

NEW BRITAIN - HARTFORD BUSWAY

HARTFORD, CT

PERMITTING SUBMISSION

NOVEMBER 6, 2009

EAST STATION

State Project No. 88-H039



RECEIVED
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INLAND WATER RESOURCES DIVISION

S E A

SE A CONSULTANTS INC.
Scientists/Engineers/Architects

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1. Introduction

1.0. Project Description

This project involves the design of eleven transit stations along an exclusive bus rapid transit (BRT) line. The BRT alignment and stations are within New Britain, Newington, West Hartford, and Hartford, Connecticut. Each site involves the design and construction of pedestrian and vehicular facilities for the busway operation. The site locations are typically urban sites that have been previously developed.

1.1. Purpose of Report

This report presents the preliminary drainage design for the BRT station sites. It provides information regarding the coordination with the proposed mainline drainage systems and data for use in preparing permitting applications.

1.2. Data Collection

In accordance with the Connecticut Department of Transportation Drainage Manual, the communities were solicited for input on existing drainage issues and concerns about the station drainage designs. Letters were sent to the Department of Public Works Directors and Town/City engineers in New Britain, Newington, West Hartford, and Hartford. A response was not received from Hartford. A request will be sent again. The following summarizes the responses received from the other communities.

Robert Trottier of the City of New Britain Department of Public Works responded via e-mail on November 19, 2008. He indicated that he and Bill Dunn, Acting General Foreman of the New Britain Sewer Crew, were not aware of any concerns at the Downtown New Britain Station, but that drainage and sanitary problems exist near the East Street Station.

2. Analysis Methodology

2.0. Design Criteria

The drainage design of the station sites was prepared in accordance with the 2000 Connecticut Department of Transportation Drainage Manual. Additional criteria of the Connecticut Department of Environmental Protection 2004 Stormwater Quality Manual was also considered.

The storm drainage systems were designed for the 10-year storm event. The rational method was used to calculate peak flows within the station sites. The hydraulic grade lines (HGLs) and pipe capacities were analyzed with StormCAD software. The Intensity/Duration/Frequency (IDF) curves used in the hydrologic analyses was from the Connecticut Department of Transportation Drainage Manual (Table B-2.1).

The inlets within the station sites were designed in accordance with the above mentioned manuals. A clogging factor of 50 percent was assumed for all basins located within a sag. Similarly, an assumed clogging factor of 75 was applied to all yard and area drains.

The CTDOT Drainage Manual specifies a minimum pipe velocity of 3 feet per second. When feasible, this velocity was achieved. However, given the nature of the site designs and the desire to eliminate nuisance flows to reduce icing conditions, not all pipes were able to be designed to meet this criterion. In general, this condition only exists in the upper reaches of the drainage systems.

For station sites where proposed drainage will be discharged into systems designed by others, drainage reports and calculations were provided to S E A Consultants for use in the station designs. References to these designs are included herein.

2.1. Design Methodology

StormCAD V8 XM software by Bentley was utilized to conduct the drainage calculations for this report. In addition, the rational method was used to compare the existing drainage at and surrounding the site to the proposed drainage design. Design points were selected around the site to accurately represent the change in flow from existing to proposed. Weighted C values were chosen to represent surface types.

2.2. Assumptions

Drainage areas were delineated using project area mapping provided by the Department.

Runoff coefficients were determined based on land cover. Two types were identified within the station limits, paved and grassed areas. The runoff coefficients were determined as 0.9 and 0.3, respectively. Due to the small size of the station sites and small proposed drainage collection areas, the time of concentration of all on-site drainage sub-areas was assumed to be five minutes.

3. Station Analysis and Summaries

3.0. East Street Station

3.0.1. Existing Condition

The site is located off of East Street behind an existing building owned by Central Connecticut State University. The parking area for the CCSU property is paved and the remaining site is lawn and light woods. The site is approximately 33.0% impervious.

A large portion of the site totaling approximately 2.28 acres drains to two existing catch basins in the neighboring apartment complex. The catch basins in the parking area of the apartment complex are Design Points A and B (see Exhibit 3.2-A). The discharge to the apartment complex basins is summarized, as follows:

Storm Frequency	Q _{PRE} (cfs)
2-year	4.79
10-year	6.24
25-year	6.97
100-year	8.12

A small portion of the site, approximately 0.08 acres, drains to a dry well located behind the existing building. This dry well is Design Point C. Discharge to this design point is summarized, as follows:

Storm Frequency	Q _{PRE} (cfs)
2-year	0.33
10-year	0.43
25-year	0.48
100-year	0.56

The remaining site area of approximately 0.64 acres drains to an existing swale along the west side of the railroad tracks. This swale is Design Point D and drains to the north, eventually discharging into Sandy Brook. Discharge to the swale is summarized, as follows:

Storm Frequency	Q _{PRE} (cfs)
2-year	1.77
10-year	2.30
25-year	2.57
100-year	3.00

3.0.2. Proposed Condition

The majority of the site has been graded so that the stormwater runoff may be collected and discharged through one outlet north of the station. The design increases impervious area on site, but reduces the total area to existing discharge points. The site is approximately 54.8% impervious. A small landscaped area near the multi-use trail on the north end of the plaza will continue to drain by sheet flow to the north and into Sandy Brook. Other small areas along the street frontages are proposed to drain directly to East Street and the existing catch basins by surface flow, similar to the existing condition. (See Exhibit 3.2-B.)

The portion of the site collected by a proposed series of catch basins and storm drain pipes totals approximately 1.89 acres. The outlet for this system connects to a proposed catch basin, Design Point D. The existing swale will be removed with the construction of the busway mainline, Contract No. 88-H034. The site discharge at the outlet, Design Point D is summarized, as follows:

Storm Frequency	Q _{PRE} (cfs)	Q _{POST} (cfs)	ΔQ (cfs)
2-year	1.77	4.67	2.90
10-year	2.30	6.13	2.83
25-year	2.57	6.80	4.23
100-year	3.00	7.86	4.86

The drainage system on the site will connect to a proposed catch basin, Contract No. 88-H034, at Sta. 121+12, 24 feet left. From the Drainage Design Report Revised September 8, 2009, the HGL for the conduit upstream of the connection point is 92.75 feet.

Portions of the site will continue to drain toward existing outlets. Approximately 0.79 acres will continue to drain to the existing catch basins within the parking area of the neighboring apartment complex, Design Points A and B. Discharge to this design point is summarized, as follows:

Storm Frequency	Q _{PRE} (cfs)	Q _{POST} (cfs)	ΔQ (cfs)
2-year	4.79	2.33	-2.46
10-year	6.24	3.03	-3.21
25-year	6.97	3.39	-3.58
100-year	8.12	3.95	-4.17

Approximately 0.07 acres will continue to drain to the dry well located behind the existing building, Design Point C. Discharge to this point is summarized, as follows:

Storm Frequency	Q _{PRE} (cfs)	Q _{POST} (cfs)	ΔQ (cfs)
2-year	0.33	0.29	-0.04
10-year	0.43	0.38	-0.05
25-year	0.48	0.42	-0.06
100-year	0.56	0.49	-0.07

3.0.3. *Environmental Issues and Stormwater Treatment*

Wetland Area 2C is within the site and will be impacted by the proposed work. The area totals approximately 728 square feet. (See Exhibit 3.2-C.) Mitigation areas are assumed to be part of the overall project and addressed under a separate project number.

3.0.4. *Soil Erosion and Sedimentation Control*

The soil erosion and sedimentation control design complies with the Department of Environmental Protection 2002 Connecticut Guidelines for Soil Erosion and Sediment Control. The design contains provisions for silt fences along with inlet protection.

4. Appendix A: Design Checklist

Project No. 88-11039
 Roadway East St. Station
 Town New Britain
 Date 11/6/2009
 Designed By SEA Consultants
 Signature of Engineer [Signature]

Drainage Design Checklist (Plans 50% Complete)

Allow a 6-8 week review time

See Note below.

Semi-Final Design Checklist (Plans 60% to 70% Complete)

Allow a 5-6 week review time

Note: A separate, earlier drainage submission (at approximately 50% completion) may be required if the drainage design is particularly complicated, requires significant right of way and/or otherwise might jeopardize the schedule of the project. **This checklist MUST accompany both of these submissions.**

Indicate which submission this checklist is for and include the following information:

Drainage Design Submission

Semi-Final Design Submission

a. Draft Drainage Report

1. Disposition of Preliminary Design/Drainage Design Submission comments with written responses justifying comments not incorporated.
 Included Not Included Not Applicable
2. A condition survey of the existing drainage pipes and structures that are to remain in use should be investigated for structural adequacy and documented. (See Section 3.6.3.)
 Included Not Included Not Applicable
3. The condition of existing ditches that are to remain in use should be field inspected, analyzed and results documented to verify their stability and the need for cleaning and reshaping.
 Included Not Included Not Applicable
4. The condition of the outlet at the existing discharge points should be investigated and documented to ensure no erosion or sediment problems exist. If outlet protection is required, it should be incorporated into the project and computations submitted.
 Included Not Included Not Applicable

