

County Route 13A Culvert Project

Design and Implementation Report

Town of Lexington, Greene County, New York

December 2007

Project Partners and Contacts

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Stream Management Program***

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Schoharie Stream Management Project County Route 13A Flood Reduction Project Report

1.0 Background

Located in the hamlet of Lexington, the CRT 13A culvert replacement project was a cooperative effort between the Greene County Soil and Water Conservation District (GCSWCD), New York City Department of Environmental Protection (NYCDEP) and Greene County Highway Department (GCHD). In 2005-06, a community visioning and planning process lead by the Catskill Center for Conservation and Development indicated that there was a strong local concern regarding flooding in the Lexington hamlet. The flooding, related to the size and condition of the culvert, ranked near the top of a list of issues identified by residents of the hamlet. In addition, the GCSWCD had been aware of this flooding problem for at least 15 years. In 2006, the project was accepted for cost share funding by NYCDEP as a Filtration Avoidance Determination (FAD) deliverable to the United States Environmental Protection Agency (EPA), under the Schoharie SMP implementation items.

2.0 Project Goals

In selecting this project, the GCSWCD and NYCDEP wanted to meet the following goals;

- Complete a project that would engage additional stakeholders as partners and increase public perception of effective stream management practices.
- Complete a project that would address a local stream priority as identified by the community and which would protect public and private property.
- Complete a project that addressed a stream problem related to infrastructure such as a bridge or culvert in order to demonstrate the benefits to stream process and habitats of upgrading these systems.
- Demonstrate the utilization of stream management practices which would improve biological function such as natural cover in the culvert invert.
- Demonstrate the use of floodplain drains
- Integrate vegetative measures to reduce the need for traditional rock riprap around drainage structures.

3.0 Description of Problem

The culvert is located on a small unnamed tributary of the Schoharie Creek which drains the south facing slopes of the Schoharie watershed. The stream originates as two 1st order streams on the slopes above NYS Route 23A which join to become a 2nd order stream after they flow under NYS route 23A. For a number of years, the residents of the hamlet have reported that the culvert is frequently unable to convey the flow from its watershed and the stream leaves its banks flooding the hamlet area. This has resulted in numerous events that have caused property damage as well as road closures.

In 2006, over 22 landowners attended a Saturday meeting at the site to discuss their concerns. Residents reported that it was a far more frequent occurrence when the tributary flooded the hamlet rather than the main Schoharie Stream. In 2005, NYSDOT replaced a culvert under Route 23A to increase its capacity, further impacting the performance of the downstream culvert.

While the GCSWCD and GCHD did not perform a hydraulic analysis, it was clearly evident that the old culvert was far undersized when compared to the two NYSDOT culverts located on the same drainage pattern above the project site. It was also noted that flooding at the culvert was highly variable and often related to flooding levels in the Schoharie Creek. When the Schoharie watershed experiences longer duration, watershed wide runoff events, the Schoharie Creek frequently backs up into the lower end of this tributary to the culvert or even above. Under these conditions, the size of the culvert is irrelevant and flooding can be expected to occur. On the other hand, during shorter duration events, when flood levels on the tributary peak before the Schoharie Creek, upsizing can be expected to have a benefit.

Based on observation of the GCSWCD as well as local landowners this second scenario has been the case in much of the most recent flooding. The Schoharie basin has a very long lag period during the larger, longer duration events and it would not be unusual for the Schoharie Creek at the tributary confluence to peak later than the actual tributary. The tributary watershed is steep, and has very few characteristics that would lengthen the lag time while the Schoharie headwaters has significant floodplain storage and take time to peak.

4.0 Project Design

The project was conducted as a partnership between GCSWCD and GCHD. The GCHD played the key role in design and contracting the work while the GCSWCD took the lead on permitting as well as dewater/sediment control. In late 2006, the GCHD retained the services of Erdman Anthony a bridge design firm that is on a list preapproved by Greene County. Staff from Erdman Anthony conducted site surveys, as well as produced the final design and specifications for the culvert. The GCSWCD developed and applied for the necessary permits.

In designing a replacement culvert, the engineers had to work with constraints on its size due to the depth that was available under the road fill as well as the width of the stream channel. The culvert is located in an area that only allows for approximately 2' of fill above the existing culvert height thus limiting placement of a taller culvert. In addition, the width of the channel at the culvert also limited the width of the replacement as the goal was to not create an over widened condition above or below the culvert which would have had significant impacts on sediment transport and diminished the value of the replacement. Based on these factors, a new culvert with a dimension of 14'x6' inside dimension was selected. This allowed the culvert to be placed within the existing road fill with adequate cover and did not result in a channel width that would be unstable. The culvert was also designed such that the bottom 1' would be below grade, allowing for a final opening of 14'x5' with 1' of gravel allowed to accumulate in the bottom to create a natural substrate.

In addition to the main culvert replacement, the GCSWCD and GCHD worked together to install a set of floodplain drains. At this location, the road fill for CRT 13A creates a dam across the floodplain, On flooding events, the stream first leaves its right bank and spills over onto an adjoining low floodplain. Movement of water to this floodplain is also facilitated by an older berm that is built up along the left bank to protect the neighboring homes. To allow more effective drainage from the floodplain, two (2) 24" culverts were placed together under the road fill. These floodplain drain culverts were placed on a very flat slope to allow for their invert to be high on the banks of the tributary on the other side of the road. Placing the culverts at this location will keep them above the water surface elevation when the Schoharie is under flood stage and backing up into the tributary.

5.0 Project Implementation

The project was undertaken in a series of stages with work completed by the in-house manpower and equipment from the GCSWCD and GCHD as well as outside contractors. First, manpower and equipment from the GCHD installed the floodplain drains as planned. The GCHD provided the equipment, manpower and materials, both culverts and backfill, to complete this task. Next, the GCHD undertook demolition and removal of the existing culvert in preparation for a private contractor who would prepare the culvert base and set the culvert.

The GCHD used its system of pre-approved vendors to seek competitive prices on supplying the culvert components, The county uses a pre-approved list system to expedite selection of bridge engineers, manufacturers as well as construction contractors. The pre-approval process allows the GCHD to pre-qualify vendors and allows the county to seek three written quotes for appropriate vendors on the list. The list is developed annually based on an open solicitation to interested parties. In this case, Rotondo Precast of Avon Ct was the low price, supplying the culvert and associated components for a price of \$66,653.

The GCHD also used its system of pre-approved bridge contractors to obtain three written quotes for installation of the main culvert to include final excavation and preparing the gravel base. The Contractor was also responsible for setting the precast concrete culvert sections. I. & O.A. Slutzky of Hunter was selected as the contractor for setting the culvert at a cost of \$52,525.

Prior to the work being done to set the culvert, it was necessary to reset several power poles and relocate electrical, phone and cable main lines as well as local services. Relocation of these utilities was necessary to meet safety criteria for crane operation.. This work was coordinated by the GCHD and was done at no cost to the project. Once the contractor completed installation of the culvert sections, the project was turned back to the GCHD which was responsible for back filling of the culvert, restoration of the road and installation of guiderails.

During the project, the GCSWCD was responsible for site dewatering as well as sediment and erosion control. While the channel was essentially dry in regards to surface flow during much of the project, there was significant groundwater encountered once the old culvert was removed and the excavation for the new, larger culvert started. The GCSWCD used two (2) 6" electric pumps and a generator to intercept clean water above the excavation and pump it to a safe location below the work.

In addition, a 3" gasoline powered pump was used during construction hours to help keep the excavation dewatered and to handle sediment laden water. Sediment control was handled by construction of a series of settling basins within the stream channel down stream of the culvert. Initially, sediment was handled by pumping to a wooded area between the tributary and the Schoharie Creek but there was insufficient herbaceous cover as well as a very limited area and problems occurred with a turbid discharge to the Schoharie. The GCSWCD adapted the sediment control plan to incorporate a series of settling basins that were effective and allowed the work to proceed,.

During construction, the only problem encountered was the presence of shallow bedrock. This required bringing in a large excavator with a ram and required just over a week to excavate sufficient bedrock to allow placement of the culvert. This work resulted in a contract increase in the amount of \$14,858.

