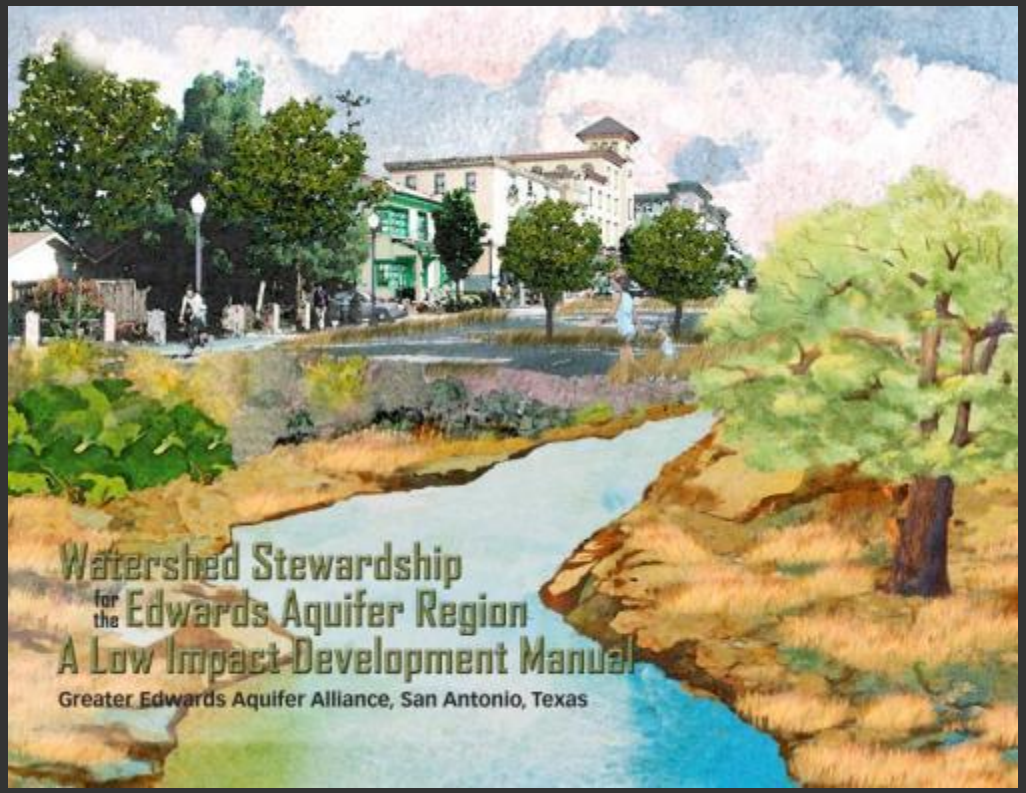
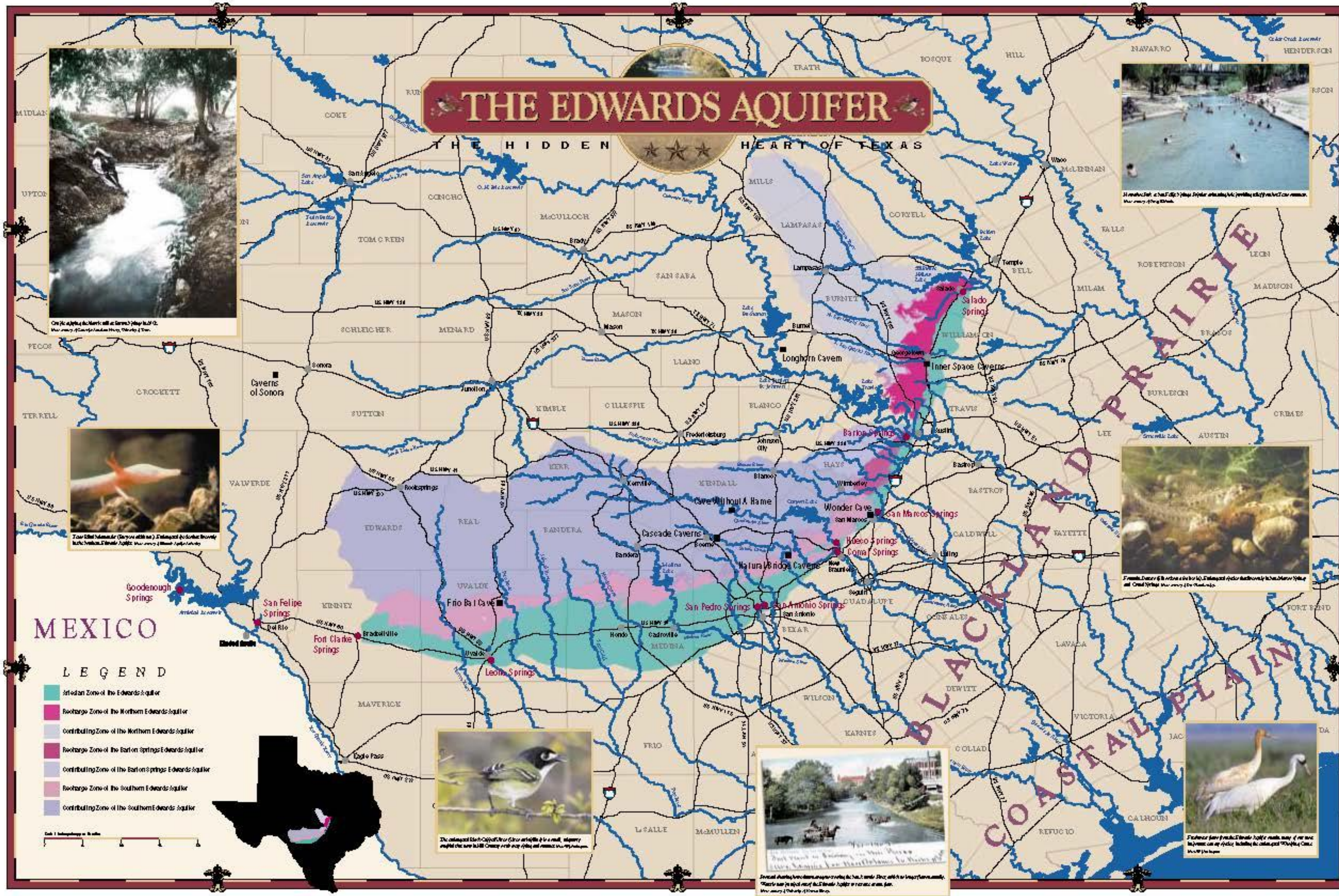