5. A condition survey report including items 2, 3, and 4 above. (See Appendix A and B, Chapter 4)
 Included Not Included Not Applicable
6. Drainage design computations should include gutter flow analysis, storm sewer design, and hydraulic gradeline (HGL). The hydraulic gradeline should be analyzed to ensure 0.3m (1 ft) freeboard is maintained at drainage structures. This analysis should consider all friction, entrance, junction, exit and bend losses. Designer to verify that the proposed drainage will not adversely impact the existing downstream storm system or property owners. (See Chapter 11, Storm Drainage Systems.)
 Included Not Included Not Applicable
7. Drainage computations should identify structures by station and offset rather than by a numerical identifier. If station and offset is not feasible for the computations then include an index with the location of the structure corresponding to its numerical identifier. The watershed map should be prepared accordingly.
 Included Not Included Not Applicable
8. Existing drainage systems shall be analyzed for hydraulic adequacy to meet the proposed conditions and, if found inadequate, an upgrade will be designed in conformance with the criteria established in the Drainage Manual.
 Included Not Included Not Applicable
9. All roadway drainage systems should be brought to a suitable outlet.
 Included Not Included Not Applicable
10. If upgrading of pipes downstream of the project is necessary, then additional rights may need to be acquired.
 Included Not Included Not Applicable
11. The need for temporary drainage should be addressed. Temporary drainage computations should be prepared in accordance with criteria in the Drainage Manual. (See Section 3.6.11.)
 Included Not Included Not Applicable
12. Proposed swales, ditches and channels should be designed in accordance with HEC-15 for discharges 1.42 m³/s (50 ft³/s) and less or HEC-11 for discharges in excess of 1.42 m³/s (50 ft³/s). (See Chapter 7, Channels.)
 Included Not Included Not Applicable
13. Minor and small cross culvert design computations with culvert data sheet. (See Chapter 8, Culverts.)
 Included Not Included Not Applicable
14. Topographic mapping with watershed area delineated for each inlet and/or cross culverts as required to perform the drainage calculations. The flow path used in the time of concentration calculation and coefficient of imperviousness should be shown for each area. (See Chapter 6, Hydrology.)
 Included Not Included Not Applicable
15. Diversion identified.
 Included Not Included Not Applicable
16. All plans, computations and reports identify the responsible engineers who prepared and checked the work.
 Included Not Included Not Applicable

b. Plans, Profiles and Cross Sections

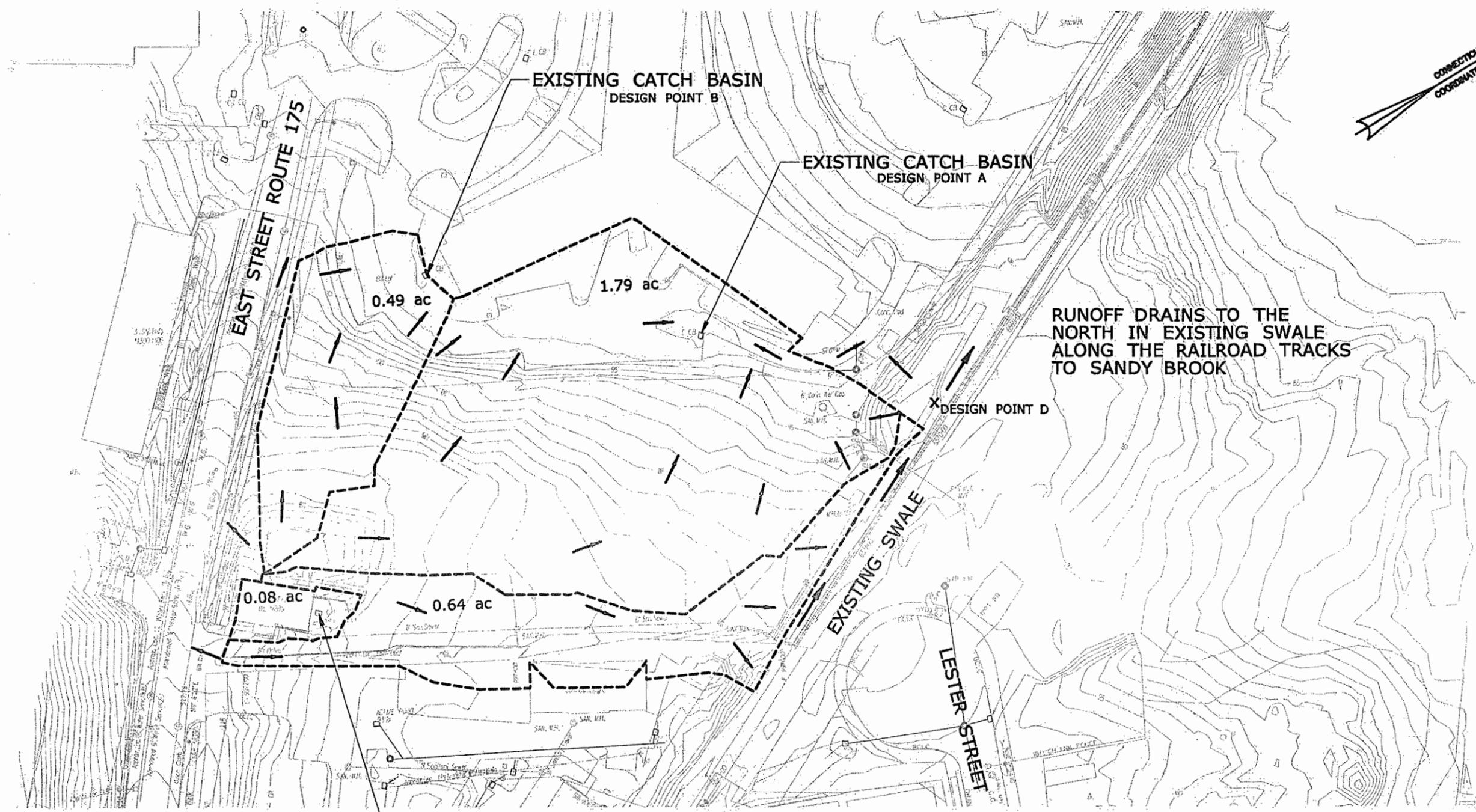
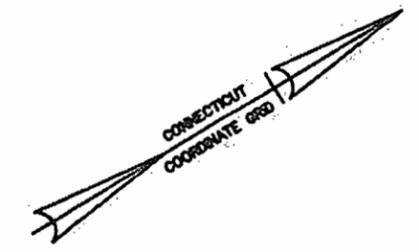
1. The existing and proposed storm drainage shown to their outlets.
 Included Not Included Not Applicable
2. Size and type of existing drainage pipes/structures and disposition of pipes/structures to be abandoned.
 Included Not Included Not Applicable
3. Properties affected by diversions should be shown on the plans so that proper rights can be acquired.
 Included Not Included Not Applicable
4. Drainage Rights and Easements.
 Included Not Included Not Applicable
5. Outlet Protection shown on plans and details provided.
 Included Not Included Not Applicable
6. Intersection grading plans to ensure inlets are located at the low points to alleviate ponding/icing conditions. Top of frame elevation should be shown.
 Included Not Included Not Applicable
7. In areas where cross culverts are being extended, replaced, or where outlet protection is proposed a profile or cross section of the natural ground should be provided to show how the inverts will tie into the existing topography.
 Included Not Included Not Applicable
8. The top of frame and invert elevations for each storm drainage structure shown. Proposed drainage structures shall be identified by station and offset on cross sections.
 Included Not Included Not Applicable
9. Existing and proposed drainage patterns (flow arrows) of pipes, ditches, channel and swales.
 Included Not Included Not Applicable
10. Details for any special drainage structures not found in the Standard Drawings.
 Included Not Included Not Applicable
11. The direction of flow should be shown by arrows to 61m (200 ft.) beyond any drainage outlet, or shown to terminate by dissipation or entrance into a watercourse or body of water.
 Included Not Included Not Applicable

c. Structures with drainage areas > 2.59 km² (1 mi²)

1. Draft hydraulic design report.
 Included Not Included Not Applicable
2. Draft scour report when the proposed structure spans the waterway.
 Included Not Included Not Applicable
3. Draft floodway report.
 Included Not Included Not Applicable
4. Draft SCEL report.
 Included Not Included Not Applicable
5. Draft scour report if required.
 Included Not Included Not Applicable

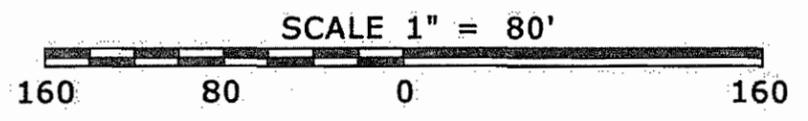
Provide justification for items **Not Included**. Justification should correspond to letter and number.

