STORMWATER DRAINAGE AND HOUSING RECOVERY ASSESSMENT

Town of Horseshoe Beach, Florida

Supplemental Technical Report to the Project Review and Post-Storm Needs Assessment
Community Planning Technical Assistance Grant

GIS-Based Field Data Capture | Infrastructure Condition Assessment | FEMA-Compliant Documentation

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Prepared For:
Town of Horseshoe Beach — Mayor, Town Council, and Citizens Advisory Task Force

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This assessment documents existing stormwater and housing conditions using GIS-based field data capture methods to support FEMA compliance, infrastructure planning, and long-term community resilience following Hurricanes Idalia, Debby, and Helene.

Data Condition and Asset Integration Statement:

All mapped features presented herein represent **baseline inventory data for municipal assets currently being incorporated into a centralized GIS framework** following the loss of historical infrastructure records due to recent storm events.

At this time, asset attributes such as condition, inspection history, obstruction status, and maintenance records are **unverified and largely unpopulated across all asset classes**. Accordingly, this dataset reflects the **current extent of available spatial information** and is intended to serve as an **initial inventory and planning tool**, rather than a comprehensive condition assessment.

This effort establishes a **standardized, citywide data structure** to support ongoing field verification, data collection, and the implementation of **GIS-based asset management practices**. The framework enables the community to systematically track infrastructure condition, identify deficiencies, and prioritize maintenance and capital improvements.

This mapping initiative represents a critical component of the community's **post-disaster recovery and resilience strategy**, providing the foundational data necessary to support **grant-funded inspection programs, infrastructure rehabilitation, and long-term stormwater system improvements**.

1. INTRODUCTION AND PURPOSE

The Town of Horseshoe Beach sustained catastrophic damage from three successive hurricane events — Idalia (2023), Debby (2024), and Helene (2024). The cumulative impacts exposed significant vulnerabilities in the Town's stormwater drainage systems and housing stock, many of which predate current floodplain and construction standards.

This Stormwater Drainage and Housing Recovery Assessment has been prepared as a supplemental technical report to the Project Review and Post-Storm Needs Assessment, funded through the Community Planning Technical Assistance Grant. It documents existing conditions across six required assessment categories and establishes GIS-based data infrastructure suitable for FEMA-compliant record-keeping, capital planning, and ongoing asset management.

1.1 Assessment Objectives

- Document current conditions of stormwater drainage systems, housing, and related infrastructure at the parcel level
- Identify drainage deficiencies, culvert constraints, and coastal flood zone exposures contributing to storm damage
- Establish a GIS spatial database linking field observations to Town parcels for FEMA reporting and capital planning
- Provide a foundation for the housing recovery and capital project strategies outlined in companion planning documents

1.2 Regulatory Context

Documentation requirements under FEMA's Public Assistance program, Hazard Mitigation Grant Program, and CDBG-DR all require spatially referenced, defensible records of storm damage and infrastructure conditions. This assessment is structured to satisfy those requirements while supporting day-to-day Town infrastructure management.

2. GIS METHODOLOGY AND FIELD DATA COLLECTION

2.1 Base Data Preparation

The assessment begins with a geospatial database built from existing municipal and FEMA datasets. The Town's parcel layer serves as the primary feature class, with all storm damage and infrastructure observations linked to parcel IDs to ensure traceability and FEMA compliance.

Key base data layers:

- Parcel Layer — primary unit of analysis representing individual properties
- FEMA Flood Zone Layer — identifies properties within VE, AE, and Coastal A zones
- Stormwater Infrastructure Data — culverts, outfalls, ditches, and drainage structures
- Aerial and Post-Storm Imagery — used to validate field observations
- Road Network Layer — used to evaluate property access conditions

2.2 Mobile GIS Field Data Collection

Field teams use a mobile GIS survey form on tablets or smartphones to collect property-level information directly in the field. Each record automatically links to the Town's parcel map and captures GPS coordinates, inspector ID, timestamp, and photographic documentation. Compatible platforms include ArcGIS Survey123, ArcGIS Field Maps, and QGIS/QField.