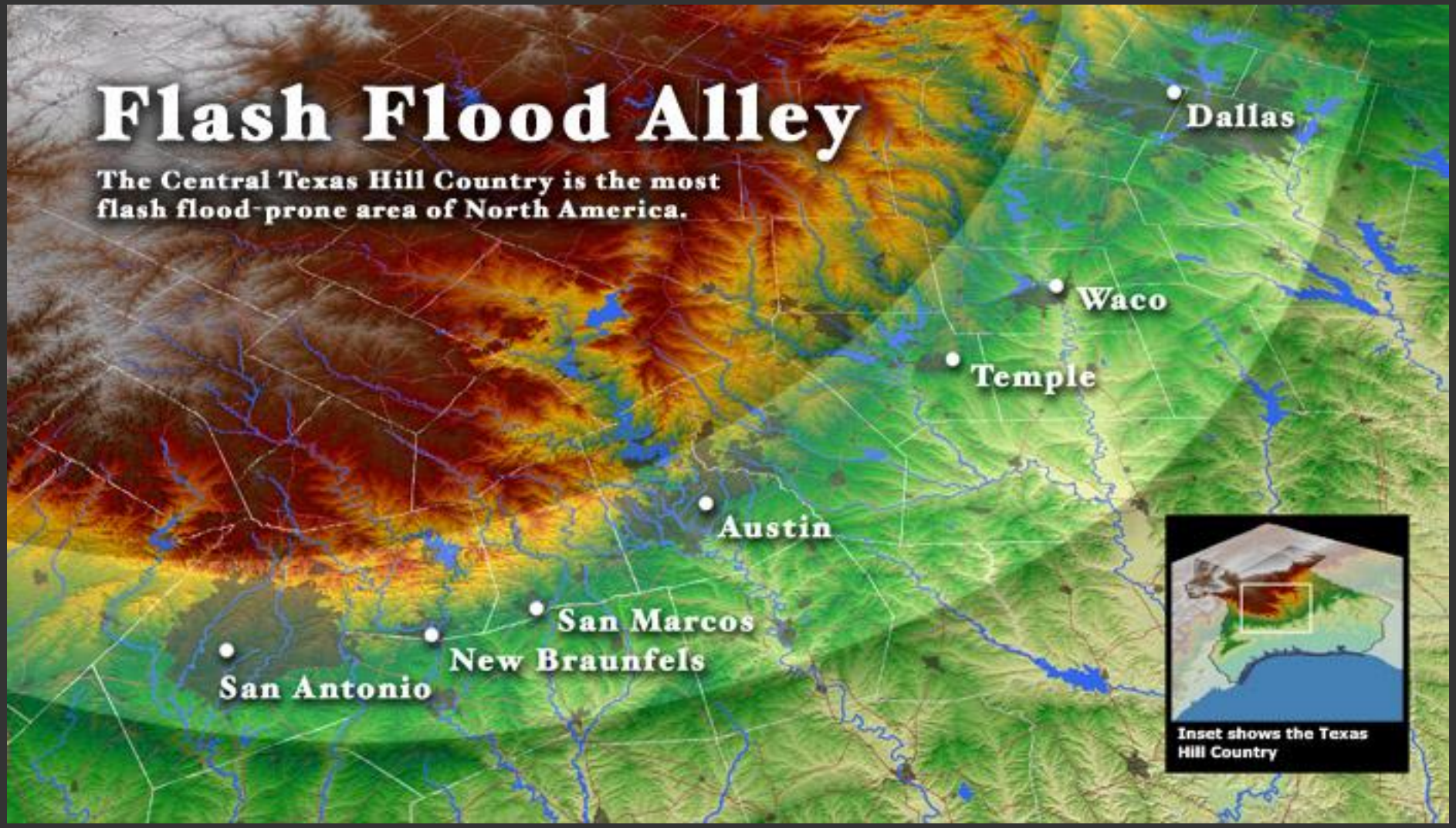
Edwards/Trinity Aquifer – Unique Challenges for LID