5. Appendix B: Watershed Mapping and Exhibits



EXISTING DRY WELL
DESIGN POINT C

EXISTING CONDITIONS



STATE PROJECT NO.: 88-H039
COUNTY: HARTFORD
CITY/TOWN: NEW BRITAIN

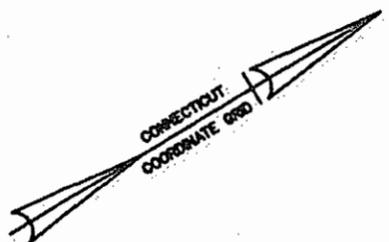
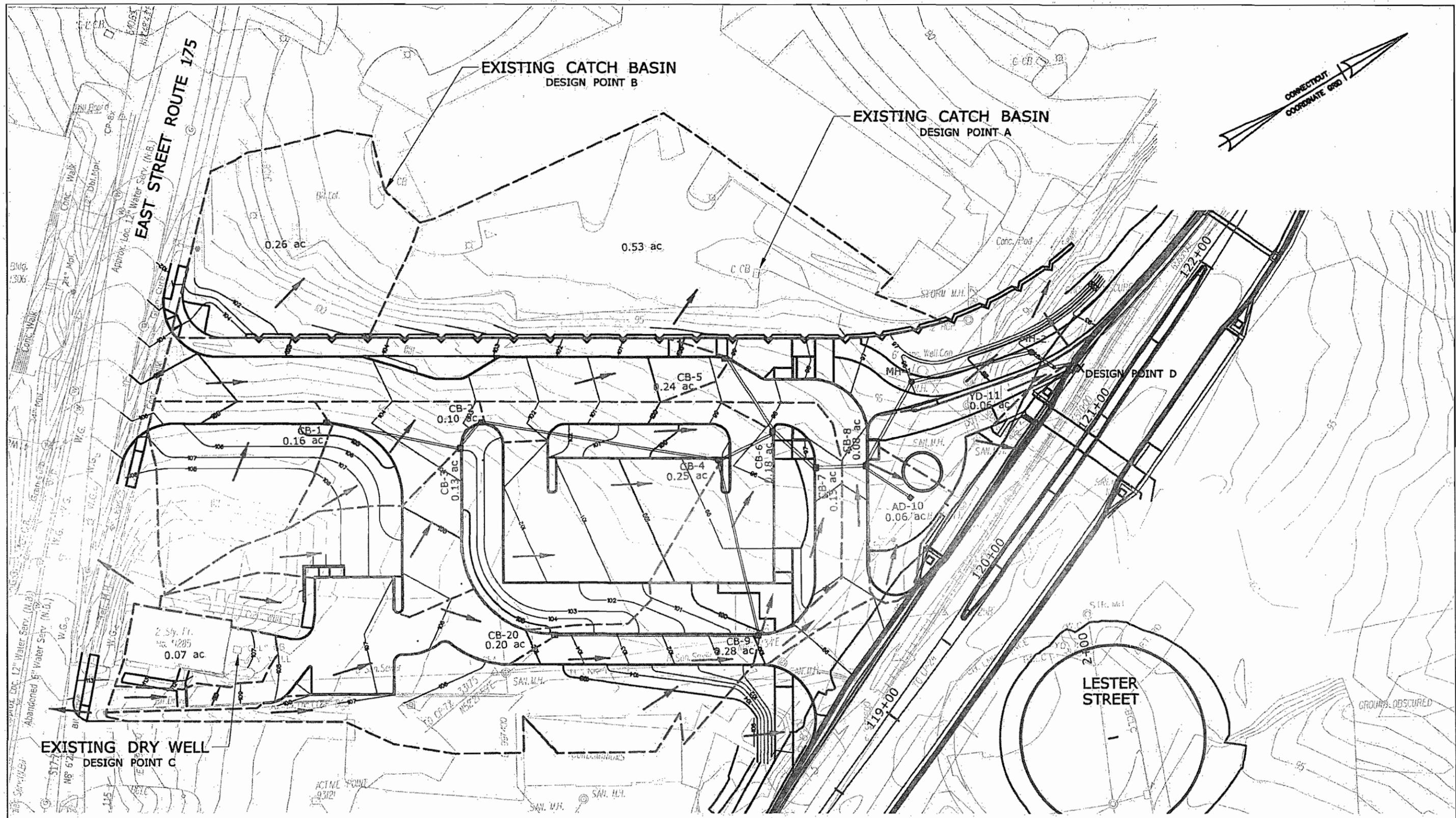
APPLICATION BY:
STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION



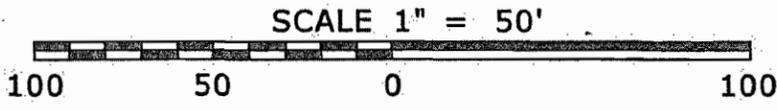
OFFICE OF
ENGINEERING

SCALE 1=80

DATE: NOVEMBER 2009
SITE: EAST STREET
STATION
EXHIBIT: 3.2-A



PROPOSED CONDITIONS

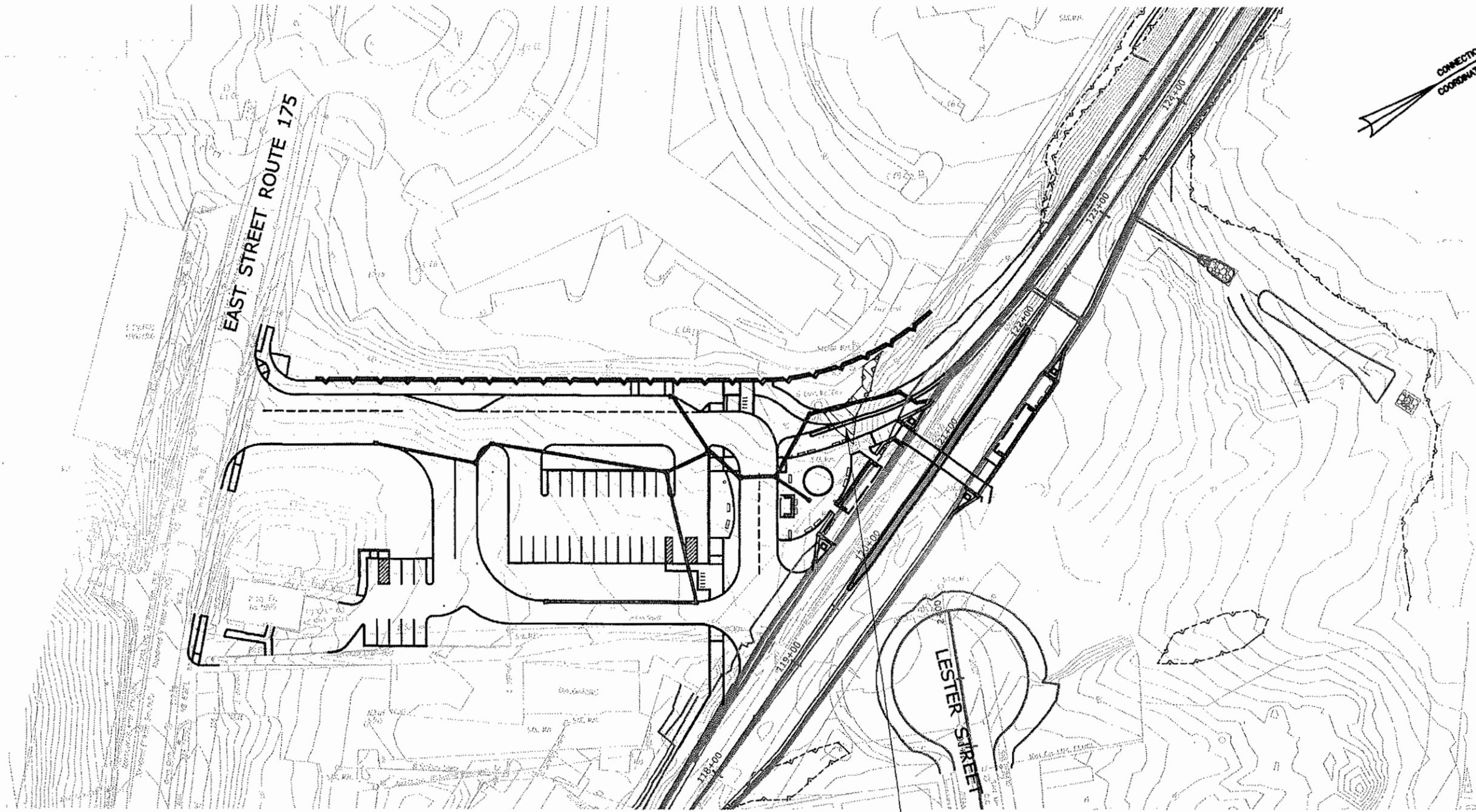


STATE PROJECT NO.: 88-H039
 COUNTY: HARTFORD
 CITY/TOWN: NEW BRITAIN

APPLICATION BY:
STATE OF CONNECTICUT
 DEPARTMENT OF TRANSPORTATION

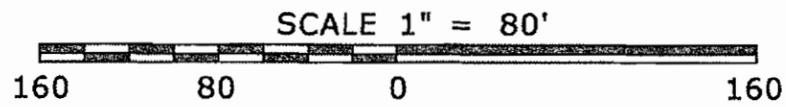


DATE: NOVEMBER 2009
 SITE: EAST STREET STATION
 EXHIBIT: 3.2-B



IMPACTED WETLAND
 AREA 728 SQFT
 PROJECT WETLAND #2C

PROPOSED IMPACT



STATE PROJECT NO.: 88-H039
 COUNTY: HARTFORD
 CITY/TOWN: NEW BRITAIN

APPLICATION BY:

STATE OF CONNECTICUT
 DEPARTMENT OF TRANSPORTATION

OFFICE OF
 ENGINEERING

 SCALE 1=80

DATE: NOVEMBER 2009
 SITE: EAST STREET
 STATION
 EXHIBIT: 3.2-C

6. Appendix C: Hydrologic and Hydraulic Calculations

SEA Consultants, Inc.
 Scientists/Engineers/Architects
 200 Corporate Place
 Rocky Hill, Connecticut 06067

PROJECT: Now Britain - Hartford Bus Rapid Transit Stations
 PROJECT NO. 08-F1030 SHEET NO. 1
 CALCULATED BY: KSR DATE: 11/2/2009
 CHECKED BY: EAS DATE: 11/4/2009

**Runoff Calculations for the 2, 10, 25, 100 Year Storms
 East Street Station**

System: Catch Basins within Apartment Complex Parking Area

Pre-Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
A	1.79	0.45	4.60	6.00	6.70	7.80	3.71	4.83	5.40	6.28
B	0.49	0.48	4.60	6.00	6.70	7.80	1.08	1.41	1.58	1.83
Total Q =							4.79	6.24	6.97	8.12