2.3 Data Integration and Analysis

Collected data automatically syncs with the central geodatabase and links to parcel records. GIS analysis includes parcel-level damage mapping, flood zone impact analysis, drainage deficiency mapping, culvert capacity assessment, and identification of high-risk drainage corridors, using overlay, proximity, and network analysis tools.

3. SIX-CONDITION ASSESSMENT FRAMEWORK

The following six conditions form the required assessment framework. Each is documented using standardized GIS field data capture methods that produce spatially referenced, defensible records suitable for FEMA reporting and grant applications.

Condition 1 — Current Conditions of Drainage Systems

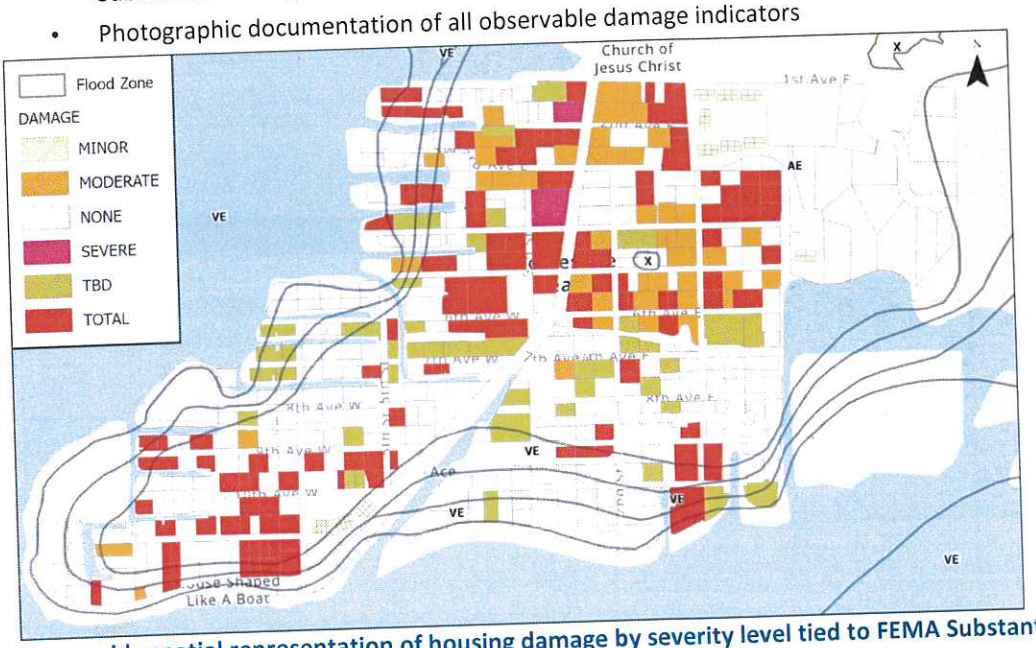
Field staff evaluate stormwater infrastructure conditions affecting each parcel, including drainage type, condition rating, and obstruction status.

GIS Field	Data Type	Purpose
Drainage system present	Yes / No	Establishes baseline infrastructure presence
Drainage type	Ditch / Culvert / Pipe / Swale	Classifies infrastructure type for analysis
Condition rating	Good / Moderate / Failed	Prioritizes maintenance and capital needs
Obstruction present	Yes / No + description	Identifies immediate flood hazards
Photo attachment	Geo-tagged image file	FEMA documentation requirement

Condition 2 — Current Conditions of Dwelling Units by Storm Damage

Each parcel receives a hurricane damage classification based on visible structural impacts, following FEMA-standardized categories to ensure defensibility for Public Assistance documentation and Hazard Mitigation Grant applications.

- Structure type and primary construction material
- Damage level: None / Minor / Major / Destroyed
- Roof damage classification and flood intrusion status
- Estimated flood depth at structure
- Substantial Damage determination reference flag
- Photographic documentation of all observable damage indicators



Town-wide spatial representation of housing damage by severity level tied to FEMA Substantial Damage records.

