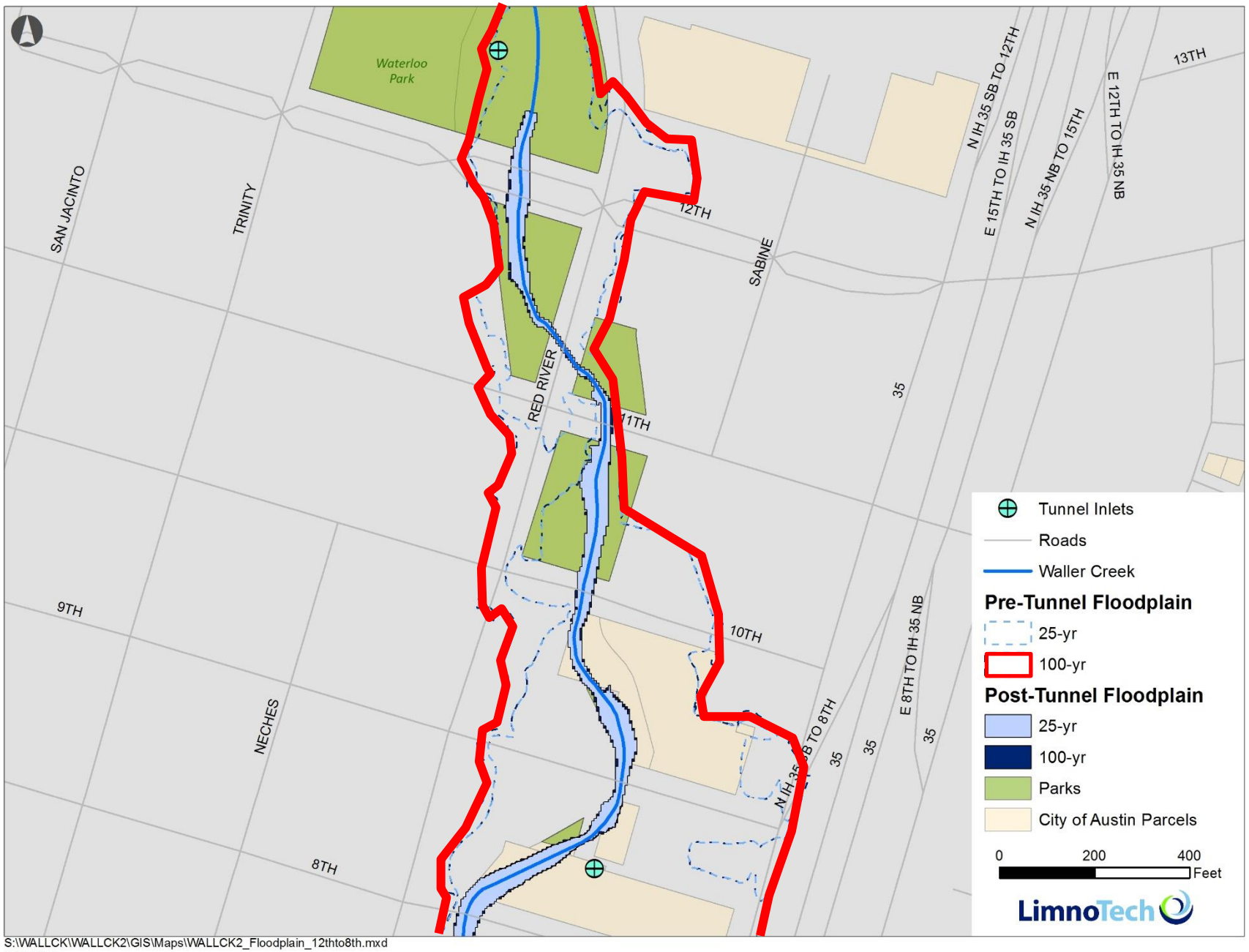
Urban Hydrology

July, 2014 Waller Creek Flooding



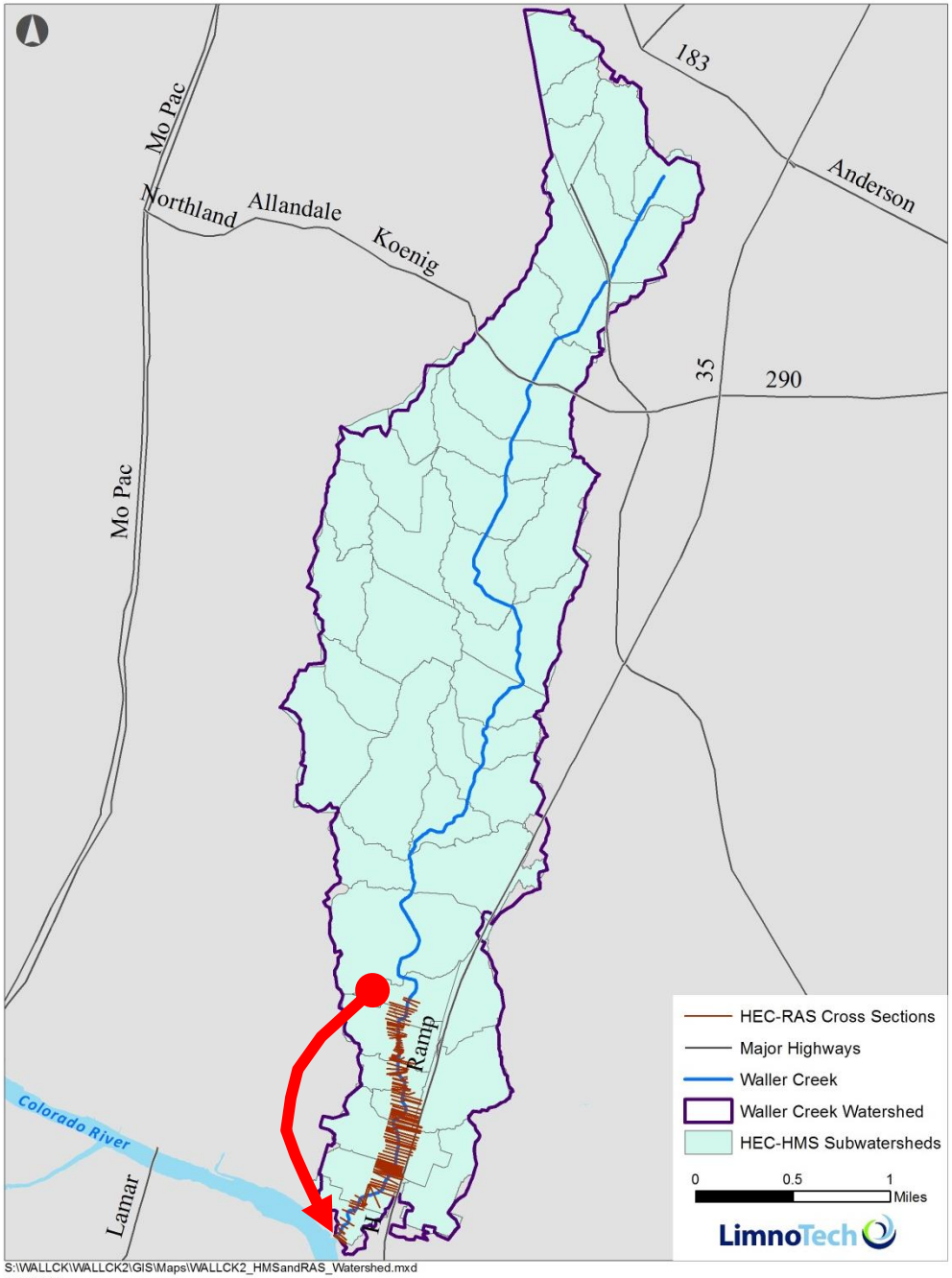
Waller Creek Flooding

Waller Creek Floodplain - 12th St. to 8th St.



