STORMWATER
AN INTRODUCTION

Informational Presentation – April 17, 2012

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TOWN OF ARLINGTON MASSACHUSETTS

Presented by

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Presentation Outline

- General understanding of stormwater
  - Definition
  - Hydrologic cycle
  - Point source vs. non-point source discharges
  - Runoff & erosion
  - Stormwater quality & receiving water impacts
  - Management & controls
- Arlington's Illicit Discharge/ Disconnection Program

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What is Stormwater?

- Stormwater is runoff water from rain or melting snow that flows across the landscape. Runoff flows off of rooftops, paved areas, bare soil, and lawns. Runoff gathers in increasingly large amounts (from puddles, to ditches, to streams, to lakes and rivers) until it flows into the ocean.

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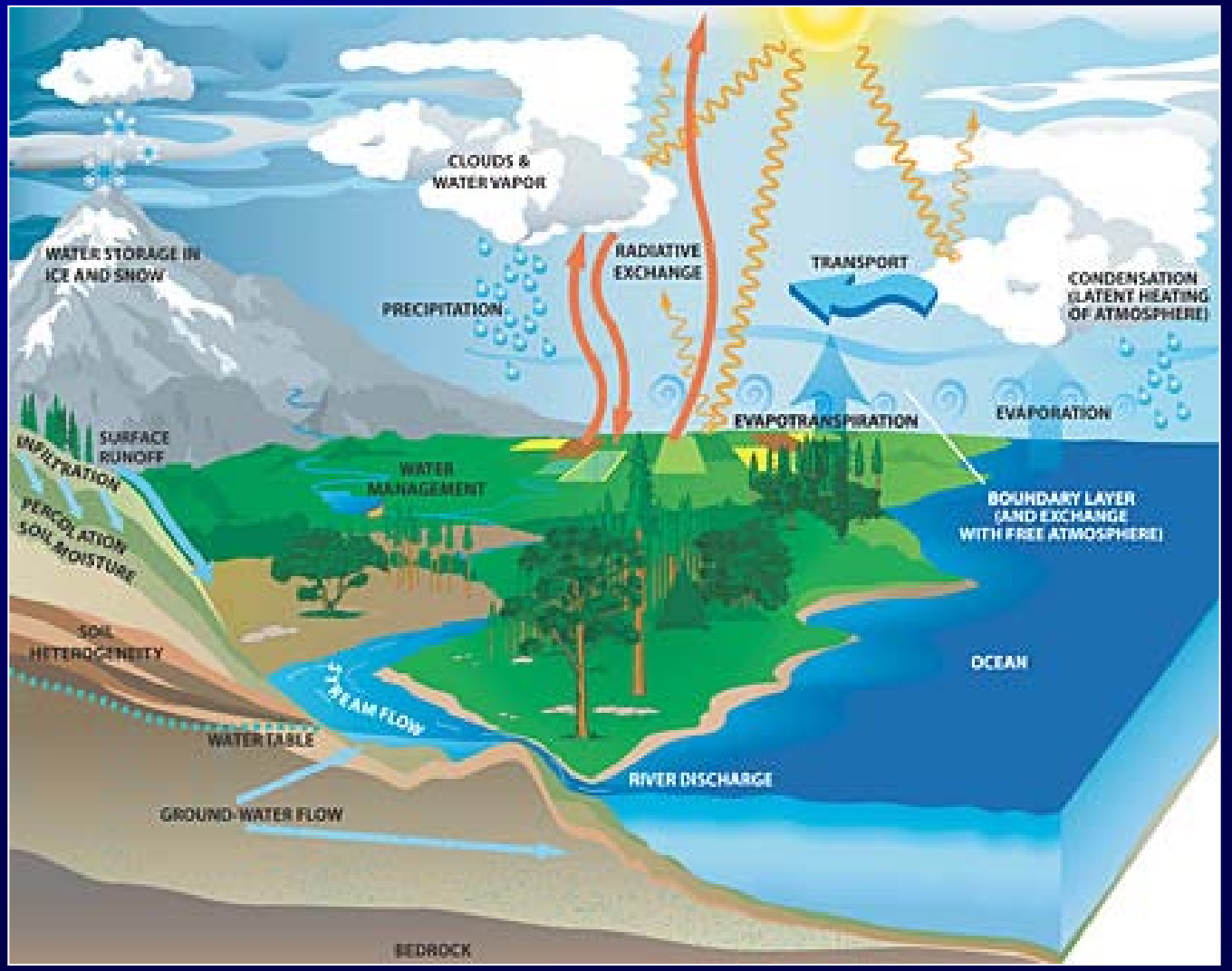
Hydrologic Cycle



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Clean Water Education Partnership