6.0 Vegetation

Upon completion of the culvert, the GCSWCD used its own hydro seeder to revegetate all disturbed areas. In addition, approximately 30 trees and shrubs as well as 125 willow tublings were planted both above and below the culvert. In the spring of 2008, the GCSWCD will return and plant additional trees and shrubs as well as replace any plants that do not survive the winter.

7.0 Monitoring

The monitoring plan for this project is fairly simple and will be based on making routine observation as well as observations under flood conditions. While the final monitoring plan has to be decided, it is expected that activities would include;

- Making site visits under a range of flood events to observe the culvert and floodplain drain function.
- Routine visits to monitor the effective growth of plantings
- Observations to insure the culvert invert maintains a natural gravel cover
- Observations for channel changes above and below the structure to include erosion, sedimentation or both.

8.0 Project Costs

The project was conducted as a cost-share between the GCSWCD/NYCDEP and the GCHD. While the NYCDEP provided the bulk of the funding via the Schoharie contract, the GCHD also contributed significant cash as well as force account resources. While final bills and expenses are being being processed at the time of this report, the following is a breakdown of the project costs.

A. NYCDEP Funded

Engineering	\$12,995
Concrete Culvert	\$66,653
Rail and Bridge Rail Posts	\$10,821
Contracted services	\$52,525
Dewatering (approximate)	\$15,000
Plantings	<u>\$ 2,500</u>
Total	\$160,494

B. Greene County Highway Funded

Floodplain Drawings	\$ 2,081
Change order for bedrock removal	\$14,858
Hoe-ram rental	\$ 2,100
Approach guiderail	\$ 8,905
Stone backfill	\$ 3,000
Guiderail contractor	\$ 1,950
Concrete	\$ 1,500
Blacktop	\$ 3,200
Compaction equipment rental	\$ 500
Force Account Labor/Equipment (Est)	<u>\$20,000</u>
Total	\$58,094

9.0 Next Steps

In addition to the monitoring as described above, in 2008 the GCSWCD and NYCDEP will continue to work in the immediate area on additional streamside plantings and the placement of an educational kiosk at the state parking area nearby. In 2007, some of these sites were prepared by undertaking herbicide treatment of blocks of Japanese knotweed using the stem injection method. Japanese knotweed (*Fallopia japonica*) was treated with glyphosate (Glypro) through an injection method with the purpose removing limited stands of *Fallopia japonica* prior to replanting with native vegetation as part of the riparian restoration project.

County Route 13A Culvert Replacement Project



County Route 13A Culvert to be replaced



2006 aerial photograph of County Route 13A culvert replacement project site

**Greene County Route 13A Culvert Upgrade Project
Photo Page 1: Preconstruction**



Photo 1: View looking downstream at entrance to existing concrete culvert. Note failed headwall.



Photo 2: View looking downstream at entrance to existing concrete culvert.

Greene County Route 13A Culvert Upgrade Project
Photo Page 2: Floodplain Drains



Photo 3: Double 24" CMP floodplain drains installed under road fill.



Photo 4: Laid up headwall on outlet of floodplain drains. Invert has been set high on the bank to allow discharge at flood stage.

**Greene County Route 13A Culvert Upgrade Project
Photo Page 4: Completed Culvert**



Photo 11: View looking downstream from new culvert



Photo 12: Light rock on left bank below outfall, note trees and shrubs planted along the banks



Photo 13: Culvert outfall and small rock on left bank. Trees, shrubs and willows were planted for long term stability

**Greene County Route 13A Culvert Upgrade Project
Photo Page 3: Construction**



Photo 5: Old culvert removed and ready for excavation and preparation of the culvert base.



Photo 6: Temporary settling basin constructed in the downstream channel to treat sediment laden water.



Photo 7: Footer and gravel base being prepared for placement of the culvert.



Photo 8: Culvert sections being set and leveled on tamped stone base,



Photo 9: A large crane was needed to lift and set sections, power lines needed to be relocated to facilitate setting of the sections.

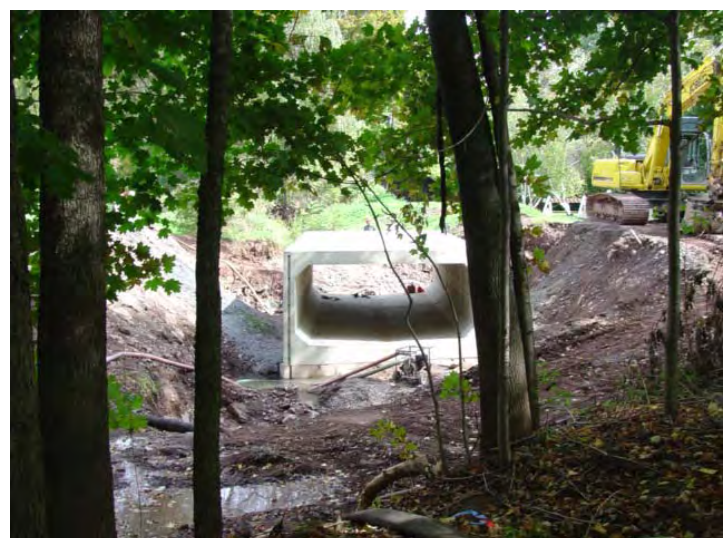


Photo 10: Culvert in place before backfill, looking upstream

**Greene County Route 13A Culvert Upgrade Project
Photo Page 3: Construction**



Photo 5: Old culvert removed and ready for excavation and preparation of the culvert base.



Photo 6: Temporary settling basin constructed in the down-stream channel to treat sediment laden water.



Photo 7: Footer and gravel base being prepared for placement of the culvert.



Photo 8: Culvert sections being set and leveled on tamped stone base,



Photo 9: A large crane was needed to lift and set sections, power lines needed to be relocated to facilitate setting of the sections.



Photo 10: Culvert in place before backfill, looking upstream

Greene County Route 13A Culvert Upgrade Project
Photo Page 4: Completed Culvert



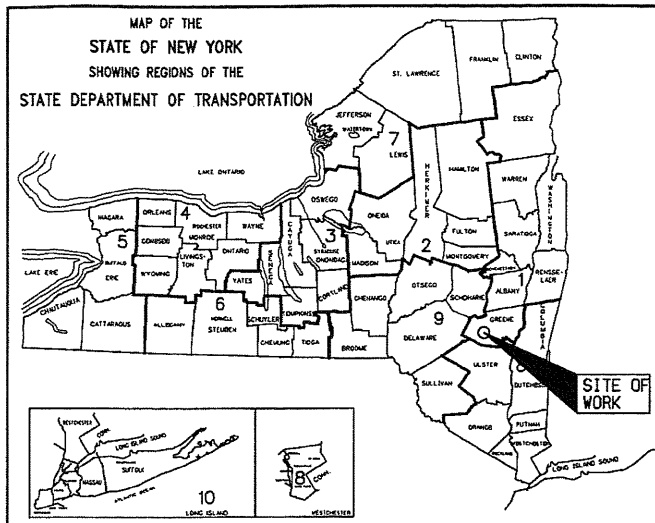
Photo 11: View looking downstream from new culvert