S:\WALLCK\WALLCK2\GIS\Maps\WALLCK2_Floodplain_12thto8th.mxd
6/12/2014

Waller Creek Watershed



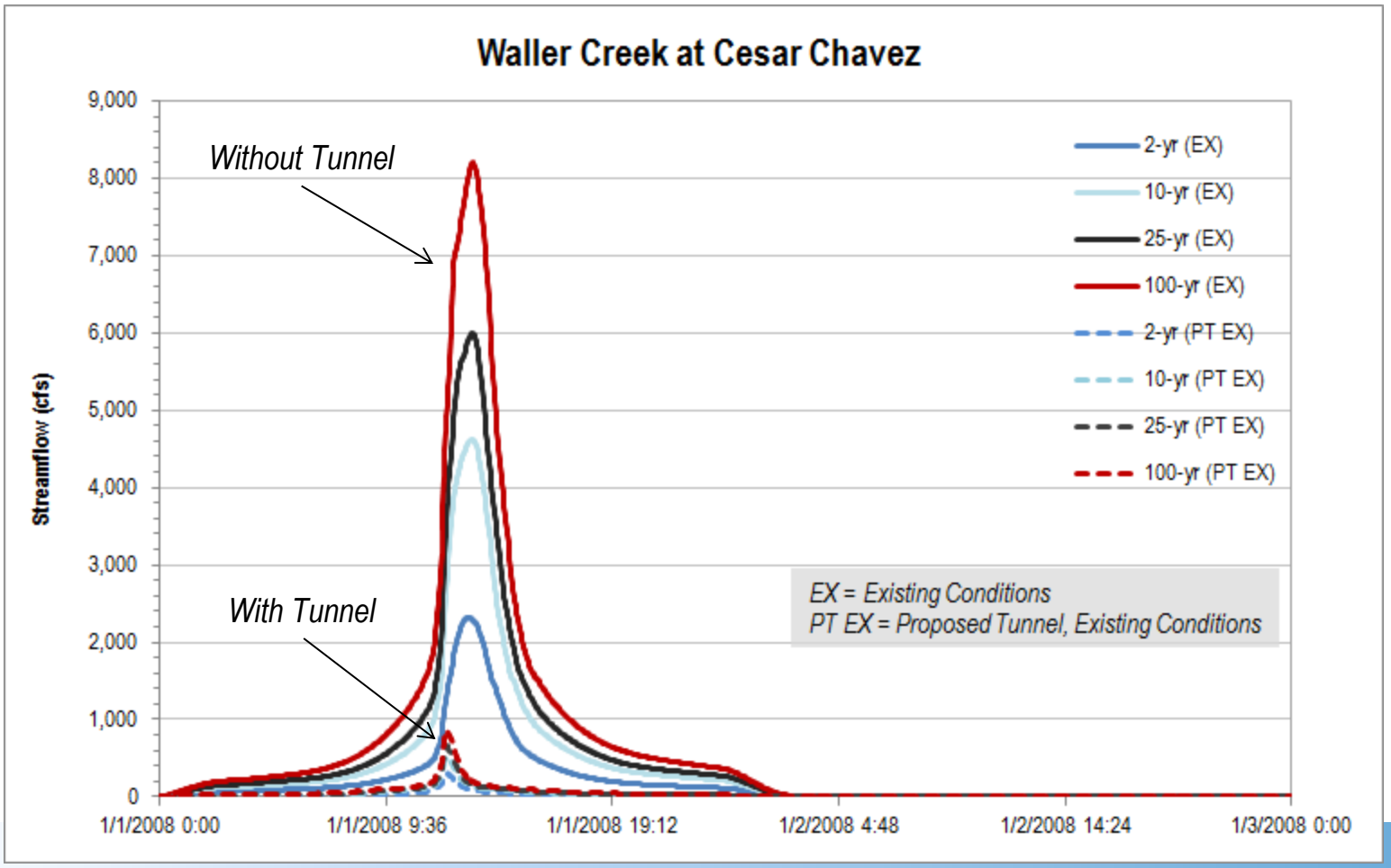
The tunnel diversion redirects approximately 82% of the watershed flows around the downstream reach of Waller Creek

