Trumbull Street Sewer Separation
New Haven, Connecticut

Presented by:

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Project Background

Yale Campus/Trumbull Street Area Sewer Separation Phase 1A
Project Background

- Greater New Haven Water Pollution Control Authority (GNHWPCA)
- 60” brick combined sewer built 1860’s
- Brick sewer in excellent condition but can’t accommodate modern combined flows during heavy rain
- Install new 36” sanitary and 72” stormwater
- Approximately 1800’ alignment, the most complex and final segment of larger project
- High visibility street with large “legacy” trees
- Design 2010, Construction 2012 – 2013
- Won the 2013 Water Resource/Environmental ACE Award and the 2013 Construction ACE Award of Merit by The Connecticut Society of Civil Engineers.
Remember this tree

Google Streetview (October 2016)
Tree Inventory

- General tree data collected (species, DBH, etc.)
- Trees assessed for health and condition
- Trees were given “Priority” rating (1-4)
- Used to inform the design
Tree Inventory

**Priority 1:** good condition, specimen trees, unique value
   - highest priority for preservation.

**Priority 2:** good to “high fair” condition, not unique or specimen
   - priority for preservation where feasible.

**Priority 3:** fair condition, and/or undesirable for some reason.
   - only retain if no conflict with construction or future use

**Priority 4:** poor to critical condition, and/or highly undesirable
   - inappropriate for preservation – should be removed.
## Tree Inventory Summary

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Decline/Dead</th>
<th>Fair</th>
<th>Good</th>
<th>Poor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Callery Pear</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Dead</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Dogwood</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>American Elm</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>English Elm</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Honey Locust</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Japanese Maple</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Magnolia</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mimosa</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Norway Maple</td>
<td>4</td>
<td>2</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Ornamental Cherry</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Pin Oak</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Scarlet Oak</td>
<td>15</td>
<td>13</td>
<td></td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>Sycamore</td>
<td>26</td>
<td>3</td>
<td>2</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>Weeping Cherry</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Zelkova</td>
<td>3</td>
<td>5</td>
<td></td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>9</strong></td>
<td><strong>55</strong></td>
<td><strong>34</strong></td>
<td><strong>5</strong></td>
<td><strong>103</strong></td>
</tr>
</tbody>
</table>
Why Priority Ratings?
Tree #35

- 24” DBH Elm
- Fair- Poor condition
- Priority 3
- GPR revealed absence of roots in areas of previous street excavation
Tree #1110

- 60” DBH Sycamore
- Largest on the street
- Appraised value $47k
Do roots grow into the street?

Yes they do.
In the street?

If so, where?
Ugly Baby
“Ugly Baby” Protects Trumbull’s Historic Trees

by ALLAN APPEL
May 28, 2010 10:27 am
## Summer of GPR Data

The results can be summarized as follows:

<table>
<thead>
<tr>
<th>Site ID</th>
<th>L1 (0-8&quot;)</th>
<th>L2 (8-16&quot;)</th>
<th>L3 (&gt;16&quot;)</th>
<th>Total</th>
<th>Depth Range where roots found (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elm #35</td>
<td>0.27</td>
<td>2.04</td>
<td>0.26</td>
<td>2.57</td>
<td>3 - 20</td>
</tr>
<tr>
<td>Honey Locust #600</td>
<td>0.51</td>
<td>1.73</td>
<td>0.26</td>
<td>2.50</td>
<td>3 - 19</td>
</tr>
<tr>
<td>Sycamore #9</td>
<td>0.09</td>
<td>1.54</td>
<td>0.34</td>
<td>1.97</td>
<td>6 - 20</td>
</tr>
<tr>
<td>Sycamore #30</td>
<td>0.19</td>
<td>1.70</td>
<td>0.37</td>
<td>2.26</td>
<td>4 - 20</td>
</tr>
<tr>
<td>Sycamore #1110</td>
<td>0.26</td>
<td>1.91</td>
<td>0.88</td>
<td>3.06</td>
<td>4 - 23</td>
</tr>
</tbody>
</table>
Sycamore #1110 Trumbull Street