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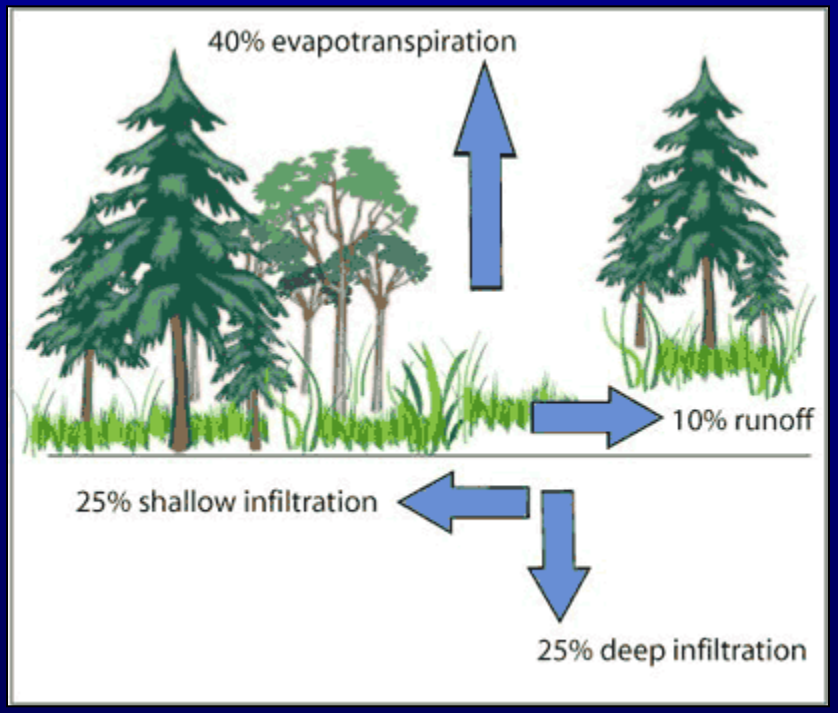
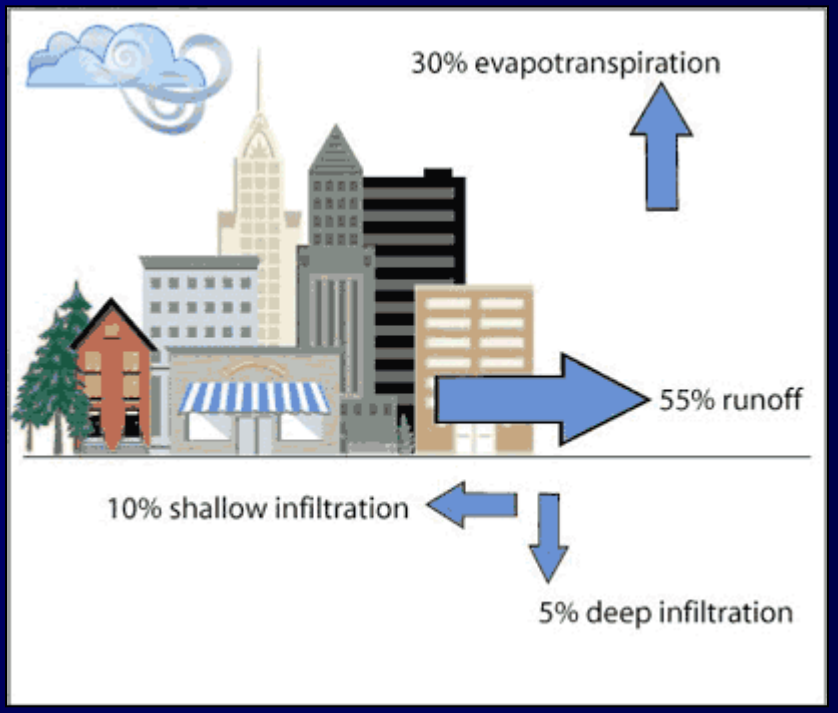
Water Cycles in Undeveloped & Developed Areas

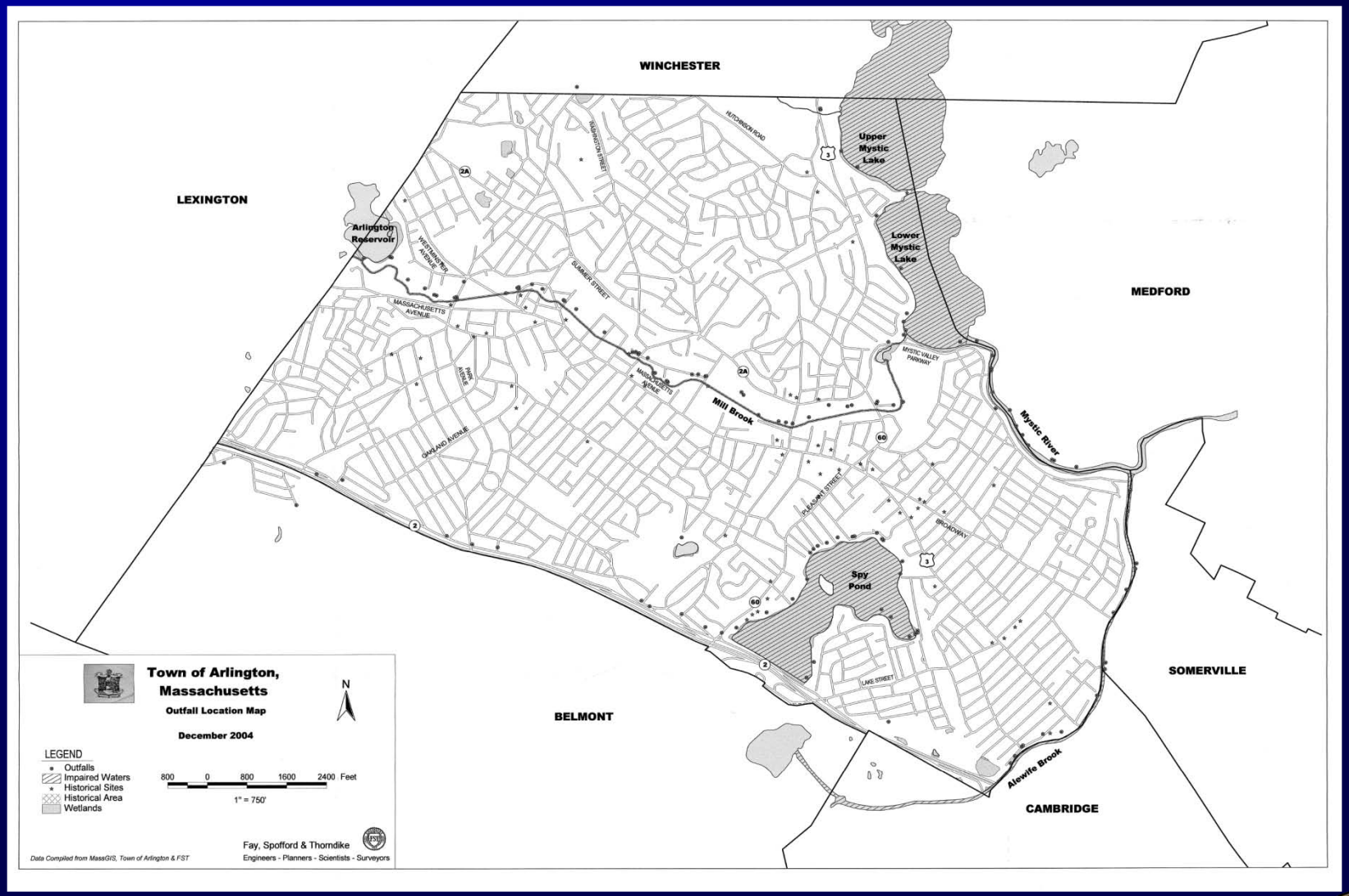


Typical water cycle in an undeveloped area.



Typical water cycle in an urban area.

Arlington Stormwater Outfalls



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Trivia

- What is the annual average precipitation (rainfall and snow) depth for Boston?

