

# Improving Private Inflow Inspection and Data Management with GIS

Greenwich, CT

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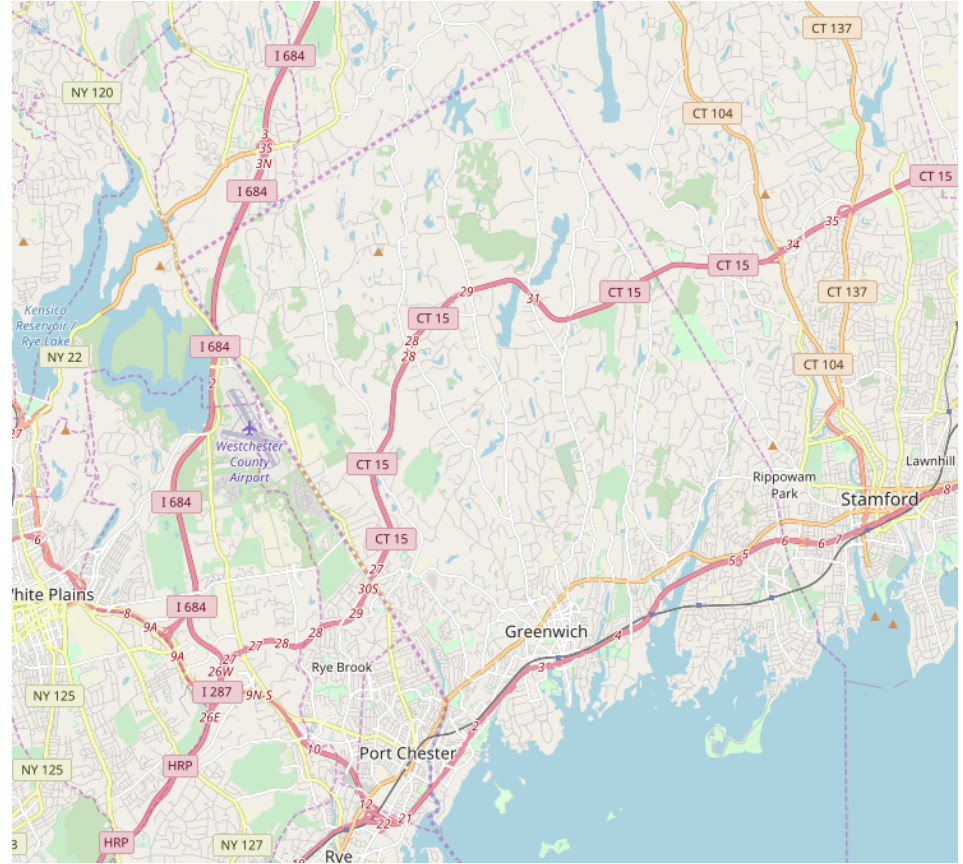
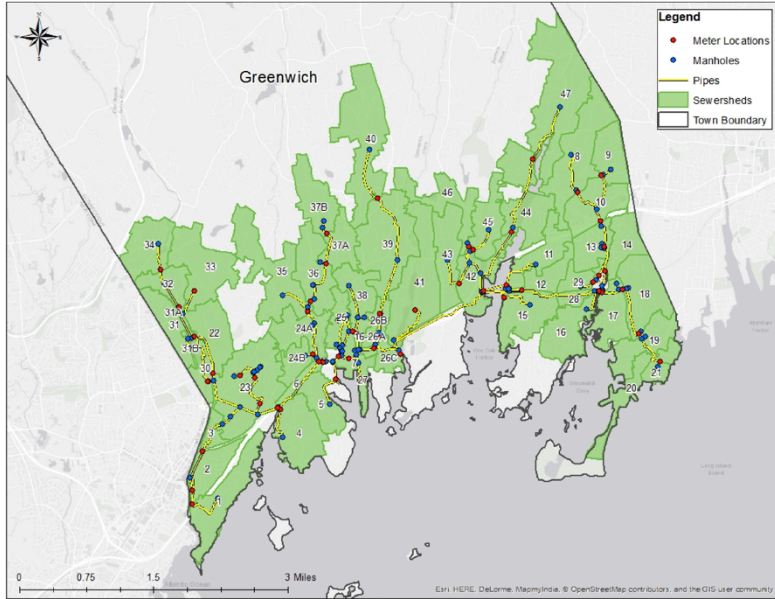
*September 10, 2018*



