

NEW BRITAIN – HARTFORD BUSWAY

CITY OF HARTFORD, TOWN OF WEST HARTFORD, CT

100% DRAINAGE DESIGN SUBMISSION

**NOVEMBER 2008
REVISED MARCH 2009
REVISED AUGUST 2009
REVISED OCTOBER 2009
REVISED DECEMBER 2009
REVISED MAY 2010
REVISED JUNE 2010**

State Project Nos. 155-H025

Connecticut Department of Transportation

**URS CORPORATION AES
500 Enterprise Drive
Rocky Hill, CT 06067**

**VN ENGINEERS, Inc.
90 High Street
Westerly, RI 02891
401-596-3726**

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CONNECTICUT DEPARTMENT OF TRANSPORTATION

PREPARED BY

**VN ENGINEERS, Inc.
90 High Street
Westerly, Rhode Island 02891
401-596-3726**

for

**URS CORPORATION AES
500 Enterprise Drive
Rocky Hill, CT 06067**

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100% DRAINAGE DESIGN

A. Project Description

This project consists of a portion of the New Britain – Hartford Busway located in the towns of Hartford and West Hartford (Sta. 332+00 to Sta. 450+00). The busway will be a dedicated Bus Rapid Transit (BRT) facility along a 9.4-mile corridor between downtown New Britain and downtown Hartford. The corridor for the busway follows an abandoned railroad right-of-way from New Britain to Newington Junction and lies mainly within the Amtrak right-of-way, essentially parallel to the active rail line, north of Newington Junction. The busway will be two lanes wide (one in each direction).

There are three (3) bus stations within the project limits, Flatbush Avenue Station, Kane Brook Station, and Park Street Station, with several bridge structures and retaining walls located along the corridor.

B. Purpose of Report

The Purpose of this report is to: 1) provide documentation relating to the analysis of the adequacy and use of existing drainage structures, 2) documentation of gutter flow analysis and storm sewer design of new drainage facilities and existing drainage facilities to convey a 10-year storm event.

C. Design Criteria

The design criteria used in all drainage evaluations was extracted from the Connecticut Department of Transportation (CDOT) *Drainage Manual*, January, 2000, as revised, unless otherwise noted. The Federal Highway Administration *Hydraulics Design Series* and *Highway Engineering Circulars*, were used as directed by the *Drainage Manual*.

The roadway drainage was designed and analyzed for a 10-year storm event. Maximum spacing of catch basins, minimum pipe size, and minimum pipe slope conform to the *Drainage Manual*. The design allows for flooding of the shoulder and half a travel lane.

Hydraflow Storm Sewers, 2005 software, version 11.0.0.9 was utilized to conduct the drainage calculations in this report.

D. Proposed Drainage Systems

There are 7 proposed drainage systems identified in this report.

SYSTEM NO. 1 - STA. 332+00 TO STA. 343+50

Sta. 332+00 - The proposed busway drainage system is proposed to tie into the adjacent busway project to the south; SPN. 93-H046, and discharge at Trout Brook. System 1 within the project limits is approximately 1.40 acres in size and consists of four (4) catch basins. The HGL of 65.93' from the adjacent project (SPN. 93-H046) was used as the system start HGL elevation.

SYSTEM NO. 2 - STA. 343+50 TO STA. 352+00

Sta. 351+98 – The proposed mainline busway drainage system is designed to tie into the abutting project, SPN. 63-643 at Sta. 351+98 at Flatbush Avenue and ultimately discharge into the Park River at an existing 30" discharge point located within an existing retaining wall on the west side of Park River. The busway runoff portion is approximately 0.53 acres and is comprised of 6 inlet structures. (See the Drainage Report for SPN. 63-643 for additional drainage details for the Flatbush Ave. project)

SYSTEM NO. 3 - STA 352+00 to STA. 384+50

Sta. 384+50 - The proposed busway drainage system is designed to discharge at Kane Brook, which is identified as Hydraulic Site No. 7 in a Hydraulic report

prepared by Baker Engineering, dated June 20, 2001. As a worst case, the 500 year with 100 year stormwater event HGL is 45.61' and was used as the system start HGL elevation. System 3 is approximately 6.54 acres in size comprised of runoff from the busway pavement. There are 15 catch basins in System No. 3.

SYSTEM NO. 4 - STA. 384+50 TO STA. 404+00

Sta. 385+00 - The proposed busway drainage system is designed to discharge at Kane Brook too. System 4 is approximately 1.70 acres in size comprised of runoff from the busway pavement and bus station. There are eleven (11) catch basin structures in System No. 4. The 500 year with 100 year stormwater event HGL is 45.61' and was used as the system start HGL elevation.

SYSTEM NO. 5 - STA. 404+00 TO 418+00

Sta. 412+75 - The proposed busway drainage system is designed to tie into a proposed underground detention piping system located within the Park Street bus station parking. The underground detention system will discharge into an existing 30" R.C.P. drainage line located on Francis Street. The existing 66" RCP stormwater system discharges into the Park River Conduit located to the east of the busway corridor; east of the I-84 corridor, off of Park Street. The existing system was analyzed to ascertain the capacity of the existing system to accommodate the additional drainage. See the Existing Conditions Report for information on the Park River Conduit.

The proposed underground detention system will utilize an array of 8, 48" HDPE pipes 175' in length to detain the stormwater before discharge into the aforementioned 30" pipe on Francis Ave. The stormwater flow from the busway drainage systems will be detained in the pipe network with (2) 4" orifices, a 48" pipe has been provided as a overflow in the event of a heavy rainfall event. This overflow pipe has been set at an elevation to allow the pipe network to only be $\frac{3}{4}$ full.

System 5 is approximately 1.30 acres comprised of busway pavement. There are nine (9) catch basins in System No. 5. The proposed underground stormwater detention system design is contained in Appendix F of this report.

SYSTEM NO. 6 - STA. 418+00 TO 439+25

Sta. 431+80 - The proposed busway drainage system is designed to tie into an existing 66" R.C.P. on Park Avenue and thus be conveyed to the Park River Conduit to the east of the project. System 6 is approximately 2.16 acres comprised of busway runoff and a channel on the west side of the busway. There are eleven (11) catch basins in System No. 6. The system is proposed to tie into the existing 66" RCP stormwater system on Park Street.

SYSTEM NO. 7 - STA. 439+25 TO 450+00

Sta. 450+00 - The proposed busway drainage system is designed to discharge onto the adjacent project to the north. There is a lowpoint at Sta. 446+81. The adjacent project to the north discharges onto this project. The drainage from System 7 is proposed to be tied into the busway contract to the north. System 7 is approximately 2.90 acres in size comprised of busway drainage and a ditch located at the west of the busway from Sta. 715+00 to 719+00. There are eleven (11) catch basins in System No. 7. The HGL of 46.28' from the adjacent project (SPN. 63-H137 June 2009 Drainage Report) was used as the system start HGL elevation.

E. Temporary Drainage

The majority of stormwater drainage system installation is offline; within the busway corridor. Therefore temporary drainage is not required.

F. Drainage Condition Survey

An existing drainage survey field review was conducted on August 28, 2008 and on September 3, 2008 and documented in a Drainage Condition Field Review memo attached to this document.

G. Grass Channel

A grass channel is proposed to be constructed between the northbound and southbound lanes from Sta. 434+25 to 442+50. This channel will be constructed with a 6:1 cross sloped. The channel will not collect any roadway stormwater and has been designed with no catch basin to allow the pervious grass surface to percolate the stormwater naturally.

APPENDIX A
DESIGN CHECKLIST
&
RESPONSE TO COMMENTS

Project No 155 - H025
 Roadway NEW BRITAIN - HARTFORD BUSWAY
 Town HARTFORD, WEST HARTFORD
 Date 08/21/09 REVISED 10/05/09
 Designed By JOSEPH BAMBARA
 Signature of Engineer [Signature]

Final Design Checklist (Plans 85% to 90% Complete)
 Allow a 4-5 week review time

The Final Design Submission should include the following

- a Disposition of Semi Final Design comments with written responses justifying comments not incorporated
 Included Not Included Not Applicable
- b Final Drainage Report and Final Plans
 Included Not Included Not Applicable
- c Final scour report
 Included Not Included Not Applicable
- d Final floodway analysis report
 Included Not Included Not Applicable
- e Final SCEL report
 Included Not Included Not Applicable
- f Final hydraulic design report
 Included Not Included Not Applicable

Provide justification for items **Not Included**. Justification should correspond to the designated letter



Busway Mainline Contract: 155-H025

DESIGN REVIEW RECORD

DOCUMENT BEING REVIEWED:		Final Plans For Review Comments	<p>REVIEWED BY: James A. Fallon Division Chief, Office of Quality Assurance, Bureau of Engineering and Construction</p> <p>REVIEW DATE: 1-20-2010</p> <p>Responses prepared by: Checked by:</p>
ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
1		The Design Report only vaguely mentions access, staging and storage under Section 15.0 Maintenance and Protection of Traffic (M&PT). There needs to be more information and direction. Access points should be shown definitively on the plans.	See URS Response to Comments.
2		<p>More details, Special Provisions and/or standard sheets are needed for various items, as well as consistency with pay item names and inclusion of items to pay for the work shown. Some examples:</p> <ul style="list-style-type: none"> Remove Conc. Wall – item = Removal of Existing Masonry which is not on the (roadway) estimate Sub-Drain – item = 6" (or whatever size you call out) Underdrain which is not on the estimate Primary Waste Stockpile Area – item = Construct, Maintain and Remove Waste Stockpile Area which is not included 	See URS Response to Comments.
3		Some of the beginning and ending stations of retaining walls labeled on the highway plan sheets differ from the stations given on the structural plan sheets.	See URS Response to Comments.
4		In places the roadway is being built over wetlands. Will there be any removal of unsuitable material? There was no item in the estimate for this.	See URS Response to Comments.
5		One would suspect there will be Areas of Environmental Concern, contaminated soil removal, handling, disposal, etc. but these things were not shown on the plans, listed on the estimate of specified. When these items are available for review, we would like to see them.	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
6		There should be an item for Test Pits in the contract.	See URS Response to Comments.
		HIGHWAY PLANS (Volume 1)	
1		TYP-05: There should be some delineation between the EPS embankment fill and the proposed fill under the roadway (Geofoam or Lightweight Fill).	See URS Response to Comments.
2		TYP-05: There are no dimensions given for the Geofoam blocks. Is it shown anywhere else in the plans or do bidders need to track it down elsewhere?	See URS Response to Comments.
3		MDS-03: References to Sheets S-3 and S-2 should be changed to MDS-05 and MDS-04 respectively to eliminate confusion when the structure sheets are added into the package.	See URS Response to Comments.
4		MDS-08: Curved Guiderrail Treatment Detail is great. Will there be a separate Curved Guiderrail item in the contract or will it be paid under the appropriate (straight) guiderail item? It should be noted on the sheet.	See URS Response to Comments.
5		MDS-20: Aetna Parking Lot Detail has no clear delineation where F-Shape PCBC ends because the property take line is too heavy. Can it be made clearer?	See URS Response to Comments.
6		MDS-21: Typical Swale with MBR detail refers to Note 7 which does not exist. Typical Swale with PCBC station is incorrect.	See URS Response to Comments.
7		MDS-28: Note 2 Mentions Pump Discharge/Sedimentation Basin but there is none shown in the plans, no such item in the estimate, etc.	Per Comment #4 by Paul Corrente on 03-01-10, this sheet has been removed from plan set.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
8		MDS-30: Underground Stormwater Detention – What pay item(s) are there for this work? What material is above the 3/4" stone-pavement, turf, gravel or what? How will the 3/4" stone be compacted between the pipes with only two feet between them?	Each item is paid for separately (ie. 48" HDPE pipe, manhole, etc.). Call out added to Section A-A detail. The stone is to be installed in 6" lifts, callout added to Section A-A detail.
9		HWY-06: The four separate sections of crash wall are all labeled SW-1. Can they be labeled differently, such as SW-1a, SW-1b, SW-1c and Sw-1d?	See URS Response to Comments.
10		HWY-10: The End Retaining Wall #112 station should be 425+00, 16' Rt. Not Lt.	See URS Response to Comments.
11		SED-03: It is unclear what the designer is trying to show with the cross hatched areas along Flatbush Avenue.	See URS Response to Comments.
12		SED-11: Why does the SCS line go behind the toe of the fill slope left of Station 712+50?	See URS Response to Comments.
13		SPM sheets: Will the sign legends be given anywhere else? Some of the signs were unreadable. (See SPM-02 – two signs shown with the Do Not Enter sign at Station 406+00, Rt.)	See URS Response to Comments.
		STRUCTURE PLANS (Volume 2)	
1		General: All references to Supplemental Specifications should be updated.	See URS Response to Comments.
2		General; Tables of Quantities item descriptions should be the same as the pay items. (For example: Removal of Structural Steel should be Removal of Superstructure, Welded Studs should be Shear Connectors, Bitumen Coating should be Bituminous Coating for Steel Piles, etc.	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
3		General: There appear to be some needed items that are not included in the Tables of Quantities and/or the estimate such as Removal of Existing Masonry, Handrail, etc.	See URS Response to Comments.
4		General: Slope Paving and Approach Slab Details are needed.	See URS Response to Comments.
5		General: Various section views refer to drawing numbers that do not exist.	See URS Response to Comments.
6		Sheet 200: Note regarding Bituminous Concrete Overlay is confusing. The first list usually refers to the bottom course of pavement and the second lift usually means the top course of pavement.	See URS Response to Comments.
7		Sheets 214, 239 and 260: Test Pile is noted to be HP 14X117 but in the estimate it is HP12X53. Please be consistent.	See URS Response to Comments.
8		Sheet 214: Note 1 calls for contractor to verify utility locations prior to construction. We recommend that the contract include an item to dig Test Pits.	See URS Response to Comments.
9		Sheet 215: There appears to be a dimension missing, missing labels and a leader arrow pointing to the concrete pad when it should point to the top plate on the bottom left diagram. The diagram should probably be labeled Elastomeric Bearing Details.	See URS Response to Comments.
10		Sheet 228: Reference is made to Sheet S3-3 (which does not exist). Do you mean Drawing S-3 for SB Busway bridge over Capitol Avenue which is Sheet 252?	See URS Response to Comments.
11		Sheet 228: Reference to Drawing S-9 for Cheekwall on Existing Bridge Seat, Hole in Wall Stem, Footing Step Detail on the North Elevation diagram appear to be incorrect and these details were not found.	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
12		Sheet 232: References to Views A and B on both North Elevation and South Elevation diagrams appear to be incorrect.	See URS Response to Comments.
13		Sheets 240 and 261: Elastomeric Bearing Details at Abutments appear to have a dimension missing, unlabeled parts and a leader arrow pointing to the concrete pad when it should point to the plate above the elastomeric pad.	See URS Response to Comments.
14		Sheets 271 through 275: To make it clearer that there are four crash walls to be constructed, can the item be changed to Retaining Walls SW-1?	See URS Response to Comments.
15		Sheet 276: Working point coordinates missing.	See URS Response to Comments.
16		Sheets 280, 284, 295 and possibly others: The Elevation view shows rub rail attached to parapet wall as a "Roadway Item" but it is not listed on the estimate.	See URS Response to Comments.
17		Sheets 285 and 287: The piles are shown as HP12X74 on one sheet and HP12x53 on the other sheet. Quantity appears to be based on HP12X74 piles.	See URS Response to Comments.
18		Sheets 296 and 301: The piles are shown as HP12X74 on one sheet and HP12X73 on the other sheet. Quantity appears to be based on HP12X74 piles.	See URS Response to Comments.
19		Sheet 302: Retaining Wall Section "B" Top of Wall Detail is missing.	See URS Response to Comments.
20		Sheets 308, 317, and 324: There are callouts for Paved Ditch (Roadway item) but no such item is listed on the estimate.	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
		Special Provisions	
1		General: When the Special Provisions have been completed (it is obvious that there are many items and/or details missing), we would like to review them.	See URS Response to Comments.
2		General: Review all references to items that may or may not be included in the final contract which definitely are not listed in the estimate now.	See URS Response to Comments.
3		Item No. 0201001A Clearing and Grubbing – Railroad facilities including cross ties and rail will be removed and disposed of under this item but there is another item (No. 0202528A) which covers these items. Please review.	See URS Response to Comments.
4		Item No. 0503151A Removal of Superstructure (Site No. 1) – This item “also includes salvage of various superstructure elements and accessories”. More includes salvage of various superstructure elements and accessories”. More information is needed and a note added to the pertinent plan sheet(s)	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
5		<p>Item No. 050799A (not enough digits – s/b 0507999A) Junction Chamber –</p> <ul style="list-style-type: none"> • Under Materials: “Connections between <u>junction chamber</u> (not manhole) structure and pipe...” • Under Materials: Ladder rungs...”as detailed on the plans” were not found on the plans. • Under Construction Methods: “Granular fill shall be placed as indicated on the plans”. Show depth of compacted granular fill on the plan views. • Under Basis of Payment: “...pipe plugs at the locations specified in the plans”. Pipe plugs were not shown on the plan views. 	<p>Special Provision revised.</p> <ul style="list-style-type: none"> • Incorporated. • Ladder added to plan. • Incorporated. • Pipe plug removed from Special Provision.
6		<p>Item No 0520035A Silicone Expansion Joint System – Under Method of Measurement and Basis of Payment calls for payment by cubic feet but the estimate shows it paid by liner feet. Whichever method is chosen, please make sure quantity is correct.</p>	See URS Response to Comments.
7		<p>Item No. 0521001A A Elastomeric Bearing Pads- Unit of measure is stated two different ways in Special Provision (each and decimeter) and is shown in cubic inches on the estimate. This could be very confusing.</p>	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
8		Item No. 0601652A Retaining Wall (Site No. 2) – This wall (these walls?) not labeled on the plan sheet but reference is made to Railroad Closure Walls, Proposed Closure Wall and New Closure Wingwall. The only detail missing is the length of each wall. Also, the Special Provision makes reference to reinforcing steel but none is shown in the only diagram depicting this item on Sheet 232.	See URS Response to Comments.
9		Item No. 0969050A Document Control Specialist – The minimum lump sum bid is specified as \$200,000 but on the estimate it is shown as \$187,000.	See URS Response to Comments.
10		Item No XXXXXXXA Expanded Polystyrene Fill - It is stated "indicated on the plans". Is this the same as Geofoam, which is shown on the plans? It appears that not enough dimensions have been provided. (See comment 2)	See URS Response to Comments.
11		Item No. XXXXXXX Geotechnical Instrumentation and Monitoring – This item is shown in the special provision as four separate items but only one item is listed in the estimate. Any questions should be directed to Janet Mazeau at (860) 594-2674	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
1		Page 15 – the geotechnical report states that a detailed listing of proposed geotechnical instruments will be submitted under separate cover. This information should have been provided as part of this report. Revise and resubmit the amended report for review.	See URS Response to Comments.
2		The geotechnical report should clarify that the geofoam roadway section was designed to carry both permanent loads (pavement section, live loads etc.) and temporary loads during construction of the embankment. Calculations demonstrating this should be submitted for review.	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
3		<p>Expanded Polystyrene Fill Construction Details, General – C should provide the minimum depth of cover on the geofoam before construction equipment can be driven on it. Clarify the method of placement and compaction requirements for this minimum cover material.</p> <p>The current details call for standard formation of embankment above the geofoam, a special provision modifying the Standard Specification Form 816 should be provided to insure the formation of embankment above the geofoam and/or below the geomembrane does not damage either. In addition, the spec may need to set maximum aggregate size in the embankment material near the geofoam to be no larger than gravel or some other appropriate size.</p> <p>The special provision calls for testing according to ASTM D6817. Each minimum material property should be listed with its corresponding testing standard, i.e. for Minimum Physical Properties (ASTM D 1622 (Density), ASTM D 1621 (Compressive Strength), ASTM C 203 (Flexural Strength) and ASTM D 2863 (Flammability). Review and revise accordingly.</p>	See URS Response to Comments.
4		Include a special provision or a Notice to Contractor that modifies the prosecution and progress to enforce at time waiting period. It should be specific about what types of construction activities (if any) can and cannot be done during the time waiting period and it should specify when the waiting period begins.	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
5		<p>Pay items and labels on the plans should match those in the specifications, for example the Geotechnical Instrumentation and Monitoring special provision states that the basis of payment are, Railroad Settlement DMP's and Monitoring, Utility Settlement DMP's and Monitoring, Tilt Meters and Inclinometers however, the detailed estimate sheet only has an item for, "Geotechnical Instrumentation."</p> <p>Sheet No. 5 – Remove the item for Geofoam Embankment. Use the item Expanded Polystyrene Fill which is already on the detailed estimate sheet on Sheet No. 4.</p> <p>Sheet No. 4 – Contract items should be generic. Remove, "(Novlite Expanded Shale Aggregate)," from Item No. 216006A Lightweight Engineered Fill.</p> <p>Sheet No. 5 – The Detailed Estimate Sheet includes a pay item for, "Additional and Modified Retaining Wall." There is no special provision for this item so please clarify what will be paid for under this item. Revise accordingly.</p>	See URS Response to Comments.
6		Sheet No. TYP-05 – The typical section for lightweight fill with over excavation has a limit of excavation callout that references EPS embankment fill. This should reference lightweight engineered fill for this section.	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
7		Sheet No. TYP-05 – There is a note that provides a time waiting period for settlement to occur. As stated in the above Comment No. 4 a special provision of Notice to Contractor should be included that modifies the prosecution and progress section to enforce the time waiting period.	See URS Response to Comments.
8		Include the boring logs from the Pilot Boring Program on the plans as well as the boring locations.	See URS Response to Comments.
9		Drainage plans – the underdrain should be labeled with the length of run and size of drain similar to other drainage runs, i.e. 75' – 6" Underdrain. The plans should show where the underdrain will outlet and the Outlets for Underdrain should be labeled in the same manner, i.e. 15' – 4" Outlet for Underdrain. Use a minimum pipe diameter of 6 inches for the underdrain.	Incorporated.
10		Sheet 52 – There is an underground stormwater detention system shown. Boring RW-21 and RW-22 show groundwater at a depth of 4.5 and 5.0 feet respectively. The designer should determine if the groundwater will affect the proposed system. Revise accordingly.	See attached Buoyancy Calculations.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
11		Sheets Nos. 54 to 56 – Use a different symbol such as:  to show the utility test pits so as to differentiate the geotechnical test borings marked with the symbol below from the utility test pits: 	See URS Response to Comments.



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12		<p>Sheet TYP-5 – Geofoam with Over-Excavation Section – The typical detail shown is not representative of the cross sections in which geogoam is to be used (Sta. 431+75 through 442+50)/ The busway is divided in this area with a median of varying widths between NB and SB. Portions of the proposed roadways are in new fill, portions are at existing grade and portions are in cut. The limits of geofoam placement should be clarified at each cross section. In addition, a special detail will be required for placement of the geofoam in and around the abandoned Park River bridge and existing I-84 piers (refer to stations 431+75+/-, 434+00+/-, 436+50+/-, etc).</p> <p>Per NCHRP, an EPS mass beneath the roadway will act as an insulator and potentially cause ice to form on the pavement at a higher ambient temperature than on the normal embankment sections. This could create a differential icing condition similar to the, "Bridge freezes before roadway," phenomenon. A minimum of 4 feet of total cover between the top of the EPS and the riding surface has been shown to be effective in preventing this problem. Current details show a minimum cover of 38". Revise the plans to assure a minimum cover of 4 feet for all geofoam.</p> <p>There are median barriers which could impact the layout and drainage capability of the geomembrane. Revise to more accurately reflect actual installation within the various cross section configurations.</p>	See URS Response to Comments.



Busway Mainline Contract: 155-H025

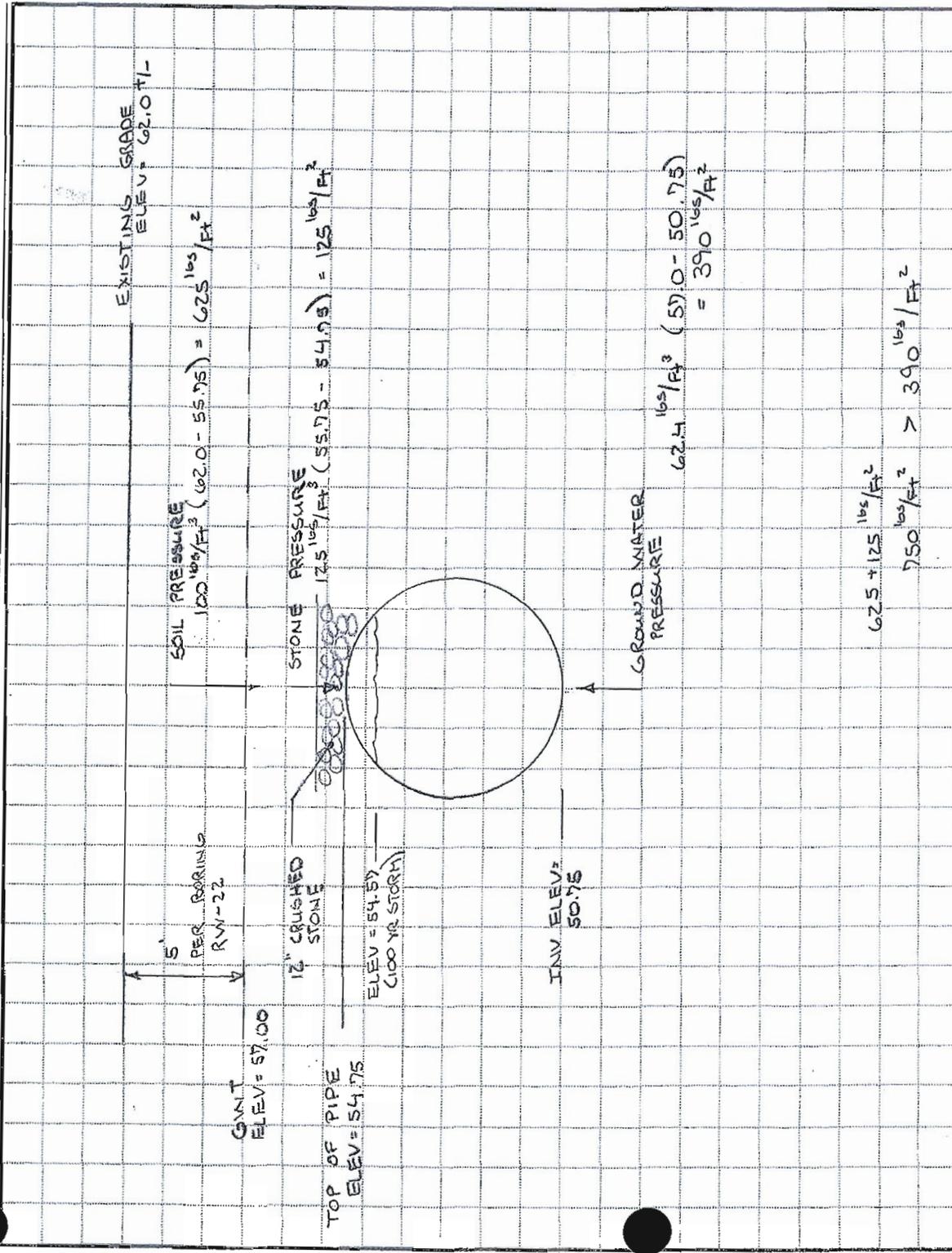
DESIGN REVIEW RECORD

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13		<p>The location of the existing (and still operating) Park River Conduit should be shown in the cross sections (sta. 434+50 and 435+00). Check to insure there is no conflict between this structure and the geofoam installation (particularly in the over-excavation area).</p> <p>A detail for installation of the guiderail and/or median barriers in the areas where there is a geofaom and/or geomembrane will be required. Check to insure there is sufficient embedment of the guiderail into suitable material (i.e. can or does the proposed railing extend into the geofoam?).</p> <p>The current typical cross section shows the geomembrane grade coinciding with the pavement grade. This would result in ponding and saturation of the subbase along the EB (right) shoulder above the geomembrane. We recommend draining the geomembrane in one direction, towards the north (left). Underdrains and/or Pavement Edge Drains should be installed just above the geomembrane and along all shoulders so as to drain any potential low spots created by any long term differential settlement that could occur.</p> <p>Provide details for installation of storm drainage systems in the geofoam and/or geomembrane.</p> <p>The detail should show the placement of the leveling sand below the geofoam, per the geotechnical report and special provision.</p> <p>Sheet TYP-05- The details should clarify the longitudinal transition of geofoam to other fill materials. The current detail lacks any dimensions. It also does not address transitions in areas like Retaining Wall 115 or the Capitol Ave. Bridge.</p>	See URS Response to Comments.

VN ENGINEERS, INC.
 116 Washington Avenue
 NORTH HAVEN, CT 06473
 (203) 234-7862

JOB DEFENTION SYSTEM 155 - H025
 SHEET NO. 1 OF 1
 CALCULATED BY JMB DATE 06-03-10
 CHECKED BY CJL DATE 06-03-10

SCALE _____



ASSUME:

- 1) 100 ^{lbs}/ft² FOR SOIL
- 2) 125 ^{lbs}/ft² FOR STONE
- 3) WORST CASE w/ PIPE EMPTY
- 4) PIPE WEIGHT NOT ACCOUNTED FOR

$$625 + 125 \frac{\text{lbs}}{\text{ft}^2} = 750 \frac{\text{lbs}}{\text{ft}^2} > 390 \frac{\text{lbs}}{\text{ft}^2}$$

$$62.4 \frac{\text{lbs}}{\text{ft}^3} (57.0 - 50.75) = 390 \frac{\text{lbs}}{\text{ft}^2}$$

$$100 \frac{\text{lbs}}{\text{ft}^2} (62.0 - 55.75) = 625 \frac{\text{lbs}}{\text{ft}^2}$$

$$125 \frac{\text{lbs}}{\text{ft}^3} (55.75 - 54.05) = 125 \frac{\text{lbs}}{\text{ft}^2}$$



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1	TYP	<ul style="list-style-type: none"> ▪ Legend H. It is not understood why a chain link fence is required on the western side of the busway. Especially in the industrial and retail areas. If it is not needed with MBR, then why is it needed everywhere else? This could provide a significant amount of cost savings and reduce future maintenance and operational costs as well. ▪ Legend I. There is no progress aggregate under guiderail. A Legend T is identified, but it is not shown on any of the Typical Sections in which MBR is called out. Please clarify. ▪ Legend W. If a drainage swale is to be proposed, it is likely the work will be performed under the busway. What is the latest on the drainage swale developments? ▪ Legend W. If a swale is to be proposed, could the F-shape PCBC or Concrete Barrier Walls (BW) be eliminated in certain areas to promote sheet flow from the busway into the drainage swale? Open drainage is always preferred over closed drainage systems. 	<ul style="list-style-type: none"> ▪ No VN Participation ▪ No VN Participation ▪ No VN Participation. VN did not design Amtrak swale. ▪ No VN Participation
2	MDS-1&2	<ul style="list-style-type: none"> ▪ Remove these E&S sheets. Not warranted and out dated. 	No VN Participation. MDS 1 & 2 are not a VN sheets.
3	MDS-21	<ul style="list-style-type: none"> ▪ The swale details are not consistent with the TYP and DRG plan sheets which call for ditches. Please clarify. ▪ Please modify the station for the Typical Swale and PCBC detail. 	No. VN Participation. MDS 21 is not a VN sheet.
4	MDS-26-28	<ul style="list-style-type: none"> ▪ See comment 2. 	Incorporated. MDS 26 to 28 removed from plan set.



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5	MDS-30	<ul style="list-style-type: none"> ▪ The detail calls for a 48-inch CPP and DRG-09 calls for a 48-inch HDPE. The two pipes are very different. One is corrugated and the other has a smooth interior. ▪ If it is to be a Corrugated HDPE, it is believed that Corrugated HDPE at that size is not a standard product and is difficult to obtain. ▪ How much cover is there above the underground detention system? ▪ A geotextile material needs to surround the entire structure. ▪ Please ensure the manhole locations and or inspection points do not interfere with key station elements or pedestrian traffic, etc. 	<ul style="list-style-type: none"> ▪ Revised to 48" HDPE pipe on detail sheet to match DRG-09 ▪ N/A ▪ There is approx. 7' of cover over the detention system. ▪ Incorporated. A geotextile material added to "Section A-A" detail. ▪ Noted



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6	HWY General	<ul style="list-style-type: none"> ▪ HWY sheets should show drainage. ▪ Stations should be shown with drainage connection points with the busway, etc... It is important to get an overall perspective of the different busway projects and how they interact as one component. ▪ Remove all references to Drainage Swales as this information is provided on the DRG plans. ▪ <u>Comment was submitted under the Busway Permit review.</u> The design regarding the proposed Amtrak drainage swales between the Busway and tracks needs to be submitted for review as this information needs to be presented to verify there are no impacts with other elements of the Busway design which may ultimately affect regulated areas. It needs to be known where the swales are discharging in relation to Amtrak's proposed manholes, Amtrak's existing utility lines to remain, proposed concrete encased ductwork, sheeting, etc...(currently not shown)_This does not take into account the work required for the proposed retaining walls (RW) located between the Busway and Amtrak tracks. 	<ul style="list-style-type: none"> ▪ No VN Participation ▪ No VN Participation ▪ No VN Participation ▪ No VN Participation. VN did not design Amtrak swale.
7	HWY-01	<ul style="list-style-type: none"> ▪ The RW situation needs to be resolved. 	See URS Response to Comments.
8	HWY-03 & 04	<ul style="list-style-type: none"> ▪ Between Sta. 358+00 LT to 395+75 LT, the plans call for a RW, yet no structural plans are provided. Please clarify. 	See URS Response to Comments.
9	HWY-04 & 05	<ul style="list-style-type: none"> ▪ The XSC indicates the RW ends at Sta. 379+00 RT. 	See URS Response to Comments.



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10	HWY-07	<ul style="list-style-type: none"> Between Sta. 394+00 LT to 395+75 LT, the plans call for a RW, yet no structural plans are provided. Please clarify. 	See URS Response to Comments.
11	Hwy-07 & 08	<ul style="list-style-type: none"> Is a CLF needed with a noise wall in place? 	See URS Response to Comments.
12	HWY-10	<ul style="list-style-type: none"> Between Sta. 427+60 LT to 429+80 LT, the plans call for a RW, yet no structural plans are provided. Please clarify. 	See URS Response to Comments.
13	DRG	<ul style="list-style-type: none"> Access will be required at those locations where drainage is located outside of the busway limits. 	URS to provide direction to address this comment.
13a	DRG-01	<ul style="list-style-type: none"> Is a Class V pipe required at Sta. 339+00? There appears to be adequate cover. Please clarify. At Sta. 339+00 LT, drainage typically has a hard time making 90-degree turns. Is there any way to resolve this issue? 	<ul style="list-style-type: none"> In our opinion, class V pipe is required as there is about 1.9' of cover over the 12" lateral pipe. Due to the location of the ditch it is not possible to avoid the 90° bend. The drainage calcs reflect a 90° bend design.
14	DRG-02	<ul style="list-style-type: none"> At Sta. 345+35 LT, the XSC show two structures, yet the plan shows only one. Please clarify. At Sta. 345+35, if a RW is required, will the unknown footing elevation and or H Piles impact the existing cross culvert? 	<ul style="list-style-type: none"> URS to revise x-section to reflect plan. URS to provide direction to address this comment.
15	DRG-03	<ul style="list-style-type: none"> At Sta. 351+98 RT, the XSC suggests a Type C CB versus a PRW as shown. At Sta. 351+98, couldn't the 12-inch lateral be a typical transition from CB to CB? The XSC shows an awkward connection. Are the Class V pipes required? There appears to be adequate cover. Please clarify. 	<ul style="list-style-type: none"> CB left revised to type "C" URS to revise invert on x-section to match plan. System #3 layout revised per DOT direction (Bob Reilly)



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16	DRG-04	<ul style="list-style-type: none"> ▪ The profile suggests that the drainage at Sta 362+50 should connect to the PRW CB located at Sta. 359+00 LT. By doing so, the installation depth for System 3 could be raised. ▪ At Sta. 367.00 RT, the XSC suggests a Type C-M versus a PRW as shown. ▪ At 367.00 LT, there is no need for a Class V pipe outside of the busway. 	<ul style="list-style-type: none"> ▪ System #3 layout revised per DOT direction (Bob Reilly) ▪ Incorporated. Plan sheet revised. URS to revise x-section to show PRW CB right & CM CB left. ▪ Incorporated. Class V pipe removed.
17	DRG-05	<ul style="list-style-type: none"> ▪ At Sta. 370+00, if a RW is required, will the unknown footing elevation and or H Piles impact the existing cross culvert? ▪ At 375+00 LT, the XSC suggests a Type C-M CB versus a PRW as shown. 	<ul style="list-style-type: none"> ▪ URS to provide direction to address this comment. ▪ Incorporated. Plan sheet revised. URS to revise x-section to show CM CB left.
18	DRG-06	<ul style="list-style-type: none"> ▪ At 380+00 LT, the XSC suggests a Type C-M CB versus a PRW as shown. ▪ At 387+90 RT, the XSC suggests a Type C-M CB versus a Type C as shown. ▪ System 3 is still a deep system. Is there anyway to raise it? ▪ Is there no way to pull back the outfall for System 3 and provide additional overland flow prior to discharging into Kane Brook? ▪ For Systems 3 & 4, why all of a sudden is ACCM pipe being proposed where elsewhere outside the busway RCP is used? ▪ How will maintenance access the outfalls for System 3 and System 4? 	<ul style="list-style-type: none"> ▪ Incorporated. Plan sheet revised. URS to revise x-section to show CM CB left. ▪ Incorporated. Plan sheet revised. URS to revise x-section to show CM CB right. ▪ System #3 layout revised per DOT direction (Bob Reilly) ▪ Due to the close proximity to the Rte. 84 overpass the outfall was kept as close as possible to Kane Brook. ▪ Due to the slope of the pipe (18%) ACMP was selected. ▪ URS to provide direction to address this comment.



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19	DRG-07	<ul style="list-style-type: none"> At Sta. 400+00, please review the XSC and clarify the 12-inch lateral connection and reason for a deep sump. 	URS to revise x-section to match plan.
20	DRG-09	<ul style="list-style-type: none"> At 411+00 LT, the XSC suggests a Type C CB versus a PRW as shown. At 417+00 RT, the XSC suggests a Type PRW CB versus a C-M as shown. Is there any way to raise the System 6? Way too deep. Given the depth of the 18-inch RCP, a significant amount of trenching will be required. However, the 12X74 H Poles for RW 111 may interfere with the installation of the sheeting limits or trench box required to install the RCP. 	<ul style="list-style-type: none"> Incorporated. Plan sheet revised. URS to revise x-section to show C CB left. Incorporated. Plan sheet revised. URS to revise x-section to show PRW CB right. Not Incorporated. A min. slope of 0.5% was used. URS to provide direction to address this comment
21	DRG-10	<ul style="list-style-type: none"> The 12-inch RCP lateral at Sta. 428+50 is too deep. 	Incorporated.
22	DRG-11	<ul style="list-style-type: none"> RW 113, 114, 115 and 116 are missing. 	Incorporated.
23	DRG-12	<ul style="list-style-type: none"> RW 116 and 117 missing Are the Class V pipes required? There appears to be adequate cover. Please clarify. Drainage at Sta. 449+25 is not shown on the XSC. 	<ul style="list-style-type: none"> Incorporated. Class V pipe was used due to the pipes going through RW 117 URS to revise x-section.
24	SED	<ul style="list-style-type: none"> Check dams not called out. The designer's response to our semi-final design indicates that the plans have been revised accordingly, yet SCS is still shown between the busway and existing tracks. Please remove. Anti-tracking pads are not shown. The background information that is not part of the project should be toned down. Too dark. 	<ul style="list-style-type: none"> No VN participation No VN participation No VN participation No VN participation
25	SED	<ul style="list-style-type: none"> Drainage is missing. 	No VN participation



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26	SPM-01	<ul style="list-style-type: none"> ▪ A tributary sign for Kane Brook is not provided. 	No VN participation
27	S-	<ul style="list-style-type: none"> ▪ Where will the RW underdrains discharge? ▪ Some of the RW's details do not show sheeting. Please verify. 	<ul style="list-style-type: none"> ▪ URS to provide direction to address this comment. ▪ No VN participation
		PLEASE CONTACT PAUL CORRENTE IF YOU HAVE ANY QUESTIONS: 860 594-2932	



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1		GENERAL COMMENTS As per Consultant Design Manual Section 304.03: "Highway & Structure submissions should be coincident but separate". This was not done.	See URS Response to Comments.
2		Design Statement was not included in submission. Please submit.	See URS Response to Comments.
3		As per Consultant Design Manual Sections 304.03: "All projects which involve railroads are to have a railroad coordination meeting during this review stage. The purpose of this meeting is to identify possible problems before the construction contract is awarded. Plans and specifications, including limitation of Contractor's operations, must be available at this meeting. The meeting should be attended by the Department's Design and Railroad Liaison Engineers, and representatives of the Railroad including engineering operations and electrical section, and the Consulting Engineer". A meeting was held by the Department and Amtrak on February 22, 2010 in New York. Your office is waived of this requirement.	See URS Response to Comments.



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4		<p>As per Consultant Design Manual Sections 304.03: A statement "THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE TRUE CONDITIONS OR ACTUAL QUANTITIES OF DISTRIBUTION OF QUANTITIES OF WORK WHICH WILL BE REQUIRED" shall appear on sheets containing estimated quantities, such as detailed estimate sheets, and bridge sheets showing estimated quantities. The statement also applies to boring sheets and certain bridge substructure sheets. It is not to be utilized on all construction drawings".</p> <p>URS has this included on every plan sheet and is not correctly written. Please correct the above-mentioned statement and only use on appropriate sheets.</p>	See URS Response to Comments.
5		Bridge Plans were not stamped by a Professional Engineer.	See URS Response to Comments.
6		Why were sheets #153-#199 and #344-399 intentionally not included in a 90% submission? What information is contained on these missing sheets?	See URS Response to Comments.
7		<p>Please go to the Department's web site and view the workflow that provides instructions on how to obtain and store CTDOT Standard or Guide Sheets and how to properly insert them into a project contract plans set. The web address is: www.ct.gov/lib/dot/documents/deng/2007_standard_sheets.pdf</p>	See URS Response to Comments.



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8		Highway Standard Drawings and Traffic Engineering Standard Drawings should be listed in the LIST OF DRAWINGS at the end and not numbered.	See URS Response to Comments.
9		Add a MDS for Drainage pipe structure in geofoam	URS to provide direction (ie. is Geofoam still being used on this project, if so where?).
		Sheet #1 Title Sheet	
1.		Add a descriptive title of the projects.	See URS Response to Comments.
2.		Add note stating future responsibilities for future maintenance.	
3.		Add assume design speeds.	
4.		Add Highway classification.	
5.		Add Design year ADT and DDHV.	
6.		Designing company's name, including signature of an officer and a Connecticut Seal with Professional Engineer's number.	
		Sheet # 2	
1.		Highway Standard Sheets should be at the end of the plan set.	See URS Response to Comments.
2.		Check boxes to HW 949-01 Planting Details for Trees.	
3.		Check boxes to HW 949-02 Planting Details for Shrubs.	
4.		There are no Highway Standard Sheets included in submission.	



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		Sheet #3	
1.		Traffic Standard Sheets should be at the end of the plan set.	See URS Response to Comments.
2.		There are no Traffic Standard Sheets included in submission.	
		Sheet #4	
1.		Sheet is overall incomplete for a 90% Submission.	See URS Response to Comments.
2.		Incomplete heading bar.	
3.		Not all Item Numbers are included.	
4.		Earth Excavation Estimate is 43,000, however adding the numbers is 40,274.	
5.		Many Quantities are missing.	
6.		Verify that no Rock Excavation is required.	
7.		There are no quantity breakdowns, only final totals.	
		Sheet #5 Detailed Estimate Sheet	
1.		Sheet is overall incomplete for a 90% Submission.	See URS Response to Comments.
2.		There are no quantity breakdowns, only final totals.	
3.		Six Item Numbers are not included.	
4.		Quantities are not broken down in 500 foot increments.	
5.		Many Quantities are missing.	



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6.		Item 3 28mm Geo-membrane #755XXX, why is this item in metric.	
7.		Add quantities for billboard removal.	
8.		Under Geotechnical Instruments, there is no unit of quantities listed.	
9.		Under additional and modified retaining walls, there are no unit numbers or quantities listed.	
10.		Verify that no Granite Curbing is required especially at crossing where we are on local roadways.	
		Sheet # 6 Detailed Estimate Sheet	
1.		Sheet is overall incomplete for a 90% Submission.	See URS Response to Comments.
2.		There are no quantity breakdowns, only final totals.	
3.		Eight Item Numbers are not included.	
4.		Quantities are not broken down in 500 foot increments.	
5.		Many quantities are missing.	
6.			
		Sheet #7 Detailed Estimate Sheet	
1.		Sheet is overall incomplete for a 90% Submission.	See URS Response to Comments.
2.		No quantities listed under Construction Signs Type 3.	
3.		Traffic and Signal items appear to be incomplete and missing.	
4.		Quantities are not broken down in 500 foot increments.	



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5.		Many quantities are missing.	
6.		No quantity for 4" White Epoxy Resin.	
7.		There are no quantity breakdowns, only final totals.	
8.		Why is Construction Field Office under the P&PT Section?	
9.		No quantities listed in M&PT.	
10.		No quantities listed under Remove and Relocate Existing Signs.	
		Sheet #8 Detailed Estimate Sheet	
1.		Sheet is overall incomplete for a 90% Submission.	See URS Response to Comments.
2.		There are no quantity breakdowns, only final totals for many items.	
3.		No quantities for item numbers: 0503151, 0508002A, 0602XXX, 06036 and 0612994.	
4.		Structure item numbers and quantities appear to be missing.	
		Sheet #9 Detailed Estimate Sheet	
1.		There is no information on this sheet.	See URS Response to Comments.
		Sheet #10	
1.		Three bridge numbers are missing.	See URS Response to Comments.
		Sheet #11	
1.		Please add appropriate street names for easier reference, i.e. Flatbush Avenue, Hamilton Avenue, Park Street, Capitol Avenue etc.	See URS Response to Comments.