Trivia Answer

- 42.5 inches (data from 1971-2000)

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Stormwater Runoff & Imperviousness

- Imperviousness – sum of roads, parking lots, sidewalks, rooftops & other impermeable surfaces of urban landscape
- Represents imprint of land development on landscape

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Trivia Question - What is the percentage of impervious surface in Arlington?

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Trivia Answer - 41.4%

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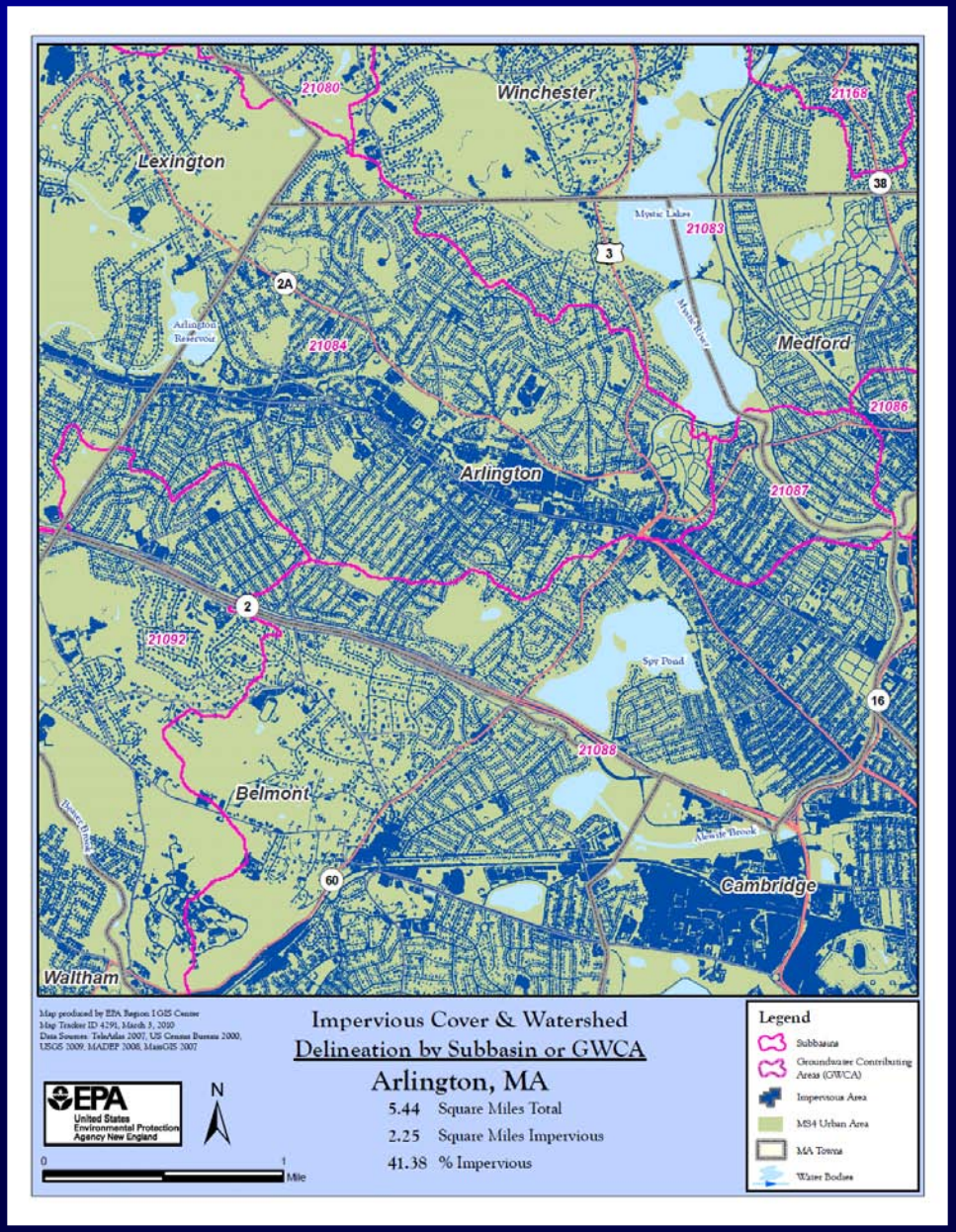
Arlington's Impervious Area



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Impervious Cover Variabilities

- Transport-related imperviousness can comprise 2/3 of total in a community
- Imperviousness can vary from 25% – 60% in single-family home development
- Stream degradation occurs at 10% - 20% impervious levels

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Directly Connected Impervious Areas

- Paved Areas
  - Directly linked to storm drain systems
  - Directly connected impervious areas

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Disconnected Impervious Areas

- Rooftops
  - Disconnected impervious areas
  - Produce ¼ - ½ runoff of directly connected areas

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Disconnected Impervious Areas

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Runoff Coefficients & Impervious Area

- Expresses fraction of rainfall volume converted into stormwater runoff
- Runoff coefficient – Rv
  - Ranges from 0 – 1
  - Parking lot Rv = 0.95
  - Undeveloped meadow = 0.06

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Stormwater Runoff Quantity

- For 1-inch storm, runoff for 1 acre is:
  - 3450 cubic feet (cf) – parking lot
  - 218 cf – meadow
- Degree of imperviousness directly impacts runoff quantity

Other Stormwater Runoff Factors

- Slope - Greater slopes result in more runoff
- Cover - Type and presence of cover impact runoff quantities
- Soil type - More impervious soils have more runoff
- Soil saturation
- Soil frost depth & ice/snow cover

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Soil Slope & Cover

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Soil Slope & Cover

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Soil Frost Depth & Saturation

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Stormwater Impacts on Receiving Waters

- More & frequent floods change streambed cross-sectional area
- Trigger cycle of streambank erosion & habitat degradation
- Streams channelized for flood control
- Reduction in biodiversity and numbers

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Mill Brook

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Stormwater Pollutants

- Organic matter
- Nutrients
- Metals
- Hydrocarbons
- Bacteria
- Suspended Solids

