Making the Most of It: Mobile GIS for Utility Infrastructure Management Presented By: Peter Witt





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ABSTRACT

Underground Assets Mapping & Inspecting Waterbury's Collection System to:



 Meet regulatory requirements
 Develop tools for efficiency and planning

3. Train staff

Presentation Outline

- 1. About Waterbury, Connecticut
- 2. Regulatory Requirements
- 3. Data Development
- 4. Manhole Investigations
 - A. Inspection Strategy
 - B. Training City Staff
 - C. Reporting



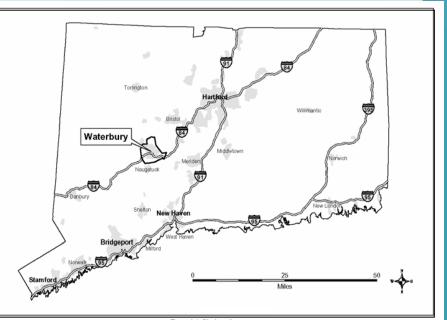
Presentation Outline (continued)

- 4. Asset Management System
- 5. Managing Project Cost



About Waterbury

- Located in New Haven County, Connecticut
- 30 miles southwest of Hartford
- 4th largest City in CT
- Growing in population, industry, and commerce
- Approximately 115,000 residents



About Waterbury's Sewers

- Aging infrastructure (early 1900's)
- 320 miles of sanitary sewer
- 93 discrete sewer sub-areas
- 9,500 manholes
- 5 other Towns discharge to Waterbury



More About Waterbury's System

- 21 pump stations
- 4 flow metering stations
- 23 MGD ADF at WPCF
- 80 MGD peak 50 MGD small event



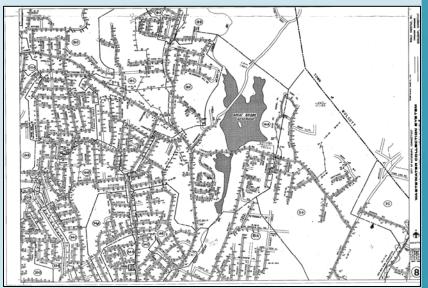
About Waterbury's Challenges

- Water Pollution
 Control
 - CSO's & SSO's
 - Regulatory concerns
 - Reactive maintenance
- City-wide
 - Administrative turnover
 - Staffing challenges



About Waterbury's Challenges

- Engineering/Technolog
 - У
 - Limited tools
 - Limited computing resources
 - Limited asset mapping
 - Limited GIS resources



Consent Decree

- USEPA and the CTDEP issued Consent Decree on November 21, 2002:
 - Evaluate the condition of City manholes
 - Inspect 5% of the City manholes
 - Develop Initial and Long-Term Maintenance
 Plans
 - Infiltration/Inflow Investigations
 - Train City Staff
 - Reporting

= CMOM Program

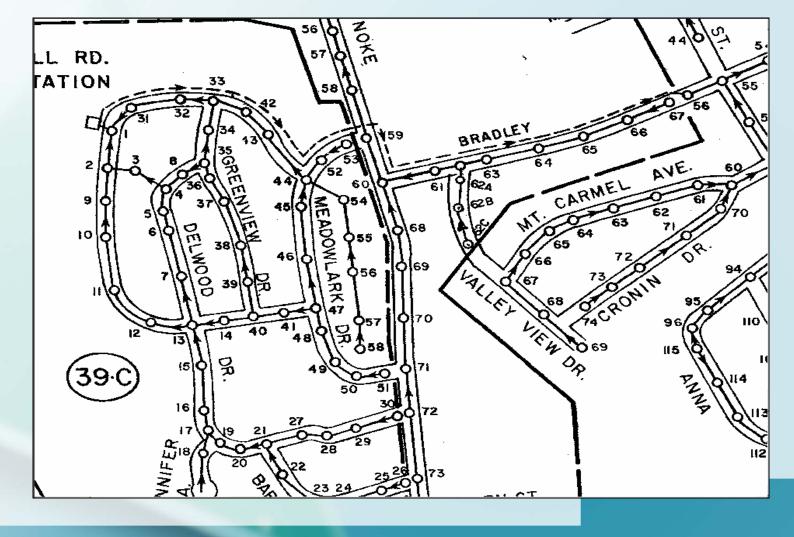
Waterbury Approach to the Consent Decree

