That Slope Shouldn't Have Failed

I-77, I-480 Landslide Repair
Cuyahoga County, Ohio

by

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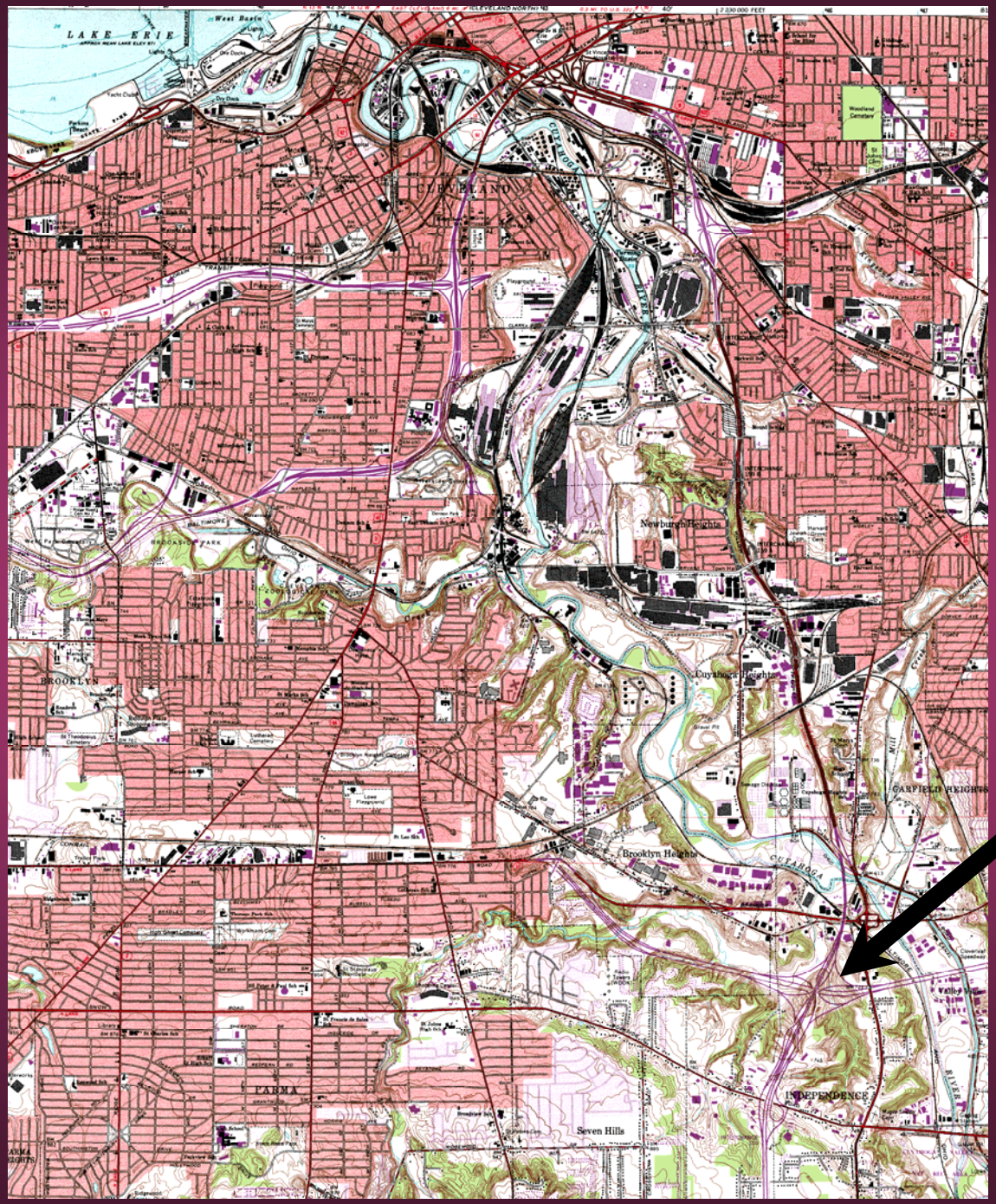
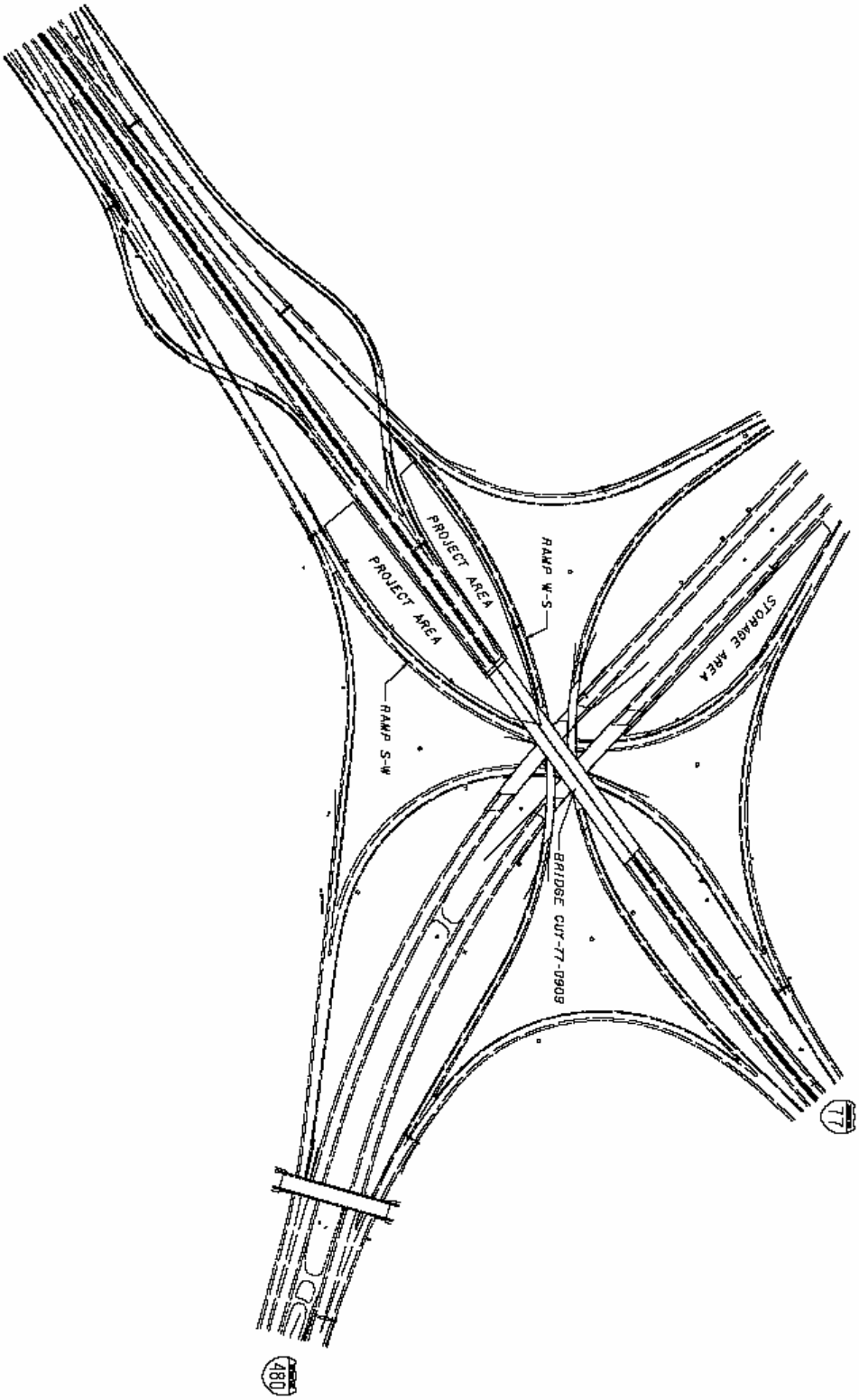
DLZ Ohio