Post-Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
A	0.53	0.66	4.60	6.00	6.70	7.80	1.61	2.10	2.34	2.73
B	0.26	0.60	4.60	6.00	6.70	7.80	0.72	0.94	1.05	1.22
Total Q =							2.33	3.03	3.39	3.95

Delta = -2.46 -3.21 -3.58 -4.17

System: Existing dry well behind existing building (CCSU Daycare Center)

Pre-Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
C	0.08	0.90	4.60	6.00	6.70	7.80	0.33	0.43	0.48	0.56
Total Q =							0.33	0.43	0.48	0.56

Post-Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
C	0.07	0.90	4.60	6.00	6.70	7.80	0.29	0.38	0.42	0.49
Total Q =							0.29	0.38	0.42	0.49

Delta = -0.04 -0.05 -0.06 -0.07

System: Existing swale along the west side of the railroad tracks to Sandy Brook

Pre-Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
D	0.64	0.60	4.60	6.00	6.70	7.80	1.77	2.30	2.57	3.00
Total Q =							1.77	2.30	2.57	3.00

Post-Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
D	Calculations from StormCad						4.67	6.13	6.80	7.86
Total Q =							4.67	6.13	6.80	7.86

Delta = 2.90 3.83 4.23 4.86

Note:

- 1.) Calculations based on Rational Method, Q = CiA
- 2.) Design Points designated on Exhibit 3.2-A and 3.2-B

SEA Consultants, Inc.
 Scientist/Engineers/Architects
 200 Corporate Place
 Rocky Hill, Connecticut 06067

PROJECT: New Britain - Hartford Bus Rapid Transit Stations
 PROJECT NO. 88-11039 SHEET NO. 1
 CALCULATED BY: KSR DATE: 1/2/2009
 CHECKED BY: EAS DATE: 1/14/2009

**Runoff Calculations for the 2, 10, 25, 100 Year Storms
 East Street Station**

System: Catch Basins within Apartment Complex Parking Area

Pre- Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
A	1.79	0.45	4.60	6.00	6.70	7.80	3.71	4.83	5.40	6.28
B	0.49	0.48	4.60	6.00	6.70	7.80	1.08	1.41	1.58	1.83
Total Q =							4.79	6.24	6.97	8.12

Post- Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
A	0.53	0.66	4.60	6.00	6.70	7.80	1.61	2.10	2.34	2.73
B	0.26	0.60	4.60	6.00	6.70	7.80	0.72	0.94	1.05	1.22
Total Q =							2.33	3.03	3.39	3.95

Delta = -2.46 -3.21 -3.58 -4.17

System: Existing dry well behind existing building (CCSU Daycare Center)

Pre- Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
C	0.08	0.90	4.60	6.00	6.70	7.80	0.33	0.43	0.48	0.56
Total Q =							0.33	0.43	0.48	0.56

Post- Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
C	0.07	0.90	4.60	6.00	6.70	7.80	0.29	0.38	0.42	0.49
Total Q =							0.29	0.38	0.42	0.49

Delta = -0.04 -0.05 -0.06 -0.07

System: Existing swale along the west side of the railroad tracks to Sandy Brook

Pre- Development

Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
D	0.64	0.60	4.60	6.00	6.70	7.80	1.77	2.30	2.57	3.00
Total Q =							1.77	2.30	2.57	3.00

Post- Development

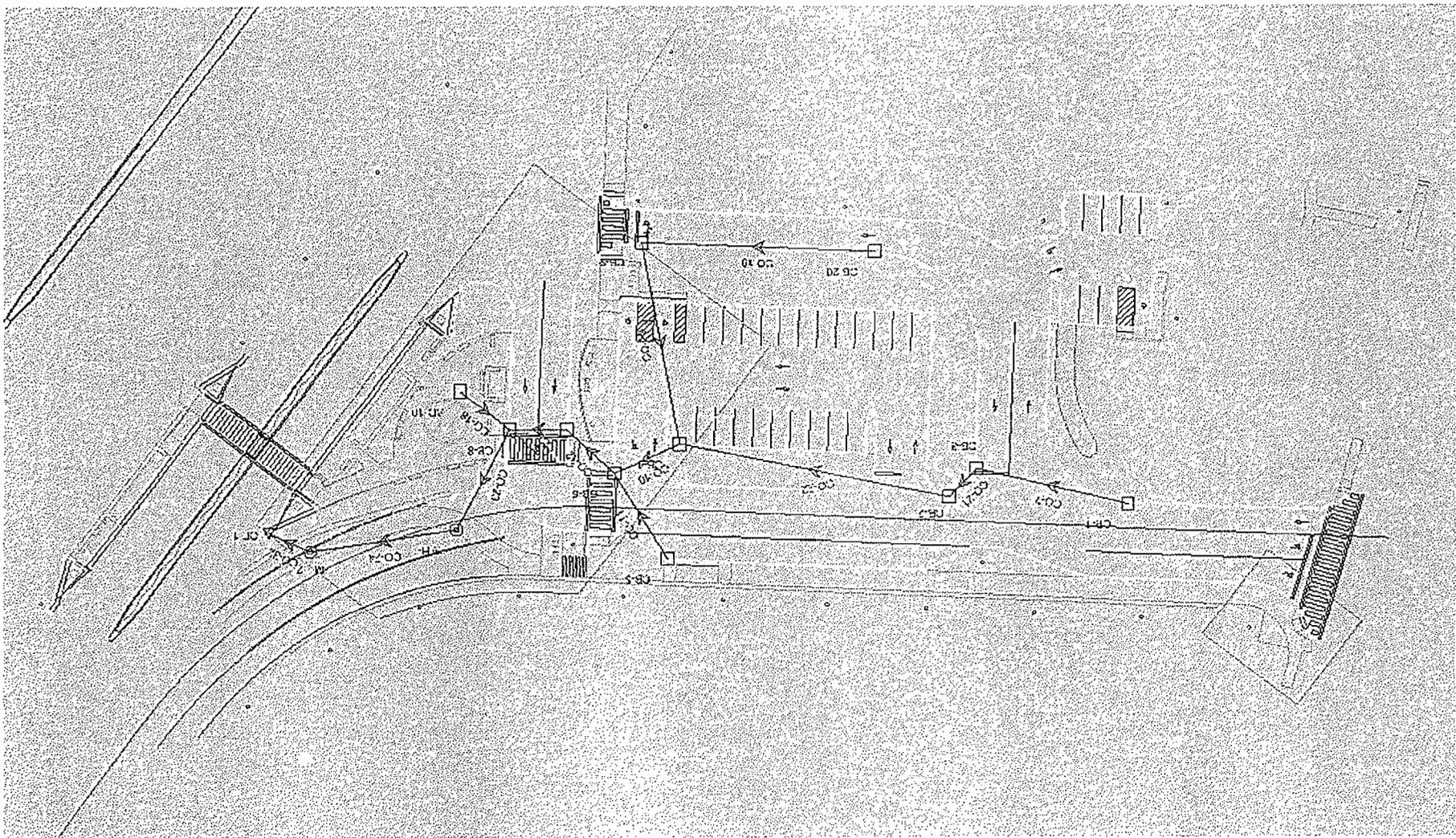
Design Point	Area (Acres)	C Value	2yr Rainfall (in/hr)	10yr Rainfall (in/hr)	25yr Rainfall (in/hr)	100yr Rainfall (in/hr)	Q _{2yr} (cfs)	Q _{10yr} (cfs)	Q _{25yr} (cfs)	Q _{100yr} (cfs)
D							4.82	6.33	7.02	8.12
Calculations from StormCad							4.82	6.33	7.02	8.12
Total Q =							4.82	6.33	7.02	8.12

Delta = 3.05 4.03 4.45 5.12

Note:

- 1.) Calculations based on Rational Method, Q = CiA
- 2.) Design Points designated on Exhibit 3.2-A and 3.2-B

East Street Station



**BRT Station Preliminary Drainage Design
DOT Report**

Label	Node Upstream Downstream	Upstream Inlet C	Upstream CA (acres)	Ground Upstream Downstream	HGL Upstream Downstream	System Rational Flow (ft ³ /s)	Length (ft)	Velocity (Average) (ft/s)	System Intensity (in/hr)
CO-7	CB-1	0.401	0.05	104.35	100.33	0.32	74	2.9	6
	CB-3			103.47	99.65				
CO-10	CB-4	0.626	0.56	98.6	95.88	3.31	34	9.46	5.826
	CB-6			97.95	94.8				
CO-11	CB-5	0.9	0.14	98.58	94.82	0.82	48	3.95	6
	CB-6			97.95	94.8				
CO-12	CB-6	0.9	0.80	97.95	94.35	4.66	31	8.92	5.814
	CB-7			96.7	93.84				
CO-13	CB-7	0.521	0.92	96.7	93.76	5.38	27	3.04	5.803
	CB-8			96.7	93.68				
CO-18	AD-10	0.639	0.04	97	93.69	0.24	30	3.76	6
	CB-8			96.7	93.68				
CO-19	CB-20	0.748	0.09	104.5	100.55	0.51	111	5.21	6
	CB-9			99.81	96.42				
CO-20	CB-9	0.403	0.18	99.81	96.28	1.1	98	3.42	5.929
	CB-4			98.6	96.19				
CO-21	CB-3	0.471	0.13	103.47	99.57	0.77	19	5.44	5.915
	CB-2			102.76	99.07				
CO-22	CB-2	0.663	0.20	102.76	98.96	1.17	131	5.68	5.903
	CB-4			98.6	96.19				
CO-23	CB-8	0.9	1.10	96.7	93.52	6.36	54	3.6	5.76
	MH-1			95.9	93.33				
CO-24	MH-1	(N/A)	1.10	95.9	93.21	6.28	70	3.55	5.685
	MH-2			94	92.96				
CO-32	MH-2	(N/A)	1.10	94	92.83	6.17	22	3.49	5.586
	OF-1			94.16	92.75				

