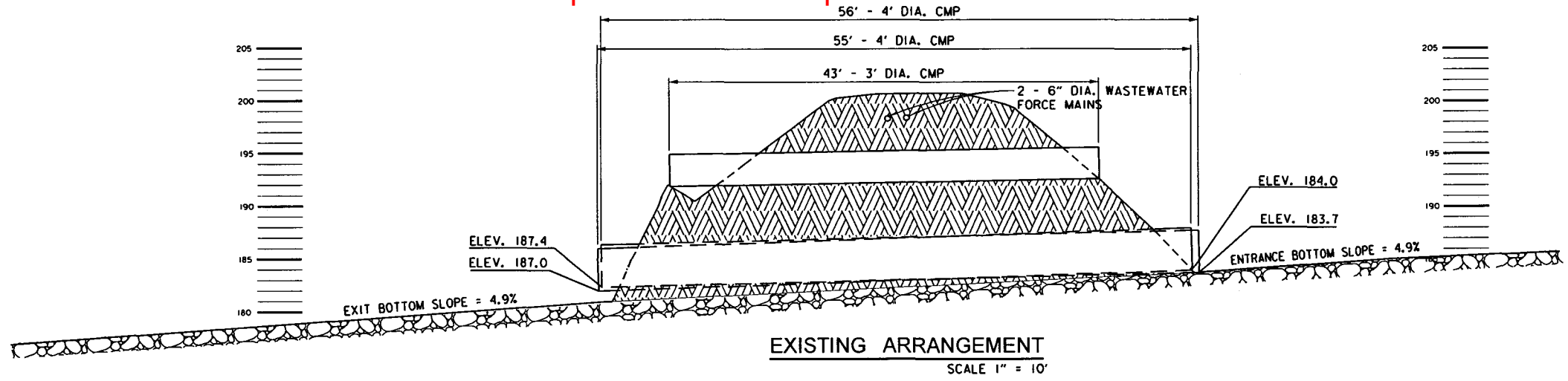
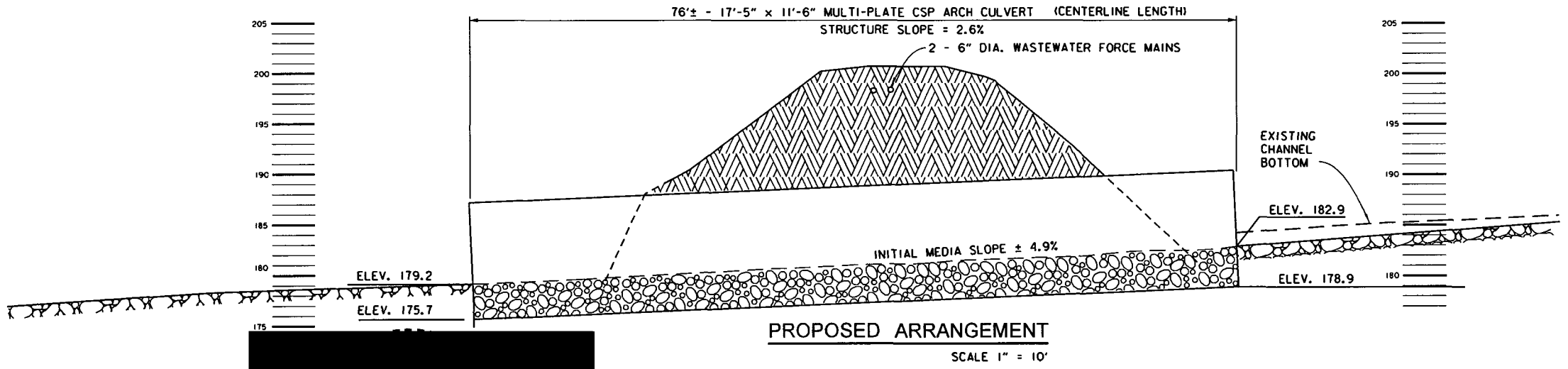


# Example #1: Culvert Replacement Plan

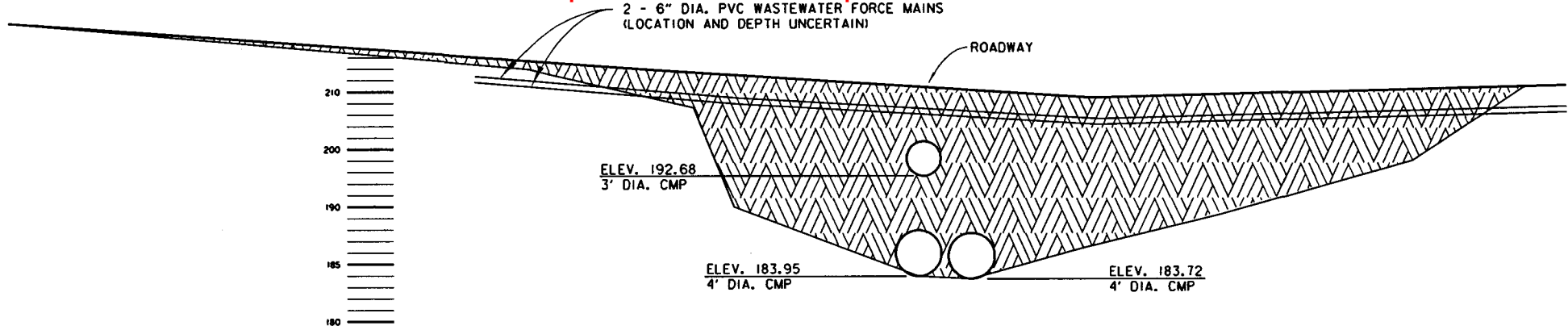


(CENTERLINE LENGTH)



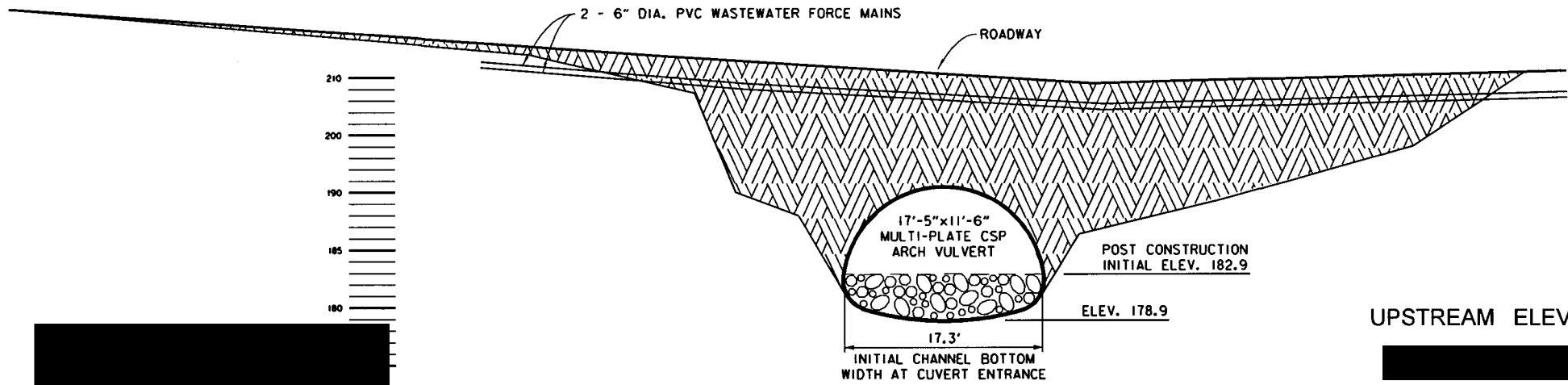
ROAD SECTION AT CROSSING  
PROPOSED CULVERT REPLACEMENT  
ROAD CROSSING

# Example #1: Culvert Replacement Plan



**EXISTING ARRANGEMENT**

SCALE 1" = 10'



**PROPOSED ARRANGEMENT**

SCALE 1" = 10'

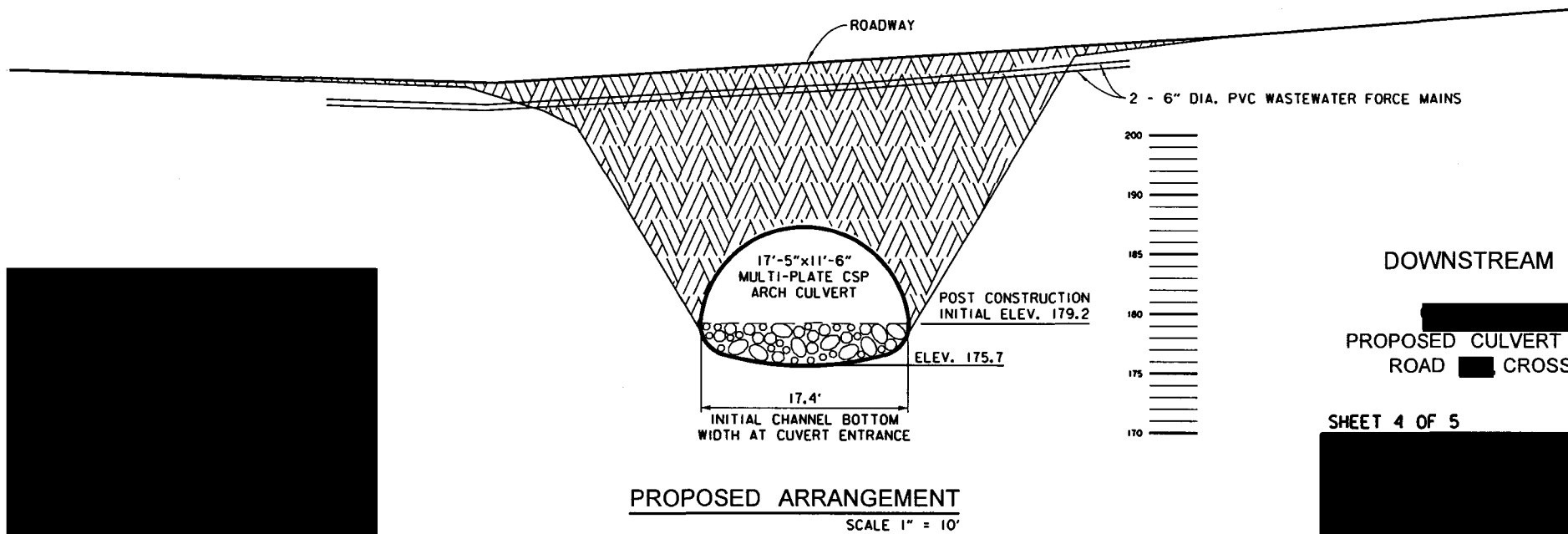
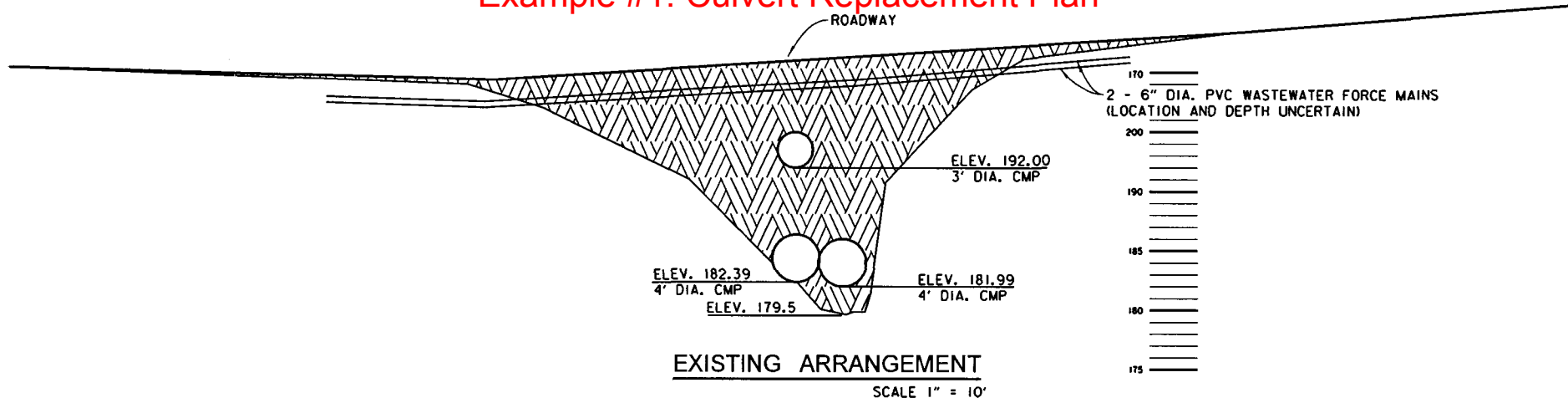
UPSTREAM ELEVATION

