Nature-Based Solutions for Flood Resilience

Region 15 Lower Rio Grande Regional Flood Planning Group

Texas Water Development Board

Freese and Nichols, Inc.

The Nature Conservancy

Agenda

- Purpose of the NBS for Flood Resilience Guidance Manual
- Definition and Examples of NBS for Flood Resilience
- Publishing Schedule
- Guidance Manual Content
- How to Promote NBS through Regional Flood Planning
- Key Takeaways

TEXAS WATER DEVELOPMENT BOARD

NBS in the State Flood Plan

FMP Type	Recommended FMP Count
Low Water Crossing or Bridge Improvement	94
Infrastructure	148
Regional Detention Ponds	73
Regional Channel Improvements	79
Storm Drain Improvements	47
Dam Improvements, Maintenance, and Repair	5
Flood Walls and Levees	4
Coastal Protections	1
Nature-Based Solutions	**8**
Comprehensive Regional Projects	83
Property or Easement Acquisition	13
Elevation of Individual Structures	4
Flood Readiness and Resilience	53
Other	3
Total	**615**

TEXAS WATER DEVELOPMENT BOARD

Project Goals

01

Synthesize Research & **Guidance** on the use of NBS for Flood Mitigation into a **Single**, **Statewide Manual** for Texas Communities

02

Provide **Strategies & Tools** to Address Common **Barriers & Challenges**

03

Support The Implementation Of NBS Into The **Regional Flood Planning Process & Community-Driven Efforts**

TEXAS WATER DEVELOPMENT BOARD

Intended Users

- Local government officials or representatives charged with planning, developing, or managing community infrastructure or assets
  - City Engineers
  - Floodplain Managers
  - Planners
  - Regional Flood Planning Group (RFPG)
- Practitioners
- Developers

City Engineer CIP Planning (Master Drainage Plans/Studies, Preliminary Engineering, etc.)

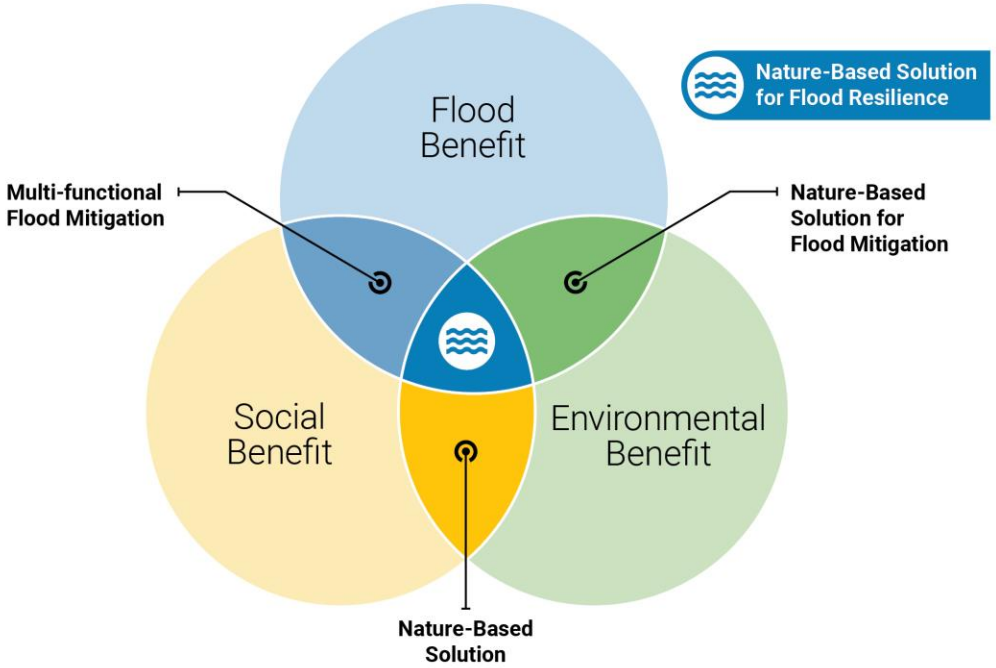
RFPG & Technical Consultant Teams Project alternative identification

Floodplain Administrator Example floodplain regulation, polices and incentives for more flood resilient community (e.g. floodplain buffers/setbacks)

TEXAS WATER DEVELOPMENT BOARD

Defining Nature-Based Solutions (NBS)

NBS use or imitate natural features and/or processes to increase resilience while providing sustainable benefits to people and the environment.



