Flood Protection and Ecosystem Restoration in an Urban Environment: The Dallas Floodway Extension, Dallas, TX

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National Conference on Ecosystem Restoration

New Orleans, LA, USA

August 30, 2018

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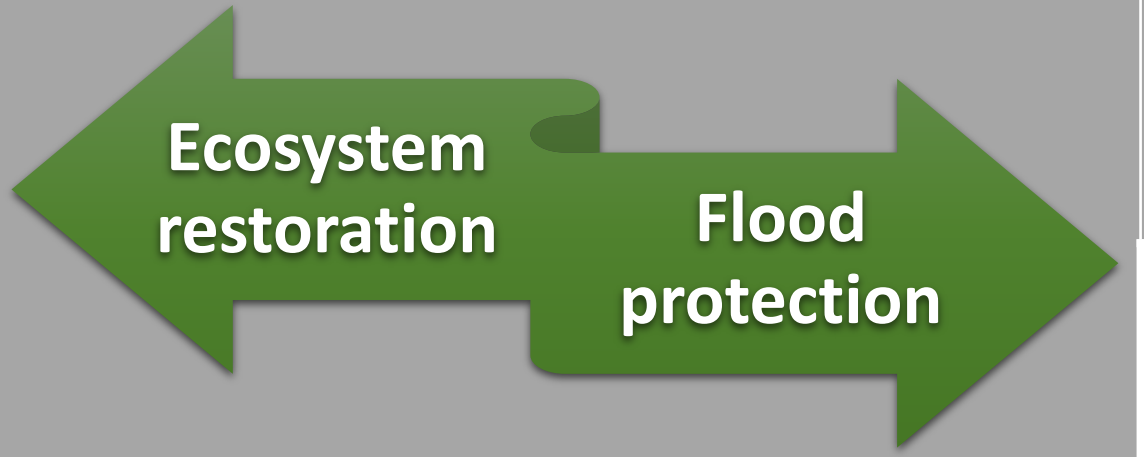
What we want is to integrate functionality with infrastructure.



Definition of USACE **Ecosystem Restoration**?
"Ecosystem restoration is the process of assisting in the recovery of ecosystems that have been **degraded, damaged, or destroyed** and focuses on establishing the ecological processes necessary to make terrestrial and aquatic ecosystems **sustainable, resilient, and healthy** under *current and future conditions*."

Focus?
"The focus of the Corps ecosystem restoration program is on **water-related ecosystem projects**, including restoration of wetland, riparian and aquatic systems."

Major Challenges to Aquatic Ecosystem Restoration in an Urban Environment

Aside from reliable funding sources to forming partnerships that work

- Hydrology - we need water, but not too much!
- Compatible floral associations that promotes desirable vegetation in an urbanized floodplains that provide the sustainable ecosystem goods and services we desire
- O&M – operations and maintenance

Overcoming Challenges* to Aquatic Ecosystem Restoration in an Urban Environment

- Defining project goals - include realistic objectives and performance measures that work with the hydrology of the project

- Involving ALL the stakeholders throughout planning, implementation, and monitoring

- Adaptive Management - this approach incorporates flexibility into project management and provides an avenue to accomplish those realistic goals and objectives; QA/QC during monitoring

**Lessons Learned*

Overview - The Dallas Floodway Extention

- Component of the Dallas Floodway Project located within the Trinity River Basin in North Texas
- General Investigation authorized in 1965 by Section 301 of the Rivers and Harbor Act authorized; modified by Section(s) 351/356 of Water Resources Development Act(s) of 1996/1999; construction began 2001
- Amended to include environmental & recreational components
- Sponsor: City of Dallas, Texas; Fort Worth District requested assistance from Engineer Research and Development Center
- Focus areas: Flood protection, Ecosystem Restoration, Recreation

The Dallas Floodway Extention

Purpose: provide overbank flowage capacity for Trinity River flood waters, ensuring reduced flood risk to the City of Dallas