“B” Line Scans – Total Depth Range

Red 0-8” depth
Green 8-16” depth
Blue 16-32” depth
Sycamore #1110 Trumbull Street

“B” Line Scans – Root Density

(all detected roots projected to surface)

Note: not to scale
GPR Scans
GPR Scans
The Solution:

Jacking the pipe
Jacking

• Reaction walls of steel piles and concrete built in the pits
• Four, 200-ton hydraulic jacks push pipe through the soil.
• Pipe is protected by a steel ring-shaped shield.
• Workers enter the pipe to hand-shovel soil into a wheeled cart
• Cart is pulled by cable back out of the pipe into the pit.
• A backhoe or crane then raises the cart to street level for disposal of the spoil.
Trumbull Street at Jacking Pit
Trumbull Street at Jacking Pit
72” stormwater pipe
36” sanitary pipe
Piles for pits & reaction walls

Overhead clearance was also an issue in places
Steel shield to protect pipe
• The existing brick sewer will remain in place

• Only used for sanitary sewage after the project was done

• New custom manholes were added over the brick sewer
Initial Design

Bore Pit centered over tree #22 (oak) and within CRZ of tree #1110
Final Design

Bore Pit moved to avoid tree #22
• Most side street trees were much smaller.

• Traditional open trenching was not a problem.
Laterals

- How to connect the buildings to the new lines?
- Many laterals went through CRZs
- Many very close to trees (SRZ impacts)
- Sanitary
- Stormwater
- Countless other utilities to work around or relocate
Laterals

Tree #34
36” Sycamore
54’ radius CRZ
10’ radius SRZ
Fair condition

CONNECT EXISTING SANITARY SEWER LATERAL TO PROPOSED 36” RCP SANITARY SEWER WITH 6” PVC. WHERE SANITARY LATERAL IS WITHIN 5’ OF UTILITY POLE THE LATERAL CONNECTION SHALL BE MADE WITH 6” DIP ENCASED IN CONCRETE (TYP). SEE NOTES.

RELOCATE EXISTING GAS MAIN (TYP) (BY OTHERS)

36” RCP CL V (JACKING) PIPE SANITARY SEWER

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36” RCP CL V (JACKING) PIPE SANITARY SEWER
How do you convey your intent to the contractor?

- Plans
- Details
- Specifications

** AIR TOOL ROOT PRUNING DOES NOT INDICATE ALL ROOTS IN THESE AREAS WILL BE CUT. CONTRACT ARBORIST TO DETERMINE IF LOCATED ROOTS CAN BE CUT OR MUST BE PROTECTED IN PLACE. IF ROOTS ARE TO BE PROTECTED, HAND EXCAVATION METHODS MUST BE USED. IF ALL ROOTS ARE PRUNED, CONVENTIONAL EXCAVATION METHODS MAY BE USED (SEE SPECIFICATIONS)
Lateral excavation within +/- 6' of tree #34
STAGING AREA MATERIAL AS DETERMINED BY PROJECT ARBORIST

ROOT PROTECTION MATTING (SEE DETAILS)

EXCAVATE WITH SSAT TO EXPOSE ROOTS. SMALL ROOTS SHALL BE HAND PRUNED BY ARBORIST AS NEEDED FOR UTILITY INSTALLATION.

SIGNIFICANT ROOTS SHALL BE PROTECTED AND REMAIN UNDISTURBED. ARBORIST MAY WRAP WITH PROTECTIVE MATERIAL/MATTING TO MINIMIZE DAMAGE.

EXISTING GRADE

EXISTING ROOTS TO BE PROTECTED

BACKFILL WITH CLEAN TOPSOIL AND COMPACT TO APPROX 80% AROUND ROOTS. ENSURE THAT NO AIR SPACE REMAINS AROUND ROOTS. PROTECTIVE WRAP TO BE REMOVED BEFORE BACKFILL.

UTILITY CONDUIT TO BE INSTALLED UNDER ROOTS. BACKFILL PER CIVIL PLANS.
SSAT used for Laterals
• Excavation done by SSAT and/or by hand

• Arborist supervision

• Larger roots protected

• Machines stay on existing hardscape