HAZUS 2014

7th Annual Conference

Translating Risk Assessment into Resilience and Policy

New Jersey Department of Environmental Protection (NJDEP) – A Partner and Hazus User in the USGS Flood Inundation Mapping (FIM) Program

James Mawby, CFM
Joseph Ruggeri, PE, CFM

Agenda

Project Information
- Background & Process

Developing UDF's
- From Tax Roll to HAZUS
  - Development Challenges and Solutions

Gage Focus – Saddle River at Lodi, NJ
- Basic Facts
- Basic FIM Facts

Communicating the Flood Risk Assessment
- Leveraging Results
- Uses of the Results

Translating Risk Assessment into Resilience and Policy

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Project Background - General

- Gov. Christie signs Exec. Order 23 establishing Passaic River Advisory Commission in 2010
- 15-Point Plan Developed
- Inundation Mapping underway at 21 locations
- All locations to receive risk assessment

Partners:

NATIONAL WEATHER SERVICE

USGS
science for a changing world

US Army Corps of Engineers®

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Project Background - Recommendations

ADVISORY COMMISSION STATEMENTS AND RECOMMENDATIONS

Based on the Governor's Executive Order 23

1. Floodway and Floodplain Buyouts
   Table 2 – Floodway/10-Year Floodplain Buyouts
2. Structure Elevations in Floodplains
3. Open Space Acquisition and Preservation
4. Pompton Lake Dam Floodgates Performance and Modifications
5. Desnagging and Shoal Dredging
6. Feeder Dam Removals
7. State Adoption of the NFIP
8. Permit Expedition for Desnagging and Shoal Dredging
9. Emergency Preparedness and Response
10. Flood Warning System
11. Inundation Mapping
12. Public Outreach
13. USACE Reevaluation Study
14. Flood Risk Mapping
15. Moratorium [illegible] New Development in the Floodplain

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Passaic River Basin Flood Advisory Commission
NJDEP Commissioner Bob Martin, Chairman

SOURCE - Report to the Governor:
Recommendations of the Passaic River Basin Flood Advisory Commission, January 2011

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Project Background - Work Underway

Summary of Gage Locations	
Hackensack River	**Hohokus Brook**
at Rivervale	At Ho-Ho-Kus
at New Milford	**Peckman River**
Passaic River	at Little Falls
at Two Bridges	**Pompton River**
at Pine Brook	At Pompton Plains
near Chatham	**Saddle River**
near Millington	at Lodi ★
at Little Falls	at Ridgewood
Dundee Dam at Clifton	at Upper Saddle River
Pequannock River	**Pascack Brook**
at Macopin Intake Dam	at Parkridge
Ramapo River	**Wanaque River**
at Pompton Lakes	at Wanaque
at Oakland	
near Mahwah	

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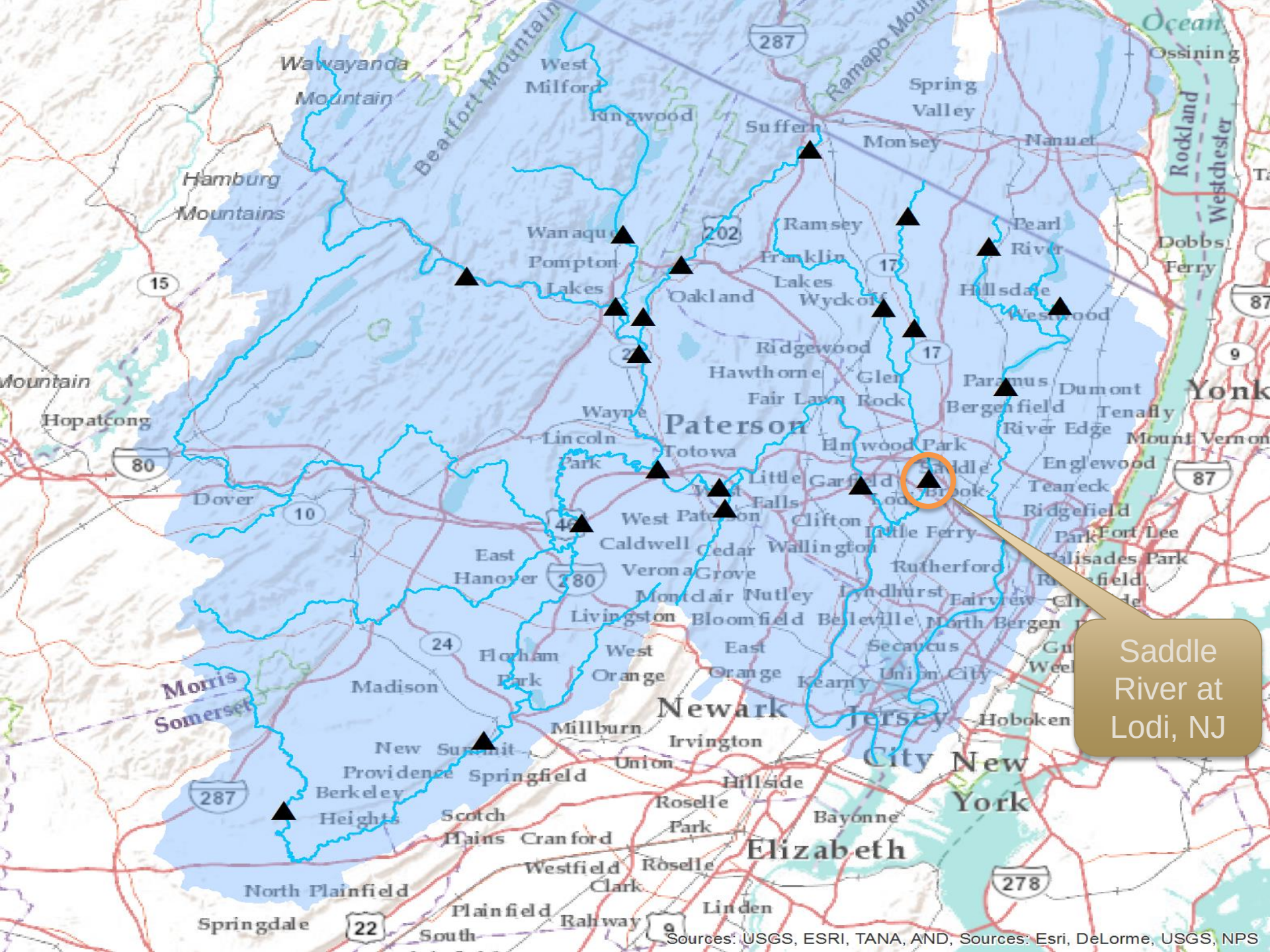
Saddle River at Lodi, NJ
Wawayanda Mountain
Hamburg Mountains
Beatfort Mountain
Ramapo Mountain
Ocean
Ossining
Rockland
Westchester
West Milford
Ringwood
Suffern
Spring Valley
Monsey
Nanuet
Wanaque
Pompton Lakes
Oakland
Ramsey
Franklin Lakes
Wyckoff
Pearl River
Hillsdale
Westwood
Dobbs Ferry
Ridgewood
Hawthorne
Glen Rock
Fair Lawn
Paramus
Bergenfield
Dumont
Tenafly
River Edge
Mount Vernon
Yonkers
Hopatcong
Wayne
Paterson
Totowa
Lincoln Park
Elmwood Park
Saddle Brook
Englewood
Teaneck
Ridgefield Park
Fort Lee
Palisades Park
Little Falls
Garfield
Clifton
Little Ferry
Rutherford
Dover
West Paterson
Caldwell
Cedar Grove
Wallington
East Hanover
Verona
Montclair
Nutley
Lyndhurst
Fairview
Livingston
Bloomfield
Belleville
North Bergen
Secaucus
Union City
Florham Park
West Orange
East Orange
Kearny
Morris
Somerset
Madison
Newark
Jersey City
Hoboken
New York
Millburn
Irvington
New Summit
Providence
Springfield
Union
Berkeley Heights
Hillside
Roselle Park
Bayonne
Scotch Plains
Cranford
Elizabeth
Westfield
Roselle
Clark
North Plainfield
Plainfield
Linden
Springdale
Rahway
South
Sources: USGS, ESRI, TANA, AND, Sources: Esri, DeLorme, USGS, NPS