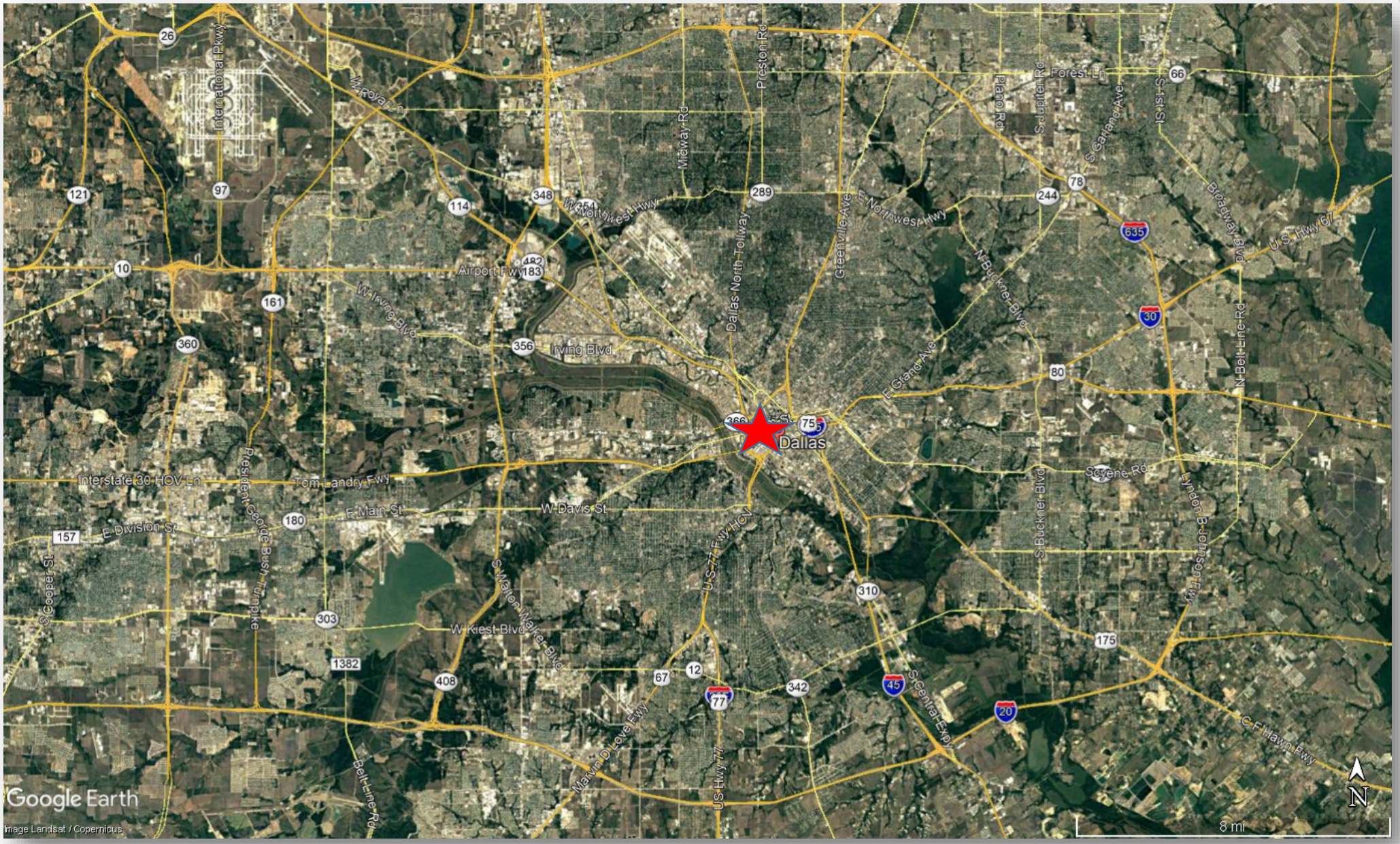
South Dallas flooding in 1989

Dallas County, TX
Pop.: 1.714 million (1984)*

Image: GE 1984

Trinity River:
710 mi.
4 forks
18K mi²
Trinity Bay

*US Census Bureau

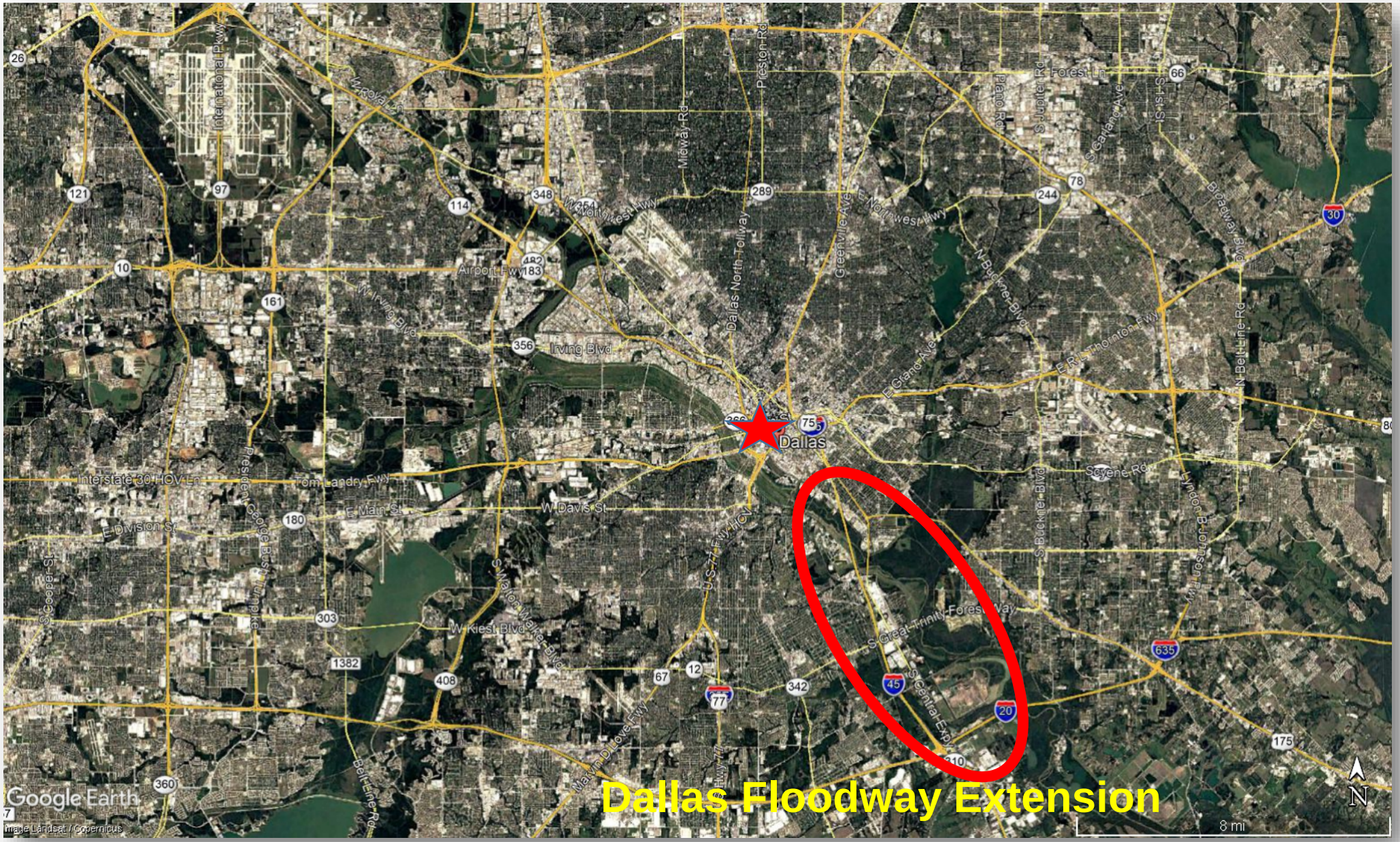


Dallas, TX Pop.: 1.318 million (2016)*

Dallas County, TX Pop.: 2.618 million (2017 est.)*

Image: GE 2016

*US Census Bureau



The Dallas Floodway Extention
Project Components

- Flood control – levees = ~3.7 miles
- Contiguous chain of constructed emergent wetlands with adjacent grasslands (~271 acres); replace woody with herbaceous plants
  - 9 wetland cells; ~6-20 ac. each
  - ~123 ac. emergent wetlands; ~45 ac. open water; ~102 ac. grasslands
  - Wetlands provide quality habitat during periods of no-flow – 95% of the time
- Recreation
  - Tie-ins to existing/proposed trails (keeps stakeholders engaged)