Effects of modified hydrology

- Altered stream hydraulics
- Altered sediment transport
- Altered stream geomorphology
  - Sectionally
  - In Plan
- Altered water quality
- Altered biology

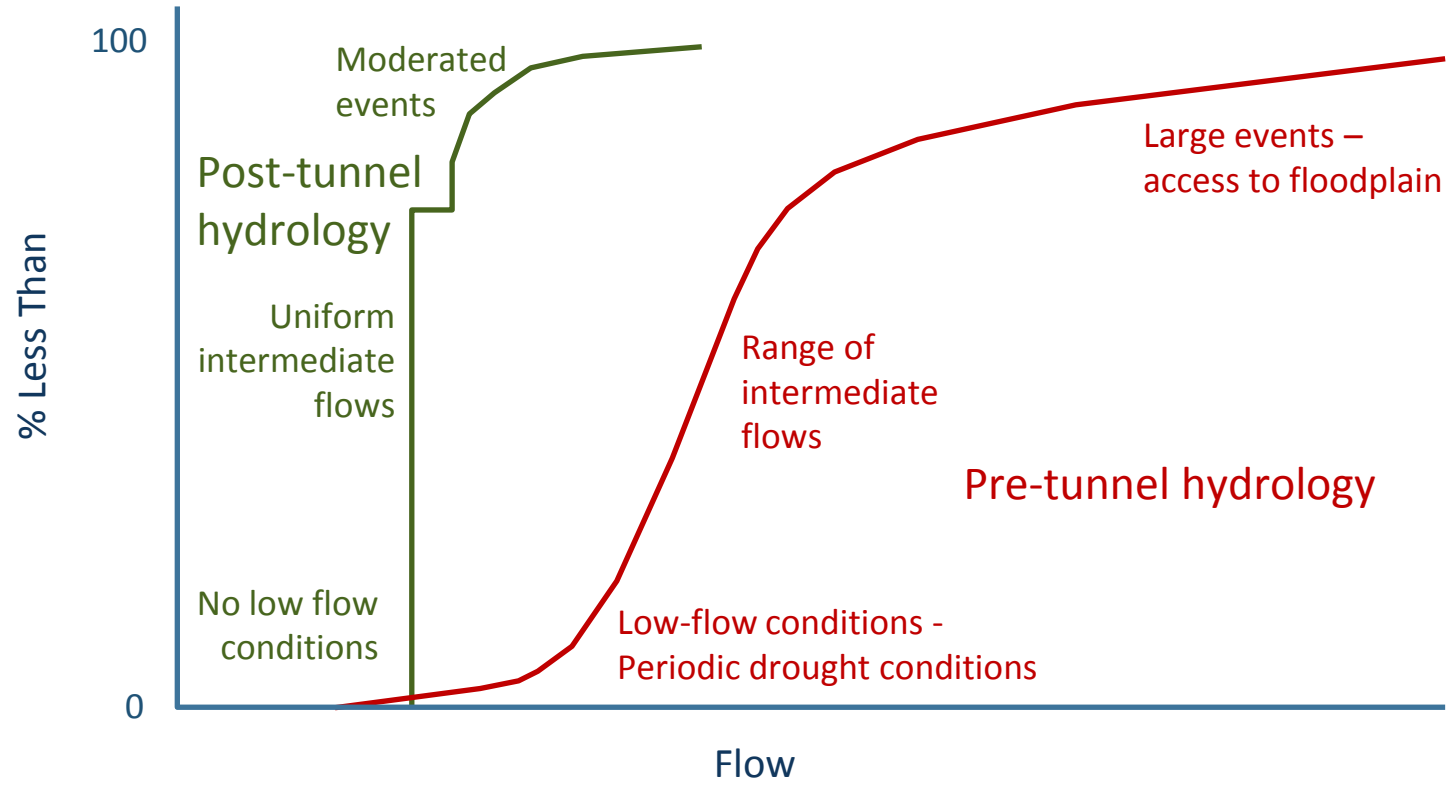
Effect on Event Flows: Hydrographs at Cesar Chavez Street

