

*Appendix F*  
*Green Infrastructure Construction Details and Photos*

## Design Standards and Standard Details that incorporate Green Infrastructure

Table 1 includes a list of green infrastructure details as well as an estimate of where each may be applied within the street right-of-way or on a site development. In most cases where a detail is denoted under Right-of-Way as well as Site Development, one detail may suffice to show both applications. Also listed are miscellaneous details that are typically a part of green infrastructure design. Specifications to consider in conjunction with the standard details are listed below the table.

**Table 1 Green Infrastructure Details and Applicability**

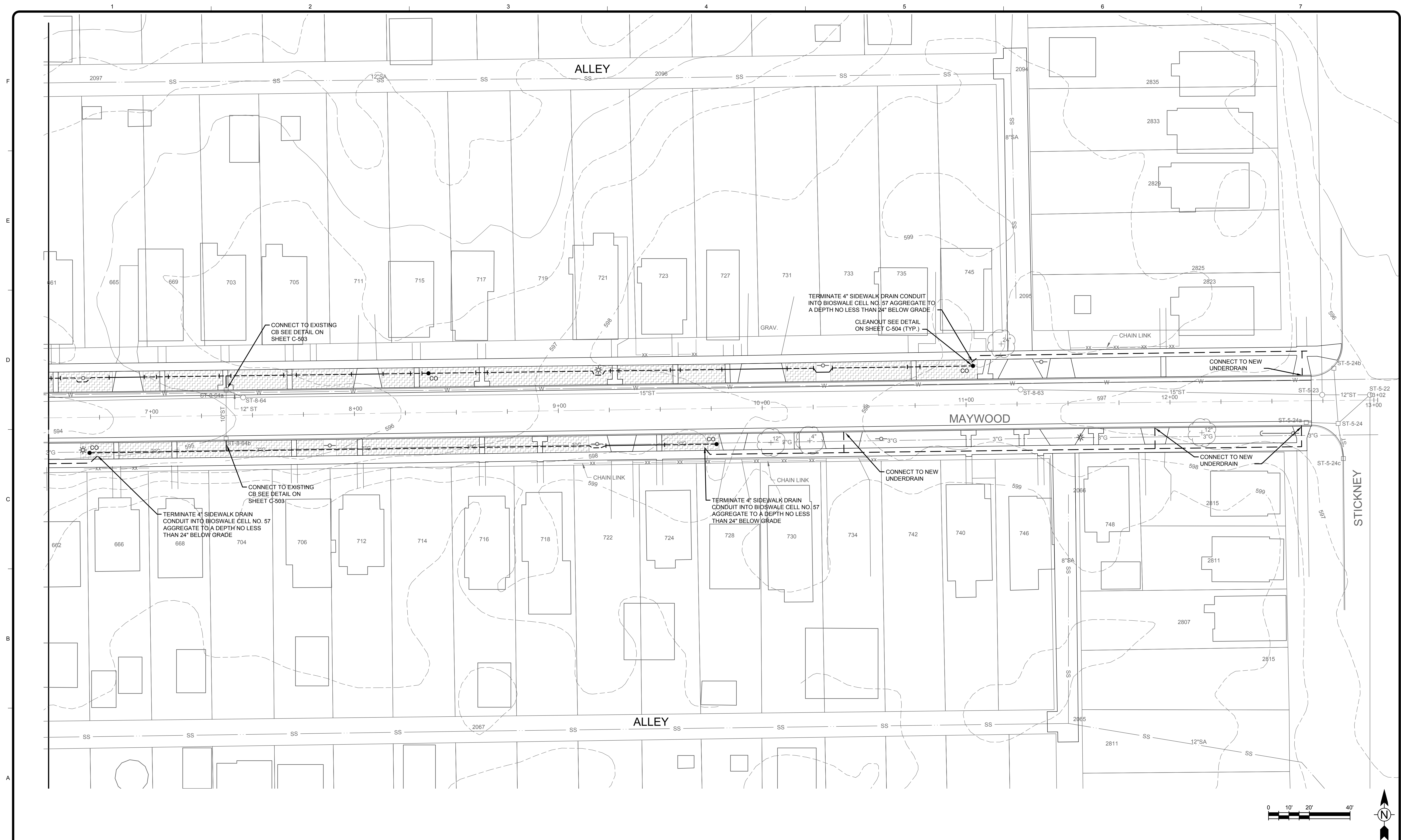
Green Infrastructure Details	Right-Of-Way					Site Development	Block and Intersection Layout Per Street Type
	Sidewalk	Greenway	Median	Parking Lane	Travel Lane		
Traditional Bioretention			●			●	
Bioswale		●				●	
Corner Curb Extension (Node)	●	●					●
Mid-block Curb Extension	●	●					●
Tree Box	●		●			●	
Planter Box	●					●	
Permeable Concrete	●			●	●	●	
Permeable Asphalt	●			●	●	●	
Permeable Concrete Pavers	●			●		●	
Grid Pavers						●	
Filter Strip and Level Spreader						●	
Sand Filter						●	
Cisterns						●	
Rain Barrel						●	
Green Roof						●	
Pocket Wetland						●	
ROW Widths (sidewalk, greenway, median, parking, travel lane)							●
<b>Miscellaneous</b>							
Curb Cut	●	●	●			●	
Sediment Sump	●					●	
Rock-lined Sediment Forebay	●	●	●				
High Flow By-Pass Structure						●	

### Possible Specifications:

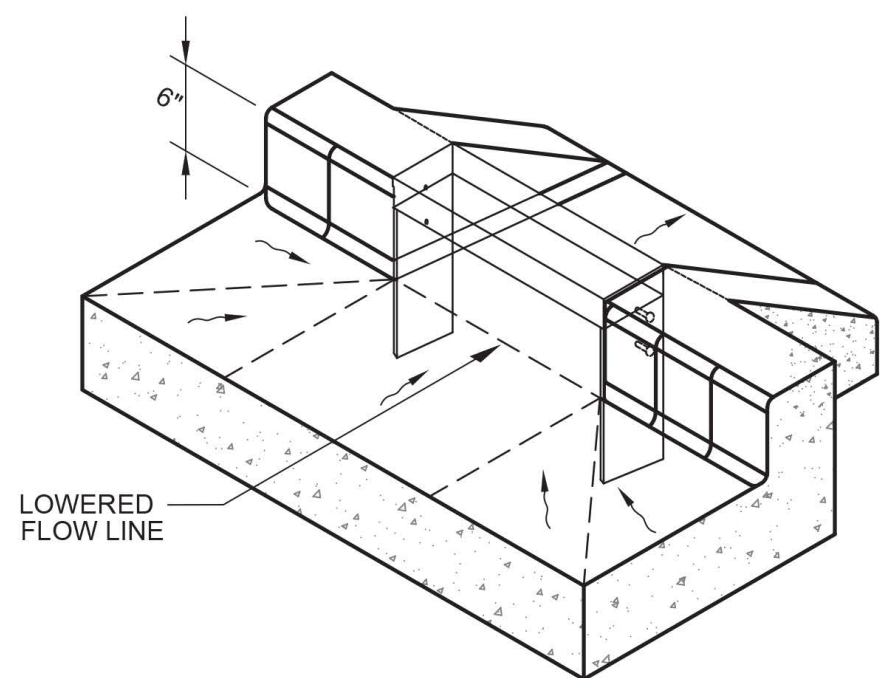
Soil amendments  
Plantings  
Engineered soil mixture  
Aggregate storage  
Aggregate Filter Layer  
Structural Soil

Modular suspended pavement (Silva cell system)  
Permeable concrete  
Permeable asphalt  
Permeable interlocking concrete pavers  
Concrete and plastic grid pavers

**BIOSWALE**







## PLAN

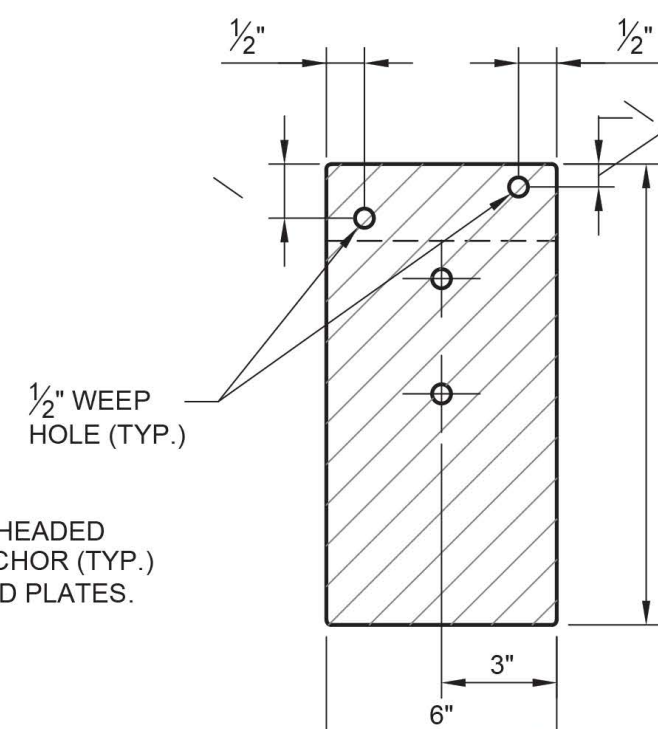


## CONCRETE INLET SPILLWAY

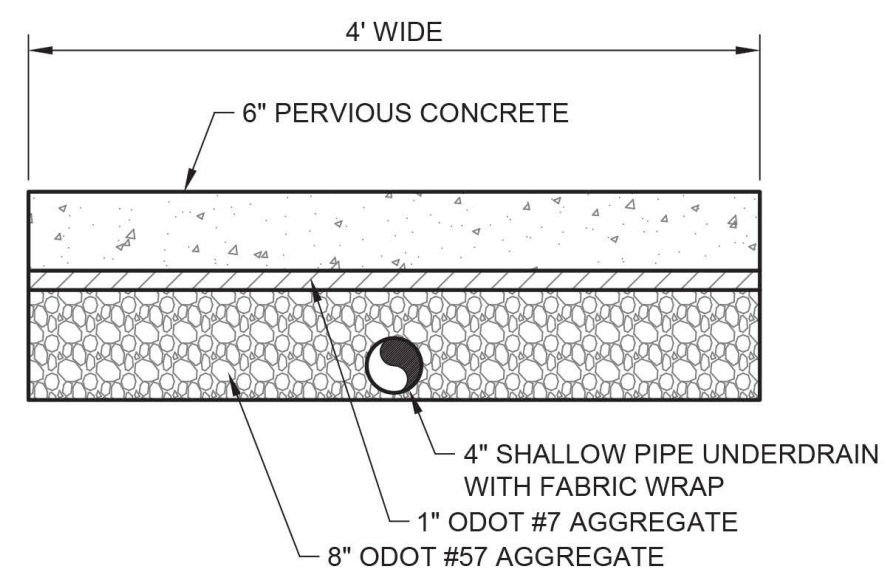
SCALE: 1" = 1'

NOTES:

1. HEADED CONCRETE ANCHORS SHALL MEET THE REQUIREMENTS OF ASTM A-108.
2. HSS 6 X 2 X 1/8 SHALL MEET THE REQUIREMENTS OF ASTM A-500 GRADE B.
3. END PLATES SHALL MEET THE REQUIREMENTS OF ASTM A-36.
4. ENTIRE ASSEMBLY SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A-123.
5. DESIGN VERTICAL WHEEL LOAD IS 8.5KIPS (1/2 OF TANDEM AXLE WEIGHT SPECIFIED IN FHWA-HOP-06-105).
6. SINGLE BEVEL GROOVE WELD.