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		Sheet #12	
1.		Note 311. "The 1.8m High Chain Link Fence" should be in English and not Metric.	See URS Response to Comments.
2.		Note #12. Remove "815" and replace with 816 .	
3.		Note #13. Check.	
4.		Remove the abbreviation KPH.	
5.		Add the abbreviation MPH.	
6.		The Plan Sheet Legend Utility Test Pit Symbols should be located under the right column.	
		Sheet #13	
1.		What does "RR" stand for, i.e. RR-9 (IP)	See URS Response to Comments.
		Sheet #15	
1.		Remove the box out label FINAL DESIGN REVIEW.	See URS Response to Comments.
		Sheets #18-21	
1.		"B" 6" Superpave 1.0. Why is this being done in only one 6" lift and not two 3" lifts.	See URS Response to Comments.
2.		"O" are we using concrete curbing? Why not just use BCLC or BCPC?	
3.		"W" This statement makes no sense. You may keep it in this section, but add typical details of this work on a different page and note accordingly.	



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4.		Sheet #18, "Section in Pavement see MDS-XX". Add sheet number.	
5.		Sheet #20, Typical Section 446+44-450+00. What goes behind Barrier Single 'F' Shapes PCBC 30" X 45". Is it capped?	
6.		Amtrak swale slopes must be at least 2 feet from barrier before sloping down.	
		Sheet #22	
1.		Give dimensions of geofoam blocks or note where to find this information. How is it installed and joint staggering.	See URS Response to Comments.
2.		Add installation with drainage typical detail.	
3.		Can Thrie Beam 350 post go in geofoam.	
4.		Can Thrie Beam 350 post go through geomembrane. Will this compromise the integrity of the geo-membrane and geo-foam?	
5.		Why is geo-membrane not directly on top of geofoam?	
		Sheet #25	
1.		Should note in reinforcement typical read #5@ 12" Top instead of #5 12 Top ?	See URS Response to Comments.
2.		How are you planning on mounting fence and sign posts>	
3.		Barrier transition cross sections 1' X ?. What is space between points? Add dimension for paving to what height on curb, i.e. 3" from top.	
		Sheet #27	
1.		Detail "A": 3.000" (76) + 0.000 – 0.000 does not make sense.	See URS Response to Comments.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
2.		Why are there metric units on MDS sheets?	
3.		Plan View at Pier Detail: Why is PCBC against pier? What is dimension of gap between pier and PCBC?	
4.		At dowels connection detail: What do you fill slot with? Do you grout bars?	
		Sheet #43	
1.		Detail # 1 & #2 (left side of barrier): You state the height "varies dimension". This dimension should have a "minimum" dimension. Can a vehicle jump the barrier?	See URS Response to Comments.
2.		Detail #3 (left side of barrier): What is distance from Back of 350 Thrie beam and barrier? Why is Thrie Beam in this detail but not in Detail 32.?	
		Sheet #52	
1.		Show all drainage flow arrows.	Flow arrows shown on DRG-09.
2.		Show pitch of piping.	Pipe slope shown on DRG-09.
3.		Section BB; Rubber O-ring not located in detail. What is size of sleeve size? What material is sleeve made of? How does sleeve attach/seal to main pipe? Sleeve is not sealed on top. Sleeve is not sealed on top. Sleeve should go to concrete pad so material can not get in.	Section B-B removed from plan set.
4.		Is ¾" broken stone installed in lifts?	Call out added to section A-A.
		Sheet #53	



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1.		No noise wall details.	The noise wall details have not been added at this time. The designers are waiting for direction from the Department as to what type of proprietary wall system will be approved for use by the Department. Once the system has been selected the designers will add the appropriate details as necessary.
		Sheet # 53	
1.		Add Baker's boring locations to plans and boring logs.	See URS Response to Comments.
		Sheet # 94	
1.		Finish Utility Test pit Chart. Add Conflicts, yes/no and resolution.	See URS Response to Comments.
2.		Check location of WTP #6 & #7 and GTP #3.	
3.		No locations for GTP #4.	
4.		Show all Utility Test Pit locations on plan sheets.	
		Sheet # 94	
1.		Ensure all take and easements lines are shown on plans.	See URS Response to Comments.
2.		Verify that CB at station 345+40L located behind the barrier is correct.	
		Sheet # 97	
1.		Need to show location of Flatbush Structure, road, abutment and piers. A lighter font should be used and appropriate project plans referenced.	See URS Response to Comments.
2.		Why do you have RB 350 Bridge attachment at station 352+00.	



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
3.		The cross sections show a cut, however plans do not show cut and fills to warrant a barrier wall.	
4.		Sta. 350+80-352+20 plans call out for 21" x 45" barrier. Cross checking between typicals, plans and cross sections is confusing. Please review and clarify.	
5.		Station 358+70: Add retaining wall number. You are not using the correct symbol for this wall. It conflicts with other symbols used on other walls.	
		Sheet #97	
1.		Station 361+00: Add retaining wall number. You are not using the correct symbol for this wall. It conflicts with other symbols used on other walls.	See URS Response to Comments.
2.		Sta, 362+50: It appears that we are installing a catch basin on private property, please ensure we have appropriate ROW.	
3.		Sta. 359+60 & 366+75 "Electric boxes to be removed by others". Who will be doing this work and is coordination required?	
		Sheet # 100	
1.		Kane Station and platforms need to be shown on plans in lighter font.	See URS Response to Comments.
		Sheet #101	
1.		You have two separate ending stations for Retaining Wall #107. You end at sta390+45 & 392+70.	See URS Response to Comments.
2.		Retaining wall begins at station 394+00. Add Wall number and symbol.	



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3.		At sta 390+64, you call out for a retaining wall and a barrier wall. This is confusing.	
4.		Station 398+20 Sta "Garage Moved by others",	
5.		Station 394+00 Add staff BEGIN NOISE WALL. Is noise wall mounted on Retaining wall? Cross sections show 3 retaining wall locations and no noise wall?	
6.		Do not see Wetlands #23 area on plans.	
7.		Station 394+70 – You have Remove chain link fence. Does this need to be relocated?	
8.		See general comments concerning noise walls.	
9.		There appears to be structures over the property line at stations 399+00 & 399+90. Both need to be identified and who will be doing this work and is coordination required?	
Sheet #102			
1.		See general comments concerning noise walls.	The noise wall details have not been added at this time. The designers are waiting for direction from the Department as to what type of proprietary wall system will be approved for use by the Department. Once the system has been selected the designers will add the appropriate details as necessary.
2.		Sta 394+00 & 395+75: Provide retaining wall numbers.	See URS Response to Comments.
3.		Sta "Metal Shed Moved by others", Who will be doing this work and is coordination required?	



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4.		Verify that there are no impacts to the building located at the following stations that are close to the property lines: 406+65, 407+40 & 409+90.	
5.		Sta 407+90: The garage is over the property line.	
6.		There are no callout to remove existing shrubs.	
		Sheet #103	
1.		Sta. 412+27 – What is going to be done with the shed? It is in busway and over property line.	See URS Response to Comments.
2.		Sta 411/50. so we need to Reinstall the CLF	
3.		Sta 410+00 Metal Storage Rack to be moved by others... who?	
4.		Sta 412+00 "Right to use a 201f strip of lane on NRPC for parking". Are we taking away that right?	
		Sheet # 105	
1.		Sta 450+00 Note end F-shape PCBC	See URS Response to Comments.
2.		How do you tie in retaining wall for parking lot	
3.		What wraps around front of retaining wall? Curbing or MBR?	
4.		Is fence required for on top of retaining wall?	
		Sheet # 122	
1.		Station 332+00 Verify drainage tie-in with adjacent designer for project H046, Ammann & Whitney.	Incorporated. System tie in has been verified.
		Sheet #123	
1.		Show flow line arrows sta 349+50-350+00	Incorporated.



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2.		Remove 2 parallel lines at sta 347+25-350+00L.	
		Sheet #124	
1.		Show flow line arrows sta 350+00-351+98	Incorporated.
		Sheet # 125	
1.		Show flow line arrows sta 362+50-367+00.	Incorporated.
		Sheet #127	
1.		Bold Kane Brook, if possible	Incorporated.
2.		Why are you using ACMP instead of RCP near Kane Brook?	Due to the slope of the pipe (18%) ACMP was selected.
		Sheet # 130	
1.		Show flow line of detention system is required. Section BB needs more details i.e. What size is angle sleeve, how do you keep material out from top, how does it attach to storm sewer pipe, what is material made out of.	Section B-B removed from plan set.
2.		Outlet piping is confusing. You have a 48" RCP out-letting into a 24" RCP. Is there a concern with having a 48" pipe on top of two 6" PVC pipes.	
		Sheet #131	
1.		Show flow line arrows sta 350+00-351+98.	Incorporated.
		Sheet #133	
1.		Show flow line arrows sta 444+50-449+25	Incorporated.



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		Miscellaneous Stuff on Plans	
1.		Station 336+80C Rectangle	See URS Response to Comments.
2.		Station 351+70R Square	
3.		Station 358+90L Square	
4.		Station 402 + 60L Metal Shed who removes	
5.		Station 403+05L-403+60L Fence	
6.		Station 404+80C Boxes	
7.		Station 404+90CR Metal Shed who Removes	
8.		Station 407+105L-408+10L Fence	
9.		Station 410+05L Metal Rack who removes	
10.		Station 412+30C Can not read, looks like it says Conc. Shed?	
11.		Station 429+60 R Rectangle	
		Design Report	
1.		In memo Notes to Reviewers: second paragraph, end of second sentence. Add "for a drainage ditch located on Amtrak property along the east side of the busway".	See URS Response to Comments.
2.		Page 3, section 3.1: after based on the 2003 edition of the CTDOT Highway Design Manual, delete "updated December 2004" replace with, "all manual updates up to and including last update of April 5, 2007"	
3.		Page 7: FYI, pavement design has been changed subsequent to your submission.	



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4.		Page 8: Section 3.5 second paragraph: Remove "as directed by Department". Replace with "Analyzed by URS".	
5.		Page 8, Section 3.5 third paragraph: Are you recommending reducing design speed to 35mph at Hamilton?	
6.		Page 8, Section 4.1 second paragraph: List sections by station number, distances less than 16 feet.	
		List sections by station number, distances less than 16 feet.	
7.		Page 9, Section 4.2 second paragraph: remove the word "and".	
8.		Page 12, Section 6.1 first paragraph: show original totals of wetland impacts too. This will document how you reduced impacts.	
9.		Page 14, Section 9.0: Do any bridges require lighting underneath? If so, they should be listed.	
10.		Page 15, Section 12: Verify noise wall limits. See previous comments relating to this issue.	
11.		Page 16, Section 15 second paragraph: Remove "done by others", replace with "done by Baker". Add note, "Baker will design all rail at grade intersections and upon approval by the department, they will be incorporated into this project plans".	
12.		On chart, please add: General Permit Registration Form for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities will be developed by URS.	
13.		Please add a Design Exception section to the Design Report.	
General Comments (Continued)			



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1.		Who will remove "utility poles to be removed by others"? This needs to be clarified.	See URS Response to Comments.
2.		At many locations you have the note – Remove Conduit (Abandoned). Please confirm that these lines are abandoned. One line appears to belong to Amtrak and needs to be relocated. Please confirm.	See URS Response to Comments.
3.		Construction Plans do not reflect cuts or fills on east side of busway. This needs to be added.	See URS Response to Comments.
4.		Need to show location of Flatbush Structure, road, abutment and piers on plan sheets. All stations should be shown on plans. A lighter font should be used and appropriate project plans referenced.	See URS Response to Comments.
5.		Ensure all take and easements lines are shown on plans.	See URS Response to Comments.
6.		At many locations you have the note, Communication Manholes to be removed by others. Who will be doing this work and is coordination required.	See URS Response to Comments.
7.		At several areas you note Remove CLF. Will CLF need to be reset or relocated or no CLF installed on property lines.	See URS Response to Comments.
8.		According to the noise wall study, Noise Walls need to be 1100 feet & 950 feet along Francis Avenue. Ensure stations match accordingly. Please note that the 950 section will need to end at the south property line of the Sack Oil property. This change was approved.	The limits of the walls have been adjusted for constructability reasons and have been previously coordinated with the Department. The wall to the north of Hamilton Ave has been extended to the Sack Oil property line.
		Please recheck Bituminous and Concrete pavement start at stop areas.	See URS Response to Comments.

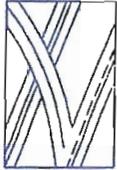


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DESIGN REVIEW RECORD

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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
1		The cross sections show that the depths for the proposed ditches are several feet deeper than what is required from the supporting computations. As a result, some of the ditches extend beyond the easement line that is defined on the cross sections. It is recommended that the ditch elevations be raised so they are consistent with the computations and constructed within the established easement lines. For example, see proposed ditches at Sta. 427+00 Left and Sta. 443+00 Left.	URS/VN Coordination Needed
2		The detail for Erosion Control Matting (ECM), located on Drawing No. MDS-25 shows the matting extending to the top of bank which may not be necessary for every ditch and channel location. Typically the limits of ECM for ditches and channels extend to a depth that allows for one foot of freeboard. Review and revise the detail accordingly.	Incorporated. Detail revised.
3		<ul style="list-style-type: none"> a. Since the "RPW" catch basins will not have throats at face of the retaining walls, a clogging factor should be applied for those that are located at low points. Guidelines for clogging factors are discussed in Section 11.9.6 of the Drainage Manual. b. "RPW" catch basins that are proposed at busway low points are creating a sag condition as defined in Section 11.7 of the Drainage Manual. A 25 year rainfall event should be imposed on the gutter flow analysis to ensure that the allowable spread width is achieved for the higher frequency storm. 	<ul style="list-style-type: none"> a. Incorporated. PRW CB's at Low Points Sta. 359+00 LT (System #3) Sta. 367+00 RT (System #3) Sta. 390+00 LT (System #4) Sta. 430+91 RT (System #6) b. Incorporated. 25 yr storm gutter flow analysis attached.



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4		A number of catch basins are proposed outside the busway ROW to intercept runoff at the low spots which are being created adjacent to the busway. A maintenance agreement should be developed for those drainage structures that are proposed outside the ROW limits but will require future access by the Department for maintenance and cleaning. For example, see Type "C" catch basins at Sta. 356+40 Far Left and Sta. 362+50 Far Left.	URS to provide direction to address this comment.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
5		<p><u>Underground detention system at Parkville station—Sta. 413+00 Far Left</u></p> <ul style="list-style-type: none"> a. Include a detail for the outlet control structure that will regulate the outflow from the underground detention facility. (See previous comment no. 17.) b. There is inconsistency in the pipe sizes specified for the outlet control structure between the plans, calculations, and the report narrative. For example, the detention calculations include two 3" diameter orifices to detain the outflow from the underground facility while the design plans show two 6" diameter and the report narrative lists two 4" diameter orifices for the same outflow structure. c. The orifice diameter for the outflow pipes should be a minimum of 6 inches. Review and revise as necessary. d. A trash rack should be provided at one of the drainage structures that are located upstream of the underground facility, to prevent debris and trash from entering. Consider providing the trash rack at catch basin Sta. 412 + 80 Left or another suitable location. 	<ul style="list-style-type: none"> a. Incorporated. Detail added to MDS-27 b. Incorporated. Revised plans & report to match calcs. (ie. 2-4" dia. orifices) c. Due to the large difference in the inflow of 7.08 cfs and the required outflow of 1.0 cfs a 6" orifice is to large a diameter. A trash rack will be added to keep debris out of the pond. d. Per discussion with Yolanda on 06-01-10. Since the last CB before the detention system does not have a throat (ie. P-R-W CB at Sta. 412+80 LT) no trash rack is needed.

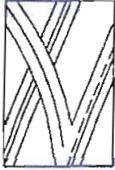


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5 (cont.)		<ul style="list-style-type: none"> e. Miscellaneous Drawing No. 26 shows several 4" cast iron pipe inserts proposed from the top of the proposed 48" diameter underground pipe to the proposed ground elevation. The purpose of these 4" diameter pipes is unclear since they are too small for access, cleaning or inspection. Explain. f. Access to the underground facility should be provided for future inspection, cleaning and maintenance. 	<ul style="list-style-type: none"> e. Detail removed. Cleanouts also removed. f. Access to the underground pond is provided via the 4 manholes at the corners of the pond.
6		Sta. 345+35 – The footing for the proposed retaining wall is not shown on the cross sections. It is unclear if the proposed retaining wall will be in conflict with the existing 4' x 2' box culvert that will cross under the new busway and existing railroad tracks. The wall and footing location should be verified with respect to the existing culvert to determine if strength computations or additional wall details are required depending on whether the wall will be above or below the box culvert.	URS to provide direction to address this comment.



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ITEM NO.	SHEET	COMMENT	RESPONSE AND ACTION TAKEN
7		<p><u>Sta. 356+10 Far Left</u> – Discussions with the Department’s project engineer indicate that there is an existing headwall on Amtrak property that intercepts parking lot drainage from the adjacent private development. It is our understanding that the invert elevations and outlet location of the headwall pipe is currently being investigated by the Department’s survey section and the designer.</p> <ul style="list-style-type: none"> a. One of the options under consideration is to discharge the private parking lot drainage to the busway drainage system which currently is designed to outlet to the existing MDC drainage system on Flatbush Avenue or to discharge it to Kane Brook which will require bucking the grade. We strongly recommend that the parking lot drainage from the private development remains separate from the busway drainage. It should continue to discharge to its present location under the railroad tracks. b. Include the existing pipe system on the respective cross section. 	Per direction given by Bob Reilly on April 22, 2010. The drainage system from the Dunkin Donuts/Crowley Parking Lot was combined with Busway System #3. The plans have been revised to reflect this direction for Bob Reilly.

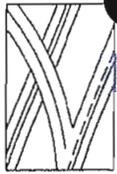


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8		<p><u>Junction Chamber Sta. 369+90 Left</u> – The detail shows the junction chamber to be 20’ wide x 10’ long and will join several 12” diameter clay pipes that are located approximately 4’ away from each other.</p> <ol style="list-style-type: none"> It is unclear why the chamber needs to be so large since the existing drainage pipes are located close to each other. Check the required design dimension to determine if the structure size can be reduced. For example, consider providing access to the chamber on the busway side rather than the side of the barrier wall. Both locations appear to be located within the busway’s ROW. Access to the chamber is proposed via a manhole but no ladder or other point of access is shown for the 9 ft. deep structure. The plans should call for 4’ pipe sections for the clay pipe that will be connected at the junction chamber. 	<ol style="list-style-type: none"> Incorporated. Junction chamber revised. Incorporated. Ladder added to detail. Incorporated.

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9		<p>The structure plans show a paved ditch proposed behind the wall of abutment 113 and 114.</p> <ul style="list-style-type: none"> a. Provide calculations with an accompanying drainage area map to demonstrate that the size and depth of each ditch is of adequate size to contain the flow and velocity. b. Concentrated flow will be discharging down the steep slope to the bottom of ditch. The runoff should be picked up by an inlet, such as a "D-G" endwall, at the bottom of slope to avoid a potential erosion problem. c. Coordinate with the Bridge Maintenance office as necessary. 	No VN Participation

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	Sta 384+35 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
2	Sta 384+35 LT	0.90	0.00	0.88	0.02	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.21	6.40	0.25	3.99	2.00	Off
3	Sta 384+35	0.00	0.05	0.00	0.05	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
4	Sta 384+35 RT	0.84	0.05	0.87	0.02	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.21	6.35	0.25	3.99	2.00	Off
5	Sta 382+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
6	Sta 380+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
7	Sta 380+00 LT	1.09	0.02	1.06	0.05	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.22	7.15	0.27	4.97	2.00	3
8	Sta 380+00 RT	1.09	0.02	1.06	0.05	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.22	7.15	0.27	4.97	2.00	4
9	Sta 377+50 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
10	Sta. 375+00 LT	0.90	0.00	0.88	0.02	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.21	6.40	0.25	3.99	2.00	7
11	Sta 372+00 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
12	Sta 372+00 RT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
13	Sta 375+00 RT	0.90	0.00	0.88	0.02	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.21	6.40	0.25	3.99	2.00	8
14	Sta 368+50 RT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
15	Sta 367+00 RT	1.81	0.00	1.81	0.00	Grate	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.16	3.92	0.24	3.95	2.00	Off
16	Sta 367+00 LT	1.81	0.00	1.81	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.16	4.17	0.25	4.17	2.00	Off
17	Sta 364+75 LT (M	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
18	Sta 362+50 LT (M	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
19	Sta 362+50 LT	2.83	0.00	2.30	0.54	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.31	11.30	0.36	9.87	2.00	Off
20	Sta 367+00 LT (C	4.26	0.00	3.14	1.13	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.35	13.50	0.41	12.32	2.00	Off
21	Sta. 360+75 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
22	Sta. 359+00 LT	1.69	0.01	1.70	0.00	Grate	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.15	3.67	0.23	3.79	2.00	Off

System 3

Number of lines: 33

Run Date: 05-13-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 101.98 / (Inlet time + 15.80) ^ 0.90; Return period = 25 Yrs. ; * Indicates Known Q added

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No		
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)	
23	Sta. 359+00 RT	1.69	0.01	1.70	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.15	3.83	0.24	3.89	2.00	Off	
24	Sta. 356+40 (MH)	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
25	Sta. 355+50 LT	0.78	0.00	0.78	0.01	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.20	5.90	0.23	3.79	2.00	22	
26	Sta. 355+50 RT	0.78	0.00	0.78	0.01	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.20	5.90	0.23	3.79	2.00	23	
27	Sta. 356+40 LT	3.20	0.00	2.52	0.68	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.32	11.90	0.38	10.57	2.00	Off	
28	X-Crowley Parkin	0.90	0.00	0.88	0.02	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.21	6.40	0.25	3.99	2.00	Off	
29	X-Crowley Parkin	1.51	0.00	1.38	0.13	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.25	8.40	0.30	6.47	2.00	Off	
30	X-Dunkin Donuts	0.90	0.63	1.41	0.13	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.25	8.50	0.30	6.57	2.00	33	
31	X-Dunkin Donuts	3.08	0.02	2.46	0.63	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.31	11.75	0.37	10.37	2.00	30	
32	X-Dunkin Donuts	0.84	0.00	0.83	0.02	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.20	6.15	0.24	3.89	2.00	31	
33	X-MIJI Realty	2.95	0.13	2.46	0.63	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.31	11.75	0.37	10.37	2.00	Off	

System 3

Number of lines: 33

Run Date: 05-13-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 101.98 / (Inlet time + 15.80) ^ 0.90; Return period = 25 Yrs. ; * Indicates Known Q added

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	Sta 385+10 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
2	Sta 385+33 LT	0.18	0.00	0.18	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.12	2.88	0.14	2.19	2.00	3
3	Sta 387+00 LT	0.42	0.00	0.42	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.16	3.95	0.19	3.00	2.00	7
4	Sta 387+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
5	Sta 387+90	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
6	Sta 390+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
7	Sta 390+00 LT	1.63	0.00	1.63	0.00	Grate	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.14	3.51	0.23	3.68	2.00	Off
8	Sta 392+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
9	Sta 392+50 LT	0.54	0.00	0.54	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.65	0.20	3.31	2.00	7
10	Sta 395+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
11	Sta 397+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
12	Sta 397+50 LT	0.66	0.00	0.66	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.19	5.30	0.22	3.55	2.00	15
13	Sta 397+50 RT	0.54	0.00	0.54	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.65	0.20	3.31	2.00	18
14	Sta 400+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
15	Sta 400+00 LT	1.99	0.00	1.99	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.18	5.17	0.27	5.17	2.00	Off
16	Sta. 390+00 RT	1.27	0.29	1.55	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.14	3.58	0.23	3.73	2.00	Off
17	Sta 392+50 RT	0.54	0.00	0.54	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.65	0.20	3.31	2.00	16
18	Sta 400+00 RT	1.45	0.00	1.45	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.13	3.33	0.22	3.57	2.00	Off
19	Sta 387+90 RT	1.03	0.00	0.74	0.29	Comb	6.0	2.31	0.00	2.31	1.35	0.003	2.00	0.040	0.020	0.013	0.20	8.10	0.30	6.47	2.00	16

System 4

Number of lines: 19

Run Date: 05-13-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 101.98 / (Inlet time + 15.80) ^ 0.90; Return period = 25 Yrs. ; * Indicates Known Q added

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No				
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)			
1	Sta.421+25 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off
2	Sta.424+75 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off
3	Sta.424+75 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off
4	Sta 425+00 LT	2.53	0.00	2.38	0.15	Comb	6.0	2.31	0.00	2.31	1.35	0.015	4.00	0.040	0.020	0.013	0.23	7.25	0.27	5.07	2.00	15			
5	Sta 425+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off	
6	Sta 425+00 RT	0.36	0.00	0.36	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.015	4.00	0.040	0.020	0.013	0.11	2.75	0.13	2.11	2.00	15			
7	Sta 427+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off	
8	Sta 428+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Off	
9	Sta 430+98 LT	1.75	0.00	1.75	0.00	Grate	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.15	3.79	0.24	3.86	2.00	Off			
10	Sta 705+09 LT	0.40	0.00	0.40	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.015	4.00	0.040	0.020	0.013	0.12	2.88	0.14	2.19	2.00	Off			
11	Sta 430+91 RT	2.05	0.62	2.67	0.00	Grate	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.23	7.46	0.32	7.46	2.00	Off			
12	Sta 434+30 RT	1.33	0.00	1.32	0.01	Comb	6.0	2.31	0.00	2.31	1.35	0.010	4.00	0.040	0.020	0.013	0.19	5.65	0.23	3.68	2.00	11			
13	Sta 434+30	0.35	0.00	0.35	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.010	4.00	0.040	0.020	0.013	0.12	2.93	0.14	2.22	2.00	Off			
14	Sta 434+30 LT	1.03	0.00	1.02	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.010	4.00	0.040	0.020	0.013	0.18	4.75	0.21	3.34	2.00	9			
15	Sta 428+50 RT	1.63	0.15	1.16	0.61	Grate	0.0	0.00	0.00	2.31	1.35	0.010	2.00	0.040	0.020	0.013	0.20	7.90	0.29	6.22	2.00	11			
16	Sta 427+50 LT	0.61	0.00	0.52	0.09	Comb	6.0	2.31	0.00	2.31	1.35	0.010	2.00	0.040	0.020	0.013	0.14	4.95	0.21	1.99	2.00	Off			

System 6

Number of lines: 16

Run Date: 05-13-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 101.98 / (Inlet time + 15.80) ^ 0.90 ; Return period = 25 Yrs. ; * Indicates Known Q added

APPENDIX B
SYSTEMS 1 – 7
HYDRAULIC CALCULATIONS

VN ENGINEERS, INC.

116 Washington Avenue
NORTH HAVEN, CT 06473
(203) 234-7862

JOB 27-114 URS BUSWAY

SHEET NO. _____ OF _____

CALCULATED BY JMB DATE 05-13-10

CHECKED BY CJL DATE 05-13-10

SCALE _____

CLOGGING FACTOR FOR TYPE "P-R-W" CB'S IN SAG

• ASSUME 20% CLOGGING FACTOR

DUE TO LIMITATIONS OF COMPUTER MODELING SOFTWARE
A CLOGGING FACTOR CAN NOT BE INPUT DIRECTLY
THEREFORE THE GRATE AREA WILL BE REDUCED
BY 20%

$$\begin{aligned} \text{AREA} &= 3.13 \text{ ft}^2 \text{ (20\%)} \\ \text{WITH} & \\ \text{FACTOR} &= 2.50 \text{ ft}^2 \end{aligned}$$

where:

- Q_1 = rate of discharge into grate opening, m^3/s (cfs)
- P = perimeter of grate excluding bar widths and the side against the curb, m (ft)
- C = 1.66 (3.0)
- d = depth of water above grate, m (ft)
- C_{FS} = factor of safety for clogging

The capacity of grate inlets operating as an orifice is:

$$Q_i = \frac{CA(2gd)^{0.5}}{C_{FS}} \quad (11.8)$$

solving for d:

$$d = \left(\frac{Q_i C_{FS}}{CA} \right)^2 / 2g$$

where:

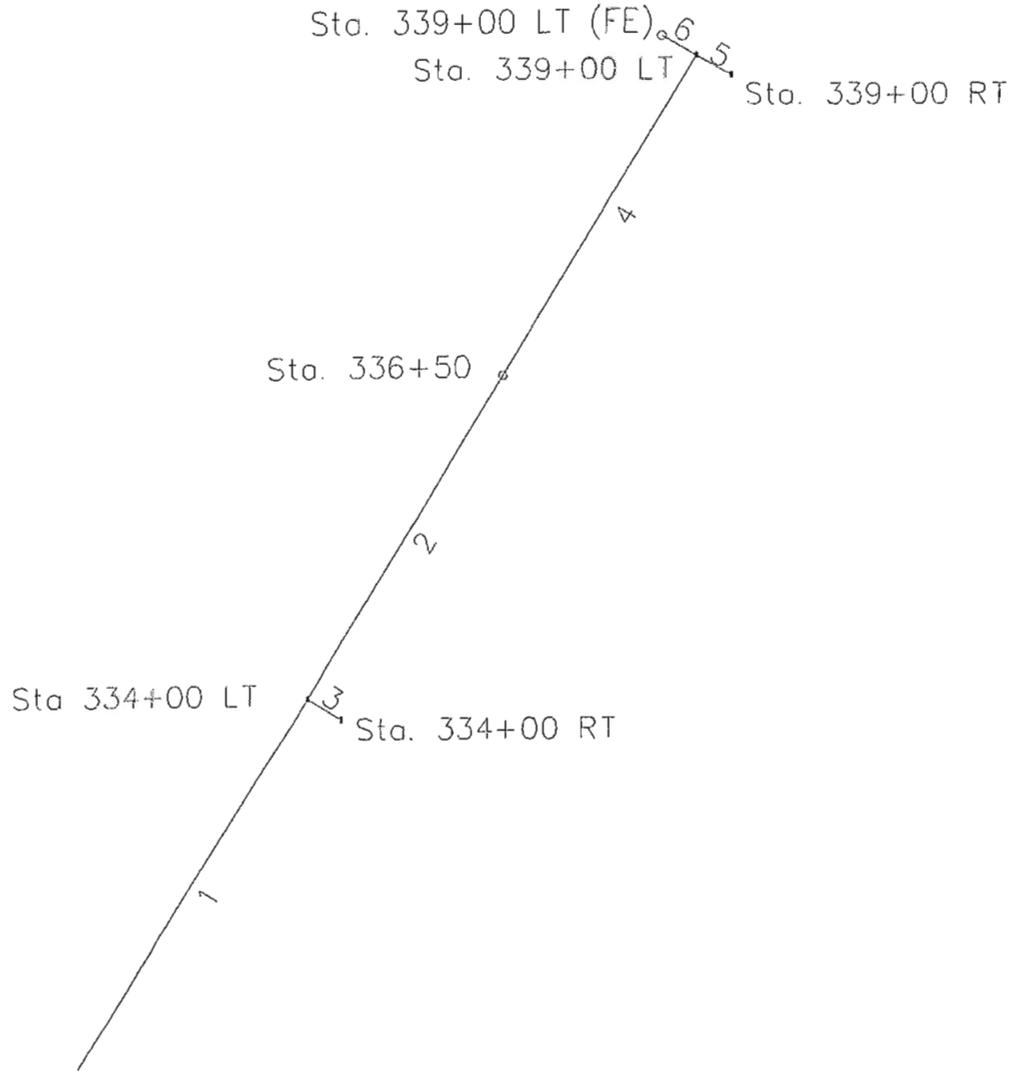
- Q_1 = rate of discharge into grate opening, m^3/s (cfs)
- C = 0.67 orifice coefficient
- A = clear opening area of the grate, m^2 (ft^2)
- g = $9.81 m/s^2$ ($32.2 ft/s^2$)
- d = depth of water above grate, m (ft)
- C_{FS} = factor of safety for clogging
 - = 1.0 – Type “C” catch basin with 0% clogging
 - = 2.0 – Type “C-L” catch basin with 50% clogging – high clogging potential
 - = $1.0 < C_{FS} < 2.0$ – Type “C-L” catch basin with 0%–50% clogging – low clogging potential. Typically for expressway medians, swales, and ditches where minimal tree growth is expected, a cfs = 1.25 for 20% clogging is appropriate.

Between depths over the grate of about 0.12m (0.4 ft.) and about 0.43m (1.4 ft.) the operation of the grate inlet is indefinite due to vortices and other disturbances. The capacity of the grate is somewhere between that given by equations 11.7 and 11.8. The larger depth is used for design purposes.

Because of the vortices and the tendency of trash to collect on the grate, a factor of safety for clogging has been added to equations 11.7 and 11.8. For Type “C-L” catch basins with a high potential for clogging a factor of safety of 2 should be used. Where danger of clogging is slight, a factor of safety less than two might be used. When a type “C” catch basin is used, the curb opening provides the safety factor from clogging therefore the factor of safety is one (1.0).

SYSTEM 1

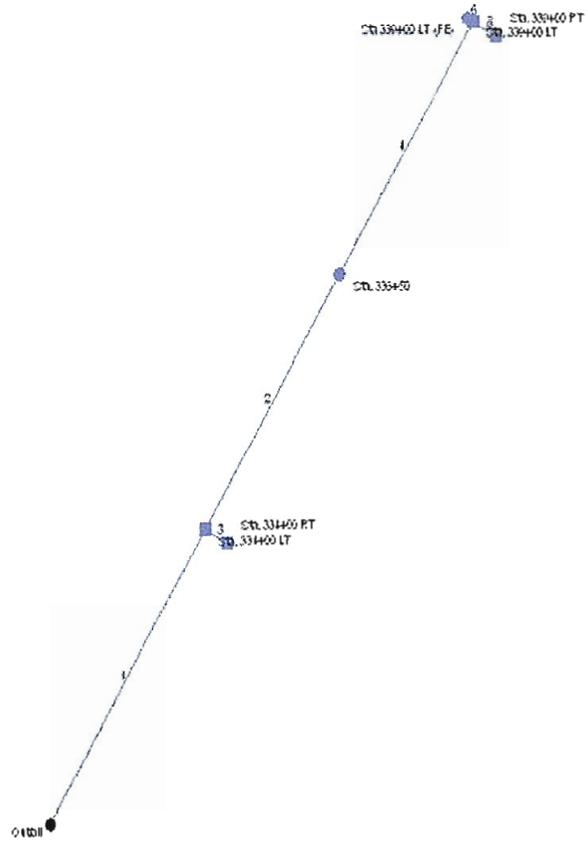
STA. 332+00 TO STA. 343+50



SYSTEM NO. 1 GRAPHIC

PERIOD: 12/1/2008 DRAWN BY: J. Barnabe CHECKED BY: C. Carpio		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	PROJECT TITLE: NEW BRITAIN - HARTFORD BUSWAY	DRAWING NO.: WEST HARTFORD/ HARTFORD 155-H025
THE INFORMATION CONTAINED HEREIN IS THE PROPERTY OF VVI ENGINEERS, INC. AND IS TO BE USED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREIN. NO PART OF THIS DOCUMENT IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF VVI ENGINEERS, INC.		ENGINEER: VVI ENGINEERS, INC. / VRS CORPORATION A/E APPROVED BY: Robert Gomez, P.E.	SHEET NO.: DRAINAGE PLAN	SHEET NO.: 155-H025
REV. DATE 12/1/2008	REVISION DESCRIPTION SYSTEM 1 GRAPHIC SHEET	NOT TO SCALE	VVI ENGINEERS, INC.	SHEET NO.: 155-H025

Hydraflow Plan View



System 1

No. Lines: 6

05-13-2010

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	Sta. 334+00 LT	3.73	15 c	286.0	63.57	65.00	0.500	65.93*	66.88*	0.22	67.10	End
2	Sta. 336+50	3.47	15 c	245.0	65.00	66.23	0.502	67.12*	67.82*	0.02	67.84	1
3	Sta. 334+00 RT	0.38	12 c	23.0	68.63	68.75	0.522	68.89	69.01	0.08	69.09	1
4	Sta. 339+00 LT	3.59	15 c	245.0	66.23	67.46	0.502	67.84	68.55	0.23	68.78	2
5	Sta. 339+00 RT	1.83	12 c	25.0	67.71	67.84	0.520	68.85*	68.92*	0.08	69.00	4
6	Sta 339+00 LT (FE)	1.45	12 c	5.0	67.71	68.73	20.400	68.88	69.24	n/a	69.24	4

System 1

Number of lines: 6

Run Date: 05-13-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown).

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	286.0	0.06	1.40	0.90	0.05	1.14	5.0	22.9	3.3	3.73	4.57	3.04	15	0.50	65.00	63.57	66.88	65.93	72.19	72.22	Sta. 334+00 LT
2	1	245.0	0.00	1.27	0.00	0.00	1.03	0.0	21.4	3.4	3.47	4.58	2.82	15	0.50	66.23	65.00	67.82	67.12	71.64	72.19	Sta. 336+50
3	1	23.0	0.07	0.07	0.90	0.06	0.06	5.0	5.0	6.0	0.38	2.57	2.32	12	0.52	68.75	68.63	69.01	68.89	72.11	72.19	Sta. 334+00 RT
4	2	245.0	0.34	1.27	0.90	0.31	1.03	5.0	20.0	3.5	3.59	4.58	3.05	15	0.50	67.46	66.23	68.55	67.84	70.72	71.64	Sta. 339+00 LT
5	4	25.0	0.34	0.34	0.90	0.31	0.31	5.0	5.0	6.0	1.83	2.57	2.33	12	0.52	67.84	67.71	68.92	68.85	70.72	70.72	Sta. 339+00 RT
6	4	5.0	0.59	0.59	0.70	0.41	0.41	20.0	20.0	3.5	1.45	16.08	2.72	12	20.40	68.73	67.71	69.24	68.88	68.73	70.72	Sta 339+00 LT (F

System 1

Number of lines: 6

Run Date: 05-13-2010

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No		
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)	
1	Sta. 334+00 LT	0.32	0.00	0.32	0.00	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.14	3.58	0.17	2.72	2.00	Off	
2	Sta. 336+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
3	Sta. 334+00 RT	0.38	0.00	0.38	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.15	3.78	0.18	2.89	2.00	Off	
4	Sta. 339+00 LT	1.83	0.00	1.83	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.16	4.17	0.25	4.17	2.00	Off	
5	Sta. 339+00 RT	1.83	0.00	1.83	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.16	4.17	0.25	4.17	2.00	Off	
6	Sta 339+00 LT (F	1.45	0.00	0.00	1.45	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.00	0.00	Off

System 1

Number of lines: 6

Run Date: 05-13-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Mino loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	15	3.73	63.57	65.93	1.25	1.23	3.04	0.14	66.07	0.334	286	65.00	66.88	1.25	1.23	3.04	0.14	67.03	0.333	0.333	0.954	1.50	0.22
2	15	3.47	65.00	67.12	1.25	1.23	2.83	0.12	67.24	0.288	245	66.23	67.82	1.25	1.23	2.82	0.12	67.95	0.288	0.288	0.706	0.15	0.02
3	12	0.38	68.63	68.89	0.26*	0.16	2.34	0.09	68.97	0.522	23.0	68.75	69.01	0.26**	0.16	2.29	0.08	69.09	0.492	0.507	0.117	1.00	0.08
4	15	3.59	66.23	67.84	1.25	1.23	2.93	0.13	67.98	0.309	245	67.46	68.55	1.09	1.13	3.17	0.16	68.70	0.283	0.296	0.725	1.50	0.23
5	12	1.83	67.71	68.85	1.00	0.79	2.33	0.08	68.94	0.265	25.0	67.84	68.92	1.00	0.79	2.33	0.08	69.00	0.265	0.265	0.066	1.00	0.08
6	12	1.45	67.71	68.88	1.00	0.79	1.84	0.05	68.94	0.166	5.0	68.73	69.24	0.51**	0.40	3.59	0.20	69.44	0.617	0.391	n/a	1.00	n/a

System 1

Number of lines: 6

Run Date: 05-13-2010

Notes: * Normal depth assumed.; ** Critical depth.