PROPOSED CULVERT REPLACEMENT  
ROAD CROSSING

SHEET 3 OF 5

REVISED: 07/10/08

# Example #1: Culvert Replacement Plan



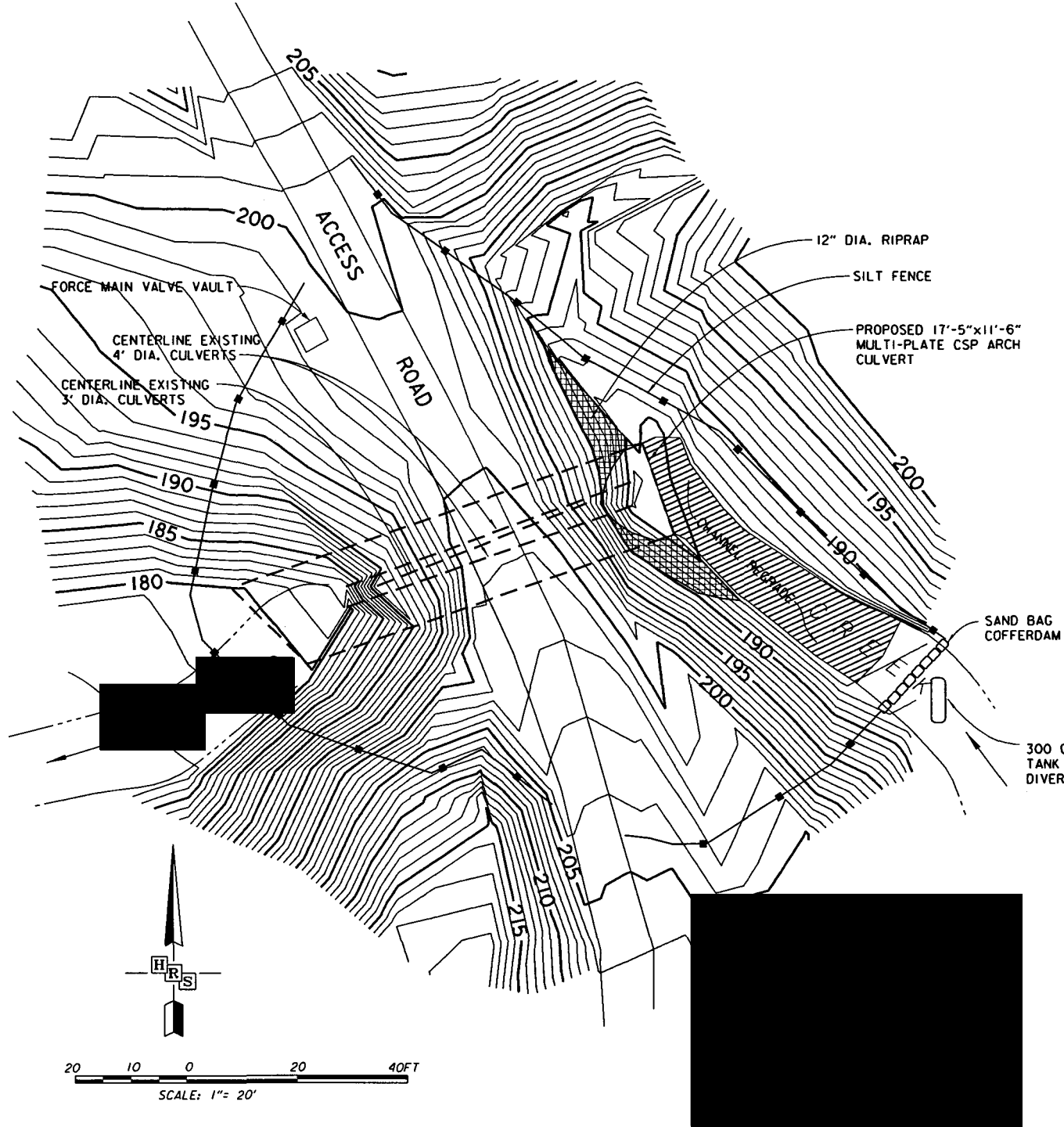
DOWNSTREAM ELEVATION

PROPOSED CULVERT REPLACEMENT  
ROAD CROSSING

SHEET 4 OF 5

REVISED: 07/10/08

# Example #1: Culvert Replacement Plan



## GENERAL CONSTRUCTION NOTES:

1. TWO 6 INCH DIAMETER PVC WASTEWATER FORCE MAINS FROM THE CRESAP BAY PARK CROSS THE FILL ABOVE THE EXISTING CULVERTS. ONLY ONE OF THE PIPES IS IN SERVICE AT ANY ONE TIME, THE OTHER THOUGHT TO BE STANDING BY FOR EMERGENCY SERVICE IN CASE OF PIPELINE FAILURE. THE HORIZONTAL AND VERTICAL LOCATION OF THESE PIPES IS NOT KNOWN. BEFORE CONSTRUCTION OF THE CULVERT REPLACEMENT BEGINS, THESE PIPES WILL BE LOCATED AND A TEMPORARY DIVERSION CONSISTING OF ONE FLEXIBLE HOSE BYPASS WILL BE INSTALLED. THE BYPASS WILL BE DOWNSTREAM OF THE PROJECT WORK, AND CROSS THE STREAM CHANNEL OVER A TEMPORARY WOODEN BRIDGE.
2. SILT FENCES WILL BE ERECTED BOTH UPSTREAM AND DOWNSTREAM OF THE WORK SITE. THE FENCES WILL BE CONTINUOUS ACROSS THE LOWEST EXISTING CULVERT UNTIL THE EXCAVATION REACHES THAT POINT WHERE THE LOW CULVERT MUST BE REMOVED AND THE EXCAVATION EXTENDED BELOW THE PRESENT CHANNEL BOTTOM TO RECEIVE THE COUNTERSUNK CULVERT.
3. FILL AND BANK MATERIAL REMOVED TO PLACE THE NEW MULTI-PLATE ARCH CULVERT WILL BE TEMPORARILY STOCKPILED ON [REDACTED] PROPERTY, IN THE VICINITY OF THE WASTEWATER DRAINFIELDS SERVING [REDACTED]. THE HAUL ROAD WILL BE THE EXISTING ACCESS ROAD TO THE DRAIN FIELD. THE HAUL DISTANCE WILL BE APPROXIMATELY 700 FEET.
4. ALL THE SUITABLE MATERIAL REFERENCED IN 3.) WILL BE USED AS BACKFILL OVER THE NEW CULVERT. ANY EXCESS OCCASIONED BY REPLACEMENT OF THE EXISTING CULVERTS WITH ONE OF LARGER DISPLACEMENT WILL BE CONSUMED BY RAISING THE GRADE OF THE CROSSING.
5. THE COMPLETED CROSSING FILL WILL BE STABILIZED AGAINST EROSION. A MIX OF PERENNIAL GRASS AND FORBS WILL BE ESTABLISHED AFTER CONSTRUCTION ACTIVITIES CEASE.
6. WHEN THE WORK IS LIKELY TO OBSTRUCT THE WATER COURSE OR WHEN THE WORK RISKS DISRUPTION OF THE CHANNEL WITHIN THE WORK SITE, STREAM DIVERSION WILL BE ACCOMPLISHED BY PUMPING STREAM FLOW AROUND THE PROJECT. A SANDBAG DIVERSION DAM WILL BE CONSTRUCTED 25 TO 50 FEET UPSTREAM OF THE EXISTING CULVERT ENTRANCE. JUST UPSTREAM OF THE DIVERSION DAM A 300+ GALLON ROUND-END STOCK TANK, 2 FEET HIGH X 3 FEET WIDE X 8 FEET LONG WILL BE PARTIALLY BURIED IN THE CHANNEL BOTTOM. TWO SUMP PUMPS, EACH CAPABLE OF PUMPING NORMAL LATE SUMMER FLOWS (ESTIMATED TO BE 100 GPM, 0.22 CFS) WILL BE SET IN THE TANK. THE TWO PUMPS WILL BE COUPLED TO SEPARATE HOSES THAT WILL DISCHARGE DOWNSTREAM OF THE WORK SITE. THE TOP OF THE TANK WILL BE COVERED WITH A FISH SCREEN. THE SCREEN WILL BE MADE OF #4 MESH WIRE CLOTH COMPOSED OF 14GA. WIRE. THERE WILL BE THREE REMOVABLE SECTIONS, SO THE SCREEN CAN BE REVERSED FOR CLEANING.

## EROSION CONTROL & WATER DIVERSION PLAN

[REDACTED]  
 PROPOSED CULVERT REPLACEMENT  
 ROAD [REDACTED] CROSSING [REDACTED]

REVISED 07/10/15  
 REVISED 07/10/08  
 REVISED 07/01/08

SHEET 5 OF 5

## Example #2: Culvert Replacement Plan



seven miles.

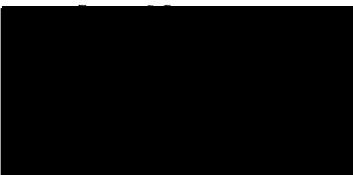
existing 48" diameter culvert, which will be replaced with a stream simulation 144"x68' aluminized steel pipe. The culvert will be buried and filled 50% and installed on a grade of 8.9%. Rock bands consisting of 16'+ diameter rock will be installed within the culvert. Please see the attached plans for details.

During the installation of the pipe the stream flow will be pumped or diverted around the construction site. All exposed banks will be strawed and grass seeded upon completion of the project in a manner that will prevent delivery of sediment to the stream.