**CDM  
Smith**

# Presentation Outline

- Greenwich Background
- Private Inflow Removal History and Process
- Previous Data Management
- ArcGIS and Survey 123
  - Survey 123 app and inspection form
  - ArcGIS online web application
  - Conversion of old data
- Benefits
- Future Work



# Town of Greenwich

- Sanitary (separated) sewer system
- 185 miles of sewer pipe
  - 8-in to 54-in
- 28 pumping stations
- 350 individual grinder pumps
- 12.5 mgd treatment plant
- Mix of development





# Consent Decree (CD)



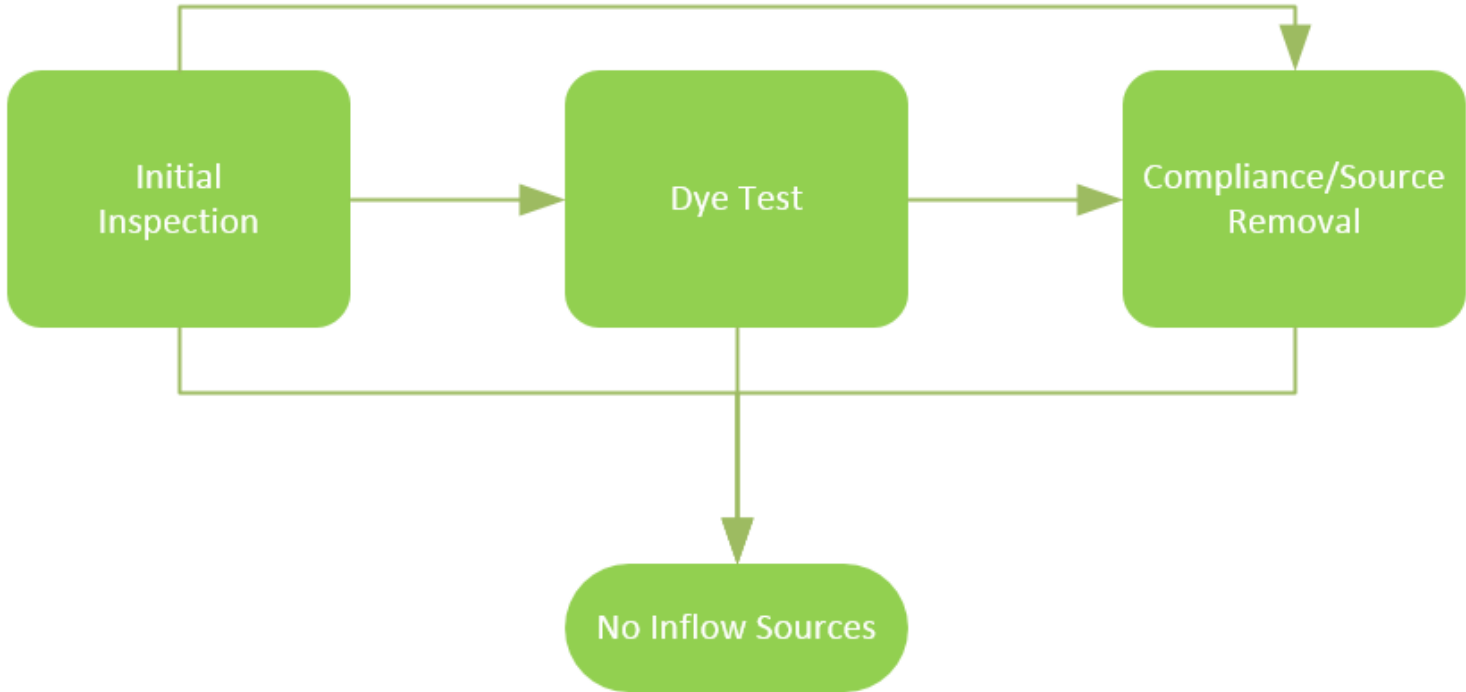
- Overflows to Long Island Sound
- EPA issued CD in 2001
- CD requirements include:
  - Force main repairs and/or replacements
  - Long term preventative maintenance
  - I/I investigation including private inflow