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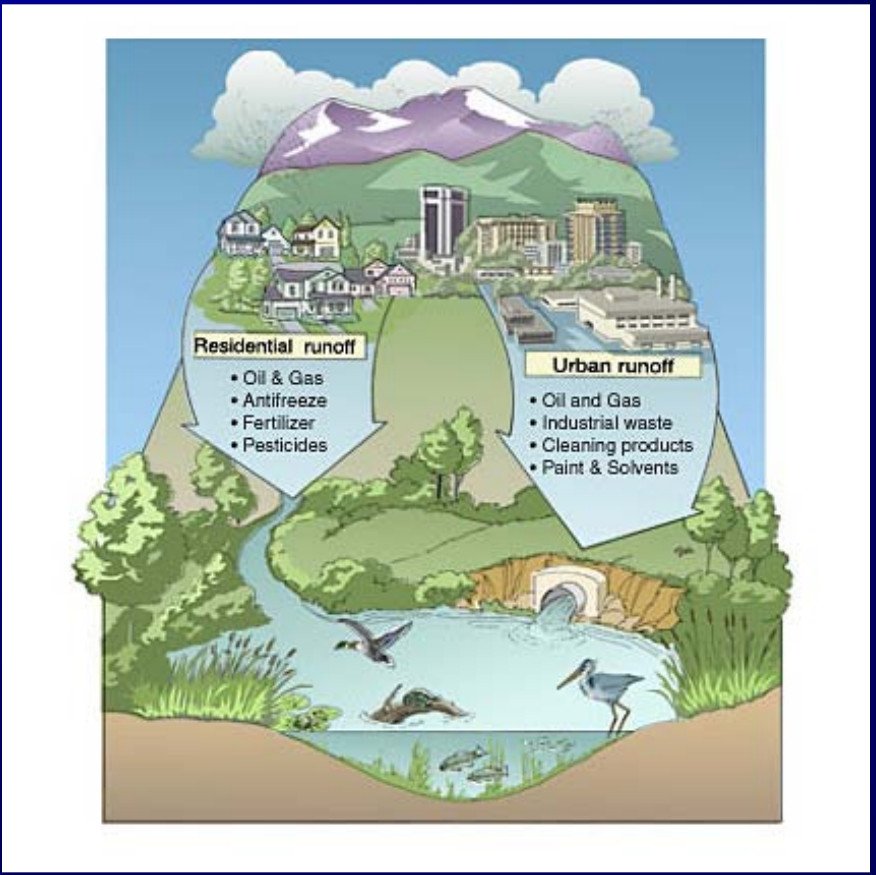
Residential & Urban Stormwater



Runoff picks up pollutants from streets, parking lots, and yards as it travels to streams.

Pollutant Load & Imperviousness

- Pollutant load proportional to watershed imperviousness
- More pollutants from paved areas than rooftops
  - Exception is zinc & copper

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Pervious Areas & Pollutant Load

- 1/3 of pervious areas in urban landscape can be “high input” turf
  - Receives large amounts of irrigation
  - Source of nutrients and pesticides

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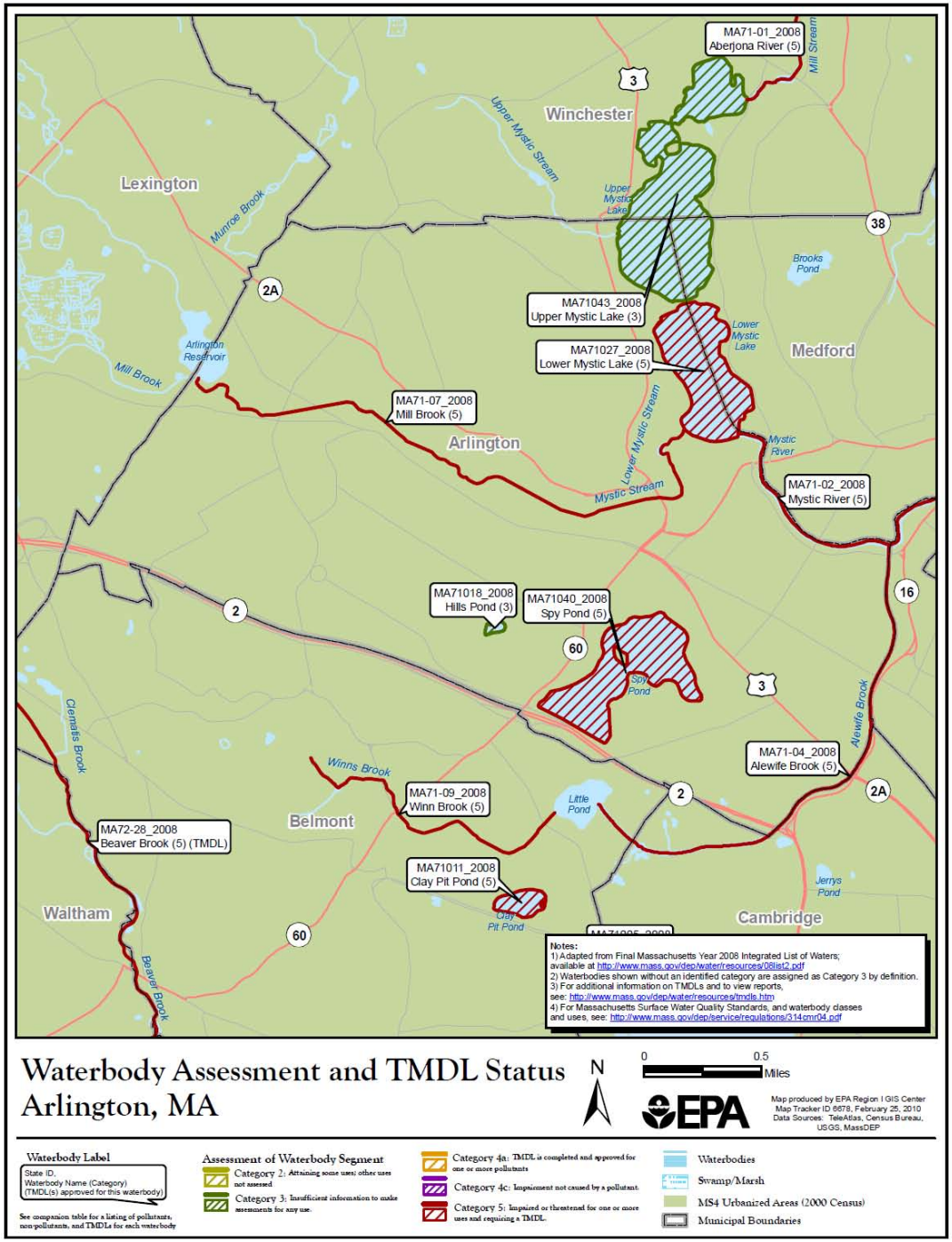

Waterbody Assessment and TMDL Status
Arlington, MA

N

0 0.5 Miles

EPA

Map produced by EPA Region 1 GIS Center
Map Tracker ID 8678, February 25, 2010
Data Sources: TeleAtlas, Census Bureau, USGS, MassDEP

Waterbody Label

State ID,
Waterbody Name (Category)
(TMDL(s) approved for this waterbody)

See companion table for a listing of pollutants, non-pollutants, and TMDLs for each waterbody

Assessment of Waterbody Segment

- Category 2: Attaining some uses; other uses not assessed
- Category 3: Insufficient information to make assessments for any use.
- Category 4a: TMDL is completed and approved for one or more pollutants
- Category 4c: Impairment not caused by a pollutant.
- Category 5: Impaired or threatened for one or more uses and requiring a TMDL.