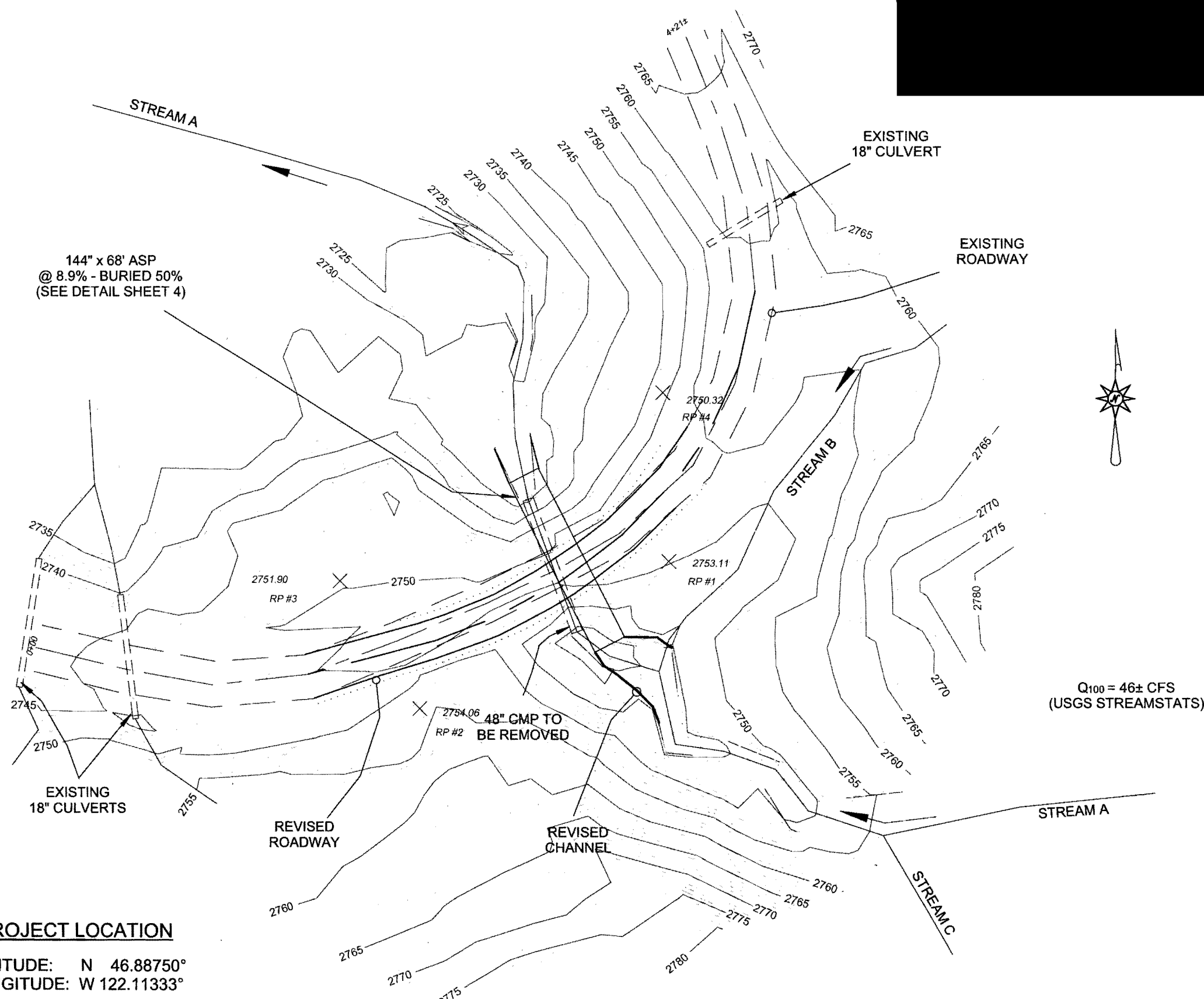
The rock pit for this project is shown as  on the attached map.

The waste site is marked "Waste Site" on the attached map and is flagged on the ground with pink flagging and painted "WA".

If you have any questions or concerns pertaining to this project please don't hesitate to contact me.



Example #2: Culvert Replacement Plan



144" x 68' ASP  
@ 8.9% - BURIED 50%  
(SEE DETAIL SHEET 4)

EXISTING  
18" CULVERT

EXISTING  
ROADWAY

STREAM B

Q<sub>100</sub> = 46± CFS  
(USGS STREAMSTATS)

48" CMP TO  
BE REMOVED

EXISTING  
18" CULVERTS

REVISED  
ROADWAY

REVISED  
CHANNEL

STREAM A

STREAM C

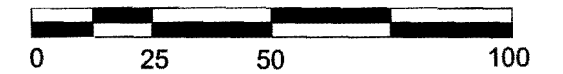
**PROJECT LOCATION**

LATITUDE: N 46.88750°  
LONGITUDE: W 122.11333°

NOTE: VERTICAL AND HORIZONTAL CONTROL BY SCHINNELL & ASSOCIATES.  
MERIDIAN ASSUMED; ELEVATION APPROXIMATED FROM GPS.

**INDEX TO SHEETS**

SITE OVERVIEW	1
PLAN VIEW	2
PROFILE VIEWS	3
CULVERT DETAIL	4
STAKE-OUT DETAIL	5

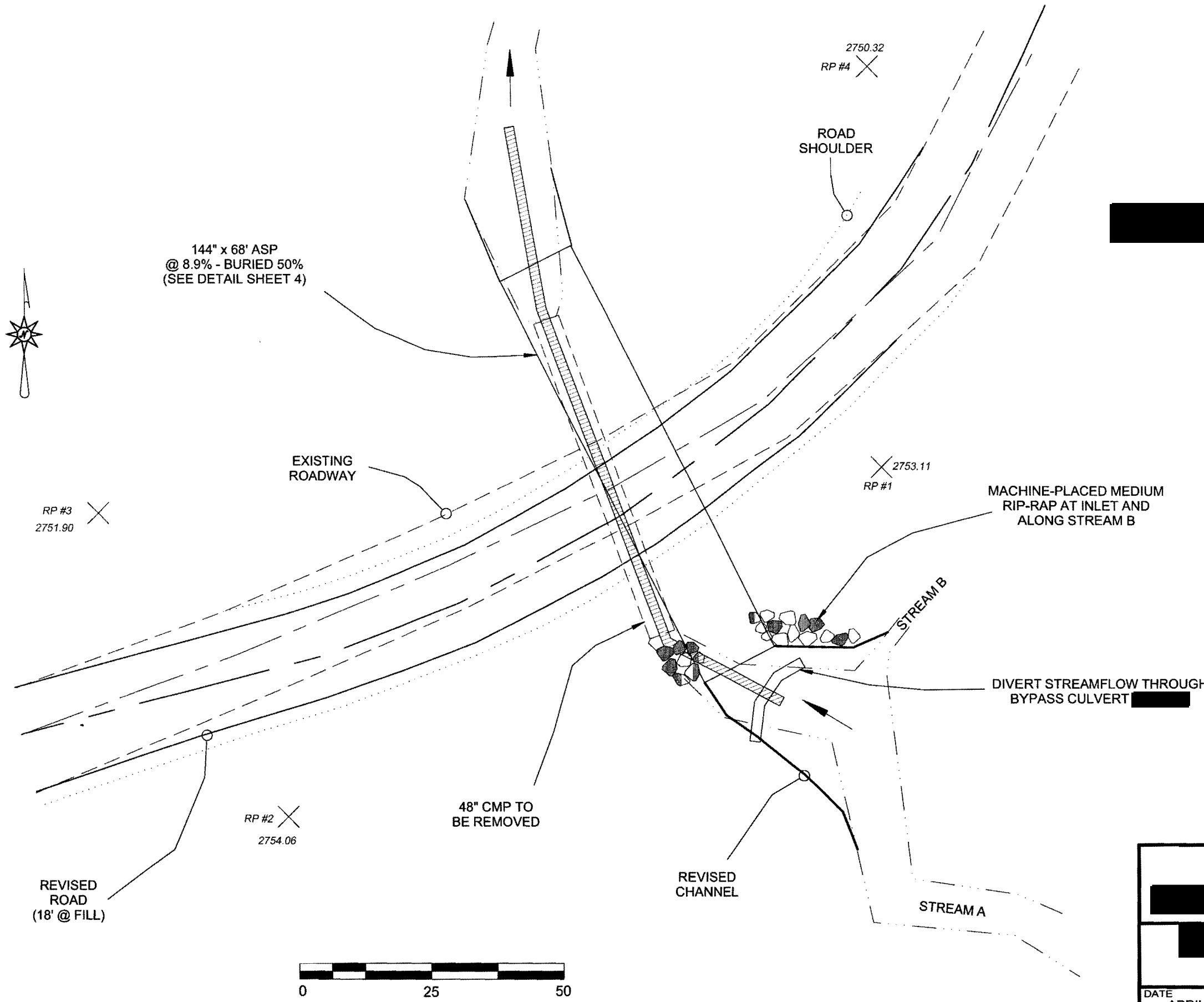


**CULVERT REPLACEMENT**

APRIL 27, 2011	8-9-2012
SCALE 1" = 40'	SHEET 1 of 5



# Example #2: Culvert Replacement Plan

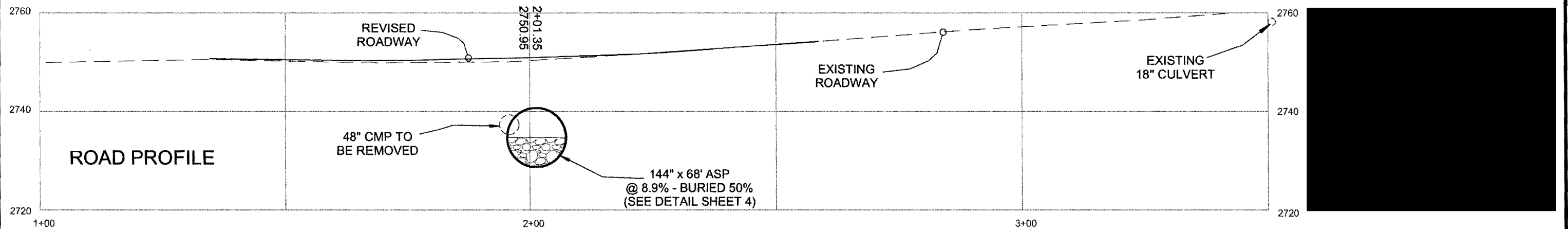
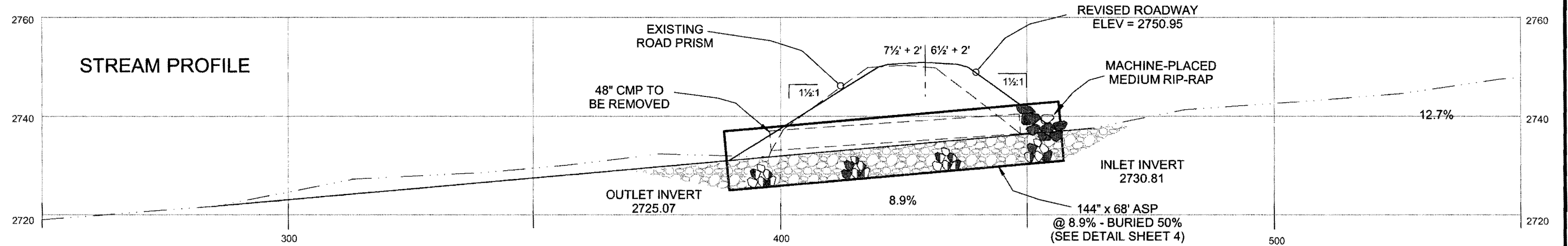


PLAN VIEW

[REDACTED] CULVERT REPLACEMENT [REDACTED]		
DATE	DRAWN	REV
APRIL 27, 2011	[REDACTED]	8-9-2012
1" = 20'	[REDACTED]	SHEET 2 of 5