Project Process

Data Collection

- H&H Models from ongoing FEMA re-studies
- LiDAR
- NWS Flood Impacts (E-19)

Inundation Mapping

- Calibrate FEMA model to USGS rating curve
- Establish WSEL values for target stages
- Develop inundation maps and depth grids

Risk Assessment

- Develop user-defined facilities from NJ ModIV tax rolls
- Evaluate parcels/structures against FIM depth grids
- Run HAZUS
- Assemble Results & Communicate Risk

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Developing UDF's

From Tax Roll to HAZUS

Develop Hazus User-Defined Facilities (UDF)

- Individual buildings/parcels in Hazus as UDF
- Represented as point feature (Centroid)
- Required model attributes:
  - Occupancy (33 Default Types)
  - Building Type (5 Default Types)
  - Replacement Cost
  - Year Built
  - Number of Stories
  - Foundation Type (7 Default Types)
  - 1st-Floor Height

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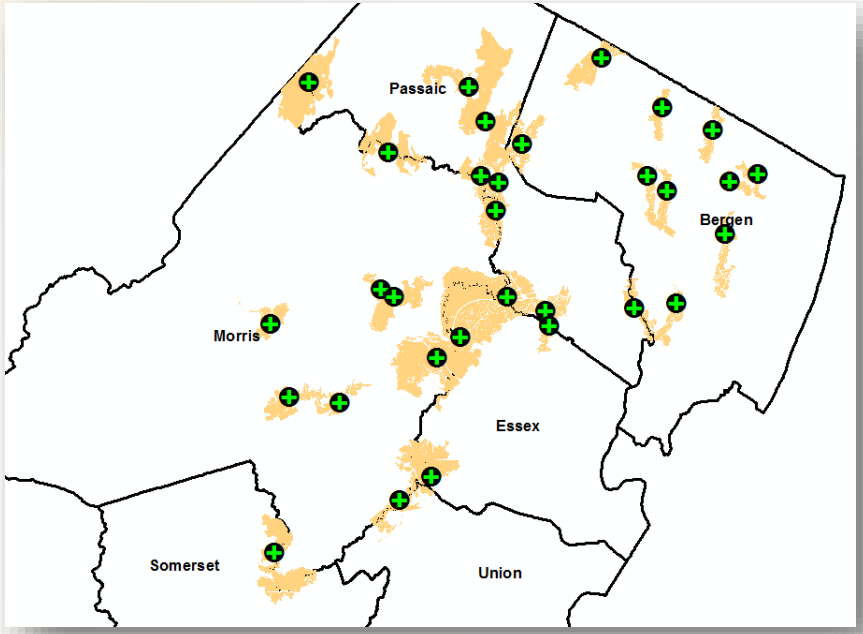
Challenges in Developing UDFs

Building Footprint

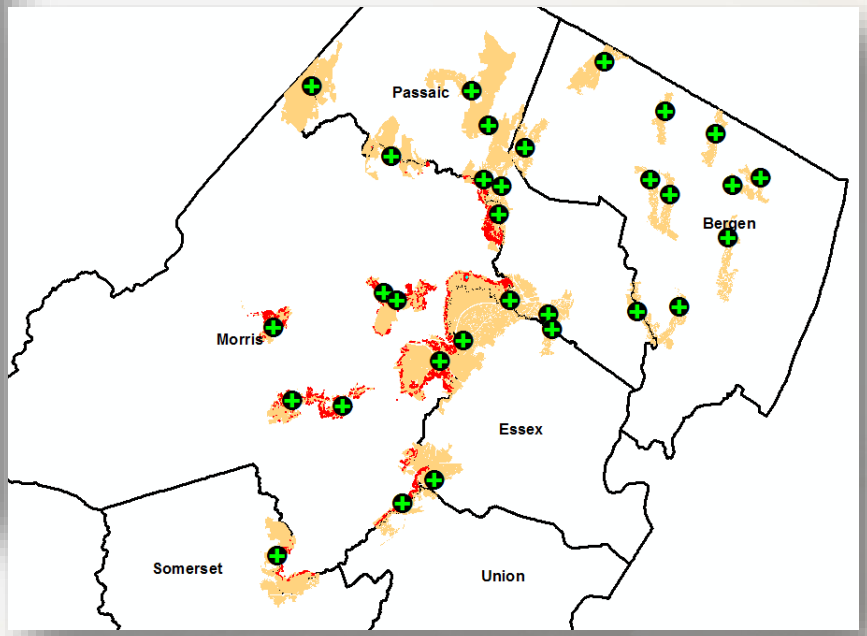
- Sporadic throughout project area
  - Digitize or Use Parcel Centroid?
  - Lodi used to demonstrate digitization.
- Differentiate use types or accessory buildings
  - Consider a strip mall typically COM1 – Retail
  - What if strip mall has the following?
    - Restaurant (COM8)
    - Beauty Salon (COM3)
    - Clothing store (COM1)
  - **CHALLENGE: replacement values could suffer if not differentiated.**