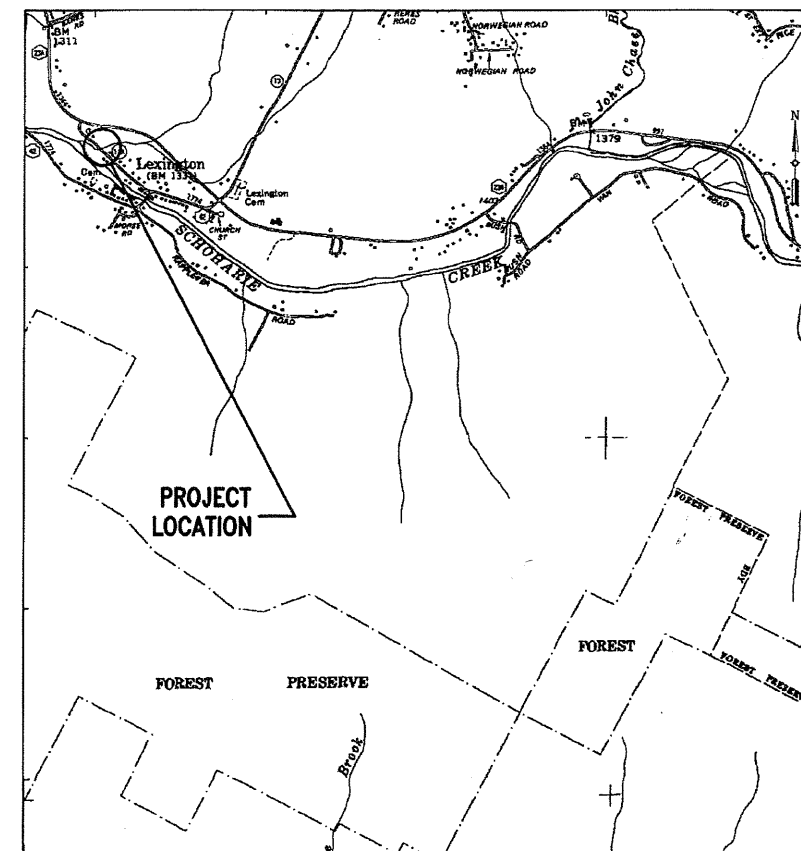
Photo 12: Light rock on left bank below outfall, note trees and shrubs planted along the banks



Photo 13: Culvert outfall and small rock on left bank. Trees, shrubs and willows were planted for long term stability



CONTRACT DRAWINGS FOR
**CR13A OVER
 TRIBUTARY OF
 SCHOHARIE CREEK
 CULVERT REPLACEMENT**



LOCATION PLAN
 N.T.S.

DRAWING INDEX		
SHEET NUMBER	DRAWING NUMBER	TITLE
1	T-1	TITLE SHEET
2	GN-1	GENERAL NOTES AND SURVEY DATA
3	C-1	PLAN & SECTIONS
4	C-2	PRECAST BOX CULVERT EXCAVATION & EMBANKMENT DETAILS
5	C-3	PRECAST BOX CULVERT DETAILS
6	C-4	RAILING DETAILS

GREENE COUNTY SOIL AND WATER
 CONSERVATION DISTRICT

RENE VAN SCHAACK
 EXECUTIVE DIRECTOR

JUNE 2007

PREPARED AND RECOMMENDED BY:

ERDMAN ANTHONY & ASSOCIATES, INC.
 MATTHEW T. SMULLEN, P.E.
 N.Y.S. LICENSE NO. 080043

DATE

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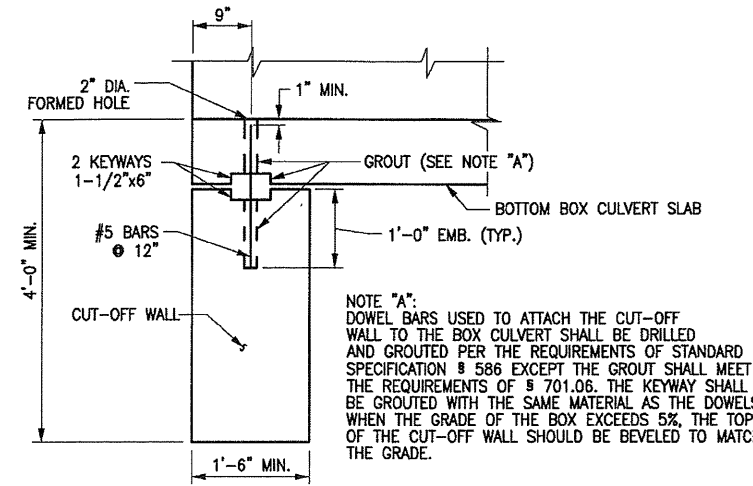
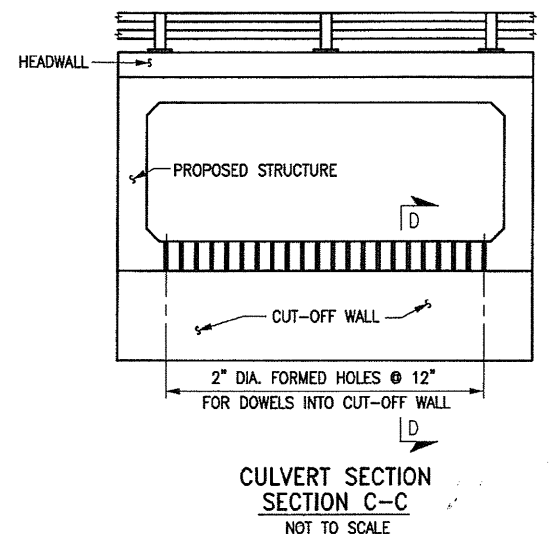
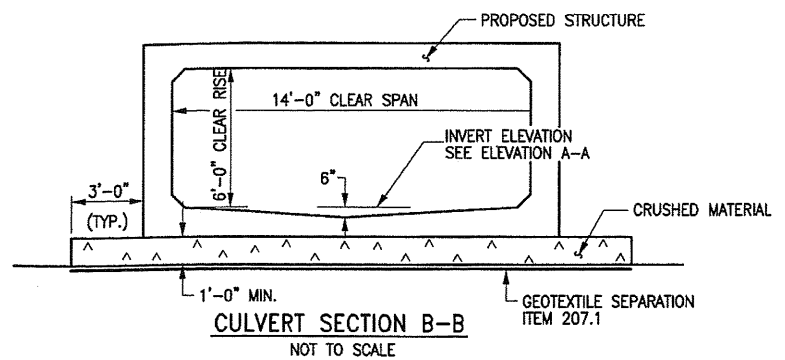
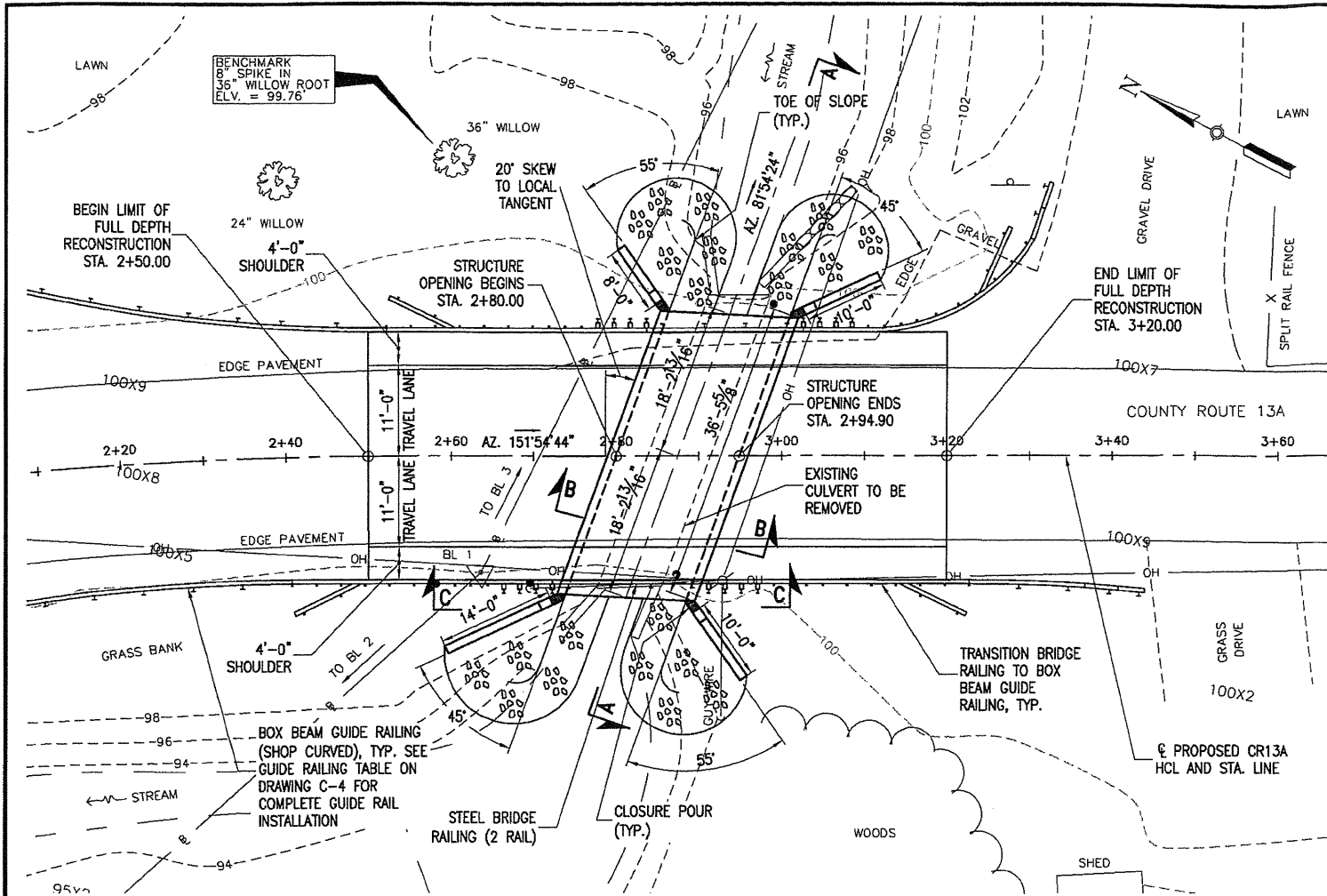
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PROJECT NAME:
**CR13A OVER
 TRIBUTARY OF
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TITLE SHEET