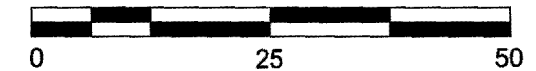
Example #2: Culvert Replacement Plan

PROFILE VIEWS



GENERAL CONSTRUCTION NOTES

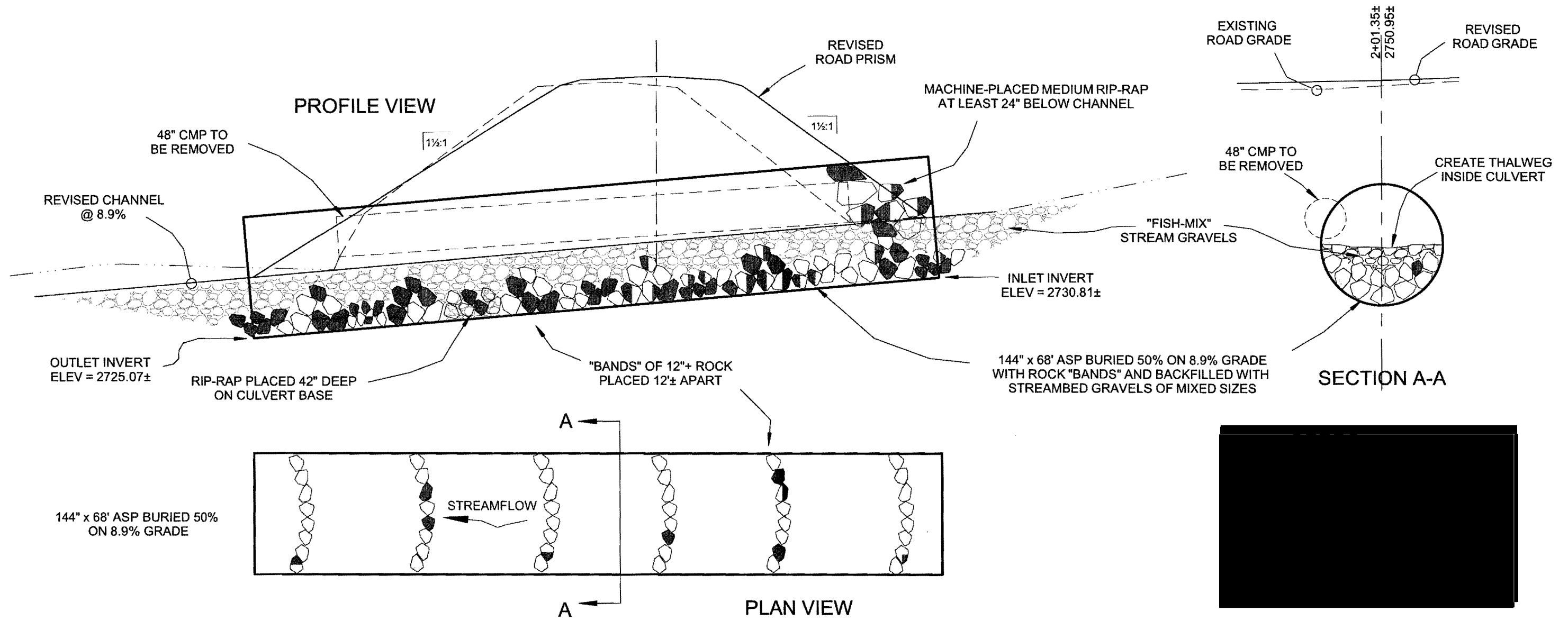
- 1) IF REQUIRED, STREAMFLOW SHALL BE ISOLATED FROM ACTIVE WORK AREA THROUGH RELOCATION INTO BYPASS CULVERT SIMILARLY TO AS SHOWN ON PLAN VIEW. NO BYPASS WILL BE NECESSARY IF CHANNEL IS DRY DURING OPERATIONS.
- 2) 144" x 68' REPLACEMENT CULVERT SHALL BE BURIED 50% AND PLACED ON A GRADIENT OF 8.9%. BACKFILL MATERIAL SHALL BE STREAMBED GRAVELS (MAXIMUM SIZE = 12") TO BE OBTAINED FROM SOURCE(S) [REDACTED] BANDS AS SHOWN ON DETAIL SHEET 4.
- 3) ROAD WIDTH THROUGH FILL SECTION TO BE 14-FEET PLUS 2-FOOT CURVE WIDENING; SURFACE SHALL BE CROWNED AT 3%; FILLSLOPES SHALL NOT EXCEED 1½:1.
- 4) MEDIUM RIP-RAP (16"±) TO BE MACHINE-PLACED AT INLET AS DIRECTED. RIP-RAP AT INLET TO BE PLACED AT LEAST 24-INCHES BELOW CHANNEL ELEVATION.
- 5) REFER TO DETAIL SHEET 4 FOR ADDITIONAL CULVERT BACKFILL DETAILS.



[REDACTED] CULVERT REPLACEMENT		
DATE APRIL 27, 2011	DRAWN [REDACTED]	REV 8-9-2012
SCALE 1" = 20'	[REDACTED]	SHEET 3 of 5

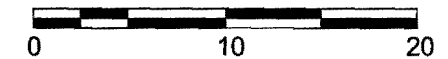


# CULVERT INSTALLATION DETAILS



**GENERAL CONSTRUCTION NOTES**

- 1) ROCK "BANDS" WITHIN CULVERT MAY BE ANGULAR ROCK, AT LEAST 12" IN SIZE. BANDS SHALL BE SPACED 12± FEET APART, 6 TO 8 FEET FROM ENDS AND EXTEND TO WITHIN 12" OF STREAM SURFACE. BOTTOM 42± INCHES OF CULVERT SHALL BE BEDDED WITH RIP-RAP AND TOPPED WITH "FISH-MIX" GRAVELS.
- 2) STREAMBED MATERIAL FOR "FISH-MIX" GRAVELS SHALL BE NATIVE MATERIAL OF MIXED SIZING UP TO D100 (12") FROM SOURCE [REDACTED].
- 3) CREATE THALWEG INSIDE CULVERT BY USE OF JUMPING-JACK COMPACTOR.
- 4) ROAD BASE SHALL BE 18 FEET WIDE OVER CULVERT; SURFACE SHALL BE CROWNED AT 3%; FILLSLOPES SHALL NOT EXCEED 1 1/2:1.
- 5) MEDIUM (16"+) RIP-RAP TO BE MACHINE-PLACED AT INLET AS DIRECTED. RIP-RAP AT INLET TO BE BURIED AT LEAST 24" BELOW CHANNEL BED AS SHOWN.

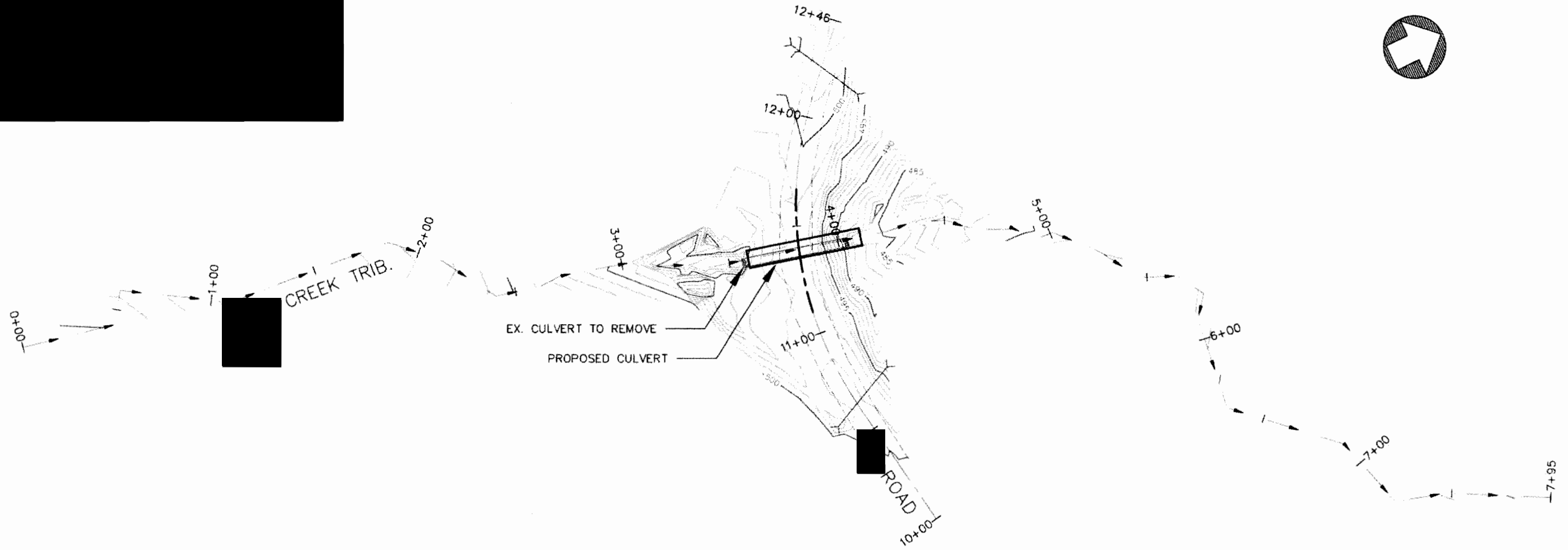
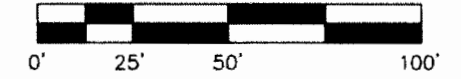


<b>[REDACTED] CULVERT REPLACEMENT [REDACTED]</b>		
DATE APRIL 27, 2011	DRAWN [REDACTED]	REV [REDACTED]
1" = 10'	[REDACTED]	SHEET 4 of 5

# Example #3: Culvert Replacement Plan

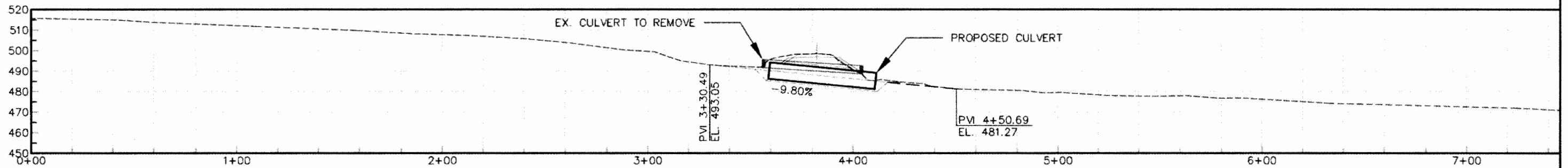
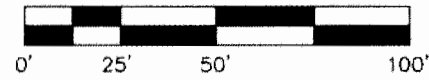
## SITE PLAN

SCALE: 1" = 50'