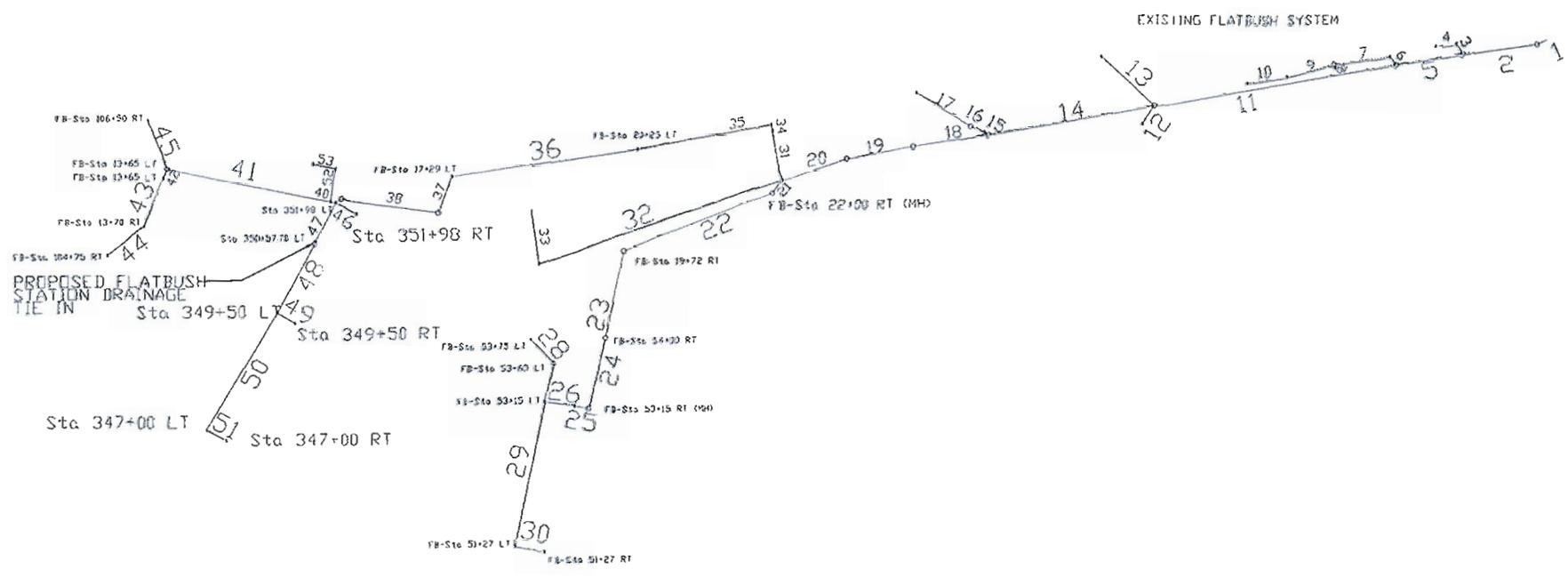
Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
1	Sta. 334+00 LT	5.0	22.9	0.013
2	Sta. 336+50	0.0	21.4	0.013
3	Sta. 334+00 RT	5.0	5.0	0.013
4	Sta. 339+00 LT	5.0	20.0	0.013
5	Sta. 339+00 RT	5.0	5.0	0.013
6	Sta 339+00 LT (FE)	20.0	20.0	0.013

System 1	Number of lines: 6	Date: 05-13-2010
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NOTES: ** Critical depth

SYSTEM 2

STA. 343+50 TO 363+00



SYSTEM NO. 2 GRAPHIC

REV. DATE	REVISION DESCRIPTION	SHEET NO.	Project: 155-025 Date: 12/22/05 THE INFORMATION CONTAINED HEREIN IS THE PROPERTY OF VN ENGINEERS, INC. AND IS TO BE USED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREIN. NO PART OF THIS DOCUMENT IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF VN ENGINEERS, INC.	DESIGNED BY: J. Bambare CHECKED BY: C. Langhear ENGINEER: VN ENGINEERS, INC. / URS CORPORATION ASS APPROVED BY: Robert Gomez, P.E.	STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION 	PROJECT TITLE: NEW BRITAIN - HARTFORD BUSWAY	DRAWING TITLE: WEST HARTFORD/ HARTFORD DRAINAGE PLAN	ACCOUNT NO.: 155-H025 SHEET NO.: 1
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Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	Exist. Flatbush	25.70	30 c	12.8	31.36	31.40	0.312	33.10	33.47	0.18	33.65	End
2	Exist. Flatbush	25.87	30 c	92.9	31.45	32.41	1.034	33.76	34.48	0.51	34.99	1
3	Exist. Flatbush	0.36	12 c	14.0	40.46	41.29	5.929	40.63	41.54	0.11	41.54	2
4	Exist. Flatbush	0.32	12 c	25.5	41.29	43.20	7.502	41.62	43.44	n/a	43.44 j	3
5	Exist. Flatbush	25.83	30 c	82.1	32.51	33.41	1.096	35.11	35.82	0.40	36.22	2
6	Exist. Flatbush	0.96	12 c	12.2	41.26	41.50	1.961	41.63	41.92	0.20	42.12	5
7	Exist. Flatbush	0.76	12 c	69.6	41.50	41.76	0.374	42.13	42.30	0.05	42.35	6
8	Exist. Flatbush	0.22	12 c	4.2	41.76	42.00	5.744	42.38	42.38	0.01	42.39	7
9	Exist. Flatbush	0.61	12 c	59.5	41.76	42.02	0.437	42.39	42.50	0.02	42.52	7
10	Exist. Flatbush	0.49	12 c	49.5	42.02	42.80	1.577	42.56	43.10	n/a	43.10 j	9
11	Exist. Flatbush	25.80	30 c	299.2	39.66	40.91	0.418	42.16*	44.96*	0.34	45.30	5
12	Exist. Flatbush	1.13	12 c	26.6	43.11	43.97	3.236	45.70*	45.76*	0.03	45.80	11
13	Exist. Flatbush	1.94	12 c	64.3	41.21	42.00	1.229	45.64*	46.09*	0.09	46.18	11
14	Exist. Flatbush	24.59	30 c	207.0	41.41	45.15	1.807	45.34	47.06	0.40	47.46	11
15	Exist. Flatbush	1.78	15 c	5.6	46.05	46.22	3.021	48.01*	48.02*	0.02	48.04	14
16	Exist. Flatbush	0.73	15 c	18.0	46.32	47.87	8.611	48.06	48.21	n/a	48.21 j	15
17	Exist. Flatbush	0.81	15 c	79.3	47.87	48.12	0.315	48.38	48.63	0.05	48.67	16
18	Exist. Flatbush	23.72	30 c	92.5	45.25	46.47	1.319	47.68	48.24	0.09	48.34	14
19	Exist. Flatbush	23.88	30 c	85.0	47.17	49.06	2.224	48.60	50.69	0.12	50.69	18
20	FB-Sta 22+00 RT	24.00	30 c	63.0	52.03	53.29	2.000	53.15	55.39	0.69	56.08	19
21	FB-Sta 21+87 RT (9.41	18 c	18.0	55.45	55.81	2.000	56.32	57.31	0.21	57.52	20
22	FB-Sta 19+72 RT	9.55	18 c	210.0	56.07	60.27	2.000	57.52	61.45	n/a	61.45 j	21
23	FB-Sta 54+00 RT	9.62	18 c	97.0	61.94	62.91	1.000	63.07	64.10	0.10	64.19	22
24	FB-Sta 53+15 RT (9.68	18 c	84.0	64.40	65.24	1.000	65.54	66.43	0.64	67.07	23
25	FB-Sta 53+15 RT	9.69	18 c	20.0	65.24	65.44	1.000	67.25*	67.42*	0.23	67.65	24
26	FB-Sta 53+15 LT	9.27	18 c	33.0	65.44	65.77	1.000	67.69*	67.95*	0.96	68.91	25
27	FB-Sta 53+60 LT	7.02	18 c	40.0	65.77	66.17	1.000	69.09*	69.27*	0.18	69.46	26
28	FB-Sta 53+75 LT	7.05	18 c	30.0	66.17	66.47	1.000	69.46*	69.59*	0.25	69.84	27
29	FB-Sta 51+27 LT	2.41	18 c	184.0	66.82	68.66	1.000	69.31	69.45	0.15	69.60	26
30	FB-Sta 51+27 RT	1.35	18 c	34.0	68.66	69.00	1.000	69.64	69.63	0.06	69.69	29
31	FB-Sta 22+00 LT	13.39	30 c	56.0	53.29	53.85	1.000	56.43*	56.49*	0.13	56.62	20
32	FB-Sta 18+70 RT	1.67	12 c	330.0	56.62	81.37	7.500	56.90	81.92	n/a	81.92	20

System 2

Number of lines: 54

Run Date: 06-25-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
33	FB-Sta 18+70 LT	1.35	12 c	63.0	81.37	82.00	1.000	82.10	82.49	n/a	82.49 j	32
34	FB-Sta 21+85 LT	12.70	30 c	15.0	53.85	54.00	1.000	56.63*	56.65*	0.11	56.75	31
35	FB-Sta 20+25 LT	12.66	30 c	156.0	54.00	55.56	1.000	56.76	56.82	0.20	57.02	34
36	FB-Sta 17+90 LT	12.04	30 c	222.0	55.56	56.67	0.500	57.33	57.83	n/a	57.83	35
37	FB-Sta 17+29 LT	11.63	30 c	63.0	60.43	60.75	0.508	61.53	61.90	0.24	62.14	36
38	FB-Sta 16+26 LT (E	11.77	30 c	90.0	60.75	61.20	0.500	62.49	62.52	0.24	62.75	37
39	Sta 351+98 LT	11.77	30 c	3.0	61.20	61.24	1.333	62.87	62.86	0.31	63.17	38
40	FB-Sta 16+13 LT	5.96	24 c	4.0	63.25	63.29	1.000	63.95	64.36	0.28	64.64	39
41	FB-Sta 13+65 LT	5.85	15 c	222.0	63.32	71.09	3.500	64.64	72.06	n/a	72.06 j	40
42	FB-Sta 13+65 LT	5.32	15 c	8.0	71.09	71.17	1.000	72.10	72.10	0.23	72.33	41
43	FB-ta 13+70 RT	2.91	12 c	62.0	71.17	71.79	1.000	72.58*	72.99*	0.18	73.17	42
44	FB-Sta 104+70 RT	2.53	12 c	73.0	71.79	72.52	1.000	73.22*	73.59*	0.16	73.75	43
45	FB-Sta. 106+50 RT	0.65	12 c	50.0	71.09	71.59	1.000	72.55	72.56	0.01	72.57	41
46	Sta 351+98 RT	0.49	12 c	25.0	65.87	66.00	0.520	66.16	66.30	0.10	66.39	39
47	Sta 350+57.7 LT	7.56	30 c	135.0	61.24	62.57	0.985	63.32	63.49	n/a	63.49 j	39
48	Sta 349+50 LT(2)	2.08	12 c	103.0	64.37	64.89	0.505	65.06	65.58	0.30	65.88	47
49	Sta 349+50 RT	0.49	12 c	25.0	66.62	66.75	0.520	66.91	67.05	0.10	67.14	48
50	Sta 347+00 LT	1.37	12 c	246.0	65.89	67.12	0.500	66.42	67.65	0.25	67.90	48
51	Sta. 347+00 RT	0.70	12 c	25.0	67.12	67.25	0.520	68.03	68.04	0.02	68.06	50
52	Sta 16+13 LT (2)	0.08	15 c	40.0	66.60	67.00	1.000	66.70	67.11	n/a	67.11	40
53	Existing	0.05	15 c	18.0	67.68	67.96	1.556	67.75	68.05	0.03	68.05	52
54	Bus Station	5.62	15 c	34.0	62.57	62.92	1.029	63.49	63.87	0.49	64.36	47

System 2

Number of lines: 54

Run Date: 06-25-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	12.8	0.00	10.86	0.00	0.00	8.58	0.0	26.7	3.0	25.70	14.90	6.48	30	0.31	31.40	31.36	33.47	33.10	41.10	41.10	Exist. Flatbush
2	1	92.9	0.00	10.86	0.00	0.00	8.58	20.0	26.4	3.0	25.87	27.10	5.70	30	1.03	32.41	31.45	34.48	33.76	46.06	41.10	Exist. Flatbush
3	2	14.0	0.01	0.07	0.90	0.01	0.06	5.0	6.0	5.7	0.36	5.64	3.15	12	5.93	41.29	40.46	41.54	40.63	44.99	46.06	Exist. Flatbush
4	3	25.5	0.06	0.06	0.90	0.05	0.05	5.0	5.0	6.0	0.32	6.34	1.82	12	7.50	43.20	41.29	43.44	41.62	45.00	44.99	Exist. Flatbush
5	2	82.1	0.00	10.79	0.00	0.00	8.52	20.0	26.1	3.0	25.83	27.91	5.29	30	1.10	33.41	32.51	35.82	35.11	46.26	46.06	Exist. Flatbush
6	5	12.2	0.05	0.21	0.90	0.05	0.19	5.0	8.6	5.1	0.96	3.24	3.34	12	1.96	41.50	41.26	41.92	41.63	45.20	46.26	Exist. Flatbush
7	6	69.6	0.00	0.16	0.00	0.00	0.14	0.0	7.6	5.3	0.76	1.42	1.60	12	0.37	41.76	41.50	42.30	42.13	45.96	45.20	Exist. Flatbush
8	7	4.2	0.04	0.04	0.90	0.04	0.04	5.0	5.0	6.0	0.22	5.55	0.61	12	5.74	42.00	41.76	42.38	42.38	45.50	45.96	Exist. Flatbush
9	7	59.5	0.03	0.12	0.90	0.03	0.11	5.0	6.3	5.6	0.61	1.53	1.39	12	0.44	42.02	41.76	42.50	42.39	45.72	45.96	Exist. Flatbush
10	9	49.5	0.09	0.09	0.90	0.08	0.08	5.0	5.0	6.0	0.49	2.91	1.82	12	1.58	42.80	42.02	43.10	42.56	46.10	45.72	Exist. Flatbush
11	5	299.2	0.00	10.58	0.00	0.00	8.33	0.0	25.2	3.1	25.80	17.23	5.26	30	0.42	40.91	39.66	44.96	42.16	47.31	46.26	Exist. Flatbush
12	11	26.6	0.21	0.21	0.90	0.19	0.19	5.0	5.0	6.0	1.13	4.16	1.44	12	3.24	43.97	43.11	45.76	45.70	48.07	47.31	Exist. Flatbush
13	11	64.3	0.36	0.36	0.90	0.32	0.32	5.0	5.0	6.0	1.94	2.57	2.47	12	1.23	42.00	41.21	46.09	45.64	47.04	47.31	Exist. Flatbush
14	11	207.0	0.00	10.01	0.00	0.00	7.82	10.0	24.5	3.1	24.59	35.83	5.57	30	1.81	45.15	41.41	47.06	45.34	53.05	47.31	Exist. Flatbush
15	14	5.6	0.22	0.37	0.90	0.20	0.33	5.0	7.5	5.3	1.78	7.29	1.45	15	3.02	46.22	46.05	48.02	48.01	52.12	53.05	Exist. Flatbush
16	15	18.0	0.00	0.15	0.00	0.00	0.14	0.0	7.0	5.4	0.73	12.32	1.64	15	8.61	47.87	46.32	48.21	48.06	53.07	52.12	Exist. Flatbush
17	16	79.3	0.15	0.15	0.90	0.14	0.14	5.0	5.0	6.0	0.81	2.36	1.74	15	0.32	48.12	47.87	48.63	48.38	55.35	53.07	Exist. Flatbush
18	14	92.5	0.00	9.64	0.00	0.00	7.48	0.0	24.1	3.2	23.72	30.62	5.62	30	1.32	46.47	45.25	48.24	47.68	54.77	53.05	Exist. Flatbush
19	18	85.0	0.00	9.64	0.00	0.00	7.48	10.0	23.9	3.2	23.88	39.75	7.62	30	2.22	49.06	47.17	50.69	48.60	59.00	54.77	Exist. Flatbush
20	19	63.0	0.26	9.64	0.90	0.23	7.48	5.0	23.6	3.2	24.00	58.00	8.35	30	2.00	53.29	52.03	55.39	53.15	61.50	59.00	FB-Sta 22+00 RT
21	20	18.0	0.00	4.04	0.00	0.00	2.93	0.0	23.6	3.2	9.41	14.85	7.11	18	2.00	55.81	55.45	57.31	56.32	60.00	61.50	FB-Sta 21+87 RT

System 2	Number of lines: 54	Run Date: 06-25-2010
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NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
22	21	210.0	0.00	4.04	0.00	0.00	2.93	0.0	22.9	3.3	9.55	14.85	5.93	18	2.00	60.27	56.07	61.45	57.52	65.00	60.00	FB-Sta 19+72 RT
23	22	97.0	0.00	4.04	0.00	0.00	2.93	0.0	22.7	3.3	9.62	10.50	6.58	18	1.00	62.91	61.94	64.10	63.07	68.50	65.00	FB-Sta 54+00 RT
24	23	84.0	0.00	4.04	0.00	0.00	2.93	0.0	22.4	3.3	9.68	10.50	6.59	18	1.00	65.24	64.40	66.43	65.54	72.00	68.50	FB-Sta 53+15 RT
25	24	20.0	0.15	4.04	0.90	0.14	2.93	5.0	22.4	3.3	9.69	10.50	5.48	18	1.00	65.44	65.24	67.42	67.25	77.00	72.00	FB-Sta 53+15 RT
26	25	33.0	0.11	3.89	0.90	0.10	2.80	5.0	22.2	3.3	9.27	10.50	5.24	18	1.00	65.77	65.44	67.95	67.69	77.00	77.00	FB-Sta 53+15 LT
27	26	40.0	0.00	2.87	0.00	0.00	2.01	0.0	20.1	3.5	7.02	10.50	3.98	18	1.00	66.17	65.77	69.27	69.09	79.02	77.00	FB-Sta 53+60 LT
28	27	30.0	2.87	2.87	0.70	2.01	2.01	20.0	20.0	3.5	7.05	10.50	3.99	18	1.00	66.47	66.17	69.59	69.46	71.00	79.02	FB-Sta 53+75 LT
29	26	184.0	0.66	0.91	0.70	0.46	0.69	20.0	20.0	3.5	2.41	10.50	1.96	18	1.00	68.66	66.82	69.45	69.31	73.00	77.00	FB-Sta 51+27 LT
30	29	34.0	0.25	0.25	0.90	0.23	0.23	5.0	5.0	6.0	1.35	10.50	1.51	18	1.00	69.00	68.66	69.63	69.64	73.00	73.00	FB-Sta 51+27 RT
31	20	56.0	0.24	5.02	0.90	0.22	4.03	5.0	22.2	3.3	13.39	41.01	2.73	30	1.00	53.85	53.29	56.49	56.43	61.50	61.50	FB-Sta 22+00 LT
32	20	330.0	0.07	0.32	0.90	0.06	0.29	5.0	5.6	5.8	1.67	9.75	6.54	12	7.50	81.37	56.62	81.92	56.90	85.00	61.50	FB-Sta 18+70 RT
33	32	63.0	0.25	0.25	0.90	0.23	0.23	5.0	5.0	6.0	1.35	3.56	2.85	12	1.00	82.00	81.37	82.49	82.10	85.00	85.00	FB-Sta 18+70 LT
34	31	15.0	0.09	4.78	0.90	0.08	3.81	5.0	22.1	3.3	12.70	41.01	2.59	30	1.00	54.00	53.85	56.65	56.63	60.00	61.50	FB-Sta 21+85 LT
35	34	156.0	0.31	4.69	0.90	0.28	3.73	5.0	21.3	3.4	12.66	41.01	3.85	30	1.00	55.56	54.00	56.82	56.76	64.00	60.00	FB-Sta 20+25 LT
36	35	222.0	0.16	4.38	0.90	0.14	3.45	5.0	20.3	3.5	12.04	29.00	4.32	30	0.50	56.67	55.56	57.83	57.33	70.00	64.00	FB-Sta 17+90 LT
37	36	63.0	0.00	4.22	0.00	0.00	3.31	0.0	19.9	3.5	11.63	29.23	5.46	30	0.51	60.75	60.43	61.90	61.53	70.00	70.00	FB-Sta 17+29 LT
38	37	90.0	0.00	4.22	0.00	0.00	3.31	0.0	19.5	3.6	11.77	29.00	3.86	30	0.50	61.20	60.75	62.52	62.49	69.00	70.00	FB-Sta 16+26 LT
39	38	3.0	0.09	4.22	0.90	0.08	3.31	5.0	19.5	3.6	11.77	47.36	3.44	30	1.33	61.24	61.20	62.86	62.87	69.38	69.00	Sta 351+98 LT
40	39	4.0	0.70	1.86	0.90	0.63	1.67	5.0	19.5	3.6	5.96	22.62	4.78	24	1.00	63.29	63.25	64.36	63.95	69.00	69.38	FB-Sta 16+13 LT
41	40	222.0	0.00	1.14	0.00	0.00	1.03	0.0	6.0	5.7	5.85	12.08	5.25	15	3.50	71.09	63.32	72.06	64.64	78.00	69.00	FB-Sta 13+65 LT
42	41	8.0	0.47	1.02	0.90	0.42	0.92	5.0	5.7	5.8	5.32	6.46	5.24	15	1.00	71.17	71.09	72.10	72.10	78.00	78.00	FB-Sta 13+65 LT

System 2

Number of lines: 54

Run Date: 06-25-2010

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
43	42	62.0	0.08	0.55	0.90	0.07	0.50	5.0	5.4	5.9	2.91	3.56	3.70	12	1.00	71.79	71.17	72.99	72.58	78.00	78.00	FB-ta 13+70 RT
44	43	73.0	0.47	0.47	0.90	0.42	0.42	5.0	5.0	6.0	2.53	3.56	3.23	12	1.00	72.52	71.79	73.59	73.22	76.00	78.00	FB-Sta 104+70 R
45	41	50.0	0.12	0.12	0.90	0.11	0.11	5.0	5.0	6.0	0.65	3.56	0.83	12	1.00	71.59	71.09	72.56	72.55	77.00	78.00	FB-Sta. 106+50
46	39	25.0	0.09	0.09	0.90	0.08	0.08	5.0	5.0	6.0	0.49	2.57	2.49	12	0.52	66.00	65.87	66.30	66.16	69.38	69.38	Sta 351+98 RT
47	39	135.0	0.00	2.18	0.00	0.00	1.47	0.0	8.4	5.1	7.56	40.71	3.18	30	0.99	62.57	61.24	63.49	63.32	70.05	69.38	Sta 350+57.7 LT
48	47	103.0	0.09	0.44	0.90	0.08	0.40	5.0	7.8	5.3	2.08	2.53	3.60	12	0.50	64.89	64.37	65.58	65.06	70.28	70.05	Sta 349+50 LT(2)
49	48	25.0	0.09	0.09	0.90	0.08	0.08	5.0	5.0	6.0	0.49	2.57	2.49	12	0.52	66.75	66.62	67.05	66.91	70.28	70.28	Sta 349+50 RT
50	48	246.0	0.13	0.26	0.90	0.12	0.23	5.0	5.5	5.9	1.37	2.52	3.27	12	0.50	67.12	65.89	67.65	66.42	70.87	70.28	Sta 347+00 LT
51	50	25.0	0.13	0.13	0.90	0.12	0.12	5.0	5.0	6.0	0.70	2.57	0.99	12	0.52	67.25	67.12	68.04	68.03	70.87	70.87	Sta. 347+00 RT
52	40	40.0	0.01	0.02	0.90	0.01	0.02	5.0	11.8	4.5	0.08	6.46	1.63	15	1.00	67.00	66.60	67.11	66.70	70.50	69.00	Sta 16+13 LT (2)
53	52	18.0	0.01	0.01	0.90	0.01	0.01	5.0	5.0	6.0	0.05	8.05	1.58	15	1.56	67.96	67.68	68.05	67.75	70.66	70.50	Existing
54	47	34.0	1.74	1.74	0.62	1.08	1.08	8.0	8.0	5.2	5.62	6.55	5.69	15	1.03	62.92	62.57	63.87	63.49	69.72	70.05	Bus Station

System 2 Number of lines: 54 Run Date: 06-25-2010

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	Exist. Flatbush	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
2	Exist. Flatbush	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
3	Exist. Flatbush	0.05	0.00	0.05	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.020	0.020	0.013	0.02	0.80	0.03	0.41	2.00	Off
4	Exist. Flatbush	0.32	0.00	0.32	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.020	0.020	0.013	0.03	1.60	0.05	0.78	2.00	3
5	Exist. Flatbush	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
6	Exist. Flatbush	0.27	0.00	0.27	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.020	0.020	0.013	0.03	1.50	0.04	0.73	2.00	4
7	Exist. Flatbush	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
8	Exist. Flatbush	0.22	0.00	0.22	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.020	0.020	0.013	0.03	1.35	0.04	0.66	2.00	6
9	Exist. Flatbush	0.16	0.00	0.16	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.020	0.020	0.013	0.03	1.25	0.04	0.60	2.00	8
10	Exist. Flatbush	0.49	0.00	0.49	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.020	0.020	0.013	0.04	1.85	0.06	0.91	2.00	9
11	Exist. Flatbush	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
12	Exist. Flatbush	1.13	0.00	1.13	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.020	0.020	0.013	0.05	2.50	0.08	1.23	2.00	Off
13	Exist. Flatbush	1.94	0.00	0.12	1.82	Curb	6.0	2.31	0.00	0.00	0.00	2.500	4.00	0.020	0.020	0.013	0.06	3.05	0.09	1.51	2.00	Off
14	Exist. Flatbush	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
15	Exist. Flatbush	1.19	0.00	1.19	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.020	0.020	0.013	0.05	2.55	0.08	1.26	2.00	Off
16	Exist. Flatbush	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
17	Exist. Flatbush	0.81	0.00	0.81	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.020	0.020	0.013	0.04	2.20	0.07	1.09	2.00	13
18	Exist. Flatbush	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
19	Exist. Flatbush	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
20	FB-Sta 22+00 RT	1.40	0.00	1.40	0.00	Comb	6.0	2.31	0.00	2.31	1.35	7.499	4.00	0.080	0.020	0.013	0.07	0.92	0.07	1.09	2.00	15
21	FB-Sta 21+87 RT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
22	FB-Sta 19+72 RT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off

System 2

Number of lines: 54

Run Date: 06-25-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (In)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
23	FB-Sta 54+00 RT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
24	FB-Sta 53+15 RT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
25	FB-Sta 53+15 RT	0.81	0.00	0.81	0.00	Comb	6.0	2.31	0.00	2.31	1.35	4.500	4.00	0.040	0.020	0.013	0.05	1.27	0.06	0.97	2.00	Off
26	FB-Sta 53+15 LT	0.59	0.00	0.59	0.00	Comb	6.0	2.31	0.00	2.31	1.35	4.500	4.00	0.040	0.020	0.013	0.05	1.15	0.05	0.88	2.00	28
27	FB-Sta 53+60 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
28	FB-Sta 53+75 LT	7.05	0.00	7.05	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.020	0.020	0.000	0.44	22.17	0.61	22.17	2.00	Off
29	FB-Sta 51+27 LT	1.62	0.00	1.62	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.020	0.020	0.000	0.06	3.17	0.23	3.73	2.00	Off
30	FB-Sta 51+27 RT	1.35	0.00	1.35	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.020	0.020	0.000	0.04	2.17	0.21	3.41	2.00	Off
31	FB-Sta 22+00 LT	1.29	0.00	1.29	0.00	Comb	6.0	2.31	0.00	2.31	1.35	7.500	4.00	0.040	0.020	0.013	0.06	1.40	0.06	1.05	2.00	20
32	FB-Sta 18+70 RT	0.38	0.00	0.38	0.00	Comb	6.0	2.31	0.00	2.31	1.35	7.500	4.00	0.040	0.020	0.013	0.04	0.87	0.04	0.66	2.00	17
33	FB-Sta 18+70 LT	1.35	0.00	1.35	0.00	Grate	6.0	2.31	0.00	2.31	1.35	7.500	4.00	0.040	0.020	0.013	0.06	1.42	0.07	1.07	2.00	26
34	FB-Sta 21+85 LT	0.49	0.00	0.49	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.040	0.020	0.013	0.05	1.20	0.06	0.91	2.00	Off
35	FB-Sta 20+25 LT	1.67	0.00	1.67	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.040	0.020	0.013	0.07	1.87	0.09	1.43	2.00	34
36	FB-17+90 LT	0.86	0.00	0.86	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.040	0.020	0.013	0.06	1.47	0.07	1.12	2.00	35
37	FB-Sta 17+29 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
38	FB-Sta 16+26 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
39	Sta 351+98 LT	0.49	0.00	0.49	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.30	0.20	3.16	2.00	Off
40	FB-Sta 16+13 LT	3.77	0.00	3.77	0.00	Comb	6.0	2.31	0.00	2.31	1.35	2.500	4.00	0.040	0.020	0.013	0.10	2.55	0.12	1.95	2.00	39
41	FB-Sta 13+65 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
42	FB-Sta 13+65 LT	2.53	0.00	2.53	0.00	Comb	6.0	2.31	0.00	2.31	1.35	7.500	4.00	0.040	0.020	0.013	0.07	1.80	0.08	1.36	2.00	45
43	FB-Sta 13+70 RT	0.43	0.00	0.43	0.00	Comb	6.0	2.31	0.00	2.31	1.35	7.500	4.00	0.040	0.020	0.013	0.04	0.92	0.04	0.71	2.00	44
44	FB-Sta 104+70 R	2.53	0.00	2.53	0.00	Comb	6.0	2.31	0.00	2.31	1.35	7.500	4.00	0.040	0.020	0.013	0.07	1.80	0.08	1.36	2.00	Off

System 2 Number of lines: 54 Run Date: 06-25-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (In)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
45	FB-106+50 RT	0.65	0.00	0.65	0.00	Comb	6.0	2.31	0.00	2.31	1.35	7.500	4.00	0.040	0.020	0.013	0.04	1.08	0.05	0.83	2.00	Off
46	Sta 351+98 RT	0.49	0.00	0.49	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.30	0.20	3.16	2.00	52
47	Sta 350+57.7 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
48	Sta 349+50 LT	0.49	0.00	0.49	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.35	0.20	3.18	2.00	47
49	Sta 349+50 RT	0.49	0.00	0.49	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.35	0.20	3.18	2.00	46
50	Sta 347+00 LT	0.70	0.00	0.70	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.19	5.50	0.22	3.63	2.00	48
51	Sta. 347+00 RT	0.70	0.00	0.70	0.00	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.19	5.50	0.22	3.63	2.00	49
52	Sta 16+13 LT (2)	0.05	0.00	0.05	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.005	4.00	0.040	0.020	0.013	0.07	1.67	0.08	1.26	2.00	Off
53	Existing	0.05	0.00	0.05	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.005	4.00	0.040	0.020	0.013	0.07	1.67	0.08	1.26	2.00	52
54	Bus Station	5.62	0.00	0.00	5.62	MH	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.080	0.050	0.013	0.00	0.00	0.00	0.00	0.00	Off

System 2

Number of lines: 54

Run Date: 06-25-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	30	25.70	31.36	33.10	1.74	3.65	7.05	0.77	33.87	1.346	12.8	31.40	33.47	2.07	4.35	5.91	0.54	34.02	0.911	1.129	0.144	0.33	0.18
2	30	25.87	31.45	33.76	2.31	4.74	5.46	0.46	34.23	0.816	92.9	32.41	34.48	2.07	4.35	5.95	0.55	35.03	0.923	0.870	0.808	0.92	0.51
3	12	0.36	40.46	40.63	0.17*	0.09	4.01	0.25	40.88	5.913	14.0	41.29	41.54	0.25**	0.16	2.28	0.08	41.63	1.202	3.557	n/a	1.37	0.11
4	12	0.32	41.29	41.62	0.33	0.23	1.42	0.03	41.65	0.343	25.5	43.20	43.44 j	0.24**	0.15	2.22	0.08	43.52	1.200	0.772	n/a	1.00	0.08
5	30	25.83	32.51	35.11	2.50	4.91	5.26	0.43	35.54	0.939	82.1	33.41	35.82	2.41	4.85	5.32	0.44	36.26	0.821	0.880	0.722	0.90	0.40
6	12	0.96	41.26	41.63	0.37*	0.27	3.59	0.20	41.83	1.959	12.2	41.50	41.92	0.42**	0.31	3.08	0.15	42.07	1.290	1.625	0.199	1.34	0.20
7	12	0.76	41.50	42.13	0.63	0.52	1.46	0.03	42.17	0.206	69.6	41.76	42.30	0.54	0.44	1.75	0.05	42.35	0.329	0.267	0.186	1.00	0.05
8	12	0.22	41.76	42.38	0.62	0.51	0.42	0.00	42.38	0.017	4.2	42.00	42.38	0.38	0.27	0.80	0.01	42.39	0.096	0.057	0.002	1.00	0.01
9	12	0.61	41.76	42.39	0.63	0.52	1.16	0.02	42.41	0.131	59.5	42.02	42.50	0.48	0.37	1.62	0.04	42.54	0.312	0.221	0.132	0.50	0.02
10	12	0.49	42.02	42.56	0.54	0.43	1.13	0.02	42.58	0.138	49.5	42.80	43.10 j	0.30**	0.19	2.50	0.10	43.19	1.216	0.677	n/a	1.00	n/a
11	30	25.80	39.66	42.16	2.50*	4.91	5.26	0.43	42.59	0.937	299	40.91	44.96	2.50	4.91	5.26	0.43	45.39	0.937	0.937	2.804	0.79	0.34
12	12	1.13	43.11	45.70	1.00	0.79	1.44	0.03	45.73	0.239	26.6	43.97	45.76	1.00	0.79	1.44	0.03	45.80	0.239	0.239	0.064	1.00	0.03
13	12	1.94	41.21	45.64	1.00	0.79	2.47	0.09	45.73	0.703	64.3	42.00	46.09	1.00	0.79	2.47	0.09	46.18	0.703	0.703	0.452	1.00	0.09
14	30	24.59	41.41	45.34	2.50	4.91	5.01	0.39	45.73	0.852	207	45.15	47.06	1.91	4.01	6.13	0.58	47.64	0.986	0.919	1.902	0.69	0.40
15	15	1.78	46.05	48.01	1.25	1.23	1.45	0.03	48.04	0.179	5.6	46.22	48.02	1.25	1.23	1.45	0.03	48.05	0.179	0.179	0.010	0.50	0.02
16	15	0.73	46.32	48.06	1.25	1.23	0.60	0.01	48.07	0.031	18.0	47.87	48.21 j	0.34**	0.27	2.69	0.11	48.33	1.131	0.581	n/a	0.15	0.02
17	15	0.81	47.87	48.38	0.51*	0.46	1.74	0.05	48.42	0.315	79.3	48.12	48.63	0.51	0.46	1.74	0.05	48.67	0.315	0.315	0.250	1.00	0.05
18	30	23.72	45.25	47.68	2.43	4.87	4.87	0.37	48.05	0.698	92.5	46.47	48.24	1.77	3.72	6.37	0.63	48.87	1.091	0.895	0.828	0.15	0.09
19	30	23.88	47.17	48.60	1.43	2.90	8.22	1.05	49.65	2.059	85.0	49.06	50.69	1.63**	3.40	7.03	0.77	51.46	1.382	1.721	n/a	0.15	0.12
20	30	24.00	52.03	53.15	1.12*	2.13	11.25	1.97	55.12	1.998	63.0	53.29	55.39	2.10	4.41	5.45	0.46	55.85	0.328	1.163	0.733	1.50	0.69
21	18	9.41	55.45	56.32	0.87*	1.06	8.89	1.23	57.55	2.000	18.0	55.81	57.31	1.50	1.77	5.32	0.44	57.75	0.789	1.395	0.251	0.48	0.21

System 2

Number of lines: 54

Run Date: 06-25-2010

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
22	18	9.55	56.07	57.52	1.45	1.75	5.46	0.46	57.98	0.726	210	60.27	61.45 j	1.18**	1.49	6.41	0.64	62.09	0.896	0.811	n/a	0.99	n/a
23	18	9.62	61.94	63.07	1.13*	1.43	6.74	0.71	63.78	0.999	97.0	62.91	64.10	1.19**	1.50	6.41	0.64	64.74	0.898	0.948	0.920	0.15	0.10
24	18	9.68	64.40	65.54	1.14*	1.44	6.74	0.71	66.24	1.000	84.0	65.24	66.43	1.19**	1.50	6.43	0.64	67.07	0.903	0.951	0.799	1.00	0.64
25	18	9.69	65.24	67.25	1.50	1.77	5.48	0.47	67.72	0.852	20.0	65.44	67.42	1.50	1.77	5.48	0.47	67.89	0.851	0.852	0.170	0.50	0.23
26	18	9.27	65.44	67.69	1.50	1.77	5.24	0.43	68.12	0.779	33.0	65.77	67.95	1.50	1.77	5.24	0.43	68.38	0.779	0.779	0.257	2.25	0.96
27	18	7.02	65.77	69.09	1.50	1.77	3.98	0.25	69.34	0.448	40.0	66.17	69.27	1.50	1.77	3.97	0.25	69.52	0.447	0.448	0.179	0.75	0.18
28	18	7.05	66.17	69.46	1.50	1.77	3.99	0.25	69.71	0.451	30.0	66.47	69.59	1.50	1.77	3.99	0.25	69.84	0.450	0.450	0.135	1.00	0.25
29	18	2.41	66.82	69.31	1.50	1.77	1.36	0.03	69.34	0.053	184	68.66	69.45	0.79	0.94	2.55	0.10	69.55	0.177	0.115	0.211	1.50	0.15
30	18	1.35	68.66	69.64	0.98	1.22	1.10	0.02	69.66	0.028	34.0	69.00	69.63	0.63	0.70	1.92	0.06	69.69	0.122	0.075	0.026	1.00	0.06
31	30	13.39	53.29	56.43	2.50	4.91	2.73	0.12	56.55	0.107	56.0	53.85	56.49	2.50	4.91	2.73	0.12	56.61	0.107	0.107	0.060	1.13	0.13
32	12	1.67	56.62	56.90	0.28*	0.18	9.28	1.34	58.24	7.495	330	81.37	81.92	0.55**	0.44	3.79	0.22	82.14	0.649	4.072	n/a	1.50	n/a
33	12	1.35	81.37	82.10	0.73	0.61	2.21	0.08	82.17	0.186	63.0	82.00	82.49 j	0.49**	0.39	3.50	0.19	82.68	0.604	0.395	n/a	1.00	0.19
34	30	12.70	53.85	56.63	2.50	4.91	2.59	0.10	56.74	0.096	15.0	54.00	56.65	2.50	4.91	2.59	0.10	56.75	0.096	0.096	0.014	1.04	0.11
35	30	12.66	54.00	56.76	2.50	4.91	2.58	0.10	56.86	0.095	156	55.56	56.82	1.26	2.47	5.12	0.41	57.22	0.373	0.234	0.365	0.50	0.20
36	30	12.04	55.56	57.33	1.77	3.73	3.23	0.16	57.50	0.119	222	56.67	57.83	1.16**	2.23	5.40	0.45	58.28	0.446	0.283	n/a	0.72	n/a
37	30	11.63	60.43	61.53	1.10*	2.07	5.61	0.49	62.02	0.507	63.0	60.75	61.90	1.15**	2.20	5.30	0.44	62.33	0.434	0.471	0.297	0.56	0.24
38	30	11.77	60.75	62.49	1.74	3.64	3.23	0.16	62.65	0.120	90.0	61.20	62.52	1.32	2.62	4.50	0.31	62.83	0.278	0.199	0.179	0.75	0.24
39	30	11.77	61.20	62.87	1.67	3.48	3.38	0.18	63.05	0.134	3.0	61.24	62.86	1.62	3.37	3.49	0.19	63.05	0.145	0.139	0.004	1.61	0.31
40	24	5.96	63.25	63.95	0.70*	0.98	6.07	0.57	64.52	0.999	4.0	63.29	64.36	1.07	1.71	3.49	0.19	64.55	0.222	0.610	0.024	1.50	0.28
41	15	5.85	63.32	64.64	1.25	1.23	4.77	0.35	65.00	0.820	222	71.09	72.06 j	0.97**	1.02	5.74	0.51	72.57	0.918	0.869	n/a	1.00	0.51
42	15	5.32	71.09	72.10	1.01	1.06	5.03	0.39	72.49	0.703	8.0	71.17	72.10	0.93**	0.97	5.46	0.46	72.56	0.841	0.772	0.062	0.50	0.23

System 2

Number of lines: 54

Run Date: 06-25-2010

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
43	12	2.91	71.17	72.58	1.00	0.79	3.71	0.21	72.79	0.668	62.0	71.79	72.99	1.00	0.79	3.70	0.21	73.21	0.668	0.668	0.414	0.83	0.18
44	12	2.53	71.79	73.22	1.00	0.79	3.23	0.16	73.38	0.506	73.0	72.52	73.59	1.00	0.79	3.23	0.16	73.75	0.506	0.506	0.370	1.00	0.16
45	12	0.65	71.09	72.55	1.00	0.79	0.82	0.01	72.56	0.033	50.0	71.59	72.56	0.97	0.78	0.83	0.01	72.57	0.029	0.031	0.016	1.00	0.01
46	12	0.49	65.87	66.16	0.29*	0.19	2.51	0.10	66.26	0.519	25.0	66.00	66.30	0.30**	0.20	2.47	0.10	66.39	0.499	0.509	0.127	1.00	0.10
47	30	7.56	61.24	63.32	2.08	4.37	1.73	0.05	63.37	0.033	135	62.57	63.49	0.92**	1.64	4.62	0.33	63.82	0.409	0.221	n/a	0.80	0.27
48	12	2.08	64.37	65.06	0.69*	0.58	3.60	0.20	65.26	0.505	103	64.89	65.58	0.69	0.58	3.60	0.20	65.78	0.506	0.505	0.520	1.50	0.30
49	12	0.49	66.62	66.91	0.29*	0.19	2.51	0.10	67.01	0.519	25.0	66.75	67.05	0.30**	0.20	2.47	0.10	67.14	0.499	0.509	0.127	1.00	0.10
50	12	1.37	65.89	66.42	0.53*	0.42	3.27	0.17	66.58	0.499	246	67.12	67.65	0.53	0.42	3.27	0.17	67.81	0.498	0.499	1.227	1.50	0.25
51	12	0.70	67.12	68.03	0.91	0.75	0.93	0.01	68.05	0.034	25.0	67.25	68.04	0.79	0.67	1.05	0.02	68.06	0.041	0.038	0.009	1.00	0.02
52	15	0.08	66.60	66.70	0.10*	0.04	1.81	0.05	66.75	0.999	40.0	67.00	67.11	0.11**	0.06	1.45	0.03	67.15	0.534	0.767	n/a	1.50	n/a
53	15	0.05	67.68	67.75	0.07*	0.03	1.86	0.05	67.81	1.552	18.0	67.96	68.05	0.09**	0.04	1.31	0.03	68.08	0.560	1.056	n/a	1.00	0.03
54	15	5.62	62.57	63.49	0.92	0.97	5.78	0.52	64.01	0.942	34.0	62.92	63.87	0.95**	1.00	5.61	0.49	64.36	0.881	0.912	0.310	1.00	0.49

System 2

Number of lines: 54

Run Date: 06-25-2010

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
1	Exist. Flatbush	0.0	26.7	0.020
2	Exist. Flatbush	20.0	26.4	0.020
3	Exist. Flatbush	5.0	6.0	0.020
4	Exist. Flatbush	5.0	5.0	0.020
5	Exist. Flatbush	20.0	26.1	0.020
6	Exist. Flatbush	5.0	8.6	0.020
7	Exist. Flatbush	0.0	7.6	0.020
8	Exist. Flatbush	5.0	5.0	0.020
9	Exist. Flatbush	5.0	6.3	0.020
10	Exist. Flatbush	5.0	5.0	0.020
11	Exist. Flatbush	0.0	25.2	0.020
12	Exist. Flatbush	5.0	5.0	0.020
13	Exist. Flatbush	5.0	5.0	0.020
14	Exist. Flatbush	10.0	24.5	0.020
15	Exist. Flatbush	5.0	7.5	0.020
16	Exist. Flatbush	0.0	7.0	0.020
17	Exist. Flatbush	5.0	5.0	0.020
18	Exist. Flatbush	0.0	24.1	0.020
19	Exist. Flatbush	10.0	23.9	0.020
20	FB-Sta 22+00 RT	5.0	23.6	0.013
21	FB-Sta 21+87 RT (MH)	0.0	23.6	0.013

System 2

Number of lines: 54

Date: 06-25-2010

NOTES: ** Critical depth

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
22	FB-Sta 19+72 RT	0.0	22.9	0.013
23	FB-Sta 54+00 RT	0.0	22.7	0.013
24	FB-Sta 53+15 RT (MH)	0.0	22.4	0.013
25	FB-Sta 53+15 RT	5.0	22.4	0.013
26	FB-Sta 53+15 LT	5.0	22.2	0.013
27	FB-Sta 53+60 LT	0.0	20.1	0.013
28	FB-Sta 53+75 LT	20.0	20.0	0.013
29	FB-Sta 51+27 LT	20.0	20.0	0.013
30	FB-Sta 51+27 RT	5.0	5.0	0.013
31	FB-Sta 22+00 LT	5.0	22.2	0.013
32	FB-Sta 18+70 RT	5.0	5.6	0.013
33	FB-Sta 18+70 LT	5.0	5.0	0.013
34	FB-Sta 21+85 LT	5.0	22.1	0.013
35	FB-Sta 20+25 LT	5.0	21.3	0.013
36	FB-17+90 LT	5.0	20.3	0.013
37	FB-Sta 17+29 LT	0.0	19.9	0.013
38	FB-Sta 16+26 LT (EXIST)	0.0	19.5	0.013
39	Sta 351+98 LT	5.0	19.5	0.013
40	FB-Sta 16+13 LT	5.0	19.5	0.013
41	FB-Sta 13+65 LT	0.0	6.0	0.013
42	FB-Sta 13+65 LT	5.0	5.7	0.013

System 2

Number of lines: 54

Date: 06-25-2010

NOTES: ** Critical depth

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
43	FB-Sta 13+70 RT	5.0	5.4	0.013
44	FB-Sta 104+70 RT	5.0	5.0	0.013
45	FB-106+50 RT	5.0	5.0	0.013
46	Sta 351+98 RT	5.0	5.0	0.013
47	Sta 350+57.7 LT	0.0	8.4	0.013
48	Sta 349+50 LT	5.0	7.8	0.013
49	Sta 349+50 RT	5.0	5.0	0.013
50	Sta 347+00 LT	5.0	5.5	0.013
51	Sta. 347+00 RT	5.0	5.0	0.013
52	Sta 16+13 LT (2)	5.0	11.8	0.013
53	Existing	5.0	5.0	0.013
54	Bus Station	8.0	8.0	0.013

System 2

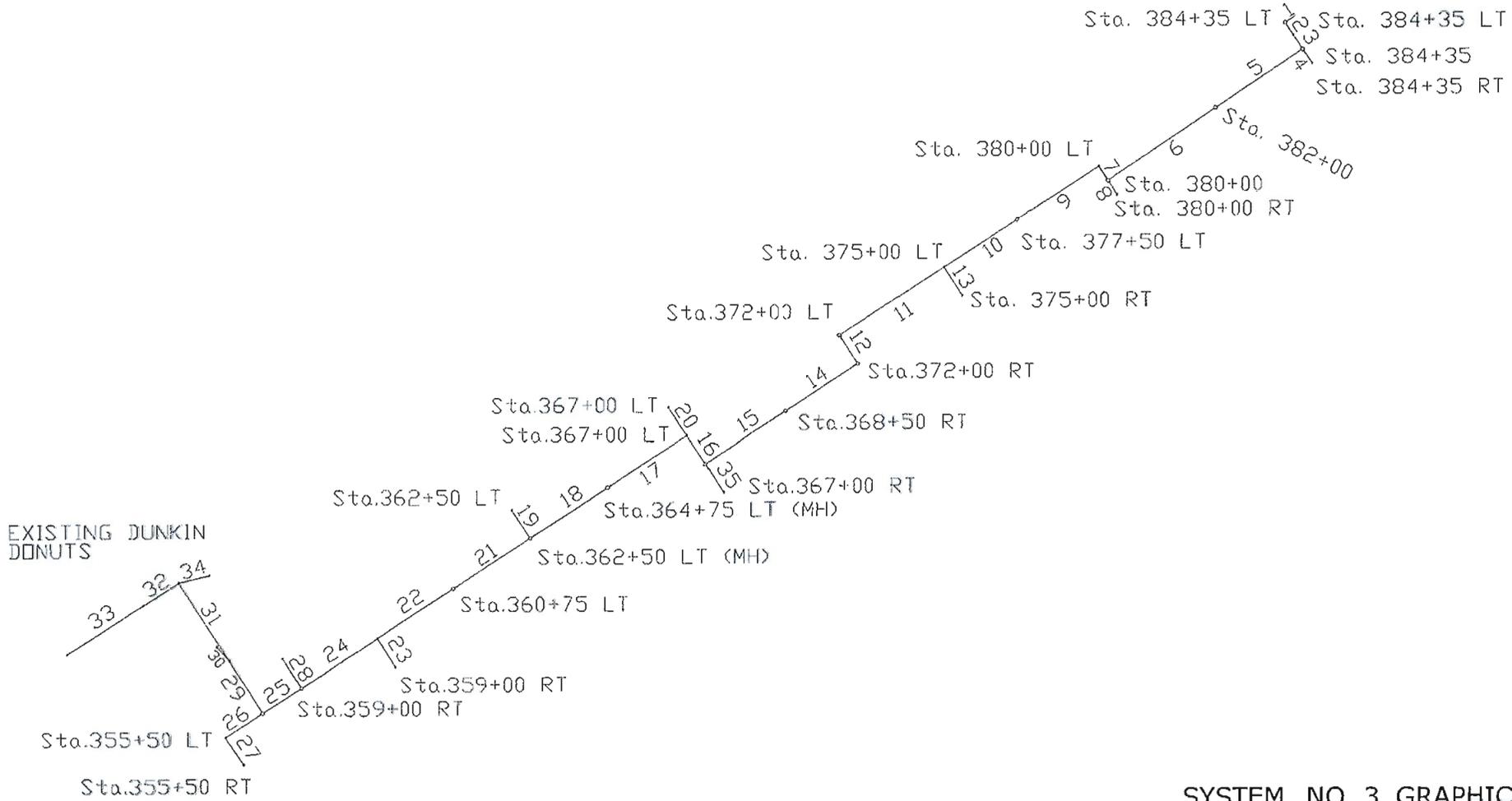
Number of lines: 54

Date: 06-25-2010

NOTES: ** Critical depth

SYSTEM 3

STA. 363+00 TO 384+50

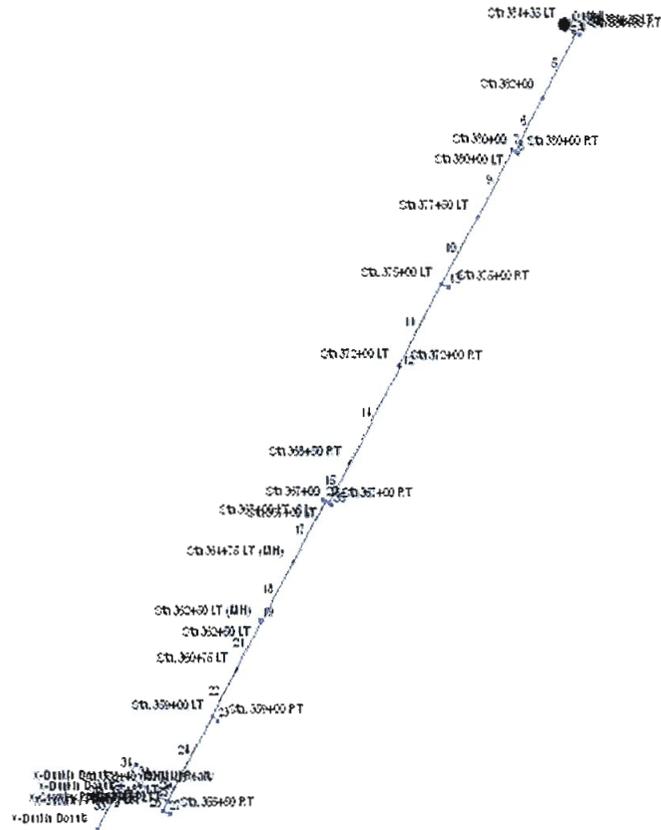


EXISTING DUNKIN
DONUTS

SYSTEM NO. 3 GRAPHIC

DESIGNER/APP'ER: J. Barnhart CHECKED BY: C. Langhear		<p>STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION</p>	<p>VI ENGINEERS, INC.</p>	PROJECT TITLE: NEW BRITAIN - HARTFORD BUSWAY	DRAWING TITLE: WEST HARTFORD/ HARTFORD DRAINAGE PLAN	PROJECT NO. 155-H025 DRAWING NO.
THE INFORMATION INCLUDING ESTIMATED QUANTITIES OF WORK, ENGINE OR OTHER COSTS IS BASED ON THE DATA PROVIDED BY THE CLIENT AND IS TO BE USED AS A GUIDE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL QUANTITIES.						
REV. DATE REVISION DESCRIPTION	SHEET NO.	NOT TO SCALE	VI ENGINEERS, INC.			