Develop Asset Management Program to Comply and Strengthen WPC

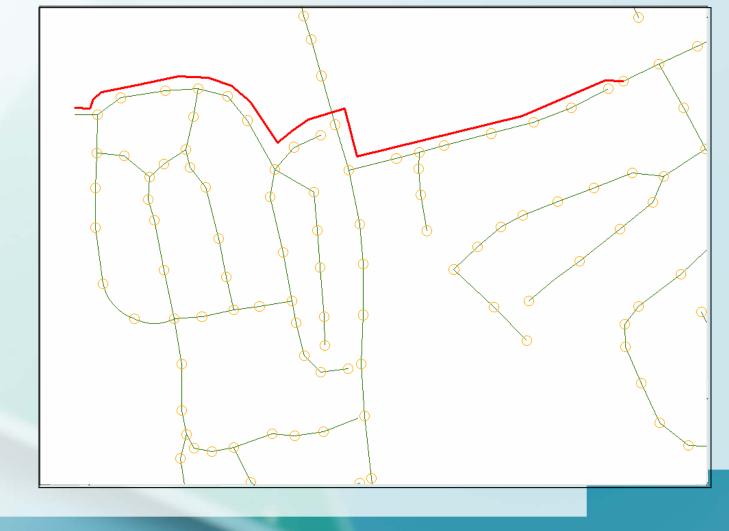
The asset management program must:

- 1. Maintain compliance
- 2. Reduce strain on Town forces
- 3. Create defendable planning tools
- 4. Grow as funds allow