Project Location



2/25	CUY-77-8.97	SCHEMATIC PLAN	0 100' 200' 400' HORIZONTAL SCALE IN FEET

View east along I-480

Interchange Facts

- Interchange constructed in mid 1970's
- I-77 has 2003 ADT of 116,000
- I-480 has 2003 ADT of 174,000
- Tallest embankment roughly 60' high

History

- Failure occurred over a weekend in May 2003 following a period of heavy rain.
- DLZ geotechnical engineers visited the site within two days.
- Informed by District 12 that the slope had failed 10 years previously and had been reconstructed. These plans indicated that the failure had been overexcavated and replaced but a layer of lime had been placed over the entire bottom of the excavation prior to backfilling.


2000. 6. 16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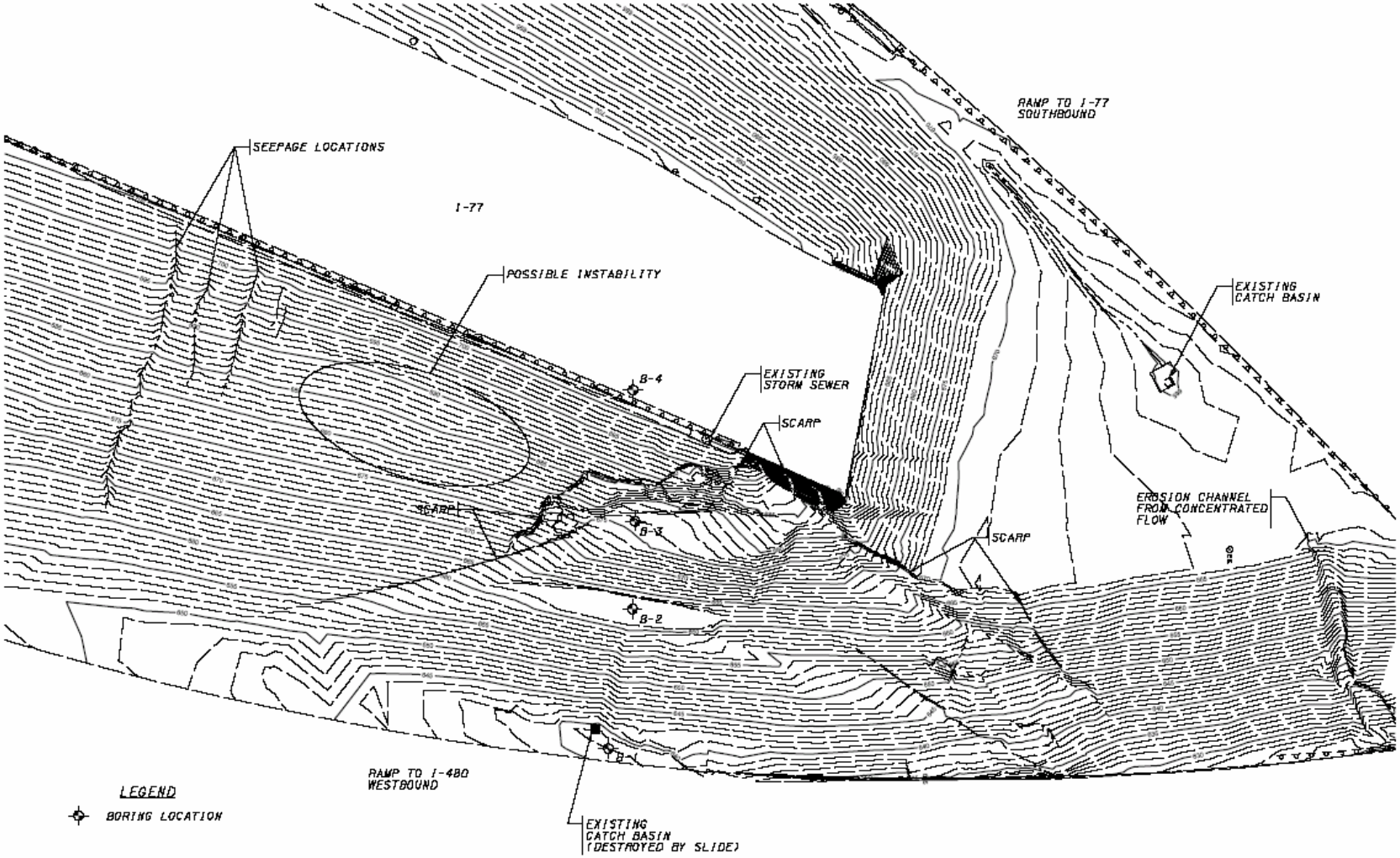
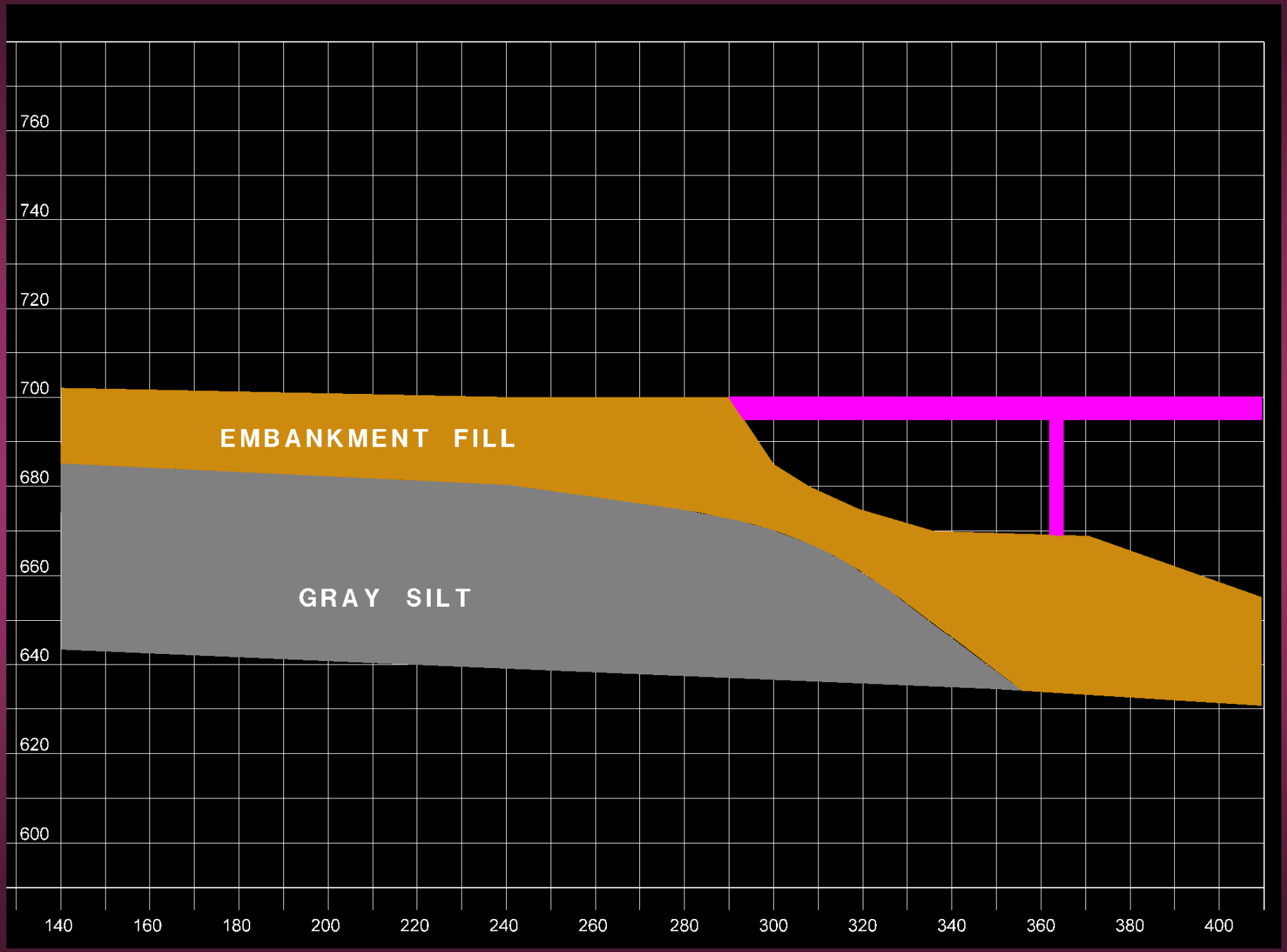
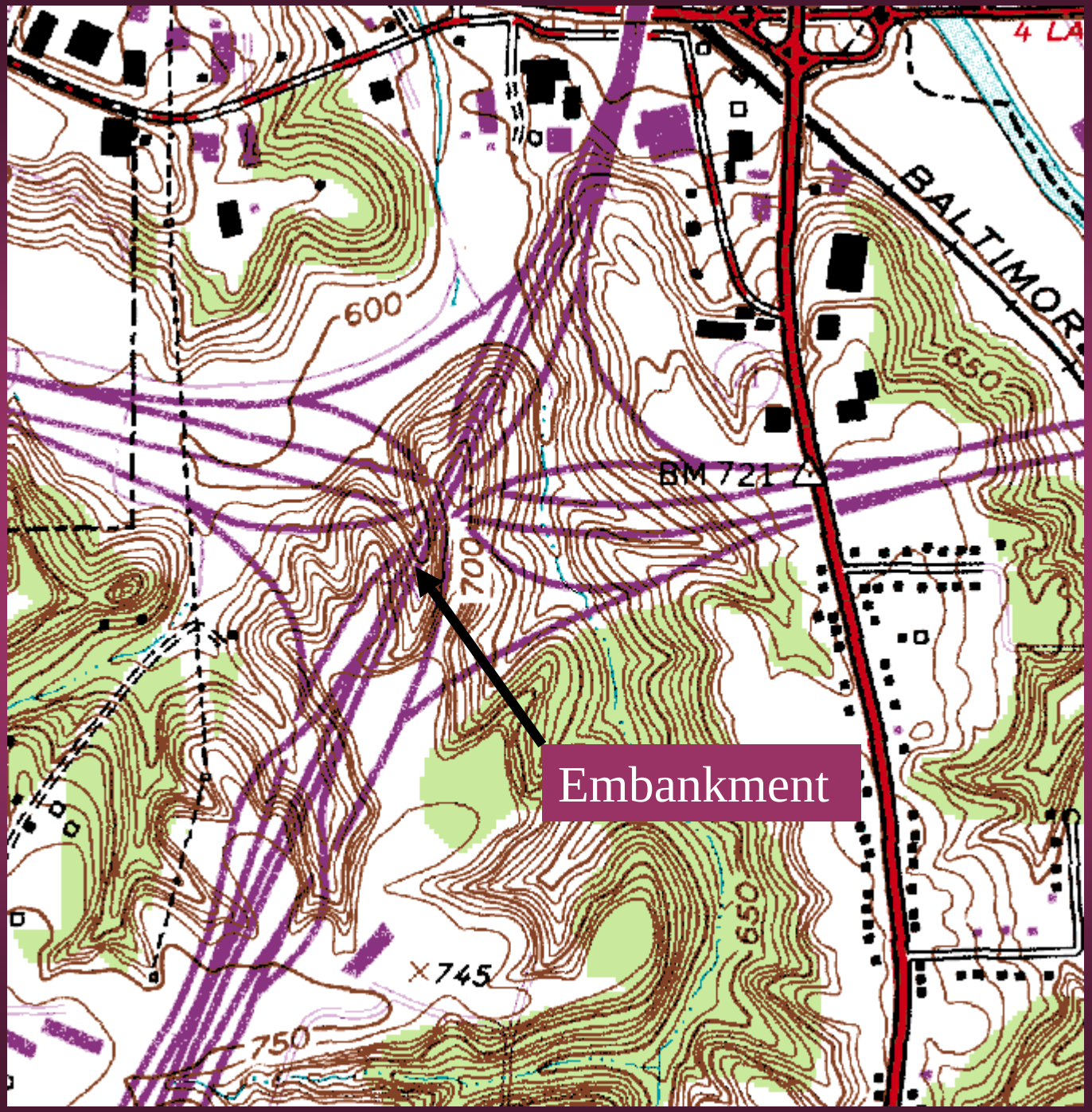