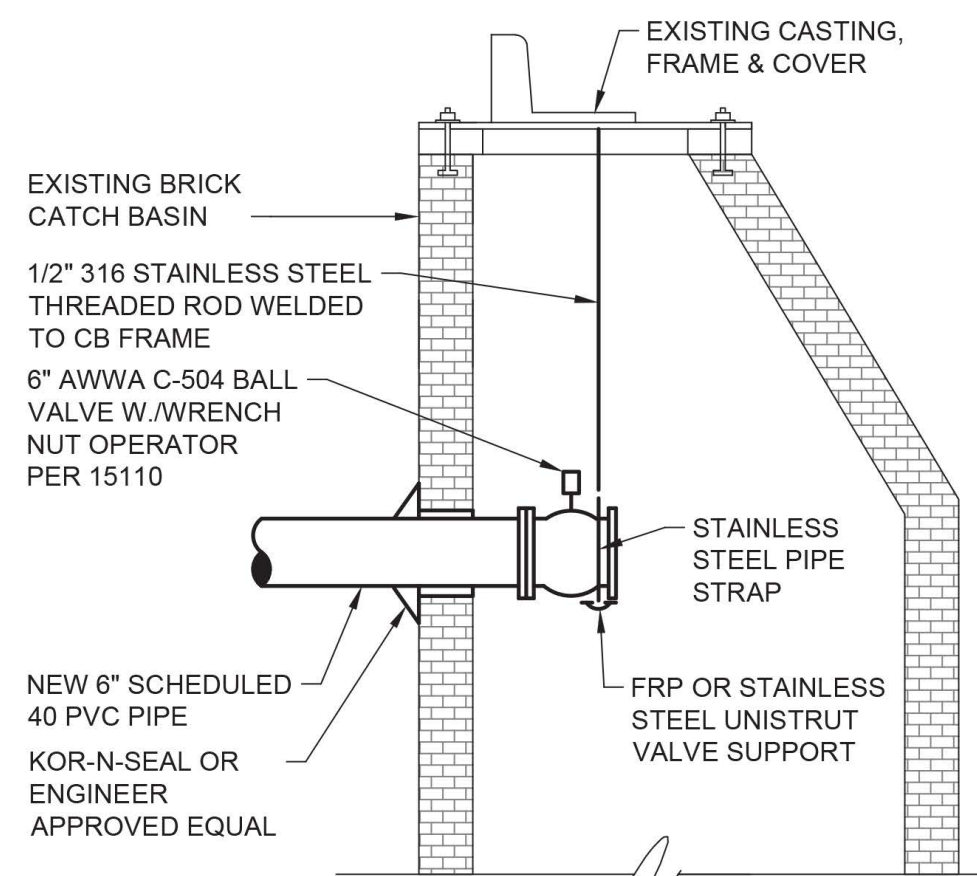


SECTION B-B  
END PLATE DETAIL



(NON-BIOSWALE AREAS)  
PERVIOUS CONCRETE SIDEWALK DETAIL

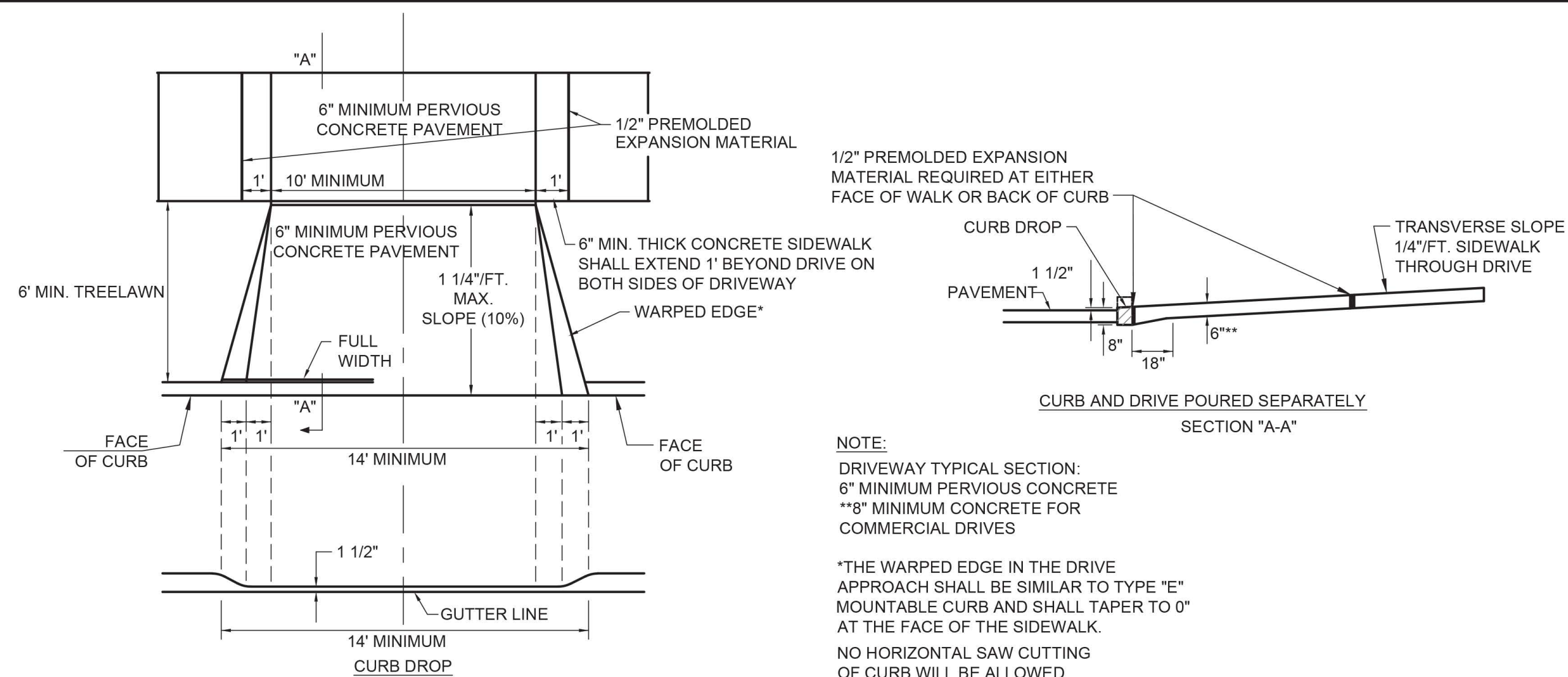
NO SCALE



- NOTES:
1. ALL HARDWARE SHALL BE 316 STAINLESS STEEL OR EQUAL.
  2. WRENCH NUT OPERATOR SHALL BE ALIGNED VERTICALLY BENEATH THE GRATE PORTION OF THE CATCH BASIN.
  3. CORING HOLE IN CB IS INCIDENTAL TO DRAINAGE CONDUIT CONNECTION TO CATCH BASIN.

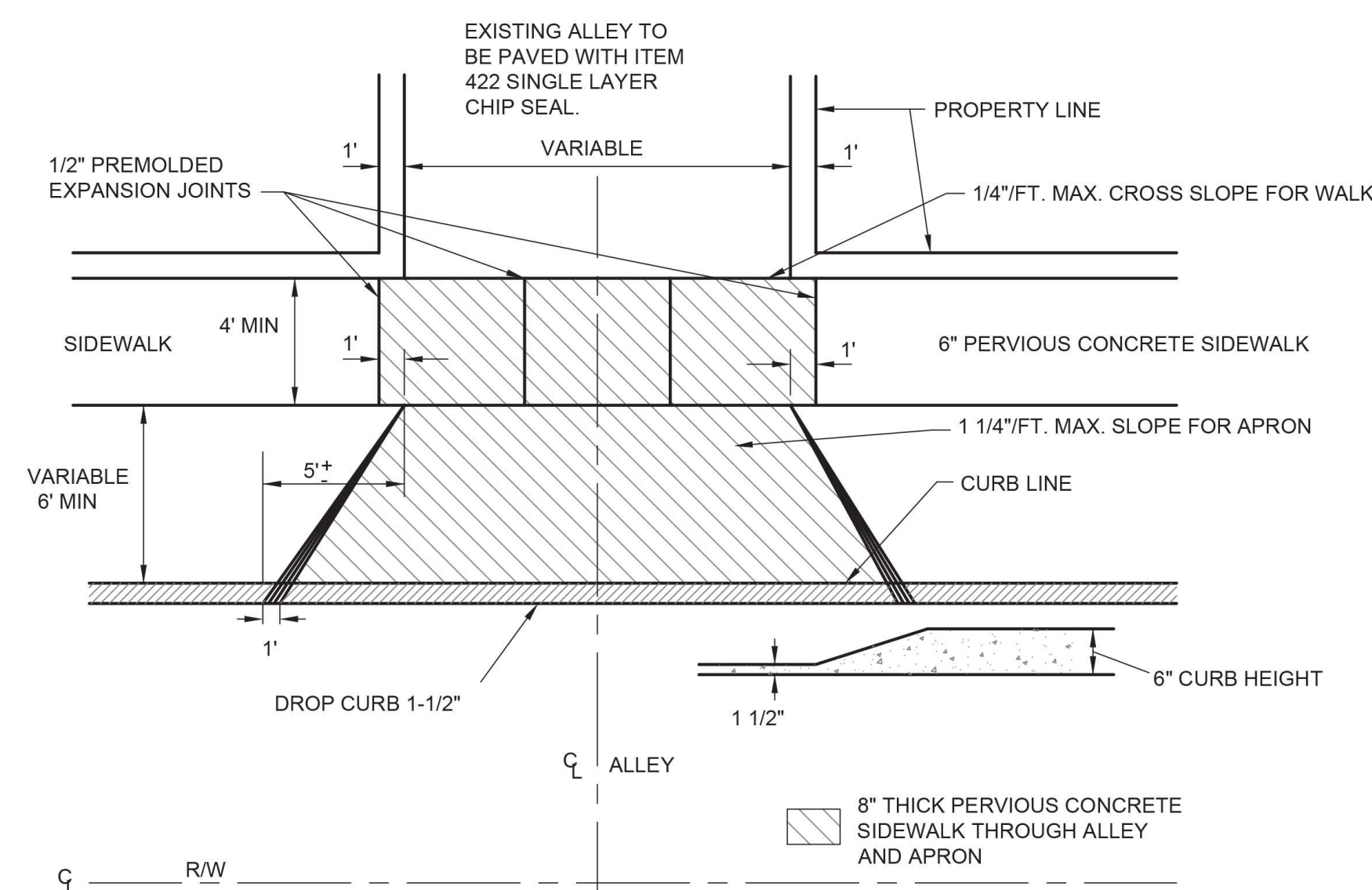
### SWALE DEWATER VALVE DETAIL

NO SCALE



## RESIDENTIAL PERVIOUS DRIVEWAY DETAILS

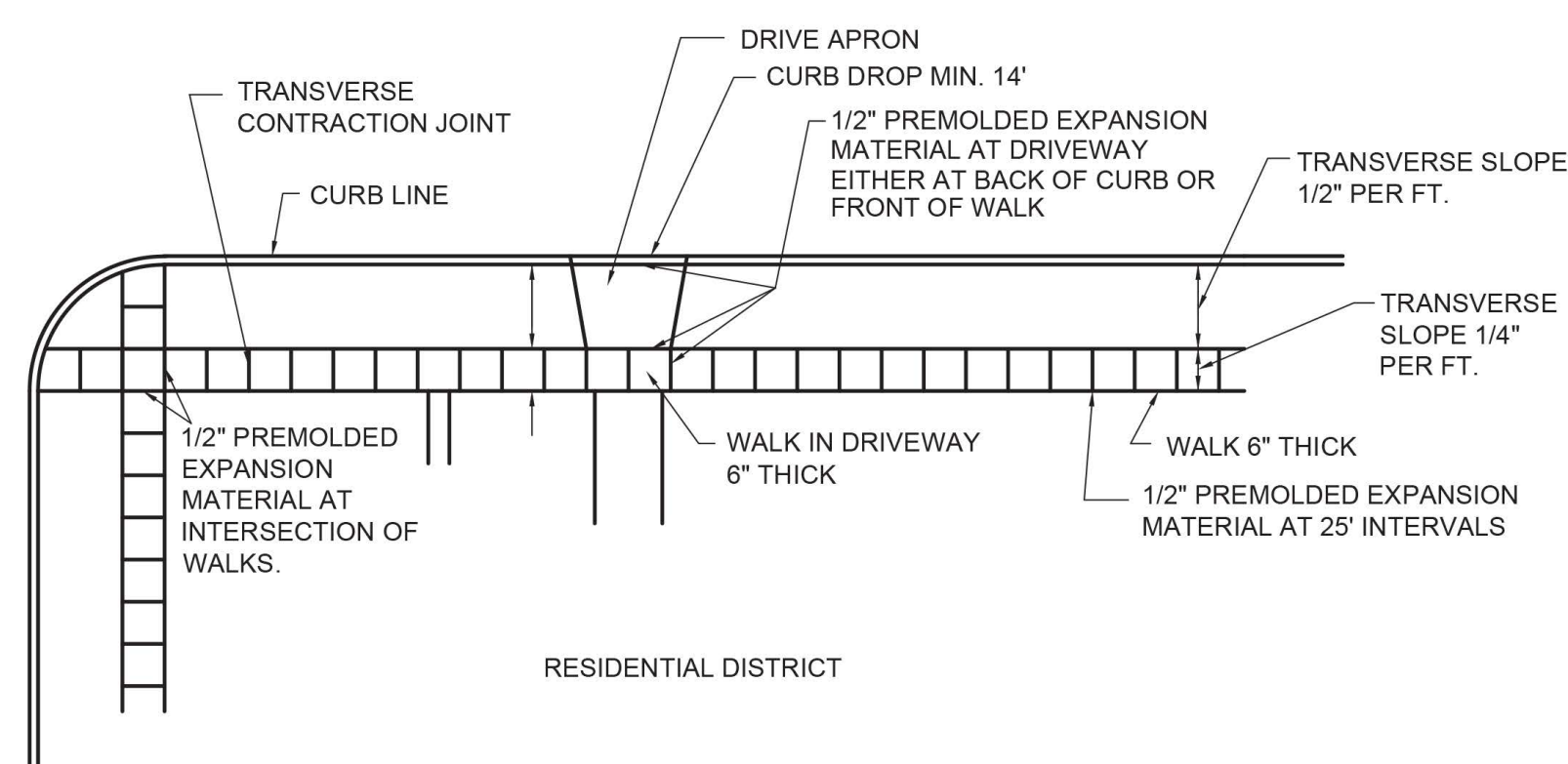
SCALE: NONE



8" ITEM SPCL PERVIOUS CONCRETE PAVEMENT

### ALLEY PERVIOUS RETURN DETAIL

SCALE: NONE



## RESIDENTIAL PERVIOUS SIDEWALK DETAILS

SCALE: NONE

- NOTES:**
1. MAXIMUM LONGITUDINAL SLOPE 1/2" PER FT.
  2. REFER TO PEDESTRIAN RAMP CONSTRUCTION DETAILS.
  3. MAXIMUM LENGTH OF RAMP IS 30 FT.
  4. WHEREVER SIGN POSTS ARE WITHIN THE SIDEWALK, A PLASTIC SLEEVE OF THE APPROPRIATE SIZE (3"-4" TYPICAL) SHALL BE PLACED FLUSH WITH THE CONCRETE SURFACE AT THE APPROPRIATE LOCATION. ALL POLES WITH IN THE SIDEWALK SHALL BE WRAPPED WITH A 1" FLEXIBLE EXPANSION MATERIAL PRIOR TO PLACEMENT OF CONCRETE.
  5. NO SIDEWALK SHALL BE PLACED DIRECTLY AGAINST ANY RIGID STRUCTURE OR FOUNDATION. MINIMUM 1" PREFORMED EXPANSION MATERIAL MUST BE PLACED BETWEEN THE STRUCTURE AND THE ADJACENT SIDEWALK.
  6. CONSTRUCT TRANSVERSE EXPANSION JOINTS IN SUCH A MANNER THAT THE JOINT WILL BE FILLED TO WITHIN ONE-HALF INCH (½") OF THE SURFACE OF THE WALK, AT INTERVALS OF NOT MORE THAN TWENTY-FIVE FEET (25'), UNLESS OTHERWISE SPECIFIED BY THE ENGINEER. PLACE JOINTS AT THE GROOVED DIVISION LINES, TRULY NORMAL TO THE GRADE. WHENEVER CONCRETE SIDEWALKS ABUT OTHER WALKS, STEPS, CURBS, MANHOLES, CATCH BASINS, BUILDING FOUNDATIONS, ETC., PROVIDE ONE-HALF INCH (½") THICK EXPANSION JOINTS. EFFECTIVELY SEPARATE WALK AT EXPANSION JOINTS FROM ADJACENT SIDEWALKS BY PLACING AN ASL CONCRETE FROM THE TOP OF THE PREMOLED JOINTS AND EDGE AS SPECIFIED ABOVE.
  7. FINISHING: PER SPEC SECTION 02795