Hydrographs for a range of storms for pre- and post- tunnel, existing conditions

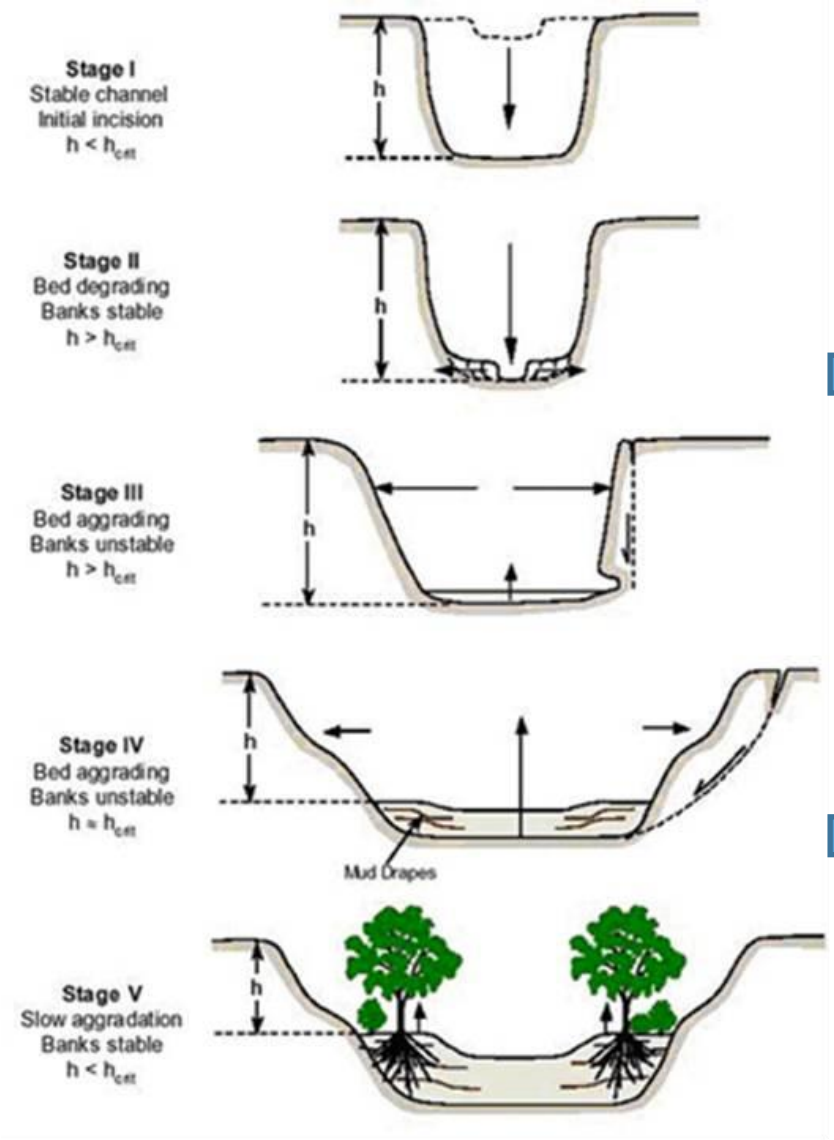


Effect on Flow Distribution:

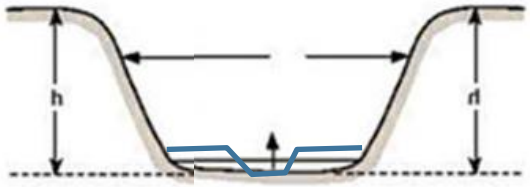
Conceptual Flow Distribution



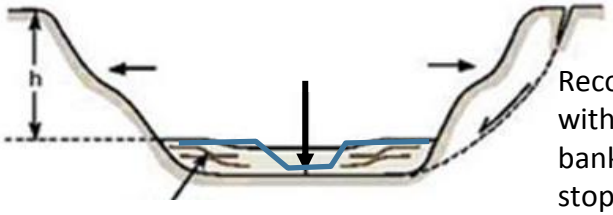
Channel Evolution



Tunnel construction -> hydrologic shift



Reconfigured channel with stabilized/sloughed banks, bed modified for low flow range



Reconfigured channel with stabilized/sloughed banks, aggradation stops /reverses, bed adapts to low flow range