International LID Conference Houston Texas January 20 2015

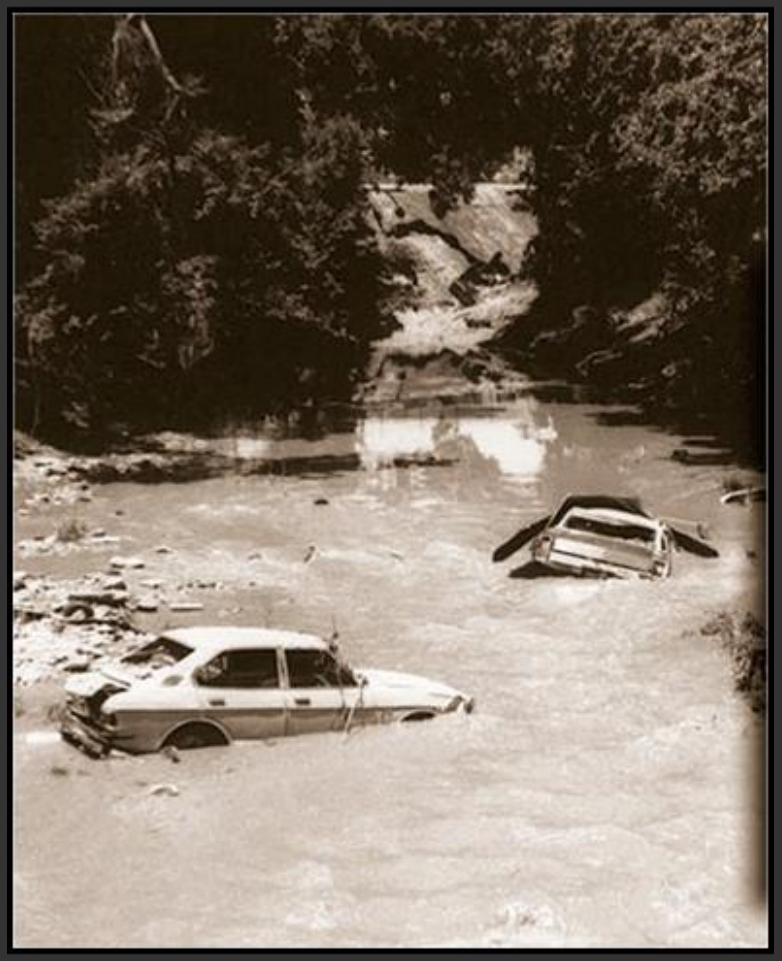
Annalisa Peace | Marita Roos RLA


THE EDWARDS AQUIFER
THE HIDDEN HEART OF TEXAS
MEXICO
BLACKLAND PRAIRIE
COASTAL PLAIN
LEGEND
Artesian Zone of the Edwards Aquifer
Recharge Zone of the Northern Edwards Aquifer
Contributing Zone of the Northern Edwards Aquifer
Recharge Zone of the Barton Springs Edwards Aquifer
Contributing Zone of the Barton Springs Edwards Aquifer
Recharge Zone of the Southern Edwards Aquifer
Contributing Zone of the Southern Edwards Aquifer
Salado Springs
Longhorn Cavern
Inner Space Caverns
Barton Springs
Wonder Cave
San Marcos Springs
Cave Without A Name
Cascade Caverns
Hueco Springs
Comal Springs
Natural Bridge Caverns
San Pedro Springs
San Antonio Springs
Frio Bat Cave
Leona Springs
Fort Clarke Springs
San Felipe Springs
Goodenough Springs
Caverns of Sonora


Largest springs in Texas
Cities and towns
SALADO
Salado Springs
AUSTIN
Barton Springs
San Marcos Springs
SAN MARCOS
Hueco Springs
Comal Springs
NEW BRAUNFELS
San Antonio Springs
San Felipe Springs
San Pedro Springs
SAN ANTONIO
BRACKETVILLE
DEL RIO
Las Moras Springs


Flash Flood Alley
The Central Texas Hill Country is the most flash flood-prone area of North America.
Dallas
Waco
Temple
Austin
San Marcos
New Braunfels
San Antonio
Inset shows the Texas Hill Country

Increased Impervious cover on the Edwards Aquifer Recharge Zone increases stormwater flows, erosion, and flooding, requiring cities to spend billions of dollars for stormwater management projects to mitigate downstream flooding.