420 Madison Ave. Suite 1001  
Toledo, OH 43604  
255-9500 FAX: (419) 255-9501

MARK	DATE	DESCRIPTION	BY	Client: CITY OF TOLEDO, OHIO Proj. Loc.: CITY OF TOLEDO, OHIO	Project No.: 200-06764-10001
	11/30/09	ISSUED FOR BID		MAYWOOD AVENUE STORM WATER VOLUME REDUCTION PROJECT	Designed By: A. DAVENPORT
				CIVIL STANDARD DETAILS	Drawn By: S. GOTHA
					Checked By: D. CHARVILLE
					C-503

Copyright: Tetra Tech





## **CORNER CURB EXTENTION (NODE)**



OPERATION
SURVEYED
PLAN PLOTTED
PLAN CHECKED
PROFILE PLOTTED
PROFILE CHECKED
PRELIMINARY GRADE
GRADE INSPECTION
SANITARY SENIOR DESIGN

NO SCALE

NO SCALE

NO SCALE

NO SCALE

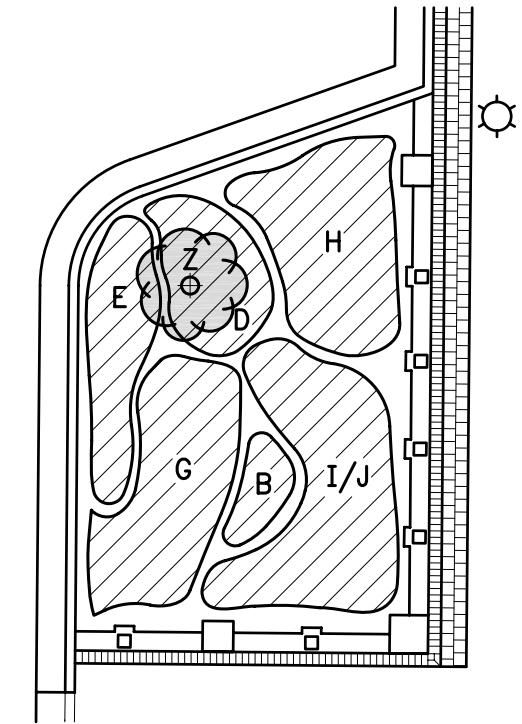
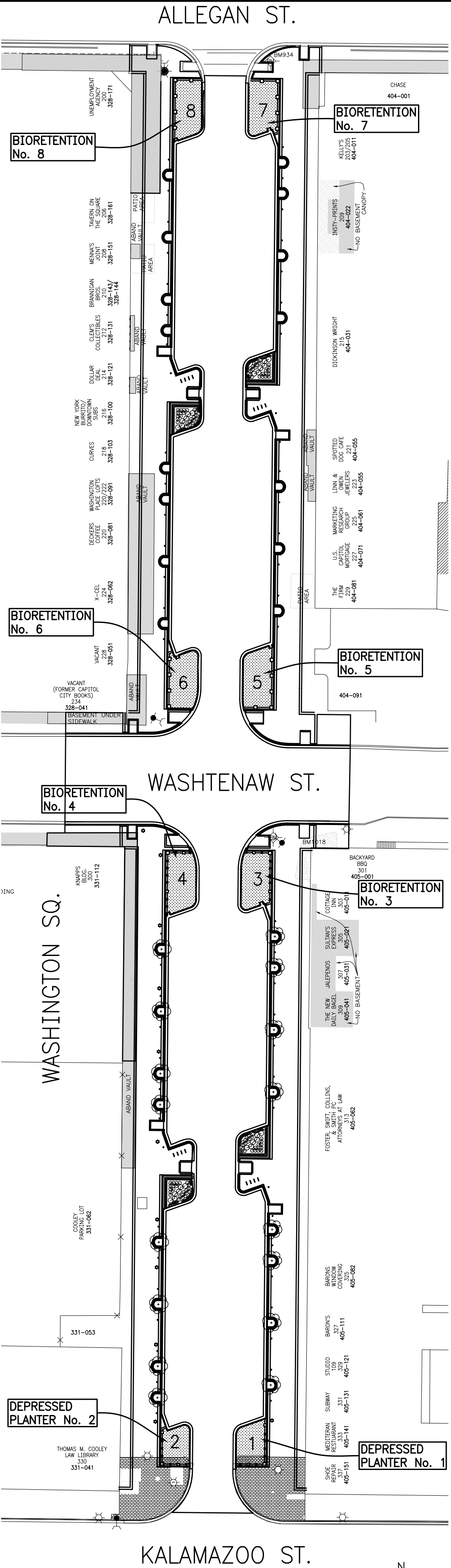
NO SCALE

NO SCALE

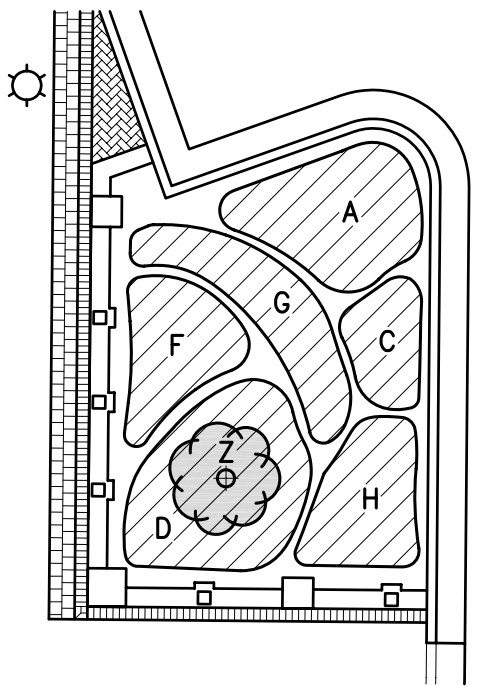
1. FOR ENTRYWAY COLUMN WITH STREETLAMP, INSTALL 1 1/2-INCH DIAMETER CONDUIT INSIDE COLUMN TO CORED HOLE IN FINIAL FOR STREETLAMP WIRING. COORDINATE WORK WITH LANSING BOARD OF WATER & LIGHT.



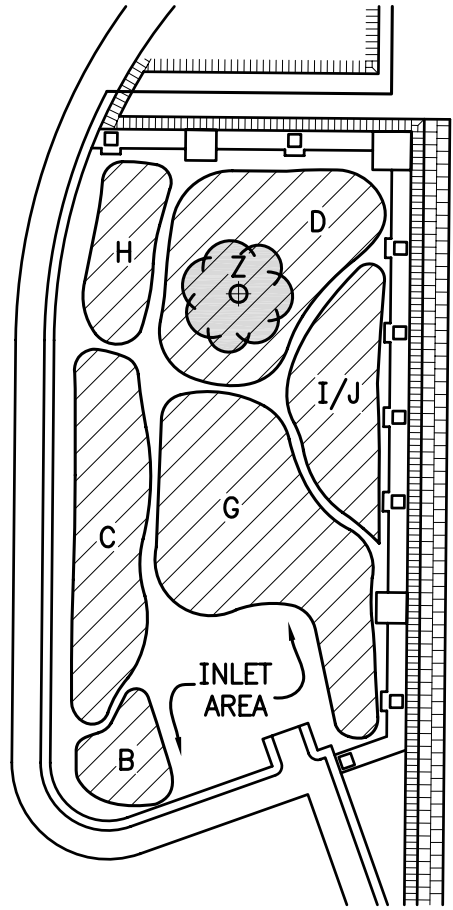
OPERATION	BY	DATE	OPERATION	BY	DATE
SURVEYED			SAN. SEWER DESIGN - OK		
PLAN PLOTTED			STORM SEWER DESIGN - OK		
PROFILE PLOTTED			SAN. SEWER QUANTITIES - OK		
PLAN CHECKED			STORM SEWER QUANTITIES - OK		
PROFILE CHECKED			STORM SEWER QUANTITIES - OK		
PRELIMINARY GRADE			STORM SEWER QUANTITIES - OK		
GRADE INSPECTION			PRELIMINARY R.O.W. - OK		
SANITARY SEWER DESIGN					



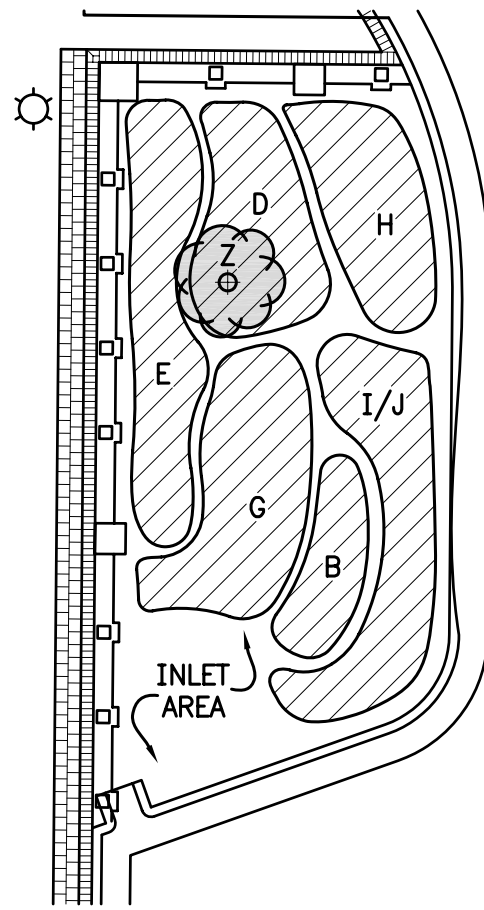
DEPRESSED PLANTER  
DETAIL No. 1  
SCALE: 1"=10'



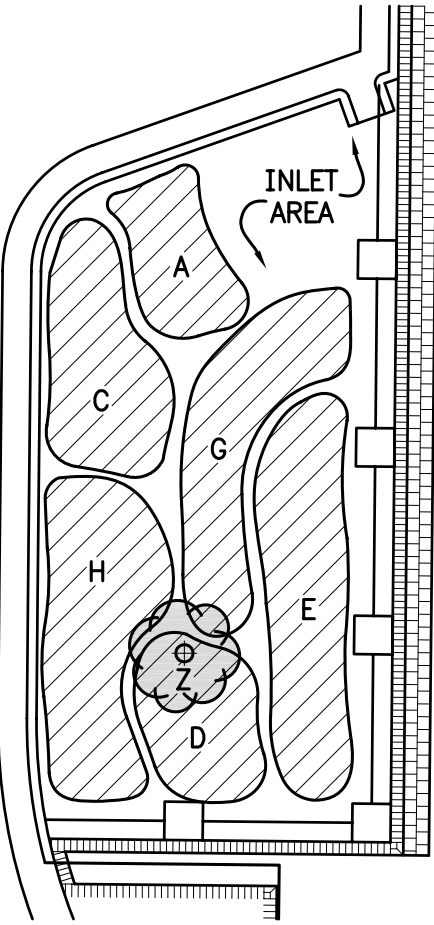
DEPRESSED PLANTER  
DETAIL No. 2  
SCALE: 1"=10'



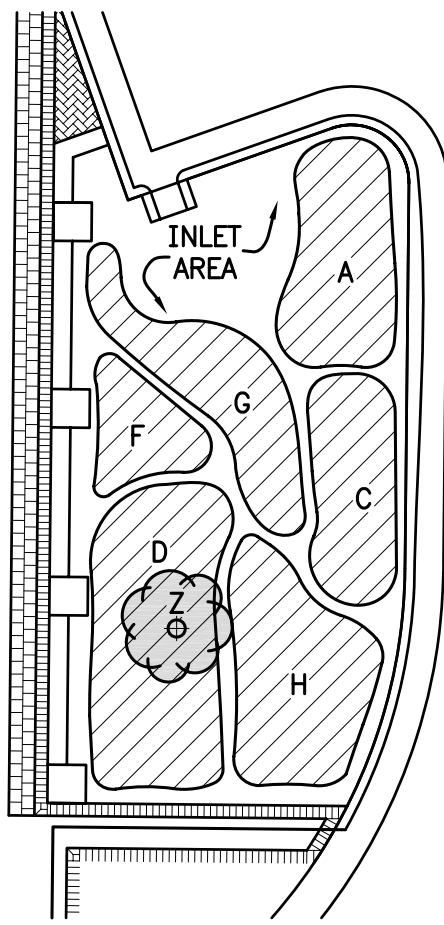
BIORETENTION  
DETAIL No. 3  
SCALE: 1"=10'