Image from http://www.austintexas.gov/faq/geomorphic-analysis


8TH ST BR
EXISTING GRADE
(SEVERE EROSION)
STABILIZED SLOPE
(PROPOSED)
CONSTRUCTED
SLUMP BLOCK
100 YR WSE
2 YR WSE
HYDROSCEEDED
SLOPE
LIMESTONE BLOCK
SEATING AT TOE OF SLOPE
SOIL LIFTS W/
BRUSH LAYERING
AND HYDROSEEDING
RECONSTRUCTED
BASEFLOW CHANNEL
COIR LOG
AT TOE
FLOODPLAIN
WETLAND BENCH

Sediment Supply → Channel Form

- Supply → Transport Mechanism → Channel Form
- Transport Mechanism
  - Baseflow – Continuously Dynamic Channel
  - Storm events – Intermittently Dynamic Channel
  - None – Static Channel
- 3 Options for Channel Form

Creek Morphology: Options

Meander Belt – Continuous

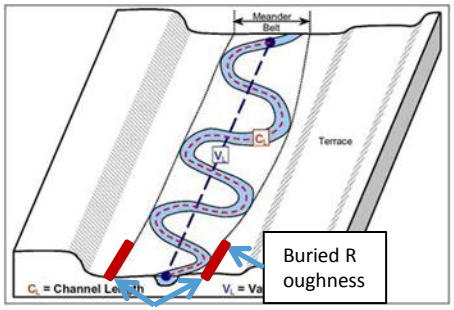
- Continuous feed
- Lower Construction Cost
- Higher O&M Cost
- High Risk of Failure

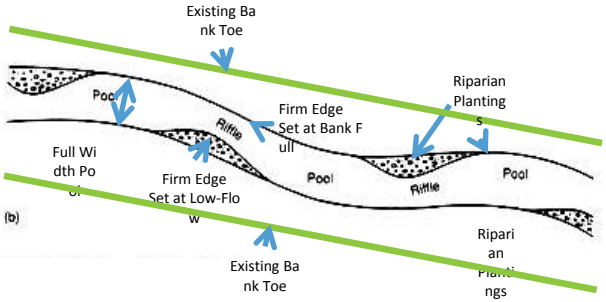
Enlarged Pools – Intermittent

- Seasonal feeding
- Costs depend of degree of stability
- Lower Risk of Failure / adaptive

Stable – Static

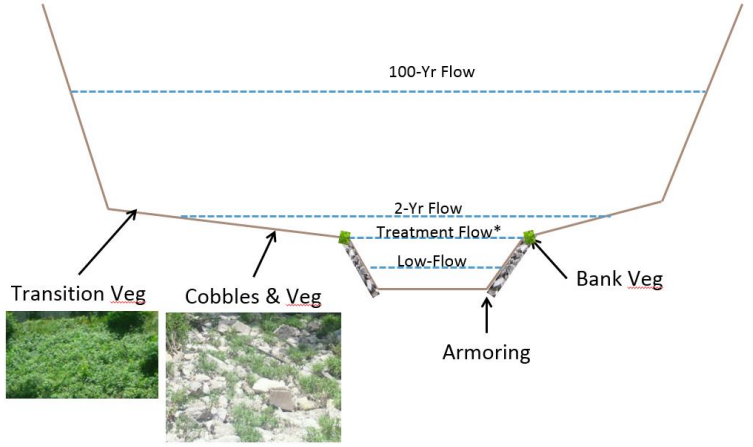
- No Feeding
- Higher Construction Cost
- Lower O&M Cost
- Low Risk of Failure