SEEPAGE LOCATIONS
I-77
POSSIBLE INSTABILITY
B-4
EXISTING STORM SEWER
SCARP
SCARP
B-3
B-2
B-1
RAMP TO I-77 SOUTHBOUND
EXISTING CATCH BASIN
EROSION CHANNEL FROM CONCENTRATED FLOW
SCARP
RAMP TO I-480 WESTBOUND
EXISTING CATCH BASIN (DESTROYED BY SLIDE)
LEGEND
BORING LOCATION
N
HORIZONTAL SCALE IN FEET
0
20
40
SITE PLAN
CUY-77-8.97

Findings

- Large slide, 25 feet deep
- Appears to have slid on plane between lime stabilized soil (from previous landslide repair) and untreated soil
- Cause related to seepage entering embankment from poor drainage within the embankment (above the silt) and below the I-77 bridge


In-Situ Conditions
Guardrail
1993 Reconstruction
Cut Slope
B-4
B-3
B-2
B-1
Failure Plane
= 20 degrees
Water Level
740
720
700
680
660
640
620
600
0
20
40
60
80
100
120
140
160
180
200
220


760
740
720
700
680
660
640
620
600
EMBANKMENT FILL
GRAY SILT
140
160
180
200
220
240
260
280
300
320
340
360
380
400


600
650
BM 721
700
650
745
750
Embankment

Stabilization Designs

Remedial Treatments Considered

- Soil nail wall to retain slope
- Drilled shaft walls
- Overexcavation and replacement
- For all of the options, drainage and catch basins along ramp below the slope would need to be replaced and it was recommended that drainage be provided for the top of the slope beneath the bridge.