- Waterbodies
- Swamp/Marsh
- MS4 Urbanized Areas (2000 Census)
- Municipal Boundaries

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Surface Water Quality & TMDL Studies

TMDL = Total Maximum Daily Load

Calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards.

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Stormwater Management/Control

- Low impact development
- Pervious pavement
- Reduced use of fertilizers & pesticides
- Green roofs
- Rain gardens
- Rain barrels
- Detention ponds
- Wetlands
- Pet waste cleanup
- Street sweeping
- Catch basin cleaning
- Drainage system modifications
- Dam flood control

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Low Impact Development

Photo by Abby Jordan

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Pervious Pavement

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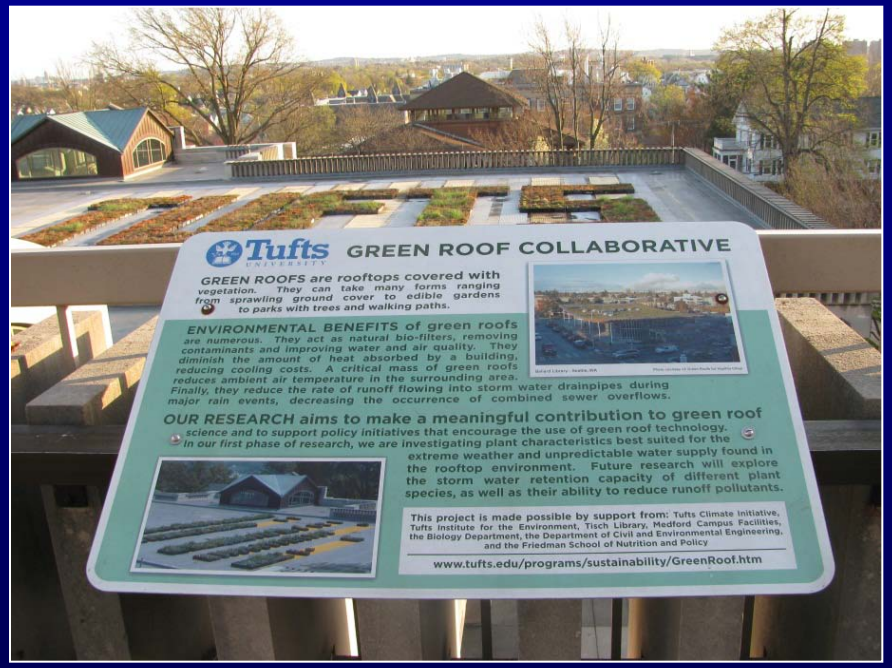
Green Roofs



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Rain Gardens

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Wetlands

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Catch Basin Cleaning

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Drainage System Modifications

Photo courtesy of Terrafix® Geosynthetics, Inc.

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Dam Flood Control

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Illicit Discharge Detection and Elimination (IDDE) Program

- Surface water quality improvements achieved with combined sewer overflow reductions
- Contamination still found at storm drain outfalls
  - Cross-connections between sewers and drains suspected

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Arlington Stormwater Outfalls

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IDDE Program Chronology

- 1999 - Arlington began outfall & storm drain investigations & sampling
- 2004 - NPDES Phase II Permit prohibits illicit discharges to storm drains
  - Town must determine non-stormwater impact and control pollutants

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IDDE Program – Outfall Investigations

- Conduct outfall sampling
  - Originally dry-weather sampling
  - Now also wet-weather sampling
- Identify outfalls with high contamination

Monitoring Parameters

- General Parameters
  - Conductivity
  - E. coli
  - Chlorine
  - Potassium
  - Ammonia
  - pH
  - Surfactants (as MBAS)
  - Temperature
  - Turbidity

IDDE Program – Storm Drain Investigation

- Dry weather sampling of storm drains upstream of outfalls
- Start at first upstream manhole from outfall & continue upstream
- May also start at most upstream manhole & continue downstream towards outfall

Arlington Storm Drain System

- Some parts over 100 years old
- Discharges stormwater to surface waters in Arlington
- Little or no treatment prior to discharge

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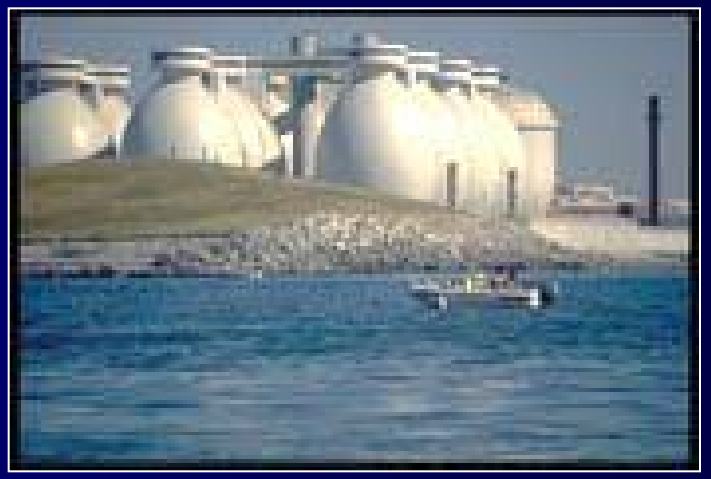
Arlington Sewer System

- Some parts over 100 years old
- Discharges to MWRA interceptors
- Wastewater treated at Deer Island Treatment Plant



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Storm Drain Sampling Follow-up