# Private Inflow Program Background

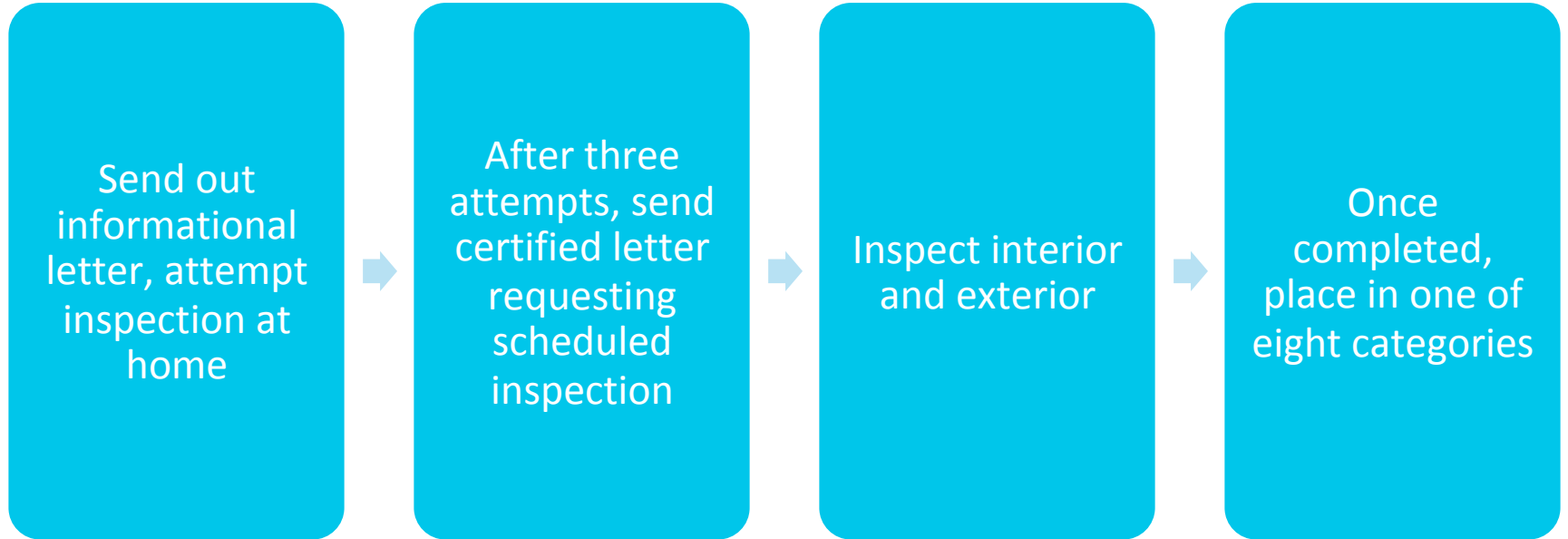
- 2002 through 2004 – SSES and Private Inflow Program Inception
  - Smoke Testing
  - Building Inspection
  - Dye Testing
- 2006 to Present: Ongoing Private Inflow Inspection and Removal Throughout Town
  - Building Inspection
  - Dye Testing