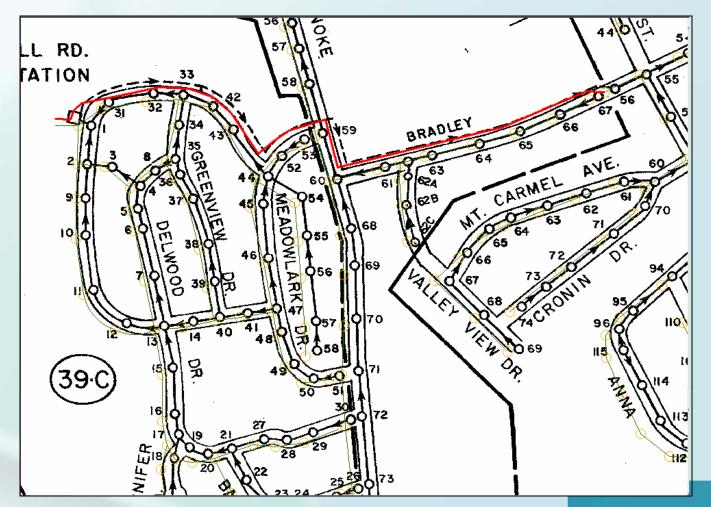
Data Development – Scanned Sewer Maps



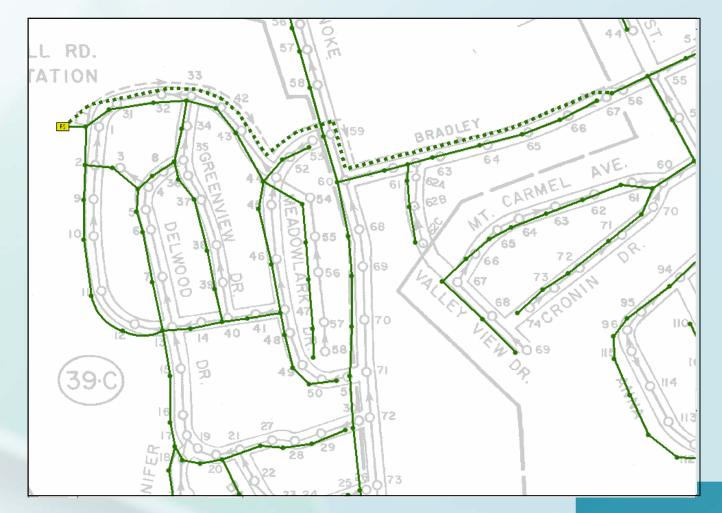
Data Development – CAD Drawing



Data Development – Georeferencing



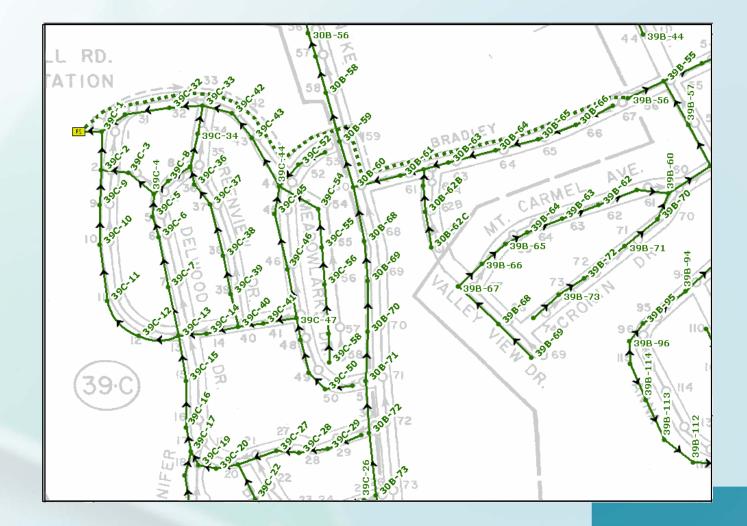
Data Development – GIS Conversion



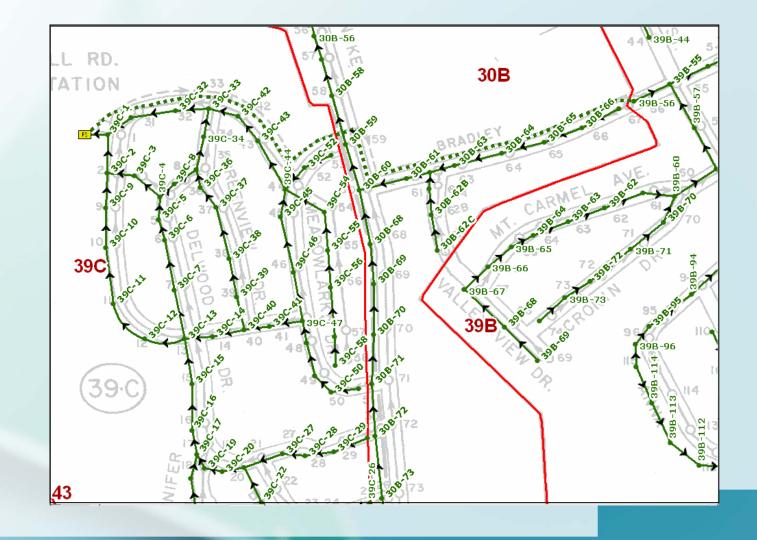
Data Development – Flow Direction



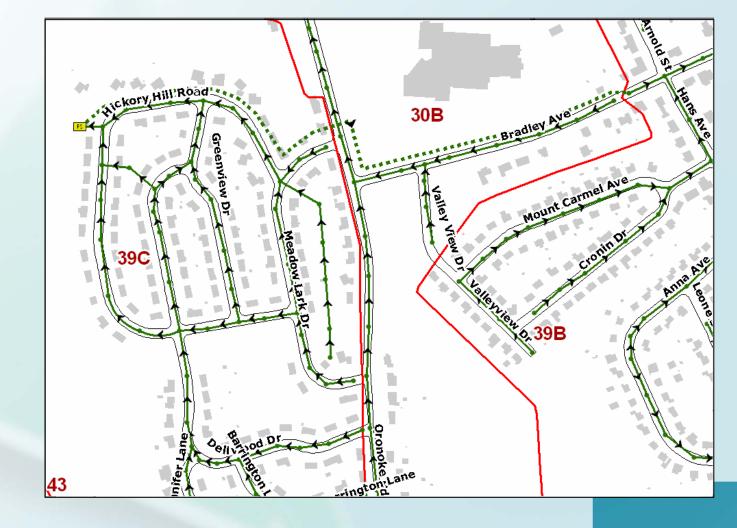
Data Development – Manhole IDs



Data Development – Subareas



Data Development – GIS Basemap



Manhole Inspection Strategy

- Locate manholes while simultaneously assessing condition
- Provide basis for the rehabilitation and management
- Joint partnership between W&C and the City