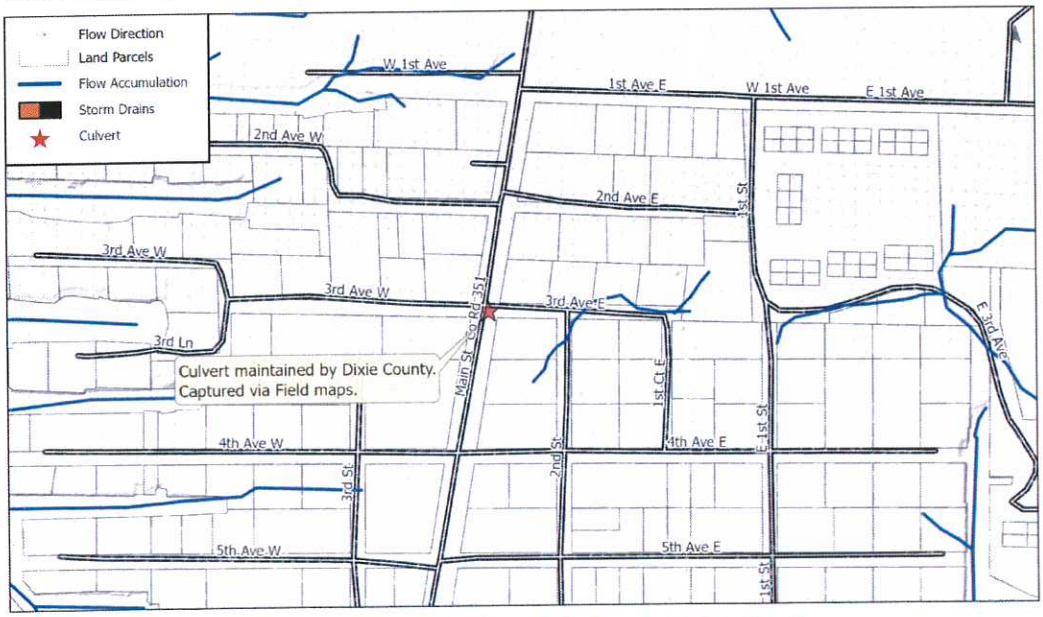
Condition 3 — Drainage Corridors

Drainage corridors are identified using existing stormwater data, topographic analysis, surface flow modeling, and direct field observation. Field crews record natural drainage pathways, overland flow routes, concentration areas during storms, and locations where obstructions restrict flow. GIS outputs include mapped corridors and flow accumulation paths informing capital investment and easement acquisition decisions.

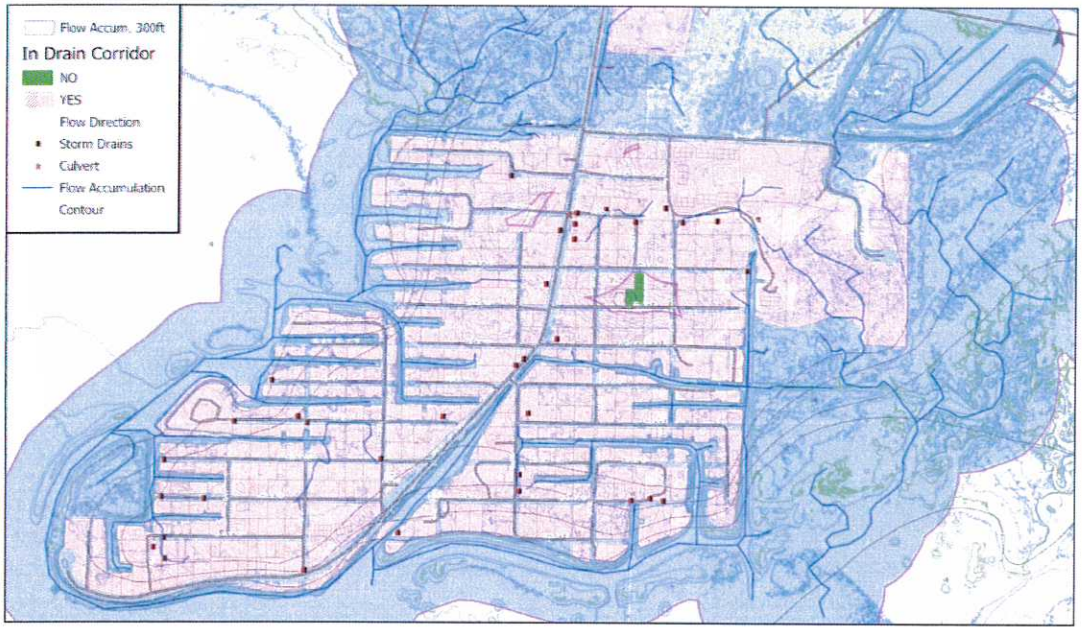
Mapped stormwater infrastructure with condition ratings, obstruction flags, and maintenance priority rankings.