Dallas Floodway

1950s

Trinity River channelized

Mowed regularly to deter woody vegetation; turf grass dominated vegetation

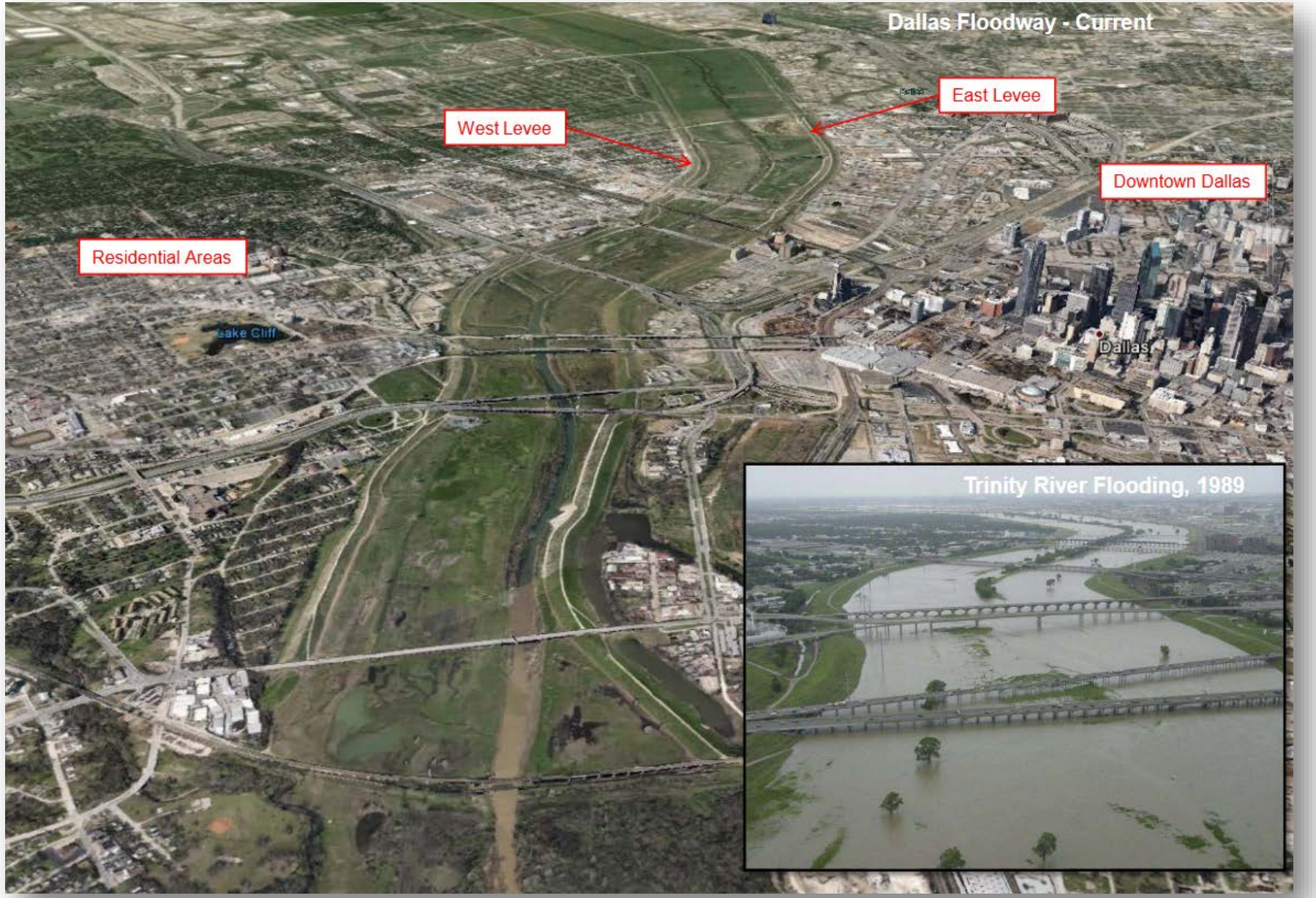
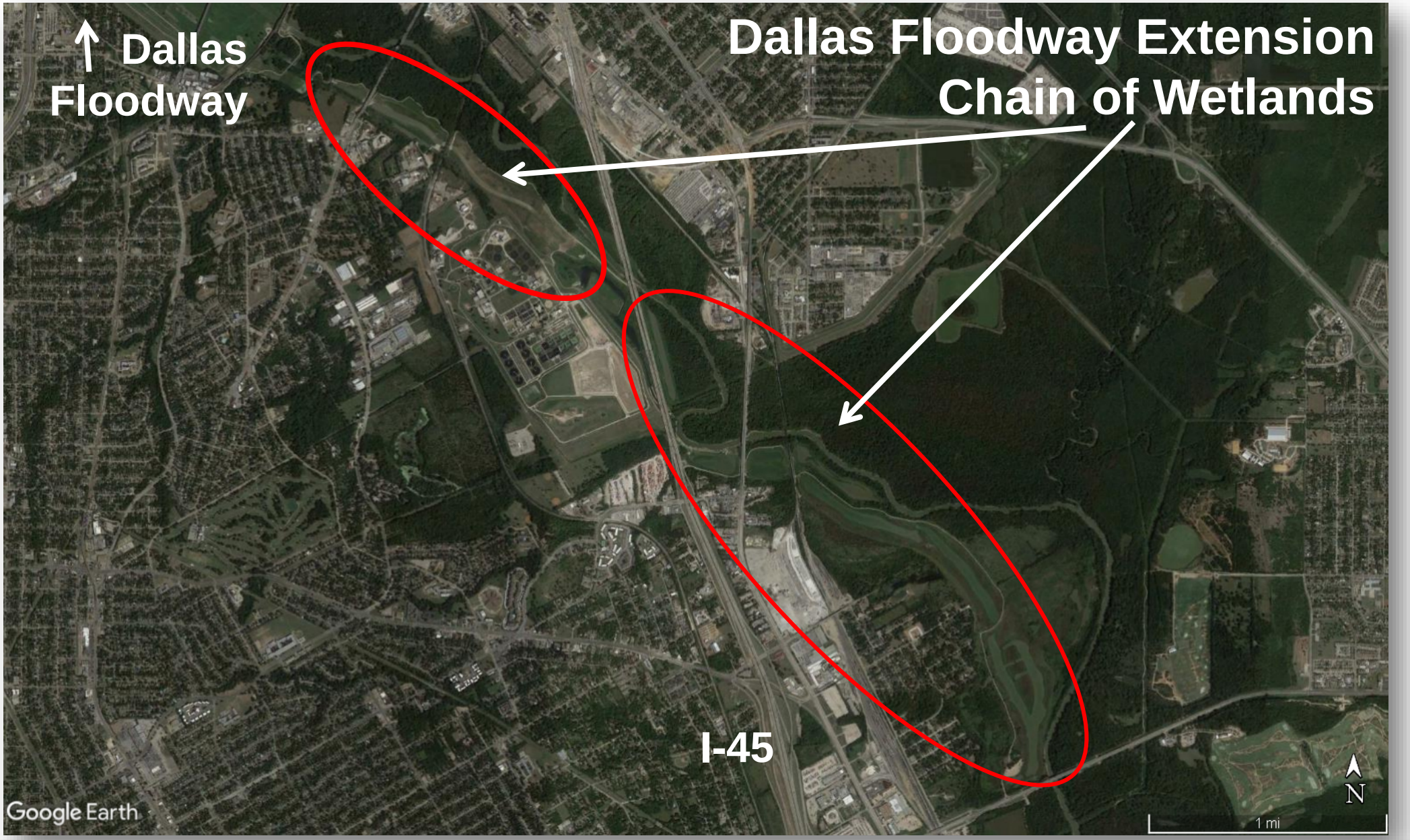