Co-benefits Examples:

- Water Supply and Drought Mitigation
- Water Quality and Public Health
- Urban Heat Reduction and Air Quality
- Recreation and Social Assets

TEXAS WATER DEVELOPMENT BOARD

NBS for Flood Resilience Spectrum

Traditional (Gray)	Hybrid	Natural
Hard, gray, engineered structures built to address development and flood risk reduction objectives	Combination of hard engineering solutions incorporated with natural and nature-based features to accomplish flood risk reduction objectives	Creation, protection, or restoration of natural systems or processes to accomplish flood risk reduction objectives

Adapted from the International Guidelines on Natural and Nature Based Features for Flood Risk Management

TEXAS WATER DEVELOPMENT BOARD

NBS for Flood Resilience Examples

Resaca Restoration

Bioretention

Structural NBS for Flood Resilience

Watershed

- Stream Restoration
- Floodplain Restoration
- Levee Setback
- Wetland Restoration
- Playa Lake Restoration

Neighborhood

- Bioretention
- Vegetated Swale
- Permeable Pavement
- Vegetative Filter Strips
- Wet Ponds
- Constructed Wetlands
- Tree Trenches
- Rainwater Harvesting
- Stormwater Parks

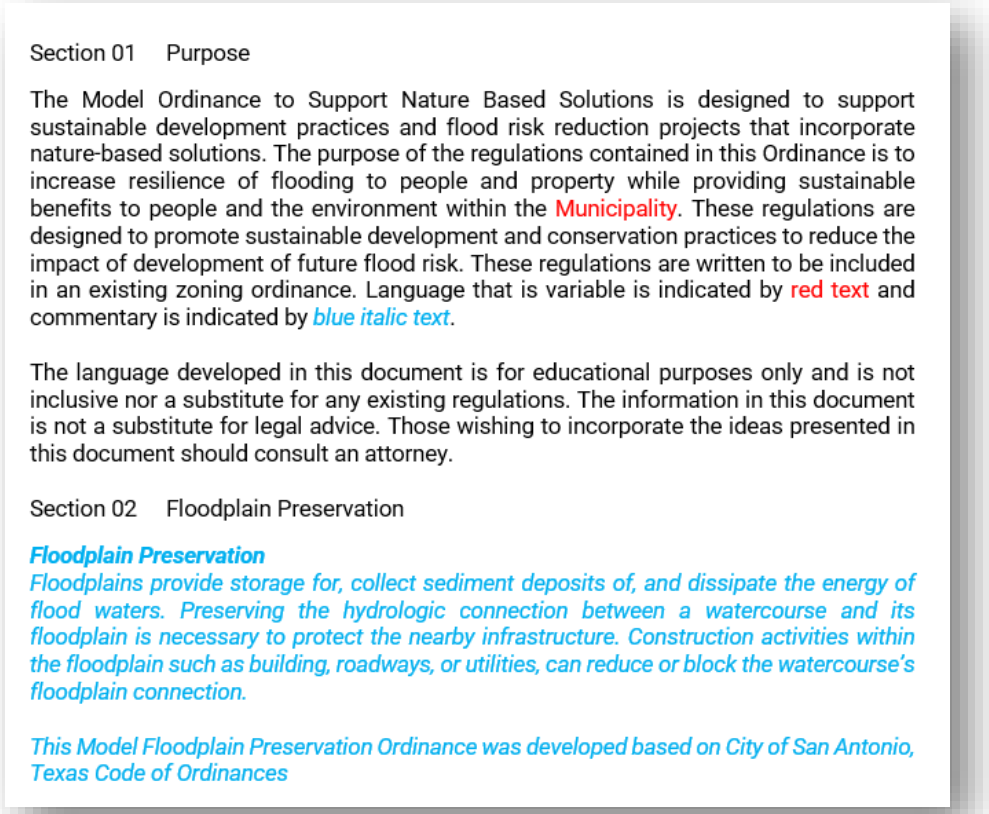
Coastal

- Beach Nourishment and Dune Restoration
- Coastal Marsh, Seagrass, and Prairie Restoration
- Natural Breakwaters and Oyster Reefs
- Waterfront Parks