**BRT Station Preliminary Drainage Design
Catch Basin Summary**

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Inlet C	Inlet	Depth (In) (ft)	Depth (Out) (ft)	Flow (Total Intercepted) (ft ³ /s)	Bypassed Rational Flow (ft ³ /s)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Gutter Depth (in)	Gutter Spread (ft)
CB-1	104.35	98.1	0.401	Combination Type C Single Grate - Grate Type A - Plain Curb	2.23	2.23	0.32	0.06	100.33	100.33	1	4.1
CB-2	102.76	96.51	0.663	Combination Type C Single Grate - Grate Type A - Plain Curb	2.56	2.45	0.4	0.09	99.07	98.96	1.1	4.5
CB-3	103.47	97.2	0.471	Combination Type C Single Grate - Grate Type A - Plain Curb	2.45	2.37	0.46	0.13	99.65	99.57	1.2	4.8
CB-4	98.6	93.1	0.626	Combination Type C Single Grate - Grate Type A - Plain Curb	3.09	2.78	1.11	0	96.19	95.88	0.5	6.1
CB-5	98.58	92.08	0.9	Combination Type C Single Grate - Grate Type A - Plain Curb	3.54	2.74	0.82	0.46	95.62	94.82	1.5	6.4
CB-6	97.95	90.75	0.9	Combination Type C Single Grate - Grate Type A - Plain Curb	4.05	3.6	0.58	0.22	94.8	94.35	1.3	5.4
CB-7	96.7	89.35	0.521	Combination Type C Single Grate - Grate Type A - Plain Curb	4.49	4.41	0.75	0	93.84	93.76	0	4.3
CB-8	96.7	89.11	0.9	Combination Type C Single Grate - Grate Type A - Plain Curb	4.57	4.41	0.83	0	93.68	93.52	0.2	4.7
CB-9	99.81	93.56	0.403	Combination Type C Single Grate - Grate Type A - Plain Curb	2.86	2.72	0.6	0.24	96.42	96.28	1.3	5.5
AD-10	97	90.75	0.639	Area Drain	2.94	2.94	0.24	0	93.69	93.69	1.7	0
CB-20	104.5	98.25	0.748	Combination Type C Single Grate - Grate Type A - Plain Curb	2.3	2.3	0.51	0.17	100.55	100.55	1.2	5.1

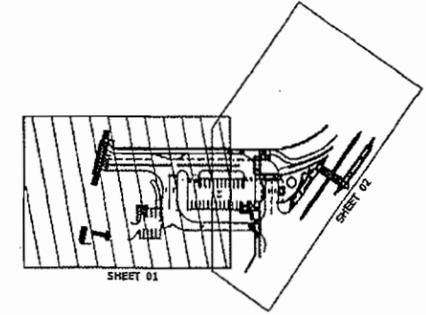
**BRT Station Preliminary Drainage Design
Conduit Summary**

Label	Start Node	Stop Node	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Section Size (in)	Flow (ft ³ /s)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Capacity (Full Flow)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Cover (Start) (ft)	Cover (Stop) (ft)	Velocity (Average) (ft/s)
CO-7	CB-1	CB-3	100.1	99.3	12 inch	0.32	74	0.011	3.7	104.35	103.47	3.25	3.17	2.9
CO-10	CB-4	CB-6	95.1	93.5	12 inch	3.31	34	0.047	7.73	98.6	97.95	2.5	3.45	9.46
CO-11	CB-5	CB-6	94.08	93.5	12 inch	0.82	48	0.012	3.92	98.58	97.95	3.5	3.45	3.95
CO-12	CB-6	CB-7	93.4	92.39	12 inch	4.66	31	0.033	6.43	97.95	96.7	3.55	3.31	8.92
CO-13	CB-7	CB-8	91.89	91.47	18 inch	5.38	27	0.016	13.1	96.7	96.7	3.31	3.73	3.04
CO-18	AD-10	CB-8	92.75	91.87	12 inch	0.24	30	0.029	6.1	97	96.7	3.25	3.83	3.76
CO-19	CB-20	CB-9	100.25	95.94	12 inch	0.51	111	0.039	7.02	104.5	99.81	3.25	2.87	5.21
CO-20	CB-9	CB-4	95.84	95.2	12 inch	1.1	98	0.007	2.88	99.81	98.6	2.97	2.4	3.42
CO-21	CB-3	CB-2	99.2	98.61	12 inch	0.77	19	0.031	6.28	103.47	102.76	3.27	3.15	5.44
CO-22	CB-2	CB-4	98.51	95.2	12 inch	1.17	131	0.025	5.66	102.76	98.6	3.25	2.4	5.68
CO-23	CB-8	MH-1	91.37	90.56	18 inch	6.36	54	0.015	12.86	96.7	95.9	3.83	3.84	3.6
CO-24	MH-1	MH-2	90.46	90.11	18 inch	6.28	70	0.005	7.43	95.9	94	3.94	2.39	3.55
CO-32	MH-2	OF-1	90.01	88.86	18 inch	6.17	22	0.052	24.02	94	94.16	2.49	3.8	3.49

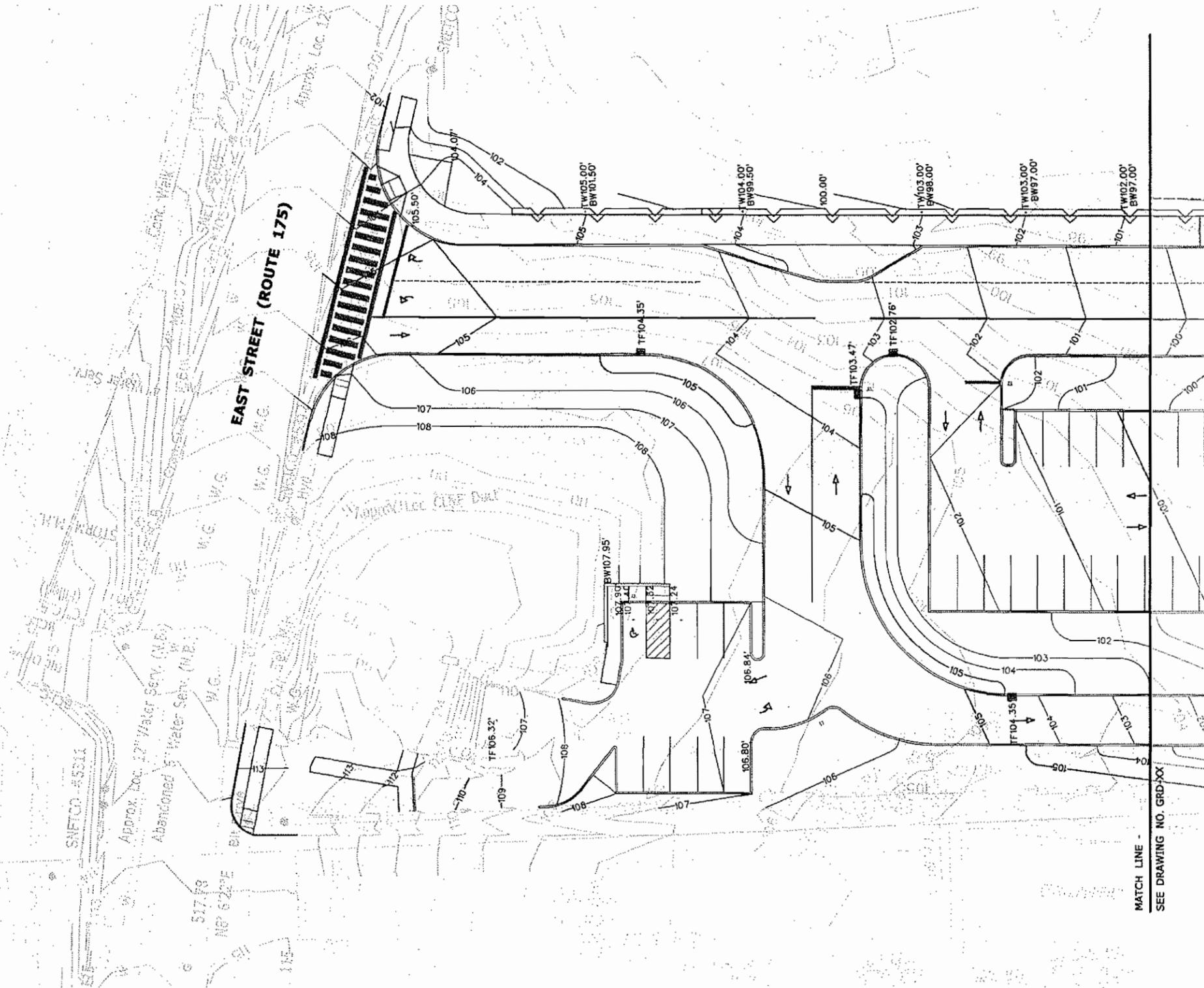
**BRT Station Preliminary Drainage Design
Catchment Area Summary**