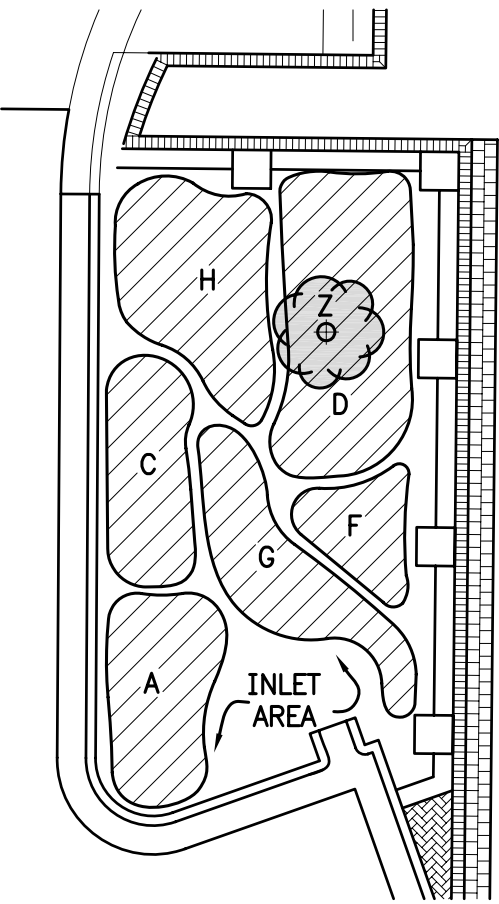
BIORETENTION  
DETAIL No. 4  
SCALE: 1"=10'



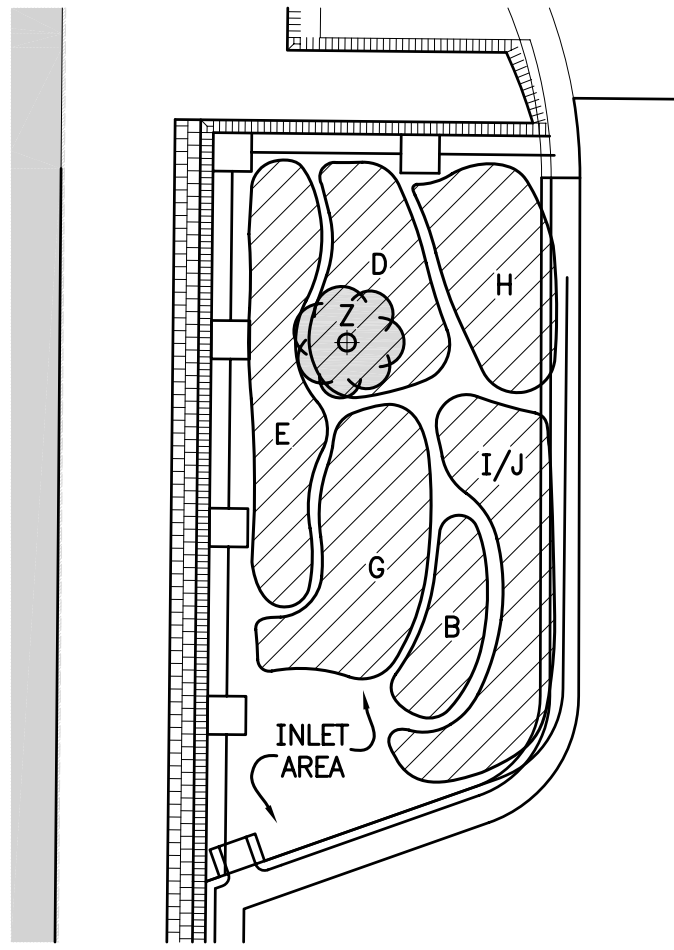
BIORETENTION  
DETAIL No. 5  
SCALE: 1"=10'



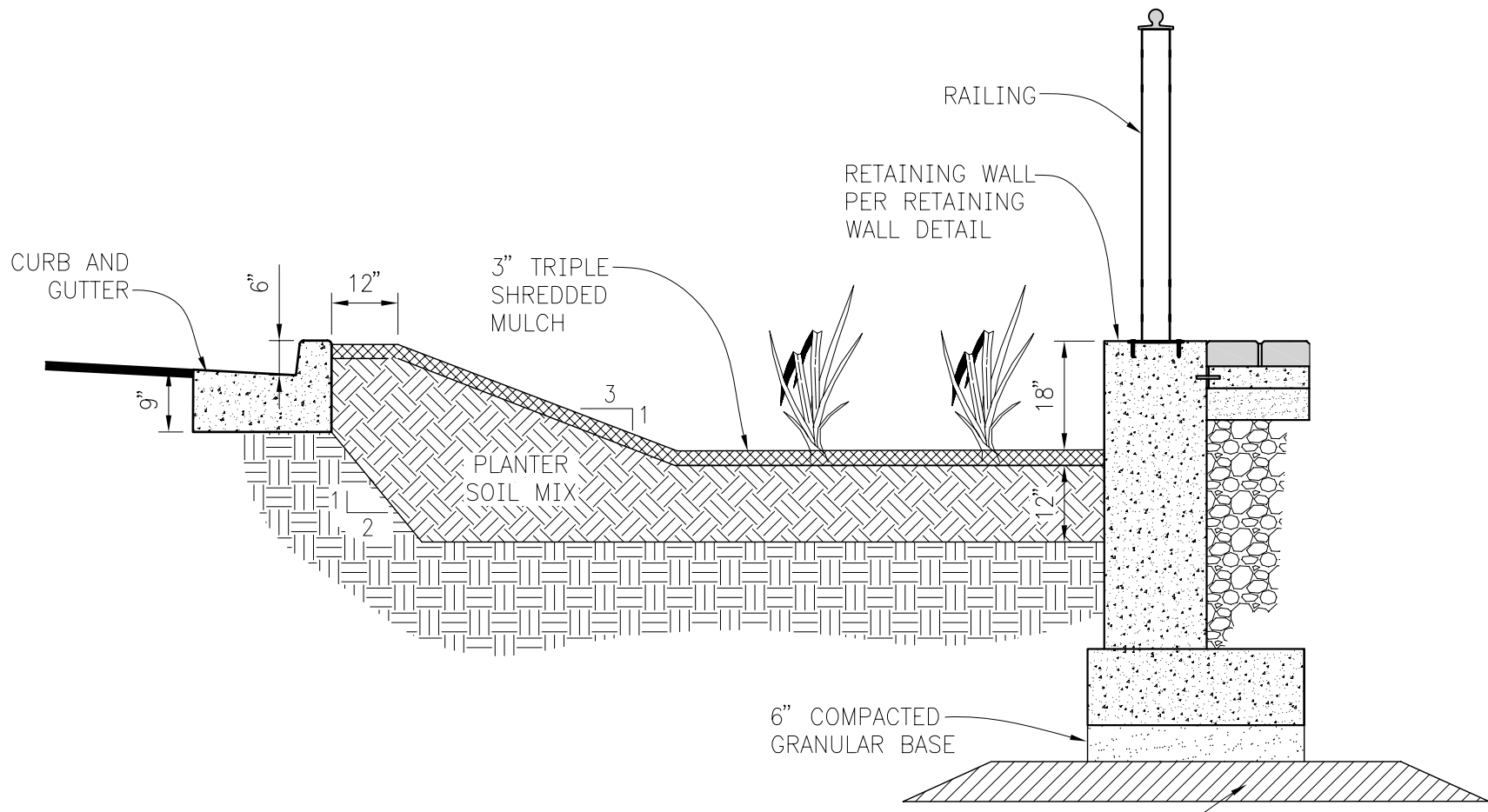
BIORETENTION  
DETAIL No. 6  
SCALE: 1"=10'



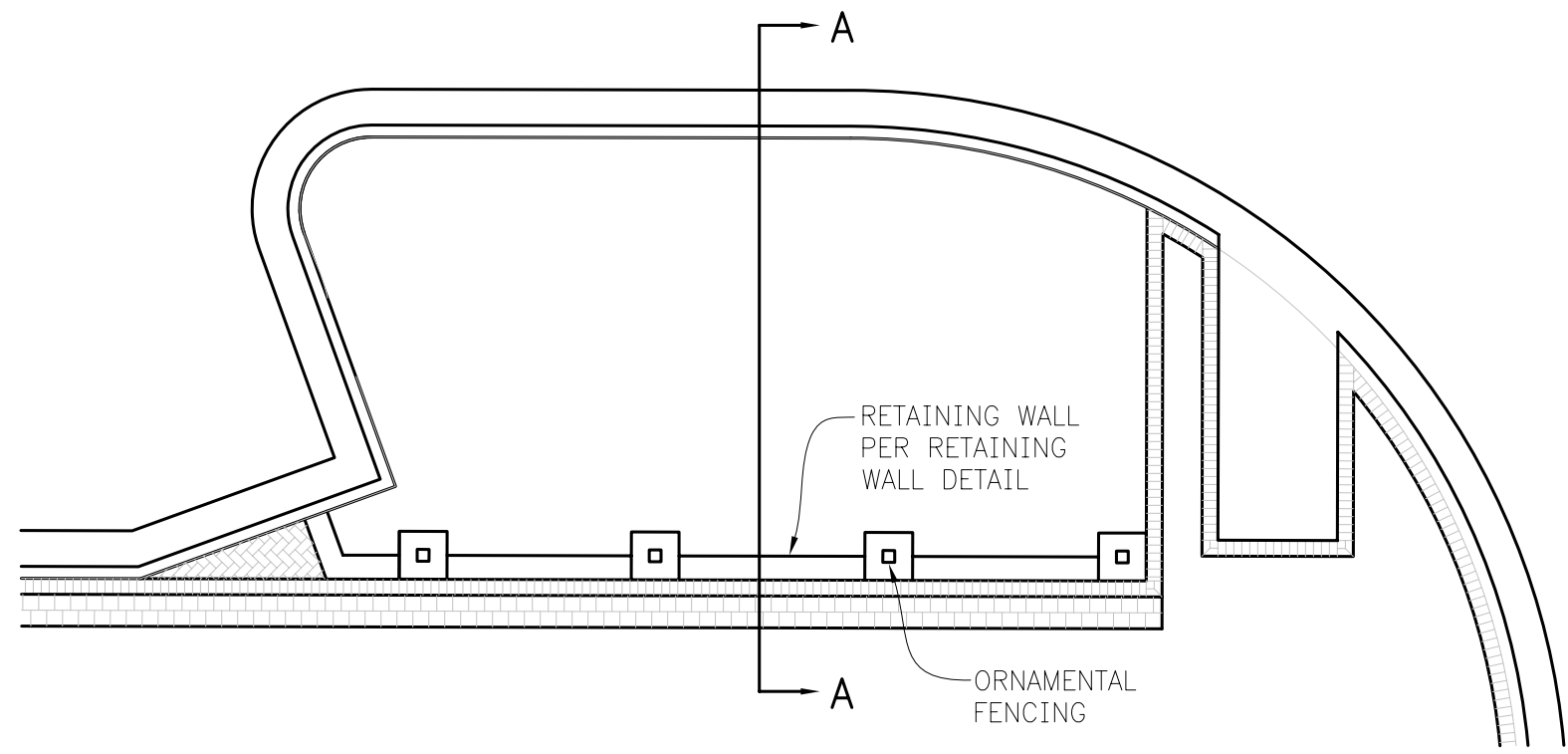
BIORETENTION  
DETAIL No. 7  
SCALE: 1"=10'



BIORETENTION  
DETAIL No. 8  
SCALE: 1"=10'





SECTION A-A  
NO SCALE



DEPRESSED PLANTER DETAIL  
NO SCALE

Plant Material List			Individual Garden Plant Quantities									
				Detail No. 1	Detail No. 2	Detail No. 3	Detail No. 4	Detail No. 5	Detail No. 6	Detail No. 7	Detail No. 8	
	Total Quantity	Plug Spacing	Common Name Botanical Name									
Deciduous Tree (BB)	8		Z - Cleveland Select Flowering Pear Pyrus C. 'Cleveland Select'	1	1	1	1	1	1	1	1	
Perennials (plug)	212	12" on center	A - Nodding Wild Onion Allium cernuum	46	49			40	77			
	102	18" on center	B - Swamp Milkweed Asclepias incarnata	10		18	28			18	28	
	246	18" on center	C - Alum Root Heuchera Americana	51	16	49		55	26	49		
	506	12" on center	D - Southern Blue Flag Iris Virginica		76	89	43	47	120	87	44	
	312	12" on center	E - Rough Blazing Star Liatris aspera	39			84	103			86	
	70	18" on center	F - Marsh Blazing Star Liatris spicata		27				43			
	348	24" on center	G - Switch Grass Panicum virgatum	38	26	57	43	43	41	56	44	
	478	12" on center	H - Beardtongue Penstemon Digitalis	84	30	29	80	98	47	28	82	
	68	18" on center	I - Three-Lobed Coneflower Rudbeckia Triloba			17	17			17	17	
	68	18" on center	J - Yellow Coneflower Ratibida Pinnata			17	17				17	

ISSUE	NATURE OF REVISION	DATE
PHASE V SEGMENT 2		
DOWNTOWN SEPARATION (WASHINGTON/OTTAWA)		
PRIME CONTRACTOR:		
CONSTRUCTION ADMINISTRATOR:		
CONSTRUCTION OBSERVATION BY:		
TL CONTRACT: 200-12741-08002.S-3	DIVISION:	
 Virg Bernero, Mayor		<b>TETRA TECH</b>
DESIGNED: A. THOMAS		CHECKED: N. McPHERSON
CADD DATE: 2/5/2010		Hollenbeck, Todd
PART: 131 BIORETENTION DEPRESSED		
DEPARTMENT OF PUBLIC SERVICE LANSING, MICHIGAN		
BIORETENTION AND DEPRESSED PLANTER PLANTING PLANS		
APPROVED		FILE NO.
DEPARTMENT OF PUBLIC SERVICE		
SCALE HORIZONTAL: AS NOTED VERTICAL: NO SCALE		
PROJECT NO. PS 36321		SHEET 31 OF 59 SHEETS