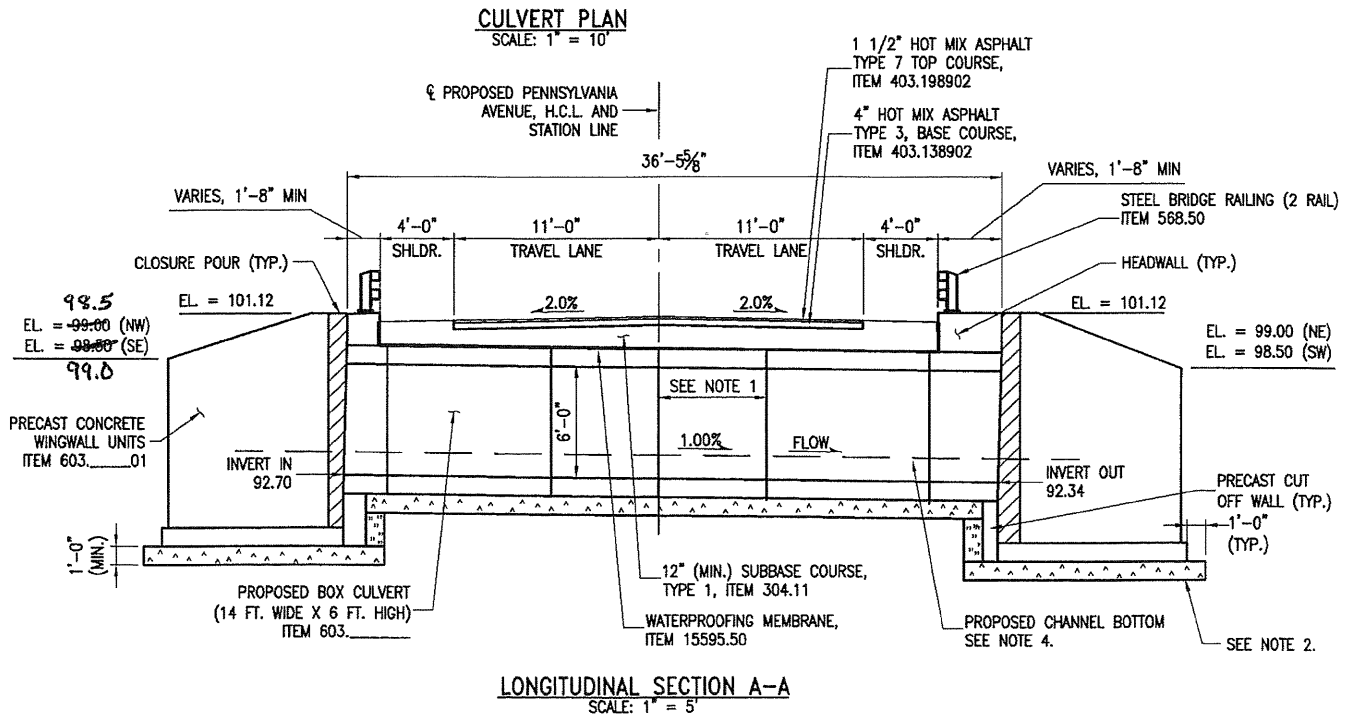
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DES. BY: LMY	DR. BY: JAM
CK'D BY: MTS	EA PROJ. NO. 1700B.67
SHEET NO. 1 OF 6	DRAWING NO. T-1



GEOTECHNICAL DESIGN DATA	
ALLOWABLE BEARING CAPACITY, ksf	3.0
SOIL UNIT Wt., pcf	125
FRICITION ANGLE, DEG.	33
COEFFICIENT OF SLIDING FRICTION	0.50

- NOTES:
1. THE LENGTH OF EACH CULVERT UNIT SHALL BE DETERMINED BY THE CONTRACTOR. IF STAGED CONSTRUCTION IS EMPLOYED, THE PRECAST BOX CULVERT UNIT LENGTH MUST BE COMPATIBLE WITH STAGING REQUIREMENTS.
 2. PRECAST CUT-OFF WALLS AND WINGWALLS SHALL BE PLACED ON A LEVELING BED OF CRUSHED MATERIAL MEETING THE REQUIREMENTS OF MATERIAL DESIGNATION 703-0201, 703-0202 OR 703-0204 WITH A PRIMARY SIZE DESIGNATION OF 2. AFTER PLACING AND LEVELING, THE AREAS BENEATH AND BEHIND THE UNITS SHALL BE GROUTED WITH FLOWABLE LOW STRENGTH MATERIAL MEETING THE REQUIREMENTS OF SECTION 701-20.
 3. THE PRECAST CONCRETE BOX CULVERT AND PRECAST CONCRETE WINGWALL UNITS SHALL BE DESIGNED BY THE FABRICATOR. DESIGN SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL DESIGN DATA SHOWN ON THIS DRAWING.
 4. THE CONTRACTOR SHALL NOT PLACE FILL MATERIAL INSIDE THE CULVERT. THE PROPOSED CHANNEL BOTTOM SHALL BE ALLOWED TO FORM NATURALLY OVER TIME BY THE AGGREGATION OF NATIVE STREAM MATERIAL.
 5. HIGH VOLTAGE ELECTRICAL LINES ARE IN PROXIMITY TO THIS BRIDGE. REFER TO THE ELECTRICAL SAFETY NOTE CONTAINED IN THE CONTRACT PROPOSAL FOR SPECIAL CONTRACTOR SAFETY REQUIREMENTS.

- LEGEND
- STONE FILLING (HEAVY), ITEM 620.05
 - CRUSHED MATERIAL MEETING THE REQUIREMENTS OF MATERIAL DESIGNATION 703-0201, 703-0202 OR 703-0204 WITH A PRIMARY SIZE DESIGNATION OF 2, ITEM 623.12
 - FLOWABLE LOW STRENGTH MATERIAL MEETING THE REQUIREMENTS OF SECTION 701-20