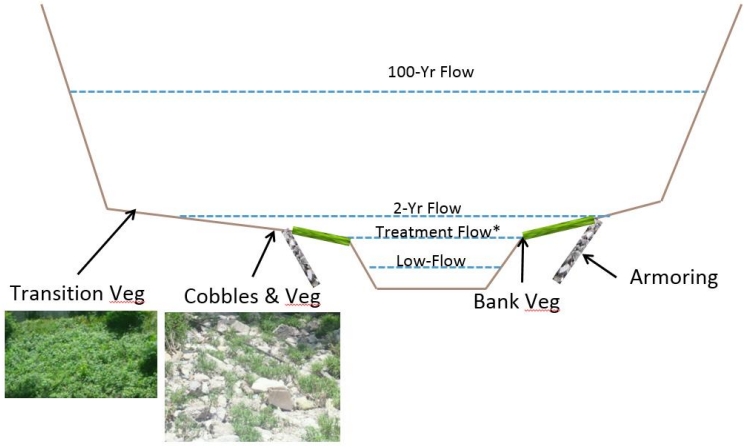


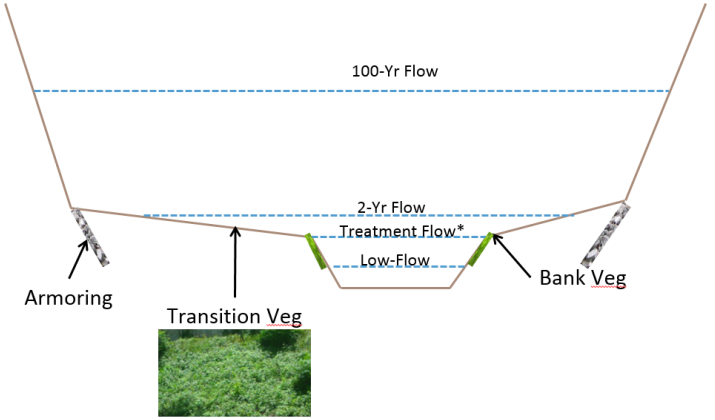


Implications for Channel Cross-Section

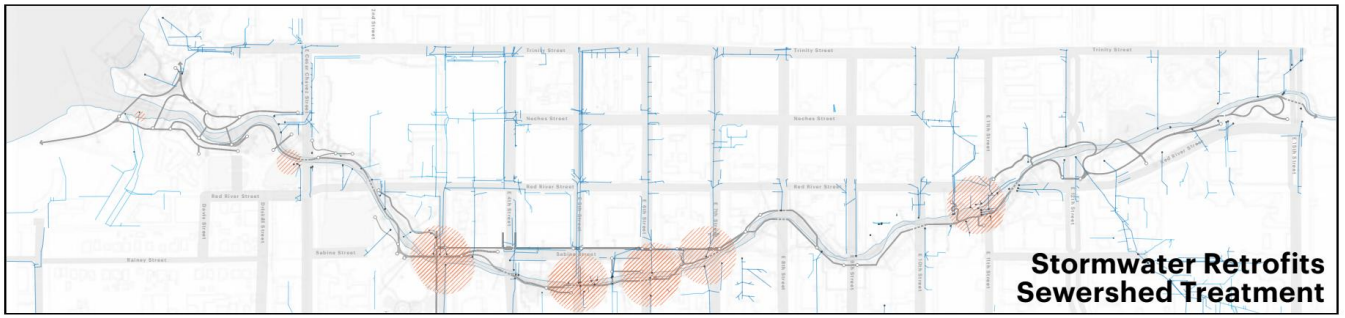
Different creek morphologies require different levels of armoring, in terms of location and intensity