Remedial Treatments Considered (cont)

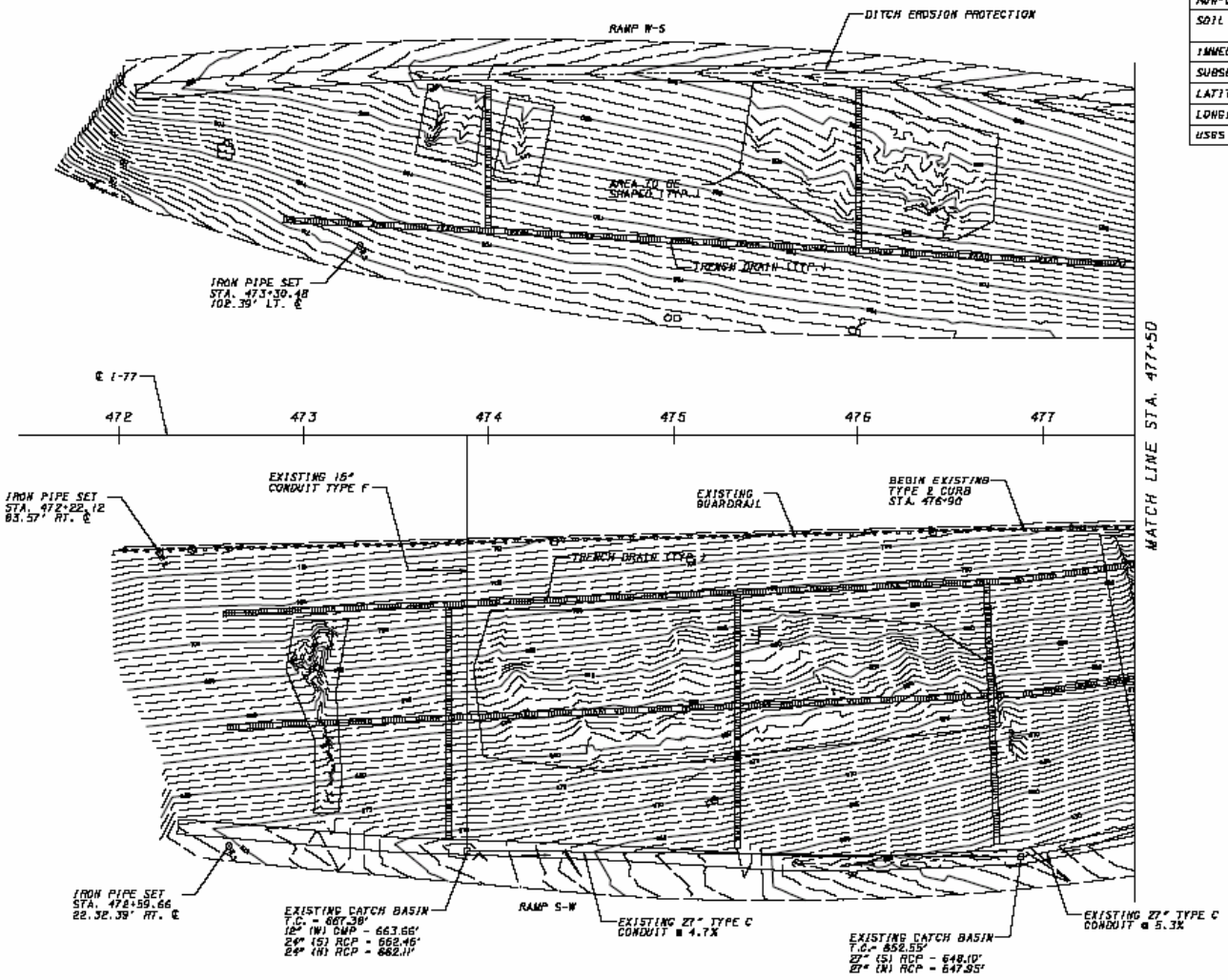
- Soil nail wall to retain slope
  - Performed in-situ
  - Would not require MOT on I-77
  - No drains needed; could be designed for hydrostatic forces
  - Estimated cost: $1.6 M

Remedial Treatments Considered (cont)

- Drilled shaft walls
  - Performed in-situ
  - Would not require MOT on I-77
  - Would require two rows of walls (3' shafts on 6' centers): one along I-77 and one near mid-slope
  - No drains needed; could be designed for hydrostatic forces
  - Estimated cost: $1.5 M

Remedial Treatments Considered (cont)

- Overexcavation and replacement
  - Overexcavate failed material with drainage; install sheetpiles to support I-77 berm
  - Would require MOT on I-77 to install sheetpiles
  - Lateral and finger drains installed at locations of questionable stability and seepage locations
  - Estimated cost: $0.7 M



PROJECT DATA	
TOTAL AREA	7.5 ACRES
AREA TO UNDERGO EXCAVATION, FILLING OR GRADING	5.25 ACRES
RUN-OFF COEFFICIENT FOR SITE	0.75
SOIL DATA	SEE BORING LOG SHEETS
IMMEDIATE RECEIVING WATERS	WEST CREEK TRIBUTARY
SUBSEQUENT RECEIVING WATERS	CUYAHOGA RIVER
LATITUDE	41°24'13"
LONGITUDE	81°38'51"
USGS 7.5' QUADRANGLE	CLEVELAND SOUTH