Non-Structural NBS for Flood Resilience

- Property Acquisition and Conservation
- Regulating Development in Floodplains
- Promoting Native Vegetation in Design Criteria

Model Ordinance



Section 01 Purpose

The Model Ordinance to Support Nature Based Solutions is designed to support sustainable development practices and flood risk reduction projects that incorporate nature-based solutions. The purpose of the regulations contained in this Ordinance is to increase resilience of flooding to people and property while providing sustainable benefits to people and the environment within the Municipality. These regulations are designed to promote sustainable development and conservation practices to reduce the impact of development of future flood risk. These regulations are written to be included in an existing zoning ordinance. Language that is variable is indicated by red text and commentary is indicated by *blue italic text*.

The language developed in this document is for educational purposes only and is not inclusive nor a substitute for any existing regulations. The information in this document is not a substitute for legal advice. Those wishing to incorporate the ideas presented in this document should consult an attorney.

Section 02 Floodplain Preservation

Floodplain Preservation
Floodplains provide storage for, collect sediment deposits of, and dissipate the energy of flood waters. Preserving the hydrologic connection between a watercourse and its floodplain is necessary to protect the nearby infrastructure. Construction activities within the floodplain such as building, roadways, or utilities, can reduce or block the watercourse's floodplain connection.

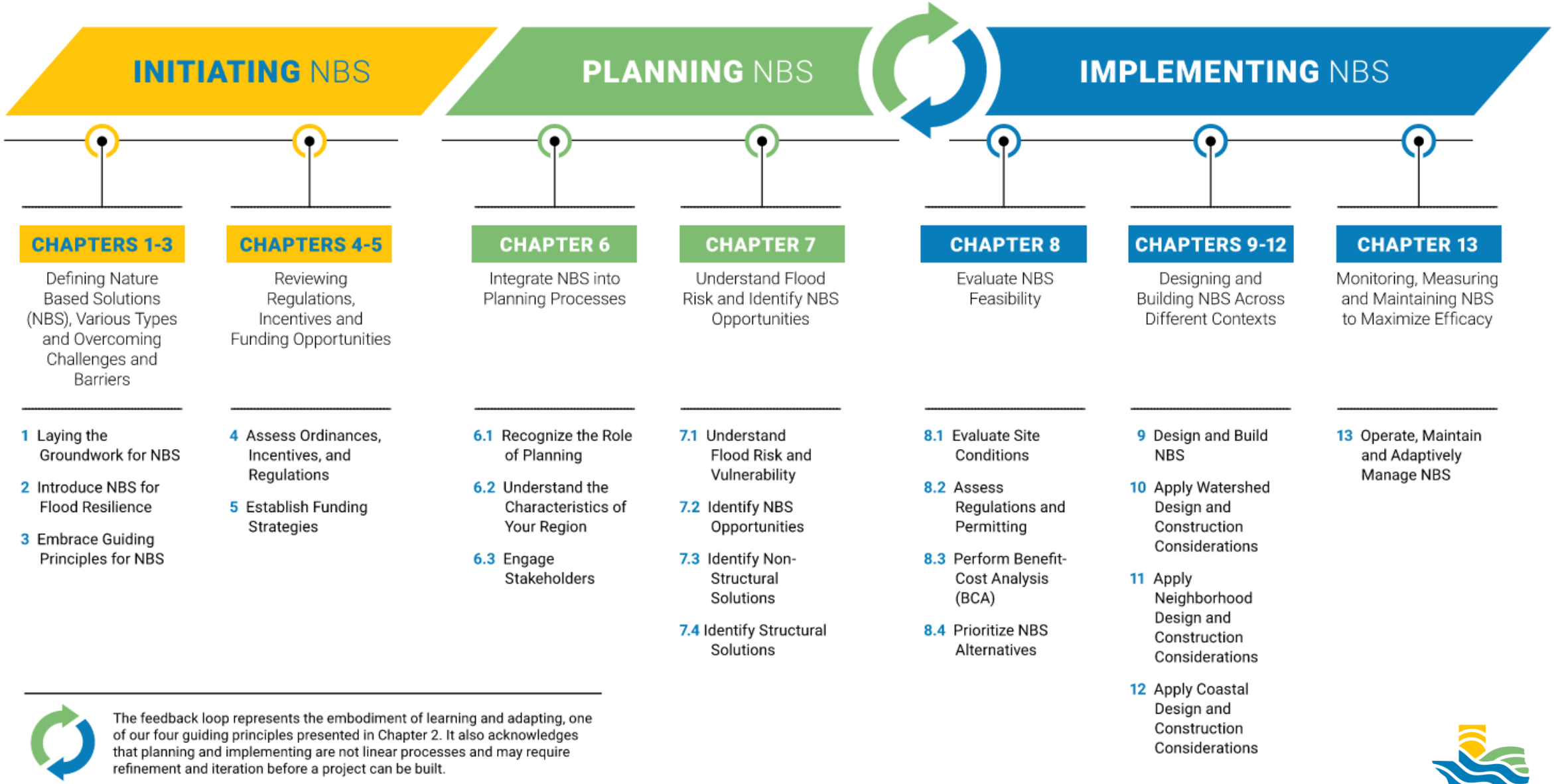
This Model Floodplain Preservation Ordinance was developed based on City of San Antonio, Texas Code of Ordinances