The Edwards Aquifer Region is one of the fastest growing areas in the nation:

Fastest Growing Cities in the Nation (Forbes 2/14/2014)

#1: Austin - 2013 Population Growth Rate: 2.5%
#20: San Antonio - 2013 Population Growth Rate: 1.83%

U.S. Census Bureau - Resident Population Estimates for the 100 Fastest Growing U.S. Counties With 10,000 or More Population in 2010: April 1, 2010 to July 1, 2013

#10 – Kendall County	13% growth
#14 – Hays County	12% growth
#17 – Williamson County	11.5% growth
#31 – Travis County	9.4% growth
#34 – Comal County	9.2% growth
#44 – Guadalupe County	8.9% growth

Due to rapid recharge and open channel flow, the Edwards is one of the most prolific aquifers in the world.

Conversely, there is minimal to no filtration of water entering the Edwards. Thus, it is extremely vulnerable to pollution.

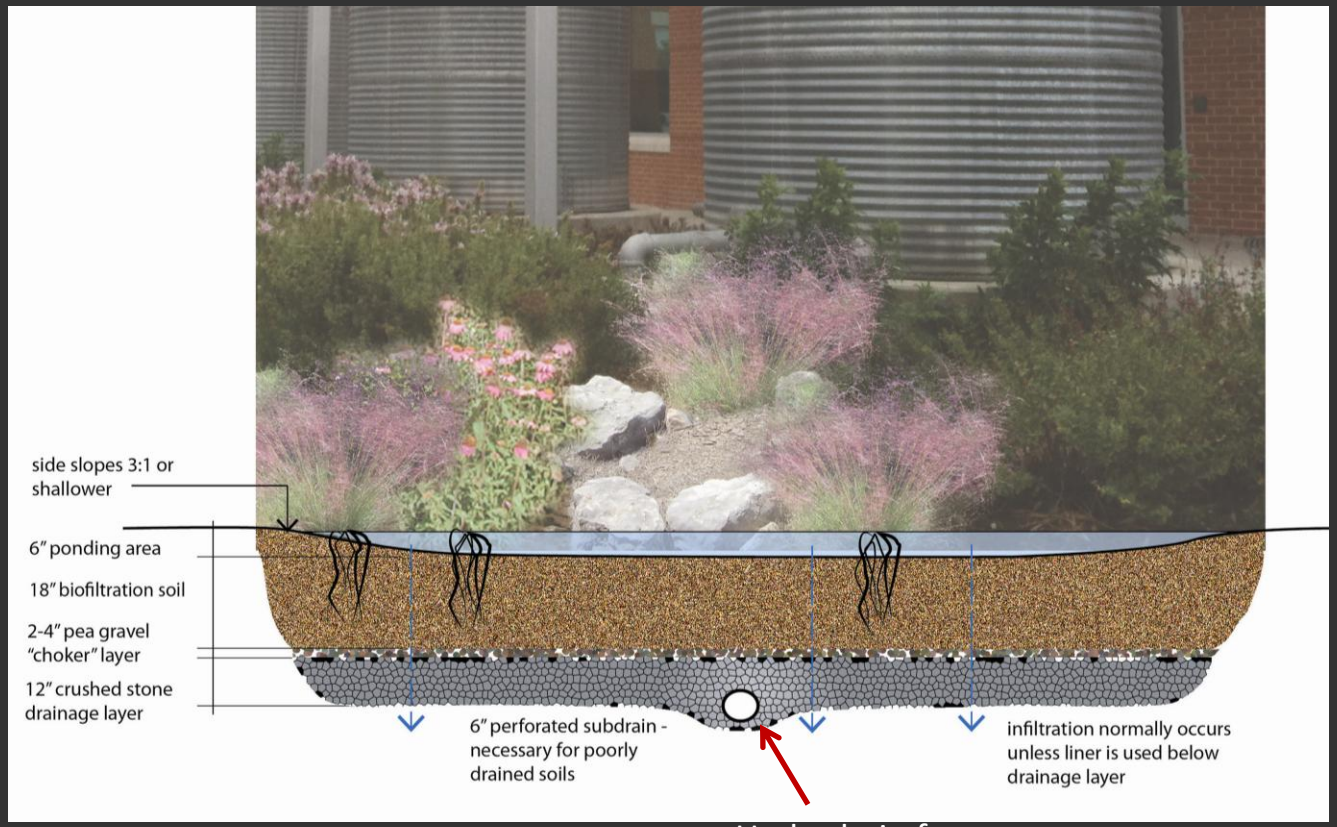
Surface water across Edwards/Trinity Aquifer region is scarce

- Surface waters and streams less prevalent in aquifer region
- Streams lose water through fissures as they flow across porous karst
- 75% of aquifer recharge occurs directly through streambeds that cross the Recharge Zone
- Available water derived from groundwater springs and seeps

Regulations permit extensive site modification thus altering the hydrologic regime

- Sand filter is prevalent BMP across the Edwards/Trinity region
- Bexar County (2010) 10 to 15% of ~ 3,000 structural BMPs are persistently non-compliant
- Up to 85% impervious cover allowed in San Antonio
- Up to 100% impervious cover allowed under State Law
- Edwards Rules treat stormwater as a pollutant