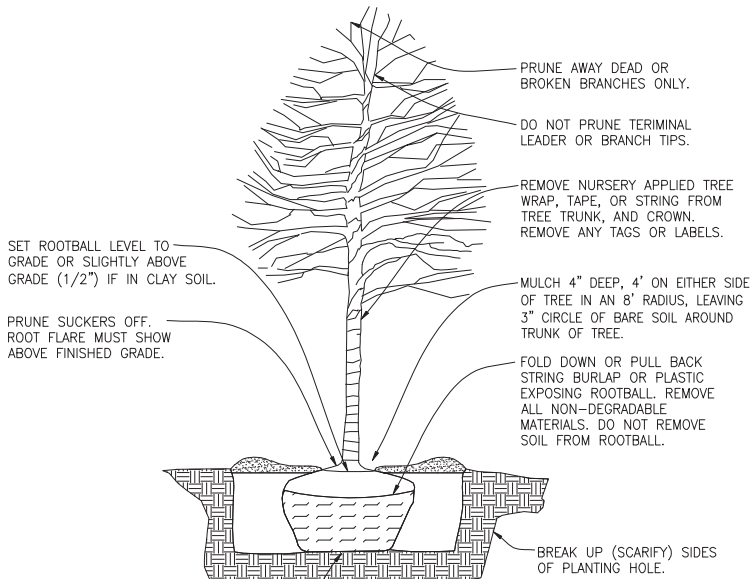


## **MID-BLOCK CURB EXTENSION**

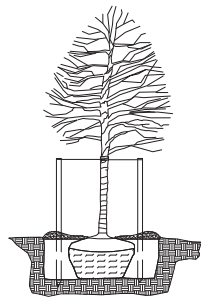
OPERATION	DATE	BY
BOARD OF WATER UTILITIES		
CONSUMERS ENERGY - GAS		
SALE TELEVISION - CATV		
FIRE DEPARTMENT		

OPERATION	DATE	BY
SAN SEWER DESIGN OK		
STORM SEWER DESIGN OK		
SAN SEWER QUANTITIES OK		
STORM SEWER QUANTITIES OK		
PRELIMINARY R.O.W. OK		

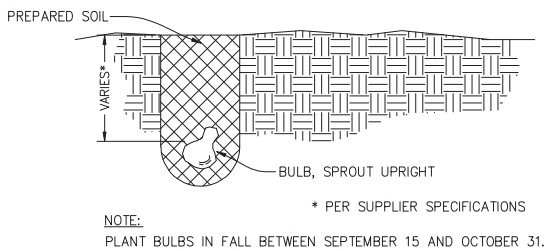
OPERATION	DATE	BY
SURVEYED		
PLAN PLOTTED		
PLAN CHECKED		
PROFILE PLOTTED		
PRELIMINARY GRADE		
GRADE INSPECTION		
SANITARY SEWER DESIGN		



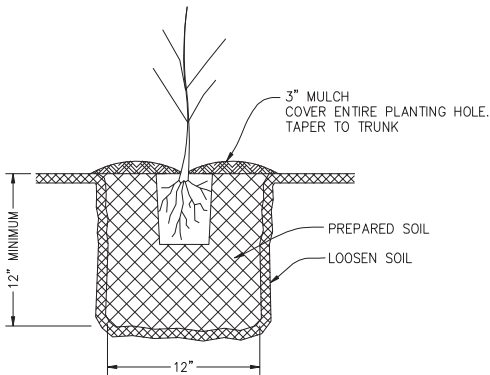
TREE PLANTING DETAIL  
NO SCALE



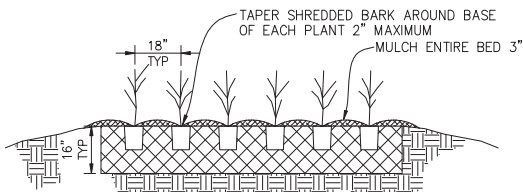
TREE PLANTING DETAIL



BULB PLANTING



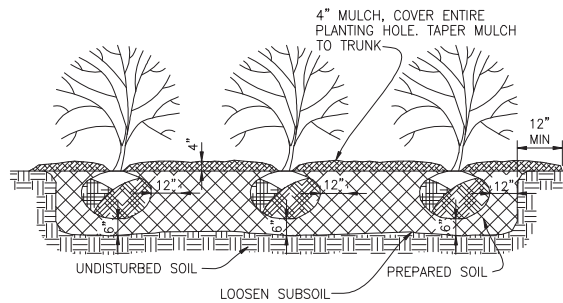
PERENNIAL PLANTING



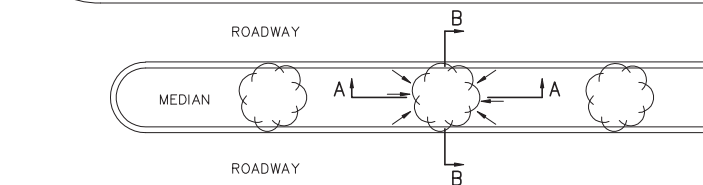
BEDDED PERENNIAL PLANTS

NOTE:  
FIRST AND SECOND WATERING AND CULTIVATION SHALL INCLUDE PERENNIAL BEDS.

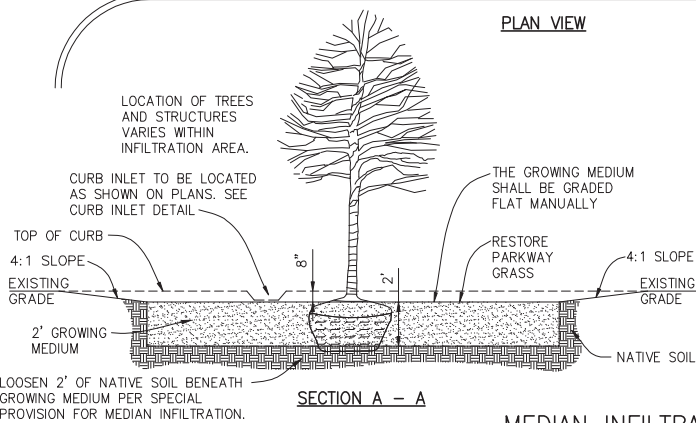
PERENNIAL PLANTS  
NO SCALE



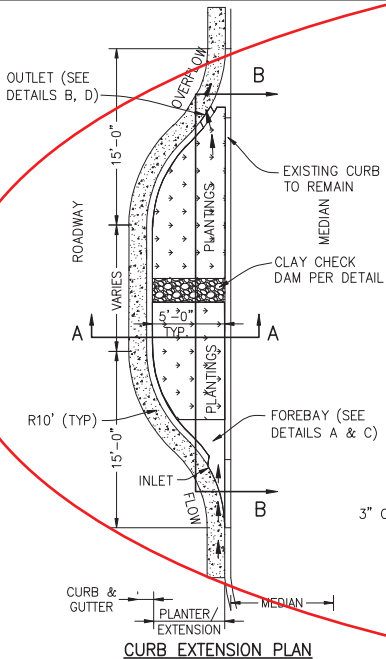
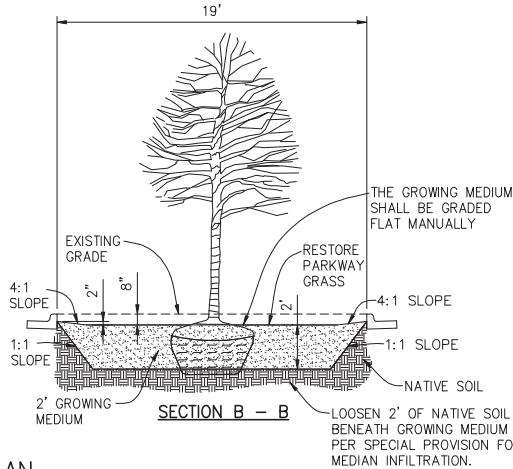
SHRUB BED DETAIL  
NO SCALE



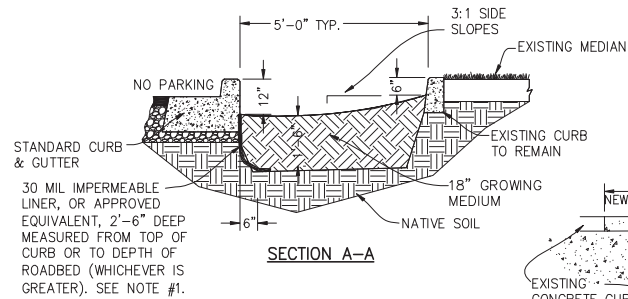
PLAN VIEW



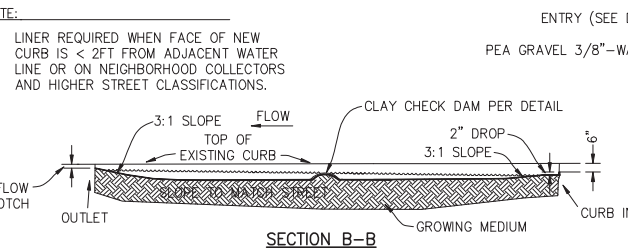
MEDIAN INFILTRATION PLAN  
NO SCALE



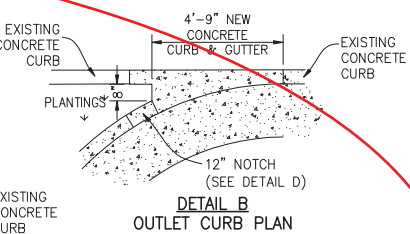
CURB EXTENSION PLAN



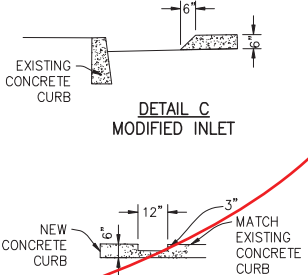
SECTION A-A



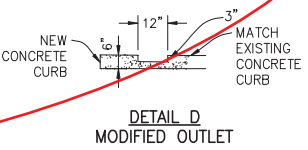
CURB EXTENSION RAIN GARDEN  
NO SCALE



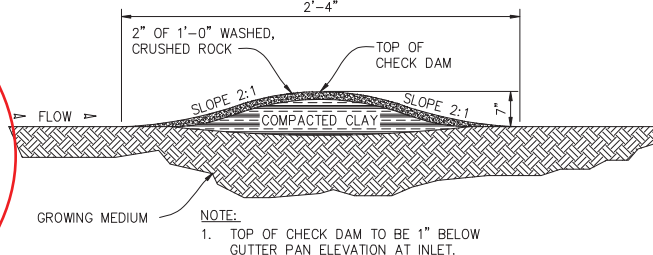
DETAIL B OUTLET CURB PLAN



DETAIL C MODIFIED INLET



DETAIL D MODIFIED OUTLET



CLAY CHECK DAM DETAIL  
NO SCALE

ISSUE	NATURE OF REVISION	DATE
	PHASE V SEGMENT 2	
	SUBAREA 034C SEPARATION	
PRIME CONTRACTOR:		
CONSTRUCTION ADMINISTRATOR:		
CONSTRUCTION OBSERVATION BY:		
TL CONTRACT: 200-12741-08002-S-2	DIVISION:	
DESTONED JWB/SMB	CHECKED WJK/RWF/ADF	
SCALE AS NOTED	CADD DATE 9/8/2009 10:12 AM	
PART R:\A\2008\LA08265.CSD\Subarea034C\Drawg\034C.PP.Detail Plantings.dwg		
DEPARTMENT OF PUBLIC SERVICE LANSING, MICHIGAN		
STANDARD DETAILS PLANTING DETAILS		
APPROVED	FILE NO.	
DEPARTMENT OF PUBLIC SERVICE		
SCALE		
HORIZONTAL: AS NOTED	VERTICAL: AS NOTED	
PROJECT NO. PS 45046		SHEET 8 OF 110 SHEETS