- Televise sewer & drain lines
- Perform dye testing
- Perform smoke testing

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Storm Drain Televising

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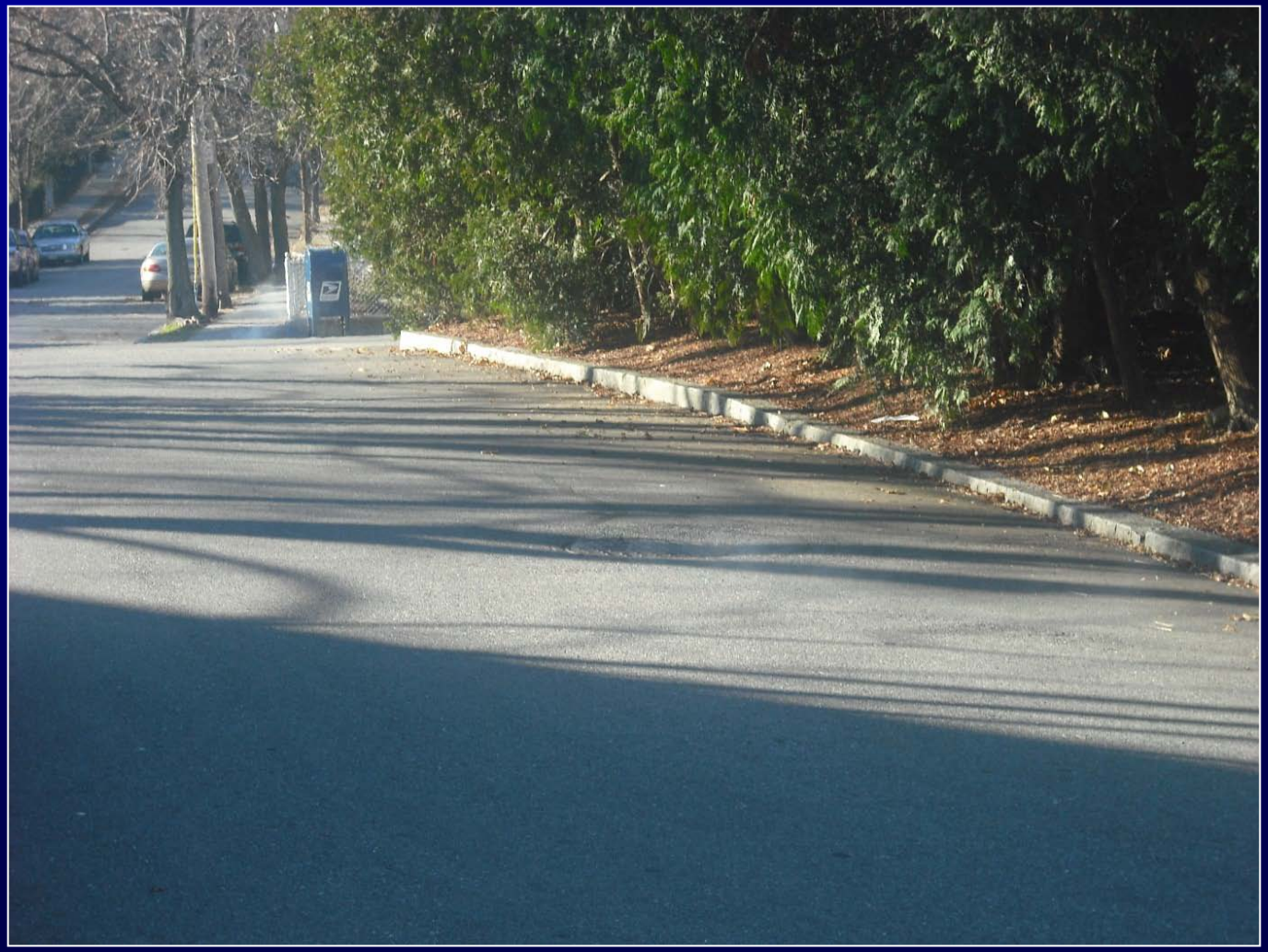
Smoke Testing



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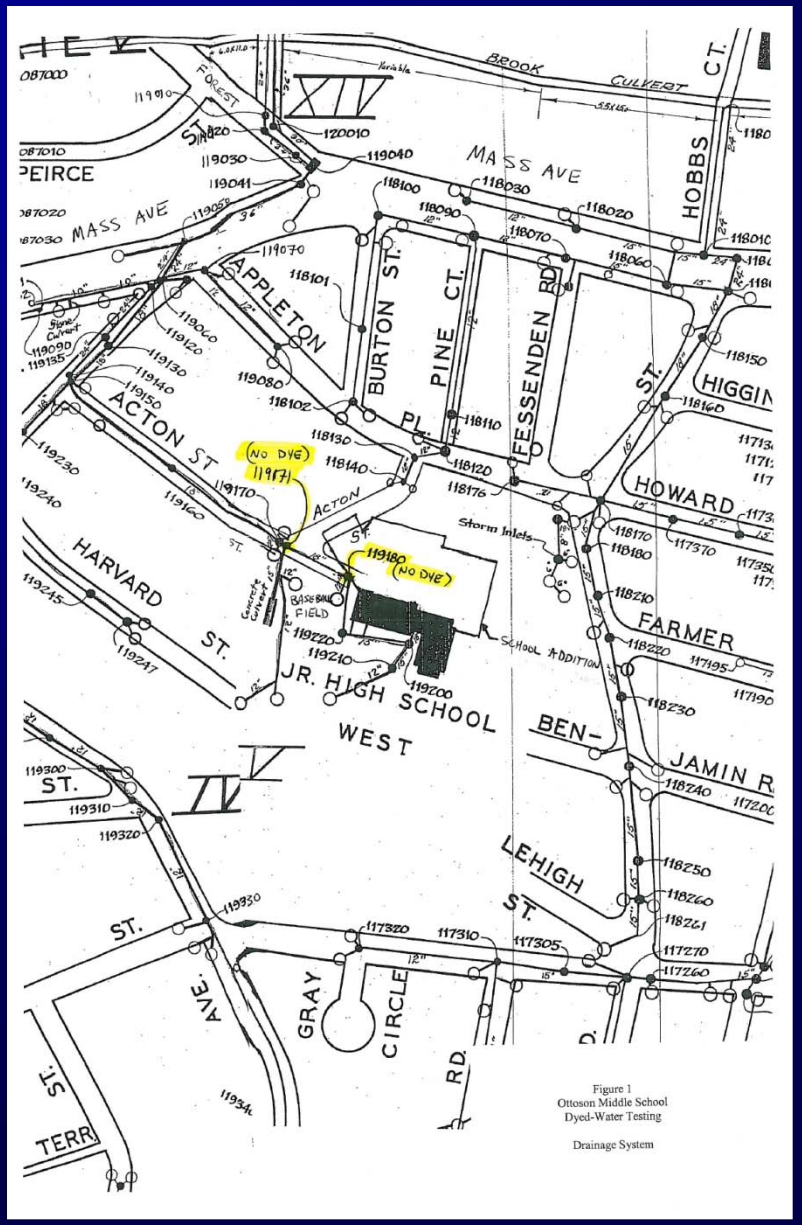
Dye Testing – Storm Drains