Hydroflow Plan View



System 3

No. Lines: 35

06-28-2010

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	Sta 384+35 LT	15.86	30 c	4.0	39.00	39.04	1.000	45.61*	45.62*	0.16	45.78	End
2	Sta 384+35 LT	15.92	30 c	36.0	39.04	45.28	17.333	45.78	46.61	n/a	46.61	1
3	Sta 384+35	15.55	30 c	11.0	45.28	45.34	0.545	47.01	47.01	0.31	47.32	2
4	Sta 384+35 RT	0.75	12 c	10.0	60.95	61.00	0.500	61.33	61.38	0.12	61.50	3
5	Sta 382+00	15.57	30 c	230.0	45.34	46.49	0.500	47.47	47.82	0.08	47.90	3
6	Sta 380+00	15.91	30 c	195.0	46.49	47.47	0.503	48.27	48.80	n/a	48.80	5
7	Sta 380+00 LT	15.44	30 c	10.0	47.47	47.52	0.500	49.20	49.21	0.45	49.66	6
8	Sta 380+00 RT	0.97	12 c	10.0	62.20	62.25	0.500	62.63	62.68	0.14	62.82	6
9	Sta 377+50 LT	15.39	30 c	245.0	47.52	48.75	0.502	49.80	50.14	0.07	50.21	7
10	Sta. 375+00 LT	15.84	30 c	245.0	48.75	49.98	0.502	50.52	51.31	n/a	51.31 j	9
11	Sta 372+00 LT	15.54	30 c	295.0	49.98	51.46	0.502	51.71	52.78	n/a	52.78 j	10
12	Sta 372+00 RT	15.56	30 c	9.0	51.46	51.51	0.556	53.17	53.16	0.32	53.48	11
13	Sta 375+00 RT	0.81	12 c	25.0	63.62	63.75	0.520	64.01	64.14	0.13	64.27	10
14	Sta 368+50 RT	16.24	30 c	345.0	51.61	53.33	0.499	53.63	54.68	n/a	54.68	12
15	Sta 367+00	16.54	30 c	145.0	53.33	54.06	0.503	55.06	55.42	0.57	55.42	14
16	Sta 367+00 LT	15.62	30 c	10.0	54.14	54.19	0.500	55.83	55.84	0.48	56.32	15
17	Sta 364+75 LT (MH)	13.77	30 c	220.0	54.19	55.29	0.500	56.52	56.72	0.05	56.78	16
18	Sta 362+50 LT (MH)	14.36	30 c	220.0	55.29	56.39	0.500	56.99	57.66	n/a	57.66	17
19	Sta 362+50 LT	2.53	15 c	10.0	63.12	63.17	0.500	63.79	63.84	0.23	64.06	18
20	Sta 367+00 LT (CL)	3.63	18 c	13.0	59.93	60.00	0.538	60.66	60.73	0.28	61.01	16
21	Sta. 360+75 LT	12.75	24 c	170.0	56.89	57.74	0.500	58.24	59.09	0.07	59.16	18
22	Sta. 359+00 LT	13.06	24 c	170.0	57.74	58.59	0.500	59.39	59.94	0.78	60.72	21
23	Sta. 359+00 RT	1.51	12 c	25.0	63.25	63.38	0.520	63.80	63.93	0.18	64.11	22
24	Sta. 356+40 (MH)	11.13	24 c	255.0	58.59	59.86	0.498	61.05	61.60	0.23	61.83	22
25	Sta. 355+87 LT	8.84	24 c	47.0	59.86	60.33	1.000	61.87	61.90	0.17	62.07	24
26	Sta. 355+50 LT(2)	1.37	12 c	32.0	64.03	64.19	0.500	64.56	64.72	0.25	64.97	25
27	Sta. 355+50 RT	0.70	12 c	25.0	64.19	64.32	0.520	65.10	65.11	0.02	65.13	26
28	Sta. 356+40 LT	2.86	15 c	16.0	63.37	63.45	0.500	64.09	64.17	0.24	64.41	24
29	X-Crowley Parking L	7.83	24 c	85.0	60.33	60.76	0.506	62.07	62.13	0.09	62.22	25
30	X-Crowley Parking L	1.35	8 c	20.0	66.86	67.11	1.250	67.53*	68.12*	0.23	68.35	29
31	X-Dunkin Donuts	6.07	18 c	81.0	62.26	65.38	3.852	62.97	66.32	n/a	66.32	29
32	X-Dunkin Donuts	3.08	12 c	40.0	65.38	66.97	3.975	66.50	67.71	n/a	67.71 j	31

System 3

Number of lines: 35

Run Date: 06-28-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
33	X-Dunkin Donuts	0.75	12 c	159.0	66.97	69.03	1.296	68.08	69.40	0.13	69.40	32
34	X-MIJI Realty	2.64	12 c	49.0	65.38	68.49	6.347	66.57	69.18	n/a	69.18 j	31
35	Sta 367+00 RT	1.62	18 c	10.0	62.83	62.88	0.500	63.43	63.48	0.09	63.57	15

System 3

Number of lines: 35

Run Date: 06-28-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (In)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	4.0	0.00	6.54	0.00	0.00	5.59	0.0	29.3	2.8	15.86	41.01	3.23	30	1.00	39.04	39.00	45.62	45.61	44.00	40.00	Sta 384+35 LT
2	1	36.0	0.15	6.54	0.90	0.14	5.59	5.0	29.2	2.8	15.92	96.51	4.61	30	17.33	45.28	39.04	46.61	45.78	64.46	44.00	Sta 384+35 LT
3	2	11.0	0.00	6.39	0.00	0.00	5.46	0.0	29.1	2.9	15.55	30.29	4.37	30	0.55	45.34	45.28	47.01	47.01	65.04	64.46	Sta 384+35
4	3	10.0	0.14	0.14	0.90	0.13	0.13	5.0	5.0	6.0	0.75	2.52	2.80	12	0.50	61.00	60.95	61.38	61.33	64.51	65.04	Sta 384+35 RT
5	3	230.0	0.00	6.25	0.00	0.00	5.33	0.0	27.9	2.9	15.57	29.00	4.68	30	0.50	46.49	45.34	47.82	47.47	65.74	65.04	Sta 382+00
6	5	195.0	0.00	6.25	0.00	0.00	5.33	0.0	26.9	3.0	15.91	29.07	5.11	30	0.50	47.47	46.49	48.80	48.27	66.34	65.74	Sta 380+00
7	6	10.0	0.18	6.07	0.90	0.16	5.17	5.0	26.8	3.0	15.44	29.00	4.31	30	0.50	47.52	47.47	49.21	49.20	65.79	66.34	Sta 380+00 LT
8	6	10.0	0.18	0.18	0.90	0.16	0.16	5.0	5.0	6.0	0.97	2.52	3.00	12	0.50	62.25	62.20	62.68	62.63	65.80	66.34	Sta 380+00 RT
9	7	245.0	0.00	5.89	0.00	0.00	5.01	0.0	25.5	3.1	15.39	29.06	4.39	30	0.50	48.75	47.52	50.14	49.80	66.79	65.79	Sta 377+50 LT
10	9	245.0	0.15	5.89	0.90	0.14	5.01	5.0	24.2	3.2	15.84	29.06	5.12	30	0.50	49.98	48.75	51.31	50.52	67.27	66.79	Sta. 375+00 LT
11	10	295.0	0.00	5.59	0.00	0.00	4.74	0.0	22.7	3.3	15.54	29.05	5.11	30	0.50	51.46	49.98	52.78	51.71	68.44	67.27	Sta 372+00 LT
12	11	9.0	0.00	5.59	0.00	0.00	4.74	0.0	22.6	3.3	15.56	30.57	4.43	30	0.56	51.51	51.46	53.16	53.17	68.74	68.44	Sta 372+00 RT
13	10	25.0	0.15	0.15	0.90	0.14	0.14	5.0	5.0	6.0	0.81	2.57	2.89	12	0.52	63.75	63.62	64.14	64.01	67.27	67.27	Sta 375+00 RT
14	12	345.0	0.00	5.59	0.00	0.00	4.74	0.0	20.9	3.4	16.24	28.96	4.92	30	0.50	53.33	51.61	54.68	53.63	68.29	68.74	Sta 368+50 RT
15	14	145.0	0.00	5.59	0.00	0.00	4.74	0.0	20.2	3.5	16.54	29.10	5.31	30	0.50	54.06	53.33	55.42	55.06	67.95	68.29	Sta 367+00
16	15	10.0	0.30	5.29	0.90	0.27	4.47	5.0	20.1	3.5	15.62	29.00	4.49	30	0.50	54.19	54.14	55.84	55.83	67.38	67.95	Sta 367+00 LT
17	16	220.0	0.00	3.51	0.00	0.00	3.16	0.0	12.7	4.4	13.77	29.00	3.81	30	0.50	55.29	54.19	56.72	56.52	67.95	67.38	Sta 364+75 LT (
18	17	220.0	0.00	3.51	0.00	0.00	3.16	0.0	11.5	4.5	14.36	29.00	4.90	30	0.50	56.39	55.29	57.66	56.99	68.56	67.95	Sta 362+50 LT (
19	18	10.0	0.47	0.47	0.90	0.42	0.42	5.0	5.0	6.0	2.53	4.57	3.82	15	0.50	63.17	63.12	63.84	63.79	68.00	68.56	Sta 362+50 LT
20	16	13.0	1.48	1.48	0.70	1.04	1.04	20.0	20.0	3.5	3.63	7.71	4.27	18	0.54	60.00	59.93	60.73	60.66	64.00	67.38	Sta 367+00 LT (C
21	18	170.0	0.00	3.04	0.00	0.00	2.74	0.0	10.8	4.7	12.75	15.99	5.65	24	0.50	57.74	56.89	59.09	58.24	68.04	68.56	Sta. 360+75 LT

System 3

Number of lines: 35

Run Date: 06-28-2010

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (In)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
22	21	170.0	0.28	3.04	0.90	0.25	2.74	5.0	10.2	4.8	13.06	15.99	5.24	24	0.50	58.59	57.74	59.94	59.39	67.38	68.04	Sta. 359+00 LT
23	22	25.0	0.28	0.28	0.90	0.25	0.25	5.0	5.0	6.0	1.51	2.57	3.40	12	0.52	63.38	63.25	63.93	63.80	67.38	67.38	Sta. 359+00 RT
24	22	255.0	0.00	2.48	0.00	0.00	2.23	0.0	9.1	5.0	11.13	15.96	3.69	24	0.50	59.86	58.59	61.60	61.05	68.05	67.38	Sta. 356+40 (MH)
25	24	47.0	0.00	1.95	0.00	0.00	1.76	0.0	8.8	5.0	8.84	22.62	3.08	24	1.00	60.33	59.86	61.90	61.87	68.45	68.05	Sta. 355+87 LT
26	25	32.0	0.13	0.26	0.90	0.12	0.23	5.0	5.5	5.9	1.37	2.52	3.27	12	0.50	64.19	64.03	64.72	64.56	68.32	68.45	Sta. 355+50 LT(2)
27	26	25.0	0.13	0.13	0.90	0.12	0.12	5.0	5.0	6.0	0.70	2.57	0.99	12	0.52	64.32	64.19	65.11	65.10	68.32	68.32	Sta. 355+50 RT
28	24	16.0	0.53	0.53	0.90	0.48	0.48	5.0	5.0	6.0	2.86	4.57	3.93	15	0.50	63.45	63.37	64.17	64.09	70.00	68.05	Sta. 356+40 LT
29	25	85.0	0.15	1.69	0.90	0.14	1.52	5.0	8.3	5.2	7.83	16.09	3.06	24	0.51	60.76	60.33	62.13	62.07	70.26	68.45	X-Crowley Parkin
30	29	20.0	0.25	0.25	0.90	0.23	0.23	5.0	5.0	6.0	1.35	0.88	3.86	8	1.25	67.11	66.86	68.12	67.53	69.71	70.26	X-Crowley Parkin
31	29	81.0	0.15	1.29	0.90	0.14	1.16	5.0	7.9	5.2	6.07	13.40	6.30	18	3.85	65.38	62.26	66.32	62.97	70.68	70.26	X-Dunkin Donuts
32	31	40.0	0.51	0.65	0.90	0.46	0.59	5.0	7.8	5.3	3.08	4.62	4.42	12	3.98	66.97	65.38	67.71	66.50	71.07	70.68	X-Dunkin Donuts
33	32	159.0	0.14	0.14	0.90	0.13	0.13	5.0	5.0	6.0	0.75	2.63	1.92	12	1.30	69.03	66.97	69.40	68.08	72.93	71.07	X-Dunkin Donuts
34	31	49.0	0.49	0.49	0.90	0.44	0.44	5.0	5.0	6.0	2.64	5.83	3.97	12	6.35	68.49	65.38	69.18	66.57	70.49	70.68	X-MIJ Realty
35	15	10.0	0.30	0.30	0.90	0.27	0.27	5.0	5.0	6.0	1.62	4.83	2.46	18	0.50	62.88	62.83	63.48	63.43	67.38	67.95	Sta 367+00 RT

System 3

Number of lines: 35

Run Date: 06-28-2010

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	Sta 384+35 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
2	Sta 384+35 LT	0.81	0.00	0.80	0.01	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.20	6.00	0.24	3.83	2.00	Off
3	Sta 384+35	0.00	0.03	0.00	0.03	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
4	Sta 384+35 RT	0.75	0.03	0.78	0.01	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.20	5.90	0.23	3.79	2.00	Off
5	Sta 382+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
6	Sta 380+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
7	Sta 380+00 LT	0.97	0.01	0.95	0.03	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.21	6.70	0.25	4.37	2.00	3
8	Sta 380+00 RT	0.97	0.01	0.95	0.03	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.21	6.70	0.25	4.37	2.00	4
9	Sta 377+50 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
10	Sta. 375+00 LT	0.81	0.00	0.80	0.01	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.20	6.00	0.24	3.83	2.00	7
11	Sta 372+00 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
12	Sta 372+00 RT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
13	Sta 375+00 RT	0.81	0.00	0.80	0.01	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.20	6.00	0.24	3.83	2.00	8
14	Sta 368+50 RT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
15	Sta 367+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.013	0.00	0.00	0.00	0.00	0.00	Off
16	Sta 367+00 LT	1.62	0.00	1.62	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.14	3.58	0.23	3.73	2.00	Off
17	Sta 364+75 LT (M	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
18	Sta 362+50 LT (M	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
19	Sta 362+50 LT	2.53	0.00	2.11	0.43	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.29	10.75	0.35	9.27	2.00	Off
20	Sta 367+00 LT (C	3.63	0.00	2.78	0.86	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.33	12.60	0.39	11.37	2.00	Off
21	Sta. 360+75 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
22	Sta. 359+00 LT	1.51	0.00	1.51	0.00	Grate	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.13	3.24	0.22	3.51	2.00	Off

System 3

Number of lines: 35

Run Date: 06-28-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
23	Sta. 359+00 RT	1.51	0.00	1.51	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.13	3.33	0.22	3.57	2.00	Off
24	Sta. 356+40 (MH)	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
25	Sta. 355+87 LT	0.00	0.00	0.00	0.00	MH	6.0	2.31	0.00	2.31	1.35	Sag	4.00	0.040	0.020	0.013	0.00	0.00	0.00	0.00	0.00	22
26	Sta. 355+50 LT	0.70	0.00	0.70	0.00	Grate	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.19	5.50	0.22	3.63	2.00	25
27	Sta. 355+50 RT	0.70	0.00	0.70	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.19	5.50	0.22	3.63	2.00	23
28	Sta. 356+40 LT	2.86	0.00	2.31	0.54	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.31	11.35	0.36	9.92	2.00	Off
29	X-Crowley Parkin	0.81	0.00	0.80	0.01	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.20	6.00	0.24	3.83	2.00	Off
30	X-Crowley Parkin	1.35	0.00	1.26	0.09	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.24	7.95	0.28	5.92	2.00	Off
31	X-Dunkin Donuts	0.81	0.51	1.23	0.09	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.24	7.85	0.28	5.82	2.00	34
32	X-Dunkin Donuts	2.75	0.01	2.24	0.51	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.30	11.15	0.36	9.72	2.00	31
33	X-Dunkin Donuts	0.75	0.00	0.75	0.01	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.20	5.75	0.23	3.73	2.00	32
34	X-MIJI Realty	2.64	0.09	2.23	0.50	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.30	11.10	0.36	9.67	2.00	Off
35	Sta 367+00 RT	1.62	0.00	1.62	0.00	Comb	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.080	0.050	0.013	0.06	0.79	0.17	1.28	2.00	Off

System 3

Number of lines: 35

Run Date: 06-28-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	30	15.86	39.00	45.61	2.50	4.91	3.23	0.16	45.77	0.150	4.0	39.04	45.62	2.50	4.91	3.23	0.16	45.78	0.149	0.150	0.006	1.00	0.16
2	30	15.92	39.04	45.78	2.50	4.91	3.24	0.16	45.94	0.472	36.0	45.28	46.61	1.33**	2.66	5.98	0.56	47.17	1.519	0.996	n/a	0.50	n/a
3	30	15.55	45.28	47.01	1.73	3.63	4.28	0.29	47.30	0.210	11.0	45.34	47.01	1.67	3.49	4.46	0.31	47.32	0.232	0.221	0.024	1.00	0.31
4	12	0.75	60.95	61.33	0.38*	0.27	2.80	0.12	61.45	0.500	10.0	61.00	61.38	0.38**	0.27	2.80	0.12	61.50	0.498	0.499	0.050	1.00	0.12
5	30	15.57	45.34	47.47	2.13	4.46	3.49	0.19	47.66	0.135	230	46.49	47.82	1.33	2.66	5.86	0.53	48.36	0.467	0.301	0.692	0.15	0.08
6	30	15.91	46.49	48.27	1.78	3.74	4.25	0.28	48.55	0.205	195	47.47	48.80	1.33**	2.66	5.98	0.56	49.36	0.485	0.345	n/a	1.00	n/a
7	30	15.44	47.47	49.20	1.73	3.63	4.25	0.28	49.49	0.207	10.0	47.52	49.21	1.69	3.53	4.37	0.30	49.51	0.222	0.214	0.021	1.50	0.45
8	12	0.97	62.20	62.63	0.43*	0.32	3.00	0.14	62.77	0.500	10.0	62.25	62.68	0.43	0.32	3.00	0.14	62.82	0.503	0.501	0.050	1.00	0.14
9	30	15.39	47.52	49.80	2.28	4.70	3.28	0.17	49.97	0.123	245	48.75	50.14	1.39	2.79	5.51	0.47	50.61	0.400	0.261	0.641	0.15	0.07
10	30	15.84	48.75	50.52	1.77	3.71	4.27	0.28	50.80	0.208	245	49.98	51.31 j	1.33**	2.65	5.97	0.55	51.86	0.485	0.346	n/a	1.50	n/a
11	30	15.54	49.98	51.71	1.73	3.62	4.29	0.29	51.99	0.212	295	51.46	52.78 j	1.32**	2.62	5.92	0.55	53.32	0.481	0.347	n/a	1.00	0.55
12	30	15.56	51.46	53.17	1.71	3.57	4.36	0.30	53.46	0.219	9.0	51.51	53.16	1.65	3.45	4.51	0.32	53.48	0.239	0.229	0.021	1.00	0.32
13	12	0.81	63.62	64.01	0.39*	0.28	2.89	0.13	64.14	0.519	25.0	63.75	64.14	0.39**	0.28	2.89	0.13	64.27	0.516	0.518	0.129	1.00	0.13
14	30	16.24	51.61	53.63	2.02	4.24	3.83	0.23	53.86	0.161	345	53.33	54.68	1.35**	2.70	6.02	0.56	55.24	0.489	0.325	n/a	0.15	n/a
15	30	16.54	53.33	55.06	1.73	3.63	4.55	0.32	55.39	0.238	145	54.06	55.42	1.36**	2.73	6.07	0.57	55.99	0.492	0.365	n/a	1.00	0.57
16	30	15.62	54.14	55.83	1.69	3.54	4.41	0.30	56.14	0.226	10.0	54.19	55.84	1.65	3.43	4.56	0.32	56.16	0.245	0.235	0.024	1.50	0.48
17	30	13.77	54.19	56.52	2.33	4.77	2.89	0.13	56.65	0.097	220	55.29	56.72	1.43	2.91	4.73	0.35	57.07	0.288	0.193	0.424	0.15	0.05
18	30	14.36	55.29	56.99	1.70	3.55	4.04	0.25	57.24	0.189	220	56.39	57.66	1.27**	2.50	5.75	0.51	58.17	0.469	0.329	n/a	1.00	n/a
19	15	2.53	63.12	63.79	0.67*	0.66	3.82	0.23	64.01	0.499	10.0	63.17	63.84	0.67	0.66	3.82	0.23	64.06	0.500	0.500	0.050	1.00	0.23
20	18	3.63	59.93	60.66	0.73*	0.85	4.30	0.29	60.94	0.538	13.0	60.00	60.73	0.73**	0.86	4.25	0.28	61.01	0.522	0.530	0.069	1.00	0.28
21	24	12.75	56.89	58.24	1.35*	2.26	5.65	0.50	58.74	0.500	170	57.74	59.09	1.35	2.26	5.65	0.50	59.59	0.499	0.500	0.849	0.15	0.07

System 3 Number of lines: 35 Run Date: 06-28-2010

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
22	24	13.06	57.74	59.39	1.65	2.78	4.71	0.34	59.74	0.329	170	58.59	59.94	1.35	2.26	5.78	0.52	60.46	0.523	0.426	0.724	1.50	0.78
23	12	1.51	63.25	63.80	0.55*	0.44	3.40	0.18	63.98	0.520	25.0	63.38	63.93	0.55	0.44	3.40	0.18	64.11	0.521	0.520	0.130	1.00	0.18
24	24	11.13	58.59	61.05	2.00	3.14	3.54	0.20	61.24	0.242	255	59.86	61.60	1.74	2.91	3.83	0.23	61.83	0.220	0.231	0.590	1.00	0.23
25	24	8.84	59.86	61.87	2.00	3.14	2.82	0.12	62.00	0.153	47.0	60.33	61.90	1.57	2.64	3.35	0.17	62.07	0.167	0.160	0.075	1.00	0.17
26	12	1.37	64.03	64.56	0.53*	0.42	3.27	0.17	64.72	0.499	32.0	64.19	64.72	0.53	0.42	3.27	0.17	64.88	0.498	0.499	0.160	1.50	0.25
27	12	0.70	64.19	65.10	0.91	0.75	0.93	0.01	65.12	0.034	25.0	64.32	65.11	0.79	0.67	1.05	0.02	65.13	0.041	0.038	0.009	1.00	0.02
28	15	2.86	63.37	64.09	0.72*	0.73	3.93	0.24	64.33	0.500	16.0	63.45	64.17	0.72	0.73	3.92	0.24	64.41	0.499	0.499	0.080	1.00	0.24
29	24	7.83	60.33	62.07	1.74	2.90	2.70	0.11	62.18	0.109	85.0	60.76	62.13	1.37	2.29	3.42	0.18	62.31	0.182	0.146	0.124	0.50	0.09
30	8	1.35	66.86	67.53	0.67*	0.35	3.86	0.23	67.76	2.943	20.0	67.11	68.12	0.67	0.35	3.86	0.23	68.35	2.948	2.945	0.589	1.00	0.23
31	18	6.07	62.26	62.97	0.71*	0.82	7.39	0.85	63.82	3.849	81.0	65.38	66.32	0.94**	1.17	5.21	0.42	66.74	1.536	2.692	2.181	2.25	n/a
32	12	3.08	65.38	66.50	1.00	0.79	3.92	0.24	66.74	1.771	40.0	66.97	67.71 j	0.74**	0.63	4.91	0.38	68.09	2.167	1.969	n/a	0.50	n/a
33	12	0.75	66.97	68.08	1.00	0.79	0.96	0.01	68.09	0.106	159	69.03	69.40	0.37**	0.26	2.87	0.13	69.53	1.268	0.687	n/a	1.00	0.13
34	12	2.64	65.38	66.57	1.00	0.79	3.36	0.18	66.74	1.303	49.0	68.49	69.18 j	0.69**	0.58	4.57	0.33	69.50	1.935	1.619	n/a	1.00	n/a
35	18	1.62	62.83	63.43	0.60*	0.66	2.46	0.09	63.52	0.500	10.0	62.88	63.48	0.60	0.66	2.47	0.09	63.57	0.504	0.502	0.050	1.00	0.09

System 3

Number of lines: 35

Run Date: 06-28-2010

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
1	Sta 384+35 LT	0.0	29.3	0.013
2	Sta 384+35 LT	5.0	29.2	0.023
3	Sta 384+35	0.0	29.1	0.013
4	Sta 384+35 RT	5.0	5.0	0.013
5	Sta 382+00	0.0	27.9	0.013
6	Sta 380+00	0.0	26.9	0.013
7	Sta 380+00 LT	5.0	26.8	0.013
8	Sta 380+00 RT	5.0	5.0	0.013
9	Sta 377+50 LT	0.0	25.5	0.013
10	Sta. 375+00 LT	5.0	24.2	0.013
11	Sta 372+00 LT	0.0	22.7	0.013
12	Sta 372+00 RT	0.0	22.6	0.013
13	Sta 375+00 RT	5.0	5.0	0.013
14	Sta 368+50 RT	0.0	20.9	0.013
15	Sta 367+00	0.0	20.2	0.013
16	Sta 367+00 LT	5.0	20.1	0.013
17	Sta 364+75 LT (MH)	0.0	12.7	0.013
18	Sta 362+50 LT (MH)	0.0	11.5	0.013
19	Sta 362+50 LT	5.0	5.0	0.013
20	Sta 367+00 LT (CL)	20.0	20.0	0.013
21	Sta. 360+75 LT	0.0	10.8	0.013

System 3

Number of lines: 35

Date: 06-28-2010

NOTES: ** Critical depth

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
22	Sta. 359+00 LT	5.0	10.2	0.013
23	Sta. 359+00 RT	5.0	5.0	0.013
24	Sta. 356+40 (MH)	0.0	9.1	0.013
25	Sta. 355+87 LT	0.0	8.8	0.013
26	Sta. 355+50 LT	5.0	5.5	0.013
27	Sta. 355+50 RT	5.0	5.0	0.013
28	Sta. 356+40 LT	5.0	5.0	0.013
29	X-Crowley Parking Lot	5.0	8.3	0.013
30	X-Crowley Parking Lot	5.0	5.0	0.020
31	X-Dunkin Donuts	5.0	7.9	0.020
32	X-Dunkin Donuts	5.0	7.8	0.020
33	X-Dunkin Donuts	5.0	5.0	0.020
34	X-MJI Realty	5.0	5.0	0.020
35	Sta 367+00 RT	5.0	5.0	0.020

System 3

Number of lines: 35

Date: 06-28-2010

NOTES: ** Critical depth

SYSTEM 4

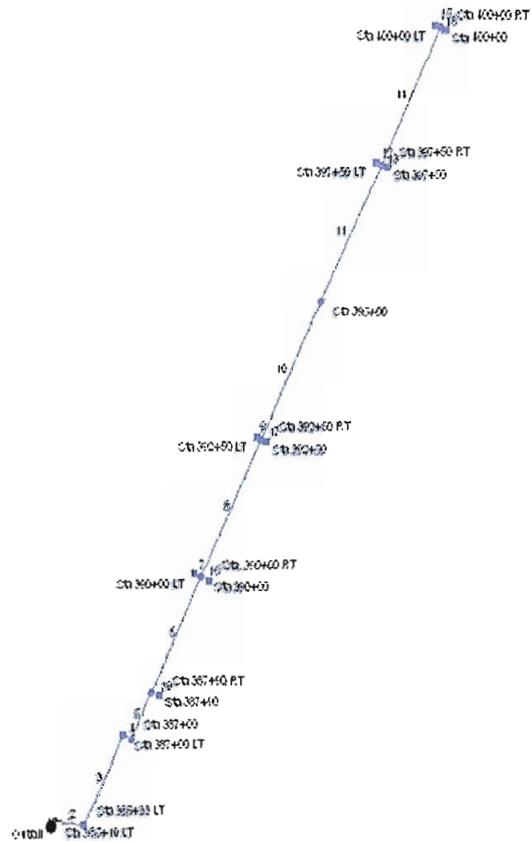
STA. 384+50 TO 404+00



SYSTEM NO. 4 GRAPHIC

REVISION DATE REVISION DESCRIPTION SHEET NO.		DRAWN BY: J. Bombara CHECKED BY: C. Lasker	STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	VW ENGINEERS, INC.	PROJECT TITLE: NEW BRITAIN - HARTFORD BUSWAY	SHEET NO.: WEST HARTFORD/ HARTFORD DRAINAGE PLAN	PROJECT NO.: 15-H025
PERM. DATE:		NOT TO SCALE	PREPARED BY: VW ENGINEERS, INC. / URS CORPORATION, INC. APPROVED BY: Robert Goring, P.E.	DATE:	DRAWN BY:	SHEET NO.:	PROJECT NO.:

Hydrflow Plan View



System 4

No. Lines: 19

05-13-2010

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	Sta 385+10 LT	6.11	18 c	12.0	39.00	39.06	0.500	45.61*	45.65*	0.17	45.82	End
2	Sta 385+33 LT	6.15	18 c	55.0	39.06	50.06	20.000	45.82	51.01	n/a	51.01 j	1
3	Sta 387+00 LT	6.18	18 c	162.0	51.80	52.61	0.500	52.85	53.65	0.52	54.17	2
4	Sta 387+00	5.94	18 c	17.0	52.61	52.70	0.529	54.34*	54.39*	0.18	54.57	3
5	Sta 387+90	6.01	18 c	85.0	52.70	53.13	0.506	54.57*	54.85*	0.18	55.03	4
6	Sta 390+00	5.55	18 c	205.0	53.13	54.16	0.502	55.05	55.58	0.16	55.74	5
7	Sta 390+00 LT	1.46	12 c	14.0	59.18	59.25	0.500	59.73	59.80	0.17	59.97	6
8	Sta 392+50	3.91	18 c	245.0	54.16	55.39	0.502	55.83	56.27	0.20	56.48	6
9	Sta 392+50 LT	0.49	12 c	10.0	59.95	60.00	0.500	60.25	60.30	0.10	60.39	8
10	Sta 395+00	3.42	18 c	245.0	55.39	56.62	0.502	56.62	57.33	n/a	57.33	8
11	Sta 397+50	3.70	18 c	245.0	56.62	57.85	0.502	57.53	58.58	n/a	58.58	10
12	Sta 397+50 LT	0.59	12 c	10.0	59.95	60.00	0.500	60.28	60.33	0.11	60.44	11
13	Sta 397+50 RT	0.49	12 c	10.0	59.95	60.00	0.500	60.25	60.30	0.10	60.39	11
14	Sta 400+00	3.06	18 c	245.0	57.85	59.08	0.502	58.83	59.75	n/a	59.75	11
15	Sta 400+00 LT	1.78	12 c	10.0	59.33	59.38	0.500	59.95	60.00	0.19	60.19	14
16	Sta. 390+00 RT	1.13	12 c	15.0	59.18	59.25	0.467	59.66	59.73	0.14	59.87	6
17	Sta 392+50 RT	0.49	12 c	10.0	59.95	60.00	0.500	60.25	60.30	0.10	60.39	8
18	Sta 400+00 RT	1.29	12 c	10.0	59.33	59.38	0.500	59.96	59.97	0.11	60.08	14
19	Sta 387+90 RT	0.92	12 c	15.0	59.42	59.50	0.533	59.83	59.91	0.14	60.05	5

System 4

Number of lines: 19

Run Date: 05-13-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	12.0	0.00	1.70	0.00	0.00	1.53	0.0	15.4	4.0	6.11	7.43	3.46	18	0.50	39.06	39.00	45.65	45.61	44.00	40.00	Sta 385+10 LT
2	1	55.0	0.03	1.70	0.90	0.03	1.53	5.0	15.2	4.0	6.15	26.54	4.36	18	20.00	50.06	39.06	51.01	45.82	64.19	44.00	Sta 385+33 LT
3	2	162.0	0.07	1.67	0.90	0.06	1.50	5.0	14.5	4.1	6.18	7.43	4.70	18	0.50	52.61	51.80	53.65	52.85	64.45	64.19	Sta 387+00 LT
4	3	17.0	0.00	1.60	0.00	0.00	1.44	0.0	14.4	4.1	5.94	7.64	3.36	18	0.53	52.70	52.61	54.39	54.34	64.24	64.45	Sta 387+00
5	4	85.0	0.00	1.60	0.00	0.00	1.44	0.0	14.0	4.2	6.01	7.47	3.40	18	0.51	53.13	52.70	54.85	54.57	63.97	64.24	Sta 387+90
6	5	205.0	0.00	1.43	0.00	0.00	1.29	0.0	13.0	4.3	5.55	7.44	3.17	18	0.50	54.16	53.13	55.58	55.05	63.45	63.97	Sta 390+00
7	6	14.0	0.27	0.27	0.90	0.24	0.24	5.0	5.0	6.0	1.46	2.52	3.32	12	0.50	59.25	59.18	59.80	59.73	62.85	63.45	Sta 390+00 LT
8	6	245.0	0.00	0.95	0.00	0.00	0.86	0.0	11.3	4.6	3.91	7.44	2.92	18	0.50	55.39	54.16	56.27	55.83	64.09	63.45	Sta 392+50
9	8	10.0	0.09	0.09	0.90	0.08	0.08	5.0	5.0	6.0	0.49	2.52	2.48	12	0.50	60.00	59.95	60.30	60.25	63.52	64.09	Sta 392+50 LT
10	8	245.0	0.00	0.77	0.00	0.00	0.69	0.0	9.3	4.9	3.42	7.44	3.19	18	0.50	56.62	55.39	57.33	56.62	64.73	64.09	Sta 395+00
11	10	245.0	0.00	0.77	0.00	0.00	0.69	0.0	7.5	5.3	3.70	7.44	3.80	18	0.50	57.85	56.62	58.58	57.53	64.09	64.73	Sta 397+50
12	11	10.0	0.11	0.11	0.90	0.10	0.10	5.0	5.0	6.0	0.59	2.52	2.61	12	0.50	60.00	59.95	60.33	60.28	63.52	64.09	Sta 397+50 LT
13	11	10.0	0.09	0.09	0.90	0.08	0.08	5.0	5.0	6.0	0.49	2.52	2.48	12	0.50	60.00	59.95	60.30	60.25	63.52	64.09	Sta 397+50 RT
14	11	245.0	0.00	0.57	0.00	0.00	0.51	0.0	5.1	6.0	3.06	7.44	3.27	18	0.50	59.08	57.85	59.75	58.83	63.45	64.09	Sta 400+00
15	14	10.0	0.33	0.33	0.90	0.30	0.30	5.0	5.0	6.0	1.78	2.52	3.48	12	0.50	59.38	59.33	60.00	59.95	62.88	63.45	Sta 400+00 LT
16	6	15.0	0.21	0.21	0.90	0.19	0.19	5.0	5.0	6.0	1.13	2.43	3.04	12	0.47	59.25	59.18	59.73	59.66	62.79	63.45	Sta. 390+00 RT
17	8	10.0	0.09	0.09	0.90	0.08	0.08	5.0	5.0	6.0	0.49	2.52	2.48	12	0.50	60.00	59.95	60.30	60.25	63.52	64.09	Sta 392+50 RT
18	14	10.0	0.24	0.24	0.90	0.22	0.22	5.0	5.0	6.0	1.29	2.52	2.59	12	0.50	59.38	59.33	59.97	59.96	62.88	63.45	Sta 400+00 RT
19	5	15.0	0.17	0.17	0.90	0.15	0.15	5.0	5.0	6.0	0.92	2.60	3.02	12	0.53	59.50	59.42	59.91	59.83	63.40	63.97	Sta 387+90 RT

System 4	Number of lines: 19	Run Date: 05-13-2010
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NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	Sta 385+10 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
2	Sta 385+33 LT	0.16	0.00	0.16	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.11	2.75	0.13	2.11	2.00	3
3	Sta 387+00 LT	0.38	0.00	0.38	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.15	3.78	0.18	2.89	2.00	7
4	Sta 387+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
5	Sta 387+90	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
6	Sta 390+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
7	Sta 390+00 LT	1.46	0.00	1.46	0.00	Grate	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.12	3.10	0.21	3.42	2.00	Off
8	Sta 392+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
9	Sta 392+50 LT	0.49	0.00	0.49	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.30	0.20	3.16	2.00	7
10	Sta 395+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
11	Sta 397+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
12	Sta 397+50 LT	0.59	0.00	0.59	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.18	4.95	0.21	3.41	2.00	15
13	Sta 397+50 RT	0.49	0.00	0.49	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.30	0.20	3.16	2.00	18
14	Sta 400+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
15	Sta 400+00 LT	1.78	0.00	1.78	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.16	4.17	0.25	4.17	2.00	Off
16	Sta. 390+00 RT	1.13	0.24	1.37	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.12	3.08	0.21	3.41	2.00	Off
17	Sta 392+50 RT	0.49	0.00	0.49	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.17	4.30	0.20	3.16	2.00	16
18	Sta 400+00 RT	1.29	0.00	1.29	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.11	2.83	0.20	3.24	2.00	Off
19	Sta 387+90 RT	0.92	0.00	0.67	0.24	Comb	6.0	2.31	0.00	2.31	1.35	0.003	2.00	0.040	0.020	0.013	0.19	7.70	0.29	5.97	2.00	16

System 4

Number of lines: 19

Run Date: 05-13-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	18	6.11	39.00	45.61	1.50	1.77	3.46	0.19	45.80	0.338	12.0	39.06	45.65	1.50	1.77	3.46	0.19	45.84	0.338	0.338	0.041	0.92	0.17
2	18	6.15	39.06	45.82	1.50	1.77	3.48	0.19	46.01	1.075	55.0	50.06	51.01 j	0.95**	1.18	5.24	0.43	51.43	2.045	1.560	n/a	1.43	0.61
3	18	6.18	51.80	52.85	1.05*	1.32	4.70	0.34	53.19	0.500	162	52.61	53.65	1.04	1.31	4.71	0.34	54.00	0.501	0.501	0.811	1.50	0.52
4	18	5.94	52.61	54.34	1.50	1.77	3.36	0.18	54.52	0.320	17.0	52.70	54.39	1.50	1.77	3.36	0.18	54.57	0.320	0.320	0.054	1.00	0.18
5	18	6.01	52.70	54.57	1.50	1.77	3.40	0.18	54.75	0.328	85.0	53.13	54.85	1.50	1.77	3.40	0.18	55.03	0.328	0.328	0.279	1.00	0.18
6	18	5.55	53.13	55.05	1.50	1.77	3.14	0.15	55.21	0.280	205	54.16	55.58	1.42	1.73	3.20	0.16	55.74	0.242	0.261	0.535	1.00	0.16
7	12	1.46	59.18	59.73	0.55*	0.44	3.32	0.17	59.90	0.499	14.0	59.25	59.80	0.55	0.44	3.31	0.17	59.97	0.497	0.498	0.070	1.00	0.17
8	18	3.91	54.16	55.83	1.50	1.77	2.22	0.08	55.90	0.139	245	55.39	56.27	0.88	1.08	3.62	0.20	56.48	0.328	0.233	0.572	1.00	0.20
9	12	0.49	59.95	60.25	0.30*	0.20	2.48	0.10	60.34	0.500	10.0	60.00	60.30	0.30**	0.20	2.47	0.10	60.39	0.499	0.499	0.050	1.00	0.10
10	18	3.42	55.39	56.62	1.23	1.55	2.20	0.08	56.70	0.106	245	56.62	57.33	0.71**	0.82	4.18	0.27	57.60	0.523	0.314	n/a	0.15	n/a
11	18	3.70	56.62	57.53	0.91	1.12	3.30	0.17	57.70	0.266	245	57.85	58.58	0.73**	0.86	4.30	0.29	58.87	0.534	0.400	n/a	1.00	n/a
12	12	0.59	59.95	60.28	0.33*	0.23	2.62	0.11	60.39	0.500	10.0	60.00	60.33	0.33**	0.23	2.61	0.11	60.44	0.494	0.497	0.050	1.00	0.11
13	12	0.49	59.95	60.25	0.30*	0.20	2.48	0.10	60.34	0.500	10.0	60.00	60.30	0.30**	0.20	2.47	0.10	60.39	0.499	0.499	0.050	1.00	0.10
14	18	3.06	57.85	58.83	0.98	1.22	2.51	0.10	58.92	0.148	245	59.08	59.75	0.67**	0.76	4.02	0.25	60.00	0.509	0.328	n/a	1.00	n/a
15	12	1.78	59.33	59.95	0.62*	0.51	3.48	0.19	60.14	0.500	10.0	59.38	60.00	0.62	0.51	3.48	0.19	60.19	0.501	0.501	0.050	1.00	0.19
16	12	1.13	59.18	59.66	0.48*	0.37	3.04	0.14	59.80	0.466	15.0	59.25	59.73	0.48	0.37	3.05	0.14	59.87	0.469	0.468	0.070	1.00	0.14
17	12	0.49	59.95	60.25	0.30*	0.20	2.48	0.10	60.34	0.500	10.0	60.00	60.30	0.30**	0.20	2.47	0.10	60.39	0.499	0.499	0.050	1.00	0.10
18	12	1.29	59.33	59.96	0.63	0.52	2.50	0.10	60.05	0.256	10.0	59.38	59.97	0.59	0.48	2.69	0.11	60.08	0.309	0.283	0.028	1.00	0.11
19	12	0.92	59.42	59.83	0.41*	0.30	3.02	0.14	59.97	0.533	15.0	59.50	59.91	0.41**	0.30	3.01	0.14	60.05	0.529	0.531	0.080	1.00	0.14

System 4

Number of lines: 19

Run Date: 05-13-2010

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
1	Sta 385+10 LT	0.0	15.4	0.013
2	Sta 385+33 LT	5.0	15.2	0.023
3	Sta 387+00 LT	5.0	14.5	0.013
4	Sta 387+00	0.0	14.4	0.013
5	Sta 387+90	0.0	14.0	0.013
6	Sta 390+00	0.0	13.0	0.013
7	Sta 390+00 LT	5.0	5.0	0.013
8	Sta 392+50	0.0	11.3	0.013
9	Sta 392+50 LT	5.0	5.0	0.013
10	Sta 395+00	0.0	9.3	0.013
11	Sta 397+50	0.0	7.5	0.013
12	Sta 397+50 LT	5.0	5.0	0.013
13	Sta 397+50 RT	5.0	5.0	0.013
14	Sta 400+00	0.0	5.1	0.013
15	Sta 400+00 LT	5.0	5.0	0.013
16	Sta. 390+00 RT	5.0	5.0	0.013
17	Sta 392+50 RT	5.0	5.0	0.013
18	Sta 400+00 RT	5.0	5.0	0.013
19	Sta 387+90 RT	5.0	5.0	0.013

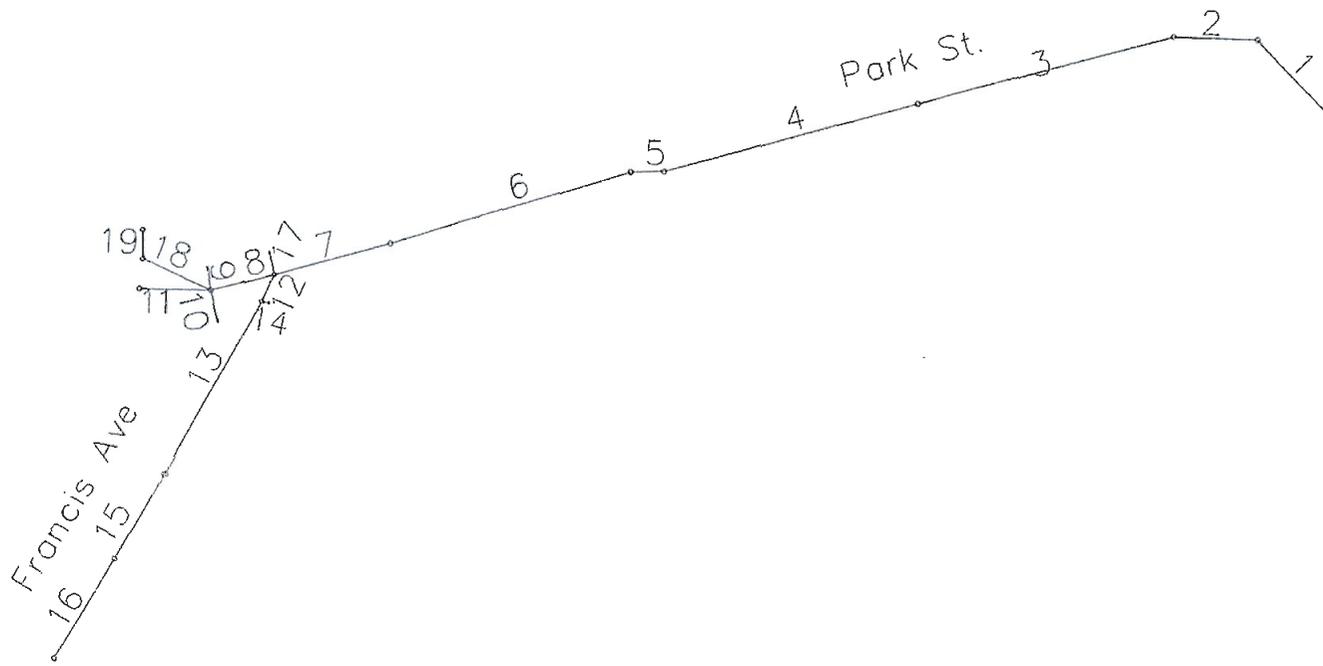
System 4

Number of lines: 19

Date: 05-13-2010

NOTES: ** Critical depth

SYSTEM 5
EXISTING PARK STREET SYSTEM
STA. 404+00 TO 418+00



SYSTEM NO. 5 GRAPHIC - EXISTING SYSTEM

DATED: 10/02/09 SHEET NO. 155-H025		DESIGNED BY: J. Barnhart CHECKED BY: C. Langhear		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION		PROJECT TITLE: NEW BRITAIN - HARTFORD BUSWAY		SHEET NO. 155-H025	
THE INFORMATION CONTAINED HEREIN IS FOR INFORMATION ONLY AND DOES NOT CONSTITUTE AN OFFER OF ANY FINANCIAL PRODUCT OR SERVICE. THE INFORMATION IS NOT INTENDED TO BE USED AS A BASIS FOR ANY INVESTMENT DECISION. THE CONDITION OF ANY WORK HEREON WILL BE FORWARDED TO THE CLIENT.		NOT TO SCALE		ENGINEER: VII ENGINEERS, INC. / URS CORPORATION A/E/S APPROVED BY: Robert Gomez, P.E.		DRAWING TITLE: DRAINAGE PLAN		PROJECT NO.: 155-H025	
REV.	DATE	REVISION DESCRIPTION	SHEET NO.	VII ENGINEERS, INC.		WEST HARTFORD/ HARTFORD		DRAWING NO.:	