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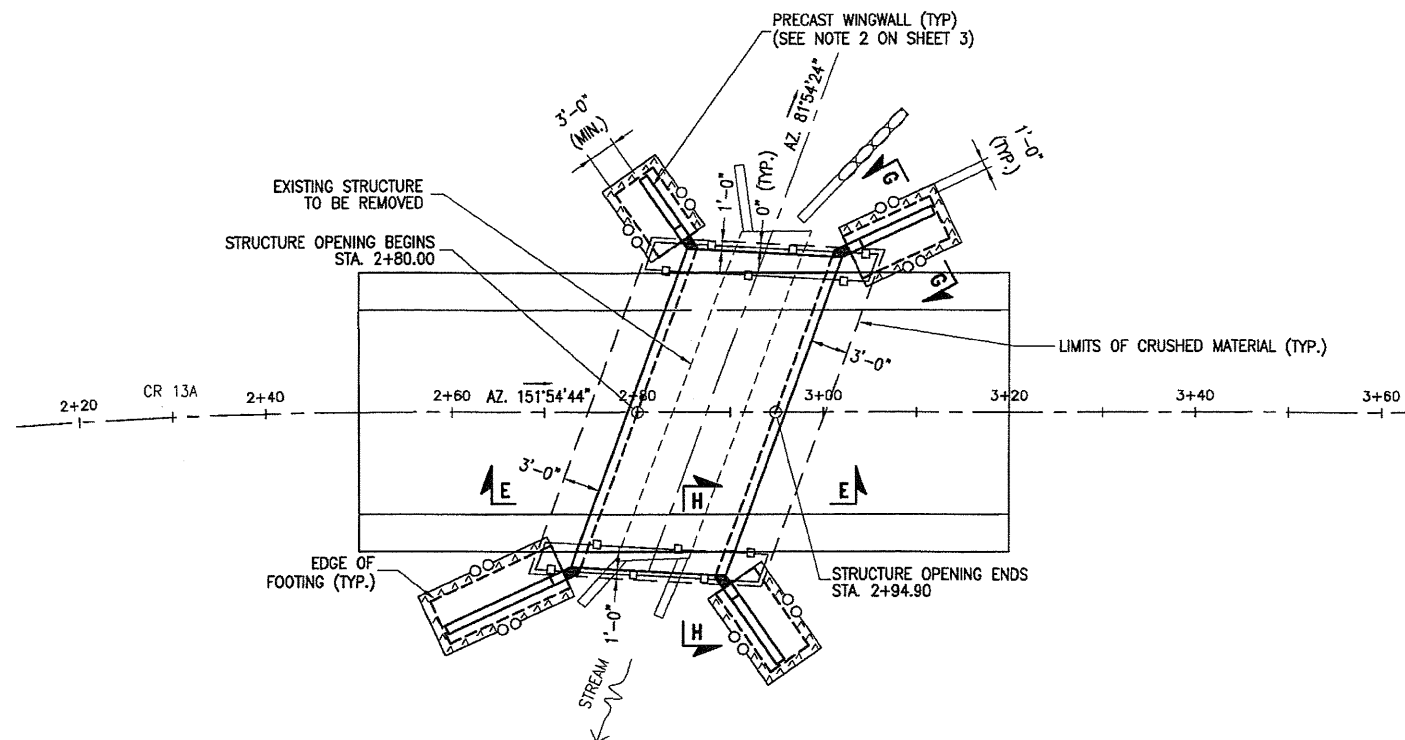
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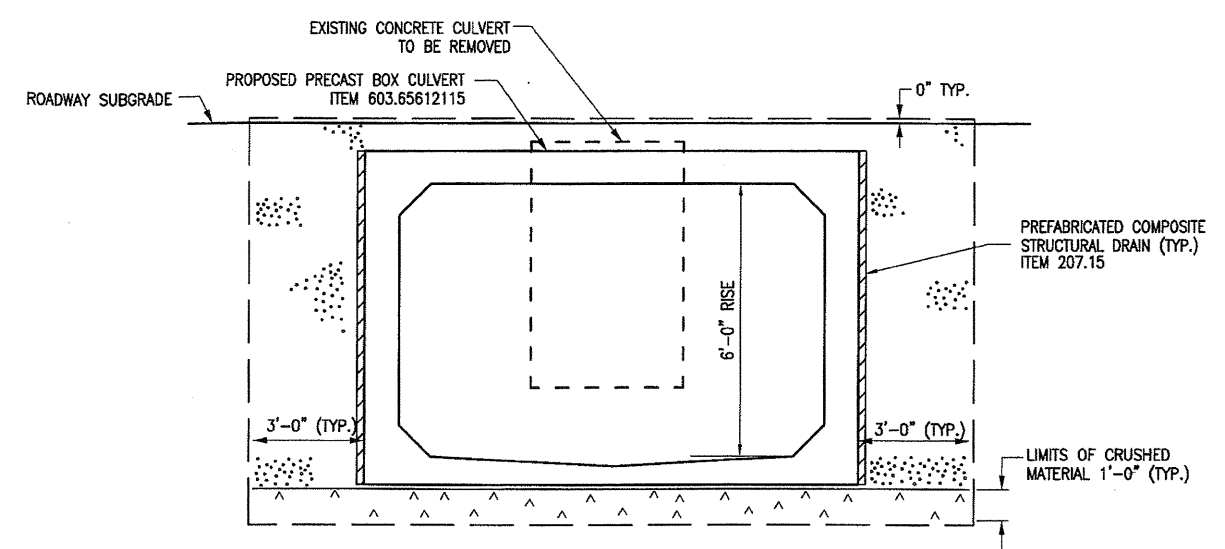
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PLAN & SECTIONS

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SHEET NO. 3 OF 6	DRAWING NO. C-1

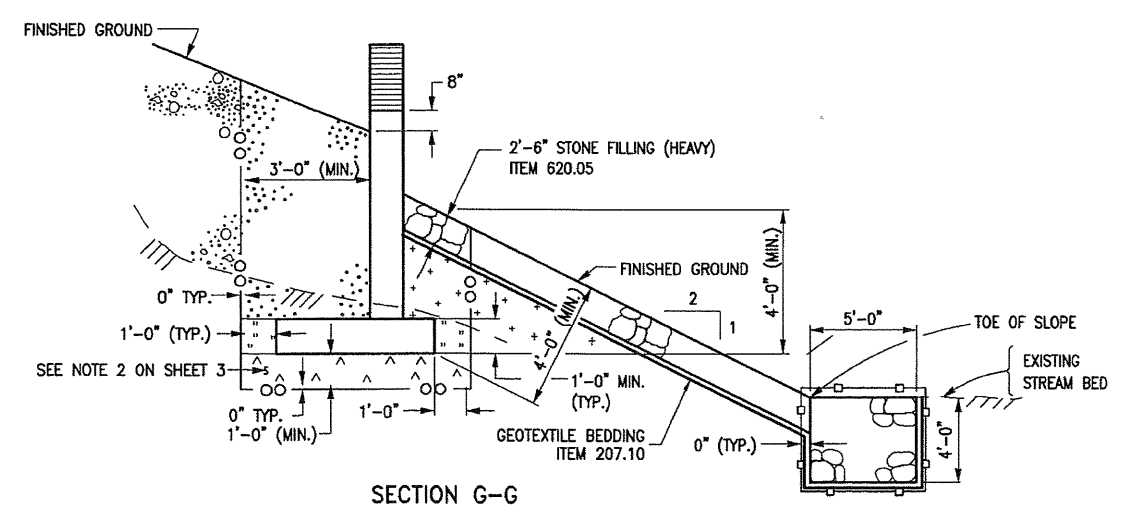


EXCAVATION PLAN
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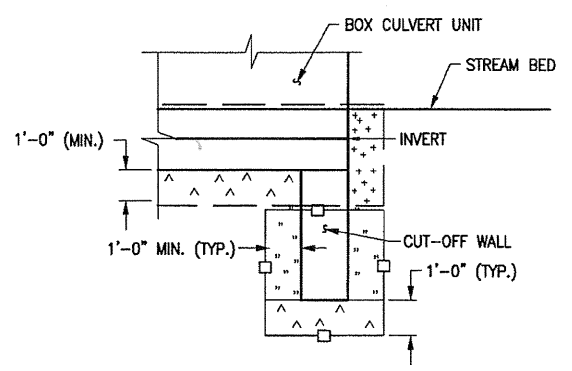
NOTE:
STONE FILL (HEAVY) NOT SHOWN FOR CLARITY.
SEE DRAWING C-1