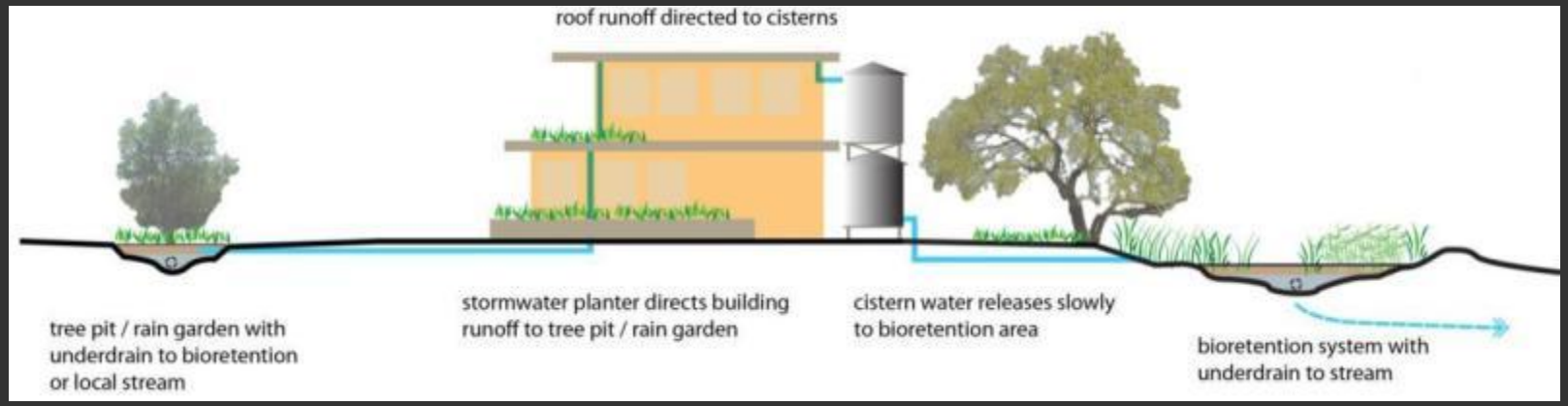
Regulations, site conditions also require modifications for use of LID



Underdrain for bioretention facility

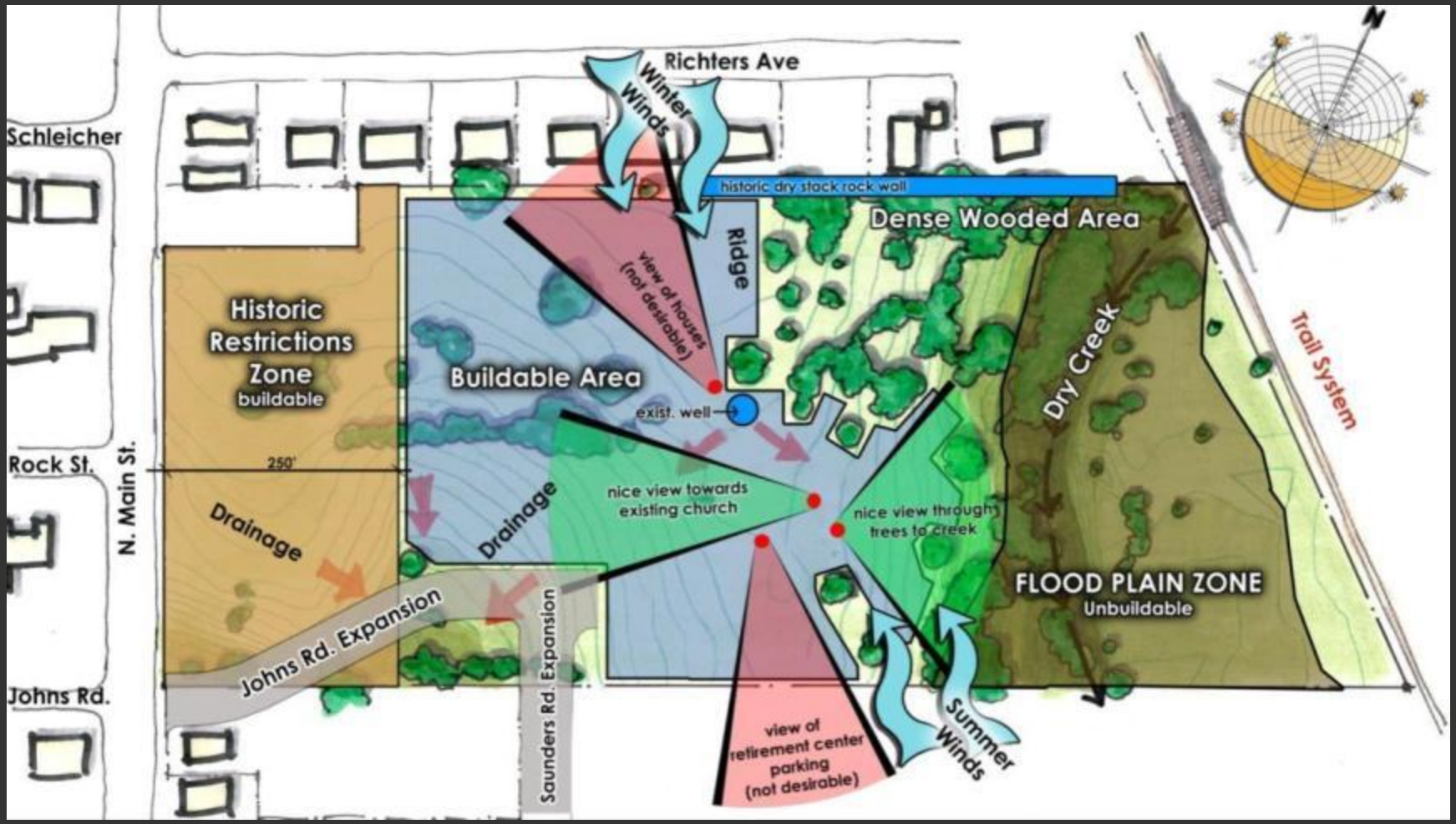
- No direct discharge to Recharge Zone
- Impermeable liners required
- Poor infiltration rates necessitate underdrains