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct. (ft)	Dns line No.
1	Park St.	117.2	66 c	114.5	30.00	30.57	0.498	32.95	34.27	0.55	34.82	End
2	Park St.	117.5	66 c	97.3	30.57	31.06	0.504	34.84	35.11	0.21	35.32	1
3	Park St.	118.6	66 c	308.2	31.06	32.60	0.500	35.54	36.47	0.10	36.57	2
4	Park St.	119.7	66 c	310.6	32.60	34.15	0.499	36.86	37.92	0.22	38.14	3
5	Park St.	119.8	66 c	37.9	34.15	34.34	0.502	38.14	38.27	0.22	38.49	4
6	Park St.	120.8	66 c	294.5	34.34	35.82	0.503	38.76	39.70	0.11	39.81	5
7	Park St.	121.3	66 c	140.0	35.53	38.07	1.814	40.11	41.07	1.21	41.07	6
8	Park St.	86.28	24 c	52.0	47.50	47.86	0.692	49.50*	67.42*	1.76	69.18	7
9	Parl St.	86.31	36 c	28.0	47.32	47.50	0.643	78.59*	79.70*	2.32	82.02	8
10	Park St.	3.77	10 c	25.7	53.54	56.33	10.848	83.59*	85.40*	0.74	86.14	9
11	Park St.	0.06	12 c	37.2	53.53	53.70	0.457	84.33*	84.33*	0.00	84.33	9
12	Park St.	76.90	36 c	83.8	47.90	50.46	3.056	82.49*	85.13*	1.84	86.97	9
13	Francis Ave	15.96	30 c	35.1	44.01	44.47	1.312	45.29	45.81	0.55	46.36	7
14	Francis Ave	16.15	30 c	233.2	45.74	46.79	0.450	47.60	48.65	0.04	48.69	13
15	Francis Ave	0.06	10 c	8.8	51.26	54.83	40.724	51.31	54.94	n/a	54.94	13
16	Francis Ave	16.25	30 c	114.4	46.88	49.15	1.985	48.78	50.50	n/a	50.50 j	14
17	Francis Ave	16.38	30 c	136.4	49.15	51.62	1.811	50.89	52.97	n/a	52.97 j	16
18	Park St.	2.08	12 c	40.0	44.01	44.41	1.000	44.75	45.15	0.17	45.33	7
19	Hazel St.	25.01	18 c	80.0	47.90	50.56	3.325	82.02*	92.76*	2.93	95.69	9
20	Hazel St.	25.06	18 c	50.0	50.56	51.06	1.000	95.69*	102.43*	3.13	105.56	19

System 5-Existing Park Ave Sys

Number of lines: 20

Run Date: 10-05-2009

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	114.5	0.00	117.5	0.00	0.00	82.41	0.0	84.2	1.4	117.2	154.0	7.97	66	0.50	30.57	30.00	34.27	32.95	49.13	53.16	Park St.
2	1	97.3	0.00	117.5	0.00	0.00	82.41	0.0	83.9	1.4	117.5	154.9	6.10	66	0.50	31.06	30.57	35.11	34.84	47.02	49.13	Park St.
3	2	308.2	0.00	117.5	0.00	0.00	82.41	0.0	82.8	1.4	118.6	154.3	6.18	66	0.50	32.60	31.06	36.47	35.54	42.76	47.02	Park St.
4	3	310.6	0.00	117.5	0.00	0.00	82.41	0.0	81.8	1.5	119.7	154.2	6.48	66	0.50	34.15	32.60	37.92	36.86	45.00	42.76	Park St.
5	4	37.9	0.00	117.5	0.00	0.00	82.41	0.0	81.6	1.5	119.8	154.6	6.54	66	0.50	34.34	34.15	38.27	38.14	44.65	45.00	Park St.
6	5	294.5	0.00	117.5	0.00	0.00	82.41	0.0	80.7	1.5	120.8	154.8	6.32	66	0.50	35.82	34.34	39.70	38.76	49.65	44.65	Park St.
7	6	140.0	20.00	117.5	0.70	14.00	82.41	48.0	80.2	1.5	121.3	294.0	7.45	66	1.81	38.07	35.53	41.07	40.11	58.58	49.65	Park St.
8	7	52.0	0.00	83.51	0.00	0.00	58.60	0.0	80.2	1.5	86.28	12.23	27.47	24	0.69	47.86	47.50	67.42	49.50	58.58	58.58	Park St.
9	8	28.0	0.00	83.51	0.00	0.00	58.60	0.0	80.1	1.5	86.31	34.76	12.21	36	0.64	47.50	47.32	79.70	78.59	59.30	58.58	Parl St.
10	9	25.7	0.70	0.70	0.90	0.63	0.63	5.0	5.0	6.0	3.77	4.69	6.92	10	10.85	56.33	53.54	85.40	83.59	58.70	59.30	Park St.
11	9	37.2	0.01	0.01	0.99	0.01	0.01	1.0	1.0	6.0	0.06	1.57	0.08	12	0.46	53.70	53.53	84.33	84.33	58.92	59.30	Park St.
12	9	83.8	74.50	74.50	0.70	52.15	52.15	80.0	80.0	1.5	76.90	75.78	10.88	36	3.06	50.46	47.90	85.13	82.49	61.33	59.30	Park St.
13	7	35.1	0.00	13.01	0.00	0.00	9.11	0.0	62.4	1.8	15.96	30.54	6.12	30	1.31	44.47	44.01	45.81	45.29	57.59	58.58	Francis Ave
14	13	233.2	0.00	13.00	0.00	0.00	9.10	0.0	61.3	1.8	16.15	17.89	4.12	30	0.45	46.79	45.74	48.65	47.60	61.72	57.59	Francis Ave
15	13	8.8	0.01	0.01	0.99	0.01	0.01	1.0	1.0	6.0	0.06	9.08	3.06	10	40.72	54.83	51.26	54.94	51.31	57.10	57.59	Francis Ave
16	14	114.4	0.00	13.00	0.00	0.00	9.10	0.0	60.7	1.8	16.25	37.56	5.04	30	1.98	49.15	46.88	50.50	48.78	60.00	61.72	Francis Ave
17	16	136.4	13.00	13.00	0.70	9.10	9.10	60.0	60.0	1.8	16.38	35.87	5.27	30	1.81	51.62	49.15	52.97	50.89	61.72	60.00	Francis Ave
18	7	40.0	1.00	1.00	0.70	0.70	0.70	27.0	27.0	3.0	2.08	2.31	3.33	12	1.00	44.41	44.01	45.15	44.75	58.70	58.58	Park St.
19	9	80.0	0.00	8.30	0.00	0.00	5.81	0.0	13.1	4.3	25.01	12.45	14.15	18	3.33	50.56	47.90	92.76	82.02	61.33	59.30	Hazel St.
20	19	50.0	8.30	8.30	0.70	5.81	5.81	13.0	13.0	4.3	25.06	6.83	14.18	18	1.00	51.06	50.56	102.43	95.69	61.33	61.33	Hazel St.

System 5-Existing Park Ave Sys

Number of lines: 20

Run Date: 10-05-2009

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
2	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
3	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
4	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
5	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
6	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
7	Park St.	29.25	0.00	0.00	29.25	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
8	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
9	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
10	Park St.	3.77	0.00	2.86	0.92	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.34	12.80	0.40	11.57	2.00	Off
11	Park St.	0.06	0.00	0.06	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.08	1.90	0.09	1.44	2.00	Off
12	Park St.	76.90	0.00	0.00	76.90	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
13	Francis Ave	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
14	Francis Ave	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
15	Francis Ave	0.06	0.00	0.06	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.08	1.90	0.09	1.44	2.00	Off
16	Francis Ave	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
17	Francis Ave	16.38	0.00	0.00	16.38	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
18	Park St.	2.08	0.00	1.97	0.11	Comb	6.0	2.31	0.00	2.31	1.35	0.010	4.00	0.040	0.020	0.013	0.23	7.30	0.27	5.12	2.00	Off
19	Hazel St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
20	Hazel St.	25.06	0.00	0.00	25.06	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off

System 5-Existing Park Ave Sys

Number of lines: 20

Run Date: 10-05-2009

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	66	117.2	30.00	32.95	2.95	12.96	9.04	1.27	34.22	0.914	115	30.57	34.27	3.70	16.99	6.90	0.74	35.01	0.458	0.686	0.786	0.74	0.55
2	66	117.5	30.57	34.84	4.27	19.79	5.94	0.55	35.39	0.323	97.3	31.06	35.11	4.05	18.77	6.26	0.61	35.72	0.363	0.343	0.334	0.34	0.21
3	66	118.6	31.06	35.54	4.48	20.73	5.72	0.51	36.05	0.298	308	32.60	36.47	3.87	17.85	6.64	0.69	37.15	0.416	0.357	1.101	0.15	0.10
4	66	119.7	32.60	36.86	4.26	19.75	6.06	0.57	37.43	0.336	311	34.15	37.92	3.77	17.33	6.90	0.74	38.66	0.455	0.395	1.228	0.30	0.22
5	66	119.8	34.15	38.14	3.99	18.48	6.48	0.65	38.80	0.391	37.9	34.34	38.27	3.93	18.17	6.59	0.68	38.95	0.407	0.399	0.151	0.32	0.22
6	66	120.8	34.34	38.76	4.42	20.47	5.90	0.54	39.30	0.318	295	35.82	39.70	3.88	17.91	6.74	0.71	40.41	0.428	0.373	1.098	0.15	0.11
7	66	121.3	35.53	40.11	4.58	21.13	5.74	0.51	40.62	0.301	140	38.07	41.07	3.00**	13.25	9.16	1.30	42.37	0.926	0.613	n/a	0.93	1.21
8	24	86.28	47.50	49.50	2.00*	3.14	27.47	11.73	61.23	34.458	52.0	47.86	67.42	2.00**	3.14	27.46	11.73	79.15	34.445	34.451	17.91	0.15	1.76
9	36	86.31	47.32	78.59	3.00	7.07	12.21	2.32	80.91	3.966	28.0	47.50	79.70	3.00	7.07	12.21	2.32	82.02	3.964	3.965	1.110	1.00	2.32
10	10	3.77	53.54	83.59	0.83	0.55	6.92	0.74	84.33	7.031	25.7	56.33	85.40	0.83	0.55	6.92	0.74	86.14	7.029	7.030	1.808	1.00	0.74
11	12	0.06	53.53	84.33	1.00	0.79	0.08	0.00	84.33	0.001	37.2	53.70	84.33	1.00	0.79	0.08	0.00	84.33	0.001	0.001	0.000	1.00	0.00
12	36	76.90	47.90	82.49	3.00	7.07	10.88	1.84	84.33	3.148	83.8	50.46	85.13	3.00	7.07	10.88	1.84	86.97	3.147	3.147	2.636	1.00	1.84
13	30	15.96	44.01	45.29	1.28*	2.54	6.29	0.61	45.91	1.312	35.1	44.47	45.81	1.34**	2.68	5.95	0.55	46.36	1.133	1.222	0.428	1.00	0.55
14	30	16.15	45.74	47.60	1.86*	3.91	4.13	0.26	47.86	0.450	233	46.79	48.65	1.86	3.92	4.12	0.26	48.91	0.450	0.450	1.050	0.15	0.04
15	10	0.06	51.26	51.31	0.05*	0.01	4.69	0.34	51.65	40.673	8.8	54.83	54.94	0.11**	0.04	1.42	0.03	54.97	1.332	21.003	n/a	1.00	n/a
16	30	16.25	46.88	48.78	1.90	4.01	4.05	0.26	49.04	0.432	114	49.15	50.50 j	1.35**	2.70	6.03	0.56	51.06	1.158	0.795	n/a	0.15	n/a
17	30	16.38	49.15	50.89	1.74	3.64	4.49	0.31	51.20	0.548	136	51.62	52.97 j	1.35**	2.71	6.04	0.57	53.54	1.161	0.854	n/a	1.00	0.57
18	12	2.08	44.01	44.75	0.74*	0.62	3.33	0.17	44.92	0.999	40.0	44.41	45.15	0.74	0.63	3.33	0.17	45.33	0.998	0.999	0.399	1.00	0.17
19	18	25.01	47.90	82.02	1.50	1.77	14.16	3.12	85.13	13.432	80.0	50.56	92.76	1.50	1.77	14.15	3.11	95.87	13.426	13.429	10.74	0.94	2.93
20	18	25.06	50.56	95.69	1.50	1.77	14.18	3.13	98.81	13.485	50.0	51.06	102.43	1.50	1.77	14.18	3.13	105.56	13.480	13.482	6.741	1.00	3.13

System 5-Existing Park Ave Sys Number of lines: 20 Run Date: 10-05-2009

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
1	Park St.	0.0	84.2	0.020
2	Park St.	0.0	83.9	0.020
3	Park St.	0.0	82.8	0.020
4	Park St.	0.0	81.8	0.020
5	Park St.	0.0	81.6	0.020
6	Park St.	0.0	80.7	0.020
7	Park St.	48.0	80.2	0.020
8	Park St.	0.0	80.2	0.020
9	Park St.	0.0	80.1	0.020
10	Park St.	5.0	5.0	0.020
11	Park St.	1.0	1.0	0.020
12	Park St.	80.0	80.0	0.020
13	Francis Ave	0.0	62.4	0.020
14	Francis Ave	0.0	61.3	0.020
15	Francis Ave	1.0	1.0	0.020
16	Francis Ave	0.0	60.7	0.020
17	Francis Ave	60.0	60.0	0.020
18	Park St.	27.0	27.0	0.020
19	Hazel St.	0.0	13.1	0.020
20	Hazel St.	13.0	13.0	0.020

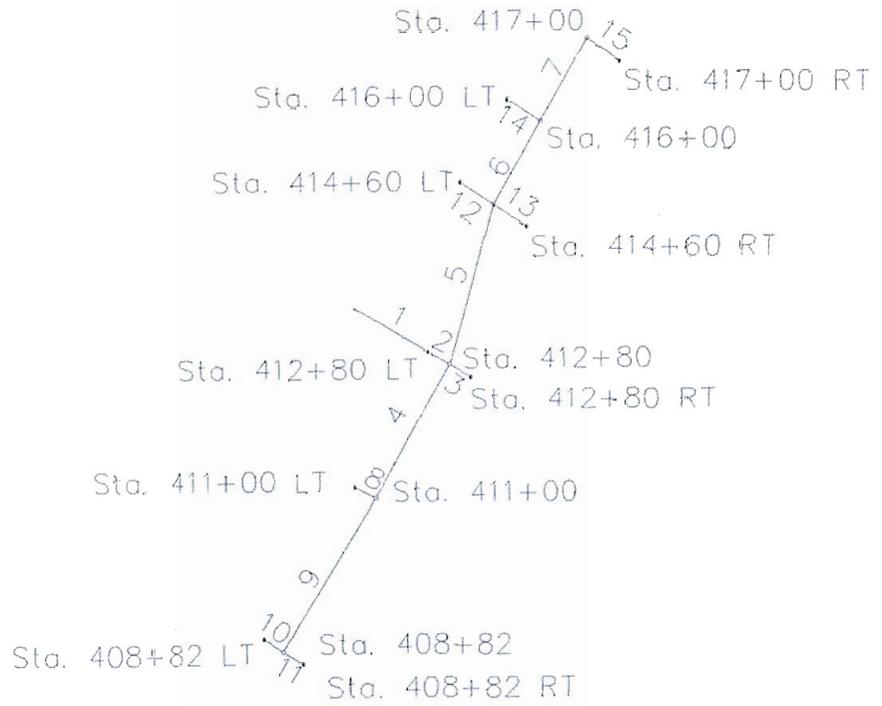
System 5-Existing Park Ave Sys

Number of lines: 20

Date: 10-05-2009

NOTES: ** Critical depth

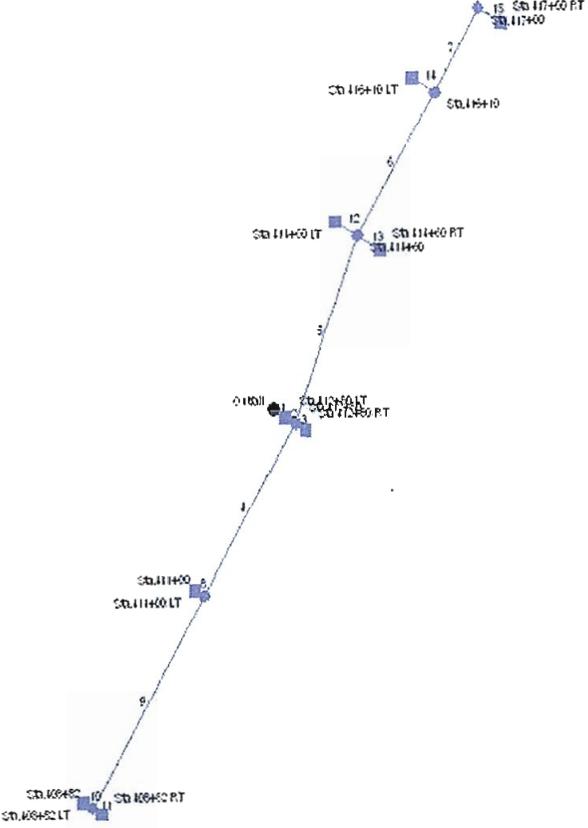
SYSTEM 5
PROPOSED BUSWAY SYSTEM
STA. 404+00 TO 418+00



SYSTEM NO. 5 GRAPHIC

REVISIONS REV. DATE REVISION DESCRIPTION SHEET NO.		DESIGNER/APPR. J. DeMatera C. Langstaff		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION		PROJECT TITLE NEW BRITAIN - HARTFORD BUSWAY		DRAWING TITLE WEST HARTFORD/ HARTFORD DRAINAGE PLAN		DRAWING NO. 155-H025	
PREP. DATE: 1/22/2009 DRAWN BY: J. DeMatera		CHECKED BY: C. Langstaff		APPROVED BY: Robert Gomez, P.E.		DATE: 1/22/2009		SCALE: NOT TO SCALE		SHEET 45	

Hydrflow Plan View



System 5 - Sta. 405+05 to 412+

No. Lines: 15

05-13-2010

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	Sta.412+80 LT	5.45	15 c	13.0	56.50	56.63	1.000	57.43	57.57	0.24	57.80	End
2	Sta.412+80	5.38	15 c	11.0	56.63	56.74	1.000	57.97*	58.04*	0.30	58.34	1
3	Sta 412+80 RT	0.86	12 c	11.0	61.94	62.00	0.545	62.33	62.40	0.14	62.53	2
4	Sta.411+00	3.13	15 c	175.0	56.74	57.63	0.509	58.54*	58.95*	0.10	59.05	2
5	Sta.414+60	2.14	12 c	175.0	61.00	61.88	0.503	61.71	62.59	0.20	62.79	2
6	Sta.416+10	1.09	12 c	145.0	61.88	62.61	0.503	62.96	63.16	0.09	63.26	5
7	Sta.417+00	0.52	12 c	85.0	62.61	63.04	0.506	63.34	63.41	0.06	63.47	6
8	Sta.411+00 LT	0.70	12 c	10.0	59.95	60.00	0.500	60.31	60.36	0.12	60.48	4
9	Sta.408+82	2.68	15 c	213.0	57.63	58.70	0.502	59.08	59.51	0.16	59.67	4
10	Sta.408+82 LT	1.46	12 c	10.0	58.95	59.00	0.500	59.73	59.74	0.09	59.82	9
11	Sta 408+82 RT	1.24	12 c	10.0	58.95	59.00	0.500	59.76	59.76	0.06	59.82	9
12	Sta 414+60 LT	0.45	12 c	25.0	61.88	62.01	0.520	62.98	62.98	0.01	62.99	5
13	Sta 414+60 RT	0.86	12 c	25.0	61.88	62.01	0.520	62.96	62.98	0.02	63.00	5
14	Sta 416+10 LT	0.70	12 c	25.0	62.61	62.74	0.520	63.31	63.31	0.04	63.35	6
15	Sta 417+00 RT	0.54	12 c	25.0	63.04	63.17	0.520	63.52	63.54	0.07	63.60	7

System 5 - Sta. 405+05 to 412+

Number of lines: 15

Run Date: 05-13-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown).

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rlm Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	13.0	0.02	1.30	0.90	0.02	1.17	5.0	10.8	4.7	5.45	6.46	5.53	15	1.00	56.63	56.50	57.57	57.43	65.32	61.10	Sta.412+80 LT
2	1	11.0	0.00	1.28	0.00	0.00	1.15	0.0	10.8	4.7	5.38	6.46	4.38	15	1.00	56.74	56.63	58.04	57.97	65.74	65.32	Sta.412+80
3	2	11.0	0.16	0.16	0.90	0.14	0.14	5.0	5.0	6.0	0.86	2.63	2.99	12	0.55	62.00	61.94	62.40	62.33	65.75	65.74	Sta 412+80 RT
4	2	175.0	0.00	0.63	0.00	0.00	0.57	0.0	6.7	5.5	3.13	4.61	2.55	15	0.51	57.63	56.74	58.95	58.54	64.39	65.74	Sta.411+00
5	2	175.0	0.00	0.49	0.00	0.00	0.44	0.0	9.7	4.9	2.14	2.53	3.60	12	0.50	61.88	61.00	62.59	61.71	67.07	65.74	Sta.414+60
6	5	145.0	0.00	0.23	0.00	0.00	0.21	0.0	7.7	5.3	1.09	2.53	1.92	12	0.50	62.61	61.88	63.16	62.96	68.20	67.07	Sta.416+10
7	6	85.0	0.00	0.10	0.00	0.00	0.09	0.0	5.6	5.8	0.52	2.53	1.41	12	0.51	63.04	62.61	63.41	63.34	68.87	68.20	Sta.417+00
8	4	10.0	0.13	0.13	0.90	0.12	0.12	5.0	5.0	6.0	0.70	2.52	2.75	12	0.50	60.00	59.95	60.36	60.31	63.82	64.39	Sta.411+00 LT
9	4	213.0	0.00	0.50	0.00	0.00	0.45	0.0	5.1	6.0	2.68	4.58	2.70	15	0.50	58.70	57.63	59.51	59.08	63.16	64.39	Sta.408+82
10	9	10.0	0.27	0.27	0.90	0.24	0.24	5.0	5.0	6.0	1.46	2.52	2.28	12	0.50	59.00	58.95	59.74	59.73	62.59	63.16	Sta.408+82 LT
11	9	10.0	0.23	0.23	0.90	0.21	0.21	5.0	5.0	6.0	1.24	2.52	1.88	12	0.50	59.00	58.95	59.76	59.76	62.59	63.16	Sta 408+82 RT
12	5	25.0	0.10	0.10	0.90	0.09	0.09	9.0	9.0	5.0	0.45	2.57	0.58	12	0.52	62.01	61.88	62.98	62.98	66.24	67.07	Sta 414+60 LT
13	5	25.0	0.16	0.16	0.90	0.14	0.14	5.0	5.0	6.0	0.86	2.57	1.10	12	0.52	62.01	61.88	62.98	62.96	66.24	67.07	Sta 414+60 RT
14	6	25.0	0.13	0.13	0.90	0.12	0.12	5.0	5.0	6.0	0.70	2.57	1.35	12	0.52	62.74	62.61	63.31	63.31	67.37	68.20	Sta 416+10 LT
15	7	25.0	0.10	0.10	0.90	0.09	0.09	5.0	5.0	6.0	0.54	2.57	1.74	12	0.52	63.17	63.04	63.54	63.52	68.04	68.87	Sta 417+00 RT

System 5 - Sta. 405+05 to 412+

Number of lines: 15

Run Date: 05-13-2010

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	Sta.412+80 LT	0.11	0.00	0.11	0.00	Grate	6.0	2.31	0.00	2.31	1.35	0.008	4.00	0.040	0.020	0.013	0.08	1.98	0.09	1.51	2.00	Off
2	Sta.412+80	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
3	Sta 412+80 RT	0.86	0.00	0.86	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.008	4.00	0.040	0.200	0.013	0.17	4.06	0.34	1.39	2.00	11
4	Sta.411+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
5	Sta.414+60	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
6	Sta.416+10	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
7	Sta.417+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
8	Sta.411+00 LT	0.70	0.00	0.70	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.008	4.00	0.040	0.020	0.013	0.16	3.98	0.19	3.03	2.00	10
9	Sta.408+82	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
10	Sta.408+82 LT	1.46	0.00	1.46	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.13	3.33	0.22	3.57	2.00	Off
11	Sta 408+82 RT	1.24	0.00	1.24	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.10	2.58	0.19	3.08	2.00	Off
12	Sta 414+60 LT	0.45	0.00	0.45	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.008	4.00	0.040	0.020	0.013	0.14	3.38	0.16	2.56	2.00	1
13	Sta 414+60 RT	0.86	0.00	0.86	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.008	4.00	0.040	0.020	0.013	0.17	4.55	0.20	3.28	2.00	3
14	Sta 416+10 LT	0.70	0.00	0.70	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.008	4.00	0.040	0.020	0.013	0.16	3.98	0.19	3.03	2.00	12
15	Sta 417+00 RT	0.54	0.00	0.54	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.008	4.00	0.040	0.020	0.013	0.14	3.60	0.17	2.74	2.00	13

System 5 - Sta. 405+05 to 412+

Number of lines: 15

Run Date: 05-13-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minc loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	15	5.45	56.50	57.43	0.93	0.98	5.54	0.48	57.91	0.864	13.0	56.63	57.57	0.94**	0.99	5.52	0.47	58.04	0.858	0.861	0.112	0.50	0.24
2	15	5.38	56.63	57.97	1.25	1.23	4.38	0.30	58.27	0.693	11.0	56.74	58.04	1.25	1.23	4.38	0.30	58.34	0.693	0.693	0.076	1.00	0.30
3	12	0.86	61.94	62.33	0.39*	0.29	3.00	0.14	62.47	0.545	11.0	62.00	62.40	0.40**	0.29	2.98	0.14	62.53	0.534	0.540	0.059	1.00	0.14
4	15	3.13	56.74	58.54	1.25	1.23	2.55	0.10	58.64	0.234	175	57.63	58.95	1.25	1.23	2.55	0.10	59.05	0.234	0.234	0.410	1.00	0.10
5	12	2.14	61.00	61.71	0.71*	0.59	3.61	0.20	61.91	0.502	175	61.88	62.59	0.71	0.59	3.60	0.20	62.79	0.501	0.502	0.878	1.00	0.20
6	12	1.09	61.88	62.96	1.00	0.79	1.39	0.03	62.99	0.094	145	62.61	63.16	0.55	0.45	2.45	0.09	63.26	0.270	0.182	0.264	1.00	0.09
7	12	0.52	62.61	63.34	0.73	0.62	0.85	0.01	63.35	0.027	85.0	63.04	63.41	0.37	0.26	1.98	0.06	63.47	0.252	0.140	0.119	1.00	0.06
8	12	0.70	59.95	60.31	0.36*	0.26	2.74	0.12	60.43	0.499	10.0	60.00	60.36	0.36**	0.25	2.75	0.12	60.48	0.505	0.502	0.050	1.00	0.12
9	15	2.68	57.63	59.08	1.25	1.23	2.19	0.07	59.15	0.172	213	58.70	59.51	0.81	0.84	3.21	0.16	59.67	0.308	0.240	0.512	1.00	0.16
10	12	1.46	58.95	59.73	0.78	0.66	2.22	0.08	59.80	0.185	10.0	59.00	59.74	0.74	0.62	2.34	0.09	59.82	0.208	0.197	0.020	1.00	0.09
11	12	1.24	58.95	59.76	0.81	0.68	1.83	0.05	59.81	0.125	10.0	59.00	59.76	0.76	0.64	1.93	0.06	59.82	0.140	0.132	0.013	1.00	0.06
12	12	0.45	61.88	62.98	1.00	0.79	0.57	0.01	62.98	0.016	25.0	62.01	62.98	0.97	0.78	0.58	0.01	62.99	0.014	0.015	0.004	1.00	0.01
13	12	0.86	61.88	62.96	1.00	0.79	1.10	0.02	62.98	0.059	25.0	62.01	62.98	0.97	0.78	1.11	0.02	63.00	0.051	0.055	0.014	1.00	0.02
14	12	0.70	62.61	63.31	0.70	0.58	1.20	0.02	63.33	0.056	25.0	62.74	63.31	0.57	0.47	1.51	0.04	63.35	0.099	0.078	0.019	1.00	0.04
15	12	0.54	63.04	63.52	0.48	0.38	1.43	0.03	63.56	0.102	25.0	63.17	63.54	0.37	0.26	2.05	0.07	63.60	0.274	0.188	0.047	1.00	0.07

System 5 - Sta. 405+05 to 412+

Number of lines: 15

Run Date: 05-13-2010

Notes: * Normal depth assumed.; ** Critical depth.

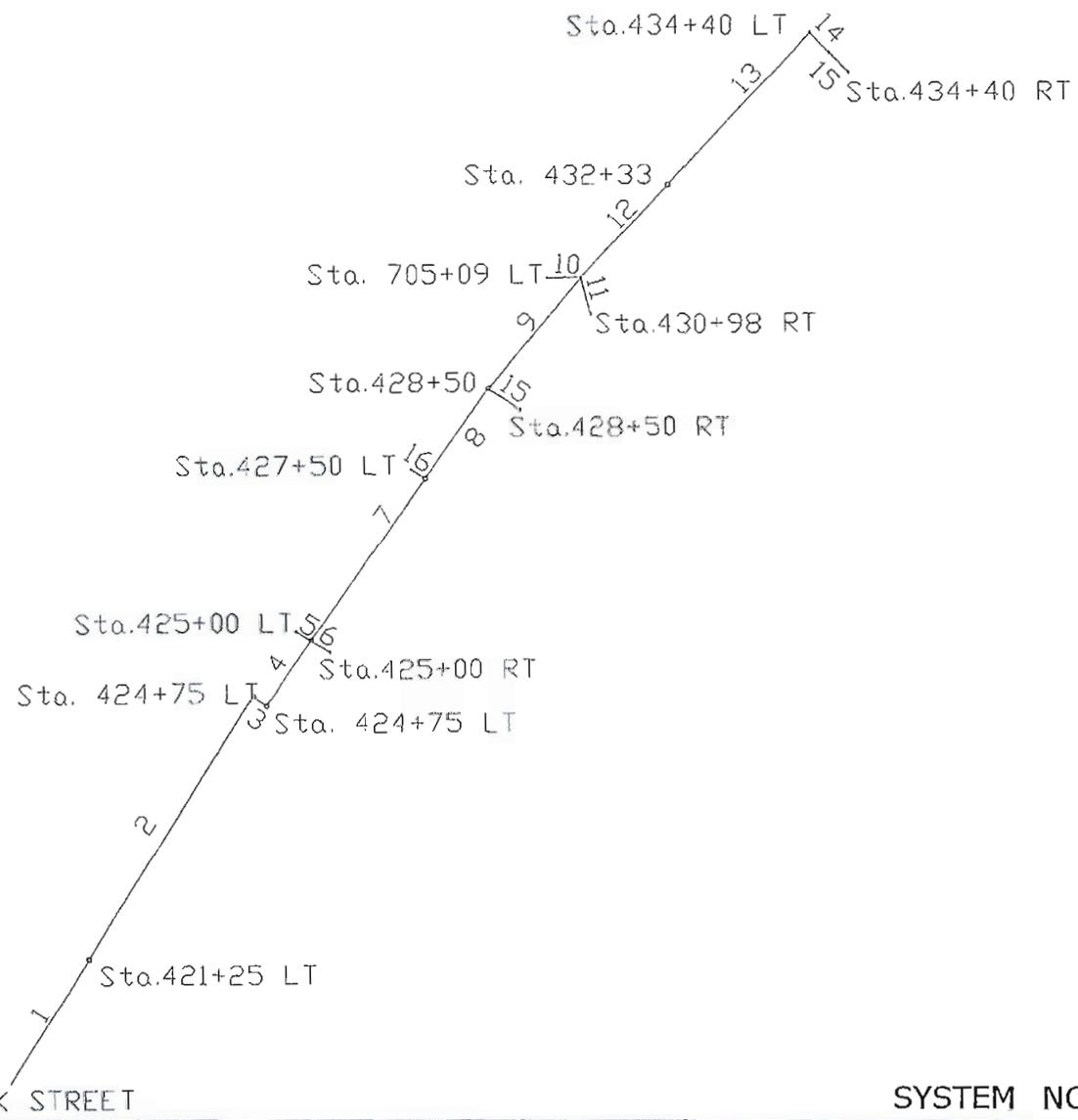
Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
1	Sta.412+80 LT	5.0	10.8	0.013
2	Sta.412+80	0.0	10.8	0.013
3	Sta 412+80 RT	5.0	5.0	0.013
4	Sta.411+00	0.0	6.7	0.013
5	Sta.414+60	0.0	9.7	0.013
6	Sta.416+10	0.0	7.7	0.013
7	Sta.417+00	0.0	5.6	0.013
8	Sta.411+00 LT	5.0	5.0	0.013
9	Sta.408+82	0.0	5.1	0.013
10	Sta.408+82 LT	5.0	5.0	0.013
11	Sta 408+82 RT	5.0	5.0	0.013
12	Sta 414+60 LT	9.0	9.0	0.013
13	Sta 414+60 RT	5.0	5.0	0.013
14	Sta 416+10 LT	5.0	5.0	0.013
15	Sta 417+00 RT	5.0	5.0	0.013

System 5 - Sta. 405+05 to 412+	Number of lines: 15	Date: 05-13-2010
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NOTES: ** Critical depth

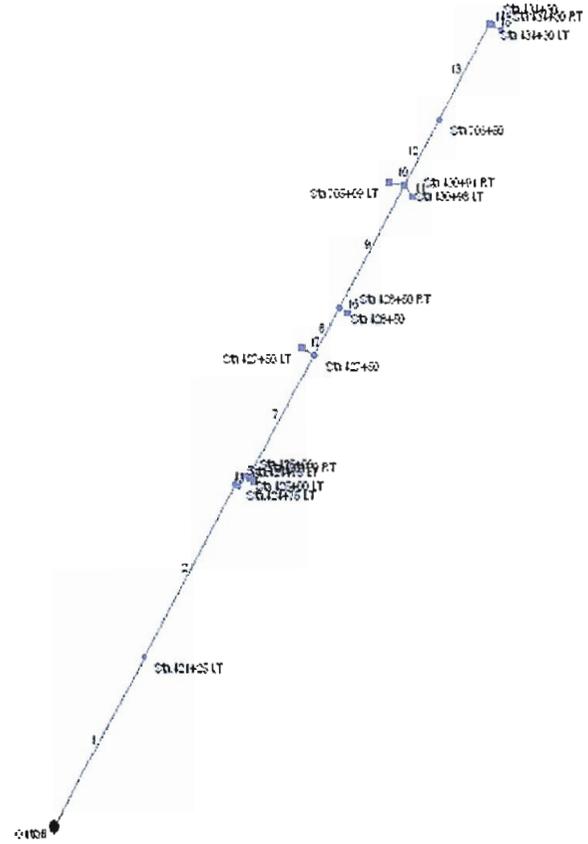
SYSTEM 6

STA. 418+00 TO 439+25



DESIGNED BY: C. Langhior/B. Sime CHECKED BY: J. Barsbam NOT TO SCALE		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION		PROJECT TITLE: NEW BRITAIN - HARTFORD BUSWAY		TOWN: WEST HARTFORD/ HARTFORD		DESIGN NO. 155-H025		
ENGINEER: VN ENGINEERS, INC. / URS CORPORATION A/E APPROVED BY: Ray Volpe, P.E.		ENGINEER: VN ENGINEERS, INC.		DRAWING TITLE: DRAINAGE PLAN		SHEET NO.		SHEET NO.		
REV. DATE REVISION DESCRIPTION SHEET NO.	DESIGN NUMBER: 4282010 BORDER VERSION: 3/2007 THE BOUNDING BOXES INDICATED ON THIS SHEET ARE FOR IDENTIFICATION ONLY AND ARE NOT TO BE USED FOR CONSTRUCTION OR AS A BASIS FOR ANY CLAIMS OR DAMAGES OF ANY KIND.		SHEET NO.		SHEET NO.		SHEET NO.		SHEET NO.	

Hydroflow Plan View



System 6

No. Lines: 17

06-28-2010

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	Sta.421+25 LT	5.17	18 c	338.0	42.06	43.75	0.500	42.93	44.73	n/a	44.96 i	End
2	Sta.424+75 LT	5.35	18 c	346.0	43.75	45.48	0.500	44.96	46.36	n/a	46.91 i	1
3	Sta.424+75 LT	5.35	18 c	7.0	45.48	45.52	0.571	46.91	46.92	0.15	47.07	2
4	Sta 425+00 LT	5.36	18 c	20.0	45.52	45.62	0.500	47.08	47.12	0.21	47.33	3
5	Sta 425+00	4.28	18 c	10.0	45.62	45.67	0.500	47.39*	47.40*	0.09	47.49	4
6	Sta 425+00 RT	0.32	12 c	10.0	56.45	56.50	0.500	56.69	56.74	n/a	56.82 i	5
7	Sta 427+50	4.27	18 c	245.0	45.67	46.91	0.506	47.50	47.93	0.17	48.10	5
8	Sta 428+50(2)	4.05	18 c	95.0	46.91	47.40	0.516	48.19	48.31	n/a	48.39 i	7
9	Sta 430+98 LT	3.46	18 c	244.0	47.40	48.62	0.500	48.39	49.33	n/a	49.69 i	8
10	Sta 705+09 LT	0.34	12 c	29.0	48.87	49.02	0.517	49.69	49.69	0.01	49.70	9
11	Sta 430+91 RT	1.83	15 c	25.0	48.87	49.00	0.520	49.69	49.70	0.10	49.80	9
12	Sta 706+50	1.43	15 c	131.0	48.87	49.53	0.504	49.69	50.01	n/a	50.21 i	9
13	Sta 434+30 LT	1.52	15 c	192.0	49.53	50.49	0.500	50.21	50.98	n/a	51.20 i	12
14	Sta 434+30	0.99	12 c	5.0	50.49	50.52	0.600	51.20	51.20	0.02	51.22	13
15	Sta 434+30 RT	1.19	12 c	20.0	50.52	50.62	0.500	51.22	51.24	0.08	51.32	14
16	Sta 428+50 RT	1.46	12 c	18.0	48.35	48.44	0.500	48.90	48.99	n/a	49.16 i	8
17	Sta 427+50 LT	0.55	12 c	27.0	49.86	50.00	0.519	50.17	50.32	n/a	50.42 i	7

System 6 Number of lines: 17 Run Date: 06-28-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; i - Inlet control.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	338.0	0.00	2.16	0.00	0.00	1.87	0.0	30.6	2.8	5.17	7.43	4.54	18	0.50	43.75	42.06	44.73	42.93	54.50	49.00	Sta.421+25 LT
2	1	346.0	0.00	2.16	0.00	0.00	1.87	0.0	28.8	2.9	5.35	7.43	4.23	18	0.50	45.48	43.75	46.36	44.96	60.00	54.50	Sta.424+75 LT
3	2	7.0	0.00	2.16	0.00	0.00	1.87	0.0	28.8	2.9	5.35	7.94	3.10	18	0.57	45.52	45.48	46.92	46.91	60.65	60.00	Sta.424+75 LT
4	3	20.0	0.42	2.16	0.90	0.38	1.87	5.0	28.7	2.9	5.36	7.43	3.04	18	0.50	45.62	45.52	47.12	47.08	60.28	60.65	Sta 425+00 LT
5	4	10.0	0.00	1.74	0.00	0.00	1.49	0.0	28.6	2.9	4.28	7.43	2.42	18	0.50	45.67	45.62	47.40	47.39	60.85	60.28	Sta 425+00
6	5	10.0	0.06	0.06	0.90	0.05	0.05	5.0	5.0	6.0	0.32	2.52	2.20	12	0.50	56.50	56.45	56.74	56.69	60.28	60.85	Sta 425+00 RT
7	5	245.0	0.00	1.68	0.00	0.00	1.43	0.0	27.0	3.0	4.27	7.47	2.88	18	0.51	46.91	45.67	47.93	47.50	57.25	60.85	Sta 427+50
8	7	95.0	0.00	1.55	0.00	0.00	1.34	0.0	26.4	3.0	4.05	7.54	3.07	18	0.52	47.40	46.91	48.31	48.19	55.70	57.25	Sta 428+50(2)
9	8	244.0	0.29	1.28	0.90	0.26	1.10	5.0	24.4	3.1	3.46	7.43	3.51	18	0.50	48.62	47.40	49.33	48.39	53.01	55.70	Sta 430+98 LT
10	9	29.0	0.14	0.14	0.70	0.10	0.10	20.0	20.0	3.5	0.34	2.56	0.56	12	0.52	49.02	48.87	49.69	49.69	50.00	53.01	Sta 705+09 LT
11	9	25.0	0.34	0.34	0.90	0.31	0.31	5.0	5.0	6.0	1.83	4.66	2.37	15	0.52	49.00	48.87	49.70	49.69	52.41	53.01	Sta 430+91 RT
12	9	131.0	0.00	0.51	0.00	0.00	0.44	0.0	22.6	3.3	1.43	4.58	2.49	15	0.50	49.53	48.87	50.01	49.69	54.00	53.01	Sta 706+50
13	12	192.0	0.17	0.51	0.90	0.15	0.44	5.0	20.1	3.5	1.52	4.57	2.80	15	0.50	50.49	49.53	50.98	50.21	55.70	54.00	Sta 434+30 LT
14	13	5.0	0.12	0.34	0.70	0.08	0.28	20.0	20.0	3.5	0.99	2.76	1.70	12	0.60	50.52	50.49	51.20	51.20	55.00	55.70	Sta 434+30
15	14	20.0	0.22	0.22	0.90	0.20	0.20	5.0	5.0	6.0	1.19	2.52	2.16	12	0.50	50.62	50.52	51.24	51.22	55.28	55.00	Sta 434+30 RT
16	8	18.0	0.27	0.27	0.90	0.24	0.24	5.0	5.0	6.0	1.46	2.52	3.32	12	0.50	48.44	48.35	48.99	48.90	52.44	55.70	Sta 428+50 RT
17	7	27.0	0.13	0.13	0.70	0.09	0.09	5.0	5.0	6.0	0.55	2.56	2.58	12	0.52	50.00	49.86	50.32	50.17	55.00	57.25	Sta 427+50 LT

System 6 Number of lines: 17 Run Date: 06-28-2010

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	Sta.421+25 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
2	Sta.424+75 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
3	Sta.424+75 LT	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
4	Sta 425+00 LT	2.26	0.00	2.18	0.09	Comb	6.0	2.31	0.00	2.31	1.35	0.015	4.00	0.040	0.020	0.013	0.22	6.85	0.26	4.52	2.00	15
5	Sta 425+00	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
6	Sta 425+00 RT	0.32	0.00	0.32	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.015	4.00	0.040	0.020	0.013	0.11	2.65	0.12	2.01	2.00	15
7	Sta 427+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
8	Sta 428+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
9	Sta 430+98 LT	1.56	0.00	1.57	0.00	Grate	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.13	3.37	0.22	3.59	2.00	Off
10	Sta 705+09 LT	0.34	0.00	0.34	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.015	4.00	0.040	0.020	0.013	0.11	2.70	0.13	2.06	2.00	Off
11	Sta 430+91 RT	1.83	0.44	2.27	0.00	Grate	0.0	0.00	2.50	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.20	5.86	0.28	5.86	2.00	Off
12	Sta 706+50	0.00	0.00	0.00	0.00	MH	6.0	2.31	0.00	2.31	1.35	Sag	4.00	0.040	0.020	0.013	0.00	0.00	0.00	0.00	0.00	11
13	Sta 434+30 LT	0.92	0.00	0.92	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.010	4.00	0.040	0.020	0.013	0.17	4.40	0.20	3.21	2.00	12
14	Sta 434+30	0.29	0.00	0.29	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.010	4.00	0.040	0.020	0.013	0.11	2.75	0.13	2.09	2.00	Off
15	Sta 434+30 RT	1.19	0.09	1.27	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.010	4.00	0.040	0.020	0.013	0.19	5.50	0.22	3.63	2.00	9
16	Sta 428+50 RT	1.46	0.00	1.01	0.44	Grate	0.0	0.00	0.00	2.31	1.35	0.010	2.00	0.040	0.020	0.013	0.19	7.30	0.28	5.42	2.00	11
17	Sta 427+50 LT	0.55	0.00	0.48	0.07	Comb	6.0	2.31	0.00	2.31	1.35	0.010	2.00	0.040	0.020	0.013	0.13	4.70	0.20	1.92	2.00	Off