SECTION E-E
NOT TO SCALE



SECTION G-G
NOT TO SCALE



SECTION H-H
NOT TO SCALE

LEGEND

- EXISTING GROUND SURFACE
- SELECT STRUCTURE FILL (ITEM 203.21 M), COMPACTED TO 95% OF STANDARD PROCTOR MAXIMUM DENSITY (BRIDGE ESTIMATE)
- HIGHWAY EMBANKMENT MATERIAL (HIGHWAY ESTIMATE)
- BACKFILL WITH SUITABLE EXCAVATED MATERIAL AS PROVIDED FOR UNDER ITEM 206.01 M, STRUCTURE EXCAVATION (BRIDGE ESTIMATE) OR 206.02 M (TRENCH & CULVERT EXCAVATION)
- CRUSHED MATERIAL MEETING THE REQUIREMENTS OF MATERIAL DESIGNATION 703-0201, 703-0202 OR 703-0204 WITH A PRIMARY SIZE DESIGNATION OF 2
- FLOWABLE LOW STRENGTH MATERIAL MEETING THE REQUIREMENTS OF SECTION 701-20
- AREA ENCLOSED WITHIN THESE LINES DESIGNATES PAYMENT LINES FOR STRUCTURE EXCAVATION (ITEM 206.01 M - BRIDGE ESTIMATE)
- AREA ENCLOSED WITHIN THESE LINES DESIGNATES PAYMENT LINES FOR TRENCH & CULVERT EXCAVATION (ITEM 206.02 M)
- WITHIN THESE LINES, EXCAVATE IN ACCORDANCE WITH ITEM 206.01M STRUCTURE EXCAVATION AND BACKFILL IN ACCORDANCE WITH ITEM 203.21 SELECT STRUCTURE FILL, ITEM 206.01M SUITABLE EXCAVATED MATERIAL AND CRUSHED MATERIAL MEETING THE REQUIREMENTS OF MATERIAL DESIGNATION 703-0201, 703-0202 OR 703-0204 WITH A PRIMARY SIZE DESIGNATION OF 2. ALL OF THESE ITEMS ARE INCLUDED IN THE PRICE BID FOR THE WINGWALL ITEM.

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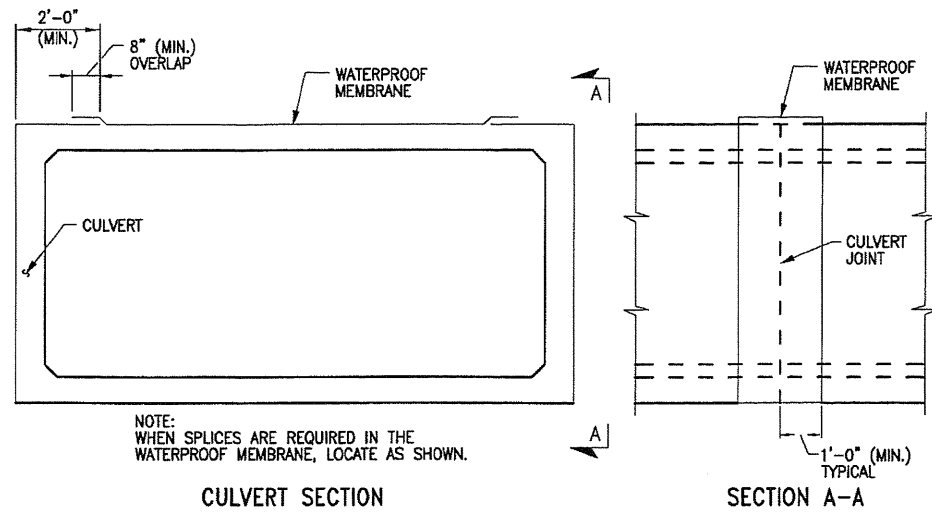
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PRECAST BOX CULVERT EXCAVATION & EMBANKMENT DETAILS

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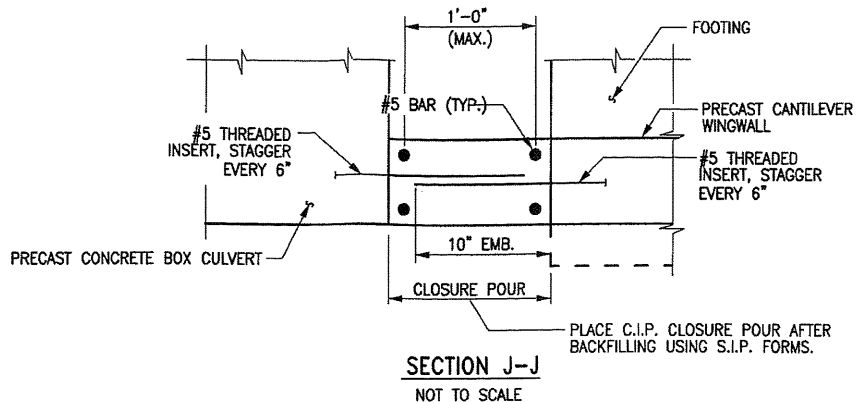


NOTE: WHEN SPLICES ARE REQUIRED IN THE WATERPROOF MEMBRANE, LOCATE AS SHOWN.

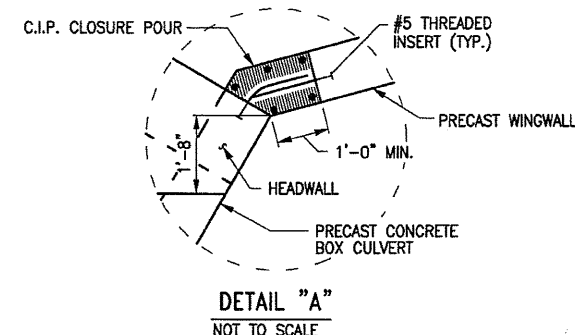
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SECTION A-A