NOTES

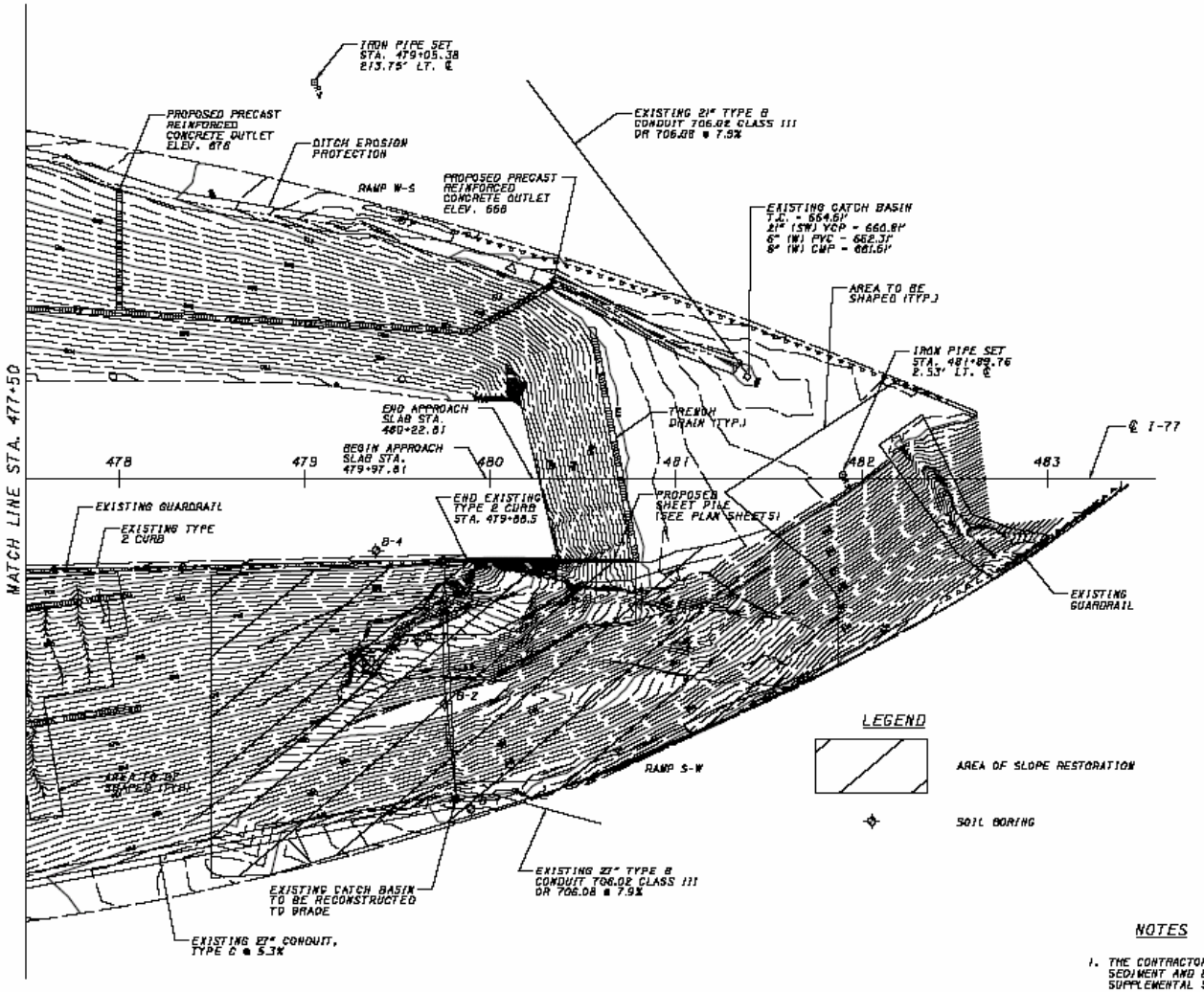
1. THE CONTRACTOR SHALL DEVELOP A TEMPORARY SEDIMENT AND EROSION PLAN IN ACCORDANCE WITH SUPPLEMENTAL SPECIFICATIONS 832 AND 833.
2. THE STORMWATER POLLUTION PREVENTION PLAN SHEETS ARE PROVIDED FOR REFERENCE ONLY.
3. DITCH EROSION PROTECTION SHOWN ON THIS SHEET IS PERMANENT EROSION CONTROL AND IS PAID FOR ON THE PLAN SHEETS.