System 6 Number of lines: 17 Run Date: 06-28-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Mino loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	18	5.17	42.06	42.93	0.87	1.06	4.88	0.37	43.30	n/a	338	43.75	44.73	0.98	1.23	4.20	0.27	45.01i	n/a	n/a	1.437	0.15	n/a
2	18	5.35	43.75	44.96	1.21	1.52	3.51	0.19	45.15	n/a	346	45.48	46.36	0.88**	1.08	4.95	0.38	46.74i	n/a	n/a	n/a	1.00	n/a
3	18	5.35	45.48	46.91	1.43	1.74	3.08	0.15	47.06	0.226	7.0	45.52	46.92	1.40	1.72	3.11	0.15	47.07	0.225	0.225	0.016	1.00	0.15
4	18	5.36	45.52	47.08	1.50	1.77	3.04	0.14	47.23	0.261	20.0	45.62	47.12	1.50	1.77	3.04	0.14	47.26	0.259	0.260	0.052	1.50	0.21
5	18	4.28	45.62	47.39	1.50	1.77	2.42	0.09	47.48	0.166	10.0	45.67	47.40	1.50	1.77	2.42	0.09	47.49	0.166	0.166	0.017	1.00	0.09
6	12	0.32	56.45	56.69	0.24*	0.15	2.20	0.08	56.77	n/a	10.0	56.50	56.74	0.24**	0.15	2.19	0.07	56.82i	n/a	n/a	-0.024	1.00	n/a
7	18	4.27	45.67	47.50	1.50	1.77	2.41	0.09	47.59	0.165	245	46.91	47.93	1.02	1.28	3.34	0.17	48.10	0.255	0.210	0.515	1.00	0.17
8	18	4.05	46.91	48.19	1.28	1.61	2.52	0.10	48.29	n/a	95.0	47.40	48.31	0.91	1.12	3.63	0.20	48.51i	n/a	n/a	0.014	1.00	n/a
9	18	3.46	47.40	48.39	0.99	1.23	2.81	0.12	48.51	n/a	244	48.62	49.33	0.71**	0.82	4.20	0.27	49.60i	n/a	n/a	n/a	2.25	n/a
10	12	0.34	48.87	49.69	0.82	0.69	0.50	0.00	49.69	0.009	29.0	49.02	49.69	0.67	0.56	0.61	0.01	49.70	0.015	0.012	0.004	1.00	0.01
11	15	1.83	48.87	49.69	0.82	0.85	2.15	0.07	49.76	0.137	25.0	49.00	49.70	0.70	0.71	2.59	0.10	49.80	0.221	0.179	0.045	1.00	0.10
12	15	1.43	48.87	49.69	0.82	0.85	1.68	0.04	49.73	n/a	131	49.53	50.01	0.48**	0.43	3.31	0.17	50.18i	n/a	n/a	n/a	0.15	n/a
13	15	1.52	49.53	50.21	0.68	0.68	2.23	0.08	50.29	n/a	192	50.49	50.98	0.49**	0.45	3.38	0.18	51.16i	n/a	n/a	n/a	1.50	n/a
14	12	0.99	50.49	51.20	0.71	0.59	1.66	0.04	51.24	0.107	5.0	50.52	51.20	0.68	0.57	1.74	0.05	51.25	0.119	0.113	0.006	0.50	0.02
15	12	1.19	50.52	51.22	0.70	0.59	2.01	0.06	51.29	0.156	20.0	50.62	51.24	0.62	0.51	2.32	0.08	51.32	0.222	0.189	0.038	1.00	0.08
16	12	1.46	48.35	48.90	0.55*	0.44	3.32	0.17	49.07	n/a	18.0	48.44	48.99	0.55	0.44	3.31	0.17	49.16i	n/a	n/a	-0.081	1.00	n/a
17	12	0.55	49.86	50.17	0.31*	0.21	2.59	0.10	50.28	n/a	27.0	50.00	50.32	0.32**	0.21	2.57	0.10	50.42i	n/a	n/a	0.038	1.00	n/a

System 6

Number of lines: 17

Run Date: 06-28-2010

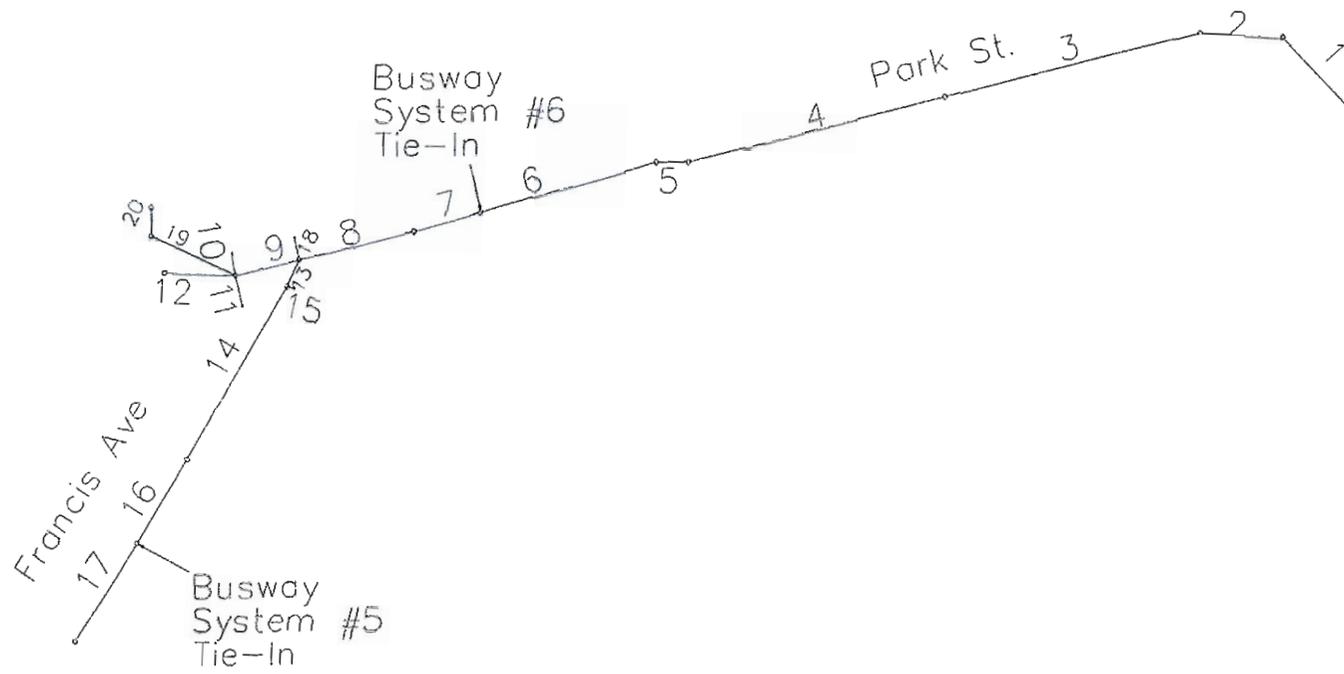
Notes: * Normal depth assumed.; ** Critical depth.

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
1	Sta.421+25 LT	0.0	30.6	0.013
2	Sta.424+75 LT	0.0	28.8	0.013
3	Sta.424+75 LT	0.0	28.8	0.013
4	Sta 425+00 LT	5.0	28.7	0.013
5	Sta 425+00	0.0	28.6	0.013
6	Sta 425+00 RT	5.0	5.0	0.013
7	Sta 427+50	0.0	27.0	0.013
8	Sta 428+50	0.0	26.4	0.013
9	Sta 430+98 LT	5.0	24.4	0.013
10	Sta 705+09 LT	20.0	20.0	0.013
11	Sta 430+91 RT	5.0	5.0	0.013
12	Sta 706+50	0.0	22.6	0.013
13	Sta 434+30 LT	5.0	20.1	0.013
14	Sta 434+30	20.0	20.0	0.013
15	Sta 434+30 RT	5.0	5.0	0.013
16	Sta 428+50 RT	5.0	5.0	0.013
17	Sta 427+50 LT	5.0	5.0	0.013

System 6	Number of lines: 17	Date: 06-28-2010
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NOTES: i Inlet control; ** Critical depth

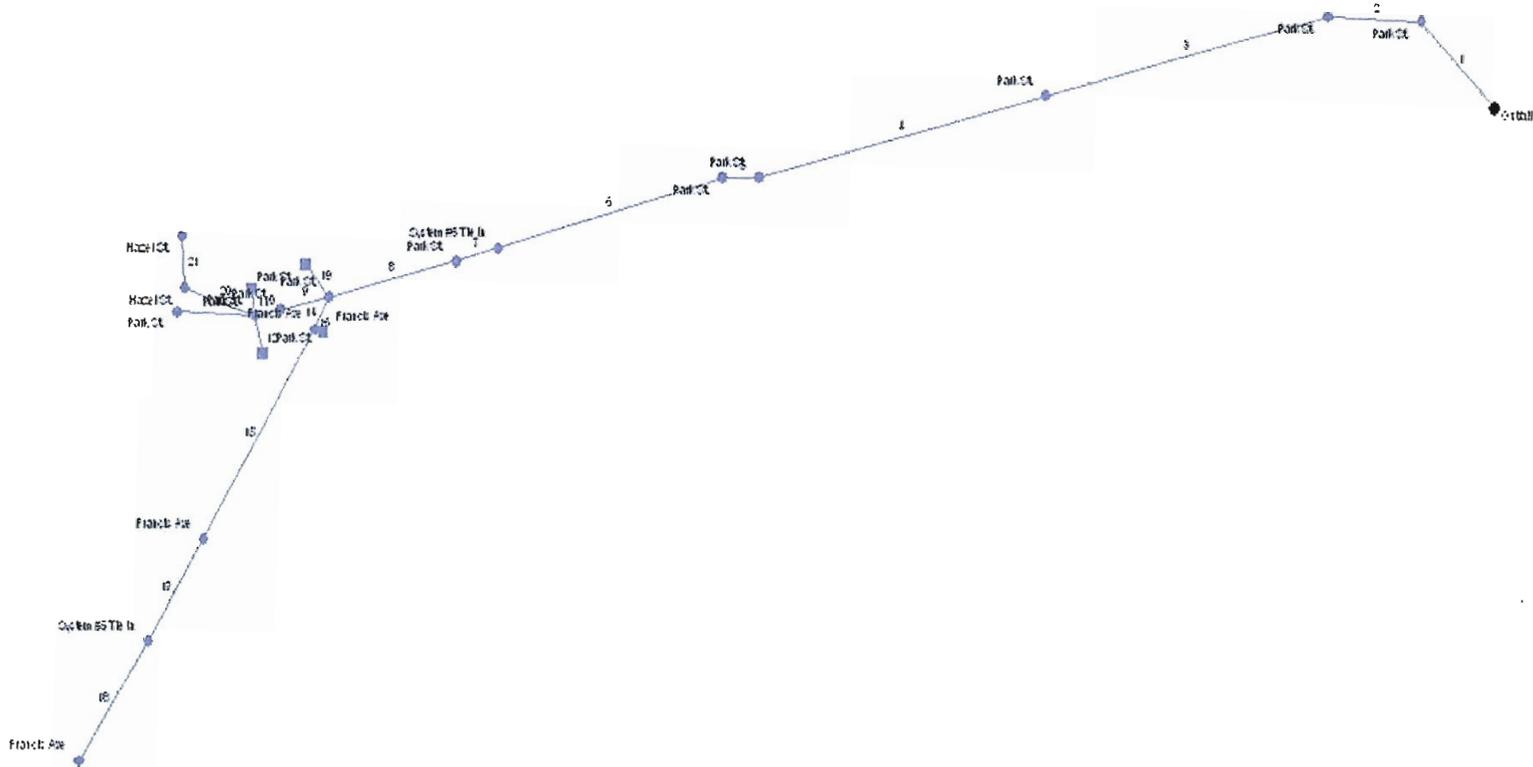
SYSTEM 5 & 6
EXISTING PARK STREET SYSTEM & BUSWAY SYSTEMS
COMBINED
STA. 404+00 TO 418+00



SYSTEM NO. 5 & 6 GRAPHIC - EXISTING AND PROPOSED SYSTEM

PROJECT NO. 155-H025 DATE 07/19/97 DRAWN BY J. Barners CHECKED BY C. Leaphar THE INFORMATION CONTAINED HEREIN IS FOR THE USE OF THE CLIENT ONLY AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.		DESIGNER: VN ENGINEERS, INC. / URS CORPORATION AES APPROVED BY: Robert Gomez, P.E.	STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	PROJECT TITLE: NEW BRITAIN - HARTFORD BUSWAY	TOWN: WEST HARTFORD/ HARTFORD	PROJECT NO. 155-H025 SHEET NO. DRAINAGE PLAN
SHEET NO.	NOT TO SCALE	DATE:	VN ENGINEERS, INC.	SHEET NO.	SHEET NO.	SHEET NO.

Hydraflow Plan View



System 5 & 6 Exist. & Proposed

No. Lines: 21

06-28-2010

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL. Dn (ft)	Invert EL. Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	Park St.	123.5	66 c	114.5	30.00	30.57	0.498	33.03	34.38	0.57	34.95	End
2	Park St.	123.9	66 c	97.3	30.57	31.06	0.504	34.99	35.28	0.21	35.49	1
3	Park St.	124.9	66 c	308.2	31.06	32.60	0.500	35.68	36.65	0.10	36.75	2
4	Park St.	125.9	66 c	310.6	32.60	34.15	0.499	37.00	38.09	0.22	38.31	3
5	Park St.	126.0	66 c	37.9	34.15	34.34	0.502	38.31	38.45	0.22	38.67	4
6	System #6 Tie In	126.8	66 c	247.0	34.34	35.58	0.502	38.90	39.70	0.10	39.80	5
7	Park St.	121.8	66 c	46.0	35.58	35.82	0.522	39.80	39.94	0.09	40.04	6
8	Park St.	122.3	66 c	140.0	35.53	38.07	1.814	40.26	41.08	n/a	41.08	7
9	Park St.	86.28	24 c	52.0	47.50	47.86	0.692	49.50*	67.42*	1.76	69.18	8
10	Park St.	86.31	36 c	28.0	47.32	47.50	0.643	78.59*	79.70*	2.32	82.02	9
11	Park St.	3.77	10 c	25.7	53.54	56.33	10.848	83.59*	85.40*	0.74	86.14	10
12	Park St.	0.06	12 c	37.2	53.53	53.70	0.457	84.33*	84.33*	0.00	84.33	10
13	Park St.	76.90	36 c	83.8	47.90	50.46	3.056	82.49*	85.13*	1.84	86.97	10
14	Francis Ave	16.98	30 c	35.1	44.01	44.47	1.312	45.34	45.85	0.58	46.43	8
15	Francis Ave	17.16	30 c	233.2	45.74	46.79	0.450	47.70	48.75	0.04	48.79	14
16	Francis Ave	0.06	10 c	8.8	51.26	54.83	40.724	51.31	54.94	n/a	54.94	14
17	System #5 Tie In	17.25	30 c	114.4	46.88	49.15	1.985	48.87	50.54	n/a	50.54 j	15
18	Francis Ave	16.38	30 c	136.4	49.15	51.62	1.811	50.96	52.97	n/a	52.97 j	17
19	Park St.	2.08	12 c	40.0	44.01	44.41	1.000	44.75	45.15	0.17	45.33	8
20	Hazel St.	25.01	18 c	80.0	47.90	50.56	3.325	82.02*	92.76*	2.93	95.69	10
21	Hazel St.	25.06	18 c	50.0	50.56	51.06	1.000	95.69*	102.43*	3.13	105.56	20

System 5 & 6 Exist. & Proposed

Number of lines: 21

Run Date: 06-28-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	114.5	0.00	117.5	0.00	0.00	82.41	0.0	84.0	1.4	123.5	154.0	8.12	66	0.50	30.57	30.00	34.38	33.03	49.13	53.16	Park St.
2	1	97.3	0.00	117.5	0.00	0.00	82.41	0.0	83.7	1.4	123.9	154.9	6.20	66	0.50	31.06	30.57	35.28	34.99	47.02	49.13	Park St.
3	2	308.2	0.00	117.5	0.00	0.00	82.41	0.0	82.7	1.4	124.9	154.3	6.26	66	0.50	32.60	31.06	36.65	35.68	42.76	47.02	Park St.
4	3	310.6	0.00	117.5	0.00	0.00	82.41	0.0	81.7	1.5	125.9	154.2	6.55	66	0.50	34.15	32.60	38.09	37.00	45.00	42.76	Park St.
5	4	37.9	0.00	117.5	0.00	0.00	82.41	0.0	81.6	1.5	126.0	154.6	6.57	66	0.50	34.34	34.15	38.45	38.31	44.65	45.00	Park St.
6	5	247.0	0.00	117.5	0.00	0.00	82.41	0.0	80.8	1.5	126.8	154.7	6.33	66	0.50	35.58	34.34	39.70	38.90	49.65	44.65	System #6 Tie In
7	6	46.0	0.00	117.5	0.00	0.00	82.41	0.0	80.7	1.5	121.8	157.7	6.30	66	0.52	35.82	35.58	39.94	39.80	0.00	49.65	Park St.
8	7	140.0	20.00	117.5	0.70	14.00	82.41	43.0	80.2	1.5	122.3	294.0	7.41	66	1.81	38.07	35.53	41.08	40.26	58.58	0.00	Park St.
9	8	52.0	0.00	83.51	0.00	0.00	58.60	0.0	80.2	1.5	86.28	12.23	27.47	24	0.69	47.86	47.50	67.42	49.50	58.58	58.58	Park St.
10	9	28.0	0.00	83.51	0.00	0.00	58.60	0.0	80.1	1.5	86.31	34.76	12.21	36	0.64	47.50	47.32	79.70	78.59	59.30	58.58	Park St.
11	10	25.7	0.70	0.70	0.90	0.63	0.63	5.0	5.0	6.0	3.77	4.69	6.92	10	10.85	56.33	53.54	85.40	83.59	58.70	59.30	Park St.
12	10	37.2	0.01	0.01	0.99	0.01	0.01	1.0	1.0	6.0	0.06	1.57	0.08	12	0.46	53.70	53.53	84.33	84.33	58.92	59.30	Park St.
13	10	83.8	74.50	74.50	0.70	52.15	52.15	80.0	80.0	1.5	76.90	75.78	10.88	36	3.06	50.46	47.90	85.13	82.49	61.33	59.30	Park St.
14	8	35.1	0.00	13.01	0.00	0.00	9.11	0.0	62.3	1.8	16.98	30.54	6.24	30	1.31	44.47	44.01	45.85	45.34	57.59	58.58	Francis Ave
15	14	233.2	0.00	13.00	0.00	0.00	9.10	0.0	61.2	1.8	17.16	17.89	4.15	30	0.45	46.79	45.74	48.75	47.70	61.72	57.59	Francis Ave
16	14	8.8	0.01	0.01	0.99	0.01	0.01	1.0	1.0	6.0	0.06	9.08	3.06	10	40.72	54.83	51.26	54.94	51.31	57.10	57.59	Francis Ave
17	15	114.4	0.00	13.00	0.00	0.00	9.10	0.0	60.7	1.8	17.25	37.56	5.14	30	1.98	49.15	46.88	50.54	48.87	60.00	61.72	System #5 Tie In
18	17	136.4	13.00	13.00	0.70	9.10	9.10	60.0	60.0	1.8	16.38	35.87	5.18	30	1.81	51.62	49.15	52.97	50.96	61.72	60.00	Francis Ave
19	8	40.0	1.00	1.00	0.70	0.70	0.70	27.0	27.0	3.0	2.08	2.31	3.33	12	1.00	44.41	44.01	45.15	44.75	58.70	58.58	Park St.
20	10	80.0	0.00	8.30	0.00	0.00	5.81	0.0	13.1	4.3	25.01	12.45	14.15	18	3.33	50.56	47.90	92.76	82.02	61.33	59.30	Hazel St.
21	20	50.0	8.30	8.30	0.70	5.81	5.81	13.0	13.0	4.3	25.06	6.83	14.18	18	1.00	51.06	50.56	102.43	95.69	61.33	61.33	Hazel St.

System 5 & 6 Exist. & Proposed

Number of lines: 21

Run Date: 06-28-2010

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No		
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)	
1	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
2	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
3	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
4	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
5	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
6	System #6 Tie In	5.17*	0.00	0.00	5.17	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
7	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
8	Park St.	31.40	0.00	0.00	31.40	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
9	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
10	Park St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
11	Park St.	3.77	0.00	2.86	0.92	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.34	12.80	0.40	11.57	2.00	Off	
12	Park St.	0.06	0.00	0.06	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.08	1.90	0.09	1.44	2.00	Off	
13	Park St.	76.90	0.00	0.00	76.90	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
14	Francis Ave	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
15	Francis Ave	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
16	Francis Ave	0.06	0.00	0.06	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.003	4.00	0.040	0.020	0.013	0.08	1.90	0.09	1.44	2.00	Off	
17	System #5 Tie In	1.00*	0.00	0.00	1.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
18	Francis Ave	16.38	0.00	0.00	16.38	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
19	Park St.	2.08	0.00	1.97	0.11	Comb	6.0	2.31	0.00	2.31	1.35	0.010	4.00	0.040	0.020	0.013	0.23	7.30	0.27	5.12	2.00	Off	
20	Hazel St.	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off
21	Hazel St.	25.06	0.00	0.00	25.06	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	Off

System 5 & 6 Exist. & Proposed

Number of lines: 21

Run Date: 06-28-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	66	123.5	30.00	33.03	3.03	13.42	9.21	1.32	34.35	0.929	115	30.57	34.38	3.81	17.56	7.04	0.77	35.15	0.470	0.699	0.801	0.74	0.57
2	66	123.9	30.57	34.99	4.42	20.45	6.06	0.57	35.56	0.334	97.3	31.06	35.28	4.22	19.54	6.34	0.62	35.90	0.369	0.351	0.342	0.34	0.21
3	66	124.9	31.06	35.68	4.62	21.32	5.86	0.53	36.22	0.313	308	32.60	36.65	4.05	18.74	6.66	0.69	37.34	0.411	0.362	1.117	0.15	0.10
4	66	125.9	32.60	37.00	4.40	20.40	6.17	0.59	37.60	0.347	311	34.15	38.09	3.94	18.20	6.92	0.74	38.83	0.448	0.398	1.235	0.30	0.22
5	66	126.0	34.15	38.31	4.16	19.30	6.53	0.66	38.98	0.392	37.9	34.34	38.45	4.11	19.03	6.62	0.68	39.13	0.404	0.398	0.151	0.32	0.22
6	66	126.8	34.34	38.90	4.56	21.08	6.02	0.56	39.47	0.330	247	35.58	39.70	4.12	19.08	6.65	0.69	40.38	0.408	0.369	0.911	0.15	0.10
7	66	121.8	35.58	39.80	4.22	19.56	6.23	0.60	40.40	0.356	46.0	35.82	39.94	4.12	19.11	6.38	0.63	40.58	0.375	0.365	0.168	0.15	0.09
8	66	122.3	35.53	40.26	4.73	21.73	5.63	0.49	40.75	0.291	140	38.07	41.08	3.01**	13.31	9.19	1.31	42.39	0.929	0.610	n/a	0.93	n/a
9	24	86.28	47.50	49.50	2.00*	3.14	27.47	11.73	61.23	34.458	52.0	47.86	67.42	2.00**	3.14	27.46	11.73	79.15	34.445	34.451	17.91	0.15	1.76
10	36	86.31	47.32	78.59	3.00	7.07	12.21	2.32	80.91	3.966	28.0	47.50	79.70	3.00	7.07	12.21	2.32	82.02	3.964	3.965	1.110	1.00	2.32
11	10	3.77	53.54	83.59	0.83	0.55	6.92	0.74	84.33	7.031	25.7	56.33	85.40	0.83	0.55	6.92	0.74	86.14	7.029	7.030	1.808	1.00	0.74
12	12	0.06	53.53	84.33	1.00	0.79	0.08	0.00	84.33	0.001	37.2	53.70	84.33	1.00	0.79	0.08	0.00	84.33	0.001	0.001	0.000	1.00	0.00
13	36	76.90	47.90	82.49	3.00	7.07	10.88	1.84	84.33	3.148	83.8	50.46	85.13	3.00	7.07	10.88	1.84	86.97	3.147	3.147	2.636	1.00	1.84
14	30	16.98	44.01	45.34	1.33*	2.66	6.38	0.63	45.98	1.311	35.1	44.47	45.85	1.38**	2.79	6.09	0.58	46.43	1.159	1.235	0.433	1.00	0.58
15	30	17.16	45.74	47.70	1.96*	4.14	4.15	0.27	47.97	0.450	233	46.79	48.75	1.96	4.14	4.15	0.27	49.02	0.450	0.450	1.049	0.15	0.04
16	10	0.06	51.26	51.31	0.05*	0.01	4.69	0.34	51.65	40.673	8.8	54.83	54.94	0.11**	0.04	1.42	0.03	54.97	1.332	21.003	n/a	1.00	n/a
17	30	17.25	46.88	48.87	1.99	4.19	4.12	0.26	49.13	0.443	114	49.15	50.54 j	1.39**	2.80	6.16	0.59	51.13	1.184	0.814	n/a	0.15	n/a
18	30	16.38	49.15	50.96	1.81	3.80	4.31	0.29	51.25	0.497	136	51.62	52.97 j	1.35**	2.71	6.04	0.57	53.54	1.161	0.829	n/a	1.00	0.57
19	12	2.08	44.01	44.75	0.74*	0.62	3.33	0.17	44.92	0.999	40.0	44.41	45.15	0.74	0.63	3.33	0.17	45.33	0.998	0.999	0.399	1.00	0.17
20	18	25.01	47.90	82.02	1.50	1.77	14.16	3.12	85.13	13.432	80.0	50.56	92.76	1.50	1.77	14.15	3.11	95.87	13.426	13.429	10.74	0.94	2.93
21	18	25.06	50.56	95.69	1.50	1.77	14.18	3.13	98.81	13.485	50.0	51.06	102.43	1.50	1.77	14.18	3.13	105.56	13.480	13.482	6.741	1.00	3.13

System 5 & 6 Exist. & Proposed

Number of lines: 21

Run Date: 06-28-2010

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe
1	Park St.	0.0	84.0	0.020
2	Park St.	0.0	83.7	0.020
3	Park St.	0.0	82.7	0.020
4	Park St.	0.0	81.7	0.020
5	Park St.	0.0	81.6	0.020
6	System #6 Tie In	0.0	80.8	0.020
7	Park St.	0.0	80.7	0.020
8	Park St.	43.0	80.2	0.020
9	Park St.	0.0	80.2	0.020
10	Park St.	0.0	80.1	0.020
11	Park St.	5.0	5.0	0.020
12	Park St.	1.0	1.0	0.020
13	Park St.	80.0	80.0	0.020
14	Francis Ave	0.0	62.3	0.020
15	Francis Ave	0.0	61.2	0.020
16	Francis Ave	1.0	1.0	0.020
17	System #5 Tie In	0.0	60.7	0.020
18	Francis Ave	60.0	60.0	0.020
19	Park St.	27.0	27.0	0.020
20	Hazel St.	0.0	13.1	0.020
21	Hazel St.	13.0	13.0	0.020

System 5 & 6 Exist. & Proposed

Number of lines: 21

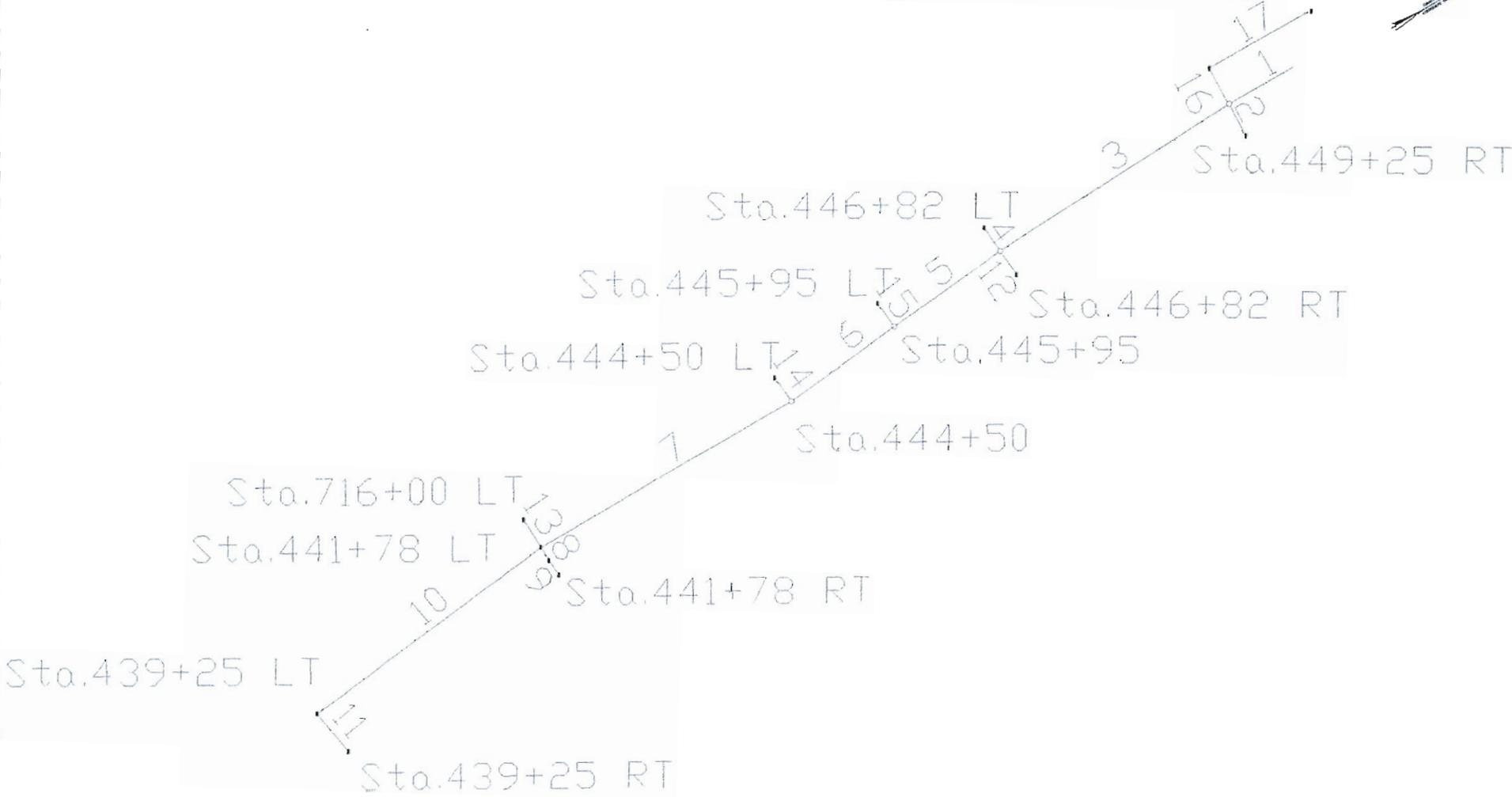
Date: 06-28-2010

NOTES: ** Critical depth

SYSTEM 7

STA. 439+25 TO STA. 450+00

AETNA PARKING LOT



SYSTEM NO. 7 GRAPHIC

REV. DATE REVISION DESCRIPTION SHEET NO.		DESIGNER: J. Stanbora CHECKED BY: C. Langhear		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION		PROJECT TITLE: NEW BRITAIN - HARTFORD BUSWAY		SHEET NO.: WEST HARTFORD/ HARTFORD		PROJECT NO.: 155-H025	
THE INFORMATION INCLUDING ESTIMATED QUANTITIES OF WORK SHOWN ON THESE SHEETS IS BASED ON LIMITED SURVEYING BY THE STATE AND IS NOT GUARANTEED TO INDICATE THE CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.		NOT TO SCALE		ENGINEER: VN ENGINEERS, INC. / URS CORPORATION AES APPROVED BY: Robert Gomez, P.E.		DRAWING TITLE: DRAINAGE PLAN		SHEET NO.:		DATE: 11/16/2009	

Hydraflow Plan View



System 7

No. Lines: 17

06-24-2010

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	Sta.449+25	8.96	24 c	115.0	44.55	45.13	0.504	46.28	46.40	0.28	46.68	End
2	Sta.449+25 RT	1.35	12 c	4.0	49.98	50.00	0.500	50.50	50.52	0.17	50.69	1
3	Sta.446+82	6.19	18 c	240.0	45.66	46.86	0.500	46.77	47.87	0.37	48.24	1
4	Sta.446+82 LT	1.29	18 c	8.0	46.86	46.91	0.625	48.60*	48.60*	0.01	48.61	3
5	Sta.445+95	4.57	15 c	82.0	47.11	47.52	0.500	48.40	48.76	0.22	48.98	3
6	Sta 444+50	3.50	15 c	140.0	47.52	48.22	0.500	49.07	49.46	0.13	49.59	5
7	Sta.441+78 LT	2.46	15 c	268.0	49.38	52.06	1.000	49.92	52.69	0.56	52.69	6
8	Sta.441+78	0.56	12 c	5.0	55.36	55.40	0.800	55.64	55.72	0.05	55.77	7
9	Sta.441+78 RT	0.32	12 c	19.0	55.40	55.50	0.526	55.84	55.84	0.03	55.87	8
10	Sta.439+25 LT	0.49	12 c	250.0	53.50	56.00	1.000	53.75	56.30	0.15	56.30	7
11	Sta.439+25 RT	0.27	12 c	41.0	56.00	56.41	1.000	56.39	56.63	n/a	56.63 j	10
12	Sta 446+82 RT	2.16	18 c	10.0	46.86	46.91	0.500	48.59*	48.59*	0.02	48.62	3
13	Sta 716+00 LT	1.59	15 c	19.0	52.06	52.28	1.158	52.91	52.88	0.12	52.99	7
14	Sta 444+50 LT	1.38	12 c	26.0	48.22	48.35	0.500	49.67*	49.71*	0.05	49.76	6
15	Sta 445+95 LT	2.32	12 c	17.0	47.52	47.61	0.529	49.06*	49.13*	0.14	49.27	5
16	Aetna Parking Lot	4.67	18 c	37.0	45.13	45.32	0.514	46.86*	46.93*	0.16	47.09	1
17	Aetna Parking Lot	2.16	12 c	125.0	54.25	55.50	1.000	54.81	56.12	n/a	56.12	16

System 7

Number of lines: 17

Run Date: 06-24-2010

NOTES: c = cir; e = ellip; b = box; Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	115.0	0.00	3.86	0.00	0.00	3.19	0.0	29.8	2.8	8.96	16.06	3.69	24	0.50	45.13	44.55	46.40	46.28	54.91	56.80	Sta.449+25
2	1	4.0	0.25	0.25	0.90	0.23	0.23	5.0	5.0	6.0	1.35	2.52	3.26	12	0.50	50.00	49.98	50.52	50.50	54.24	54.91	Sta.449+25 RT
3	1	240.0	0.00	2.71	0.00	0.00	2.15	0.0	28.6	2.9	6.19	7.43	4.64	18	0.50	46.86	45.66	47.87	46.77	51.46	54.91	Sta.446+82
4	3	8.0	0.24	0.24	0.90	0.22	0.22	5.0	5.0	6.0	1.29	8.30	0.73	18	0.62	46.91	46.86	48.60	48.60	50.86	51.46	Sta.446+82 LT
5	3	82.0	0.00	2.07	0.00	0.00	1.58	0.0	28.3	2.9	4.57	4.57	3.72	15	0.50	47.52	47.11	48.76	48.40	52.03	51.46	Sta.445+95
6	5	140.0	0.00	1.64	0.00	0.00	1.19	0.0	27.5	2.9	3.50	4.57	2.85	15	0.50	48.22	47.52	49.46	49.07	54.80	52.03	Sta 444+50
7	6	268.0	0.04	1.08	0.90	0.04	0.80	5.0	25.2	3.1	2.46	6.46	4.45	15	1.00	52.06	49.38	52.69	49.92	60.06	54.80	Sta.441+78 LT
8	7	5.0	0.15	0.21	0.70	0.11	0.16	20.0	20.0	3.5	0.56	3.19	2.82	12	0.80	55.40	55.36	55.72	55.64	59.00	60.06	Sta.441+78
9	8	19.0	0.06	0.06	0.90	0.05	0.05	5.0	5.0	6.0	0.32	2.58	1.18	12	0.53	55.50	55.40	55.84	55.84	59.74	59.00	Sta.441+78 RT
10	7	250.0	0.05	0.10	0.90	0.05	0.09	5.0	7.0	5.4	0.49	3.56	2.84	12	1.00	56.00	53.50	56.30	53.75	60.45	60.06	Sta.439+25 LT
11	10	41.0	0.05	0.05	0.90	0.05	0.05	5.0	5.0	6.0	0.27	3.56	1.52	12	1.00	56.41	56.00	56.63	56.39	59.91	60.45	Sta.439+25 RT
12	3	10.0	0.40	0.40	0.90	0.36	0.36	5.0	5.0	6.0	2.16	7.43	1.22	18	0.50	46.91	46.86	48.59	48.59	50.86	51.46	Sta 446+82 RT
13	7	19.0	0.73	0.73	0.70	0.51	0.51	25.0	25.0	3.1	1.59	6.95	2.27	15	1.16	52.28	52.06	52.88	52.91	58.00	60.06	Sta 716+00 LT
14	6	26.0	0.56	0.56	0.70	0.39	0.39	20.0	20.0	3.5	1.38	2.52	1.75	12	0.50	48.35	48.22	49.71	49.67	52.07	54.80	Sta 444+50 LT
15	5	17.0	0.43	0.43	0.90	0.39	0.39	5.0	5.0	6.0	2.32	2.59	2.95	12	0.53	47.61	47.52	49.13	49.06	57.00	52.03	Sta 445+95 LT
16	1	37.0	0.50	0.90	0.90	0.45	0.81	5.0	5.8	5.8	4.67	7.53	2.64	18	0.51	45.32	45.13	46.93	46.86	62.50	54.91	Aetna Parking Lot
17	16	125.0	0.40	0.40	0.90	0.36	0.36	5.0	5.0	6.0	2.16	3.56	4.47	12	1.00	55.50	54.25	56.12	54.81	60.50	62.50	Aetna Parking Lot

System 7

Number of lines: 17

Run Date: 06-24-2010

NOTES: Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs.

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp line No	
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (In)
1	Sta.449+25	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
2	Sta.449+25 RT	1.35	0.00	1.35	0.00	Comb	6.0	1.00	0.46	1.00	2.00	Sag	2.00	0.080	0.050	0.000	0.17	2.20	0.17	2.20	0.00	Off
3	Sta.446+82	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
4	Sta.446+82 LT	1.29	0.00	1.29	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.11	2.83	0.20	3.24	2.00	Off
5	Sta.445+90	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
6	Sta 444+50	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off
7	Sta.441+78 LT	0.22	0.00	0.22	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.09	2.15	0.10	1.64	2.00	4
8	Sta.441+78	0.37	0.00	0.37	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.11	2.63	0.12	2.01	2.00	11
9	Sta.441+78 RT	0.32	0.00	0.32	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.10	2.50	0.12	1.91	2.00	8
10	Sta.439+25 LT	0.27	0.00	0.27	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.09	2.35	0.11	1.78	2.00	7
11	Sta.439+25 RT	0.27	0.00	0.27	0.00	Grate	0.0	0.00	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.09	2.35	0.11	1.78	2.00	9
12	Sta 446+82 RT	2.16	0.00	2.16	0.00	Comb	6.0	2.31	3.13	2.31	1.35	Sag	4.00	0.040	0.020	0.000	0.19	5.67	0.28	5.67	2.00	Off
13	Sta 716+00 LT	1.59	0.00	1.58	0.01	Comb	6.0	2.31	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.18	5.05	0.21	3.45	2.00	Off
14	Sta 444+50 LT	1.38	0.00	1.38	0.00	Comb	6.0	2.31	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.17	4.60	0.20	3.28	2.00	Off
15	Sta 445+95 LT	2.32	0.00	2.26	0.06	Comb	6.0	2.31	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.21	6.40	0.25	3.99	2.00	Off
16	Aetna Parking Lot	2.70	0.00	2.57	0.13	Comb	6.0	2.31	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.22	6.95	0.26	4.67	2.00	17
17	Aetna Parking Lot	2.16	0.13	2.21	0.08	Comb	6.0	2.31	0.00	2.31	1.35	0.020	4.00	0.040	0.020	0.013	0.21	6.30	0.24	3.96	2.00	Off

System 7

Number of lines: 17

Run Date: 06-24-2010

NOTES: Inlet N-Values = 0.016 ; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	24	8.96	44.55	46.28	1.73	2.89	3.10	0.15	46.43	0.144	115	45.13	46.40	1.27	2.10	4.27	0.28	46.68	0.296	0.220	0.253	1.00	0.28
2	12	1.35	49.98	50.50	0.52*	0.41	3.26	0.17	50.67	0.499	4.0	50.00	50.52	0.52	0.41	3.27	0.17	50.69	0.502	0.501	0.020	1.00	0.17
3	18	6.19	45.66	46.77	1.11	1.41	4.40	0.30	47.07	0.428	240	46.86	47.87	1.01	1.27	4.87	0.37	48.24	0.544	0.486	1.167	1.00	0.37
4	18	1.29	46.86	48.60	1.50	1.77	0.73	0.01	48.61	0.015	8.0	46.91	48.60	1.50	1.77	0.73	0.01	48.61	0.015	0.015	0.001	1.00	0.01
5	15	4.57	47.11	48.40	1.25	1.23	3.72	0.22	48.61	0.500	82.0	47.52	48.76	1.24	1.23	3.72	0.22	48.98	0.473	0.486	0.399	1.00	0.22
6	15	3.50	47.52	49.07	1.25	1.23	2.85	0.13	49.20	0.294	140	48.22	49.46	1.24	1.23	2.86	0.13	49.59	0.278	0.286	0.401	1.00	0.13
7	15	2.46	49.38	49.92	0.54*	0.50	4.90	0.37	50.29	0.999	268	52.06	52.69	0.63**	0.62	3.99	0.25	52.94	0.572	0.785	n/a	2.25	0.56
8	12	0.56	55.36	55.64	0.28*	0.18	3.05	0.14	55.79	0.800	5.0	55.40	55.72	0.32**	0.22	2.58	0.10	55.82	0.505	0.652	0.033	0.50	0.05
9	12	0.32	55.40	55.84	0.44	0.33	0.98	0.02	55.85	0.053	19.0	55.50	55.84	0.34	0.23	1.38	0.03	55.87	0.136	0.094	0.018	1.00	0.03
10	12	0.49	53.50	53.75	0.25*	0.15	3.18	0.16	53.91	0.998	250	56.00	56.30	0.30**	0.20	2.51	0.10	56.39	0.514	0.756	n/a	1.50	0.15
11	12	0.27	56.00	56.39	0.39	0.29	0.94	0.01	56.41	0.054	41.0	56.41	56.63 j	0.22**	0.13	2.10	0.07	56.70	0.507	0.280	n/a	1.00	n/a
12	18	2.16	46.86	48.59	1.50	1.77	1.22	0.02	48.61	0.042	10.0	46.91	48.59	1.50	1.77	1.22	0.02	48.62	0.042	0.042	0.004	1.00	0.02
13	15	1.59	52.06	52.91	0.85	0.89	1.79	0.05	52.96	0.094	19.0	52.28	52.88	0.60	0.58	2.74	0.12	52.99	0.283	0.188	0.036	1.00	0.12
14	12	1.38	48.22	49.67	1.00	0.79	1.75	0.05	49.72	0.149	26.0	48.35	49.71	1.00	0.79	1.75	0.05	49.76	0.149	0.149	0.039	1.00	0.05
15	12	2.32	47.52	49.06	1.00	0.79	2.95	0.14	49.20	0.424	17.0	47.61	49.13	1.00	0.79	2.95	0.14	49.27	0.424	0.424	0.072	1.00	0.14
16	18	4.67	45.13	46.86	1.50	1.77	2.64	0.11	46.96	0.198	37.0	45.32	46.93	1.50	1.77	2.64	0.11	47.04	0.198	0.198	0.073	1.50	0.16
17	12	2.16	54.25	54.81	0.56*	0.45	4.75	0.35	55.16	0.999	125	55.50	56.12	0.62**	0.51	4.19	0.27	56.40	0.726	0.862	n/a	1.00	n/a

System 7

Number of lines: 17

Run Date: 06-24-2010

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump.

Line No.	Inlet ID	Inlet Time (min)	Tc (min)	n-val Pipe	
1	Sta.449+25	0.0	29.8	0.013	
2	Sta.449+25 RT	5.0	5.0	0.013	
3	Sta.446+82	0.0	28.6	0.013	
4	Sta.446+82 LT	5.0	5.0	0.013	
5	Sta.445+90	0.0	28.3	0.013	
6	Sta 444+50	0.0	27.5	0.013	
7	Sta.441+78 LT	5.0	25.2	0.013	
8	Sta.441+78	20.0	20.0	0.013	
9	Sta.441+78 RT	5.0	5.0	0.013	
10	Sta.439+25 LT	5.0	7.0	0.013	
11	Sta.439+25 RT	5.0	5.0	0.013	
12	Sta 446+82 RT	5.0	5.0	0.013	
13	Sta 716+00 LT	25.0	25.0	0.013	
14	Sta 444+50 LT	20.0	20.0	0.013	
15	Sta 445+95 LT	5.0	5.0	0.013	
16	Aetna Parking Lot	5.0	5.8	0.013	
17	Aetna Parking Lot	5.0	5.0	0.013	

System 7

Number of lines: 17

Date: 06-24-2010

NOTES: ** Critical depth

APPENDIX C
OUTLET PROTECTION

VN ENGINEERS, INC.
 116 Washington Avenue
 North Haven 06473
 (203) 234-7862

Job. NEW BRITIAN-HARTFORD BUSWAY
 Sheet No. 1 Of 1
 Calculated By JMB Date 6/28/2010
 Checked By _____ Date _____
 Scale _____

OUTLET PROTECTION
Station 384+57 LT; Outlet System #3

GIVEN:

Qd = 15.86 cfs
 Vexit = 3.23 ft/s
 Pipe Size (Sp) = 30 in (Sp = Rp = inside diameter for circular sections)
 Tw = 1.25 ft (0.5 Rp = 1.25 ft)

Type B Riprap Apron (Maximum Tailwater Condition) TW ≥ 0.5 Rp
 Assume Tailwater Elevation equal to depth of flow from HGL.