# PISRP Process

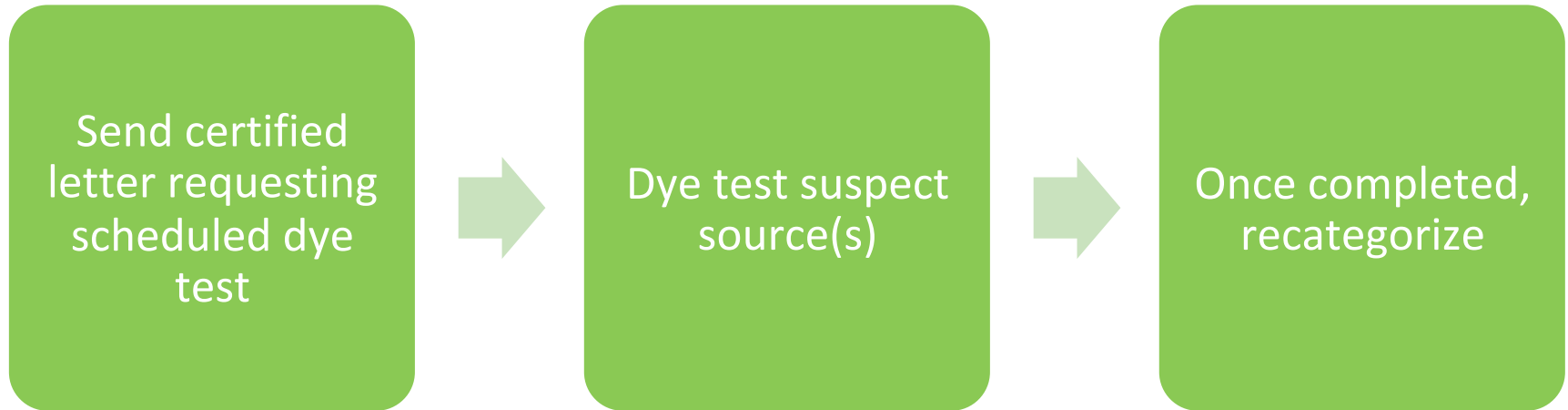


# PISRP Process – Inspection

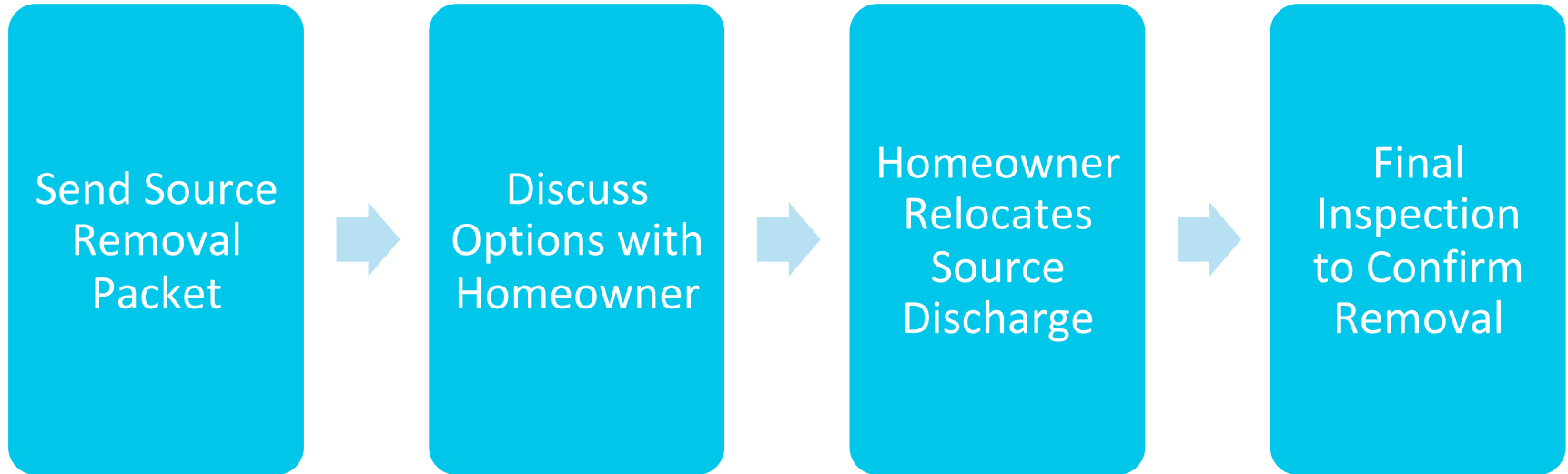




# PISRP Process – Dye Test



# PISRP Process – Source Removal



# Data Management



An Excel spreadsheet with a data table. The table has columns for 'ACCTNO', 'DEPT', 'OWNER', 'LOCATION', 'OWNER\_NAME', 'OWNER\_ADDR', 'OWNER\_CITY', 'OWNER\_STATE', 'OWNER\_ZIP', 'Underinsured', 'Dis Test Letters', and 'Dis Test Exp'. The data rows are highlighted in green.