LID treatment train mimics predevelopment site hydrology



- Sustain long flow path for captured rainwater
- Slow water velocity to reduce erosive force
- Infiltrate water in appropriate locations
- Sustains native vegetation
- Disharge treated water to streams for recharge

Successful LID implementation requires watershed-level analysis with site preservation and impervious cover limits



- Site analysis plan for Boerne Public Library – Paul Barwick ASLA
- Library sited above Trinity Aquifer
- Site plan included restoration of dry creek by volunteers


Parking bioswales
Rainwater harvesting
Overflow meadow
Restored forest slope
Detention

LID methods a natural extension of site topography and hydrology

- Bioswale medians in parking area collect first flush runoff and convey to detention
- Cisterns collect 23,500 gallons water from library roof for site reuse

LID is complementary to overall water / site preservation strategy

- Rainwater capture sustains plant habitats around the site
- Informative presentation of water cycle is part of library education program

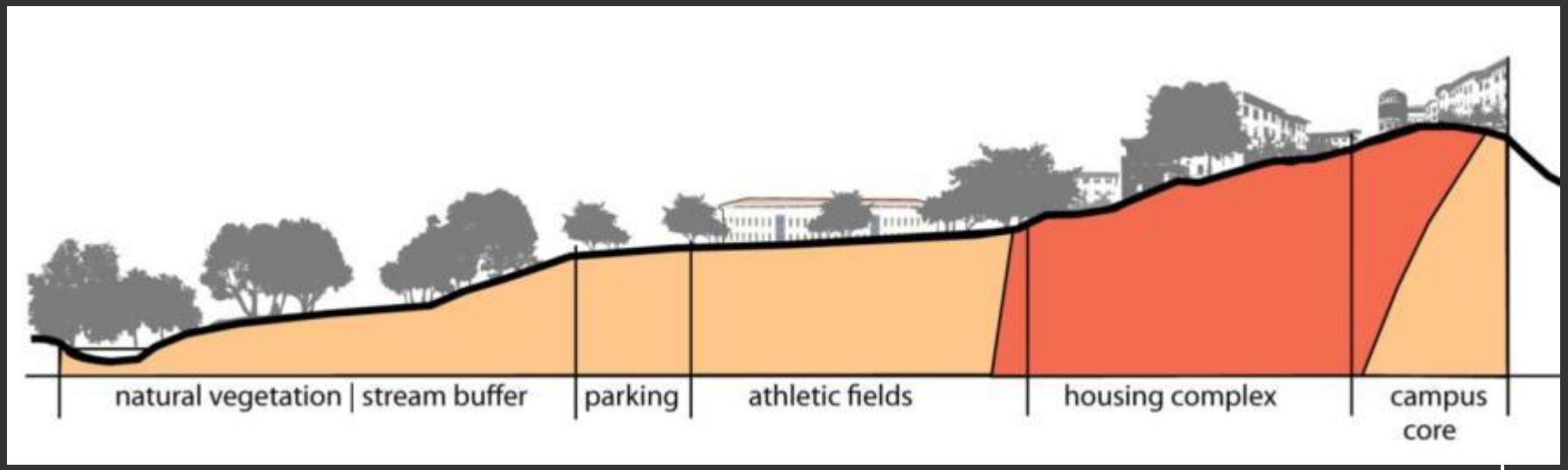
UTSA Main Campus located in northern Bexar County over EA Recharge Zone

Campus has spectacular views and areas of protected landscape – not necessarily integrated with campus activity areas

Campus core and planned housing are over the most permeable area of Edwards limestone