Label	Scaled Area (acres)	Rational C	Catchment CA (acres)	Time of Concentration (min)	Outflow Node	Catchment Rational Flow (ft ³ /s)
CM-1	0.03	0.9	0.02	5	CB-1	0.14
CM-2	0.055	0.3	0.016	5	CB-1	0.1
CM-4	0.05	0.3	0.01	5	CB-3	0.09
CM-5	0.06	0.9	0.049	5	CB-2	0.3
CM-6	0.036	0.3	0.011	5	CB-2	0.06
CM-7	0.158	0.9	0.142	5	CB-5	0.86
CM-8	0.08	0.9	0.07	5	CB-5	0.43
CM-10	0.07	0.9	0.06	5	CB-8	0.37
CM-12	0.16	0.9	0.14	5	CB-4	0.87
CM-13	0.131	0.9	0.118	5	CB-6	0.71
CM-14	0.045	0.3	0.014	5	CB-4	0.08
CM-15	0.09	0.3	0.03	5	CB-4	0.16
CM-16	0.061	0.9	0.055	5	CB-7	0.33
CM-17	0.105	0.3	0.031	5	CB-7	0.19
CM-18	0.04	0.9	0.03	5	AD-10	0.19
CM-19	0.018	0.3	0.005	5	AD-10	0.03
CM-20	0.075	0.3	0.022	5	CB-1	0.14
CM-26	0.04	0.3	0.012	5	CB-3	0.07
CM-27	0.04	0.3	0.01	5	CB-3	0.08
CM-28	0.005	0.3	0.002	5	CB-3	0.01
CM-32	0.01	0.3	0.003	5	CB-20	0.02
CM-34	0.01	0.3	0.00	5	CB-20	0.02
CM-35	0.00	0.9	0.00	5	CB-20	0.01
CM-37	0.02	0.3	0.01	5	CB-20	0.03
CM-40	0.01	0.3	0.00	5	AD-10	0.02
CM-42	0.054	0.9	0.048	5	CB-3	0.29
CM-43	0.025	0.9	0.022	5	CB-20	0.14
CM-44	0.086	0.9	0.077	5	CB-20	0.47
CM-45	0.047	0.9	0.042	5	CB-9	0.26
CM-46	0.113	0.3	0.034	5	CB-9	0.2
CM-47	0.031	0.3	0.009	5	CB-9	0.06
CM-48	0.084	0.3	0.025	5	CB-9	0.15

7. Appendix D: Drainage, Grading, and Soil Erosion and Sedimentation Control Plans



KEY PLAN



ENVIRONMENTAL PERMIT REVIEW

REV.	DATE	DESIGN COORDINATION REVISIONS	SHEET NO.
1	NOV. 09	DESIGN COORDINATION REVISIONS	
		REVISION DESCRIPTION	

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 CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

Printed Date: 11/2/2009

DESIGNER/DRAFTER:
KRV

CHECKED BY:
-

SCALE IN FEET
0 20 40
SCALE 1"=20'



SIGNATURE/BLOCK:
OFFICE OF ENGINEERING

APPROVED BY: _____ DATE: _____

PROJECT TITLE:
**NEW BRITAIN - HARTFORD
BUS RAPID TRANSIT STATIONS**

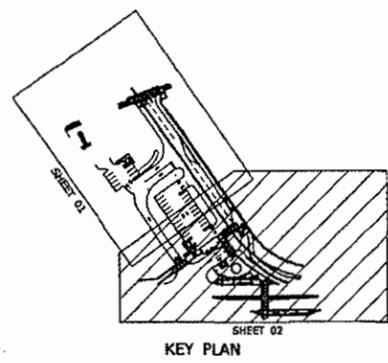
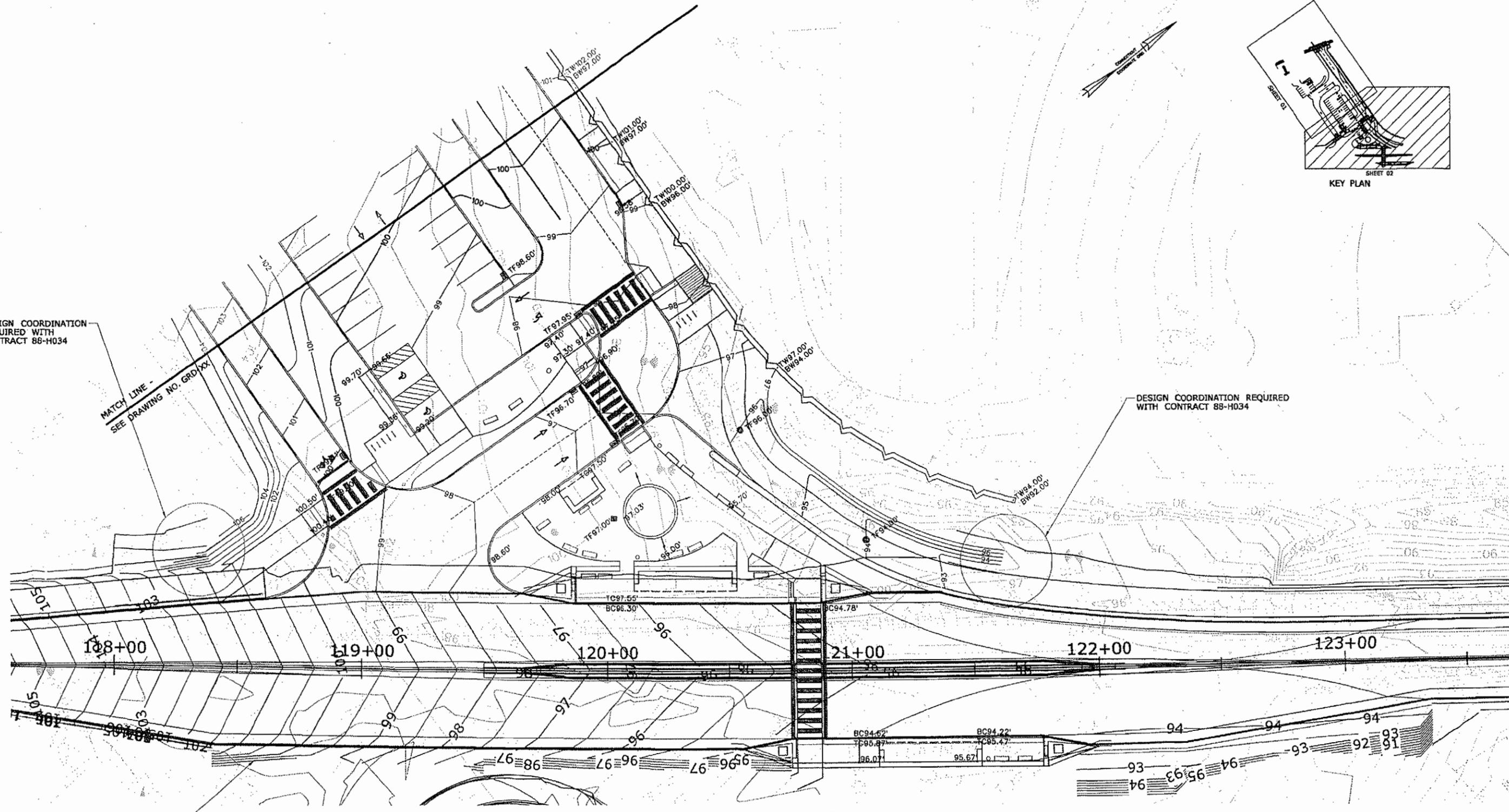
TOWN:
NEW BRITAIN

DRAWING TITLE:
**EAST STREET STATION
GRADING PLAN**

PROJECT NO.
88-H039

DRAWING NO.
GRD-XX

SHEET NO.
\$\$



DESIGN COORDINATION
REQUIRED WITH
CONTRACT 88-H034

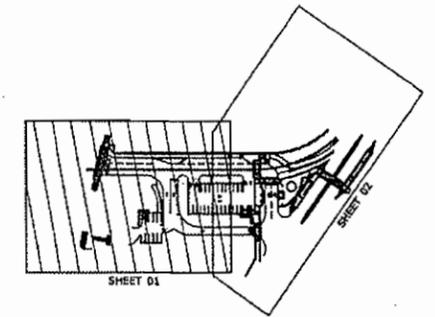
MATCH LINE -
SEE DRAWING NO. GRD-XX

DESIGN COORDINATION REQUIRED
WITH CONTRACT 88-H034

PROPOSED GRADING DESIGN
CONTRACT 88-H034
REV. 04/08/2009

ENVIRONMENTAL PERMIT REVIEW

1 NOV 09 REV. DATE	DESIGN COORDINATION REVISIONS	SHEET NO.	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 CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.	DESIGNER/DRAFTER: KRV	 STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	SIGNATURE/ BLOCK:	PROJECT TITLE: NEW BRITAIN - HARTFORD BUS RAPID TRANSIT STATIONS	TOWN:	NEW BRITAIN PROJECT NO. 88-H039
	REVISION DESCRIPTION			CHECKED BY:		OFFICE OF ENGINEERING		DRAWING TITLE:	
				SCALE IN FEET 0 20 40 SCALE 1"=20'	 APPROVED BY: DATE:				SHEET NO. GRD-XX \$\$\$



KEY PLAN

C.B.#1, CATCH BASIN
TYPE 'C'
TF = 104.35'
INV. OUT = 100.10'
BTM = 98.10'

C.B.#2, CATCH BASIN
TYPE 'C'
TF = 102.76'
INV. IN = 98.61'
INV. OUT = 98.51'
BTM = 96.51'

C.B.#3, CATCH BASIN
TYPE 'C'
TF = 103.47'
INV. IN = 99.30'
INV. OUT = 99.20'
BTM = 97.20'

C.B.#20, CATCH BASIN
TYPE 'C'
TF = 104.35'
INV. OUT = 100.25'
BTM = 98.25'