ACCTNO	DEPT	OWNER	LOCATION	OWNER_NAME	OWNER_ADDR	OWNER_CITY	OWNER_STATE	OWNER_ZIP	Underinsured	Dis Test Letters	Dis Test Exp
2921-12-0000	7	GREYTHORN RD	14 GREYTHORN RD	NEAL W. WACHS	14 GREYTHORN RD	GREENWICH	CT	06039	no		8/15/18
2007-03-0149	56	GREYTHORN RD	14 GREYTHORN RD	STONY BROOK & CHESTER	14 GREYTHORN RD	GREENWICH	CT	06039	no		8/15/18
2921-12-0000	7	GREYTHORN RD	14 GREYTHORN RD	PARSON OF CHRIST CHURCH GREENWICH	14 EAST 21 <sup>ST</sup> AVENUE	GREENWICH	CT	06039	no		10/1/18
2921-12-0000	0	GRUBBS LANE	14 GRUBBS LANE	FARBELL PARISH	14 GRUBBS LANE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	1	GRUBBS LANE	14 GRUBBS LANE	FARBELL & JOHN COOPER	14 GRUBBS LANE	CT	06039	no			1/15/20
2921-12-0000	0	HARRIS TON AVENUE	14 HARRIS TON AVENUE	ST PETERS CHURCH GREENWICH	14 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	100	HARRIS TON AVENUE	14 HARRIS TON AVENUE	GREENWICH FIRE DEPT MICHAEL & DEANNE JAM	PO BOX 4447	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	1	HARRIS TON AVENUE	14 HARRIS TON AVENUE	PROFESSIONAL OFFICE & CONSULTING	14 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	1	HARRIS TON AVENUE	14 HARRIS TON AVENUE	GREENWICH FIRE DEPT MICHAEL & DEANNE JAM	PO BOX 4447	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	200	HARRIS TON AVENUE	200 HARRIS TON AVENUE	CHELA STEPHEN RANNEY-GERALDINE LIFE LIFE	200 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	21	HARRIS TON AVENUE	21 HARRIS TON AVENUE	HARRIS TON AVENUE	21 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	21	HARRIS TON AVENUE	21 HARRIS TON AVENUE	HARRIS TON AVENUE	21 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	23	HARRIS TON AVENUE	23 HARRIS TON AVENUE	HARRIS TON AVENUE	23 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	8	HARRIS TON AVENUE	8 HARRIS TON AVENUE	HARRIS TON AVENUE	8 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	14	HARRIS TON AVENUE	14 HARRIS TON AVENUE	HARRIS TON AVENUE	14 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	14	HARRIS TON AVENUE	14 HARRIS TON AVENUE	HARRIS TON AVENUE	14 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	18	HARRIS TON AVENUE	18 HARRIS TON AVENUE	HARRIS TON AVENUE	18 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20
2921-12-0000	88	HARRIS TON AVENUE	88 HARRIS TON AVENUE	HARRIS TON AVENUE	88 HARRIS TON AVENUE	GREENWICH	CT	06039	no		1/15/20

# Data Management

- Over 15 years worth of data
  - 9,500 inspections
  - 1,500 dye tests
- Varying forms of data
  - Paper forms
  - Excel spreadsheets
  - Access database
  - Digital and printed photographs
- Complex but we made it work





# Challenges from Previous System

- Duplicate information
- Difficulty keeping paper and electronic data up-to-date
- Data not available in field
- Client needed to contact us for information
- Data not directly linked to property location

**Building Inspection Survey Form**

Building Identification Information				Basis of Inspection			
Owner:				Inspector:	0200		
Interviewee:				Date of Inspection:	9-13-13		
Building #:	17A			Time of Inspection:	4:37		
Street Name:	Sycamore Street, Rowland			Entry Basis:	<input type="checkbox"/> Permitted by Owner <input type="checkbox"/> Informed by Owner		
Usage:	<input type="checkbox"/> R-Residential <input type="checkbox"/> I-Industrial			<input type="checkbox"/> Permitted by Tenant <input type="checkbox"/> Informed by Tenant			
	<input type="checkbox"/> C-Commercial <input type="checkbox"/> O-Other			<input type="checkbox"/> Permitted by Other <input type="checkbox"/> Informed by Other			
	<input type="checkbox"/> M-Municipal			<input type="checkbox"/> Refused			
GIS #:	04-162-15			<input type="checkbox"/> Deferred			
Building Status:	<input type="checkbox"/> In Use <input type="checkbox"/> Vacant <input type="checkbox"/> Demolished			Deferred to: _____			
				Visit # 1			

Details of Findings																
Discharge Location	Building Exterior						Building Exterior									
	Drain Type	Group	Subwalk	Driveway	Vent	Patio	Shower/	Window	Roof	Leak	Service Type	Condition	Foundation	Drain	Stump	Basement Interior
San	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	Basement: <input type="checkbox"/> Full <input type="checkbox"/> Partial <input type="checkbox"/> Slab
Storm																Floor Material: <input type="checkbox"/> Gravel <input type="checkbox"/> Block <input type="checkbox"/> Concrete <input type="checkbox"/> Stone
Waste																Building Sewer Service
Grid																Exit Height (Below Sill (in feet))
Dwell																Pipe Size (in inches)
Uhn																Exit Location (as viewed from Street)
Total																Building Side:

Other Services			
Sewer Backups:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reason:	<input type="checkbox"/> Rain Event <input type="checkbox"/> Blockage
Known Street Flooding:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reason:	<input type="checkbox"/> Rain Event <input type="checkbox"/> San Blockage <input type="checkbox"/> Storm Blockage
Evidence of Wet Basement:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Reason:	<input type="checkbox"/> Rain Event <input type="checkbox"/> San Blockage <input type="checkbox"/> Storm Blockage
		Height above floor (in inches):	

Category After Inspection						
<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	<input type="checkbox"/> E	<input type="checkbox"/> F	<input type="checkbox"/> G <input type="checkbox"/> NFA

Comments

# Previous Paper-Based Systems - Not Connected

## Inspection Records

**Building Inspection Survey Form**

Building Identification Information

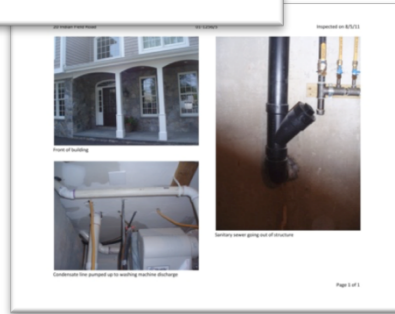
Inspection Details

Inspection Results

**PISR Inspection Form**

Site Plan with Annotations

**Capacity Also Question**



## Dye Test Records

**Greenwich Dye Test Inspection Form**

Property Address

Inspection Details

Inspection Results

COMMENTS

ADDITIONAL COMMENTS

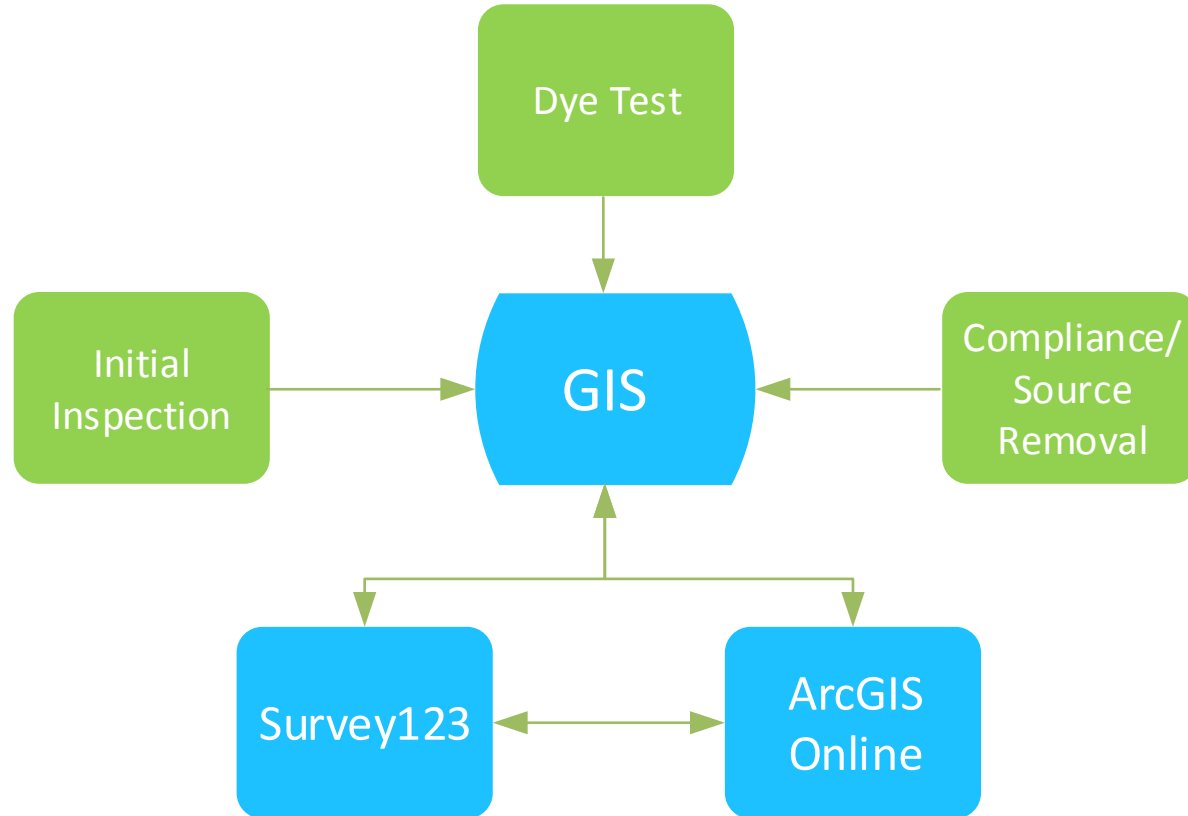
04 5023 - 7 South Street South

Front of House

Year 16, finished, dyed, but that seems to contain dye

Aerial View with Annotations

# Conversion to GIS



# Survey 123 Inspection Process

- ArcGIS Product customized by CDM Smith staff