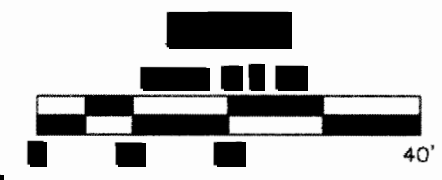
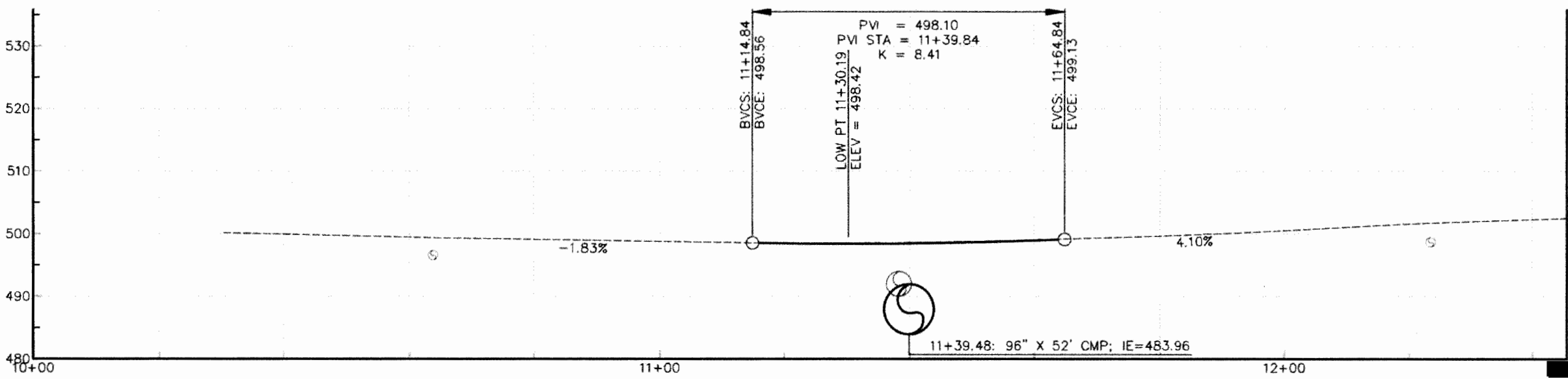
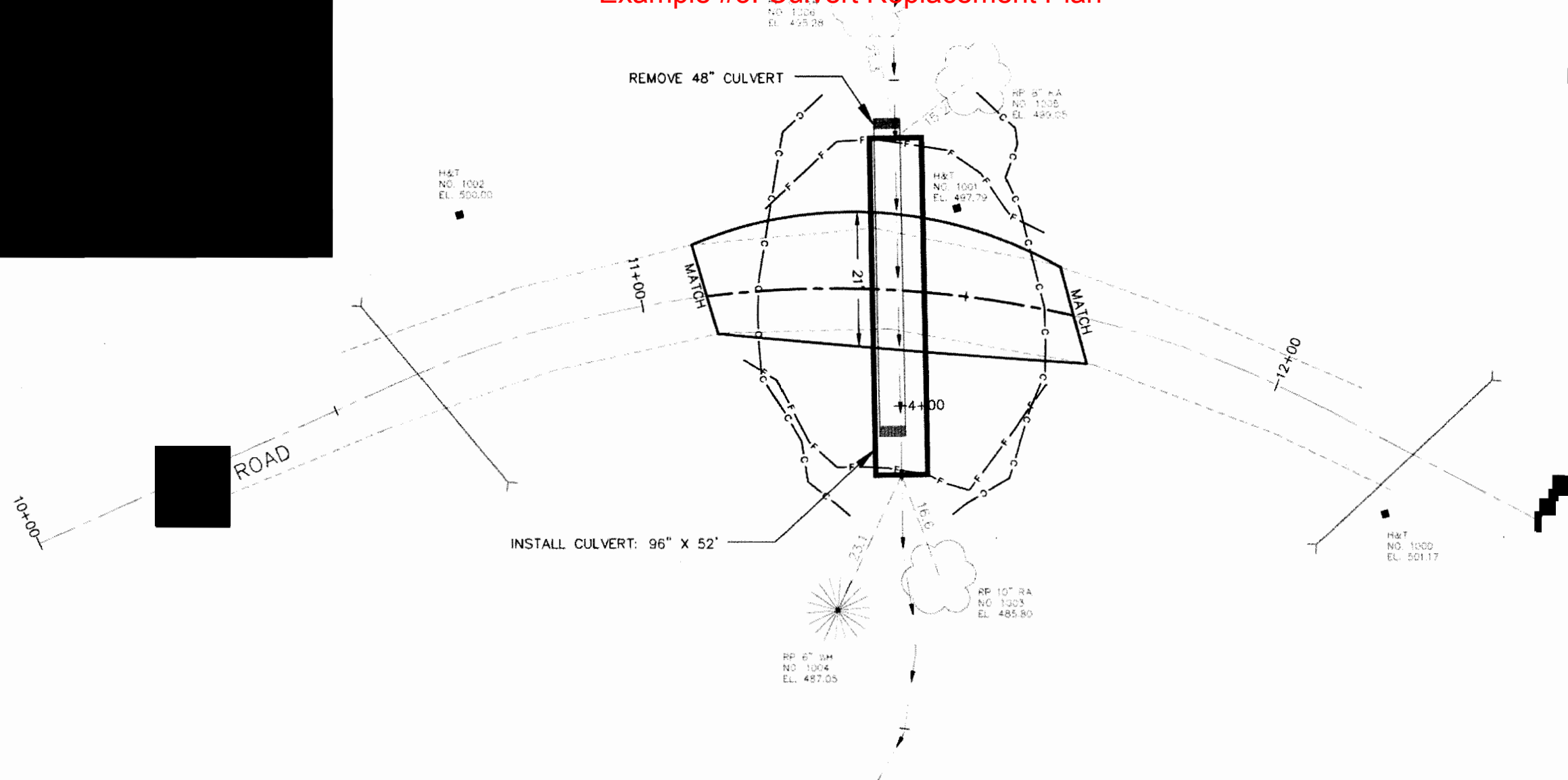
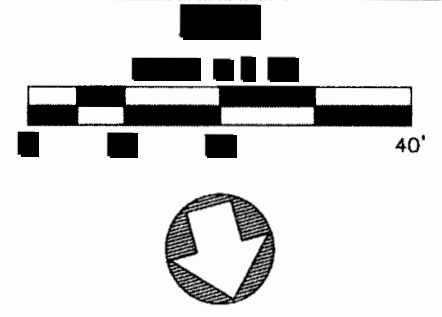
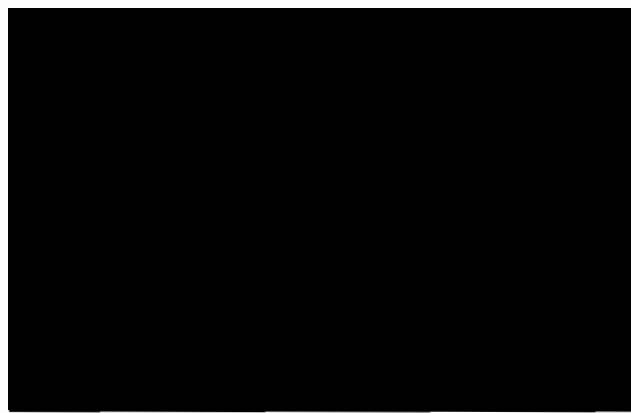
## STREAM PROFILE

SCALE: 1" = 50'



SCALE: HOR: 1" = VER: 1" =  DESIGNER: DATE: 5/15/13	BY			DATE	REVISIONS	FOR:	RD CULVERT ( ) SITE OVERVIEW	JOB NO. 13.29.07
	△							

# Example #3: Culvert Replacement Plan



SCALE: HOR: 1" = 20' VER: 1" = 20'  DESIGNER: [Redacted] DATE: 5/15/13	BY      DATE      REVISIONS			FOR: [Redacted]	[Redacted]	JOB NO. 13.29.07
	△					SHEET 3
	△					5
	△					
	△					

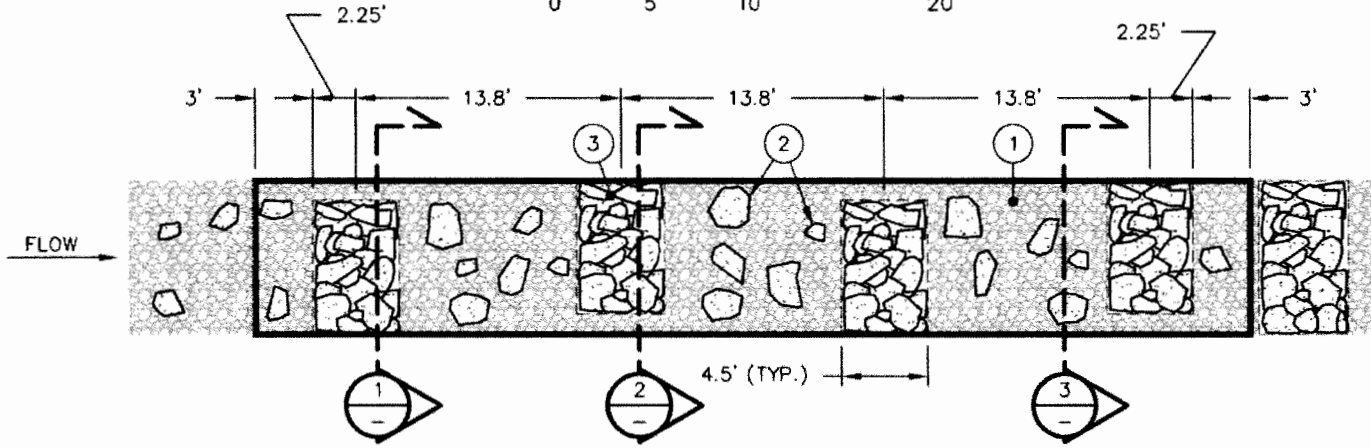
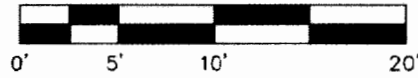


### Example #3: Culvert Replacement Plan



CULVERT PLAN VIEW

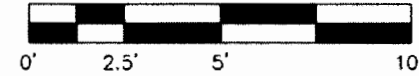
SCALE: 1" = 10'



- NOTES**
- ① 18-IN COMPACTED ROAD AGGREGATE
  - ② COMPACTED COMMON FILL
  - ③ COMPACTED CRUSHED PIPE ZONE BACKFILL
  - ④ LOOSE CRUSHED BEDDING
  - ⑤ ARMOR FOR SLOPES
  - ⑥ INSTALL CMP:  
144" X 60'  
5X1 CORR.  
GA: 12  
LENGTH: 60'
  - ⑦ EX. 48-IN CMP TO BE REMOVED

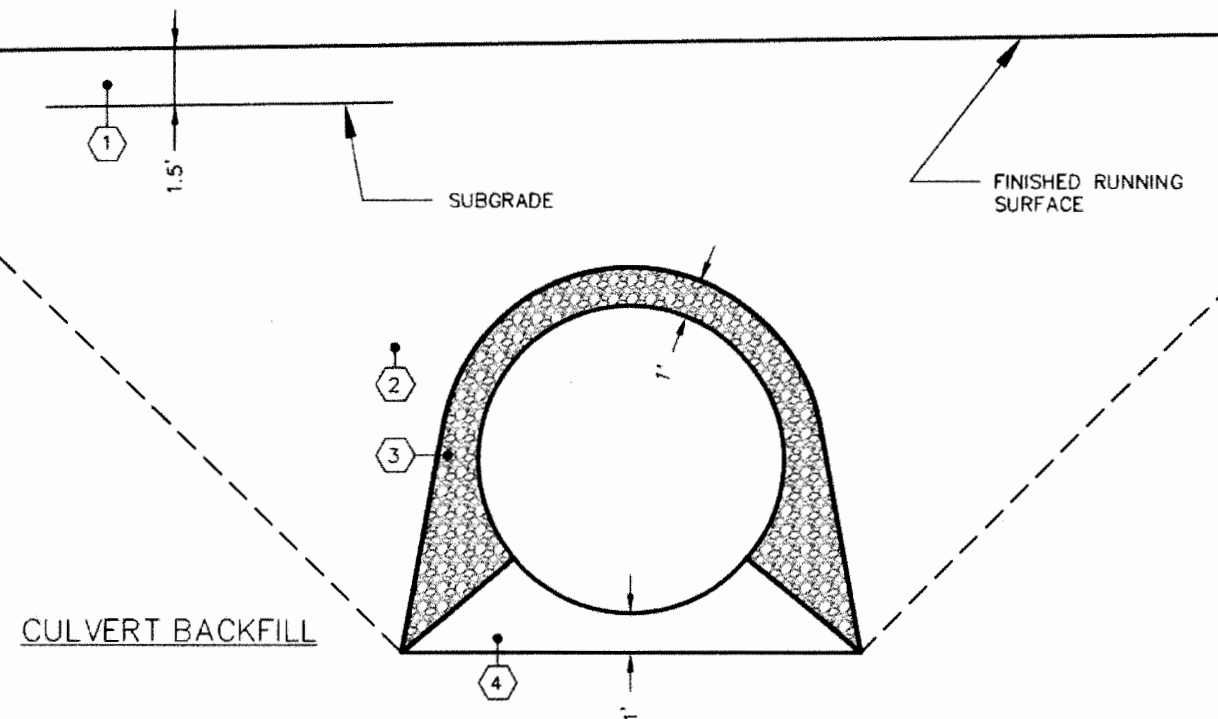
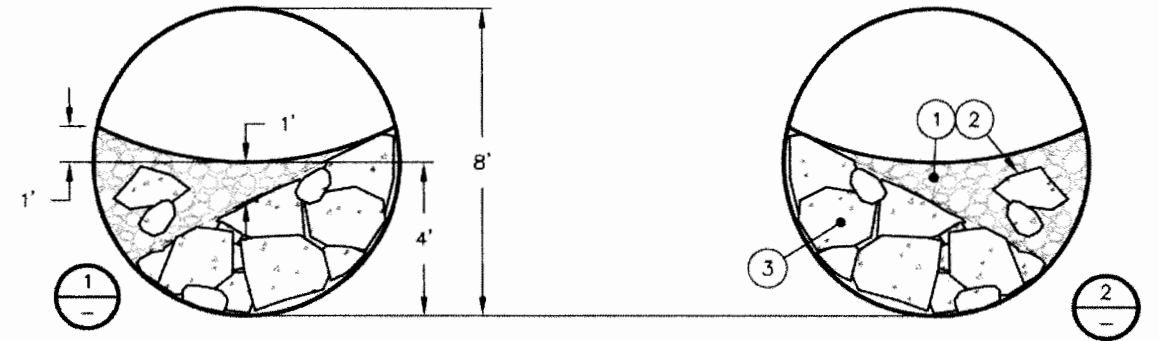
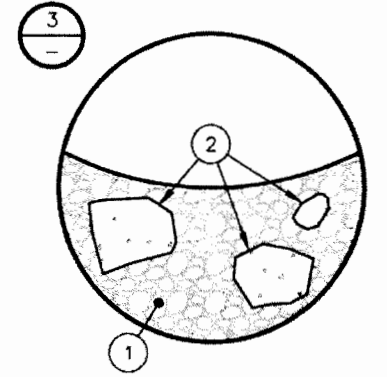
CULVERT SECTIONS