Condition 4 — Culvert Constraints

Culverts are individually inspected and mapped to identify capacity limitations. Each record captures location coordinates, pipe diameter and material, blockage level, structural condition, hydraulic conditions, and whether a restriction is present. Results identify critical bottlenecks and inform a capital improvement priority list aligned with available grant funding.



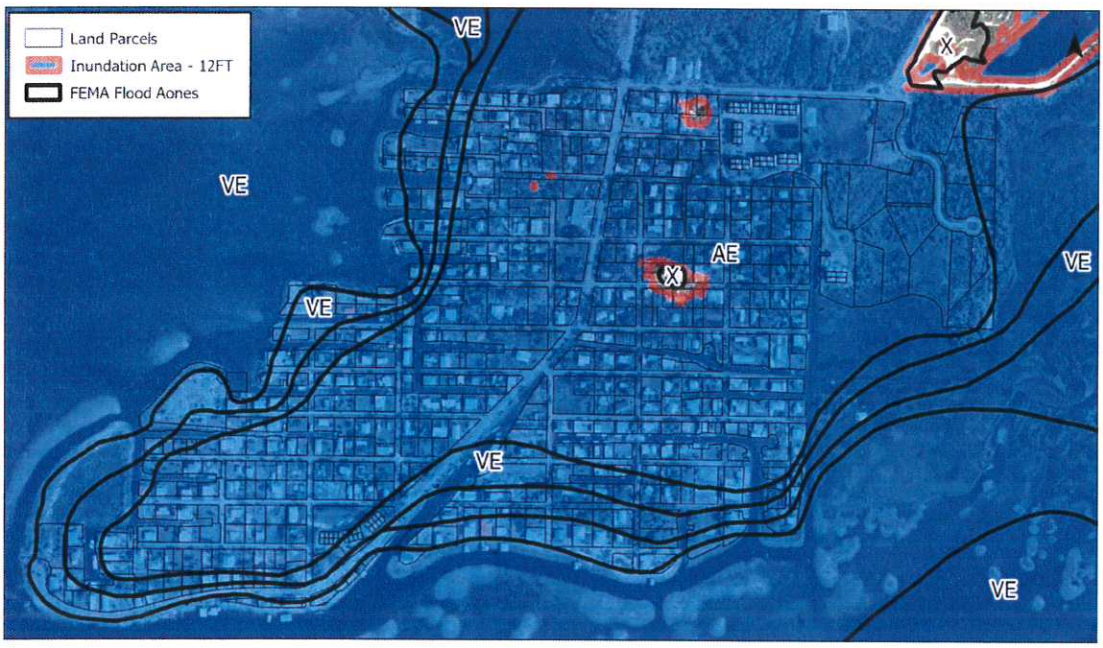
Culvert location collected but is maintained by Dixie County Public Works.



Mapped natural and constructed drainage pathways identifying flow paths, constraint locations, and easement needs.

Condition 5 — Coastal Flooding Zones

The FEMA Flood Zone layer is spatially joined to the parcel dataset to identify properties within VE Zones (highest coastal hazard), AE Zones, and Coastal A Zones. Additional fields capture zone designation, storm surge exposure estimates, and observed surge damage indicators. This layer prioritizes elevation and acquisition projects within the HMGP portfolio.