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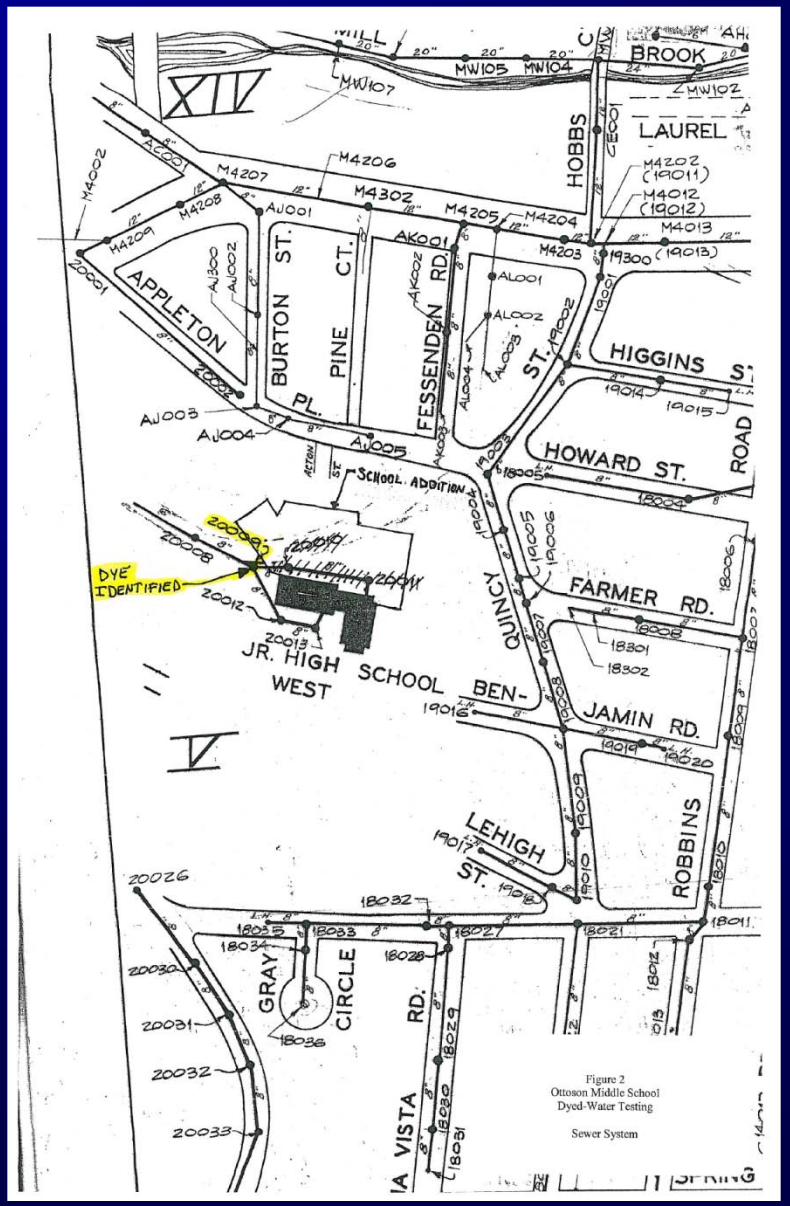
Dye Testing - Sewers



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Pipeline Investigation Results

- Arlington's sewer & drain system needs repair!
- Investigations revealed:
  - Cracks, sags or holes in pipelines
  - Roots in pipelines
  - Improper service connections to sewer

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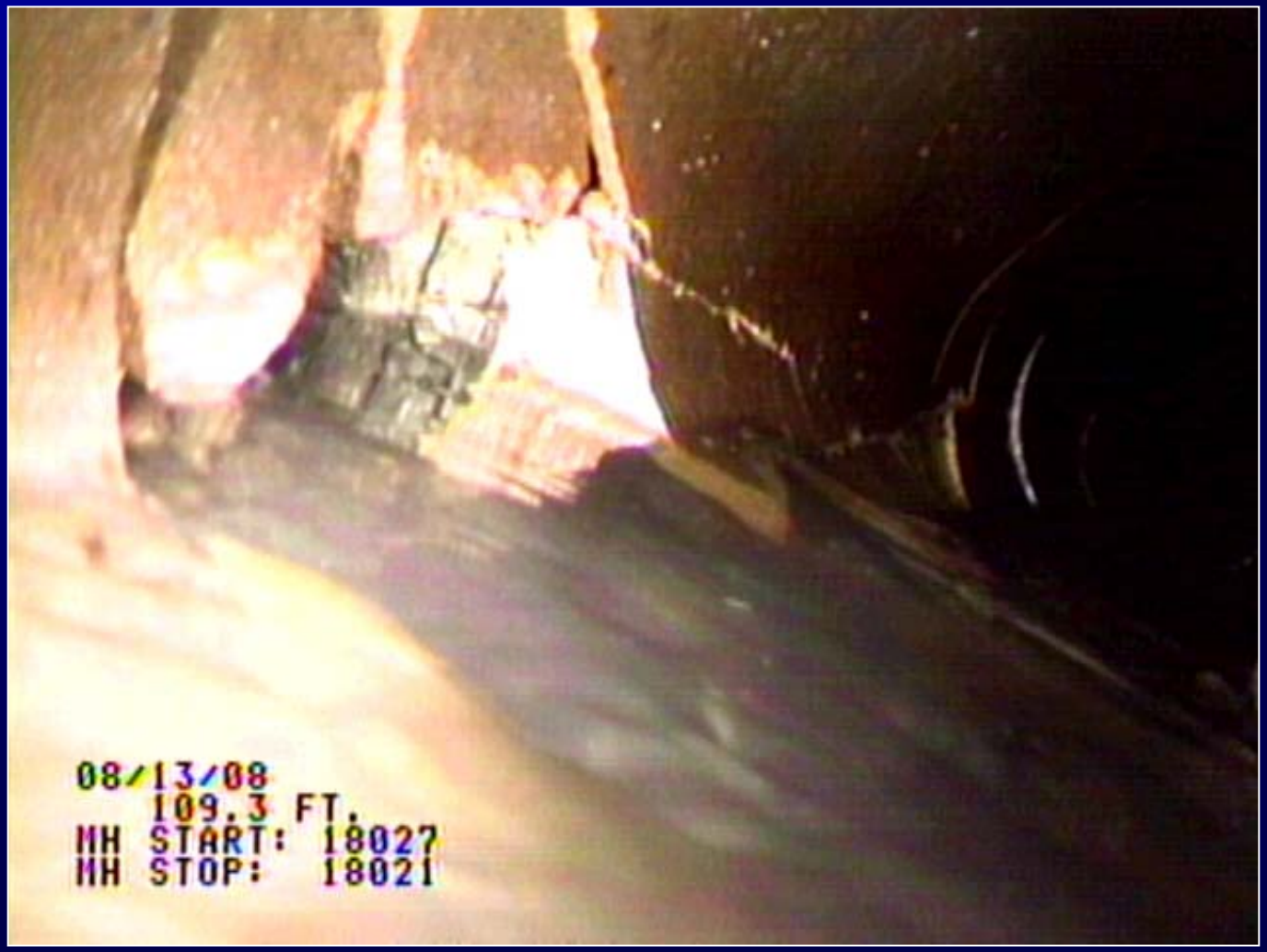
Cracks in Sewer