Manhole Inspection Strategy

- Sustainable method of documenting inspections
- Train City staff to use Geographical Information Systems (GIS)



Routine Maintenance Tracking

- Simple MS Access database
- Low cost
- Electronic data
- Future link to GIS

| 🛱 Waterbury Pipe Cleaning Log | |
|---|--|
| Employee: | Waterbury Sewer Service Log |
| Start Time: 11:44 AM End Time: 11:44 AM Duration (min): 0 Location From Subarea: | Underlined fields are required. Service Activity Check all that apply: Jetter Bypass Jetter TV Inspection Bucket Machine Root-cutting Tool Clam Sewer Cleaner Routine Cleaning Freezing Conditions Emergency Cleaning Private Cleaning Contractor Other: Line Condition: Image: Comments Submit Report Close Help Close Help |

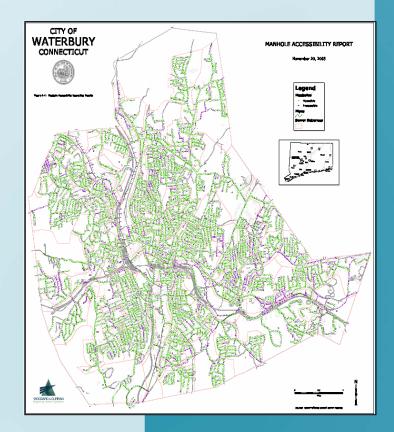
Training City Staff

- Worked with staff in field
- Separate training sessions
- Tools have built in QA/QC
- Simple tools and software



Reporting to Regulatory Agencies

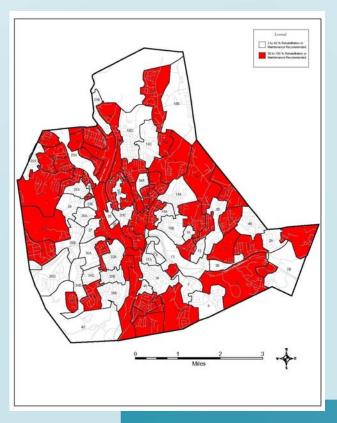
- Graphics and mapping make things clear
- Results easily analyzed
- Complex information now searchable
- Regulators pleased with results



Reporting to Regulatory Agencies

Example:

 Areas with evidence of I/I



Reporting to Regulatory Agencies

Waterbury Sewer Service Log

Example:

 Maintenance activity reports

| water | waterbury Sewer Service Log | | | | | | |
|--------------|-----------------------------|-----------|--------------------------|---------------------------|----------------------|----------------|--|
| Cleaning | Event | Location | I. | Line Condition | Activities Performed | | |
| Date: | 7/8/2002 | From MH : | 15A-2 | Length: 1025ft | Jetter | | |
| Employee: | Darren O/Pe | To MH | 15A-70 | Flush Direction: Upstream | Routine Cleaning | | |
| StartTime: | 8:00:00 AM | From St: | Robin <i>s</i> on Street | Debris: Septic | | | |
| EndTime: | 9:00:00 AM | To St: | Robin <i>s</i> on Street | | | | |
| Duration : | 60 min | Quadrant | Section A | | | | |
| Comments: | | | | | | | |
| Date: | 7/8/2002 | From MH : | 15A-71 | Length: 400 ft | Jetter | | |
| Employee: | Peter V. | To MH | 15A-74 | Flush Direction: Upstream | Routine Cleaning | | |
| StartTime: | 8:00:00 AM | From St: | E Farm St | Debris: Septic | | | |
| EndTime: | 8:33:00 AM | To St: | E Farm St | | | | |
| Duration : | 33 min | Quadrant: | Section A | | | | |
| Comments: | | | | | | | |
| Date: | 7/8/2002 | From MH : | 15A-6 | Length: 375 ft | Jetter | | |
| Employee: | Peter Y. | To MH | 15A-17 | Flush Direction: Upstream | Routine Cleaning | | |
| StartTime: | 8:45:00 AM | From St: | Griggs St | Debris: Septic | | | |
| EndTime: | 9:45:00 AM | To St: | Griggs St | | | | |
| Duration : | 60 min | Quadrant | Section A | | | | |
| Comments: | | | | | | | |
| Date: | 7/8/2002 | From MH : | 15A-4 | Length: 400 ft | Jetter | | |
| Employee: | Peter Y. | To MH | 15A-6 | Flush Direction: Upstream | Routine Cleaning | | |
| StartTime: | 9: 50: 00 AM | From St: | Robinson St. | Debris: Septic | | | |
| EndTime: | 10: 15:00 AM | To St: | Robinson St. | | | | |
| Duration : | 25 min | Quadrants | Section A | | | | |
| Comments: | | | | | | | |
| 11 261 20 05 | | | | | | 2 age 1 of 342 | |
| | | | | | | | |