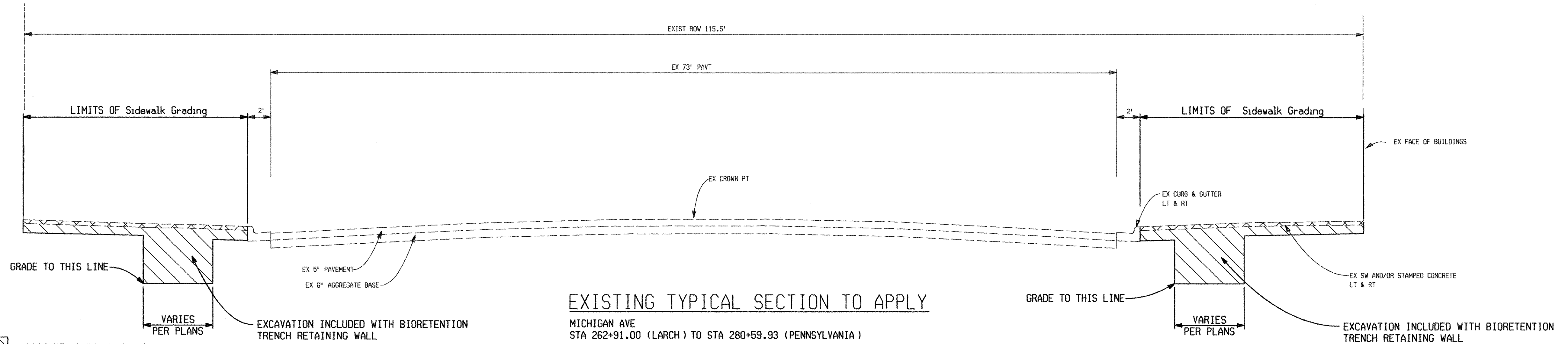


## **PLANTER BOX**

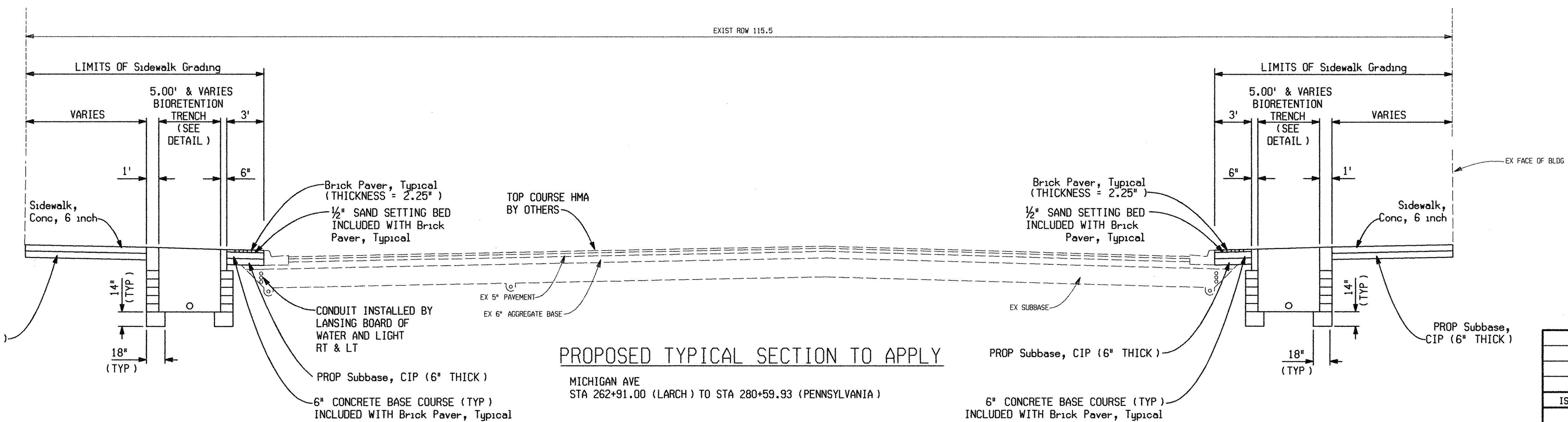
DATE	BY	OPERATION
		BOARD OF WATER & LIGHT
		ELECTRIC
		WATER
		CONSUMERS ENERGY - GAS
		BELL TELEPHONE
		CABLE TELEVISION - CATV
		FIRE DEPARTMENT


DATE	BY	OPERATION
		SAN. SEWER DESIGN - CK.
		STORM SEWER DESIGN - CK.
		STORM SEWER DESIGN - CK.
		SAN. SEWER QUANTITIES - CK.
		STORM SEWER QUANTITIES - CK.
		PRELIMINARY B.I.M.V. - CK.

DATE	BY	OPERATION
		SURVEYED
		PLAN PLOTTED
		PLAN CHECKED
		PROFILE CHECKED
		PRELIMINARY GRADE
		STATION SEVER DESIGN



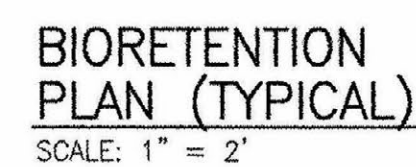
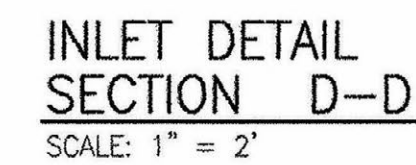
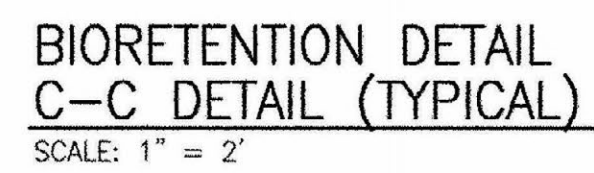
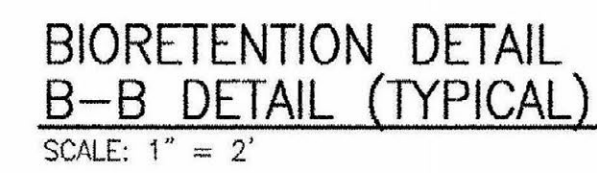
- INDICATES EARTH EXCAVATION
- INDICATES Sidewalk, Rem





ISSUE	NATURE OF REVISION	DATE
PRIME CONTRACTOR:		
CONSTRUCTION ADMINISTRATOR:		
CONSTRUCTION OBSERVATION BY:		
MPS CONTRACT:		DIVISION:
		
DESIGNED	CHECKED	
SCALE: 1"=5'	CADD DATE: 10/5/06	
PART: 45594e3.tsp		
DEPARTMENT OF PUBLIC SERVICE LANSING, MICHIGAN		
TYPICAL CROSS SECTIONS MICHIGAN AVENUE		
APPROVED	FILE NO.	
DEPARTMENT OF PUBLIC SERVICE		
SCALE HORIZONTAL: 1"=5' VERTICAL: 1"=5'	SHEET 6 OF 66 SHEETS	
PROJECT NO. PS 36313		



OPERATION	BY	DATE
SURVEYED		
PLAN PLOTTED		
PLAN CHECKED		
PROFILE PLOTTED		
PROFILE CHECKED		
PRELIMINARY GRADE		
GRADE INSPECTION		
SANITARY SEWER DESIGN		



ISSUE	NATURE OF REVISION	DATE
PRIME CONTRACTOR:		
CONSTRUCTION ADMINISTRATOR:		
CONSTRUCTION OBSERVATION BY:		
MPS CONTRACT:		UNVISION:
 <b>TETRA TECH</b>		
	DESIGNED	CHECKED
	SCALE	CADD DATE Dec/14/2008 - 2:36pm
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<b>DEPARTMENT OF PUBLIC SERVICE</b> LANSING, MICHIGAN		
<b>BIORETENTION</b> <b>DETAILS</b>		
APPROVED  DEPARTMENT OF PUBLIC SERVICE SCALE HORIZONTAL:      VERTICAL:		FILE NO.
<b>PROJECT NO.</b> PS 36313		SHEET <b>13</b> OF <b>66</b> SHEETS