12" Ø RCP +/- 19 LF
S = 0.031

12" Ø RCP +/- 74 LF
S = 0.011

12" Ø RCP +/- 34 LF
S = 0.047

12" Ø RCP +/- 111 LF
S = 0.039

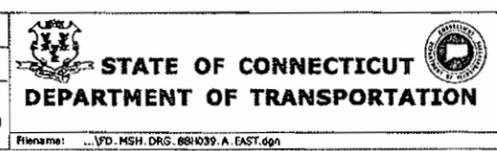
MATCH LINE -
SEE DRAWING NO. DRG-XX

ENVIRONMENTAL PERMIT REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
1	NOV.	DESIGN COORDINATION REVISIONS	

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 CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

DESIGNER/DRAFTER:
KSR
CHECKED BY:
SCALE IN FEET
0 20 40
SCALE 1"=20'



SIGNATURE/
BLOCK:
OFFICE OF ENGINEERING
APPROVED BY: DATE:

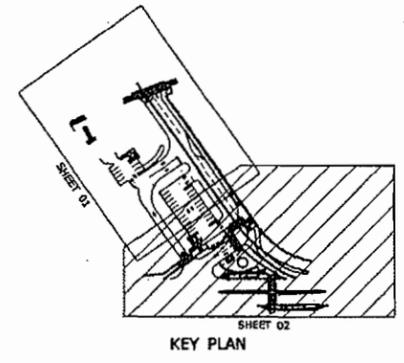
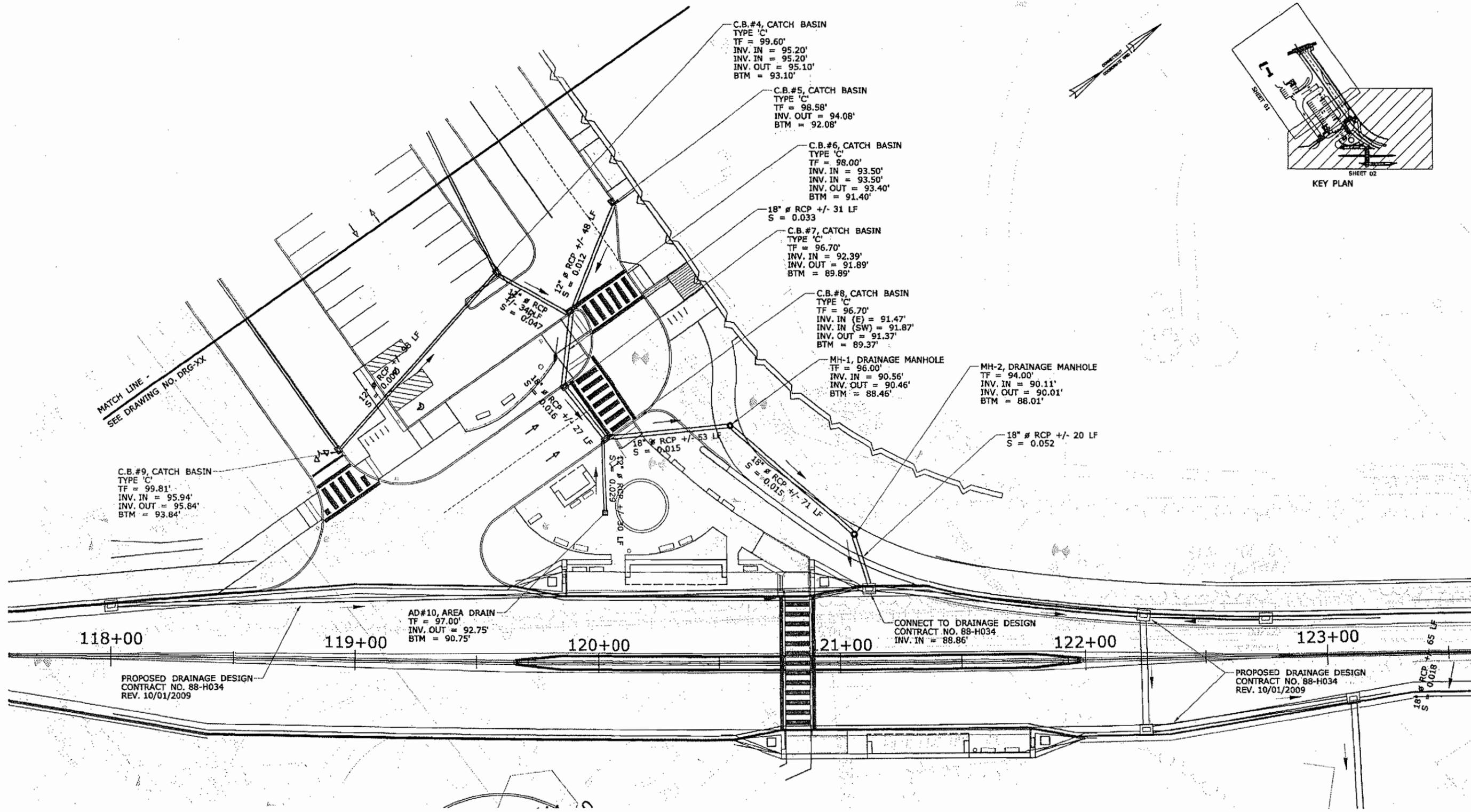
PROJECT TITLE:
**NEW BRITAIN - HARTFORD
BUS RAPID TRANSIT STATIONS**

TOWN:
NEW BRITAIN
DRAWING TITLE:
**EAST STREET STATION
DRAINAGE**

PROJECT NO.
88-H039
DRAWING NO.
DRG-XX
SHEET NO.
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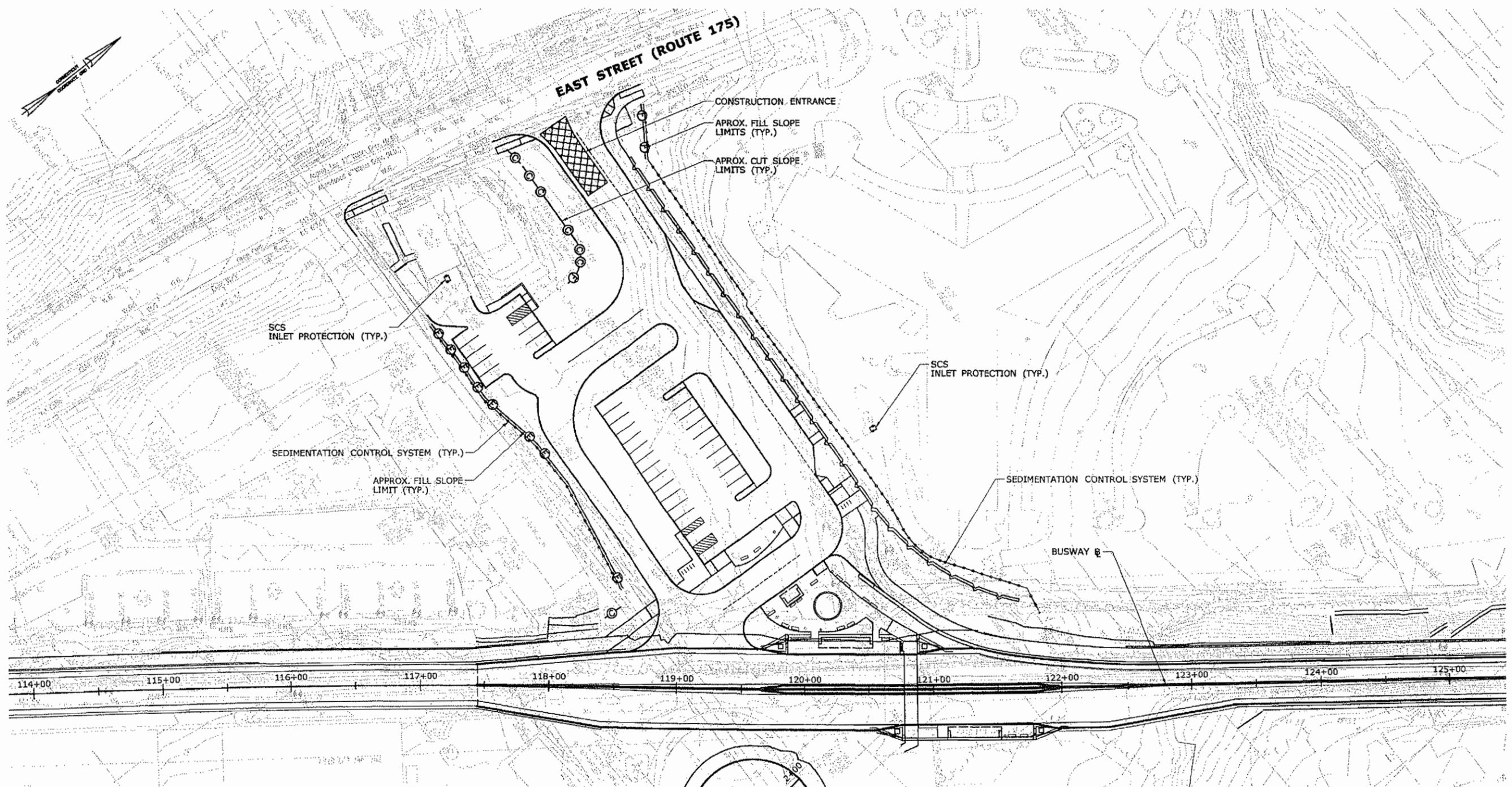
Plotted Date: 11/3/2009