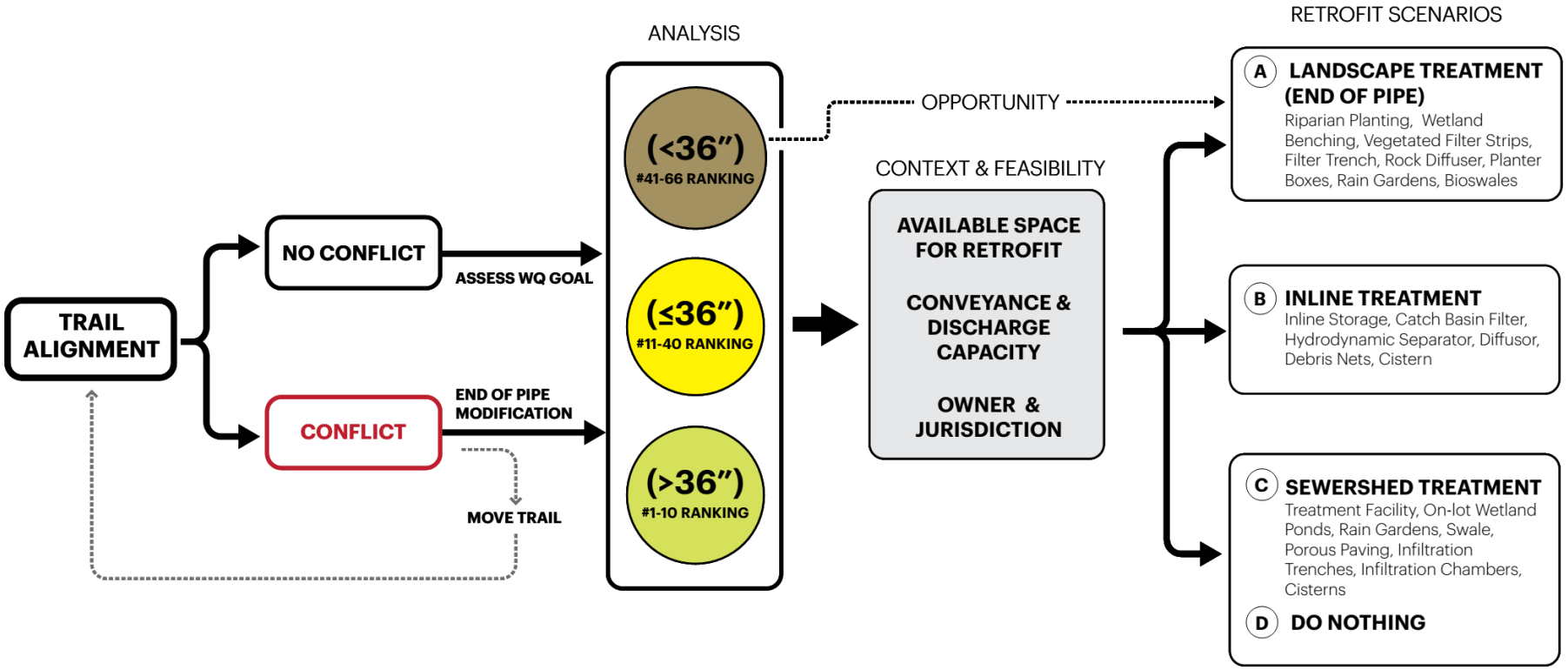


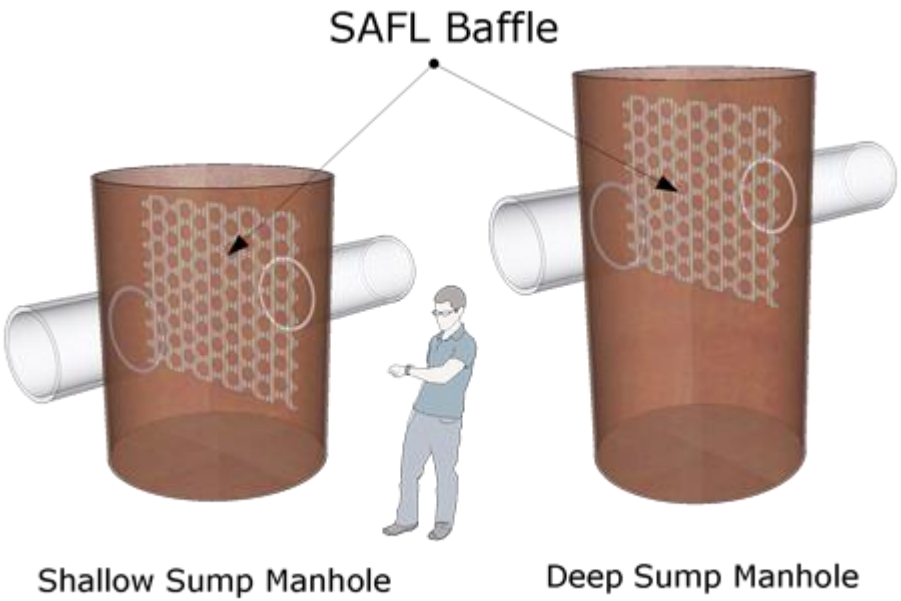


Stormwater Quality Improvement Opportunities



Stormwater Quality Improvement Opportunities

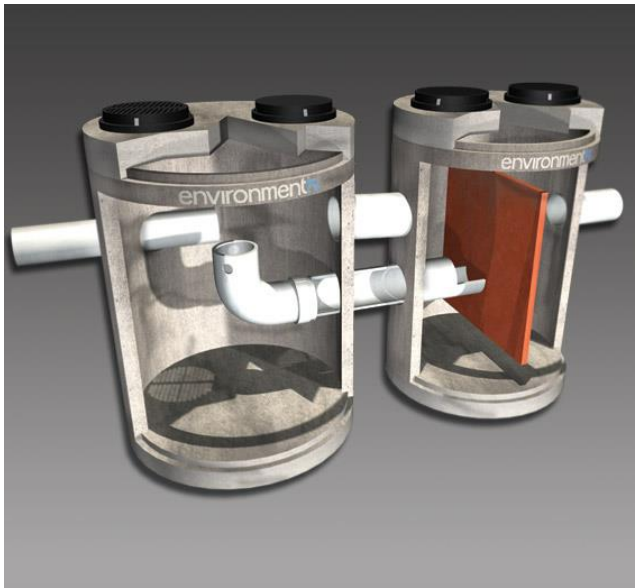


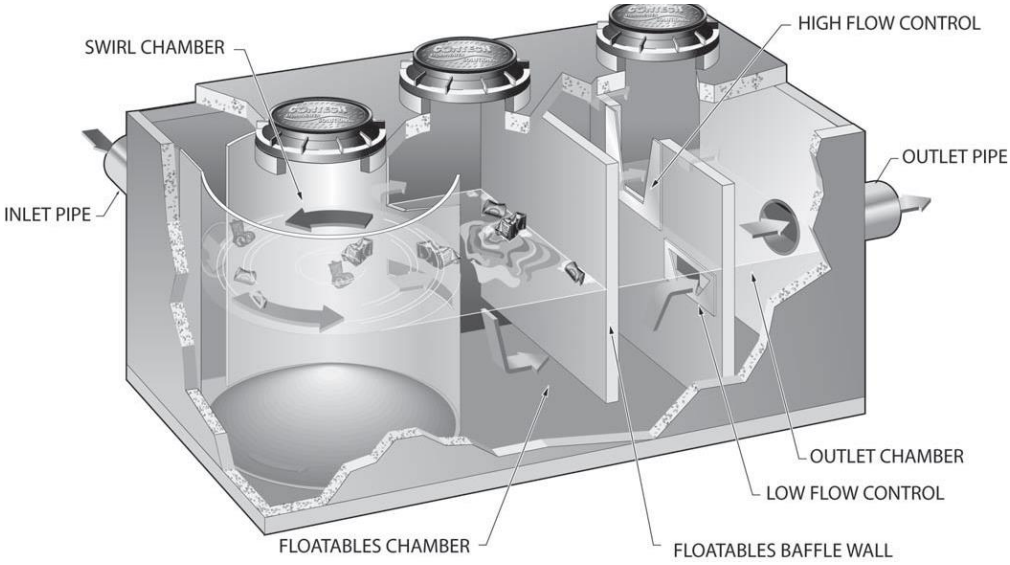


Stormceptor (STC)