GIS Applications for Water Utilities

- Inventory & Mapping
- Visualization
 - 3D
 - Schematics
- Network Tracing
- Hydraulic Modeling
- Asset Management



GIS-based Asset Management

- Mapping
 - Spatially accurate representation of network
- Inspections / Conditions
 - Puts data about features in a spatial context
- Service Requests / Work Orders
 - Provides link between feature data and service, maintenance, and cost histories
- Data Collection / Maintenance
 - Integrates addition & update of data into workflow

Mobile GIS



Mobile GIS

- Data Capture
- Data Editing
- Location / Navigation

Data Capture

- GPS
 - "digitize" locations
- ArcPad
 - Edit forms
 - Simple maps
 - Customizable

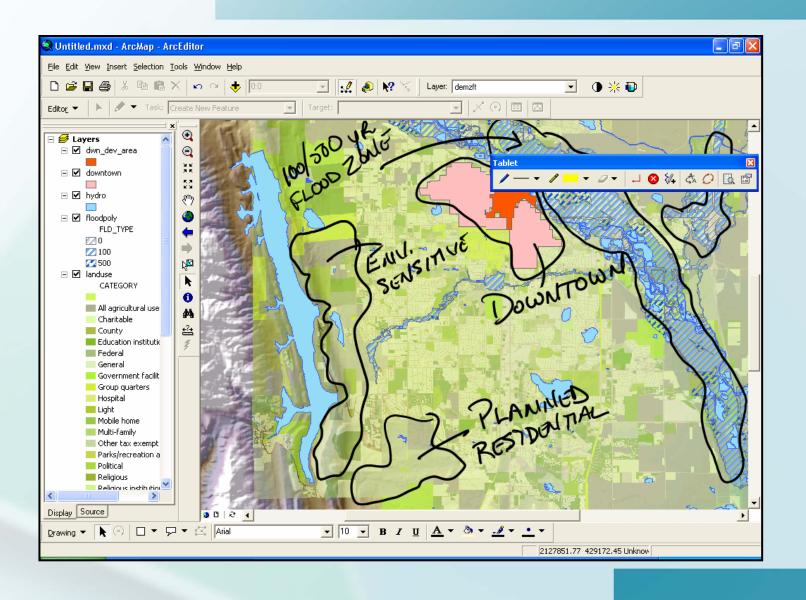
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| Aerial Hand Drawn 💌 |
| Differential Correction |
| N/A |
| Travel Method |
| N/A 💌 |
| Map scale of source |
| 1:24,000 |
| OK Cancel |



Data Editing

- Handheld device
 - iPAQ
 - Ruggedized PDA
 - Simple edits
- PC
 - Laptop
 - Tablet PC
 - Advanced edits
 - "Geographic sketching"