Sporadic Building Coverage

Project Stream Gages and Project Areas



Building Footprint Coverage in Red

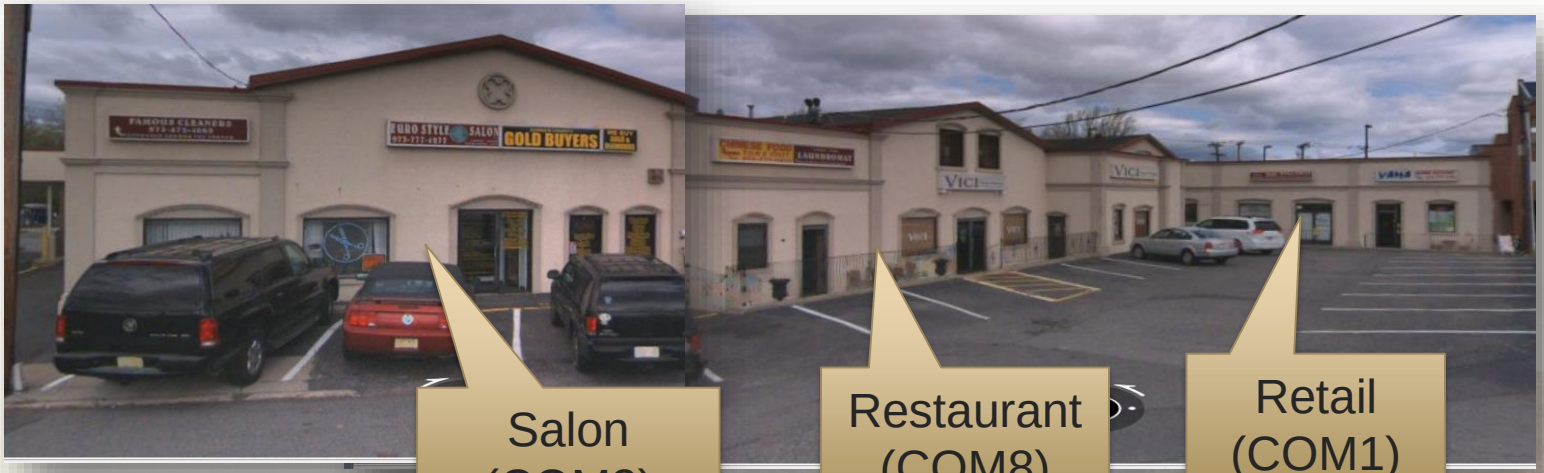


SOLUTION: use centroid of parcel; not perfect but is considered industry-standard

One footprint, many uses

Occupancy	Cost SF
COM1	$ 82.63
COM2	$ 75.95
COM3	$ 102.34
COM4	$ 133.43
COM5	$ 191.53
COM6	$ 224.29
COM7	$ 164.18
COM8	$ 170.51
COM9	$ 122.05

SOLUTION: split building polygons



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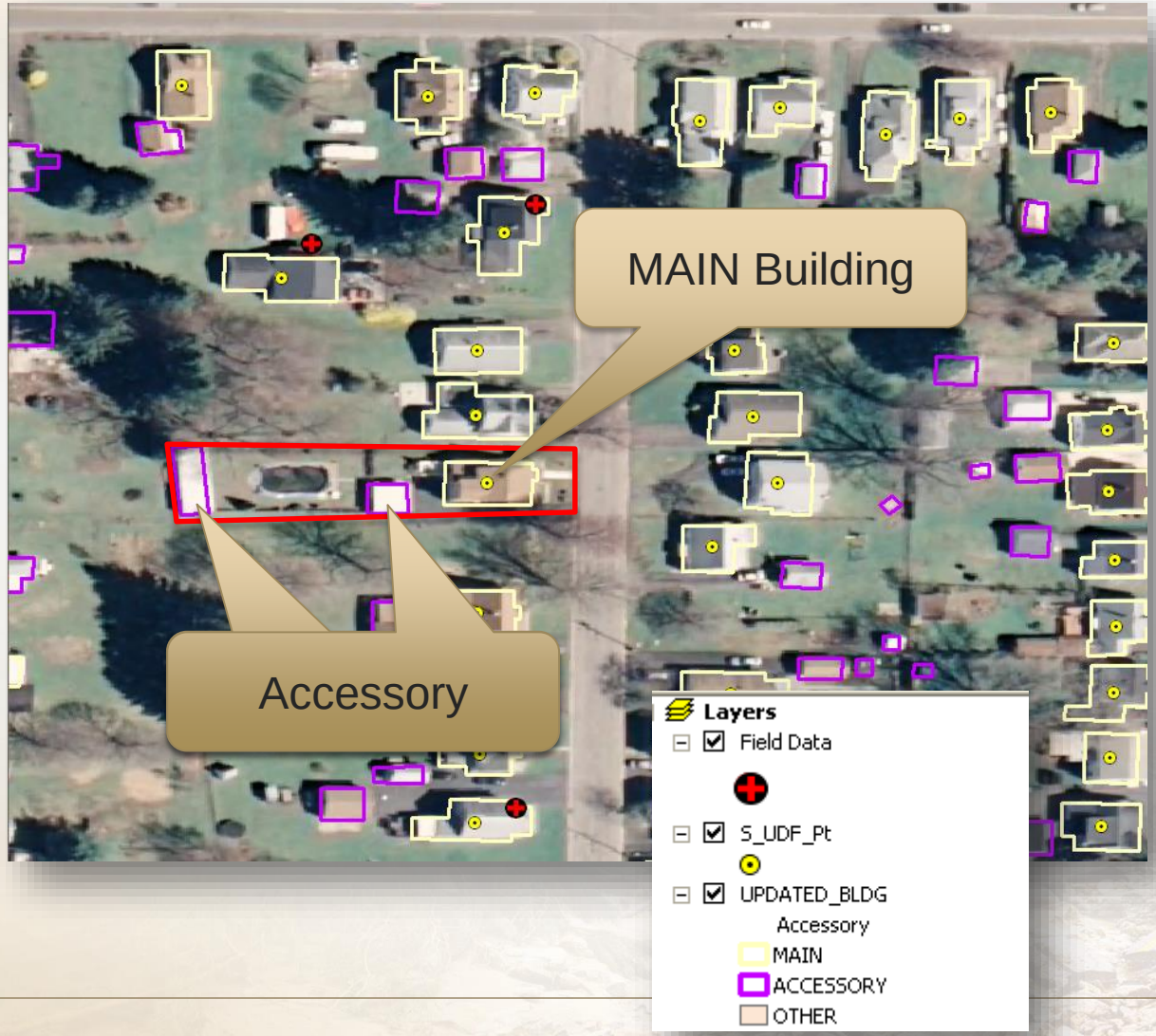
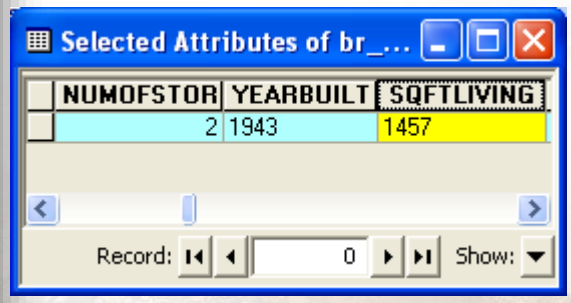
Outbuildings