SCALE: 1" = 5'

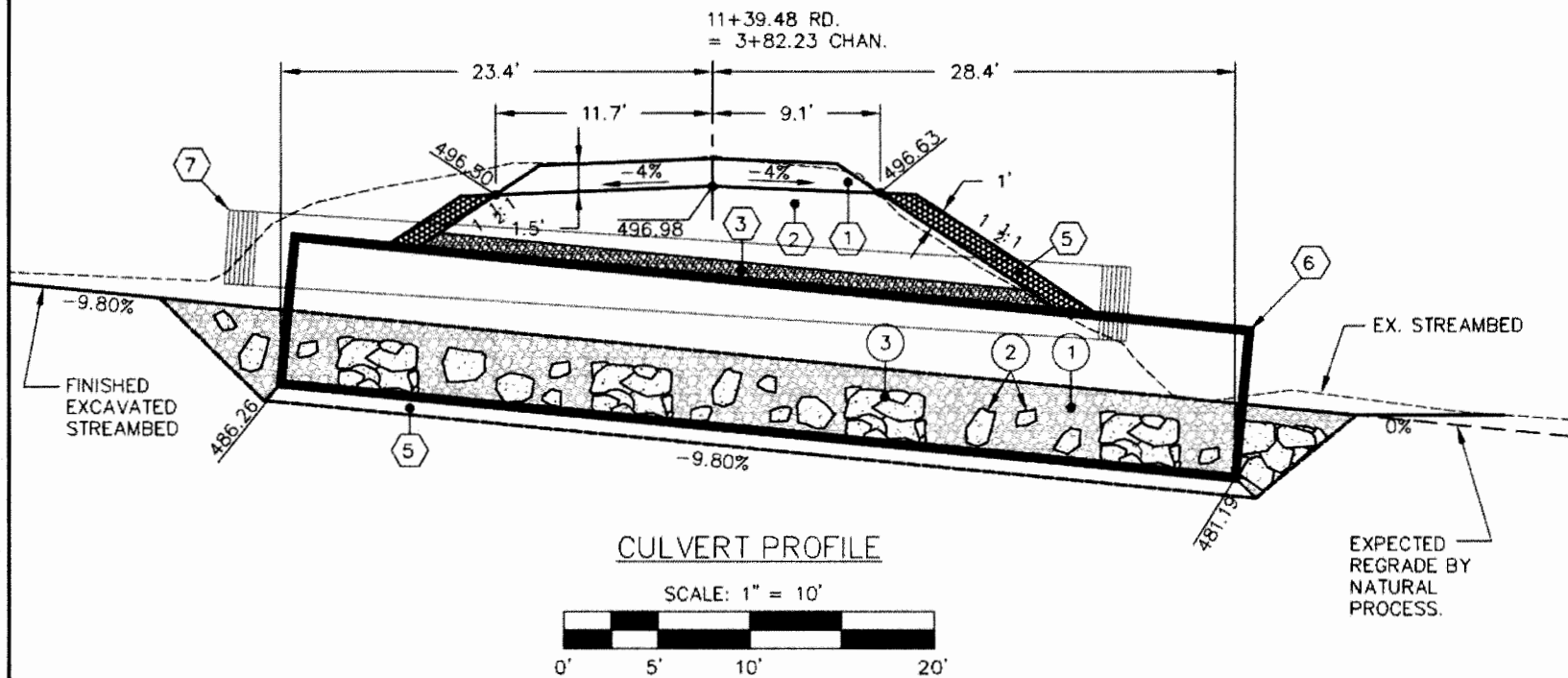


FISH MIX KEY

- ① 8-INCH MINUS WELL-GRADED, ROUNDED MATERIAL.
- ② BOULDERS: SIZE 14" TO 20" IF ANGULAR. 18" TO 24" IF SUB-ANGULAR OR ROUNDED. ARRANGEMENT: UNIFORMLY THROUGHOUT, AS SHOWN. QUANTITY: 30% TOTAL VOLUME BTWN. BOULDER CLUSTERS.
- ③ BOULDER CLUSTERS: BOULDER SPECS ARE SAME AS ABOVE. FILL THE VOIDS TIGHTLY WITH 8-INCH MINUS ROUNDED MATERIAL DESCRIBED ABOVE.

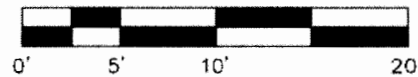


CULVERT BACKFILL



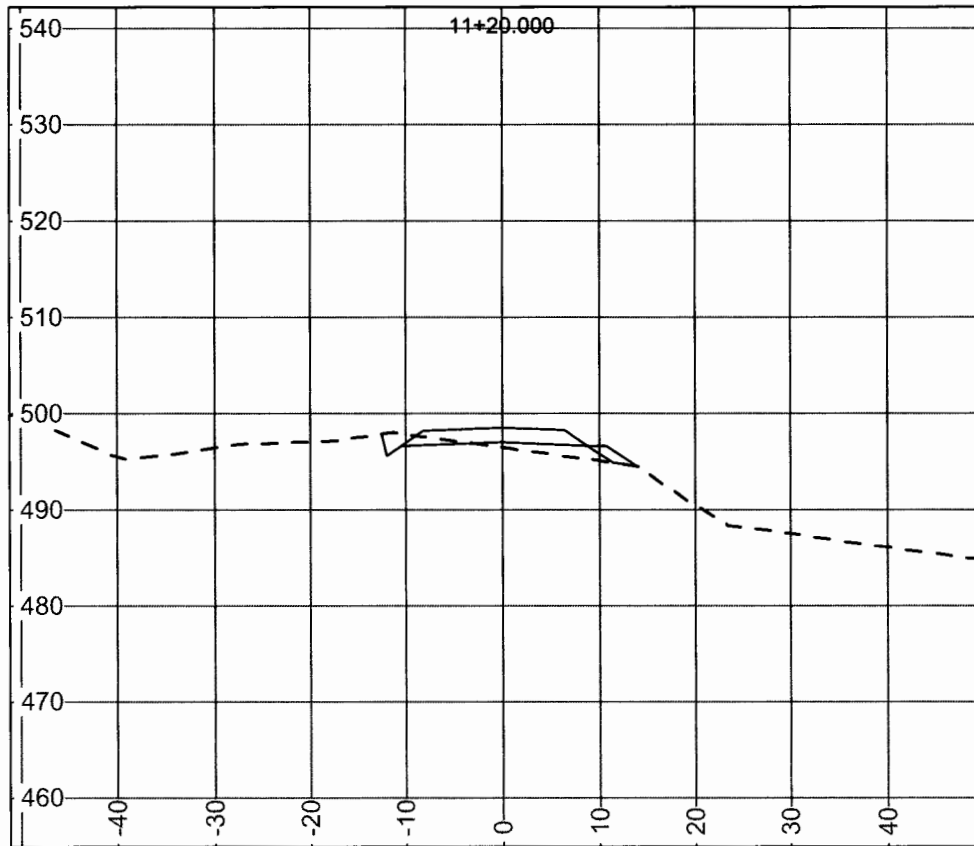
CULVERT PROFILE

SCALE: 1" = 10'



SCALE: HOR: 1" = VER: 1" =	BY	DATE	REVISIONS	FOR:	RD CULVERT CULVERT DETAILS	JOB NO.
	DESIGNER:					
DRAFTER:						SHEET
DATE: 5/15/13						4
						5