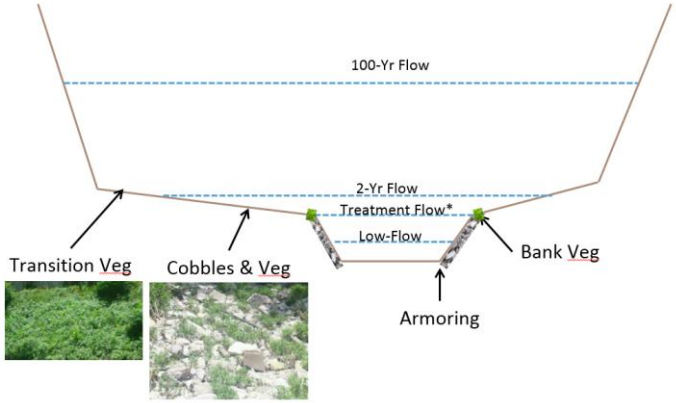
Vortechs

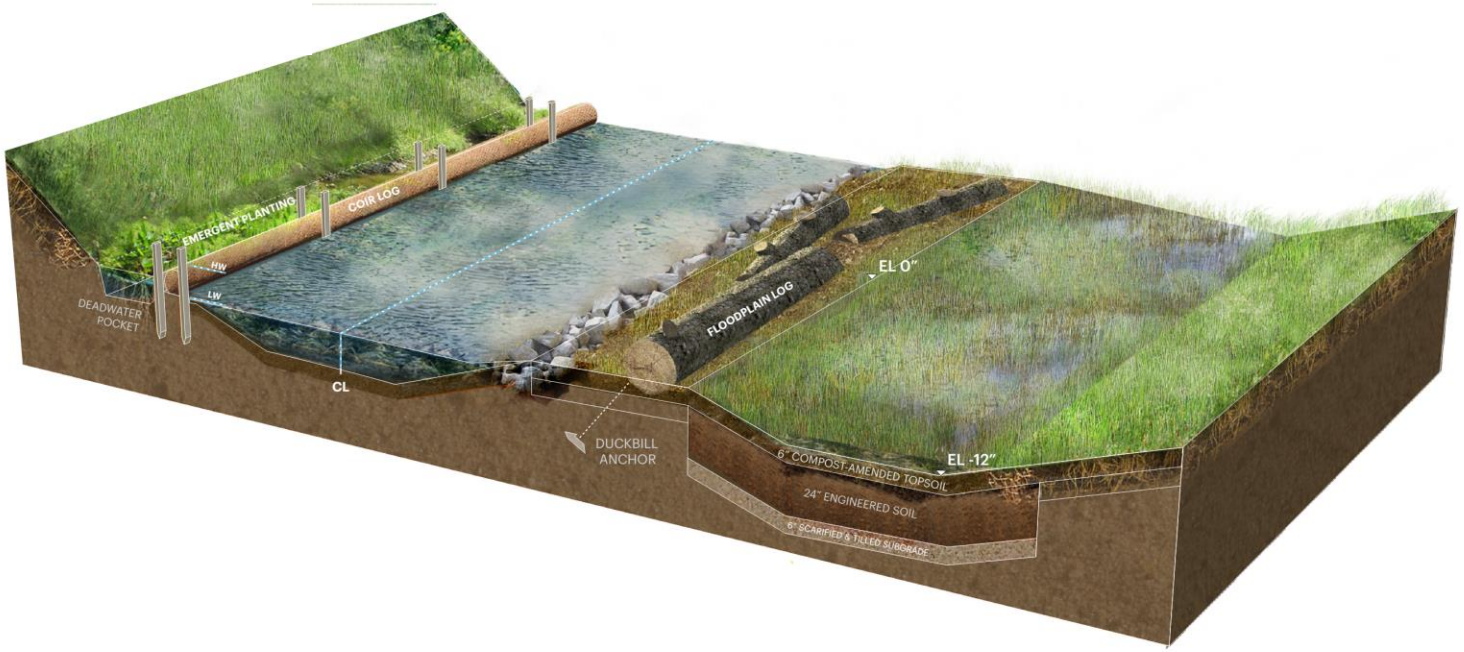
Environment 21 - V2B1





Habitat creation opportunities





Conclusions

- Waller Creek framework plan presents an unusual opportunity to accomplish real restoration of hydrologic, geomorphic, and ecologic function in an urbanized creek
- Waller Creek functional restoration addresses: altered stream hydraulics, sediment transport, stream geomorphology, water quality, and biology
- Creates a new functional waterway that supports human use, complements development in the corridor, and provides a haven for a new biological community