- Distinction between “MAIN” and “ACCESSORY” necessary for conflation of parcel attributes to building footprints



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More challenges…

Parcel Polygons

- Parcels may come from different base map than footprints
  - Spatial inaccuracy such that footprint may not be 100% contained in proper parcel
  - **CHALLENGE: buildings assigned to wrong parcel will have wrong attributes**

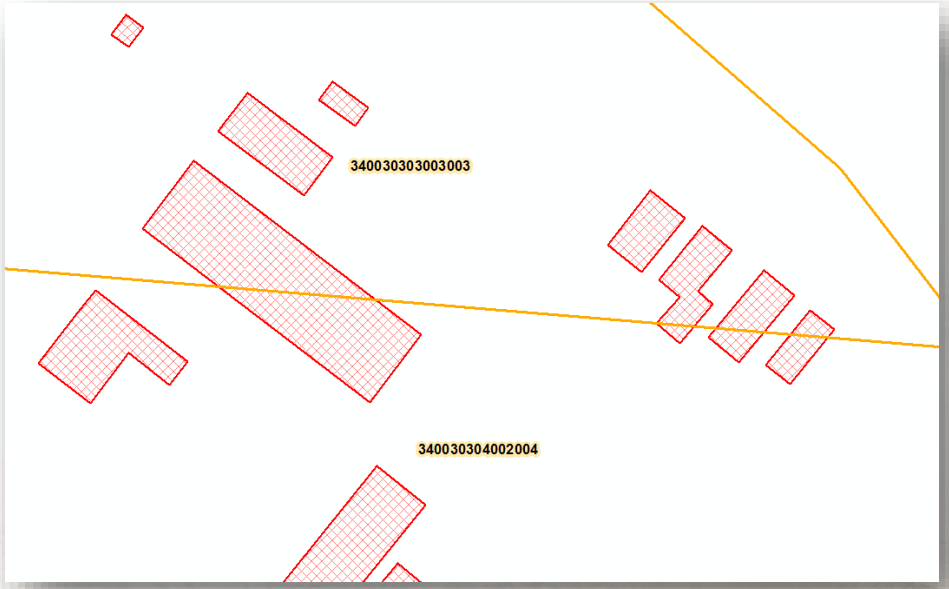
State-Level Assessor Attributes

- Prepared to join with Parcel Polygons but **NOT**:
  - 100% of a 1 To 1 Relationship (e.g. condominiums)
  - **CHALLENGE: assigning proper model attributes, calculating proper replacement cost**

Spatial Inconsistencies

Structures straddle parcels; Tax Assessor records only associated with one of the parcels

Structures straddle Census Blocks; assignment affects Risk MAP census block totals



SOLUTION: analyze building polygons and assign appropriate parcel and census block

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Conflation

Translate existing tax data to parcels/structures

Tax Records

- NJ Assessor Database
  - Some attributes cannot fully translate to the 33 Hazus Occupancy Types
- Building Description Issues
  - Many records do NOT follow the data dictionary
  - **CHALLENGE: inability to assign Occupancy and other Hazus UDF attributes**

NJ MOD IV Database

Revised as of January 2010

MOD IV USER MANUAL
TABLE OF CONTENT

1	Vacant Land
2	Residential (four families or less)
3A	Farm (Regular)
3B	Farm (Qualified)
4A	Commercial
4B	Industrial
4C	Apartment
5A	Class I Railroad Property
5B	Class II Railroad Property

- **Property Class (2) in NJ can be one of four types in Hazus**

Table 3.1 Hazus Building Occupancy Classes

Hazus Label	Occupancy Class	Standard Industrial Codes
	Residential	
RES1	Single Family Dwelling	
RES2	Mobile Home	
RES3A	Multi Family Dwelling - Duplex	
RES3B	Multi Family Dwelling – 3-4 Units	
RES3C	Multi Family Dwelling – 5-9 Units	
RES3D	Multi Family Dwelling – 10-19 Units	
RES3E	Multi Family Dwelling – 20-49 Units	
RES3F	Multi Family Dwelling – 50+ Units	
RES4	Temporary Lodging	70
RES5	Institutional Dormitory	
RES6	Nursing Home	8051, 8052, 8059

SOLUTION: additional attributes MUST be considered

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Deciphering MOD IV

Revised as of January 2010

MOD IV USER MANUAL
TABLE OF CONTENT

- The field is "supposed to" follow a specific format…reality is otherwise
- Approximately 254,000 unique values in this field for State of NJ
- Approximately 6,000 unique values in this field for the project area

Building Description Field

This is a fifteen space, alpha-numeric field.

Example: 1.5SSTL2AG means: 1 1/2 story stone colonial with a 2 car attached garage

Example Actual Values

BLDG_DESC	FREQUENCY	INTERPRETATION
2SF	1573	2story framed
1SF	1488	1story framed
1 F	1458	1story framed
1SF1G	1077	1story framed 1garage
2SF2G	787	2story framed 2garages
1SF2G	695	1story framed 2garages
1SFG1	654	1story framed 1garage
1S F	572	1story framed
1F	496	1story framed
1S F G1	465	1story framed 1garage
2SF1G	432	2story framed 1garage
2S-F	386	2story framed

SOLUTION: street-level photos, interpretations from other tax data (*or*) assign per Hazus mapping scheme (*or*) contact each municipality.