- GIS info from Town defines parcels and ownership
  - Imported into the customized Survey 123 application
- Inspectors input results into mobile application in the field
- Data of interest
  - Confirmed or suspected sources
  - Photos
  - Property Maps

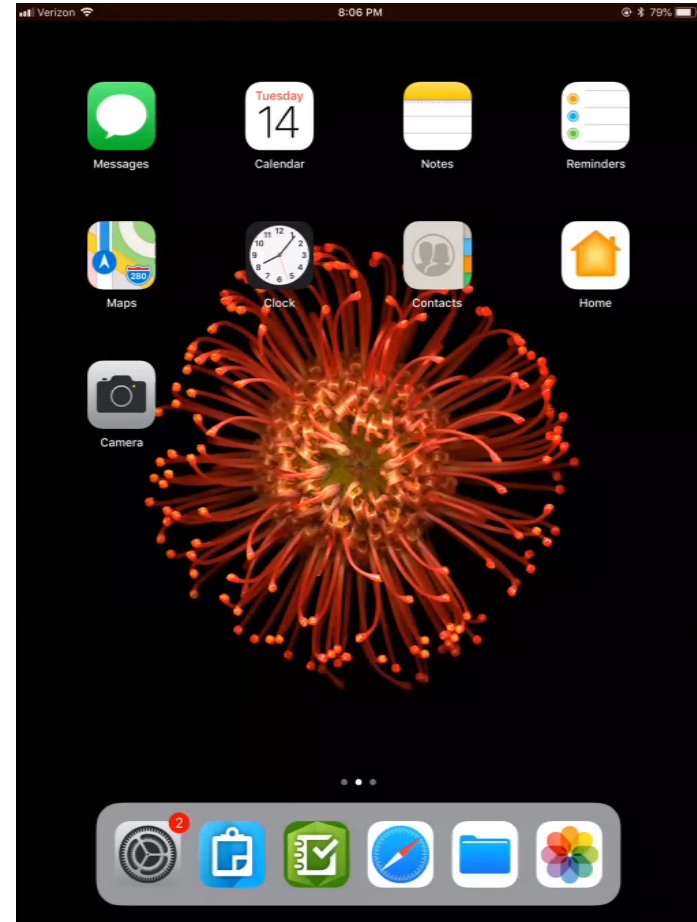


# Survey 123 Demo

The screenshot shows a mobile application interface for a 'Building Inspection Survey'. The form includes the following fields and options:

- Building Address \***: A text input field.
- Basis of Inspection**: A section header.
- Inspector \***: Radio buttons for Dan Thompson, Matt DeSanti, Taylor Rodrigue, and Other (selected).
- Date of Inspection**: A date picker set to August 15, 2018.
- Time of Inspection**: A time picker set to 12:26 PM.
- Entry Basis \***: Radio buttons for Permitted by Owner, Permitted by Tenant, Permitted by Other, Informed by Owner, Informed by Tenant, Informed by Other, Refused, Deferred, and Not Home.
- Deferred To**: A text input field.
- Visit Number**: A text input field.
- Usage**: Radio buttons for R-Residential, C-Commercial, M-Municipal, I-Industrial, and O-Other.
- Number of Units**: A text input field.
- Building Status**: Radio buttons for In Use, Vacant, and Demolished.
- Photo**: A section with camera and gallery icons.

The app has a red header bar with a close button, the title 'Building Inspection Survey', and a menu icon. A red bar at the bottom contains a checkmark icon.