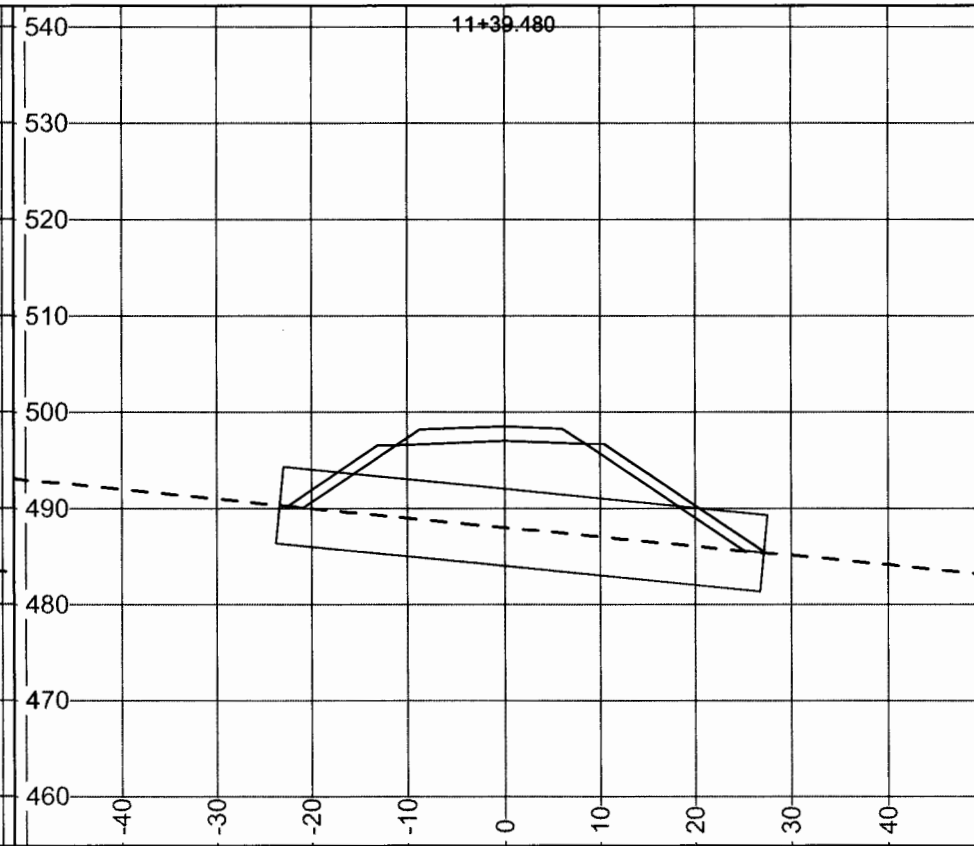
Example #3: Culvert Replacement Plan



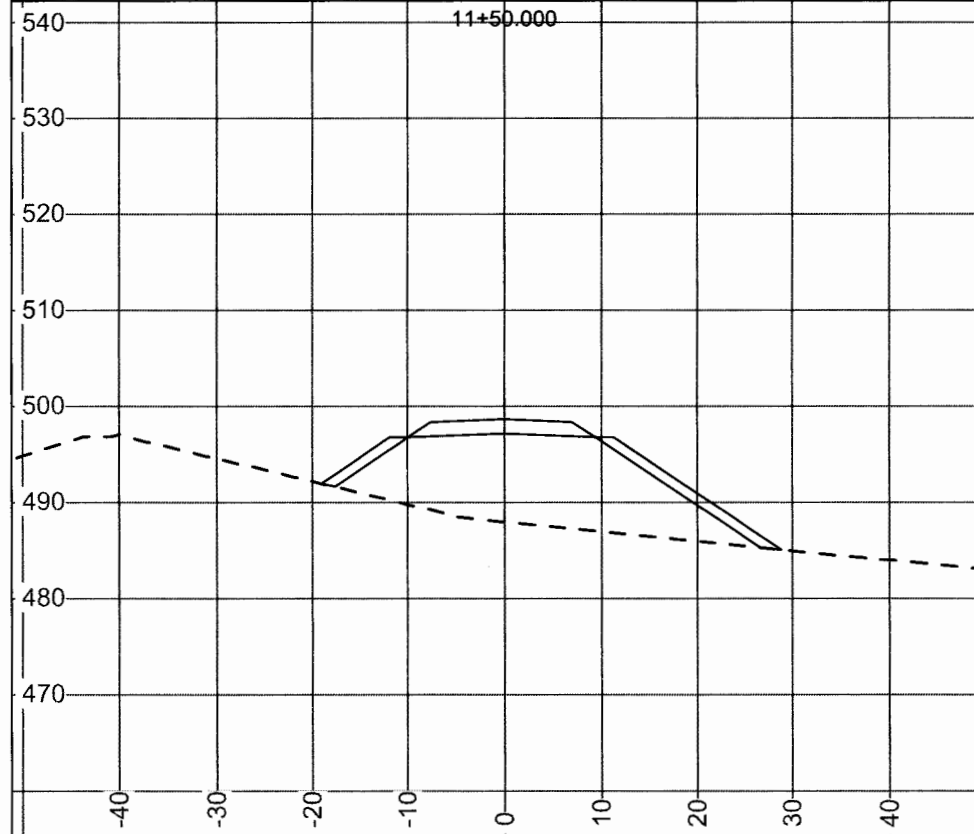
L-Strn:	11+20.000	Rd. Wd. L:	10.485	F Slope R:	0
CL Elev:	498.484	Rd. Wd. R:	8.760	Grd.Lst:	-1
Cut Dp:	-2.048	F Slope L:	400	Grd.Nxt:	-1



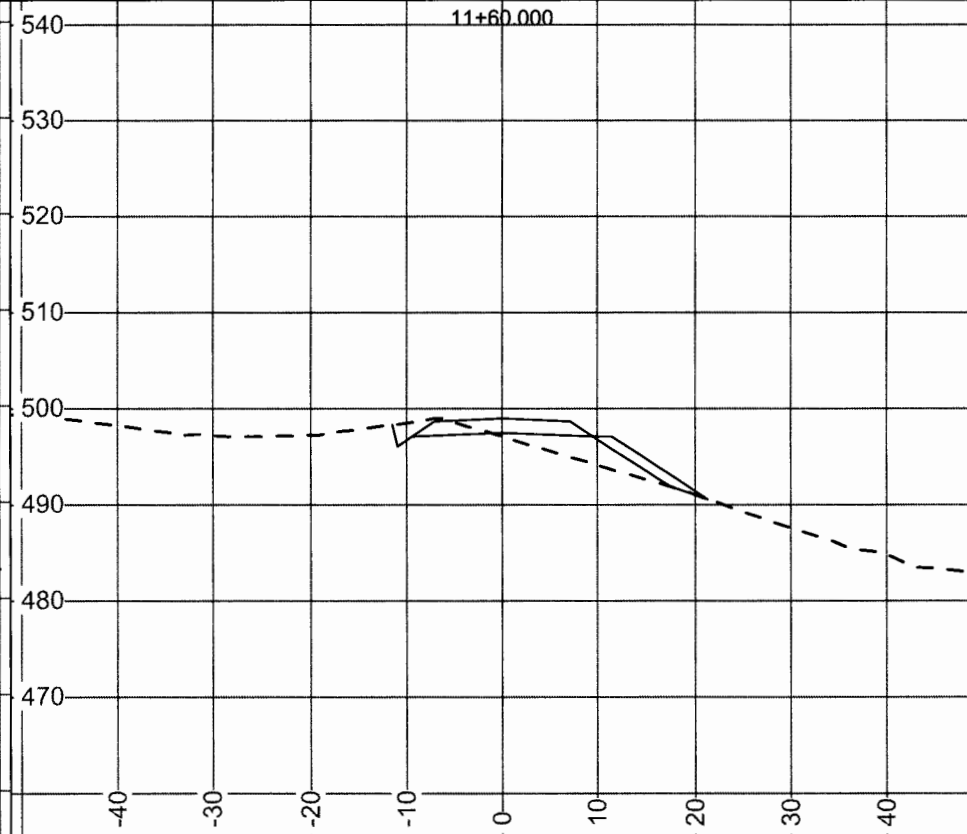
L-Strn:	11+30.000	Rd. Wd. L:	11.135	F Slope R:	0
CL Elev:	498.422	Rd. Wd. R:	8.800	Grd.Lst:	0
Cut Dp:	-10.437	F Slope L:	0	Grd.Nxt:	0



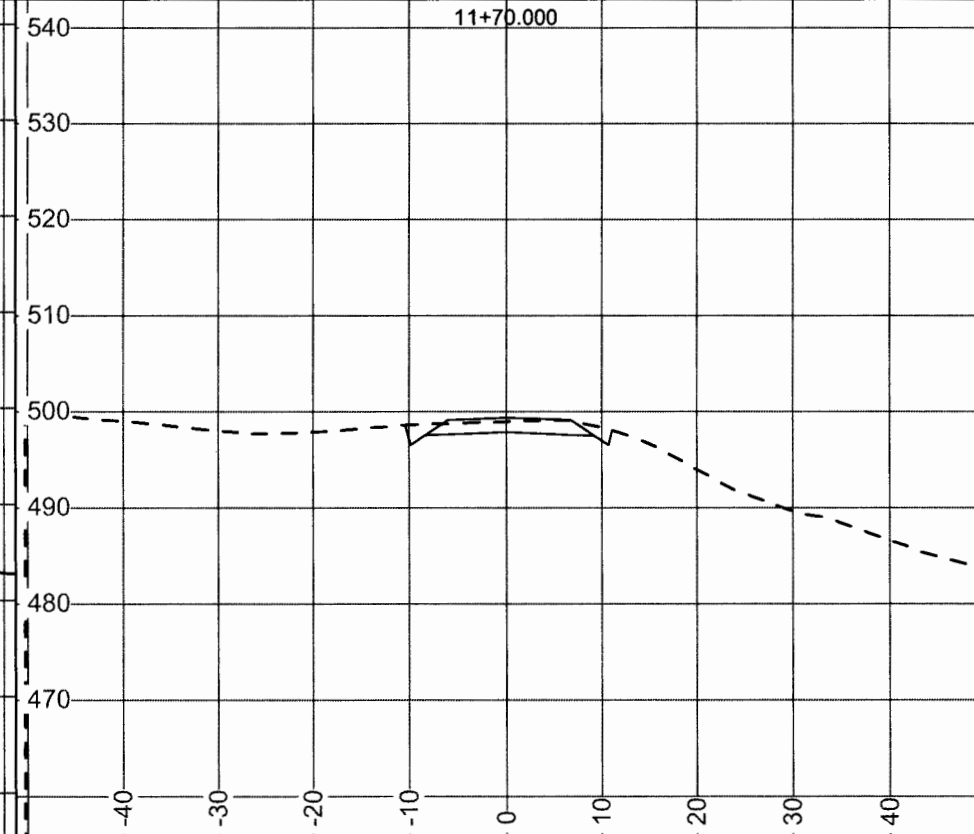
L-Strn:	11+39.480	Rd. Wd. L:	11.117	F Slope R:	0
CL Elev:	498.473	Rd. Wd. R:	8.476	Grd.Lst:	1
Cut Dp:	-10.487	F Slope L:	0	Grd.Nxt:	1



L-Strn:	11+50.000	Rd. Wd. L:	9.936	F Slope R:	0
CL Elev:	498.656	Rd. Wd. R:	9.340	Grd.Lst:	2
Cut Dp:	-10.736	F Slope L:	-67	Grd.Nxt:	2

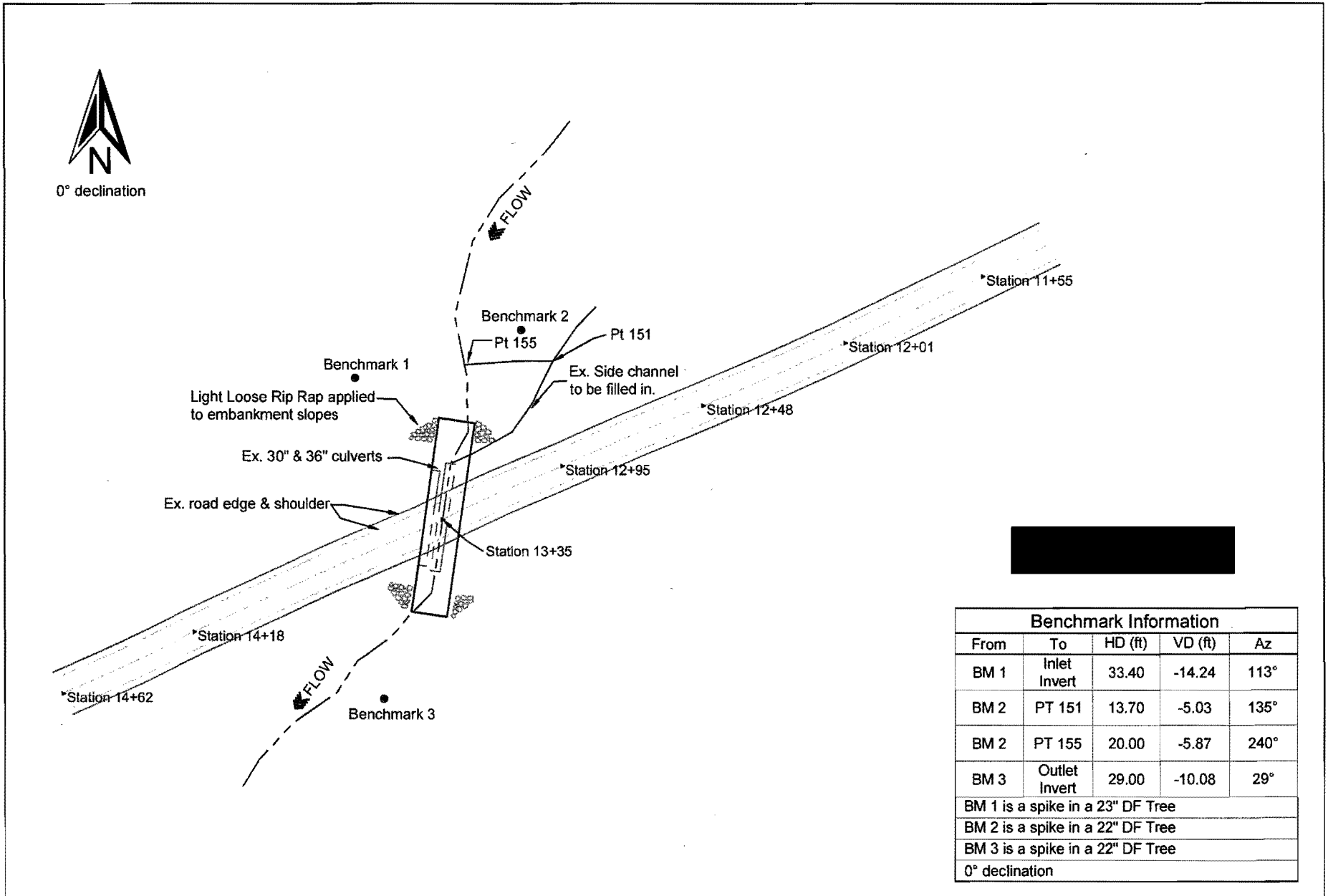


L-Strn:	11+60.000	Rd. Wd. L:	9.479	F Slope R:	0
CL Elev:	498.953	Rd. Wd. R:	9.556	Grd.Lst:	4
Cut Dp:	-1.895	F Slope L:	400	Grd.Nxt:	4