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Saddle River at Lodi, NJ

Saddle River at Lodi, NJ

- Approximately 2.5 mile reach

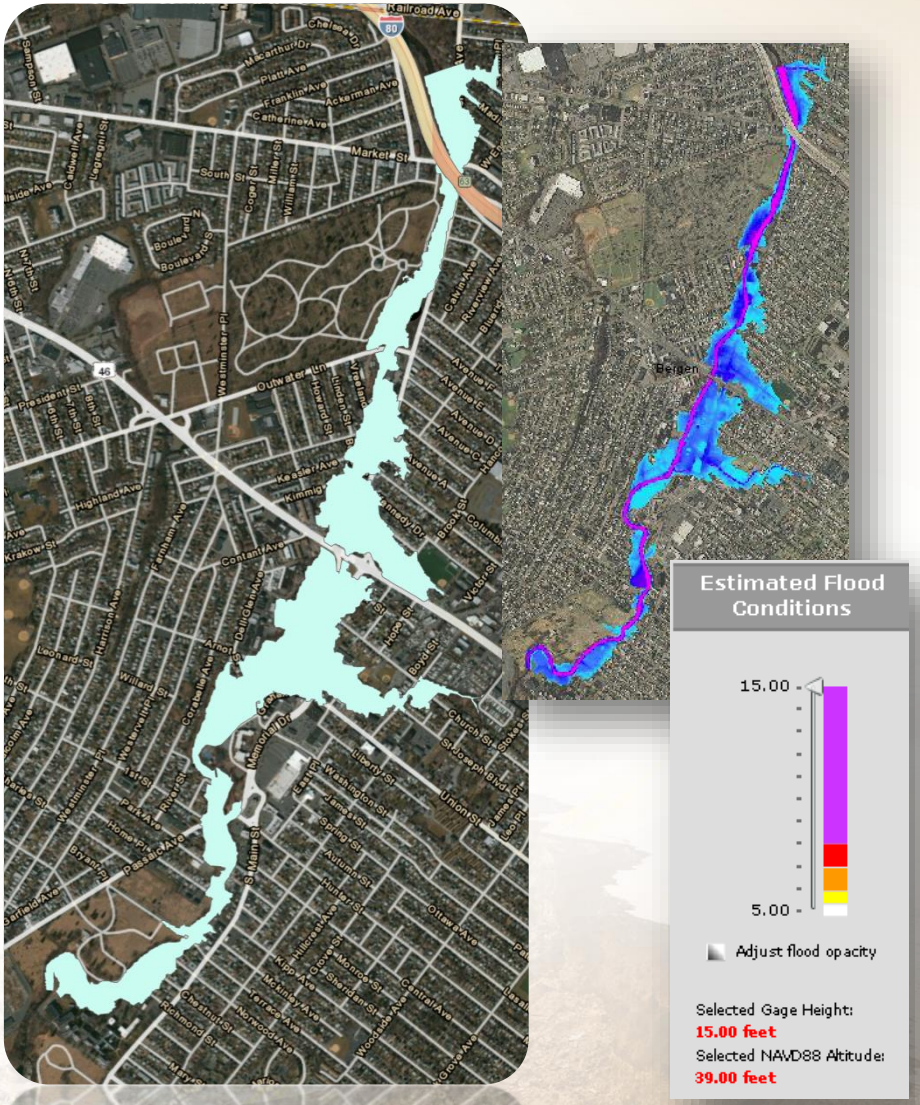
- Approximately 200 at-risk structures

- Two significant floods in recent years:

- August 2011: 13.5 ft
- April 2007: 12.9 ft

- Flood of record

- September 1999: 13.9 ft



Max Stage

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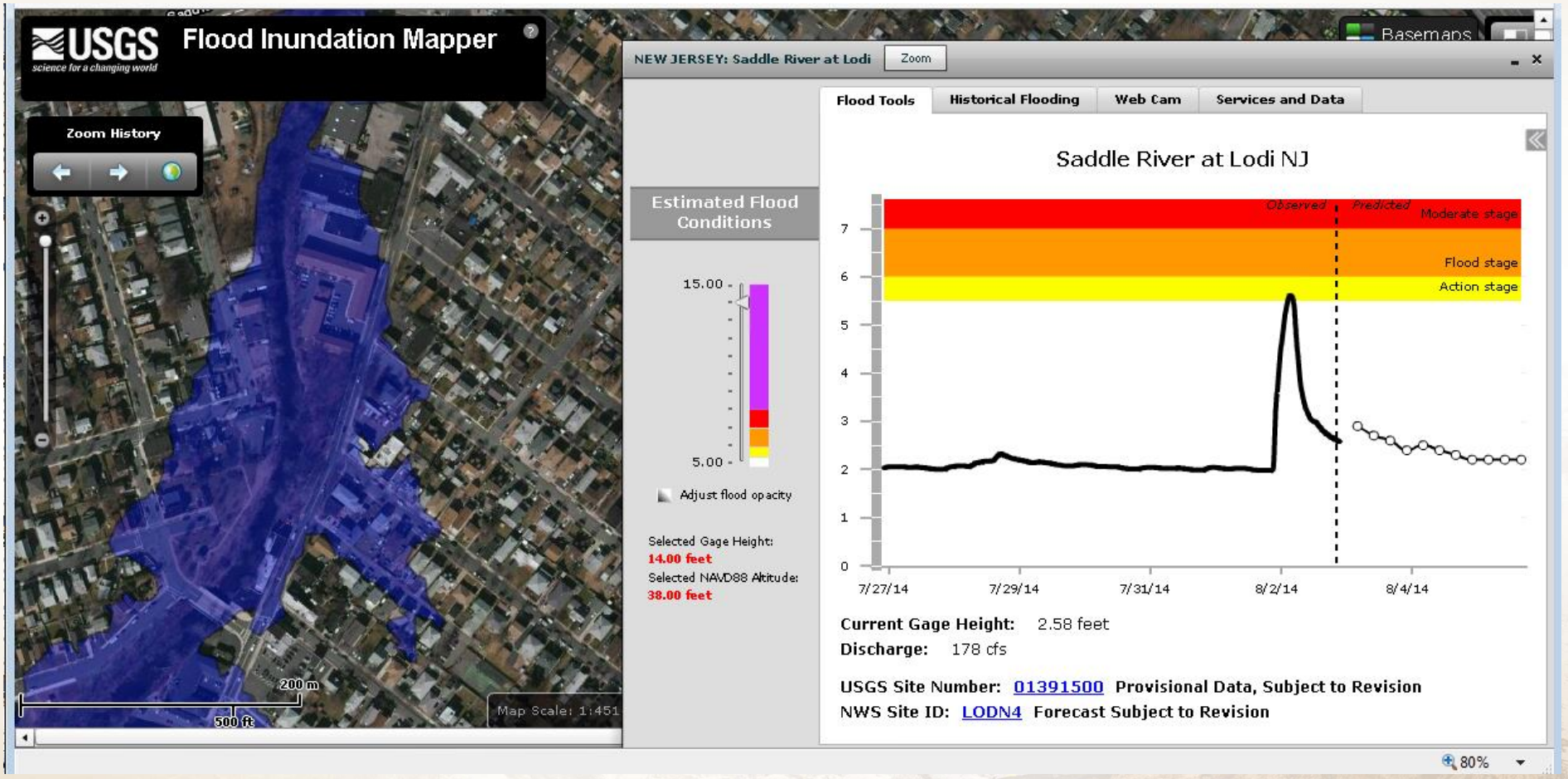
FIM: Saddle River at Lodi, NJ

http://wim.usgs.gov/FIMI/FloodInundationMapper.html?siteno=01391500#



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Communicating the Flood Risk Assessment

Leveraging Flood Risk Assessments

Leverage all tools – Map Modernization Program and Risk MAP and now FIM - for flood mapping using today's and tomorrows technologies.