# ArcGIS Online Web Application

The screenshot displays a web browser window with the URL `cdmsmith.maps.arcgis.com/apps/webappviewer/index.html?id=60e1c37c397847b3a5b6963bb4a8967`. The application title is "Greenwich, CT: Work Order Application". The map shows a residential area with red-outlined lots and green-outlined streets. Numerous red and blue circular markers are scattered across the map, representing work order locations. A pop-up window titled "(1 of 2)" is open over a specific marker, displaying the following information:

Date	
Evidence of Wet Basement	No
Height Above Floor	
Category	NFA
After Inspection	
Comments	No sources to report
Attachments:	
	<a href="#">photo1-20160801-132031.jpg</a>
	<a href="#">photo2-20160801-132229.jpg</a>
	<a href="#">photo3-20160801-133150.jpg</a>
Edited by	desantima_CDMSmith8 on 9/6/16 at 10:01 AM
Zoom to	

# Conversion of Old Data

- This is an ongoing process
- All parcels are identified by a unique GIS field
- Older files can be linked into ArcGIS online
  - Paper records scanned
  - Access database



# Benefits of CDM Smith Customized Survey 123 & ArcGIS Online System

- User friendly
- Improved data collection accuracy
- Offline collection, upload when WiFi connection is available
- Real time monitoring of data collection
- Fewer follow-up activities required
- Better collaboration between field and office staff
- Easy to access, review, and edit data
- Cost savings



# Benefits of GIS Conversion of Old Data

- All data is centralized & streamlined
- Reduce number of separate tracking systems
- Single location for all program data
- Easier to access and share required data
- Historical data can be accessed in the field
- Eventual client access to all data

# Future Work

- Property Maps
- The continued conversion of historical data
- Development of Survey 123 applications for:
  - Dye Testing
  - Source Compliance Activities

**PISRP INSPECTION FORM**  
External Conditions

1 CANDELIGHT PLACE  
04-2172/S

174 BYRAM SHORE ROAD  
04-2365/S

172 BYRAM SHORE ROAD  
04-1062/S

176 BYRAM SHORE ROAD  
04-1003/S

178 BYRAM SHORE ROAD  
04-2095/S

BYRAM SHORE RD

173 BYRAM SHORE ROAD  
04-2221/S

LEGEND:  
(LABEL ALL FEATURES)

○ ROOF LEADER	FOUNDATION DRAIN	⊕ FLOOR DRAIN
× SUMP PUMP	▢ PROPERTY DRAIN	⊖ WINDOW DRAIN

OWNER NAME: CIULLO PATRICK

ADDRESS: 172 BYRAM SHORE ROAD  
GREENWICH, CT.

METER AREA: 1

CDM SMITH INSPECTOR: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Hydrology  
Paved Areas  
Parcel Boundary  
Building Footprint

NOTES: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

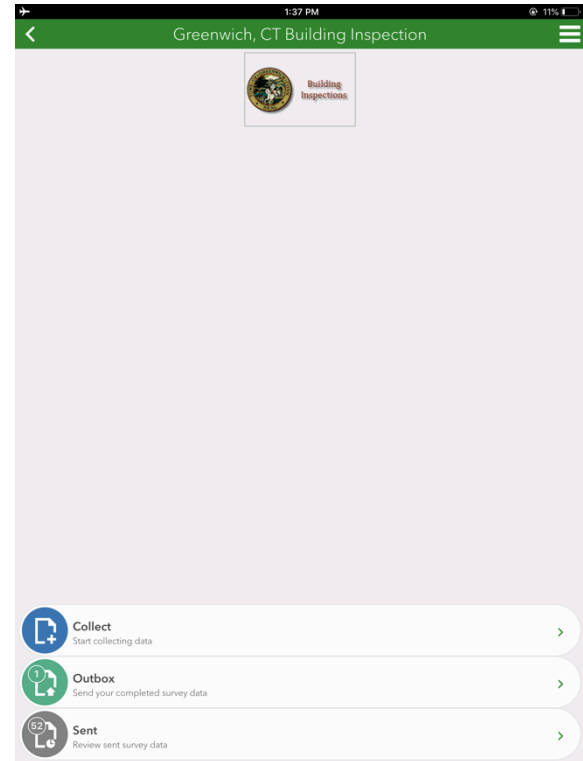
1 inch = 30 feet

**CDM Smith**

The map shows a property at 172 Byram Shore Road with handwritten annotations in red ink. The annotations include 'Sum' with an arrow pointing to a roof feature, 'FD' with an arrow pointing to a roof feature, and several 'R/L' with arrows pointing to roof features. The map also shows surrounding properties and roads, including Byram Shore Rd and Candlelight Pl.

# Additional Applications for Survey 123

- Manhole inspections
- Pipe cleaning data
- CCTV
- Fats, oils & greases
- Pump station maintenance inspections
- Bypass/overflow reporting





# Questions and Answers