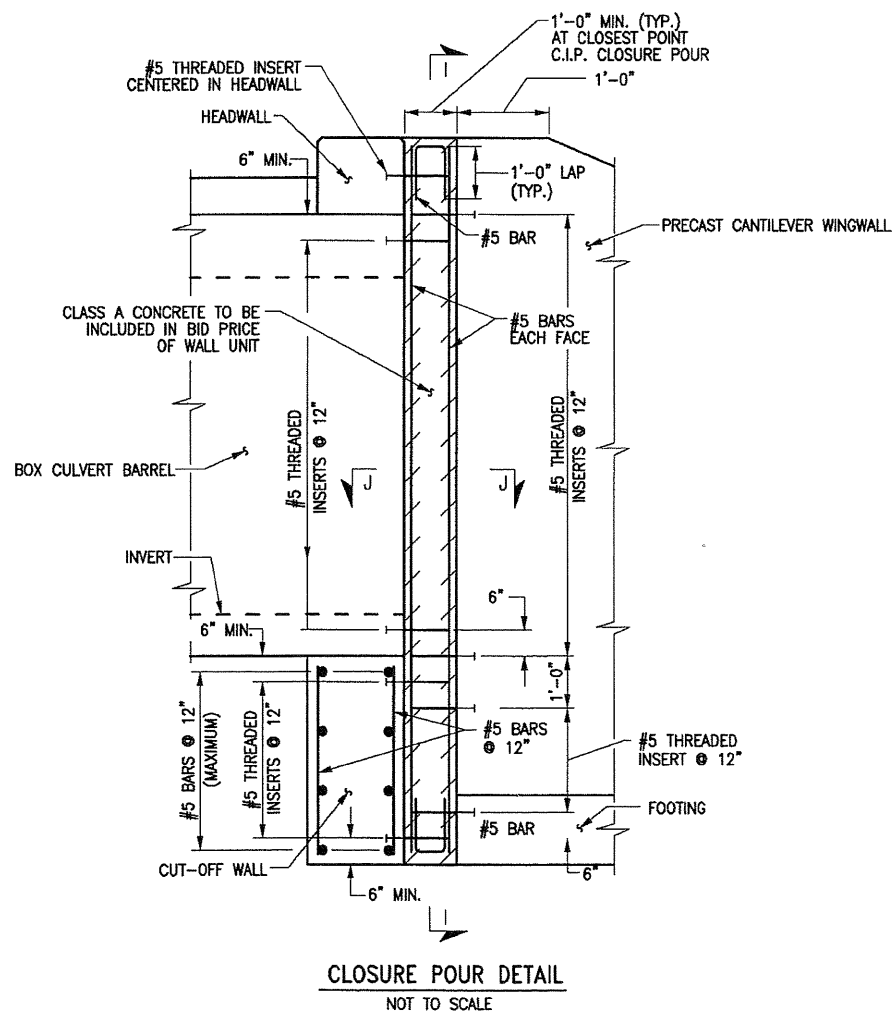
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SPLICE DETAIL
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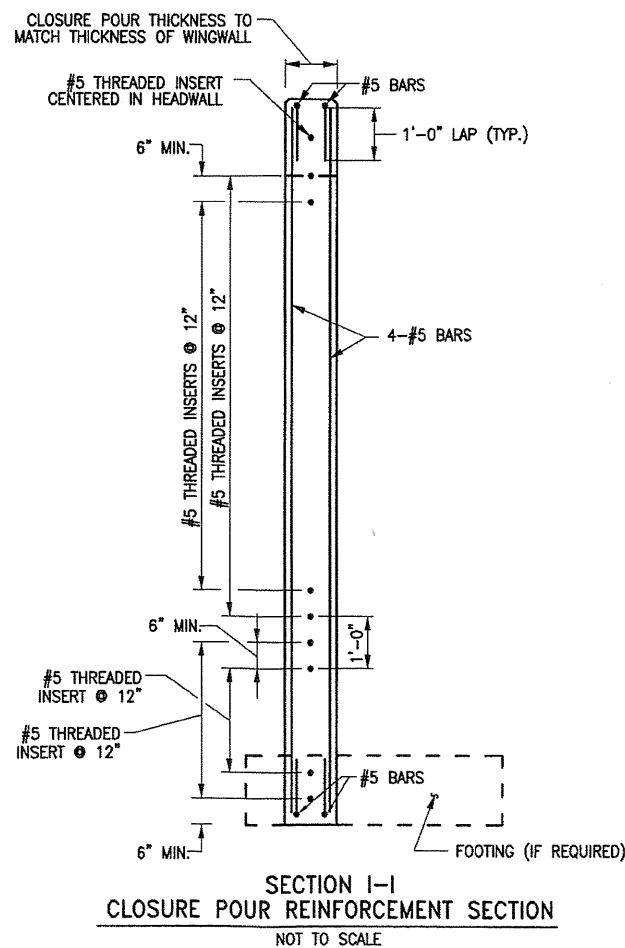
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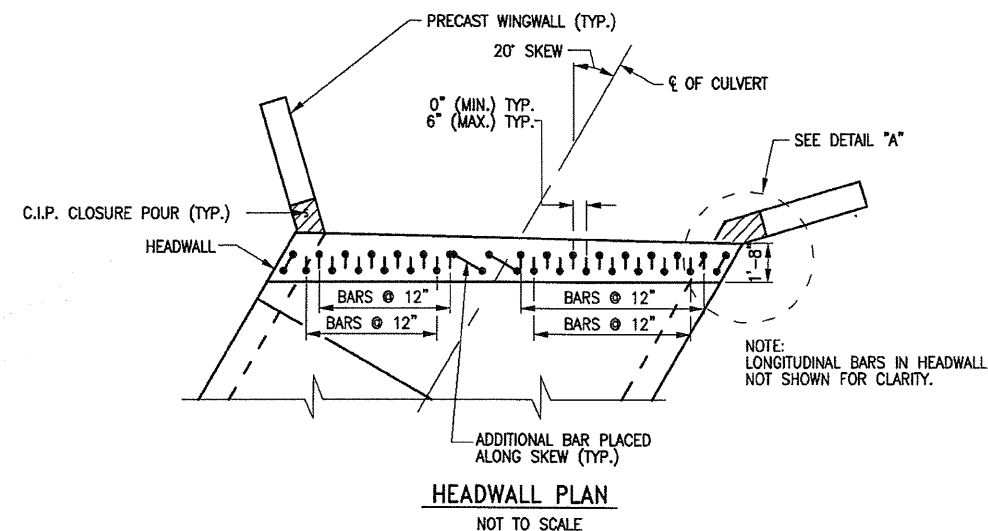
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CLOSURE POUR DETAIL
NOT TO SCALE



SECTION I-I
CLOSURE POUR REINFORCEMENT SECTION
NOT TO SCALE



HEADWALL PLAN
NOT TO SCALE

NOTES:

1. ACTUAL WALL AND SLAB THICKNESS, REINFORCEMENT SIZE AND SPACINGS TO BE DETERMINED BY FABRICATOR'S ENGINEER.
2. ALL REINFORCEMENT COVER ON PRECAST UNITS SHALL BE 0'-1" UNLESS OTHERWISE NOTED.
3. THE RAILING POST ANCHORAGE MUST BE A MINIMUM OF 9" FROM ANY JOINT BETWEEN CULVERT SECTIONS. IF NECESSARY, AN ADDITIONAL RAILING POST MAY BE INSERTED, KEEPING THE POST SPACINGS EQUAL.

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CLIENT:

GREENE COUNTY
SOIL AND WATER
CONSERVATION DISTRICT

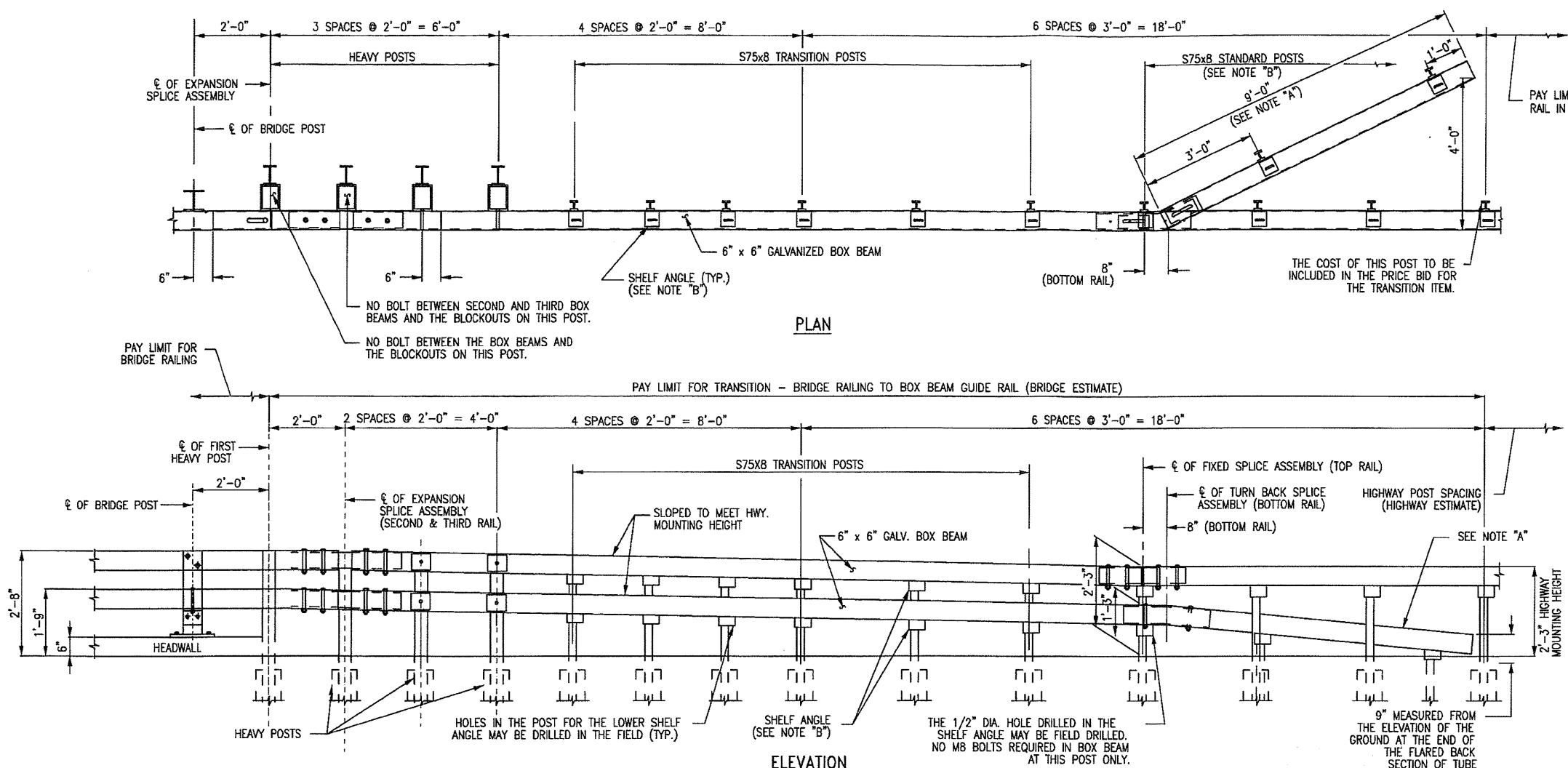
PROJECT NAME:

CR13A OVER
TRIBUTARY OF
SCHOHARIE CREEK

DRAWING TITLE:

PRECAST BOX CULVERT
DETAILS

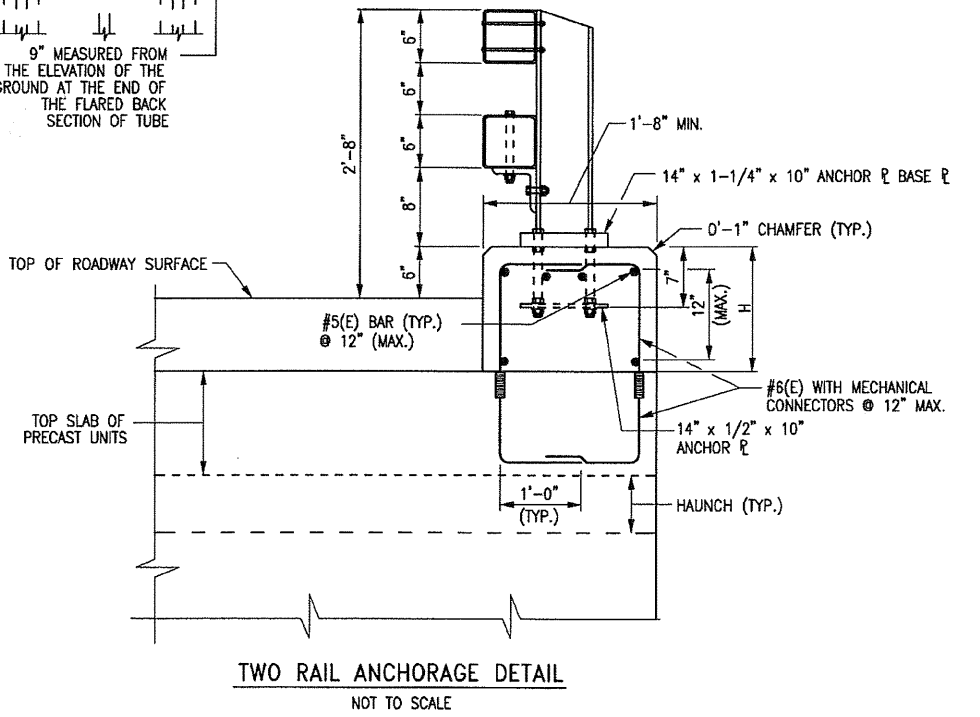
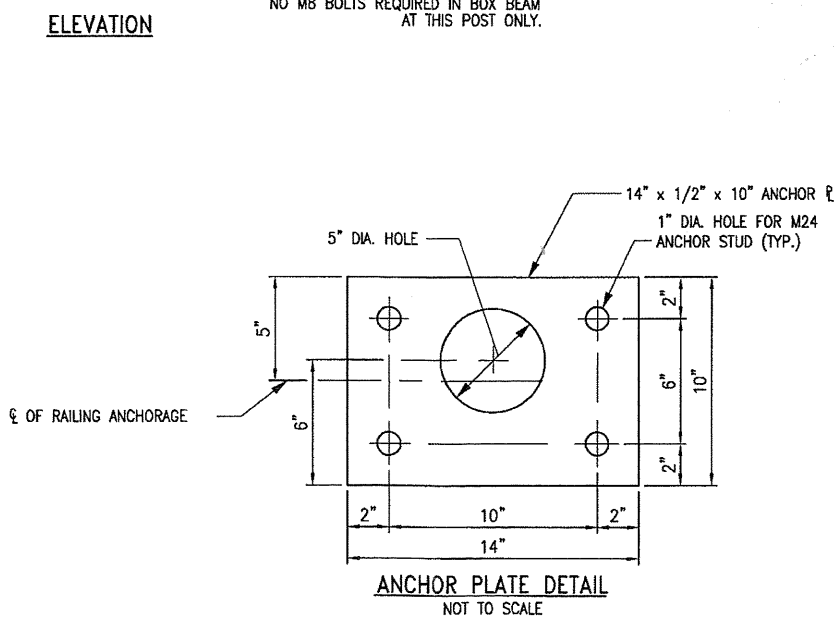
SCALE: AS NOTED	DATE: JUNE 2007
DES. BY: LMY	DR. BY: JAM
CK'D BY: MTS	EAM PROJ. NO. 1700B.67
SHEET NO. 5 OF 6	DRAWING NO. C-3



NOTES:

- NOTE "A":
THE COST OF THE POSTS, SPLICE TUBE AND RAIL FOR THE LOWER TUBE FLARE SECTION IS INCLUDED IN THE PRICE BID FOR THE TRANSITION ITEM.
- NOTE "B":
SEE TYPICAL RAIL TO POST CONNECTION DETAIL ON CURRENT HIGHWAY STANDARD SHEET TITLED "BOX BEAM GUIDE RAIL".
- NOTE "C":
PAVE THE VEGETATION CONTROL STRIP WITH THE SAME MATERIAL AS IN THE PAVED SHOULDER. PAYMENT WILL BE MADE UNDER THE PAVED SHOULDER ITEM.
- DETAILS ON THE DRAWINGS LABELED AS "NOT TO SCALE" ARE INTENTIONALLY DRAWN NOT TO SCALE FOR VISUAL CLARITY. ALL OTHER DETAILS, FOR WHICH NO SCALE IS SHOWN, ARE DRAWN PROPORTIONAL AND ARE FULLY DIMENSIONED.

GUIDE RAIL TABLE							
℄ STA TO ℄ STA	SIDE	568.50 (ft)	568.70		606.100001		606.1201 (EA)
			LENGTH (ft)	RADIUS (ft)	LENGTH (ft)	RADIUS (ft)	
STA: 1+81.36 TO STA: 1+88.81	RT	-	-	-	-	-	1
STA: 1+88.81 TO STA: 2+40.44	RT	-	-	-	50.00	205.25	-
STA: 2+40.44 TO STA: 2+72.27	RT	-	31.50	-	-	-	-
STA: 2+72.27 TO STA: 2+91.21	RT	18.94	-	-	-	-	-
STA: 2+91.21 TO STA: 3+22.71	RT	-	31.50	-	-	-	-
STA: 3+22.71 TO STA: 3+36.77	RT	-	-	-	14.00	205.25	-
STA: 3+36.77 TO STA: 3+43.96	RT	-	-	-	-	-	1
STA: 1+98.16 TO STA: 2+04.67	LT	-	-	-	-	-	1
STA: 2+04.67 TO STA: 2+52.15	LT	-	-	-	50.00	205.25	-
STA: 2+52.15 TO STA: 2+83.65	LT	-	31.50	-	-	-	-
STA: 2+83.65 TO STA: 3+02.59	LT	18.94	-	-	-	-	-
STA: 3+02.59 TO STA: 3+30.59	LT	-	31.50	23.00	-	-	-
STA: 3+30.59 TO STA: 3+32.91	LT	-	-	-	-	-	1
TOTAL		37.88	126.00	23.00	114.00	615.75	4



FILENAME - N:\1700B-71-MIS\Drawings\Construction\1700B71-design.dwg [C-4] May 30, 2007 - 2:20pm McKeough

ERDMAN ANTHONY

Rochester, NY
Buffalo, NY
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Harrisburg, PA
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REVISIONS			
NO.	DESCRIPTION	BY	DATE

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CLIENT:
GREENE COUNTY SOIL AND WATER CONSERVATION DISTRICT

PROJECT NAME:
CR13A OVER TRIBUTARY OF SCHOHARIE CREEK

DRAWING TITLE:
RAILING DETAILS

SCALE: AS NOTED	DATE: JUNE 2007
DES. BY: LMY	DR. BY: JAM
CK'D BY: MTS	EAM PROJ. NO. 1700B.67
SHEET NO. 6 OF 6	DRAWING NO. C-4