Filename: ...VD, MSH, DRG, 88H039, A, EAST.dgn



ENVIRONMENTAL PERMIT REVIEW

REV. DATE	REVISION DESCRIPTION	SHEET NO.	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 CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED. Plot Date: 11/6/2009	DESIGNER/DRAWER: KSR	 STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	SIGNATURE/ BLOCK: OFFICE OF ENGINEERING	PROJECT TITLE: NEW BRITAIN - HARTFORD BUS RAPID TRANSIT STATIONS	TOWN: NEW BRITAIN	PROJECT NO. 88-H039
				CHECKED BY: SCALE IN FEET SCALE 1"=20'		APPROVED BY: DATE:		DRAWING TITLE: EAST STREET STATION DRAINAGE	DRAWING NO. DRG-XX



ENVIRONMENTAL PERMIT REVIEW

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 CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.		DESIGNER/DRAFTER: KRV CHECKED BY: - SCALE IN FEET 0 40 80 SCALE 1"=40'	STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	SIGNATURE/BLOCK: OFFICE OF ENGINEERING APPROVED BY: _____ DATE: _____	PROJECT TITLE: NEW BRITAIN - HARTFORD BUS RAPID TRANSIT STATIONS	TOWN: NEW BRITAIN	PROJECT NO. 88-H039 DRAWING NO. SED-XX SHEET NO. \$\$\$
REV.	DATE	REVISION DESCRIPTION	SHEET NO.	Plotted Date: 11/6/2009	Filename: ...VD_MSH_SED_88H039_EAST.dgn		

**8. Appendix E: CTDOT Preliminary Design
Comment Responses**

**STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION**

subject: Project No. 88-H039 (171-305 P.E.)
New Britain-Hartford Busway
East Street Station
New Britain

m e m o r a n d u m

date: August 10, 2009

to: Mr. Richard B. Armstrong
Trans. Principal Engineer
Consultant Design
Bureau of Engineering
and Construction

from: 
Michael E. Masayda
Trans. Principal Engineer
Hydraulics and Drainage
Bureau of Engineering
and Construction

The Hydraulics and Drainage Section has reviewed the Preliminary Design submission for the subject project and has the following comments:

No.	Comment	Inc.	Not Inc.
1	Drawing No. GRD-XX: The grading plans show low points without drainage features at the following locations. Provisions should be made to address the drainage issue. a. Low point at the northeast corner of the small parking lot adjacent to an existing two story building. b. Low point at the parking lot thruway (90 degree bend) near the multi-trail access point.		
2	Drawing No. DRG-XX: a. The plan shows a proposed hydrodynamic separator at the end of the drainage system just prior to leaving the East Street Station limits (near busway mainline Sta. 121+50). The system then connects to the busway mainline drainage system and discharges at Sta. 123+00. If a hydrodynamic separator is deemed necessary, it should be located just prior to the mainline drainage discharge point in order to treat the remainder of the flow. b. A pipe connection is shown from the East Street Station to the busway mainline near Sta. 119+50. The source of this pipe flow is not clear.		

 Chong Lung Chow/clc:sd
cc: Joseph J. Obara
Mark W. Alexander
Paul N. Corrente
Brian T. Cunningham
Chong Lung Chow · Yolanda Antoniak
088-H039C

Reviewer Comment 1a).

1	<p>Drawing No. GRD-XX:</p> <p>The grading plans show low points without drainage features at the following locations. Provisions should be made to address the drainage issue.</p> <p>a. Low point at the northeast corner of the small parking lot adjacent to an existing two story building.</p>
---	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

S E A Response: *An existing dry well is in this location and will remain in use following the site development.*

Reviewer Comment 1b).

b.	Low point at the parking lot thruway (90 degree bend) near the multi-trail access point.
----	------------------------------------------------------------------------------------------

S E A Response: *Additional spot elevations have been added to the grading plan to clarify drainage patterns.*

Reviewer Comment 2a).

2	<p>Drawing No. DRG-XX:</p> <p>a. The plan shows a proposed hydrodynamic separator at the end of the drainage system just prior to leaving the East Street Station limits (near busway mainline Sta. 121+50). The system then connects to the busway mainline drainage system and discharges at Sta. 123+00. If a hydrodynamic separator is deemed necessary, it should be located just prior to the mainline drainage discharge point in order to treat the remainder of the flow.</p>
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S E A Response: *The HDS has been removed from the project. The station drainage ties to the mainline system and will receive primary treatment by a proposed water quality basin before discharge to the brook.*

Reviewer Comment 2b).

b.	A pipe connection is shown from the East Street Station to the busway mainline near Sta. 119+50. The source of this pipe flow is not clear.
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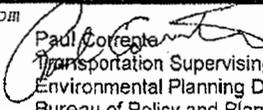
S E A Response: *Coordination is required between S E A and the mainline designers. This work is ongoing.*

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

subject: Preliminary Design Submission
88-H039 / 171-305
East Street Station
New Britain – Hartford Busway

date: August 21, 2009

memorandum

to	from	ext.
Richard Armstrong Transportation Principal Engineer Consultant Design Bureau of Engineering and Construction	 Paul Corrente Transportation Supervising Planner Environmental Planning Division Bureau of Policy and Planning	

Type of Review:

- Schematic Preliminary Design Semi-Final Design Final Design Permit Other:

My staff has reviewed the above mentioned project and the water resource compliance section of this office offers the following comments:

Comment #	Loc. or Sheet #	Comment	Inc.	Not Inc. (If not, WHY)
1	General	<ul style="list-style-type: none"> Please note that many of the preliminary design comments provided for the Cedar Street Station will apply to the Parkville Station design. Make changes as necessary. The plan sheets shall include the station markings, toe of slope, cut and fill, and E&S controls, etc... Please coordinate with the designers of Project 88-H034 regarding the transition points connecting retaining walls, curbing, etc...between the busway and platform stations. The Offline Hydrodynamic Separator is not needed and should be removed from the project, as the station drainage will ultimately discharge into Water Quality Basin No. 1 to be constructed under Project 88-H034. As CIV-XX correctly calls out the use of turf establishment, other drawings within the project set and other station design submittals have been incorrect. No Meadow Mix. Turf Establishment only. 		

If you have any questions regarding these comments, please contact Mr. Paul Corrente at 860-594-2932.

Andrew Pirane 

cc: Colleen Kissane – Paul Corrente
Mark Alexander – Kim Lesay – Amanda Freitas
Brian Cunningham – Dave Mancini – Jacob Argiro
Kevin Mahoney – Bob Reilly – Laurie LaRocca
Mike Masayda - Chong Lung Chow – Yolanda Antoniak

Reviewer Comment 1a)

- Please note that many of the preliminary design comments provided for the Cedar Street Station will apply to the Parkville Station design. Make changes as necessary.

S E A Response: *Noted.*

Reviewer Comment 1b)

- The plan sheets shall include the station markings, toe of slope, cut and fill, and E&S controls, etc...

S E A Response: *Appropriate detail has been added to the plan sheets.*

Reviewer Comment 1c)

- Please coordinate with the designers of Project 88-H034 regarding the transition points connecting retaining walls, curbing, etc...between the busway and platform stations.

S E A Response: *Coordination between S E A and the mainline designers is continuous. This work relates to all aspects of the project and will continue through final design.*

Reviewer Comment 1d)

- The Offline Hydrodynamic Separator is not needed and should be removed from the project, as the station drainage will ultimately discharge into Water Quality Basin No. 1 to be constructed under Project 88-H034.

S E A Response: *The HDS has been removed from the project.*

Reviewer Comment 1e)

- As CIV-XX correctly calls out the use of turf establishment, other drawings within the project set and other station design submittals have been incorrect.

S E A Response: *Call-outs will be modified for the semi-final design submission.*

Station: East Reviewer: Environmental Planning Reviewer Date: 8/21/2009
Responder: Liz Sommer, P.E. Responder Date: 2009-11-06

Reviewer Comment 1f)

- No Meadow Mix. Turf Establishment only.

SE A Response: *An appropriate seed mix determined in coordination with the Department will be specified.*

I have reviewed the PD plans submitted August 4th and offer the following comments:

- **It appears that a large portion of the proposed site is located on CT State University Land. Please clarify who will be the owner / responsible party for maintenance following construction.**
- **The site incorporates over 10 CB's. Primary Stormwater Treatment Practices must be investigated before they can be dismissed. Specifically, if the site is not contaminated, infiltration should be considered.**
- **The current HDS appears difficult to access for future maintenance. Please review in light of long term maintenance and needed equipment for cleaning.**

I will pass these plans along to Paul Corrente's unit for further review.

Kimberly Lesay

Environmental Planning Division

Department of Transportation

2800 Berlin Turnpike

PO Box 317546

Newington, CT 06131-7546

phone (860) 594-2933

fax (860) 594-3028

Kimberly.Lesay@po.state.ct.us

Reviewer Comment 1a).

- **It appears that a large portion of the proposed site is located on CT State University Land. Please clarify who will be the owner / responsible party for maintenance following construction.**

S E A Response: Right of way review is in process for the site development.

Reviewer Comment 1b).

- **The site incorporates over 10 CB's. Primary Stormwater Treatment Practices must be investigated before they can be dismissed. Specifically, if the site is not contaminated, infiltration should be considered.**

S E A Response: The station drainage will discharge to the proposed mainline drainage system. A water quality basin is proposed downstream which will provide primary treatment for the station flows.

Reviewer Comment 1c).

- **The current HDS appears difficult to access for future maintenance. Please review in light of long term maintenance and needed equipment for cleaning.**

S E A Response: The hydrodynamic separator has been removed from the project.