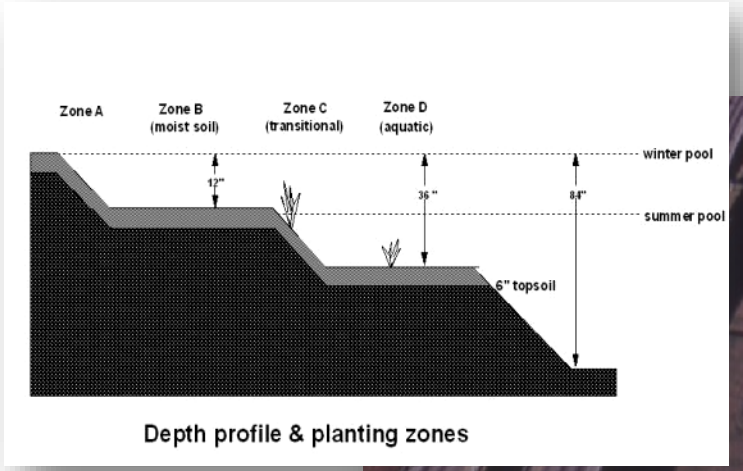
*Image credit: Jon Loxley, COE-SWF


↑ Dallas Floodway
Dallas Floodway Extension
Chain of Wetlands
I-45
Google Earth
N
1 mi

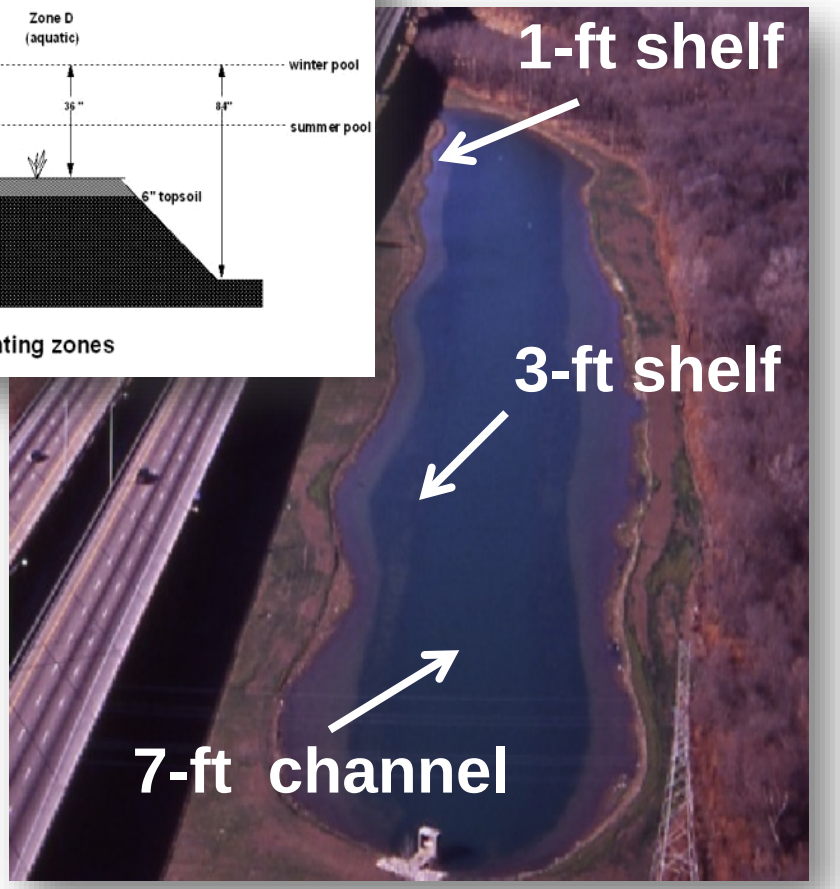
Trinity River during an overbanking event

Design and Function - Wetlands

- What does an aquatic plant want?
  - Design a system conducive to wetland plant growth
- Contours promote variety in structure/ food availability
  - 1-ft shelf --- mixed grassland & wetland plants – moist soil
  - 3-ft shelf --- wetland & aquatic plants
  - 7-ft channel --- open water (& flood conveyance)



Depth profile & planting zones



Hydrology - Wetlands

- Vary water level to attract migratory birds (moist soil management)
  - Fall & winter pools (full) for waterfowl (Central Flyway)
  - Spring & summer pools (1 foot or more lower) for plants

Hydrology - Wetlands

- Wetlands hold water during non-flood periods
  - RELIABLE WATER = sustain wetland plant communities

- Three water sources
  - Precipitation --- unpredictable
  - Overbanking --- unpredictable
  - Pumping --- managed, reuse from Dallas' Waste Water Treatment Plant
    - Gravity fed through the wetland cells

Hydrology - Challenges

- Too little water to wetlands
  - Pump malfunction; weir gate vandalism
    - Delays in repairs – sometimes for months
    - Water loss during the wrong time of the year, i.e. mid-summer

- Too much water
  - Stormwater/overbanking
  - 13 of the top 120 historic crests since 1908 occurred early in the project

Hydrology – Overcoming Challenges

- Include species that can tolerate adverse conditions; diversity is key
  - Promote desirable volunteer annuals (fac, facw, facu)
  - Choose hardy perennial species able to tolerate drought or prolonged inundation; tuber producers and/or rhizomatic species
  - Go with what works! Use reference wetland plant associations!