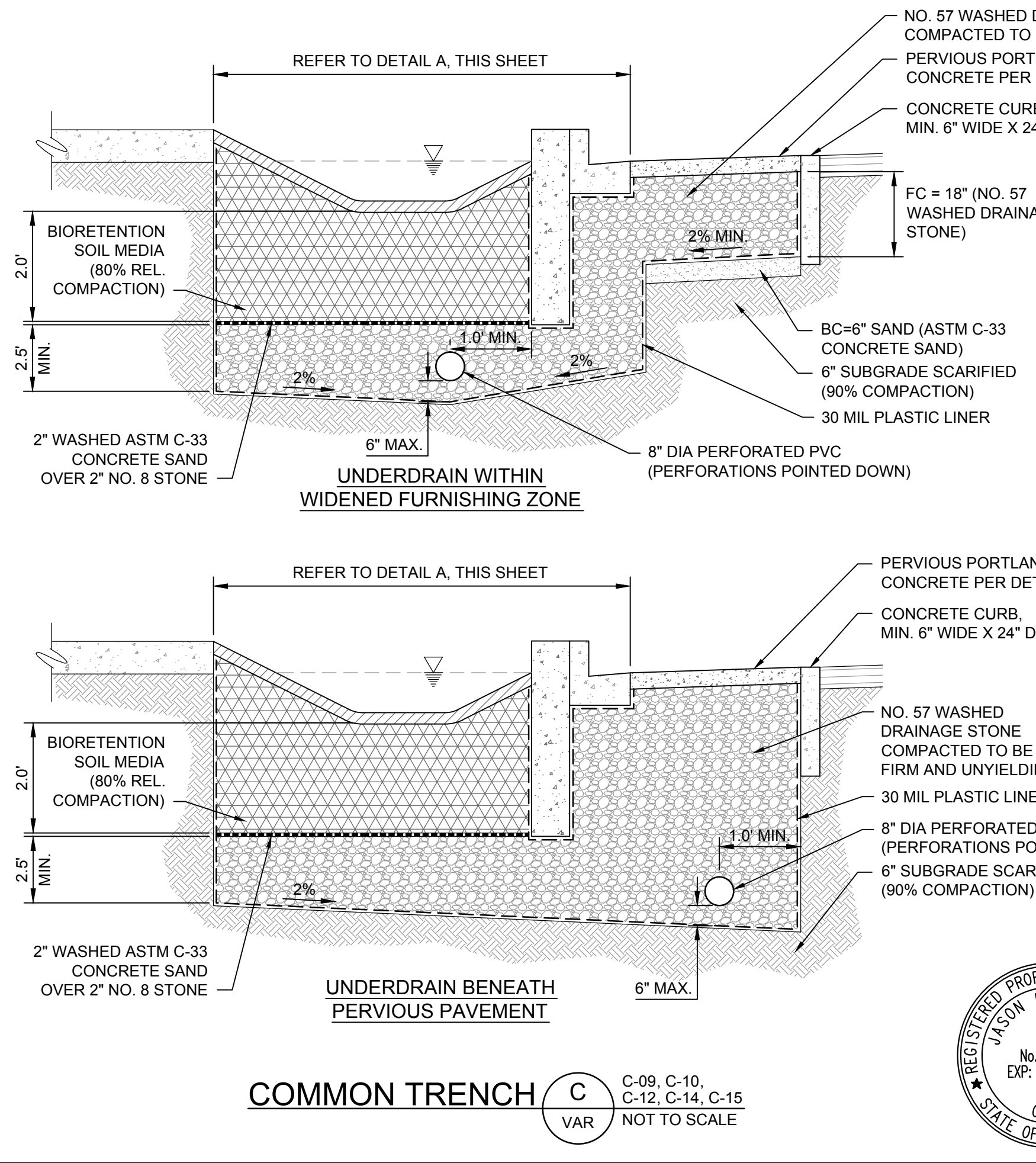
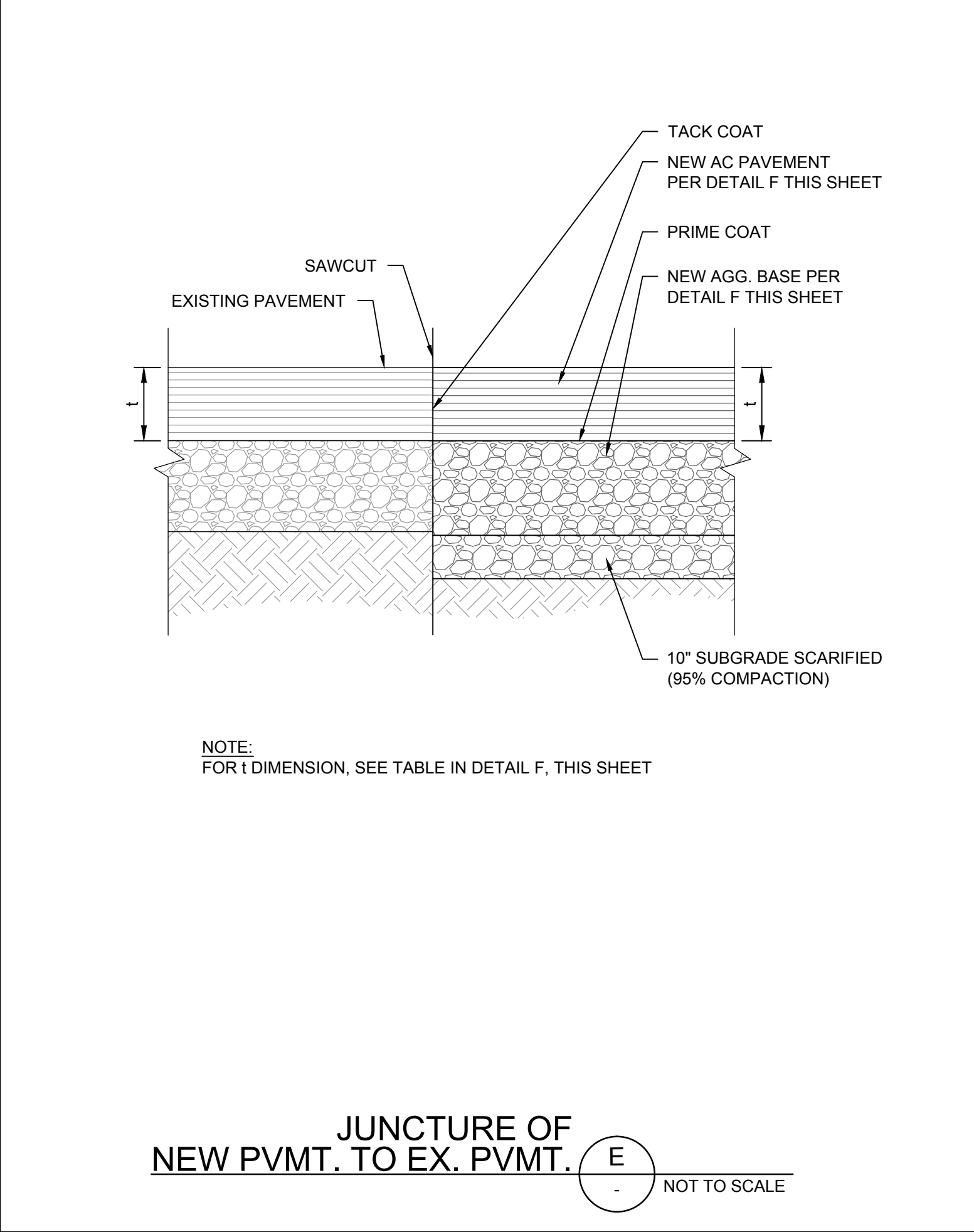
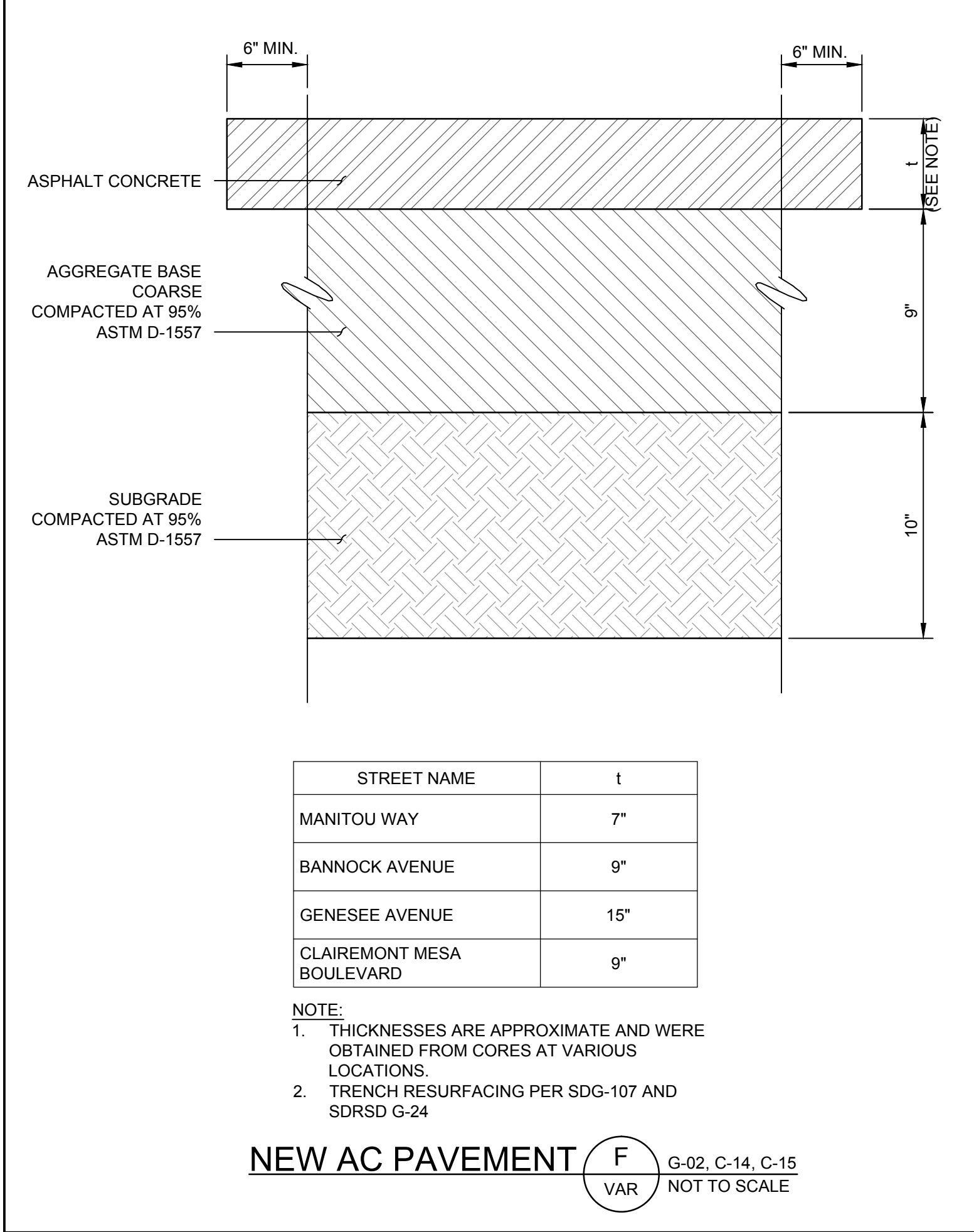
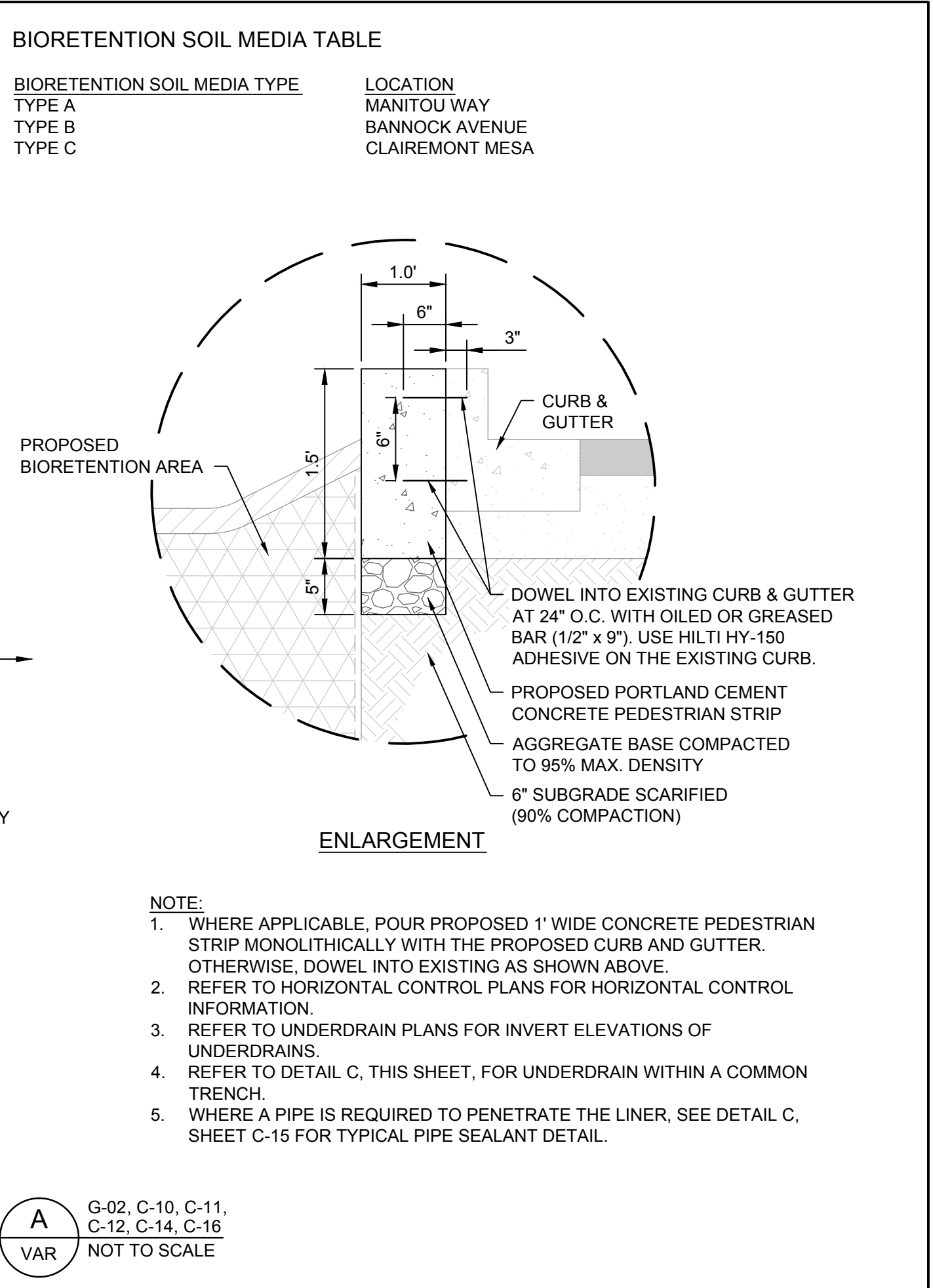
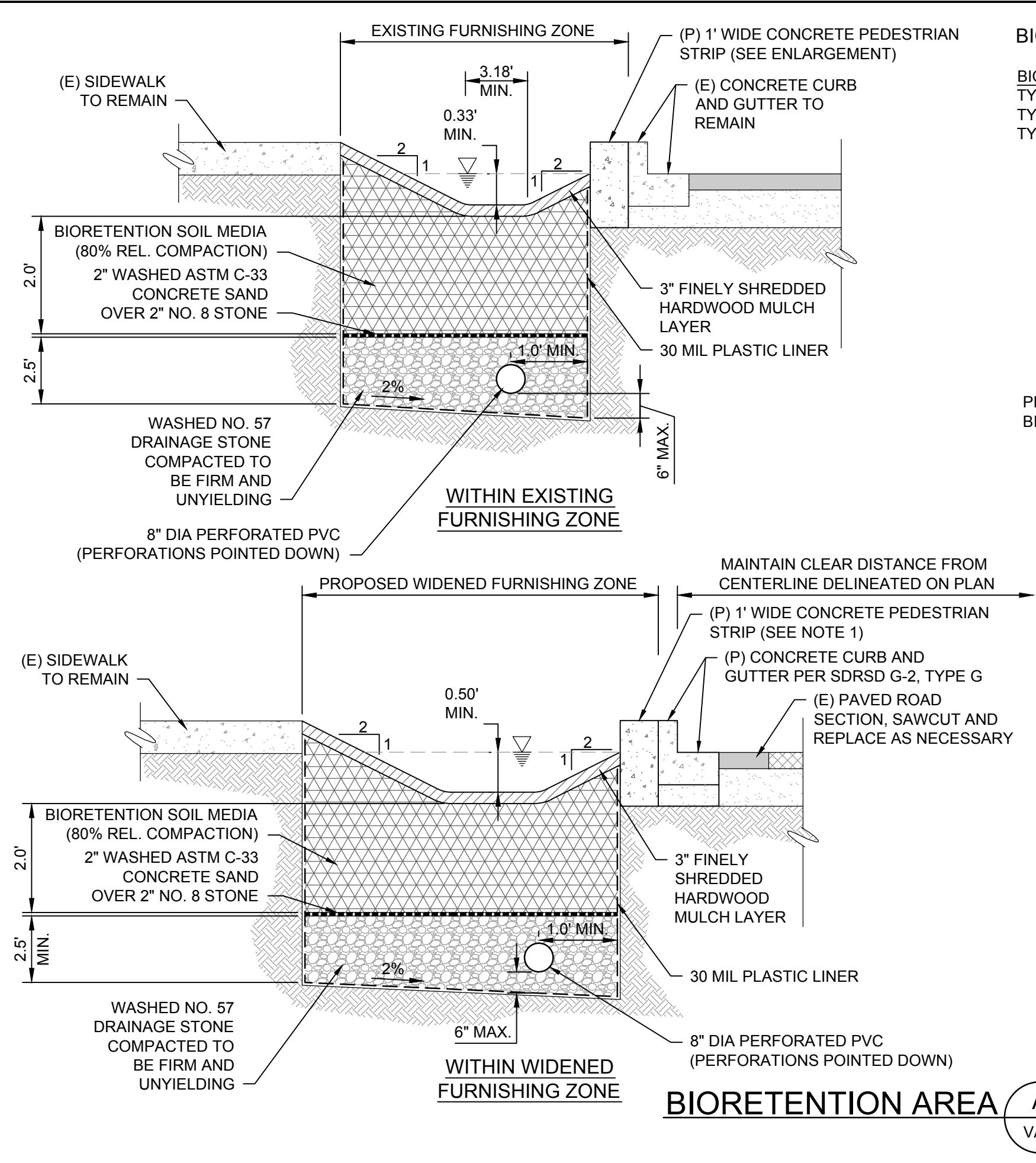
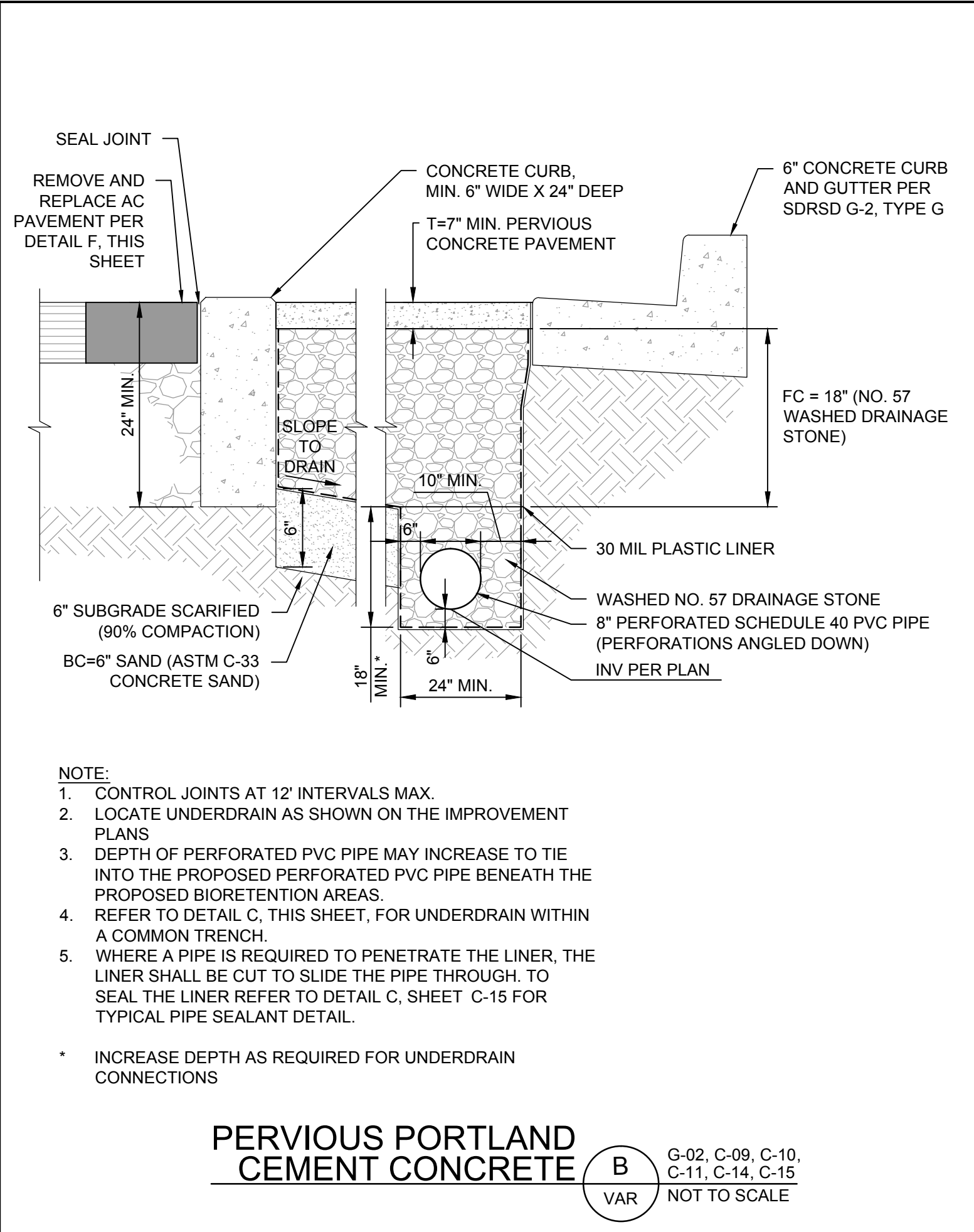
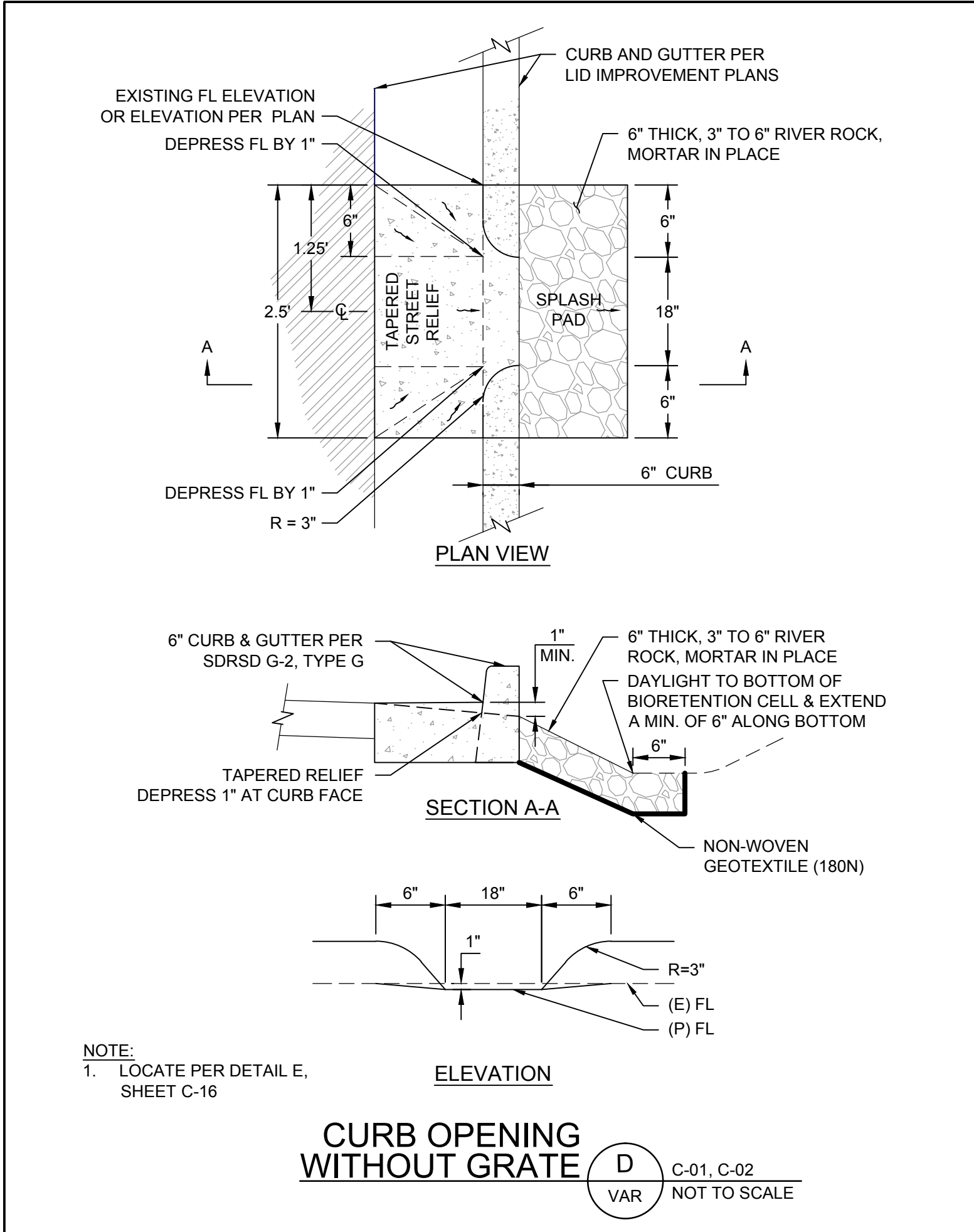