HORIZONTAL SCALE IN FEET

CALCULATED NAS
DRAWN AEN

STORMWATER POLLUTION PREVENTION PLAN
STA. 471+50 TO STA. 477+50

CUY-77-8.97



LEGEND

AREA OF SLOPE RESTORATION

SOIL BORING

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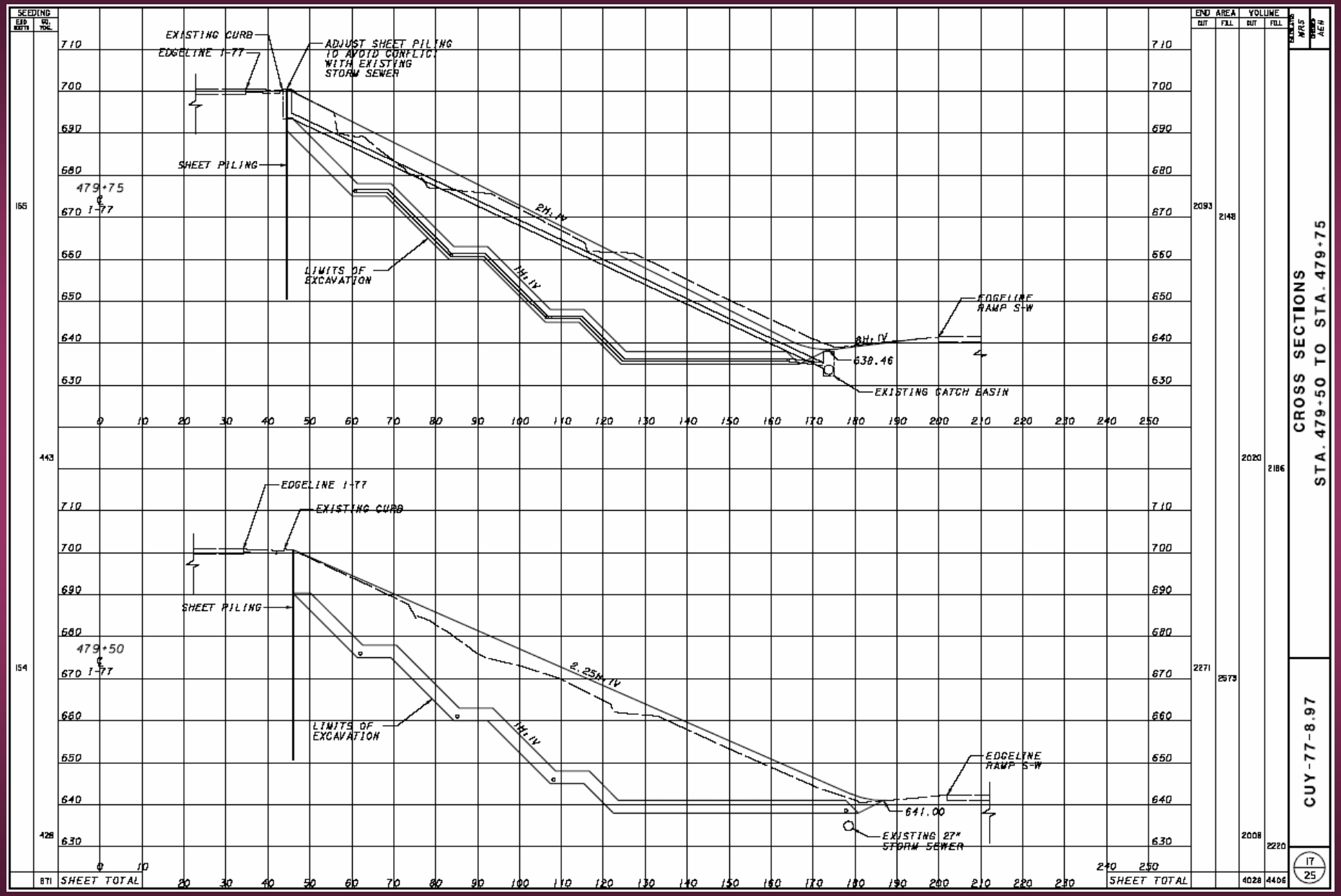
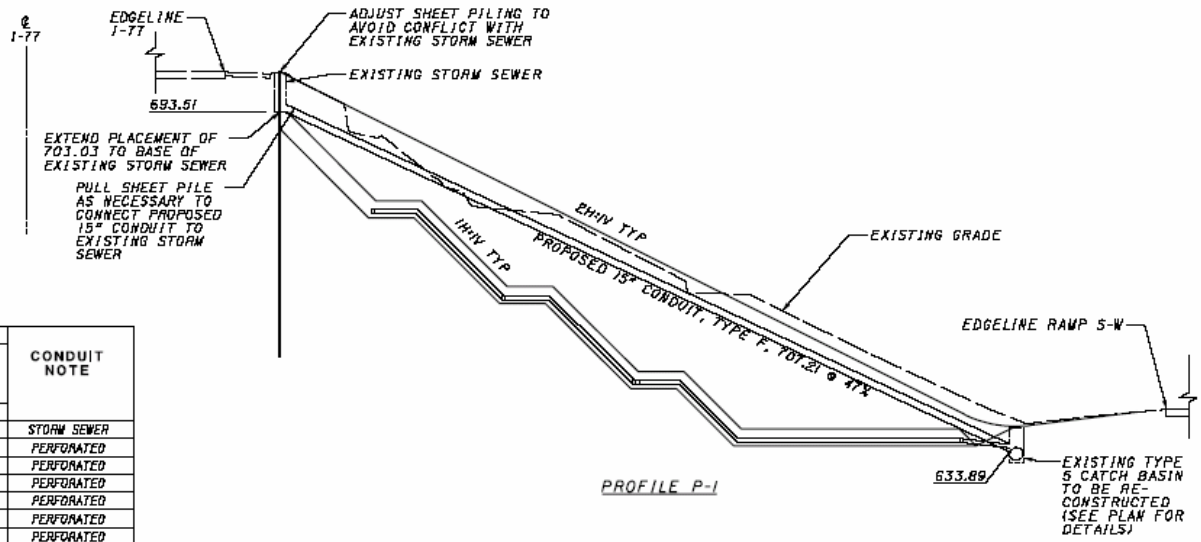
HORIZONTAL SCALE IN FEET