LID strategies can integrate with main campus spaces

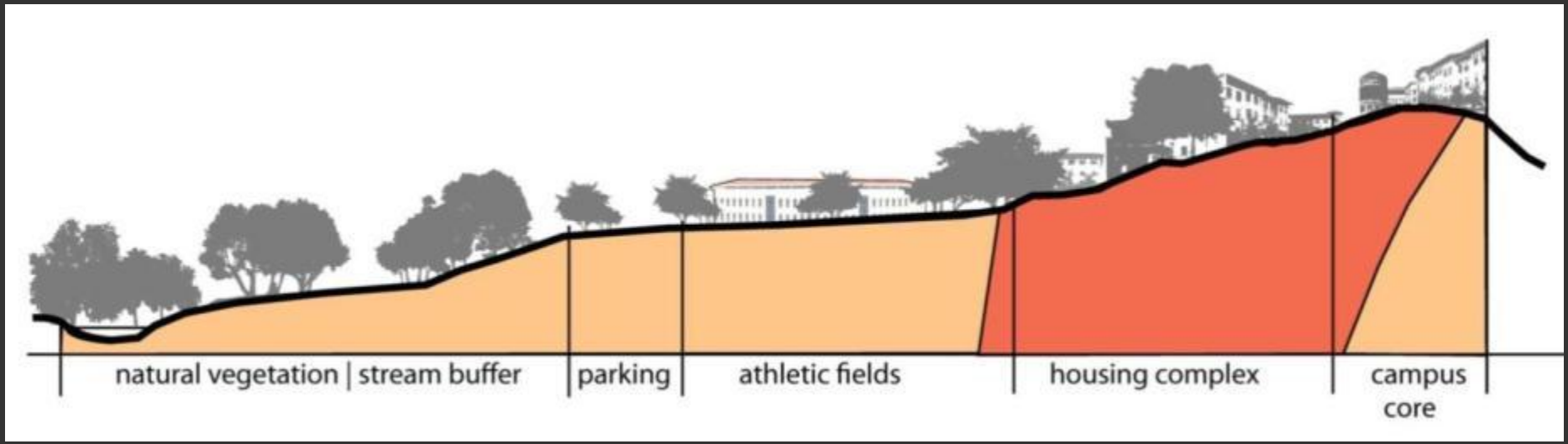
- Capture rooftop drainage at source for reuse in buildings
- Use bioretention to recharge clean water and create focused habitat areas



Relatively clean runoff from walkways and pedestrian plazas can be directed to bioretention facilities

Proposed campus expansion, athletic fields and most parking is located in less permeable limestones

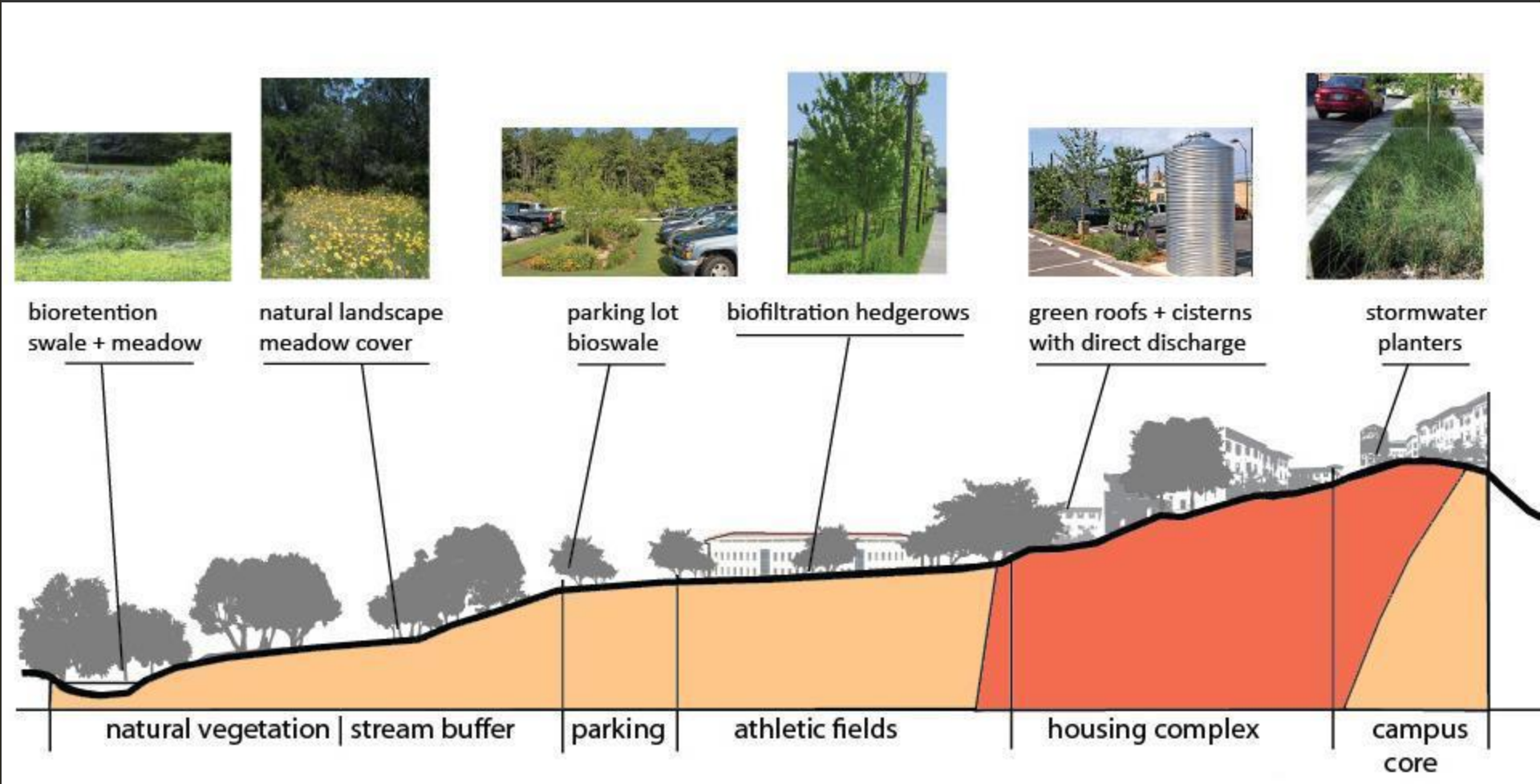
- LID strategies can be used to reintroduce natural drainage patterns