- Monitor closely the effects of water level manipulations on vegetation, what worked last year may not work this year

Compatible Flora Association – Wetlands/Grassland

- Herbaceous vegetation required for flood conveyance (grassland/emergent wetland)
- "Dig it" & they will come - *Not recommended*
  - Some volunteer species are good, some are bad; depends on the seed bank
- Assisted *succession* for plant establishment
  - Manage volunteer species
  - Combine with aquatic & wetland plantings
  - Ensures beneficial species are present
  - Manage undesirable (pre-emption)

Compatible Flora Association – Challenges

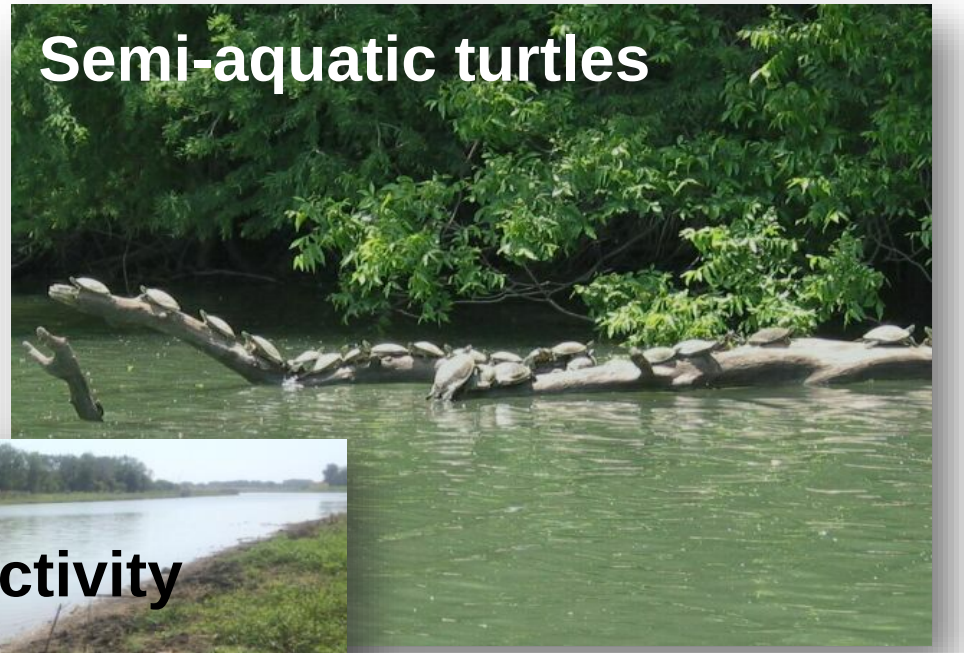
- Urban floodplain hydrology promotes disturbance = succession
- Propagule source
  - Hard to find aquatic/wetland plants in the numbers needed that are the species desired and regionally appropriate
  - Seeds are scarce for aquatic/wetland plants
  - Seeds/plants for grasses and forbs
    - Found commercially; germplasms avail.
    - Regionally appropriate?
- Herbivory
  - Thanks USACE for bringing dinner


waterlily

Herbivory


Carp


Geese


Semi-aquatic turtles


Feral hog activity


Crayfish


Nutria

Flora Association – Overcoming Challenges

- Containerized perennial plants are more robust; withstand adverse conditions, can be planted at any time – even when dormant
  - Grow your own to ensure species/biotype desired; stay within your ecoregion/watershed to get desired genetics
  - Quarantined from exotics, i.e. zebra mussels


Pondweed

- Supplement commercial seed mixes with regionally harvested seed (stakeholders)
  - Interseeding and re-seeding may be required; especially in areas managed for invasive species