## **PERMEABLE CONCRETE**









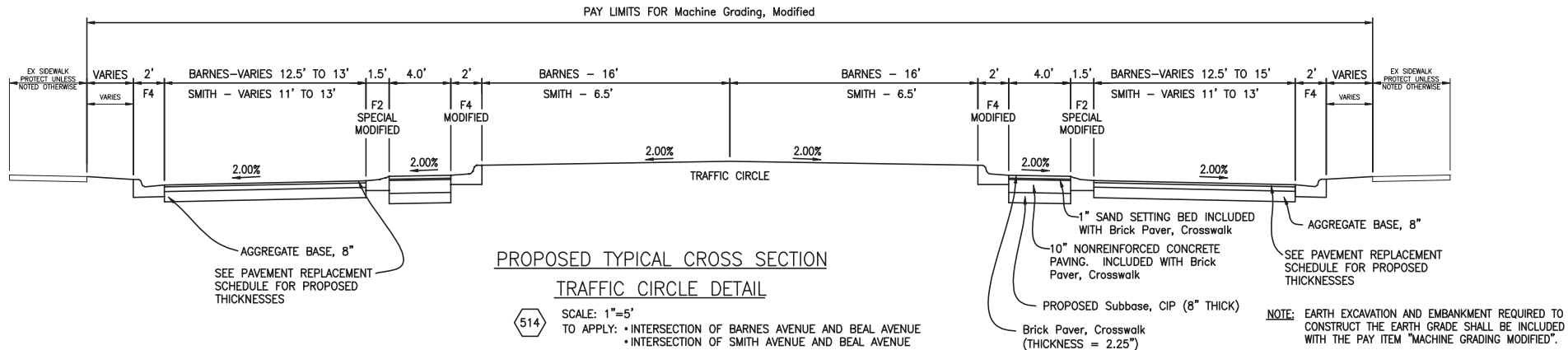
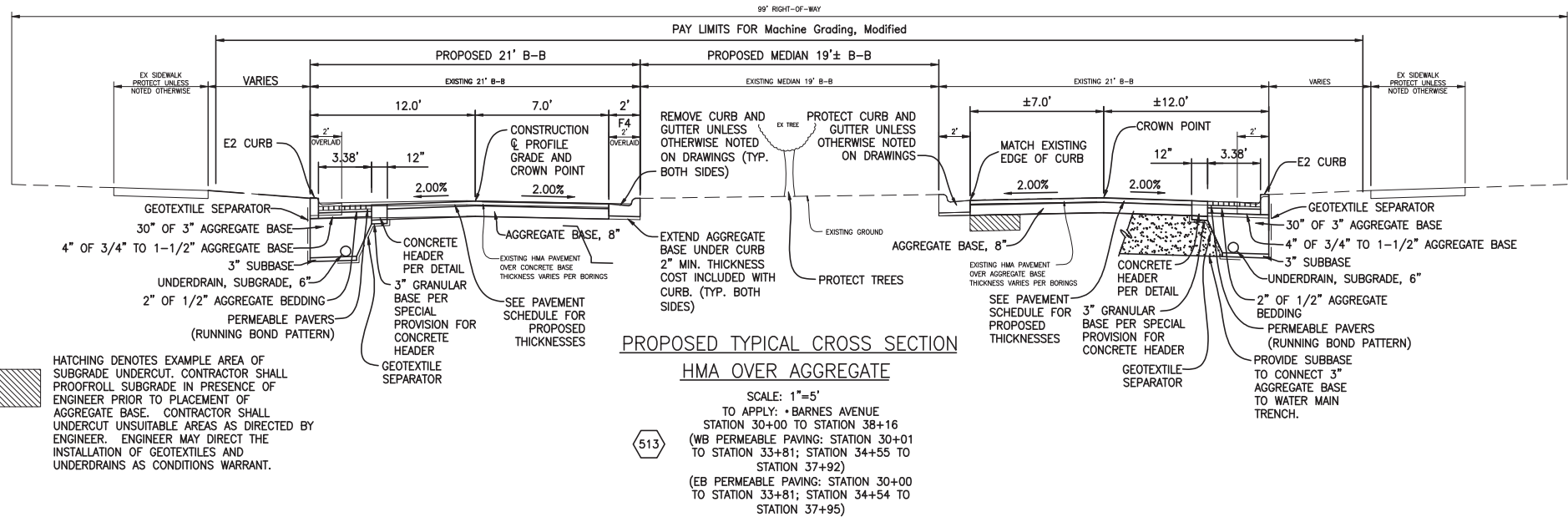
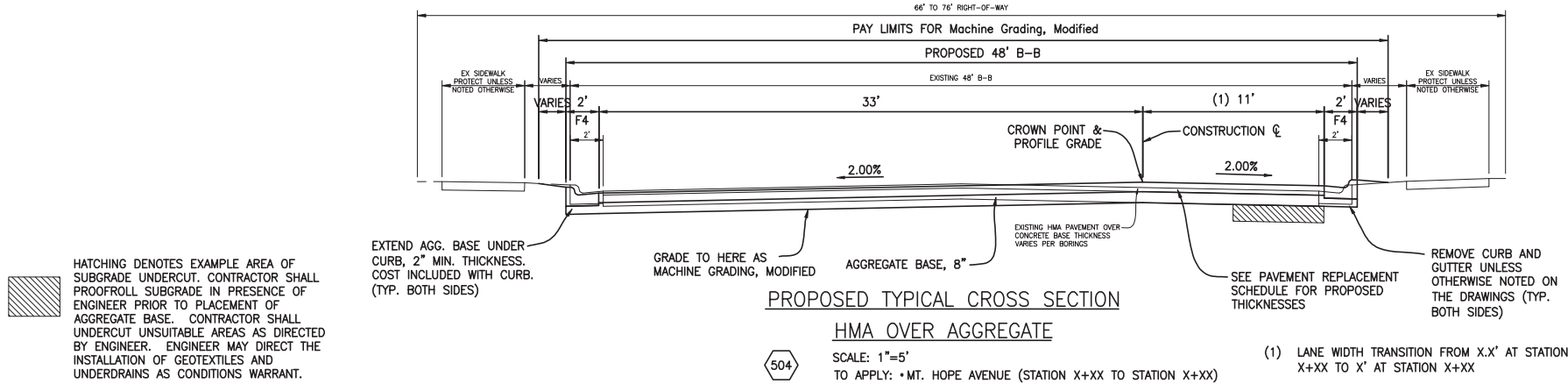
## **PERMEABLE CONCRETE PAVERS**






OPERATION	BY	DATE
BOARD OF WATER LIGHTS & ELECTRIC		
WATER		
CONSUMERS ENERGY - GAS		
TELEVISION - CABLE TELEVISION		
FIRE DEPARTMENT		

OPERATION	BY	DATE
SAN. SEWER DESIGN	OK	
STORM SEWER DESIGN	OK	
SAN. SEWER QUANTITIES	OK	
STORM SEWER QUANTITIES	OK	
STORM SEWER QUANTITIES	OK	
PRELIMINARY R.O.W.	OK	

OPERATION	BY	DATE
SURVEYED		
PLAN PLOTTED		
PLAN CHECKED		
PROFILE PLOTTED		
PRELIMINARY GRADE		
GRADE INSPECTION		
SANITARY SEWER DESIGN		



ISSUE	NATURE OF REVISION	DATE
PHASE V SEGMENT 2		
SUBAREA 034C SEPARATION		
PRIME CONTRACTOR:		
CONSTRUCTION ADMINISTRATOR:		
CONSTRUCTION OBSERVATION BY:		
TR. CONTRACT: 200-12741-08002-S-2		DIVISION:
  		
DESIGNED JWB/SMB		CHECKED WJK/RWF/ADF
SCALE AS NOTED		CADD DATE 10/22/2009 3:23 PM
PART R:\LA\2008\LA08265.CS\Subarea034C\Drawn\034C.PP\typicals.dwg		
DEPARTMENT OF PUBLIC SERVICE LANSING, MICHIGAN		
TYPICAL PAVEMENT REPLACEMENT CROSS SECTIONS		
APPROVED		FILE NO.
DEPARTMENT OF PUBLIC SERVICE		
SCALE HORIZONTAL: AS NOTED VERTICAL: AS NOTED		SHEET 13 OF 110 SHEETS
PROJECT NO. PS 45046		