TYPE B:

LENGTH

see CTDOT Drainage Manual (2000) pg 11.13-9 for La

Use La = 10 ft

WIDTH

W1 = 3Sp (min.) (Width of apron at pipe outlet)
 W2 = 3Sp + 0.4La for TW ≥ 0.5 Rp (Width of apron at terminus)

Then: **W1 = 7.5 ft**
W2 = 11.5 ft

Then:

Exit velocity requires:

MODIFIED

Outlet Velocity (ft/s)	RipRap Specification
0 - 8	Modified
8 - 10	Intermediate
10 - 14	Standard

from CTDOT Drainage Manual (2000) pg 11.13-2

Then:

Find depth according to riprap type

CHANNEL TYPE = **MODIFIED**

Choose factor:

12 in = Modified RipRap

18 in = Intermediate RipRap

36 in = Standard RipRap

depth D = **12 in**

Then:

Volume of Riprap Required is

Volume = **95.0 C.F.**

Then:

Find depth of granular fill according to riprap type

Choose factor:

6 in = Modified RipRap

6 in = Intermediate RipRap

12 in = Standard RipRap

depth D = **6 in**

Then:

Volume of granular fill required is

Volume = **47.5 C.F.**

VN ENGINEERS, INC.
 116 Washington Avenue
 North Haven 06473
 (203) 234-7862

Job. NEW BRITIAN-HARTFORD BUSWAY
 Sheet No. 1 Of 1
 Calculated By JMB Date 10/5/2009
 Checked By _____ Date _____
 Scale _____

OUTLET PROTECTION
Station 384+89; Outlet System #4

GIVEN:

Qd = 6.11 cfs
 Vexit = 3.46 ft/s
 Pipe Size (Sp) = 18 in (Sp = Rp = inside diameter for circular sections)
 Tw = 1.00 ft (0.5 Rp = 0.75 ft)

Type B Riprap Apron (Maximum Tailwater Condition) TW ≥ 0.5 Rp
 Assume Tailwater Elevation equal to depth of flow from HGL.

TYPE B:

LENGTH

see CTDOT Drainage Manual (2000) pg 11.13-9 for La

Use La = 11 ft

WIDTH

W1 = 3Sp (min.) (Width of apron at pipe outlet)
 W2 = 3Sp + 0.4La for TW ≥ 0.5 Rp (Width of apron at terminus)

Then: **W1 = 4.5 ft**
W2 = 8.9 ft

Then:

Exit velocity requires: **MODIFIED**

Outlet Velocity (ft/s)	RipRap Specification
0 - 8	Modified
8 - 10	Intermediate
10 - 14	Standard

from CTDOT Drainage Manual (2000) pg 11.13-2

Then:

Find depth according to riprap type

CHANNEL TYPE = **MODIFIED**

Choose factor:

- 12 in = Modified RipRap
- 18 in = Intermediate RipRap
- 36 in = Standard RipRap

depth D = **12 in**

Then:

Volume of Riprap Required is

Volume = **73.7 C.F.**

Then:

Find depth of granular fill according to riprap type

Choose factor:

- 6 in = Modified RipRap
- 6 in = Intermediate RipRap
- 12 in = Standard RipRap

depth D = **6 in**

Then:

Volume of granular fill required is

Volume = **36.9 C.F.**

APPENDIX D
SWALES, CHANNELS

VN ENGINEERS, INC.
 116 Washington Avenue
 North Haven 06473
 (203) 234-7862

Job.	NEW BRITIAN-HARTFORD BUSWAY		
Sheet No.	1	Of	6
Calculated By	JMB	Date	10/5/2009
Checked By		Date	
Scale			

CHANNEL NO. 1 (STA. 337+00 TO STA. 339+00)

Swale Type = Trapezoidal

B = 2

Z = 2

Material = Vegetal Cover - Class C

Permissible Unit Shear Stress = 1.00 lb/ft²

{Per CTDOT Drainage Manual, Table 7-4 pg 7.6-11}

Design Frequency = 10 years

Design Procedure

Step 1:

Channel Slope (S₀) = 0.0024 ft/ft (Max. Slope)

Design (Q) = C I A = 2.04 ft³/s (Design Q)

Area = .59 Ac.

I = 4.95 in/hr

C = 0.70

C_n = 0.22 {Per HEC-15, Table 4.4}

Step 2:

Initial Depth (d_i) = 1.05 ft

Cross Sectional Area (A) = 4.31 ft²

Wetted Perimeter (P) = 6.70 ft

R = A/P = 0.64 ft

Applied Shear Stress = $\tau_0 = \gamma R S_0 = 0.10$ lb/ft²

Manning's n = $\alpha C_n \tau^{-0.4} = 0.120$

Q = $\alpha/nAR^{2/3}S^{1/2} = 1.96$ {Calculated Q is within 5% of Design Q}

$\tau_0 = \gamma D S_0 = 0.157$ lb/ft²

Type E Erosion Control Matting {Per CTDOT Drainage Manual, Table 7-5 pg. 7.6-12}

Maximum Shear Stress (τ_0) is less than Permissible Unit Shear Stress
 Therefore, lining material is acceptable

Design Depth = 2.05 ft {1' Freeboard}

CHANNEL NO. 2 (STA. 364+00 TO STA. 371+00)

Swale Type = Trapezoidal

B = 2

Z = 2

Material = Vegetal Cover - Class C

Permissible Unit Shear Stress = 1.00 lb/ft² {Per CTDOT Drainage Manual, Table 7-4 pg 7.6-11}

Design Frequency = 10 years

Design Procedure

Step 1:

Channel Slope (S _o) =	0.01	ft/ft	(Max. Slope)
Design (Q) = C I A =	5.13	ft ³ /s	(Design Q)
Area =	1.48	Ac.	
I =	4.95	in/hr	{per Storm Sewer Calcs.}
C =	0.70		{per Storm Sewer Calcs.}
C _n =	0.22		{Per HEC-15, Table 4.4}

Step 2:

Initial Depth (d _i) =	0.91	ft
Cross Sectional Area (A) =	3.48	ft ²
Wetted Perimeter (P) =	6.07	ft

R = A/P = 0.57 ft

Applied Shear Stress = $\tau_0 = \gamma R S_0 = 0.36$ lb/ft²

Manning's n = $\alpha C_n \tau^{-0.4} = 0.071$

Q = $\alpha / n A R^{2/3} S^{1/2} = 5.05$ {Calculated Q is within 5% of Design Q}

$\tau_0 = \gamma D S_0 = 0.568$ lb/ft²

Type F Erosion Control Matting {Per CTDOT Drainage Manual, Table 7-5 pg. 7.6-12}

Maximum Shear Stress (τ_0) is less than Permissible Unit Shear Stress
 Therefore, lining material is acceptable

Design Depth = 1.91 ft {1' Freeboard}

VN ENGINEERS, INC.
 116 Washington Avenue
 North Haven 06473
 (203) 234-7862

Job.	NEW BRITIAN-HARTFORD BUSWAY		
Sheet No.	3	Of	6
Calculated By	JMB	Date	10/5/2009
Checked By		Date	
Scale			

CHANNEL NO. 3 (STA. 425+00 TO STA. 427+00)

Swale Type = Trapezoidal

B = 2

Z = 2

Material = Vegetal Cover - Class C

Permissible Unit Shear Stress = 1.00 lb/ft² {Per CTDOT Drainage Manual, Table 7-4 pg 7.6-11}

Design Frequency = 10 years

Design Procedure

Step 1:

Channel Slope (S_o) = 0.01 ft/ft (Max. Slope)
 Design (Q) = C I A = 0.45 ft³/s (Design Q)
 Area = 0.13 Ac.
 I = 4.95 in/hr {per Storm Sewer Calcs.}
 C = 0.7 {per Storm Sewer Calcs.}
 C_n = 0.22 {Per HEC-15, Table 4.4}

Step 2:

Initial Depth (d_i) = 0.30 ft
 Cross Sectional Area (A) = 0.78 ft²
 Wetted Perimeter (P) = 3.34 ft

R = A/P = 0.23 ft

Applied Shear Stress = $\tau_0 = \gamma R S_0 = 0.15 \text{ lb/ft}^2$

Manning's n = $\alpha C_n \tau^{-0.4} = 0.101$

Q = $\alpha / n A R^{2/3} S^{1/2} = 0.44$ {Calculated Q is within 5% of Design Q}

$\tau_0 = \gamma D S_0 = 0.187 \text{ lb/ft}^2$

Type E Erosion Control Matting {Per CTDOT Drainage Manual, Table 7-5 pg. 7.6-12}

Maximum Shear Stress (τ_0) is less than Permissible Unit Shear Stress
 Therefore, lining material is acceptable

Design Depth = 1.30 ft {1' Freeboard}

CHANNEL NO. 4 (STA. 427+50 TO STA. 430+89)

Swale Type = Trapezoidal

B = 2

Z = 2

Material = Vegetal Cover - Class C

Permissible Unit Shear Stress = 1.00 lb/ft²

{Per CTDOT Drainage Manual, Table 7-4 pg 7.6-11}

Design Frequency = 10 years

Design Procedure

Step 1:

Channel Slope (S_o) = 0.005 ft/ft (Max. Slope)
 Design (Q) = C I A = 0.49 ft³/s (Design Q)
 Area = 0.14 Ac.
 I = 4.95 in/hr {per Storm Sewer Calcs.}
 C = 0.70 {per Storm Sewer Calcs.}
 C_n = 0.22 {Per HEC-15, Table 4.4}

Step 2:

Initial Depth (d_i) = 0.42 ft
 Cross Sectional Area (A) = 1.19 ft²
 Wetted Perimeter (P) = 3.88 ft

R = A/P = 0.31 ft

Applied Shear Stress = $\tau_0 = \gamma R S_0 = 0.10$ lb/ft²

Manning's n = $\alpha C_n \tau^{-0.4} = 0.120$

Q = $\alpha / n A R^{2/3} S^{1/2} = 0.48$ {Calculated Q is within 5% of Design Q}

$\tau_0 = \gamma D S_0 = 0.131$ lb/ft²

Type E Erosion Control Matting {Per CTDOT Drainage Manual, Table 7-5 pg. 7.6-12}

Maximum Shear Stress (τ_0) is less than Permissible Unit Shear Stress
 Therefore, lining material is acceptable

Design Depth = 1.42 ft {1' Freeboard}

CHANNEL NO. 5 (STA. 443+00 TO STA. 444+50)

Swale Type = Trapezoidal

B = 2

Z = 2

Material = Vegetal Cover - Class C

Permissible Unit Shear Stress = 1.00 lb/ft²

{Per CTDOT Drainage Manual, Table 7-4 pg 7.6-11}

Design Frequency = 10 years

Design Procedure

Step 1:

Channel Slope (S _o) =	0.005	ft/ft	(Max. Slope)
Design (Q) = C I A =	1.94	ft ³ /s	(Design Q)
	Area =	.56	Ac.
	l =	4.95	in/hr {per Storm Sewer Calcs.}
	C =	0.70	{per Storm Sewer Calcs.}
	C _n =	0.22	{Per HEC-15, Table 4.4}

Step 2:

Initial Depth (d _i) =	0.79	ft
Cross Sectional Area (A) =	2.83	ft ²
Wetted Perimeter (P) =	5.53	ft

R = A/P = 0.51 ft

Applied Shear Stress = $\tau_0 = \gamma R S_0 = 0.16$ lb/ft²

Manning's n = $\alpha C_n \tau^{-0.4} = 0.098$

Q = $\alpha/nAR^{2/3}S^{1/2} = 1.95$ {Calculated Q is within 5% of Design Q}

$\tau_0 = \gamma D S_0 = 0.246$ lb/ft²

Type E Erosion Control Matting {Per CTDOT Drainage Manual, Table 7-5 pg. 7.6-12}

Maximum Shear Stress (τ_0) is less than Permissible Unit Shear Stress
 Therefore, lining material is acceptable

Design Depth = 1.79 ft {1' Freeboard}

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Job.	NEW BRITAIN-HARTFORD BUSWAY		
Sheet No.	6	Of	6
Calculated By	JMB	Date	6/24/2010
Checked By		Date	
Scale			

CHANNEL NO. 6 (STA. 444+95 TO STA. 448+50)

Swale Type = Trapezoidal

B = 2

Z = 2

Material = Vegetal Cover - Class C

Permissible Unit Shear Stress = 1.00 lb/ft² {Per CTDOT Drainage Manual, Table 7-4 pg 7.6-11}

Design Frequency = 10 years

Design Procedure

Step 1:

Channel Slope (S₀) = 0.014 ft/ft (Max. Slope)
 Design (Q) = C I A = 1.92 ft³/s (Design Q)
 Area = 0.43 Ac.
 I = 4.95 in/hr {per Storm Sewer Calcs.}
 C = 0.9 {per Storm Sewer Calcs.}
 C_n = 0.22 {Per HEC-15, Table 4.4}

Step 2:

Initial Depth (d_i) = 0.52 ft
 Cross Sectional Area (A) = 1.58 ft²
 Wetted Perimeter (P) = 4.33 ft

R = A/P = 0.37 ft

Applied Shear Stress = $\tau_0 = \gamma R S_0 = 0.32 \text{ lb/ft}^2$

Manning's n = $\alpha C_n \tau^{-0.4} = 0.074$

Q = $\alpha/nAR^{2/3}S^{1/2} = 1.93$ {Calculated Q is within 5% of Design Q}

$\tau_0 = \gamma D S_0 = 0.454 \text{ lb/ft}^2$

Type E Erosion Control Matting {Per CTDOT Drainage Manual, Table 7-5 pg. 7.6-12}

Maximum Shear Stress (τ_0) is less than Permissible Unit Shear Stress
 Therefore, lining material is acceptable

Design Depth = 1.52 ft {1' Freeboard}

APPENDIX E

**SYSTEM 5 UNDERGROUND STORMWATER DETENTION
SYSTEM CALCULATIONS**

Appendix B - Rainfall**RAINFALL – DURATION – FREQUENCY
RELATIONSHIPS FOR CONNECTICUT**

DURATION	RETURN FREQUENCY (Years)					
	2	5	10	25	50	100
Min	RAINFALL IN MM (INCHES)					
5	9.1(0.36)	11.4(0.45)	13.0(0.51)	15.2(0.60)	17.2(0.67)	18.5(0.73)
15	18.3(0.72)	22.6(0.89)	25.9(1.02)	30.5(1.20)	34.0(1.34)	37.6(1.48)
60	33.0(1.3)	43.2(1.7)	50.8(2.00)	58.4(2.30)	65.3(2.57)	71.1(2.80)
Hrs						
2	40.6(1.60)	54.6(2.15)	63.5(2.50)	72.4(2.85)	82.6(3.25)	91.4(3.60)
3	44.5(1.75)	61.0(2.40)	69.9(2.75)	82.6(3.25)	90.2(3.55)	101.6(4.00)
6	59.7(2.35)	74.9(2.95)	87.6(3.45)	101.6(4.00)	115.6(4.55)	127.0(5.00)
12	69.9(2.75)	90.2(3.55)	101.6(4.00)	123.2(4.85)	135.9(5.35)	152.4(6.00)
24	82.6(3.25)	106.7(4.20)	125.7(4.95)	146.1(5.75)	161.3(6.35)	177.8(7.00)
24 HOUR RAINFALL BY COUNTY						
Fairfield	83.8(3.3)	109.2(4.3)	127.0(5.0)	144.8(5.7)	162.6(6.4)	182.9(7.2)
Hartford	81.3(3.2)	104.1(4.1)	119.4(4.7)	139.7(5.5)	157.5(6.2)	175.3(6.9)
Litchfield	81.3(3.2)	104.1(4.1)	119.4(4.7)	139.7(5.5)	157.5(6.2)	177.8(7.0)
Middlesex	83.8(3.3)	106.7(4.2)	127.0(5.0)	142.2(5.6)	160.0(6.3)	180.3(7.1)
New Haven	83.8(3.3)	106.7(4.2)	127.0(5.0)	142.2(5.6)	160.0(6.3)	180.3(7.1)
New London	86.4(3.4)	109.2(4.3)	127.0(5.0)	144.8(5.7)	160.0(6.3)	180.3(7.1)
Tolland	81.3(3.2)	104.1(4.1)	121.9(4.8)	139.7(5.5)	157.5(6.2)	175.3(6.9)
Windham	81.3(3.2)	106.7(4.2)	121.9(4.8)	139.7(5.5)	157.5(6.2)	175.3(6.9)

Sources:

1. "Rainfall Frequency Atlas of the United States", Technical Paper No. 40, U.S. Department of Commerce, Weather Bureau.
2. NOAA Technical Memorandum "NWS Hydro-35", June 1977, U.S. Department of Commerce, National Weather Service.

Table B-1

VN ENGINEERS, INC.

116 Washington Avenue
 NORTH HAVEN, CT 06473
 (203) 234-7862

JOB 27-114 URS BUSWAY

SHEET NO. 1 OF _____

CALCULATED BY JMB DATE 10/19/09

CHECKED BY REVISED JMB DATE 06/09/10

SCALE _____

<u>WATERSHED</u>	<u>FLOW (STORM SEWER)</u>	<u>10 YR STORM</u>	<u>AREA</u>
1	2.68 cfs		0.50 AC
2	5.45 - 2.68 = 2.77 cfs		1.30 - 0.5 = 0.80 AC
STATION - YARD DRAINS (#3)	1.27 1.96 cfs (per JULY 2009 ^{OCT 2009} REPORT BY SEA)		0.38 0.74 AC
- CB* (#4)	0.48 cfs		0.09 AC

FLOW CHECK (10 YR STORM)

	<u>STORM SEWER</u>	<u>HYDROCAD</u>	
SYSTEM #5	5.45 cfs	(#1) ✓ (2) ✓ 2.33 + 3.35 = 5.68 cfs	✓ ok ✓ ok
STATION - YARD DRAINS	1.27 1.96 cfs (BY OTHERS)	1.54 + 0.88 cfs	✓ ok ✓ ok
- CB* 1	0.48 cfs	(#4) 0.48 cfs	✓ ok

3. Station Analysis and Summaries

3.0. Parkville Station

3.0.1. Existing Condition

The site previously had industrial uses and an auto repair business. The site and surrounding areas studied are approximately 93.0% impervious.

The site generally drains to Francis Avenue on the west and Park Street on the north. These flows are collected by a drainage system within the streets. (See Exhibit 3.8-A). Two catch basins are located on Francis Avenue that collect site flows. The southern catch basin is Design Point A. The tributary area to this catch basin is approximately 1.07 acres. The northern catch basin on Francis Avenue is Design Point B. The tributary area to this catch basin is approximately 0.58 acres.

Both catch basins connect to an existing 30-inch storm drain pipe within Francis Avenue that drains to a 66-inch reinforced concrete pipe in Park Street. A catch basin on Park Street tied to this system is Design Point C. The tributary area to this catch basin is approximately 0.77 acres. This system ultimately discharges to the Park River Conduit. URS, Contract No. 155-H025, analyzed this existing system to determine its capacity. The discharge to the Park Street system is summarized, as follows:

Storm Frequency	Q _{PRE} (cfs)
2-year	9.85
10-year	12.84
25-year	14.34
100-year	16.70

3.0.2. Proposed Condition

To the extent possible, the site has been graded so that the majority of the stormwater runoff from the site may be collected and discharged to the detention system designed by the Hartford South section designer, Contract No. 155-H025.

The proposed site design will significantly increase the amount of pervious area on the site. (See Exhibit 3.8-B.) The proposed site and surrounding drainage areas are approximately 67.5% impervious. The areas delineated match the limits of the existing drainage area.

The plaza area and terraced site areas facing Francis Avenue are proposed to be collected and discharged to the detention system by way of several yard drains and area drains. These drains are proposed within the site to collect nuisance flows and prevent significant discharges over the terraced walls, stairs, and handicap ramps.

The pipe system consists of 12-inch plastic pipes. The drainage areas, basin locations, and connection points are shown in Exhibit 3.8-C. The site drainage area tributary to the detention system totals approximately 0.38 acres and the discharge is summarized, as follows

Storm Frequency	Q _{POST} (cfs)
2-year	0.96
10-year	1.27
25-year	1.43
100-year	1.67

Many of the inlets proposed on the station site are for collection of nuisance flow and to minimize the stormwater runoff from flowing over the terraced walls, stairs, and handicap ramps. As the flow rates are small through many of the pipes, the CTDOT minimum velocity criteria are not always met. To the extent feasible, pipe slopes have been increased and diameters reduced to achieve the highest velocity possible. This design balances the velocity goals with the site uses to develop the most efficient station site.

The majority of the parking area is proposed to be collected by a catch basin located within the parking area drive. This catch basin will have a 4 foot sump and discharge the detention system, as well (See Exhibit 3.8-B). The site drainage area tributary here totals approximately 0.09 acres and the discharge is summarized, as follows:

Storm Frequency	Q _{POST} (cfs)
2-year	0.37
10-year	0.48
25-year	0.54
100-year	0.63

Portions of the proposed parking area drive along with sidewalks and terraced areas will drain toward the existing Park Street system. The tributary area to the catch basins within this system, Design Points A, B, and C, are 0.89, 0.14, and 0.28 acres respectively. The discharge to these catch basins is summarized, as follows:

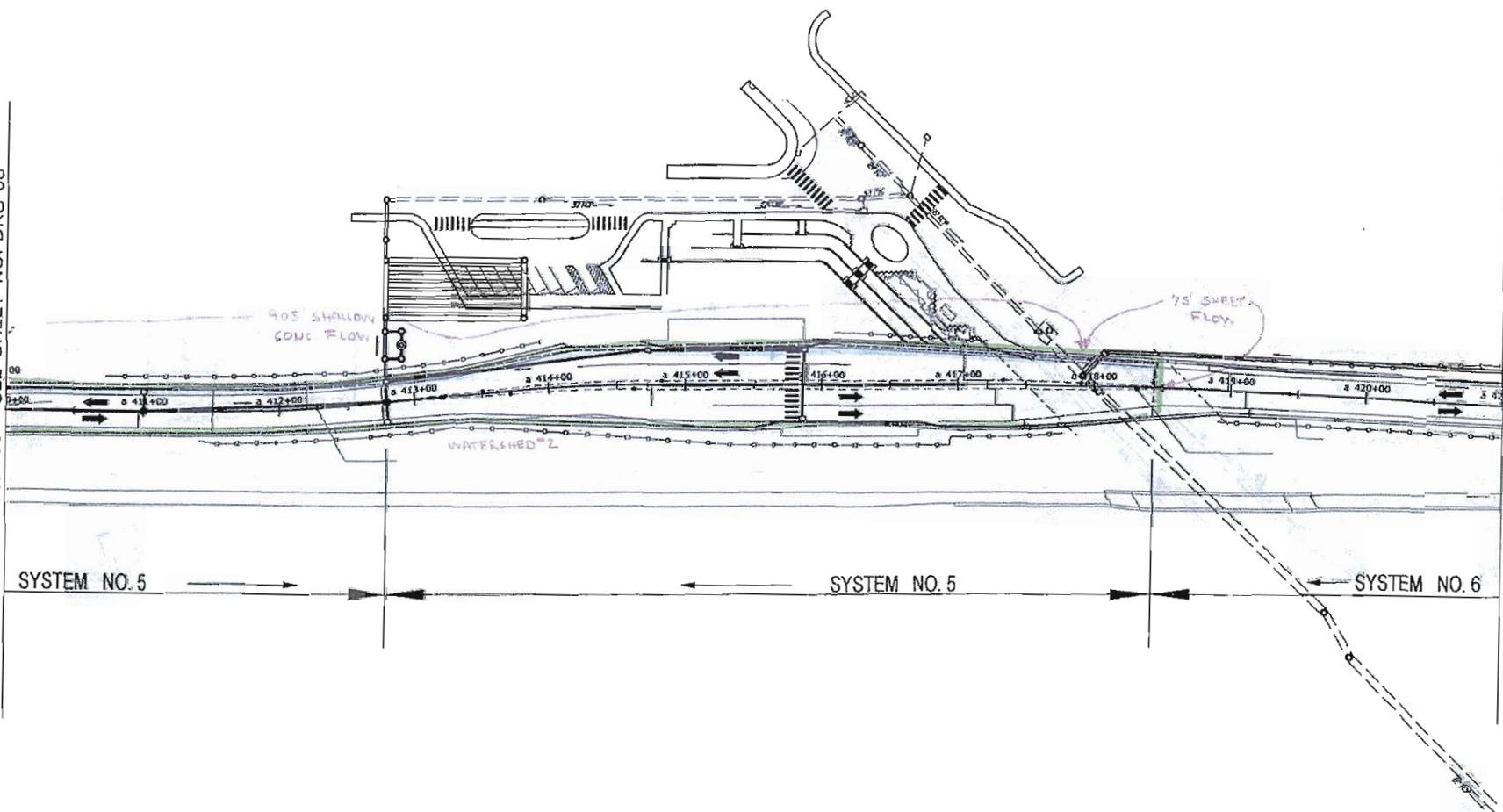
Storm Frequency	Q _{PRE} (cfs)	Q _{POST} (cfs)	ΔQ (cfs)
2-year	9.85	4.41	-5.44
10-year	12.84	5.75	-7.09
25-year	14.34	6.42	-7.92
100-year	16.70	7.48	-9.22

**BRT Station Preliminary Drainage Design
DOT Report**

Label	Node Upstream Downstream	Upstream Inlet C	Upstream GA (acres)	Ground Upstream Downstream	HGL Upstream Downstream	System Rational Flow (ft ³ /s)	Length (ft)	Velocity (Average) (ft/s)	System Intensity (in/hr)
CO-2	YD-2	0.343	0.01	59.8	56.72	0.04	60	1.46	6
	YD-1			60.1	56.41				
CO-5	YD-10	0.331	0.02	62.5	58.47	0.11	46	3.17	6
	YD-11			62.5	57.5				
CO-6	YD-11	0.372	0.03	62.5	57.49	0.2	44	3.56	5.952
	YD-12			62.5	56.66				
CO-7	YD-12	0.715	0.06	62.5	56.68	0.33	56	4.14	5.91
	YD-13			62.8	55.95				
CO-8	YD-13	0.9	0.19	62.8	55.79	1.04	39	3.74	5.573
	YD-14			61.8	55.65				
CO-12	CB-1	0.881	0.08	61	57.12	0.49	23	2.52	6
	OF-2			61.5	57				
CO-14	YD-21	0.424	0.02	61.6	55.95	0.13	12	2.03	5.603
	YD-13			62.8	55.95				
CO-15	AD-1	0.9	0.01	68.1	64.05	0.09	25	2.28	6
	AD-2			68.38	63.81				
CO-16	AD-2	0.9	0.04	68.38	63.77	0.22	43	3.03	5.963
	AD-3			68.08	63.37				
CO-17	AD-3	0.9	0.06	68.08	63.3	0.36	46	8.09	5.916
	YD-13			62.8	58.11				
CO-20	YD-1	0.3	0.01	60.1	56.34	0.07	54	1.7	5.863
	YD-3			60.5	56.06				
CO-21	YD-3	0.358	0.02	60.5	55.99	0.1	49	1.85	5.736
	YD-21			61.6	55.95				
CO-22	YD-14	0.457	0.23	61.8	55.54	1.27	13	6.88	5.521
	OF-2			62.8	55.07				

MATCH LINE STA. 410+00 - SEE SHEET NO. DRG-08

MATCH LINE STA. 421+00 - SEE SHEET NO. DRG-10



SEMI FINAL DESIGN REVIEW

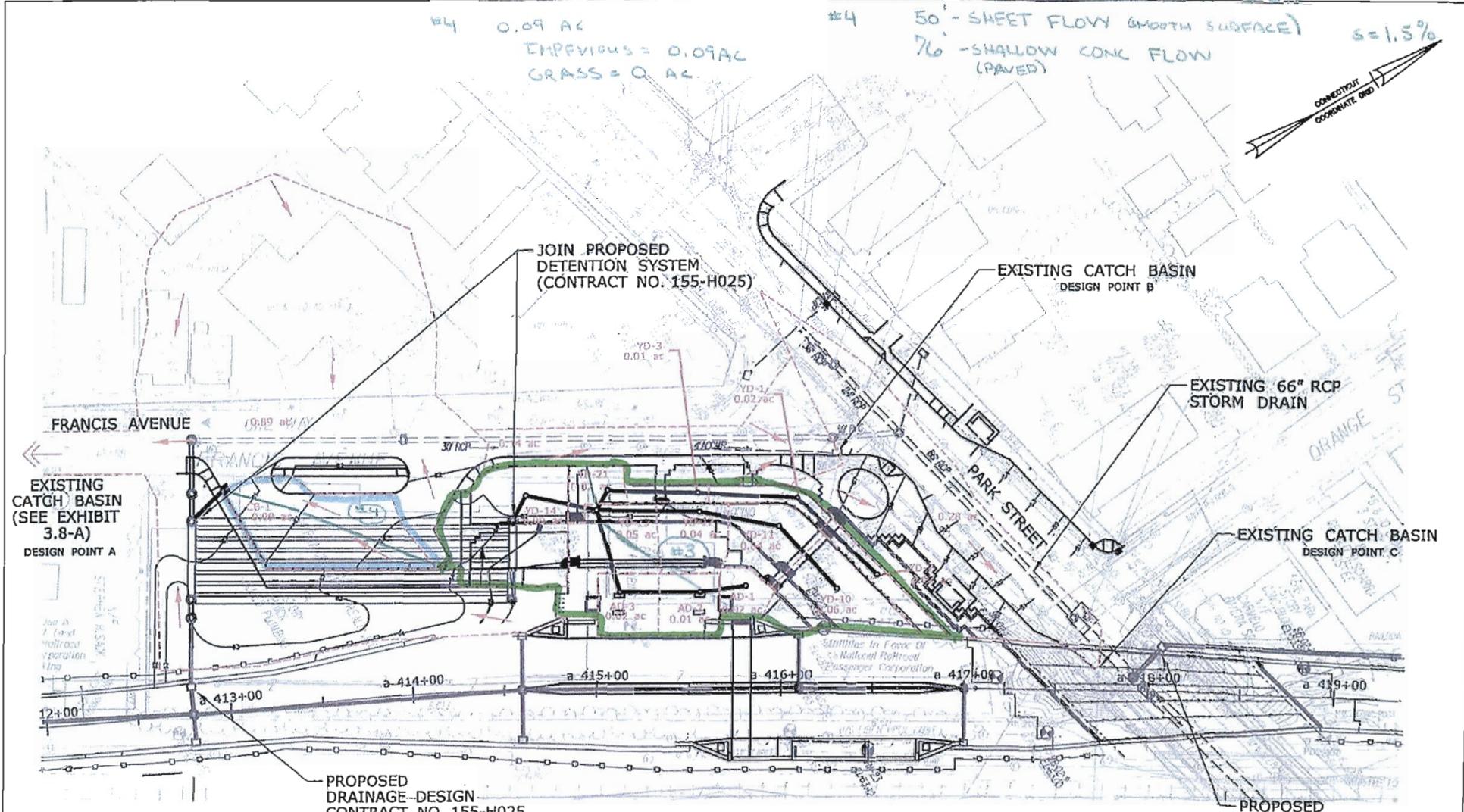
PERMIT: S202009 DRAWN BY: J. Hernandez CHECKED BY: C. Joseph		STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION		PROJECT TITLE: NEW BRITAIN - HARTFORD BUSWAY		DRAWING TITLE: HARTFORD DRAINAGE PLAN		PROJECT NO.: 155-H025 DRAWING NO.: DRG-09	
REVISION: NONE DATE:		SCALE: 1"=40' 0 40 80		ENGINEER: VN ENGINEERS, INC. / URS CORPORATION AES APPROVED BY: Robert Gomez, P.E.		DATE:		VN ENGINEERS, INC.	

TOTAL AREA #3 0.38 AC
 IMPEVIOUS = 0.23 AC
 GRASS = 0.15 AC

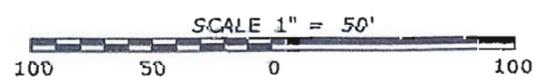
#3 50' - SHEET FLOWY } 3.8%
 28' - SHALLOW CONC FLOW }
 35' - SHALLOW CONC FLOW - 2.8%

#4 0.09 AC
 IMPEVIOUS = 0.09 AC
 GRASS = 0 AC

#4 50' - SHEET FLOWY (SMOOTH SURFACE) } s=1.5%
 76' - SHALLOW CONC FLOW (PAVED) }



PROPOSED CONDITIONS

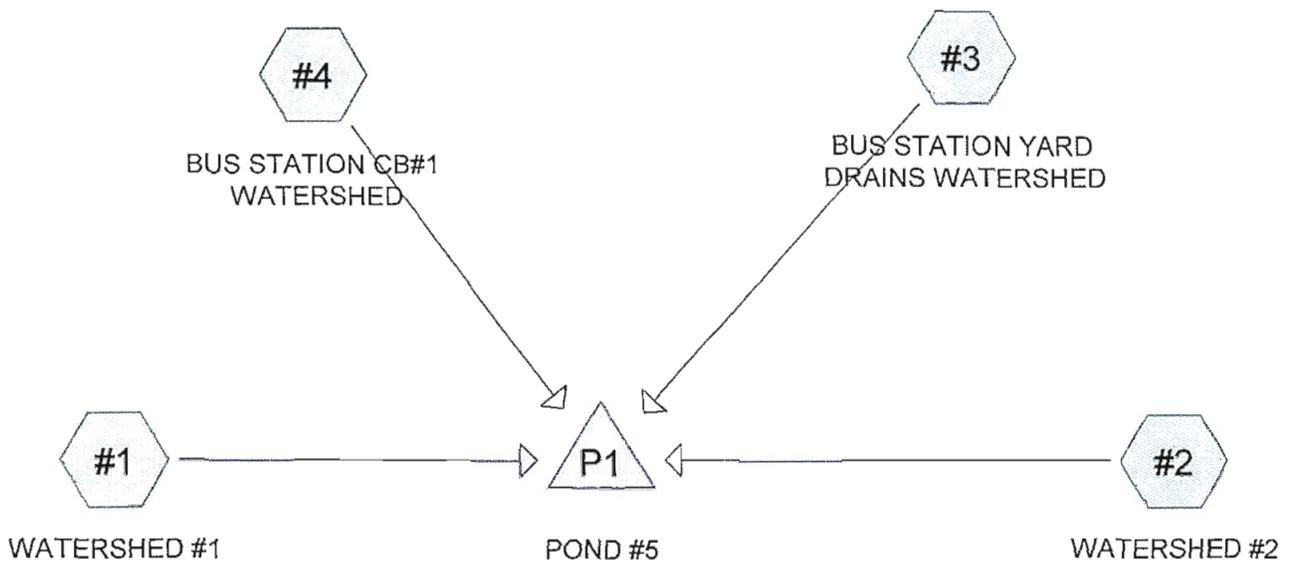


STATE PROJECT NO.: 88-H039	APPLICATION BY: STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	OFFICE OF ENGINEERING	DATE: OCTOBER 2009
COUNTY: HARTFORD			SITE: PARKVILLE STATION
CITY/TOWN: HARTFORD			EXHIBIT: 3.8-B
		SCALE 1"=50'	

IMPEVIOUS AREA = 0.38 AC + 0.09 = 0.47 AC

PER OCT 2009 SEA REPORT PG 4 → 67.5% IMPEVIOUS
 0.47(0.675) = 0.32 AC

WATERSHED #2



Drainage Diagram for SYSTEM #5_2 YR (Revised 06-08-10)
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SYSTEM #5_2 YR (Revised 06-08-10)

Type III 24-hr Rainfall=3.25"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment #1: WATERSHED #1

Runoff Area=0.500 ac Runoff Depth>3.02"

Flow Length=386' Slope=0.0030 '/' Tc=6.7 min CN=98 Runoff=1.52 cfs 0.126 af

Subcatchment #2: WATERSHED #2

Runoff Area=0.800 ac Runoff Depth>3.01"

Flow Length=980' Slope=0.0075 '/' Tc=10.0 min CN=98 Runoff=2.18 cfs 0.201 af

Subcatchment #3: BUS STATION YARD DRAINS WATERSHED Runoff Area=0.380 ac Runoff Depth>1.65"

Flow Length=113' Tc=1.1 min CN=83 Runoff=0.81 cfs 0.052 af

Subcatchment #4: BUS STATION CB#1 WATERSHED

Runoff Area=0.090 ac Runoff Depth>3.02"

Flow Length=126' Slope=0.0150 '/' Tc=1.3 min CN=98 Runoff=0.31 cfs 0.023 af

Pond P1: POND #5

Peak Elev=52.53' Storage=0.173 af Inflow=4.27 cfs 0.401 af

Outflow=0.53 cfs 0.396 af

Total Runoff Area = 1.770 ac Runoff Volume = 0.401 af Average Runoff Depth = 2.72"

12.99% Pervious Area = 0.230 ac 87.01% Impervious Area = 1.540 ac

SYSTEM #5_2 YR (Revised 06-08-10)

Type III 24-hr Rainfall=3.25"

Prepared by {enter your company name here}

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Subcatchment #1: WATERSHED #1

Runoff = 1.52 cfs @ 12.10 hrs, Volume= 0.126 af, Depth> 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.500	98	Paved parking & roofs
0.500		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	75	0.0030	0.61		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
4.7	311	0.0030	1.11		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
6.7	386	Total			

Subcatchment #2: WATERSHED #2

Runoff = 2.18 cfs @ 12.14 hrs, Volume= 0.201 af, Depth> 3.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.800	98	Paved parking & roofs
0.800		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	75	0.0075	0.88		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
8.6	905	0.0075	1.76		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
10.0	980	Total			

Subcatchment #3: BUS STATION YARD DRAINS WATERSHED

Runoff = 0.81 cfs @ 12.02 hrs, Volume= 0.052 af, Depth> 1.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.230	74	>75% Grass cover, Good, HSG C
0.150	98	Paved parking & roofs
0.380	83	Weighted Average
0.230		Pervious Area

SYSTEM #5_2 YR (Revised 06-08-10)

Type III 24-hr Rainfall=3.25"

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0.150 Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0380	1.56		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
0.1	28	0.0380	3.96		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
0.5	35	0.0260	1.13		Shallow Concentrated Flow, SHALLOW CONC. FLOW (GRASS) Short Grass Pasture Kv= 7.0 fps
1.1	113	Total			

Subcatchment #4: BUS STATION CB#1 WATERSHED

Runoff = 0.31 cfs @ 12.02 hrs, Volume= 0.023 af, Depth> 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.25"

Area (ac)	CN	Description
0.090	98	Paved parking & roofs
0.090		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.08		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
0.5	76	0.0150	2.49		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
1.3	126	Total			

Pond P1: POND #5

Inflow Area = 1.770 ac, Inflow Depth > 2.72"
 Inflow = 4.27 cfs @ 12.10 hrs, Volume= 0.401 af
 Outflow = 0.53 cfs @ 12.85 hrs, Volume= 0.396 af, Atten= 88%, Lag= 44.9 min
 Primary = 0.53 cfs @ 12.85 hrs, Volume= 0.396 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 52.53' @ 12.85 hrs Surf.Area= 0.128 ac Storage= 0.173 af

Plug-Flow detention time= 152.9 min calculated for 0.395 af (98% of inflow)
 Center-of-Mass det. time= 143.5 min (910.2 - 766.6)

Volume	Invert	Avail.Storage	Storage Description
#1	50.75'	0.404 af	48.0"D x 140.00'L Horizontal Cylinder x 10

SYSTEM #5_2 YR (Revised 06-08-10)

Type III 24-hr Rainfall=3.25"

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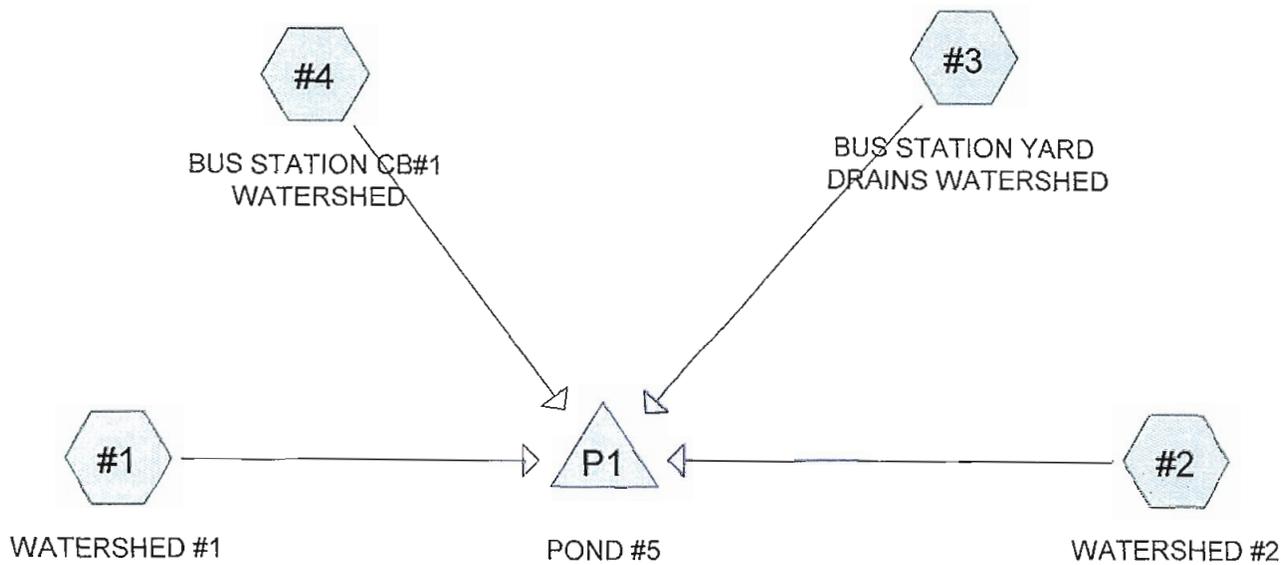
Device	Routing	Invert	Outlet Devices
#1	Primary	50.75'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	53.00'	4.0" Vert. Orifice/Grate C= 0.600
#3	Primary	53.75'	48.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.53 cfs @ 12.85 hrs HW=52.53' (Free Discharge)

1=Orifice/Grate (Orifice Controls 0.53 cfs @ 6.11 fps)

2=Orifice/Grate (Controls 0.00 cfs)

3=Orifice/Grate (Controls 0.00 cfs)



Drainage Diagram for SYSTEM #5_10 YR (Revised 06-08-10)
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SYSTEM #5_10 YR (Revised 06-08-10)

Type III 24-hr Rainfall=4.95"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment #1: WATERSHED #1

Runoff Area=0.500 ac Runoff Depth>4.71"

Flow Length=386' Slope=0.0030 '/' Tc=6.7 min CN=98 Runoff=2.33 cfs 0.196 af

Subcatchment #2: WATERSHED #2

Runoff Area=0.800 ac Runoff Depth>4.71"

Flow Length=980' Slope=0.0075 '/' Tc=10.0 min CN=98 Runoff=3.35 cfs 0.314 af

Subcatchment #3: BUS STATION YARD DRAINS WATERSHED Runoff Area=0.380 ac Runoff Depth>3.13"

Flow Length=113' Tc=1.1 min CN=83 Runoff=1.54 cfs 0.099 af

Subcatchment #4: BUS STATION CB#1 WATERSHED

Runoff Area=0.090 ac Runoff Depth>4.71"

Flow Length=126' Slope=0.0150 '/' Tc=1.3 min CN=98 Runoff=0.48 cfs 0.035 af

Pond P1: POND #5

Peak Elev=53.45' Storage=0.291 af Inflow=6.72 cfs 0.645 af

Outflow=0.89 cfs 0.622 af

Total Runoff Area = 1.770 ac Runoff Volume = 0.645 af Average Runoff Depth = 4.37"

12.99% Pervious Area = 0.230 ac 87.01% Impervious Area = 1.540 ac

SYSTEM #5_10 YR (Revised 06-08-10)

Type III 24-hr Rainfall=4.95"

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Subcatchment #1: WATERSHED #1

Runoff = 2.33 cfs @ 12.10 hrs, Volume= 0.196 af, Depth> 4.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.95"

Area (ac)	CN	Description
0.500	98	Paved parking & roofs
0.500		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	75	0.0030	0.61		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
4.7	311	0.0030	1.11		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
6.7	386	Total			

Subcatchment #2: WATERSHED #2

Runoff = 3.35 cfs @ 12.14 hrs, Volume= 0.314 af, Depth> 4.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.95"

Area (ac)	CN	Description
0.800	98	Paved parking & roofs
0.800		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	75	0.0075	0.88		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
8.6	905	0.0075	1.76		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
10.0	980	Total			

Subcatchment #3: BUS STATION YARD DRAINS WATERSHED

Runoff = 1.54 cfs @ 12.02 hrs, Volume= 0.099 af, Depth> 3.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.95"

Area (ac)	CN	Description
0.230	74	>75% Grass cover, Good, HSG C
0.150	98	Paved parking & roofs
0.380	83	Weighted Average
0.230		Pervious Area

SYSTEM #5_10 YR (Revised 06-08-10)

Type III 24-hr Rainfall=4.95"

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0.150 Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0380	1.56		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
0.1	28	0.0380	3.96		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
0.5	35	0.0260	1.13		Shallow Concentrated Flow, SHALLOW CONC. FLOW (GRASS) Short Grass Pasture Kv= 7.0 fps
1.1	113	Total			

Subcatchment #4: BUS STATION CB#1 WATERSHED

Runoff = 0.48 cfs @ 12.02 hrs, Volume= 0.035 af, Depth> 4.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.95"

Area (ac)	CN	Description
0.090	98	Paved parking & roofs
0.090		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.08		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
0.5	76	0.0150	2.49		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
1.3	126	Total			