Flora Association – Overcoming Challenges

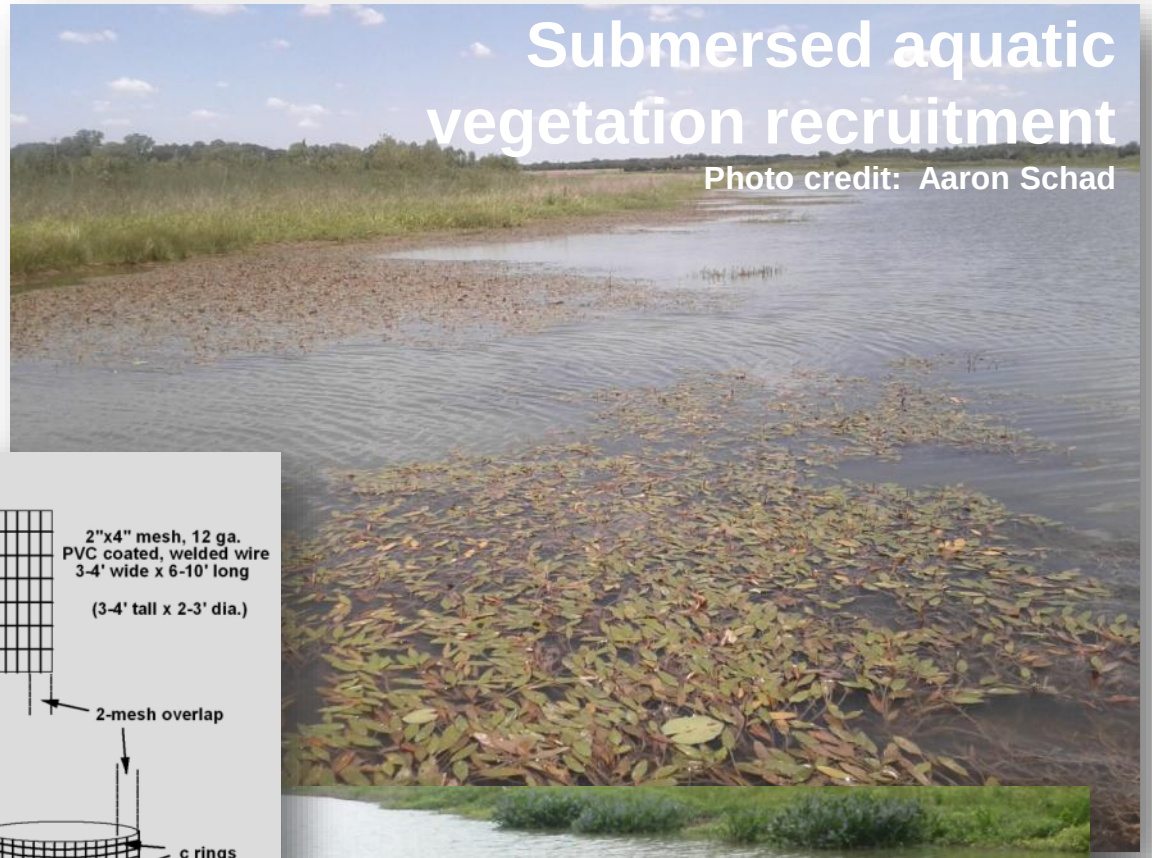
- Herbivory – implement strategies to protect establishing plants (especially aquatic species); established plants usually outgrow herbivore populations
- Implement vegetation management strategies that promote desirable vegetation
  - IPM – Integrated Pest Management (mowing, chemical, mechanical, biocontrol) for invasive species
    - i.e. Biocontrol/chemical control/drawdown - alligatorweed
  - Identify problematic species in baseline vegetation surveys; identify sources and target those for management

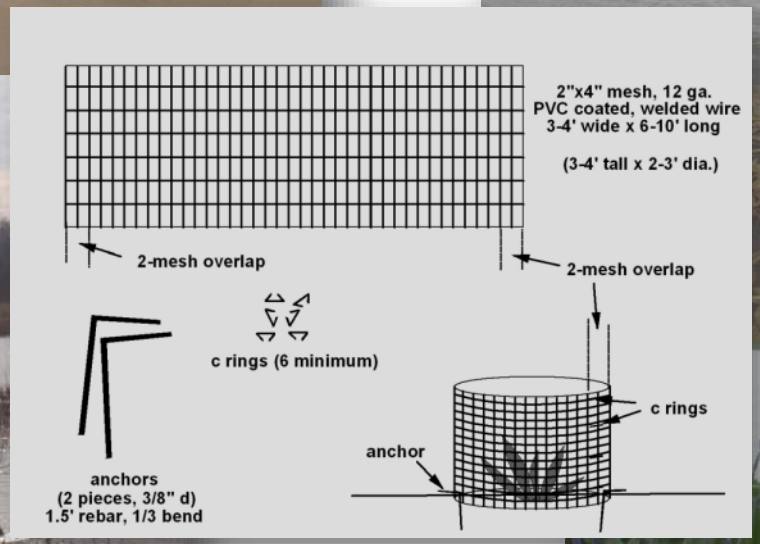
Submersed aquatic vegetation establishment in exclosures