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Roots in Sewer

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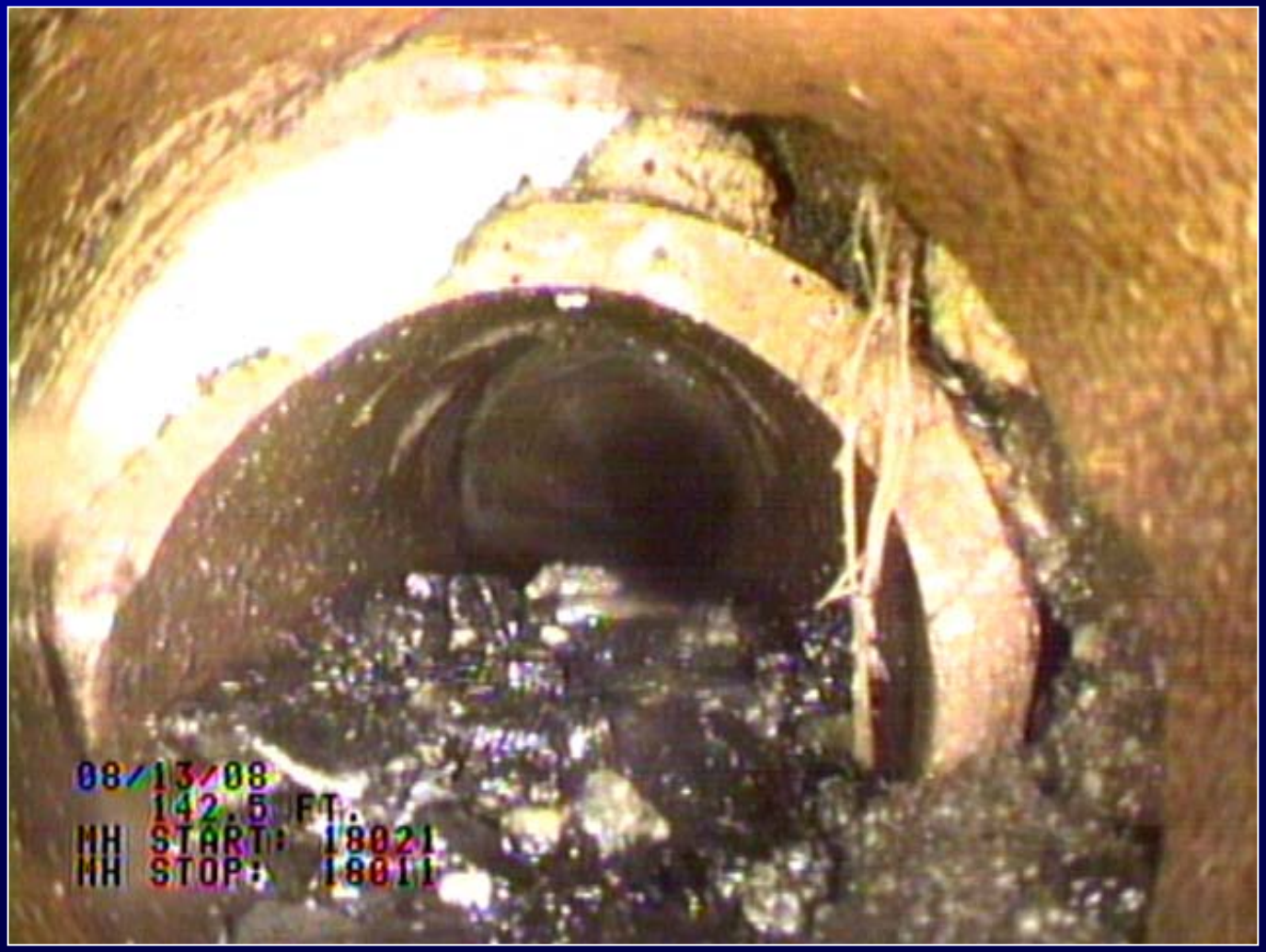
Defective Sewer Service Connection



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Sewer/Drain Rehabilitation Design

- Re-line cracked pipe
- Repair sewer service connection
- Seal pipeline joints
- Replace pipeline section – point repair
- Replace pipeline manhole-to-manhole

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Sewer Service Connection Repair

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Pipeline Point Repair

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Pipeline Lining

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Areas Rehabilitated

- Cross St. & Waldo Rd.
  - Alewife Brook outfall
- Hemlock St., Lansdowne Rd. & Pine St.
  - Mill Brook outfall near Grove St.
- Mystic Bank Area
  - Mill Brook outfall at Mystic Bank

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Areas Rehabilitated

- Robbins Rd., Gray St. & Old Colony La.
  - Mill Brook outfall near Old Colony La.
- Forest St., Overlook Rd. & Washington St.
  - Mill Brook outfall (north side) at skating rink

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Questions?

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