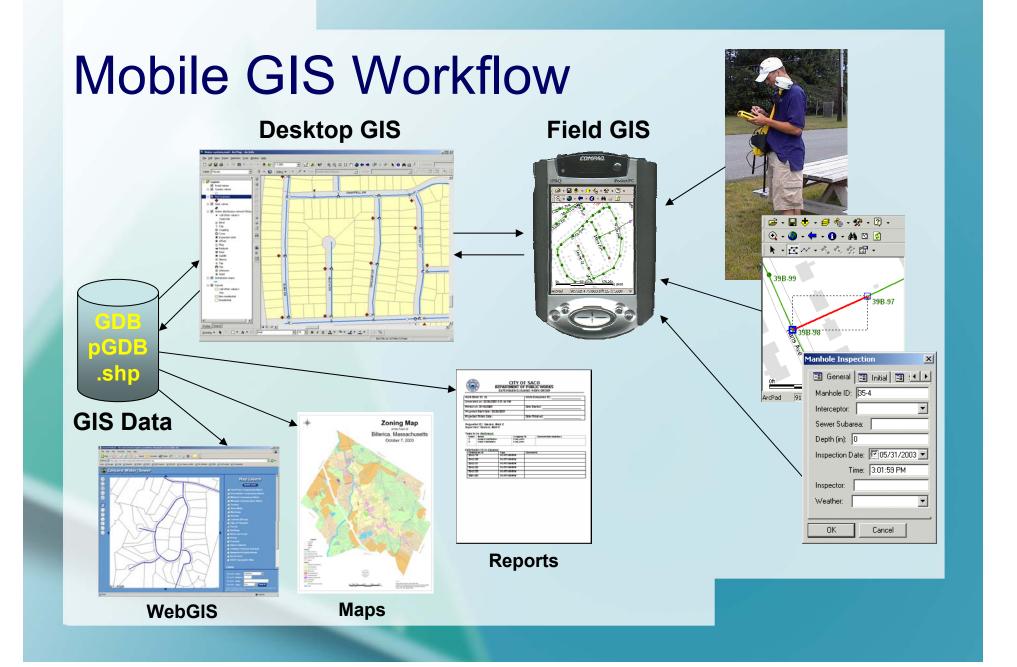




Location / Navigation

- Address lookups
- Routing
- Waypoint navigation
- Distance & bearing



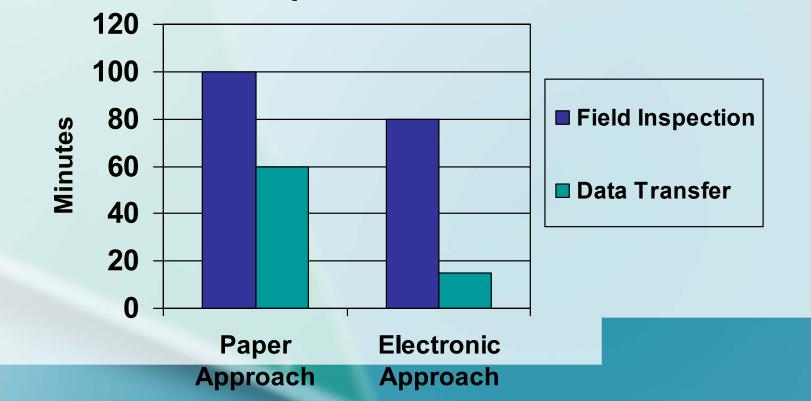


Benefits of Mobile GIS

- Improved Efficiency
 - Decreased hardcopy map production
 - Faster field data integration
- Better accuracy
 - Reduces data entry errors
 - Field workers have more and better data
- Leverages other enterprise GIS components
- Lower data collection and maintenance costs

Asset Management Tools Reduce Strain on City Forces

Water Pollution Control Effort to Inspect 10 Manholes



Managing Project Cost

- Start with "low hanging fruit"
 - What data exists?
 - What data can be easily developed?
- Develop phased plan
 - Build momentum by solving immediate problems