Parcel-level analysis correlating FEMA zone designations with observed storm damage by event.

Condition 6 — Additional Relevant Recovery Information

A flexible GIS category captures additional field observations influencing recovery planning: access limitations, utility damage, debris accumulation, infrastructure failures such as collapsed culverts or failed bulkheads, and inspector notes. This ensures important contextual information is preserved for future grant applications and emergency response planning.

4. PARCEL ANALYSIS AND RECOVERY PRIORITIZATION REPORT

Summary

This report summarizes parcel-level analysis for the Town of Horseshoe Beach using the Land Parcels Spatial Join dataset. A total of 581 parcels were reviewed to identify flood exposure, damaged dwelling units, drainage corridor impacts, and priority recovery needs. Findings support applications for FEMA, HMGP, CDBG, and state funding programs.

Key Findings

- 581 parcels evaluated.
- Majority of parcels are located in FEMA AE or VE flood hazard zones.
- Multiple parcels show major or total storm damage.
- Many parcels are influenced by mapped drainage corridors.
- Housing recovery and drainage improvements should be advanced together.

Flood Zone Summary

Flood Zone	Estimated Parcels
AE	480
VE	78
Mixed AE/VE	23

Housing Damage Assessment

Damage Category	Estimated Impact	Notes
Destroyed Homes	75+ after Idalia	Significant structural loss
Destroyed Homes	70% of Town after Helene	Widespread devastation
Major Damage	Numerous dwellings	Roof loss, wall failure, flood damage
Minor Damage	25+ structures after Debby	Water intrusion, cosmetic repairs
Repetitive Loss Properties	Multiple	Candidates for elevation/acquisition
Temporary Displacement	High	Residents relocated due to unsafe conditions

Common Residential Damages

- Storm surge inundation
- Foundation undermining
- Mold and moisture intrusion

- Roof uplift / failure
- Electrical and HVAC loss
- Septic / utility damage
- Access blocked by debris

Priority Damage Parcels

Priority	Parcel ID	Address	Flood Zone	Damage
High	141210061400100040	149 1ST ST	AE	TOTAL
High	141210061400110040	144 5TH AVE E	AE	TOTAL
High	141210061400110050	155 6TH AVE E	AE	TOTAL
High	141210061400120040	54 5TH AVE E	AE	TOTAL
High	141210061400120050	65 6TH AVE E	AE	TOTAL

Planning Implications

Housing Recovery

Parcels with major or total damage should be prioritized for elevation, acquisition, reconstruction assistance, and hazard mitigation funding.

Stormwater and Drainage System Damage

Drainage corridor overlaps indicate the need for culvert replacement, ditch restoration, roadway drainage improvements, and storm surge management.

Asset Type	Current Condition	Priority
Culverts	Blocked / undersized	High
Drainage Ditches	Eroded / overgrown	High
Outfalls	Damaged / obstructed	High
Roadside Swales	Sediment filled	Medium
Storm Drain Pipes	Unknown age / condition	High
Drainage Paths	Fragmented	High

Key Findings

- Standing water after rain events
- Tidal backflow impacts
- Roadway flooding during storms
- Insufficient discharge capacity
- Lack of mapped drainage network
- Deferred maintenance from limited resources

Public Safety, Infrastructure Damage and Access

Flood-prone streets and damaged residential clusters may reduce evacuation reliability and emergency response access during future storms.

Facility	Damage Summary
Town Hall	Damaged after Debby; washed away after Helene
Marina	Destroyed
Bulkheads	Structural failure / erosion
Roads	Washouts, pavement loss, shoulder erosion
Street Signs	Extensive replacement needed
Water Treatment Plant	Repeated storm impacts
Water Lines	Breaks, leaks, exposure, corrosion
Fire Protection Assets	Access and hydrant mapping needed
Community Park	Damaged amenities and flooding

Recommended Projects

1. Residential elevations in AE and VE zones.
2. Acquisition of repetitive loss properties where cost-effective.
3. 3rd Street drainage and roadway improvements.
4. 11th Avenue East surge mitigation and bulkhead improvements.
5. Town-wide culvert inspection and replacement program.
6. Ongoing GIS parcel tracking and post-storm inspections.