Programs	Map Mod	Risk MAP	FIM
Hazard Data	1% Depth Grid*	0.2%, 1%, 2%, 4%, 10% Depth Grids	Multi-stage depth grids
User-Supplied Data	Structures & DDF's	Structures & DDF's	Structures & DDF's
Results	1% Annual Chance Losses*	Frequency & Annualized Losses	Stage-Based Losses

* Risk MAP conversion projects typically only include 1%.

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Leveraging Flood Risk Assessments

- Mapped stages cover a wide range of flows and subsequent delineations.

- Understanding the full spectrum of structures / parcels affected by lower inundation levels is important = greater value for mitigation options.

Results in the FEMA FRD

FEMA Flood Risk Database (FRD):

-Designed to store data by Annual Chance

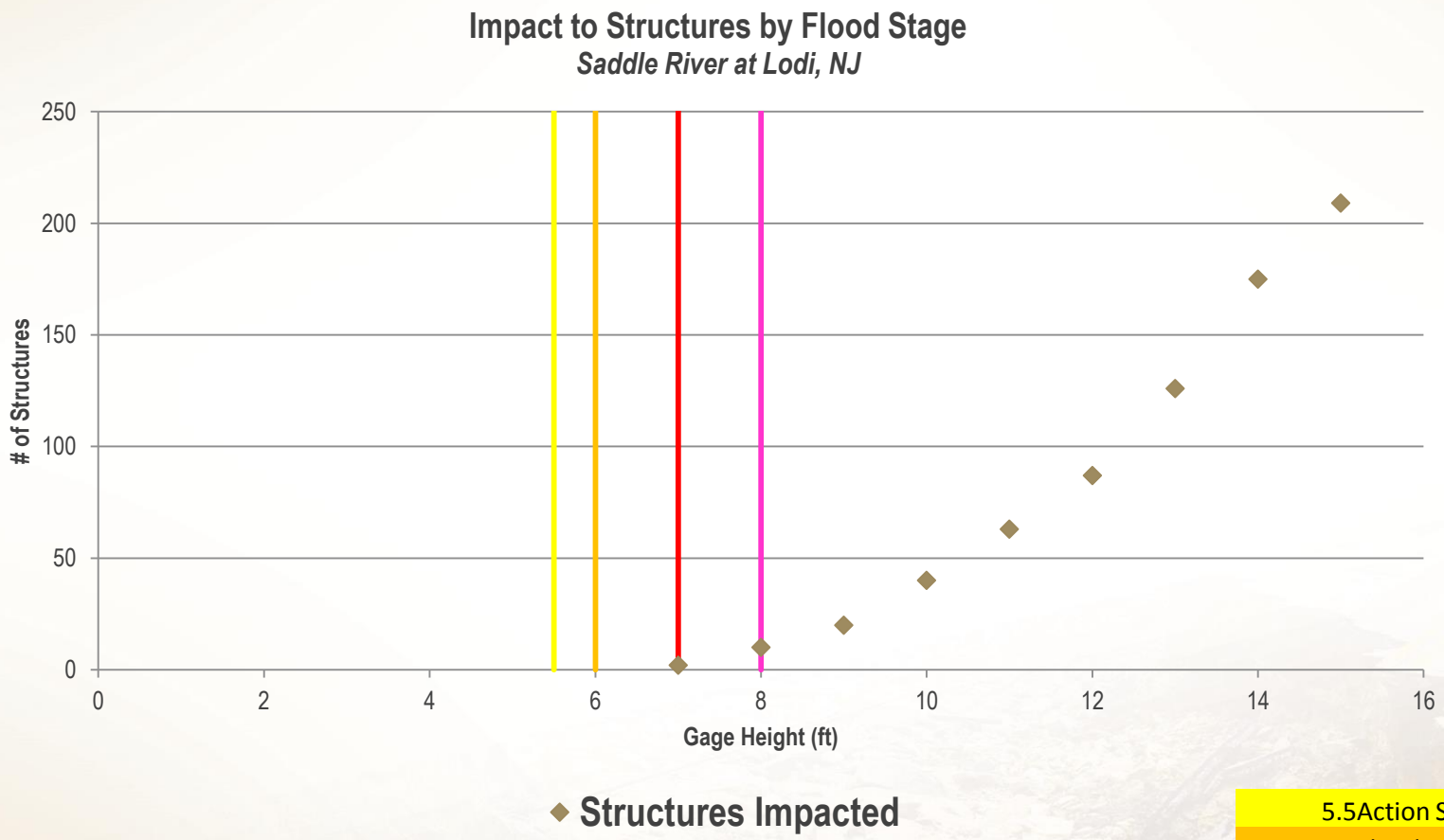
- FIM Substituted by Stage Height
  - Modification of the **D_Event** domain

Workspace Domains

Domains

Domain Name	Description
AvgAnn	Average Annual
0_2pct	0.2% Chance Event (500-yr)
0_5pct	0.5% Chance Event (200-yr)
01pct	1% Chance Event (100-yr)
02pct	2% Chance Event (50-yr)
04pct	4% Chance Event (25-yr)
10pct	10% Chance Event (10-yr)
20pct	20% Chance Event (5-yr)
50pct	50% Chance Event (2-yr)
5stg	Stage 5 (Ft. Above Gage Datum)
6stg	Stage 6 (Ft. Above Gage Datum)
7stg	Stage 7 (Ft. Above Gage Datum)
8stg	Stage 8 (Ft. Above Gage Datum)
9stg	Stage 9 (Ft. Above Gage Datum)
10stg	Stage 10 (Ft. Above Gage Datum)
11stg	Stage 11 (Ft. Above Gage Datum)
12stg	Stage 12 (Ft. Above Gage Datum)
13stg	Stage 13 (Ft. Above Gage Datum)
14stg	Stage 14 (Ft. Above Gage Datum)
15stg	Stage 15 (Ft. Above Gage Datum)