Pond P1: POND #5

Inflow Area = 1.770 ac, Inflow Depth > 4.37"
 Inflow = 6.72 cfs @ 12.09 hrs, Volume= 0.645 af
 Outflow = 0.89 cfs @ 12.78 hrs, Volume= 0.622 af, Atten= 87%, Lag= 41.2 min
 Primary = 0.89 cfs @ 12.78 hrs, Volume= 0.622 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 53.45' @ 12.78 hrs Surf.Area= 0.120 ac Storage= 0.291 af

Plug-Flow detention time= 192.1 min calculated for 0.620 af (96% of inflow)
 Center-of-Mass det. time= 170.7 min (929.5 - 758.8)

Volume	Invert	Avail.Storage	Storage Description
#1	50.75'	0.404 af	48.0"D x 140.00'L Horizontal Cylinder x 10

SYSTEM #5_10 YR (Revised 06-08-10)

Type III 24-hr Rainfall=4.95"

Prepared by {enter your company name here}

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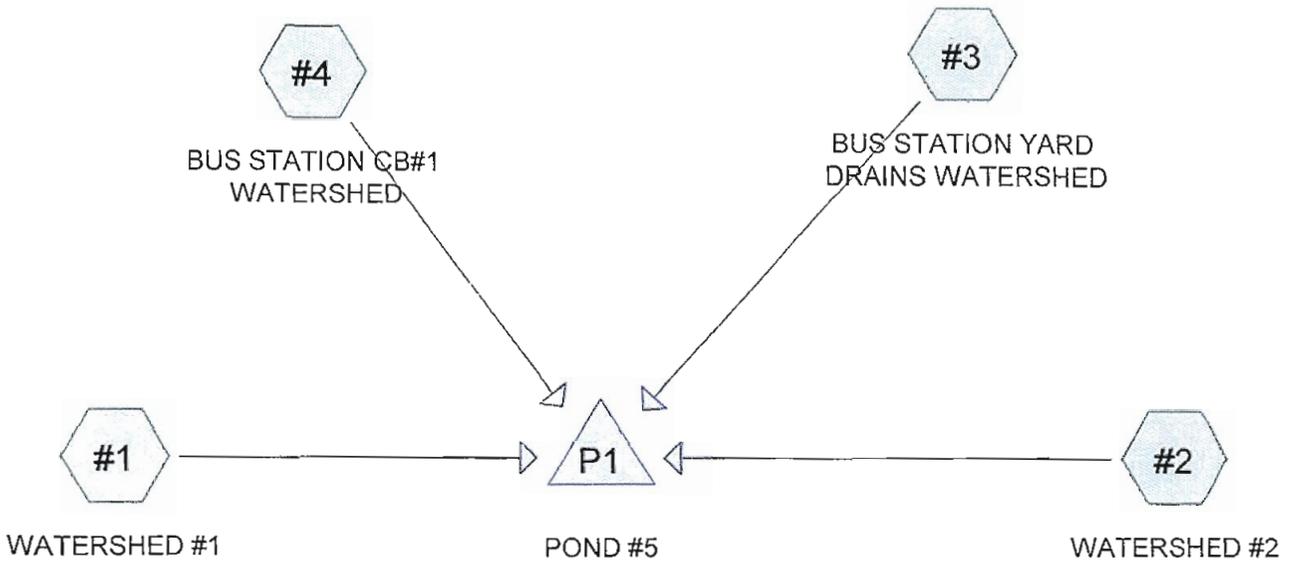
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Device	Routing	Invert	Outlet Devices
#1	Primary	50.75'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	53.00'	4.0" Vert. Orifice/Grate C= 0.600
#3	Primary	53.75'	48.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.89 cfs @ 12.78 hrs HW=53.45' (Free Discharge)

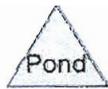
- 1=Orifice/Grate (Orifice Controls 0.67 cfs @ 7.67 fps)
- 2=Orifice/Grate (Orifice Controls 0.23 cfs @ 2.58 fps)
- 3=Orifice/Grate (Controls 0.00 cfs)



Subcat



Reach



Pond



Link

Drainage Diagram for SYSTEM #5_25 YR (Revised 06-08-10)
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SYSTEM #5_25 YR (Revised 06-08-10)

Type III 24-hr Rainfall=5.75"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment #1: WATERSHED #1

Runoff Area=0.500 ac Runoff Depth>5.51"

Flow Length=386' Slope=0.0030 '/' Tc=6.7 min CN=98 Runoff=2.71 cfs 0.230 af

Subcatchment #2: WATERSHED #2

Runoff Area=0.800 ac Runoff Depth>5.51"

Flow Length=980' Slope=0.0075 '/' Tc=10.0 min CN=98 Runoff=3.90 cfs 0.367 af

Subcatchment #3: BUS STATION YARD DRAINS WATERSHED Runoff Area=0.380 ac Runoff Depth>3.86"

Flow Length=113' Tc=1.1 min CN=83 Runoff=1.89 cfs 0.122 af

Subcatchment #4: BUS STATION CB#1 WATERSHED

Runoff Area=0.090 ac Runoff Depth>5.51"

Flow Length=126' Slope=0.0150 '/' Tc=1.3 min CN=98 Runoff=0.56 cfs 0.041 af

Pond P1: POND #5

Peak Elev=53.90' Storage=0.341 af Inflow=7.87 cfs 0.760 af

Outflow=1.28 cfs 0.725 af

Total Runoff Area = 1.770 ac Runoff Volume = 0.760 af Average Runoff Depth = 5.15"

12.99% Pervious Area = 0.230 ac 87.01% Impervious Area = 1.540 ac

SYSTEM #5_25 YR (Revised 06-08-10)

Type III 24-hr Rainfall=5.75"

Prepared by {enter your company name here}

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Subcatchment #1: WATERSHED #1

Runoff = 2.71 cfs @ 12.10 hrs, Volume= 0.230 af, Depth> 5.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.75"

Area (ac)	CN	Description
0.500	98	Paved parking & roofs
0.500		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	75	0.0030	0.61		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
4.7	311	0.0030	1.11		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
6.7	386	Total			

Subcatchment #2: WATERSHED #2

Runoff = 3.90 cfs @ 12.14 hrs, Volume= 0.367 af, Depth> 5.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.75"

Area (ac)	CN	Description
0.800	98	Paved parking & roofs
0.800		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	75	0.0075	0.88		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
8.6	905	0.0075	1.76		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
10.0	980	Total			

Subcatchment #3: BUS STATION YARD DRAINS WATERSHED

Runoff = 1.89 cfs @ 12.02 hrs, Volume= 0.122 af, Depth> 3.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.75"

Area (ac)	CN	Description
0.230	74	>75% Grass cover, Good, HSG C
0.150	98	Paved parking & roofs
0.380	83	Weighted Average
0.230		Pervious Area

SYSTEM #5_25 YR (Revised 06-08-10)

Type III 24-hr Rainfall=5.75"

Prepared by {enter your company name here}

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0.150 Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0380	1.56		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
0.1	28	0.0380	3.96		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
0.5	35	0.0260	1.13		Shallow Concentrated Flow, SHALLOW CONC. FLOW (GRASS) Short Grass Pasture Kv= 7.0 fps
1.1	113	Total			

Subcatchment #4: BUS STATION CB#1 WATERSHED

Runoff = 0.56 cfs @ 12.02 hrs, Volume= 0.041 af, Depth> 5.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.75"

Area (ac)	CN	Description
0.090	98	Paved parking & roofs
0.090		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.08		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
0.5	76	0.0150	2.49		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
1.3	126	Total			

Pond P1: POND #5

Inflow Area = 1.770 ac, Inflow Depth > 5.15"
 Inflow = 7.87 cfs @ 12.09 hrs, Volume= 0.760 af
 Outflow = 1.28 cfs @ 12.65 hrs, Volume= 0.725 af, Atten= 84%, Lag= 33.7 min
 Primary = 1.28 cfs @ 12.65 hrs, Volume= 0.725 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 53.90' @ 12.65 hrs Surf.Area= 0.105 ac Storage= 0.341 af

Plug-Flow detention time= 191.4 min calculated for 0.725 af (95% of inflow)
 Center-of-Mass det. time= 164.2 min (920.4 - 756.3)

Volume #1	Invert	Avail.Storage	Storage Description
	50.75'	0.404 af	48.0"D x 140.00'L Horizontal Cylinder x 10

SYSTEM #5_25 YR (Revised 06-08-10)

Type III 24-hr Rainfall=5.75"

Prepared by {enter your company name here}

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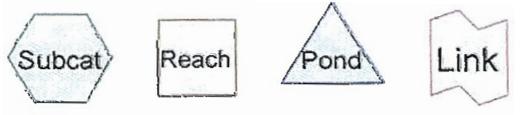
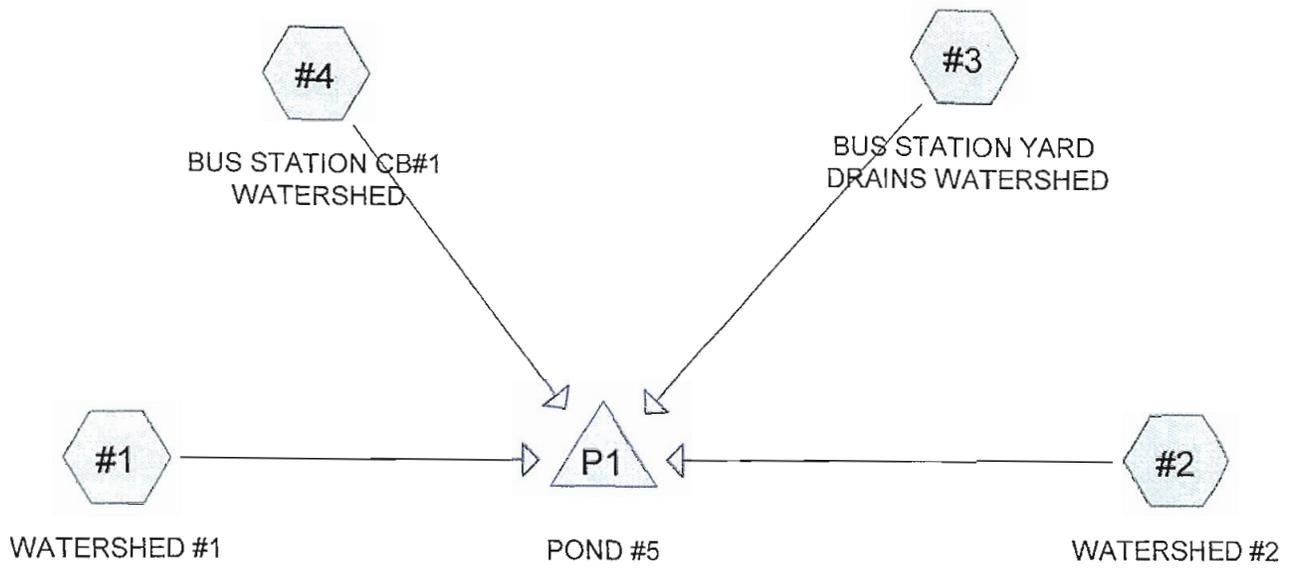
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Device	Routing	Invert	Outlet Devices
#1	Primary	50.75'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	53.00'	4.0" Vert. Orifice/Grate C= 0.600
#3	Primary	53.75'	48.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=1.28 cfs @ 12.65 hrs HW=53.90' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.73 cfs @ 8.31 fps)
- 2=Orifice/Grate (Orifice Controls 0.36 cfs @ 4.12 fps)
- 3=Orifice/Grate (Orifice Controls 0.20 cfs @ 1.31 fps)



Drainage Diagram for SYSTEM #5_100 YR (Revised 06-08-10)
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SYSTEM #5_100 YR (Revised 06-08-10)

Type III 24-hr Rainfall=7.00"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment #1: WATERSHED #1

Runoff Area=0.500 ac Runoff Depth>6.76"

Flow Length=386' Slope=0.0030 '/' Tc=6.7 min CN=98 Runoff=3.30 cfs 0.282 af

Subcatchment #2: WATERSHED #2

Runoff Area=0.800 ac Runoff Depth>6.75"

Flow Length=980' Slope=0.0075 '/' Tc=10.0 min CN=98 Runoff=4.76 cfs 0.450 af

Subcatchment #3: BUS STATION YARD DRAINS WATERSHED Runoff Area=0.380 ac Runoff Depth>5.03"

Flow Length=113' Tc=1.1 min CN=83 Runoff=2.44 cfs 0.159 af

Subcatchment #4: BUS STATION CB#1 WATERSHED

Runoff Area=0.090 ac Runoff Depth>6.76"

Flow Length=126' Slope=0.0150 '/' Tc=1.3 min CN=98 Runoff=0.68 cfs 0.051 af

Pond P1: POND #5

Peak Elev=54.30' Storage=0.379 af Inflow=9.66 cfs 0.942 af

Outflow=3.85 cfs 0.891 af

Total Runoff Area = 1.770 ac Runoff Volume = 0.942 af Average Runoff Depth = 6.38"

12.99% Pervious Area = 0.230 ac 87.01% Impervious Area = 1.540 ac

SYSTEM #5_100 YR (Revised 06-08-10)

Type III 24-hr Rainfall=7.00"

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Subcatchment #1: WATERSHED #1

Runoff = 3.30 cfs @ 12.09 hrs, Volume= 0.282 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=7.00"

Area (ac)	CN	Description
0.500	98	Paved parking & roofs
0.500		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	75	0.0030	0.61		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
4.7	311	0.0030	1.11		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
6.7	386	Total			

Subcatchment #2: WATERSHED #2

Runoff = 4.76 cfs @ 12.14 hrs, Volume= 0.450 af, Depth> 6.75"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=7.00"

Area (ac)	CN	Description
0.800	98	Paved parking & roofs
0.800		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	75	0.0075	0.88		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
8.6	905	0.0075	1.76		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
10.0	980	Total			

Subcatchment #3: BUS STATION YARD DRAINS WATERSHED

Runoff = 2.44 cfs @ 12.02 hrs, Volume= 0.159 af, Depth> 5.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=7.00"

Area (ac)	CN	Description
0.230	74	>75% Grass cover, Good, HSG C
0.150	98	Paved parking & roofs
0.380	83	Weighted Average
0.230		Pervious Area

SYSTEM #5_100 YR (Revised 06-08-10)

Type III 24-hr Rainfall=7.00"

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0.150 Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0380	1.56		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
0.1	28	0.0380	3.96		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
0.5	35	0.0260	1.13		Shallow Concentrated Flow, SHALLOW CONC. FLOW (GRASS) Short Grass Pasture Kv= 7.0 fps
1.1	113	Total			

Subcatchment #4: BUS STATION CB#1 WATERSHED

Runoff = 0.68 cfs @ 12.02 hrs, Volume= 0.051 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=7.00"

Area (ac)	CN	Description
0.090	98	Paved parking & roofs
0.090		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0150	1.08		Sheet Flow, SHEET FLOW Smooth surfaces n= 0.011 P2= 3.25"
0.5	76	0.0150	2.49		Shallow Concentrated Flow, SHALLOW CONC. FLOW Paved Kv= 20.3 fps
1.3	126	Total			

Pond P1: POND #5

Inflow Area = 1.770 ac, Inflow Depth > 6.38"
 Inflow = 9.66 cfs @ 12.09 hrs, Volume= 0.942 af
 Outflow = 3.85 cfs @ 12.40 hrs, Volume= 0.891 af, Atten= 60%, Lag= 18.4 min
 Primary = 3.85 cfs @ 12.40 hrs, Volume= 0.891 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 54.30' @ 12.40 hrs Surf.Area= 0.081 ac Storage= 0.379 af

Plug-Flow detention time= 172.5 min calculated for 0.889 af (94% of inflow)
 Center-of-Mass det. time= 141.9 min (895.0 - 753.1)

Volume #	Invert	Avail.Storage	Storage Description
#1	50.75'	0.404 af	48.0"D x 140.00'L Horizontal Cylinder x 10

SYSTEM #5_100 YR (Revised 06-08-10)

Type III 24-hr Rainfall=7.00"

Prepared by {enter your company name here}

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Device	Routing	Invert	Outlet Devices
#1	Primary	50.75'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	53.00'	4.0" Vert. Orifice/Grate C= 0.600
#3	Primary	53.75'	48.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=3.83 cfs @ 12.40 hrs HW=54.30' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.77 cfs @ 8.85 fps)
- 2=Orifice/Grate (Orifice Controls 0.45 cfs @ 5.12 fps)
- 3=Orifice/Grate (Orifice Controls 2.62 cfs @ 2.52 fps)

APPENDIX F
EXISTING CONDITIONS

It was determined after looking at the survey and existing conditions that a swale would not be appropriate for this area.

Sta. 381+00 to 384+20, Underneath I-84 Ramps. This area was inspected to be used as a potential storm water detention area. Currently it is being used as a staging area for work being done on Farmington Avenue. This area is paved and does not appear to have any catch basins. Runoff from this area sheet flows into Kane Brook and has caused significant erosion in two areas on the south bank of Kane Brook.

Sta. 431+00 to 437+00, Area under the I-84 ramps and connection to the Park River Conduit. We searched this area again for any sign of the Park River Conduit. We were able to find two structures that were also located by the CTDOT survey at Station 435+40, (100' Left). These structures appear to be a sanitary system that runs parallel to the Park River Conduit. If it is not possible to connect to these structures then we may have to connect to the west side of the Park River Conduit in this area. The Park River Conduit will have to be located in the field with test pits to confirm its location if we connect at this location.

Field Review 9/3/08:

Kane Brook Area. This area was inspected for the inclusion of two new outfalls. There are two existing endwalls located near the opening of the culvert that goes under the railroad. These endwalls are in very poor condition. It should also be noted that the endwall on the north side of the Brook is experiencing significant erosion coming from above near the pier for the ramps. We have before and after photographs of this area and we have recommended that CTDOT Maintenance crews move to stop the erosion before the pier or culvert sustain any damage. It is difficult to determine the extent of the erosion from the pictures and we recommend that this matter be investigated further. The Busway project will likely connect two new outfalls to the west of these apparently abandoned outfalls. The existing outfalls should be removed and stabilized. We requested survey of these existing outfalls and it was provided by CTDOT, however, it is not clear what active drainage systems if any lead to these pipes. There is an existing sewer running parallel along the north bank of Kane Brook that will require coordination with the drainage design work.

Kane Station Area. Station 386+00 to 387+50. We searched for signs of any existing drainage in this area and found nothing. The area is heavily wooded and it was difficult to get in close to the right-of-way line to try to find anything connected to the collapsing endwall on the north side of Kane Brook.

Station 395+00, Court Street and Francis Avenue. This area was investigated as a possible outfall location. The drainage structures along Francis Avenue were surveyed by CTDOT. From the street level these structures appear older but in good condition. Additional rights of way would be required to facilitate a connection to Francis Avenue from the Busway.

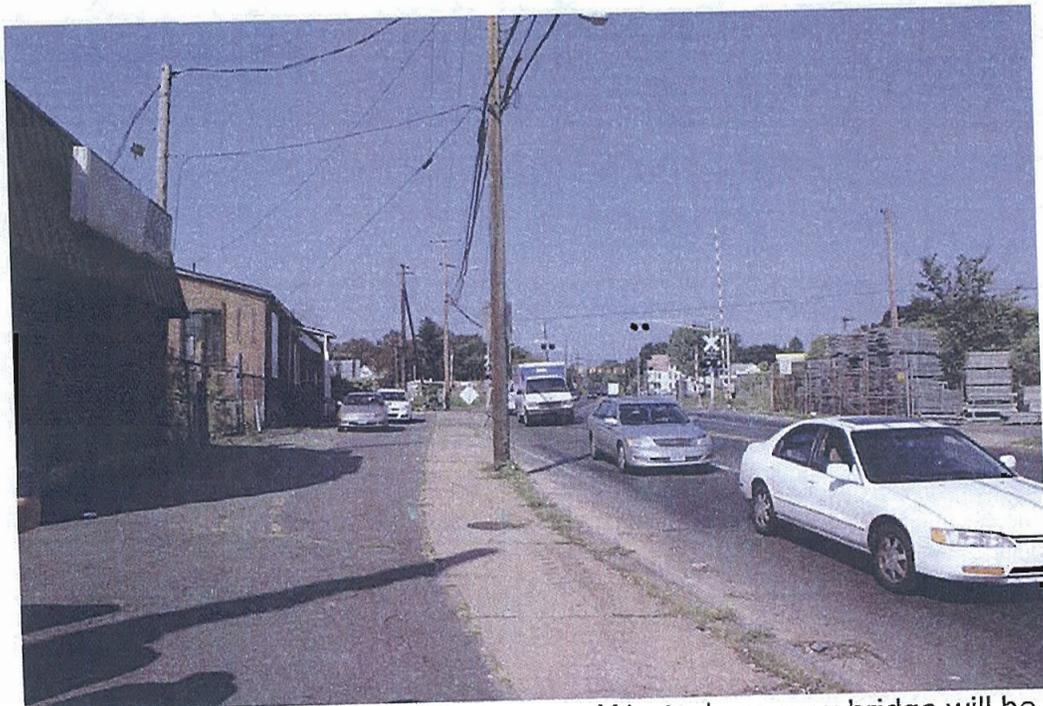
Flatbush Avenue Outfall



Sta. 31+50 - Outfall to Park River Looking East



Sta. 17+50 – On Flatbush Ave. -Viewing West near Railroad tracks



Sta. 18+00 – On Flatbush Ave. View to West where new bridge will be.



Sta. 18+00 – On Flatbush Ave. View of intersection of New Field Avenue looking northeast.



Sta. 22+00 – On Flatbush Avenue looking east.

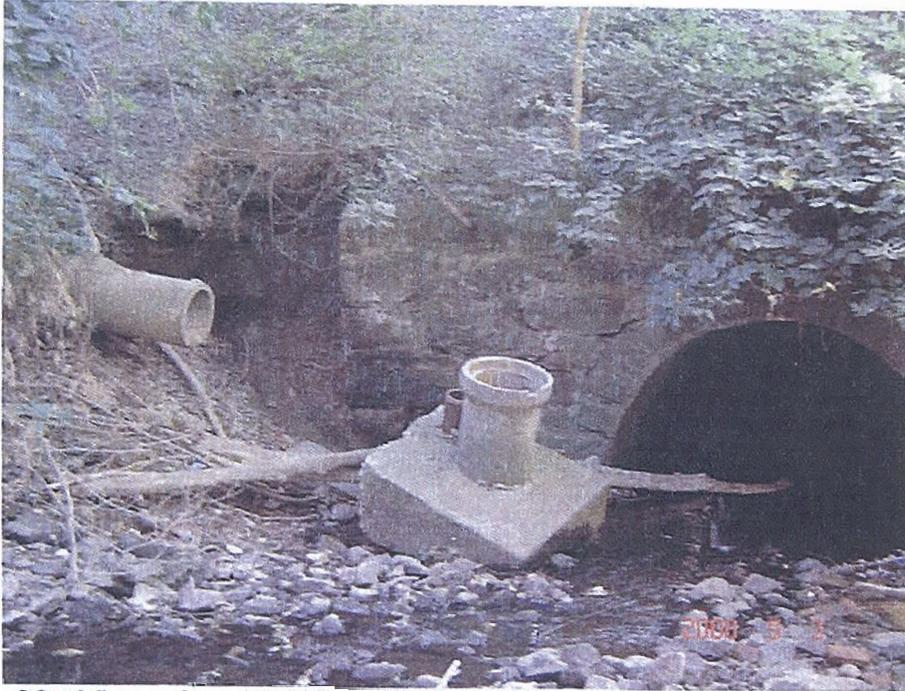


Sta. 52+00 - View of New Field Avenue looking north toward Flatbush Avenue



Sta. 49+00 - View of New Field Avenue looking north toward Flatbush Avenue further south.

Kane Brook Area Photos



Sta. 385+00 - View of north side of Kane Brook with erosion behind exposed pipe section



Sta. 385+00 - View of north side of Kane Brook with erosion behind exposed pipe section



Sta. 385+00 - View of culvert under railroad

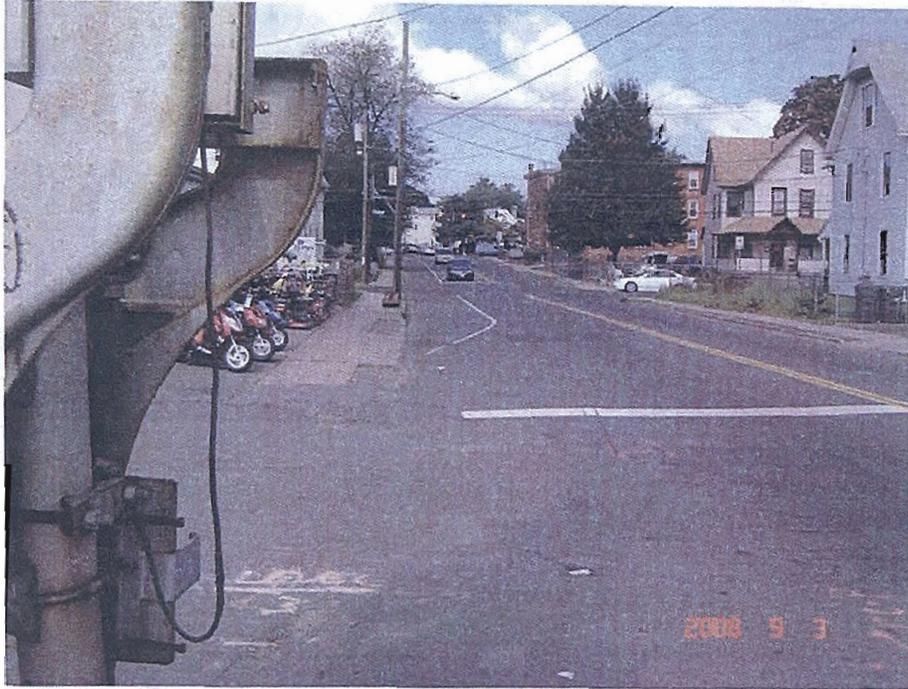


Sta. 385+00 - View of endwall on south side of Kane Brook
draining the old parking lot under the I-84 ramps.



Sta. 385+00 Close up view of endwall on south side of Kane Brook draining the old parking lot under the I-84 ramps.

Hamilton Street Outfall



STA. 405+50 - View to east on Hamilton Street "North of Busway"



Sta. 405+50 - View to north at intersection of Hamilton and Francis Avenue. "North of Busway"

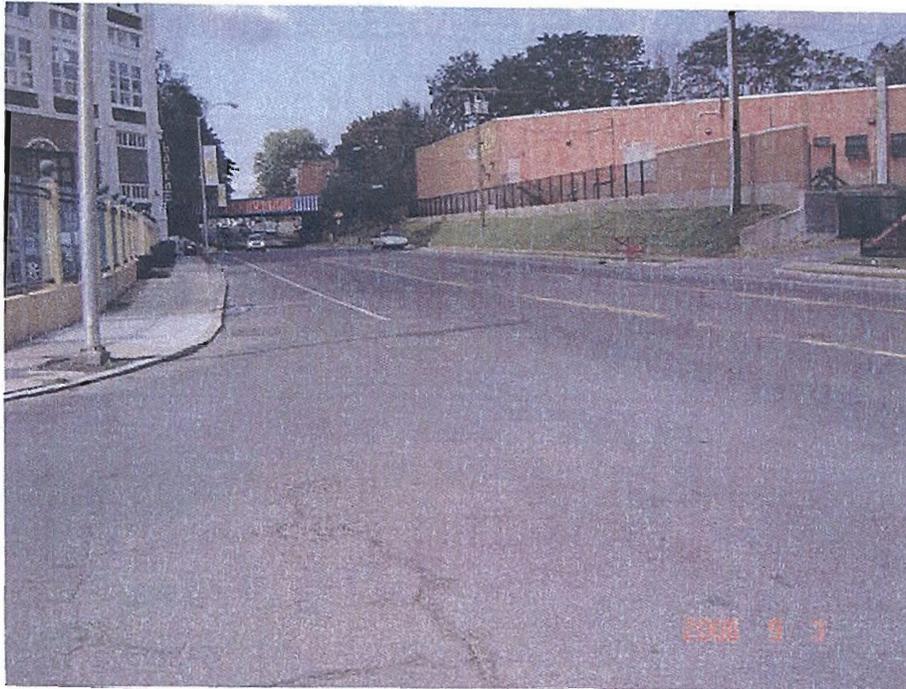
Park Street Outfall



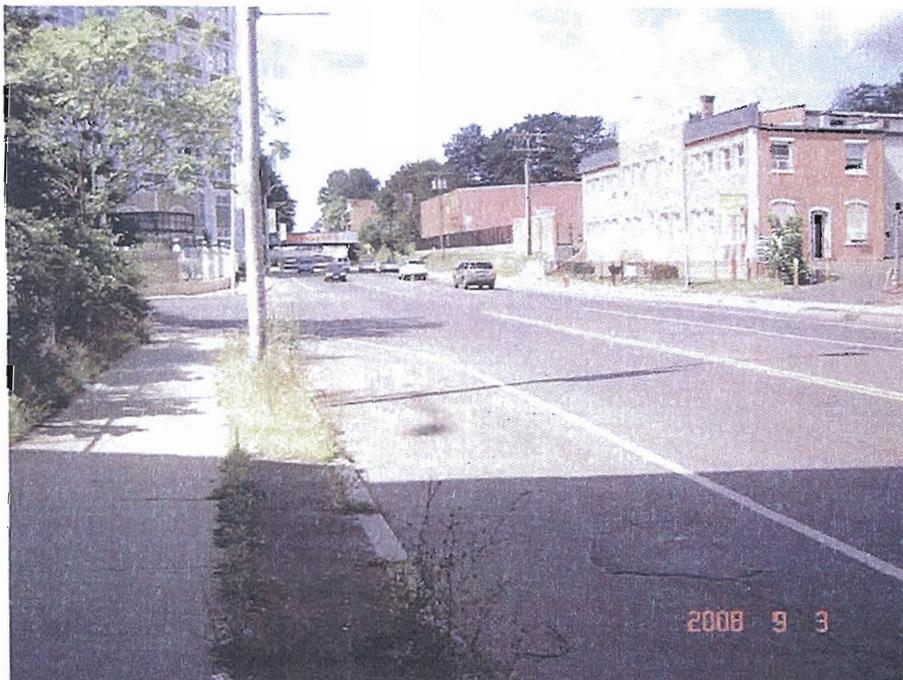
Sta. 417+00 – On Park Street viewing west to Francis Avenue on Left
“North of Busway”



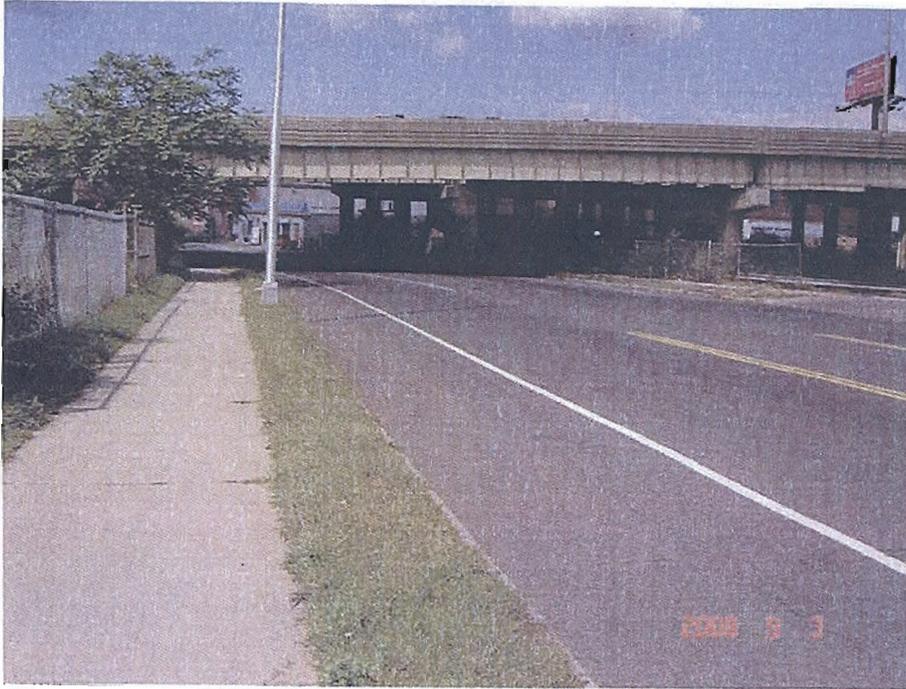
Sta. 418+00 – On Park Street view at intersection of Orange Street looking northwest.
“North of Busway”



Sta. 420+50 – On Park Street at Bartholomew view to the west. “South of the Busway”



Sta. 423+00 – On Park Street view of intersection of Park Street and Bartholomew Avenue looking west. “South of Busway”



Sta. 424+00 – On Park Street View along Park Avenue looking west toward I-84. "South of Busway"



Sta. 424+50 – On Park Street Existing Structure connecting to the Park River Conduit of Park Street east of Bartholomew Avenue. "South of Busway"

Laurel Street Area



Sta 441+00 View looking to southeast towards proposed Busway.
The elevation here is higher than the Busway.

Park River Conduit



View of entrance to Park River Conduit off Farmington Avenue.

FORM 2: STORM SEWER SYSTEM - DRAINAGE STRUCTURES

Station, Offset: 357+98, 14' LT
 Type: TYPE "C" CATCH BASIN

Project No. 155-H025
 Route No. BUSWAY
 Date 9/5/08

Condition

	Good	Fair	Poor	N/A
Cover	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grate	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Top	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Crack, Spall, Settlement	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Siltation, Debris	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Remarks/Findings:

EXISTING CATCH BASIN TIES INTO EXISTING
MANHOLE WITH 30" RCP UNDER RAILROAD TO THE
EAST

Recommendations:

RE BUILD CATCH BASIN TO TIE IN PROPOSED
DRAINAGE FROM EAST OF BUSWAY AS WELL
AS BUSWAY DRAINAGE FROM SOUTH & NORTH

FORM 2: STORM SEWER SYSTEM - DRAINAGE STRUCTURES

Station, Offset: 352+04, 11' LTProject No. 155-H025Type: MANHOLERoute No. BuswayDate 9/5/08

	Condition			
	Good	Fair	Poor	N/A
Cover	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Top	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Crack, Spall, Settlement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Siltation, Debris	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Remarks/Findings:

THIS MANHOLE PROVIDES ACCESS TO A
30" RCP PIPE TO THE EAST UNDER THE RAILROAD
TRACKS ALONG FLOEBUS AVENUE

Recommendations:

ADJUST FRAME & GRATE, REBUILD MANHOLE TO FACILITATE
CONNECTING PROPOSED DRAINAGE FROM THE WEST AND
BUSWAY SYSTEMS TO NORTH & SOUTH.

FORM 2: STORM SEWER SYSTEM – DRAINAGE STRUCTURES

Station, Offset: 405+13, 133 LT
 Type: TYPE "C" CB

Project No. 155-H025
 Route No. BUSWAY
 Date 9/5/08

	Condition			
	Good	Fair	Poor	N/A
Cover	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Grate	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Top	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Crack, Spall, Settlement	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Siltation, Debris	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Remarks/Findings:

EXISTING CATCH BASIN INLET IS NOT A STANDARD
SIZE. ACCUMULATION OF SEDIMENT FOUND IN STRUCTURE

Recommendations:

REPLACE INLET WHEN CONSTRUCTING TIE INTO
FRANCIS AVENUE FROM HAMILTON STREET/BUSWAY.

APPENDIX G
DRAINAGE PIPE & CULVERT
SELECTION JUSTIFICATION

VN ENGINEERS, INC.

DRAINAGE MEMORANDUM

RE: CTDOT PROJECT #155-H025, NEW-BRITAIN-HARTFORD
BUSWAY

DESCRIPTION: DRAINAGE PIPE AND CULVERT SELECTION JUSTIFICATION
DOCUMENTATION

DATE: DECEMBER 9, 2008
REVISED AUGUST 26, 2009

PREPARED BY: CRAIG LANPHEAR
REVISED BY JOSEPH BAMBARA

With respect to the consideration of alternative pipe materials for the subject project we offer the following:

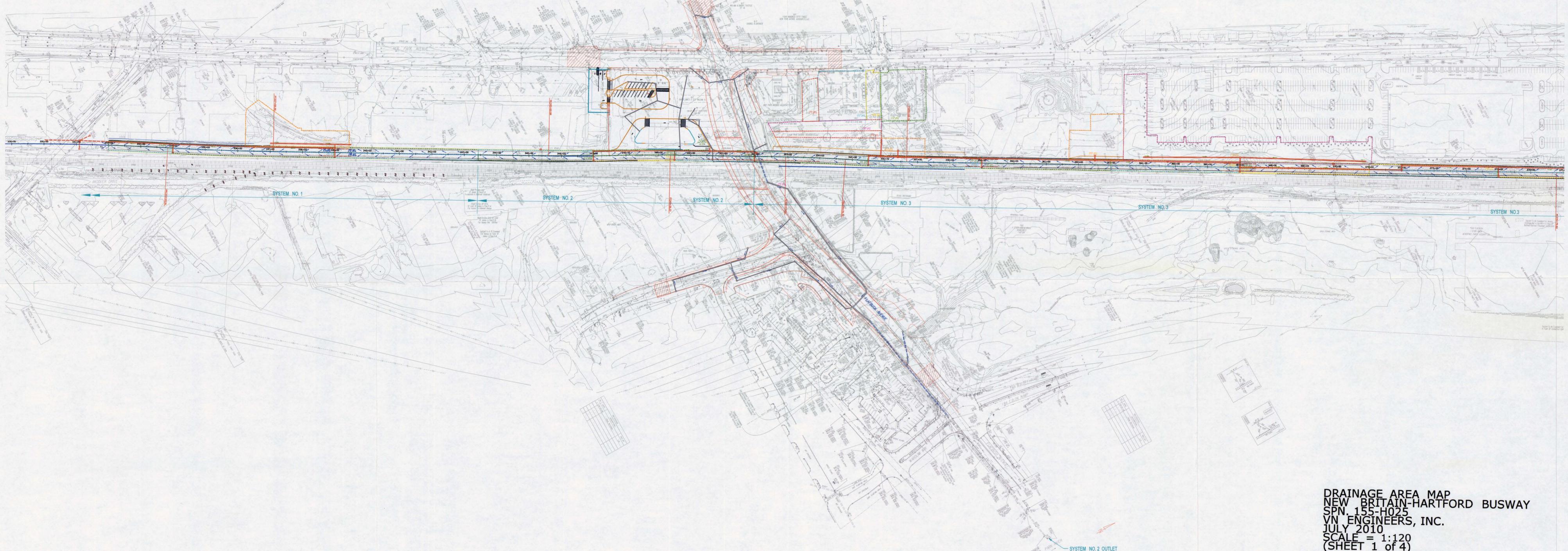
The following pipe materials were considered in design of the drainage system: RCP, HDPE, PVC, corrugated metal, and corrugated aluminum. RCP or HDPE are the only pipe materials that are suitable for use in this project due to the deep embedment depth of several of the drainage systems and the increased loading of the travelway. Following are notable elements regarding the use of alternative piping materials.

1. Type II bedding may be required if native soils is found to be unsuitable.
2. HDPE max. fill cover should be limited to 8'. Over 8' requires pipe strength calculations.
3. HDPE, PVC and metal pipe is only recommended for longitudinal installations on local and collector roads not heavy loads as experienced on the Busway.
4. HDPE is not recommended where parallel utility lines are present.
 - System 2 will require parallel pipe installations adjacent to existing utility lines on Flatbush Avenue, New Park Avenue, and New Field Avenue.
 - The project lies within an urban environment of which may require future utility work adjacent to drainage lines.
5. Several systems implement a minimum slope of 0.5% to achieve outlet elevation objectives which will require precision placement, extensive inspection and documentation.

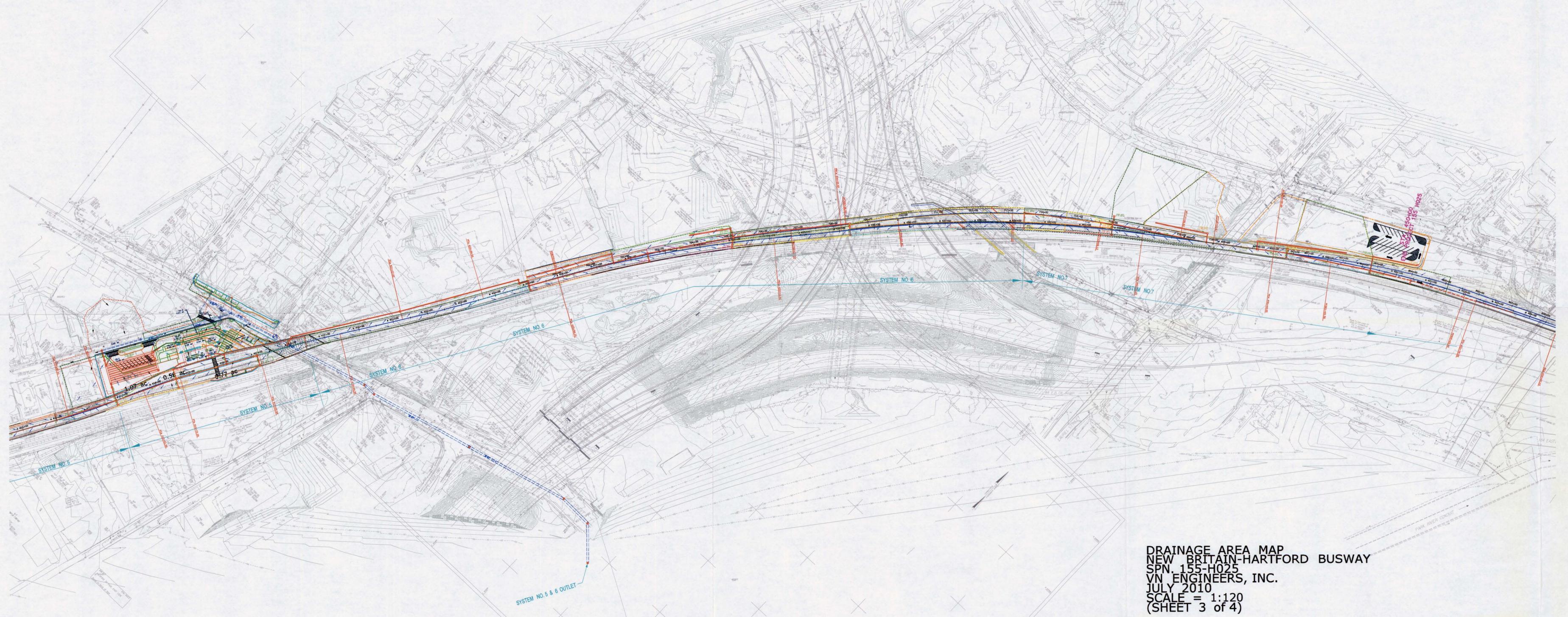
6. It is anticipated that heavy machinery will be present on-site and will require traversing pipes adjacent to construction of retaining walls, noise wall, stations & bridge structures.
7. Due to documented areas of contamination throughout the project, corrugated metal and corrugated aluminum pipe could become structurally compromised due to corrosion.

RCP is recommended for this project due to the urban setting with the potential for future utility work and the deep piping requirements.

Note: Major culverts are not proposed in this project.

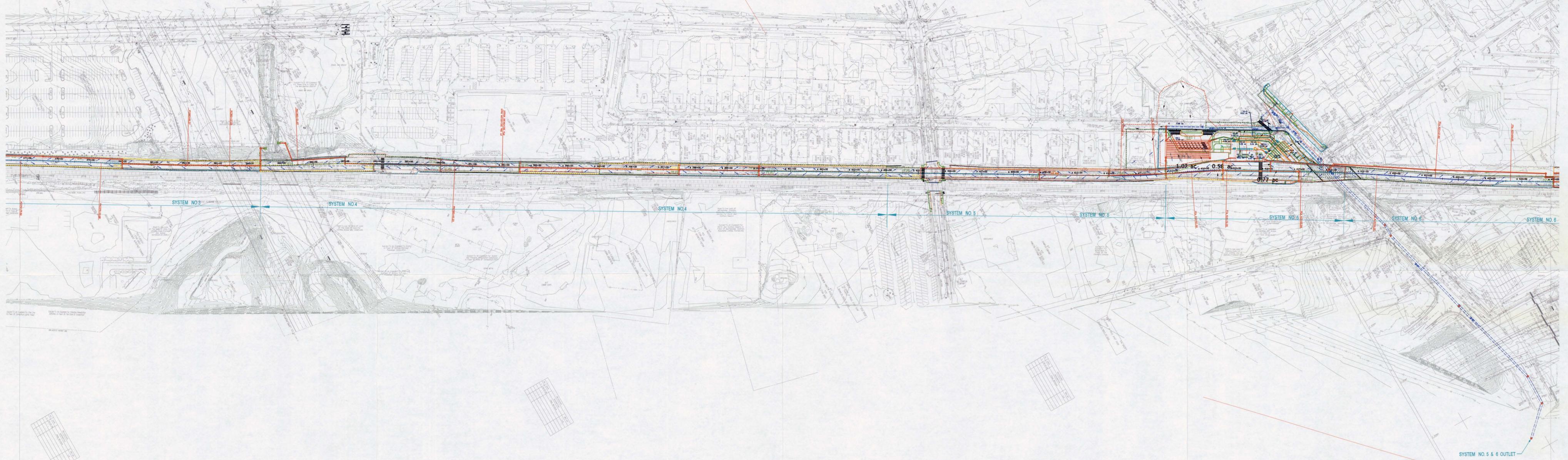


DRAINAGE AREA MAP
 NEW BRITAIN-HARTFORD BUSWAY
 SPN. 155-H025
 VN ENGINEERS, INC.
 JULY 2010
 SCALE = 1:120
 (SHEET 1 of 4)



PROJECT 155-H025

DRAINAGE AREA MAP
NEW BRITAIN-HARTFORD BUSWAY
SPN. 155-H025
VN ENGINEERS, INC.
JULY 2010
SCALE = 1:120
(SHEET 3 of 4)



DRAINAGE AREA MAP
 NEW BRITAIN-HARTFORD BUSWAY
 SPN 155-H025
 VN ENGINEERS, INC.
 JULY 2010
 SCALE = 1:120
 (SHEET 2 of 4)