Funding Alignment

Need	Potential Funding Source
Housing Mitigation	HMGP, BRIC, CDBG
Drainage Improvements	CDBG, State Appropriations
Roadway Resilience	FEMA PA, CDBG
Public Facilities	FEMA PA, State Grants
Planning / GIS	Florida Commerce, CDBG

The parcel dataset confirms substantial continuing need across housing, drainage, and flood resilience categories. Horseshoe Beach can use this report as a grant-ready justification document and as a roadmap for phased recovery implementation.

Please see the attached document Land Parcels Report for the full report.

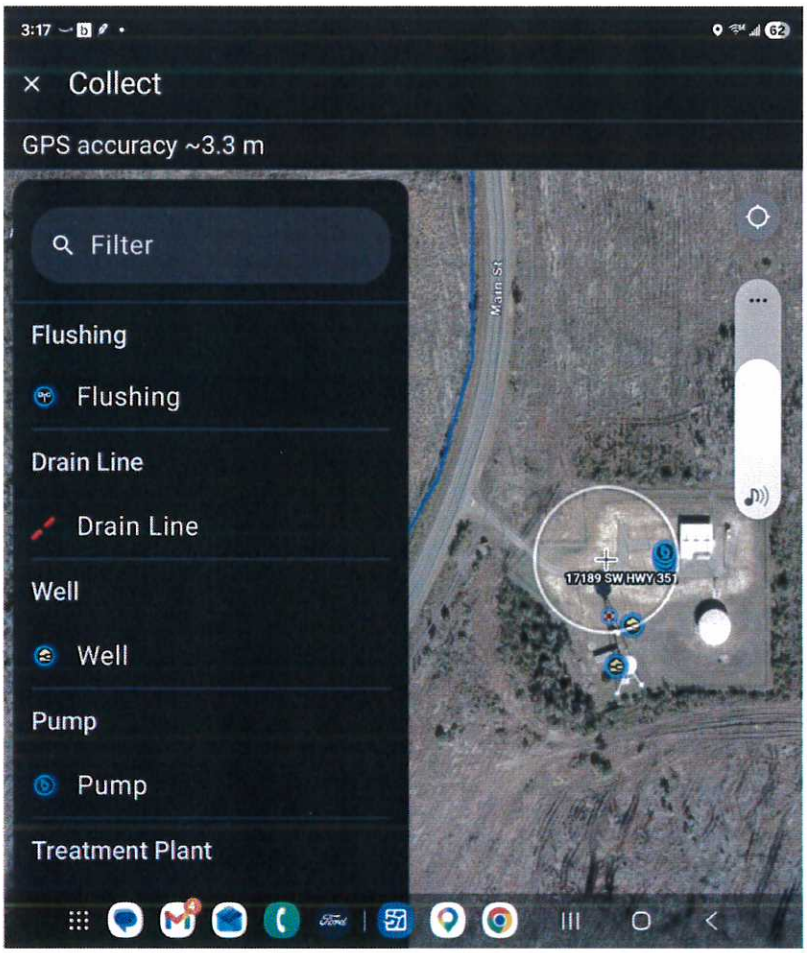
5. GIS DELIVERABLES AND OUTPUTS

Deliverable	Description
GIS Parcel Assessment Database	Central geodatabase of all assessed parcels with linked damage, drainage, and flood zone attributes
Storm Damage Classification Map	Town-wide spatial representation of housing damage by severity level tied to FEMA Substantial Damage records
Drainage System Condition Map	Mapped stormwater infrastructure with condition ratings, obstruction flags, and maintenance priority rankings
Culvert Constraint Map	Individual culvert locations rated by capacity, blockage level, and flood impact priority
Flood Zone Impact Analysis	Parcel-level analysis correlating FEMA zone designations with observed storm damage by event
Drainage Corridor Map	Mapped natural and constructed drainage pathways identifying flow paths, constraint locations, and easement needs
Asset Inspection Tracking Tool	GIS-integrated tool for ongoing inspection scheduling, work orders, and FEMA-compliant record keeping by Town staff

These tools are designed as a living system. Each storm event, inspection cycle, or capital improvement adds to a growing record supporting FEMA Public Assistance closeouts, HMGP applications, CDBG-DR documentation, and day-to-day asset management.