Phasing Implementation Makes Asset Management Affordable

Start with basics

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|--|--------------------|---|
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| System Type: SANITARY SEWER / STORMWATER DRAIN ldentification Number | | |
| proor, gip Identification Number: | (PLAN_MIAN) | Map Number: D-1Z Street Name / Location: PlayIdELecc /L.G.Num |
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| Stape: SQUARE (ROUSE) Diameter of Structure (in inches) | (DEPTH) | Rim to Invert Depth (in feet): 6.0 9 |
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| Cookey Observed Odors: ORE / MUSTV / sewage / EGCS / SOUR / OTHER ctor.cop Observed Color: Orr CLOUD / logaque / SOLIDS / OTHER ctor.cop Observed Statistics: MORE / SEMARSCE / SEWAGE / OTHER ctor.cop Observed Statist: MORE / SEMINENT / oil / OTHER ctor.cop Evidence of Animals Residing? Y conversor Sampled Status: Y Sample Identification Number: Sample Identification Number: | | |
| teologic Observed Color: emr / CLOUDY / opaque / SOLIDS / OTHER (PLOATO) Observed Floatables: NORE / Ø/ GARBAGE / SEWAGE / OTHER (PLOATO) Observed Statis: NORE / Ø/ GARBAGE / SEWAGE / OTHER (DASWLD) Evidence of Animals Residing? Y N/A (circle one) Sampled Statis: Y () (circle one) Sample Identification Number: | | |
| PLOATU Observed Floatables: NONE / DF GARBAGE / SEWAGE / OTHER GTAND, Observed Floatables: NONE / DF GARBAGE / SEWAGE / OTHER NOTMARN, Evidence of Animals Residing? Y N N/A (clircle one) Sampled Status: Y V (clircle one) Sampled Identification Number: | | |
| araan) Observed Stalis: الم 2000 / SEDIMENT / oll / OTHER المعاملية Evidence of Animals Resisting? Y (N) N/A (circle one) Sampled Stamus: Y (V) (circle one) Sampled Identification Nympter: | | |
| ANSWARD, Evidence of Animals Residing? Y (N) N/A (clicle one) (ANSWARD, Sampled Status: Y (S) (clicle one) Sample Identification Number: | | |
| CAMPARY Sampled Status: Y () (circle one) Sample Identification Number | | |
| Sample Identification Number: | | |
| | (XAMPL/0) | |
| | | Sample Identification Numper |

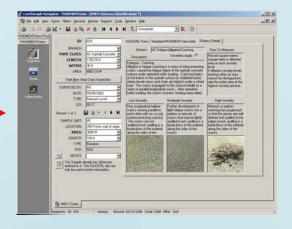
Get more sophisticated

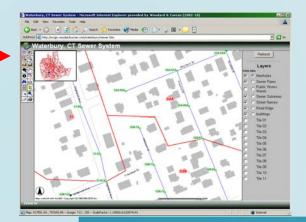




Programs Grow as Funds Allow Implement What You Can Afford

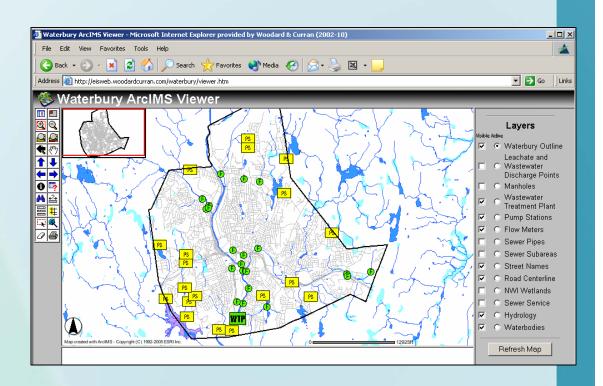
- Higher cost example a "Pavement Management Program"
- Lower cost example
 Waterbury's Manhole
 Inspection Program





Future System Enhancements

- Expand WebGIS
- TV Inspection tracking
- Link maintenance program
- Add other utilities
- Add other layers



Initiating an Asset Management Program Strengthened Waterbury

Waterbury's Collection System Asset Management Program:

- 1. Maintains Compliance
- 2. Reduces strain on Town forces
- 3. Creates defendable planning tools
- 4. Grows as funds allow

Our Program Brought Waterbury Many Benefits

- Explanation of tools and visuals received praise from City
- Many City departments want to implement something similar
- Asset management and GIS are well under way, enthusiastically supported

Thank You

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