Structures by Stage



5.5Action Stage
6Flood Stage
7Moderate Flood Stage
8Major Flood Stage

Results in the FEMA FRD (Stage 8)

Table Of Contents

- FRD_Spatial_Layers
  - S_UDF_Pt
    - ARV_BLDG (Replacement Value)
    - $11,303.00 - $679,107.00
    - $679,107.01 - $2,047,436.00
    - $2,047,436.01 - $3,690,769.00
    - $3,690,769.01 - $8,015,182.00
    - $8,015,182.01 - $14,132,648.00

L_RA_UDF_Refined

UDF_ID *	RETURN_PER	BLDG_LOSS	BLDGPCTDAI
US000022	Stage 8 (Ft. Above Gage Datum)	$2,952.00	0.5%
US000028	Stage 8 (Ft. Above Gage Datum)	$887.00	0.3%
US000089	Stage 8 (Ft. Above Gage Datum)	$0.00	0%
US000090	Stage 8 (Ft. Above Gage Datum)	$29.00	0.2%
US000140	Stage 8 (Ft. Above Gage Datum)	$11,991.00	2.9%
US000152	Stage 8 (Ft. Above Gage Datum)	$727.00	0.4%
US000210	Stage 8 (Ft. Above Gage Datum)	$2,515.00	0.4%

0 (10 out of 732 Selected)

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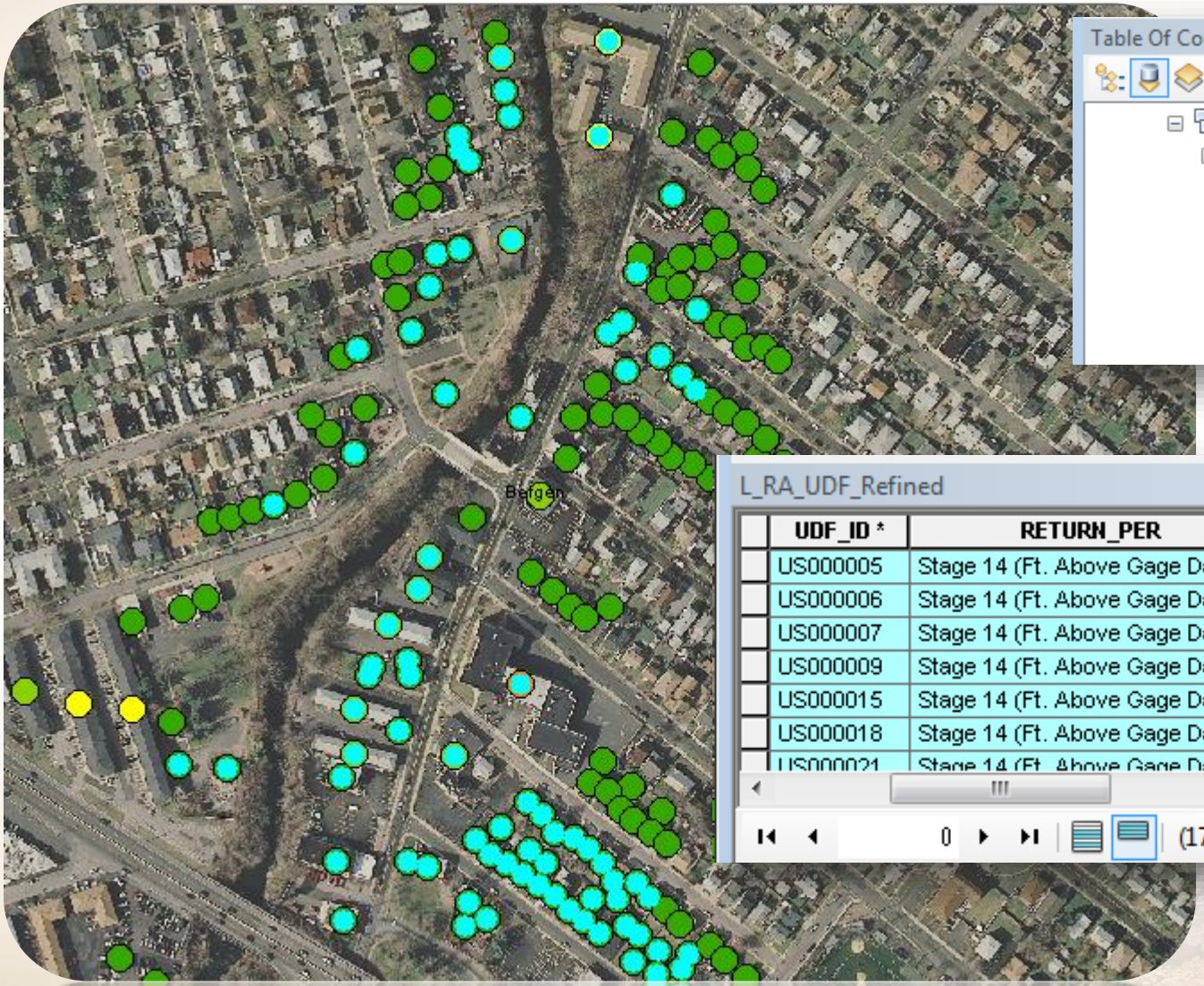
Results in the FEMA FRD (Stage 14)



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- FRD_Spatial_Layers
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    - $11,303.00 - $679,107.00
    - $679,107.01 - $2,047,436.00
    - $2,047,436.01 - $3,690,769.00
    - $3,690,769.01 - $8,015,182.00
    - $8,015,182.01 - $14,132,648.00

L_RA_UDF_Refined

UDF_ID *	RETURN_PER	BLDG_LOSS	BLDGPCTDAM
US000005	Stage 14 (Ft. Above Gage Datum)	$8,630.00	7.5%
US000006	Stage 14 (Ft. Above Gage Datum)	$6,785.00	4.4%
US000007	Stage 14 (Ft. Above Gage Datum)	$4,946.00	6.9%
US000009	Stage 14 (Ft. Above Gage Datum)	$2,449.00	0.6%
US000015	Stage 14 (Ft. Above Gage Datum)	$2,875.00	0.4%
US000018	Stage 14 (Ft. Above Gage Datum)	$945.00	0.6%
US000021	Stage 14 (Ft. Above Gage Datum)	$1,458,625.0	12.6%

0 (175 out of 732 Selected)