ArcGIS Field Maps were utililized to train staff on field data collection of municipal assets, prioritizing water meter inventory as a key dataset, Water facility depicted below.

Leveraged ArcGIS Survey123 was used to train Horseshoe Beach staff in creating and editing FEMA-compliant reporting forms, with initial deployments focused on fire hydrant, Storm Drains, Bulkhead Surveys.



Bulkhead Survey

Storm Drain Survey

Hydrant Survey

Hydrant Report

Hydrant Location

Lat: 29.440944 Lon: -83.287390

Month and Day

Hydrant Number

Hydrant Volume Test Type

Hydrant Volume

Flow Rate (Pitot)

Area Condition

Valve Tested

Open Hydrant to Slow Flush

- [x] Yes
- [ ] No

Maintenance Needed

No

Photo

Drop image here or select image

Inspected By

John Doe

Signature

Please sign above the line

Reset

John Doe

Please sign above the line

Submit

6. RELATIONSHIP TO ACTIVE GRANT PROGRAMS

Assessment Condition	Supporting Grant Programs
Drainage System Conditions	CDBG-DR Stormwater Drainage ($3M), HMGP Mitigation Construction, DWSRF Water System Repairs ($7.95M)
Dwelling Unit Damage	HMGP Residential Elevations ($13.8M combined), FEMA PA Substantial Damage Evaluations, CDBG-DR Infrastructure Repair ($19.5M)
Drainage Corridors	CDBG-DR Stormwater ($3M), 3rd St. Elevation & Bulkhead ($3M), Town-wide Streets Elevation ($4M)
Culvert Constraints	CDBG-DR Stormwater Drainage, 11th Ave E Replacement & Bulkhead ($1M), HMGP MitCon Projects
Coastal Flooding Zones	HMGP 25% Match Waiver ($1.95M), HMGP Acquisitions, Hurricane Protection Jetty Expansion ($12M)
Additional Recovery Info	FEMA PA Emergency Protective Services, Disaster Recovery Planning ($75k), State Appropriations

7. PRIORITY FINDINGS AND RECOMMENDED ACTIONS

7.1 Immediate Priority Areas

- Stormwater drainage network serving coastal flood zones — multiple failed culverts and blocked corridors across three storm events
- Residential structures in VE and AE zones with Substantial Damage determinations — elevation or acquisition required before reconstruction
- 11th Avenue East — repeated storm surge intrusion and roadway damage requiring elevation and bulkhead mitigation
- 3rd Street drainage corridor — primary overland flow path with undersized conveyance capacity creating backwater flooding
- Town Hall site drainage — constraints on current site reinforce the case for relocation to the preferred X-zone site

7.2 GIS-Based Ongoing Inspection Program

A formal, GIS-integrated inspection and maintenance program is recommended: annual culvert and drainage structure inspection with photographic rating, post-storm corridor condition assessments, bulkhead and seawall condition ratings, and parcel-level housing updates as reconstruction progresses. This continuous program builds the documented maintenance record required by FEMA for Public Assistance closeouts and future disaster declarations.

8. CONCLUSION

The Stormwater Drainage and Housing Recovery Assessment provides Horseshoe Beach with a structured, GIS-based framework for documenting infrastructure conditions, prioritizing capital investments, and maintaining FEMA-compliant records across more than $57 million in pending grant applications — while giving Town staff practical tools for day-to-day infrastructure management.

This document, together with the Capital Projects and Investment Strategy and the Phase II Recovery Implementation Plan, forms the foundational planning infrastructure for Horseshoe Beach's long-term recovery and resilience.