Photo credit: Aaron Schad

Submersed aquatic vegetation recruitment

Photo credit: Aaron Schad

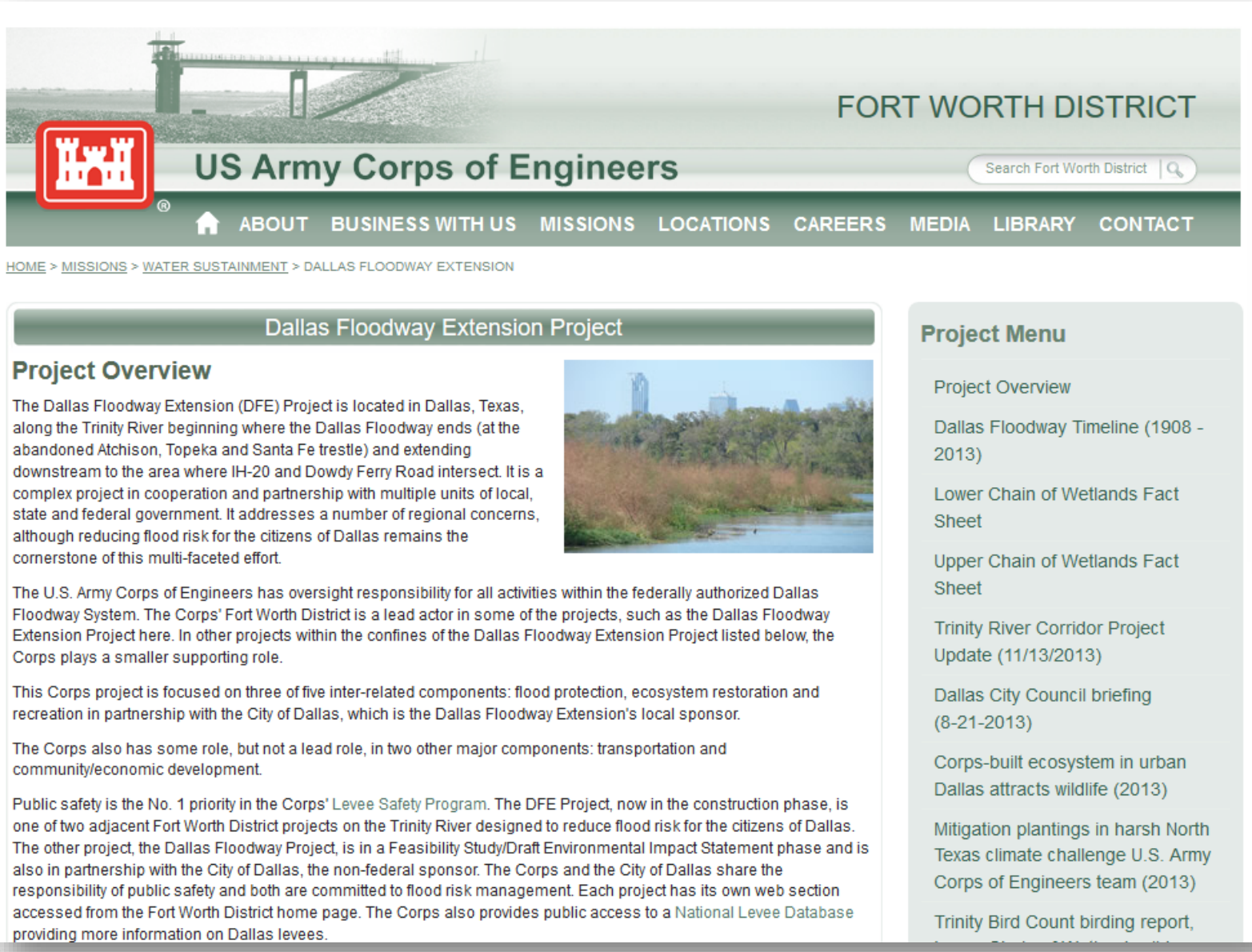


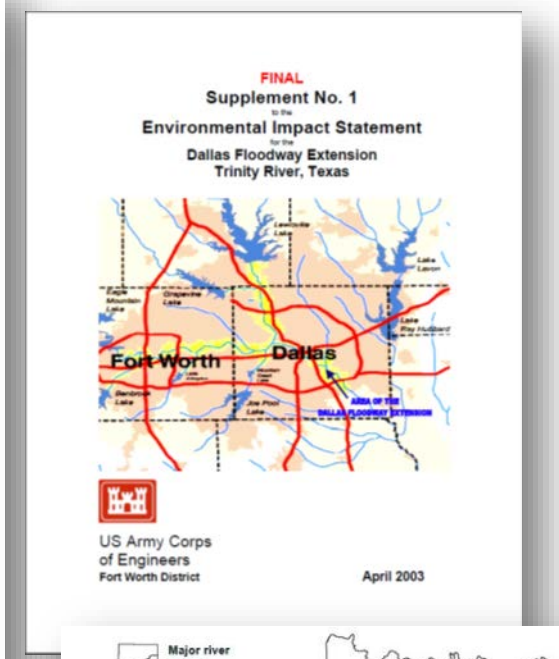


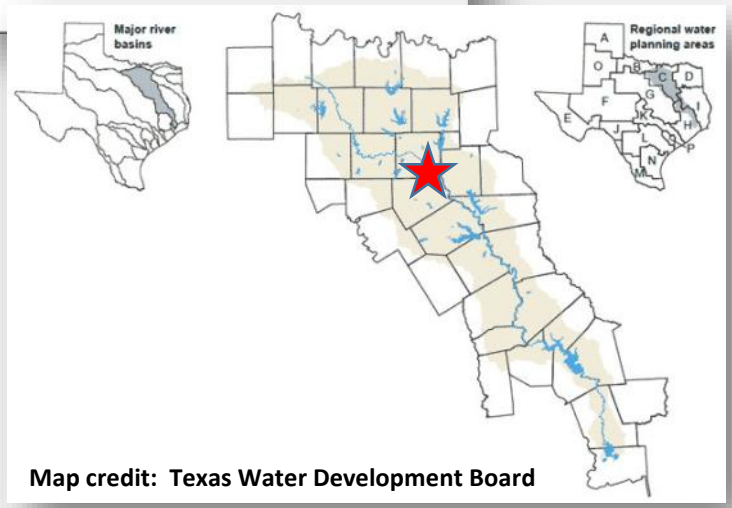
Winter plantings

Emergent vegetation

https://www.swf.usace.army.mil/Missions/Water-Sustainment/Dallas-Floodway-Extension/







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