TEXAS WATER DEVELOPMENT BOARD

NBS Guidance Manual Schedule

- **Spring 2026** Draft Guidance Manual for Public Comment
- **Summer 2026** Final Guidance Manual Published
- https://www.twdb.texas.gov/flood/research/Nature-based-Solutions-2022/index.asp

TEXAS WATER DEVELOPMENT BOARD



TEXAS WATER DEVELOPMENT BOARD

Promote NBS through Regional Flood Planning

Task 3	Task 4A	Task 4C	Task 5A
• Set goal for NBS implementation • Recommend NBS floodplain management practices	• **Discuss NBS opportunities with local sponsors** • Identify potential FMPs and FMSs	• Consider potential for co-benefits when selecting FMEs to evaluate • **Develop NBS alternatives while performing FMEs**	• Document project benefits, % NBS by cost • Include ecosystem services, co-benefits in project BCAs
NBS Guidance Manual Resource	**NBS Guidance Manual Resource**	**NBS Guidance Manual Resource**	**NBS Guidance Manual Resource**
• Guiding Principles • Example NBS floodplain management practices • Model Ordinance for NBS	• How to: developing a proactive stakeholder engagement strategy • How to: identify structural and non-structural NBS • Matrix of flood mitigation, environmental, and social benefits by NBS type	• Example alternative prioritization approach • Matrix of site suitability characteristics by NBS type • One Pager by NBS Type	• How to: calculate expected flood damages • Monetary value of ecosystem services • Conceptual BCA for NBS

Key FMP Criteria to Capture for NBS

- Nature-Based Solution (% by cost)
  - *Engineering Judgement*
- Other/Multiple Benefits

TEXAS WATER DEVELOPMENT BOARD

Key Takeaways – NBS for Flood Resilience

- Have more co-benefits than mono-functional flood infrastructure
- Should be considered in planning phase, before design begins
- Offer additional funding opportunities

TEXAS WATER DEVELOPMENT BOARD

Questions?

Kim Patak, PE, CFM ENV SP | kkp@freese.com

Justin Kozak, PhD, CFM | Justin.Kozak@tnc.org