CHECKED HAS
DESIGNED AEM

STORMWATER POLLUTION PREVENTION PLAN
STA. 477+50 TO STA. 483+50

CUY-77-8.97


SEEDING
END WIDTH
SQ. YDS.
EXISTING CURB
EDGELINE I-77
ADJUST SHEET PILING TO AVOID CONFLICT WITH EXISTING STORM SEWER
SHEET PILING
479+75
℄ I-77
LIMITS OF EXCAVATION
2H:1V
1H:1V
EDGELINE RAMP S-W
8H:1V
638.46
EXISTING CATCH BASIN
EDGELINE I-77
EXISTING CURB
SHEET PILING
479+50
℄ I-77
2.25H:1V
1H:1V
LIMITS OF EXCAVATION
EDGELINE RAMP S-W
641.00
EXISTING 27" STORM SEWER
SHEET TOTAL
END AREA
VOLUME
CUT
FILL
2093
2148
2271
2573
2020
2186
2008
2220
4028
4406
CROSS SECTIONS
STA. 479+50 TO STA. 479+75
CUY-77-8.97
17
25



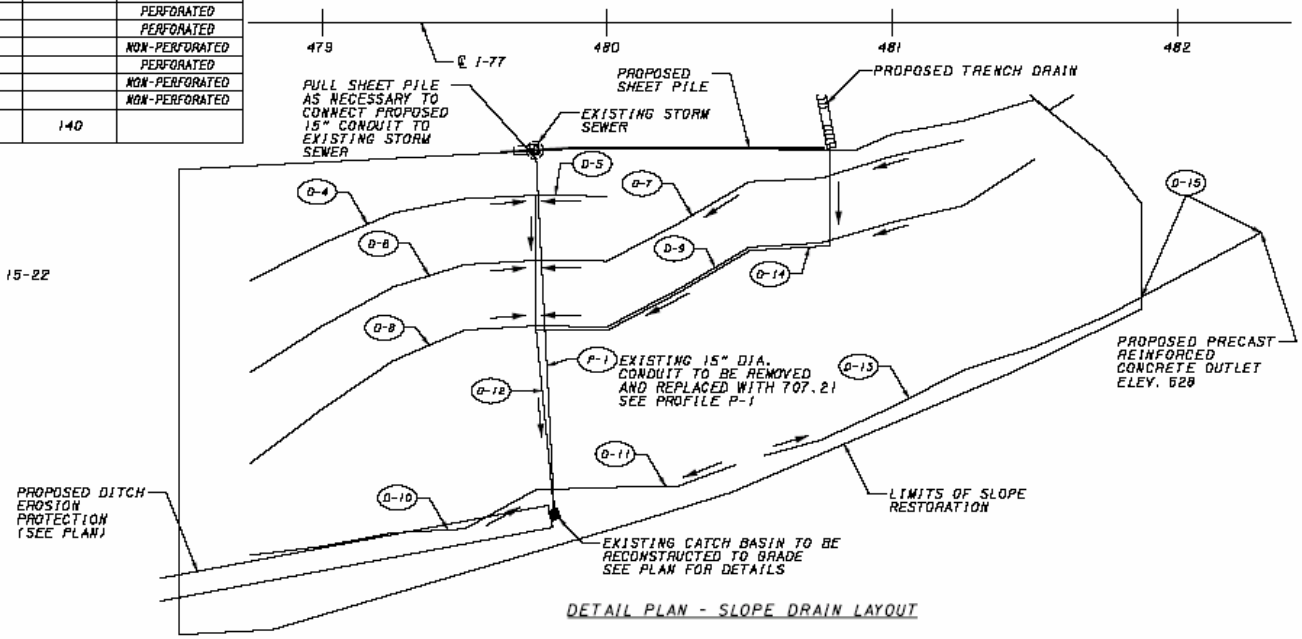
PROFILE P-1

DRAINAGE QUANTITIES

REF NO.	SIDE	603 8" CONDUIT, TYPE F, AS PER PLAN B	603 PRECAST REINFORCED CONCRETE OUTLET	202 PIPE REMOVED	603 15" CONDUIT, TYPE F, 707.21	CONDUIT NOTE
		FT.	EACH	FT.	FT.	
P-1	RT.			140	140	STORM SEWER
D-4	RT.	106				PERFORATED
D-5	RT.	25				PERFORATED
D-6	RT.	110				PERFORATED
D-7	RT.	160				PERFORATED
D-8	RT.	114				PERFORATED
D-9	RT.	190				PERFORATED
D-10	RT.	110				PERFORATED
D-11	RT.	66				PERFORATED
D-12	RT.	130				NON-PERFORATED
D-13	RT.	144				PERFORATED
D-14	RT.	150				NON-PERFORATED
D-15	RT.	48	1			NON-PERFORATED
TOTALS CARRIED TO GENERAL SUMMARY		1353	1	140	140	

NOTES

1. FOR PLAN SEE SHEETS 13-14
2. FOR CROSS-SECTIONS SEE SHEETS 15-22



DETAIL PLAN - SLOPE DRAIN LAYOUT

DRAINAGE DETAILS

CUY-77-8.97


6. 29. 2004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6. 29. 2004


6.29.2004

Questions?