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Example Use – Benefit Cost

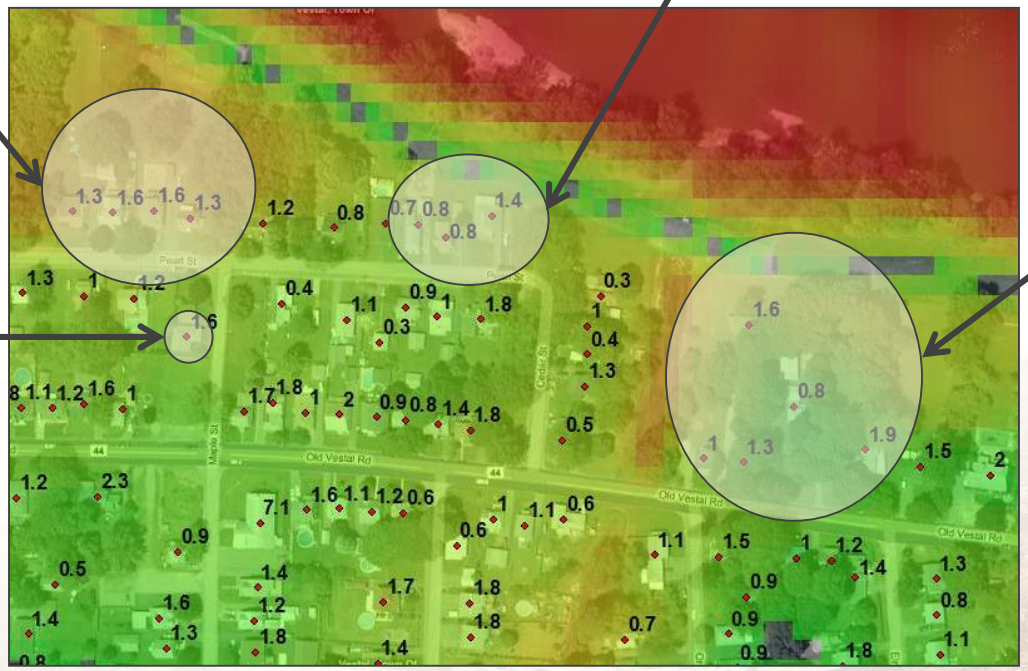
Individual BCRs may be combined to get an overall project BCR.

Acquisition
BCR: 4.3

Elevation of 3’
BCR: 3.2

Elevation of 1’
BCR: 1.5

Floodwall
BCR: 1.3



Translating Risk Assessment into Resilience and Policy

What have we created here?

Quantitative basin-wide assessment of flood risk in populated areas near gages.

- Actionable data that can support future mitigation planning efforts and provide BCA justifications

Developed a repository of structures and estimated losses

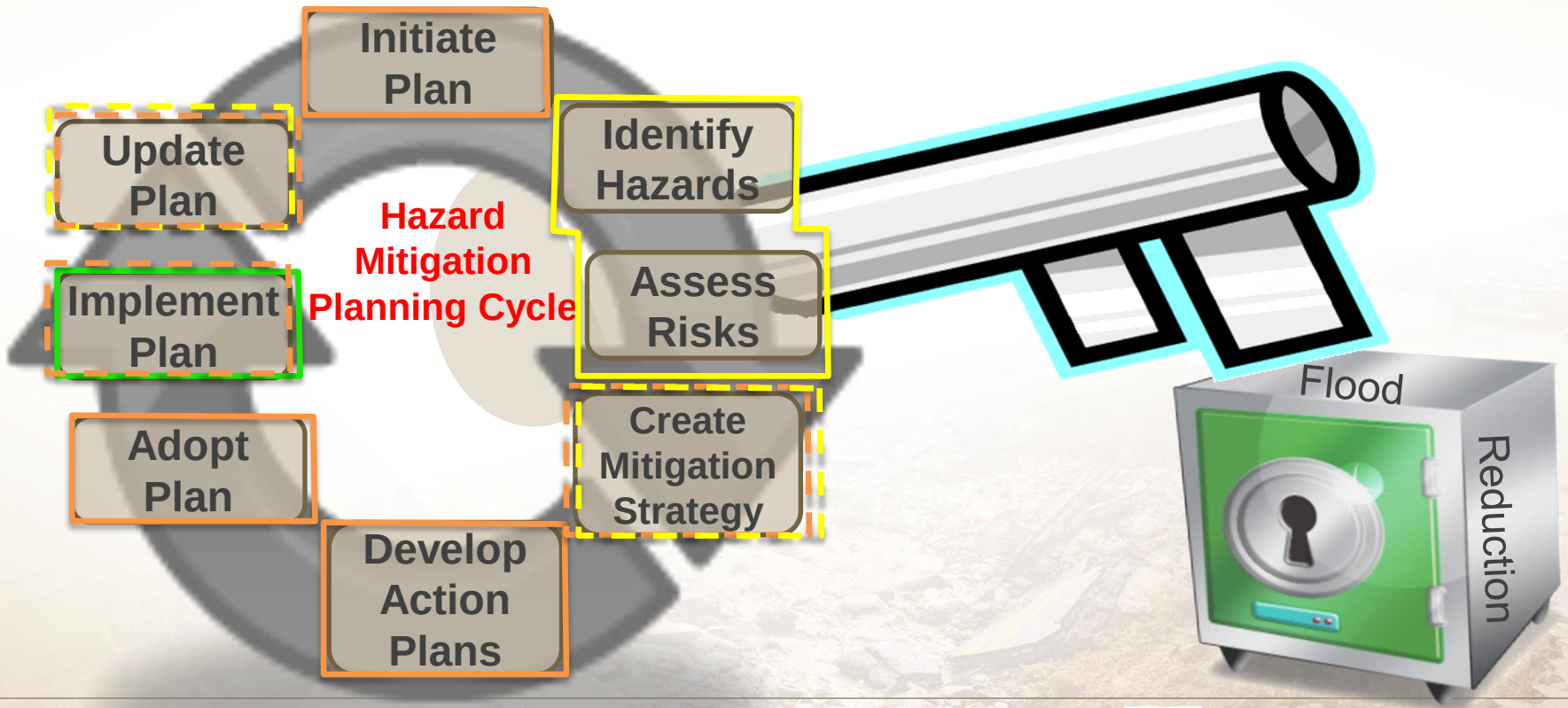
- Stored in a FEMA Flood Risk Database (FRD) schema (with slight modification)
- Demonstrate how different Federal Program Data can be leveraged

Comprehensive identification and assessment of flood risk that can be used to:

- Communicate risk
- Develop tools for decision makers
- Identify markets and/or targets for mitigation

Mitigation Planning is Key

Risk Assessment + Policy = Resiliency



Contact Us

Joseph Ruggeri
New Jersey Dept of Environmental Protection
joseph.ruggeri@dep.state.nj.us
609.292.2296

James Mawby
Dewberry
jmawby@dewberry.com
703.849.0528

Questions