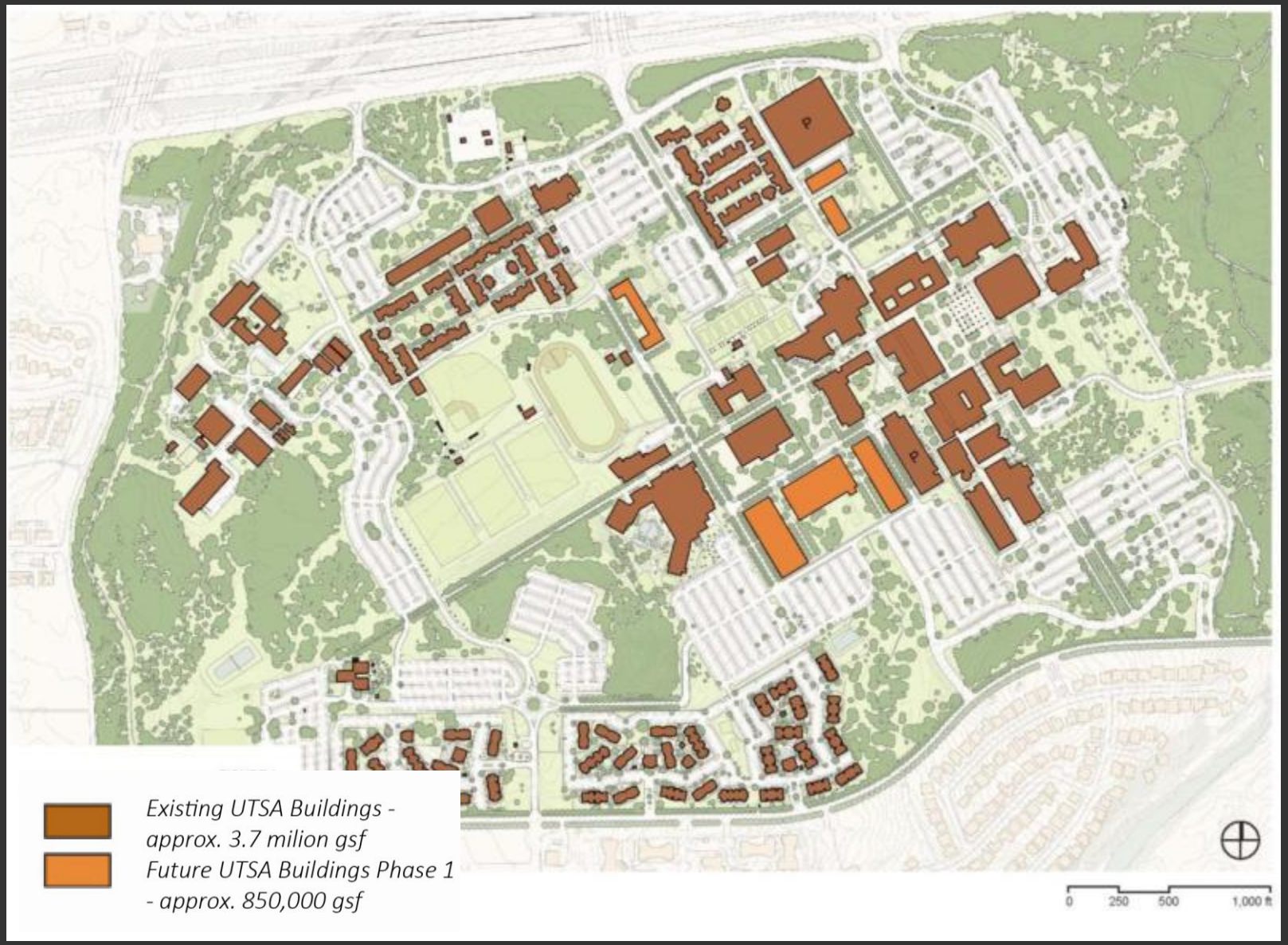
Convert turf swale to bioswale with checkdams

- Slow runoff and retain water for habitat
- Treat recharge water directed to streams

Using LID as "treatment train" will improve recharge amount, improve water quality and integrate landscape + buildings



UTSA master plan



UTSA plan with LID features

Retrofitting campus with LID features could capture significant amounts of runoff for onsite treatment and stream recharge