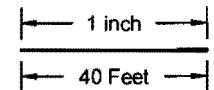
L-Strn:	11+70.000	Rd. Wd. L:	8.381	F Slope R:	400
CL Elev:	499.353	Rd. Wd. R:	9.187	Grd.Lst:	4
Cut Dp:	-0.415	F Slope L:	400	Grd.Nxt:	4

# Example #4: Culvert Plan



Benchmark Information				
From	To	HD (ft)	VD (ft)	Az
BM 1	Inlet Invert	33.40	-14.24	113°
BM 2	PT 151	13.70	-5.03	135°
BM 2	PT 155	20.00	-5.87	240°
BM 3	Outlet Invert	29.00	-10.08	29°
BM 1 is a spike in a 23" DF Tree				
BM 2 is a spike in a 22" DF Tree				
BM 3 is a spike in a 22" DF Tree				
0° declination				

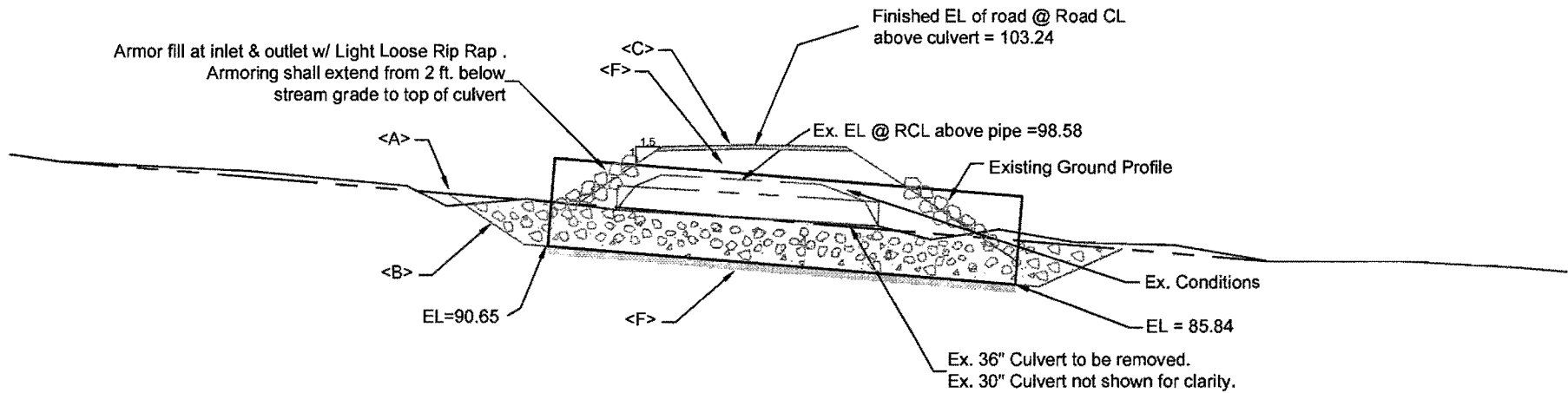
Date: 20 December 2011  
Sheet 1 of 3





# Example #4: Culvert Plan

## PROFILE - CENTERLINE OF CULVERT



<A> Construct stream channel from point 151 to point 155 according to CHANNEL CONSTRUCTION CROSS SECTION. Also fill in approx. 40 feet of old channel from point 151 to new culvert inlet. Apply 2 Foot Minus Engineered Streambed Material to a depth of 2 feet if existing material is unsuitable.

<B> Extend 2 Foot Minus Engineered Streambed Material to excavation Extents.

<C> 3 Inch Crushed Rock applied to a compacted depth of 6 inches over excavation extents.

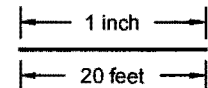
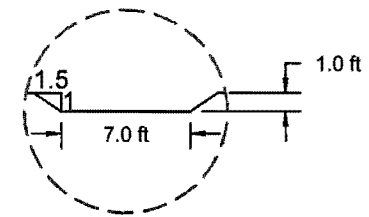
<D> Select Borrow backfill material.

<E> 3 Inch Crushed Rock Pipe Bedding

**Note:**

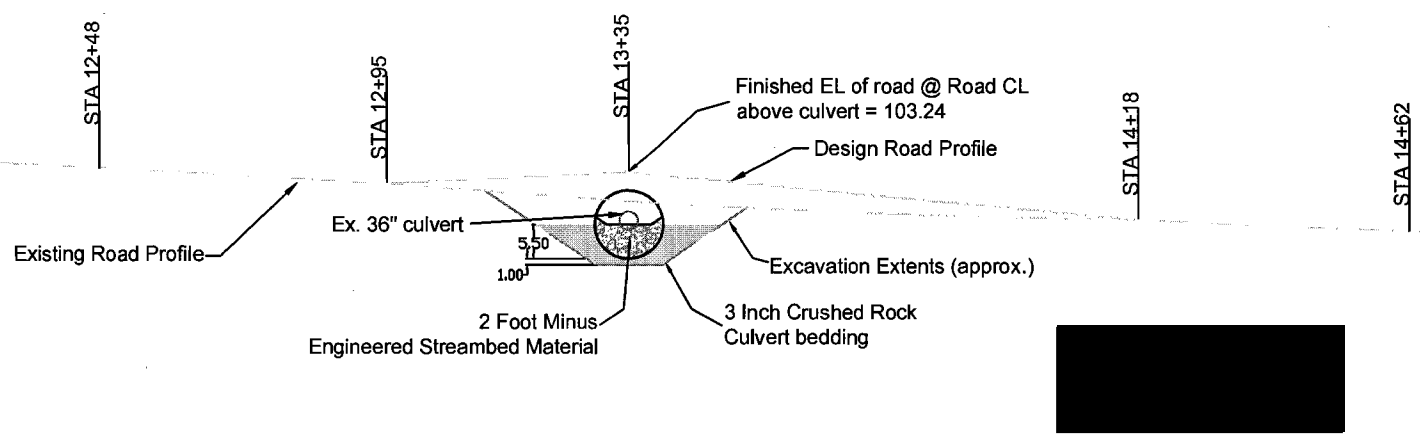
- 1) Crown at centerline not shown
- 2) Culvert Dimensions:  
132" x 59', 3" x 1" or 5" x 1" corrugations  
10 gauge aluminized steel
- 3) Culvert lay = Approx. 8 %
- 4) Culvert AZ = 8.3° (Outlet to Inlet)

### CHANNEL CONSTRUCTION CROSS SECTION NOT TO SCALE



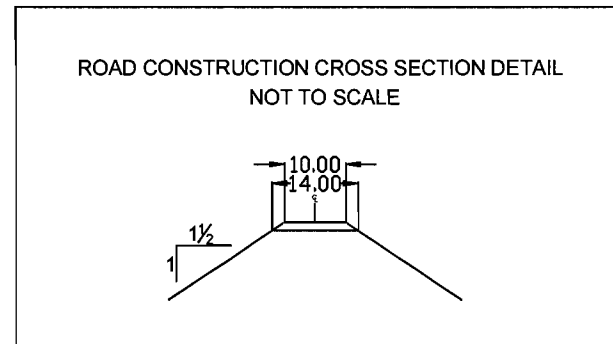
# Example #4: Culvert Plan

## CULVERT CROSS SECTION - CENTERLINE OF ROAD LOOKING DOWNSTREAM

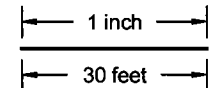


**Note:**

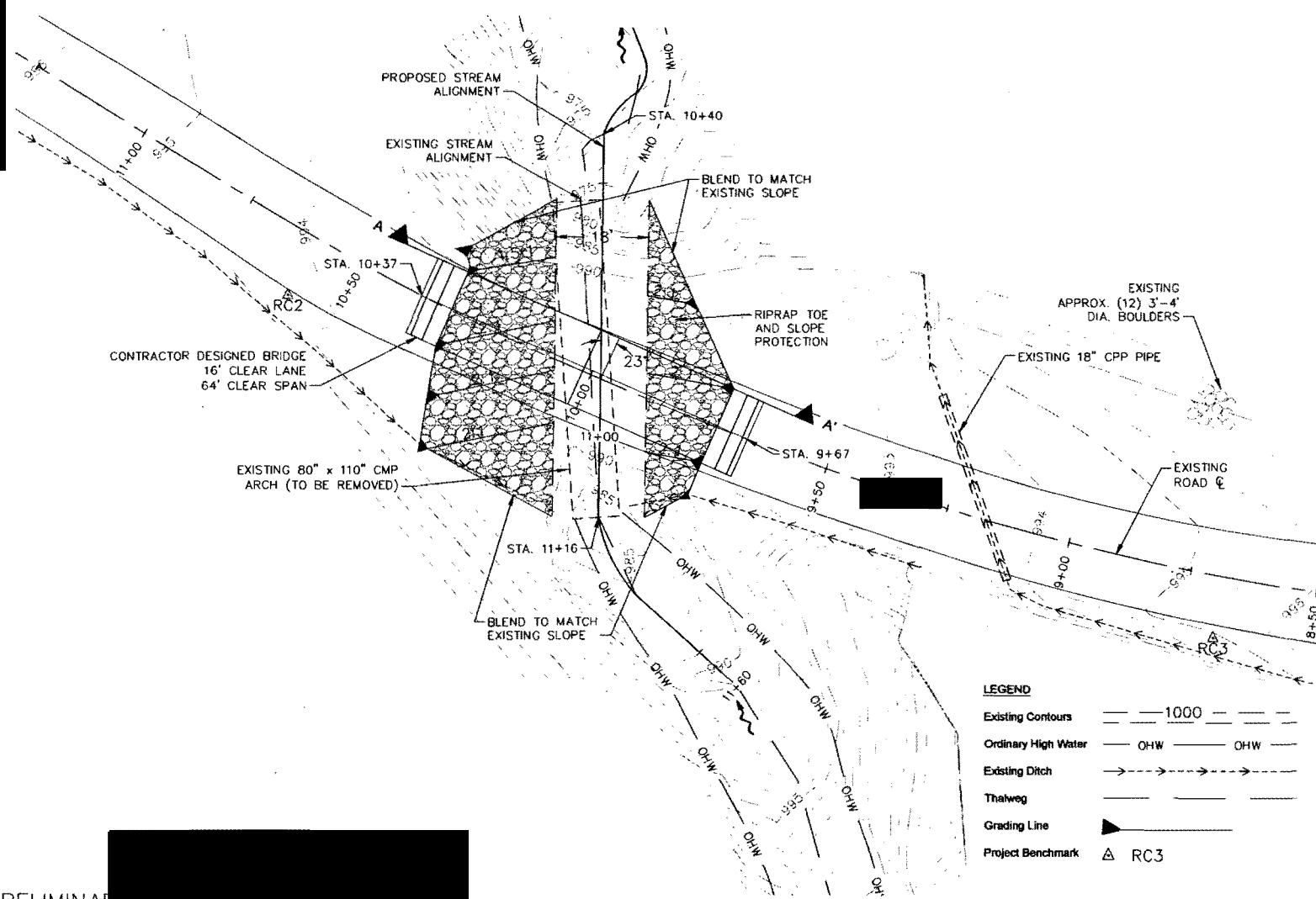
- 1) Begin fill @ Sta. 12+95.
- 2) End fill @ Sta. 14+18.
- 3) Grade from Sta. 12+95 to Sta. 13+35 = +4.0%
- 4) Grade from Sta. 13+35 to Sta. 14+18 = -9.4%



Date: 20 December 2011  
Sheet 3 of 3



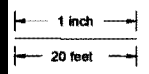
# Example #5: Culvert Removal and Bridge Installation Plan



**LEGEND**

Existing Contours	--- 1000 ---
Ordinary High Water	— OHW — OHW —
Existing Ditch	→ → → → →
Thalweg	— — — — —
Grading Line	▲ —————
Project Benchmark	△ RC3

PRELIMINARY

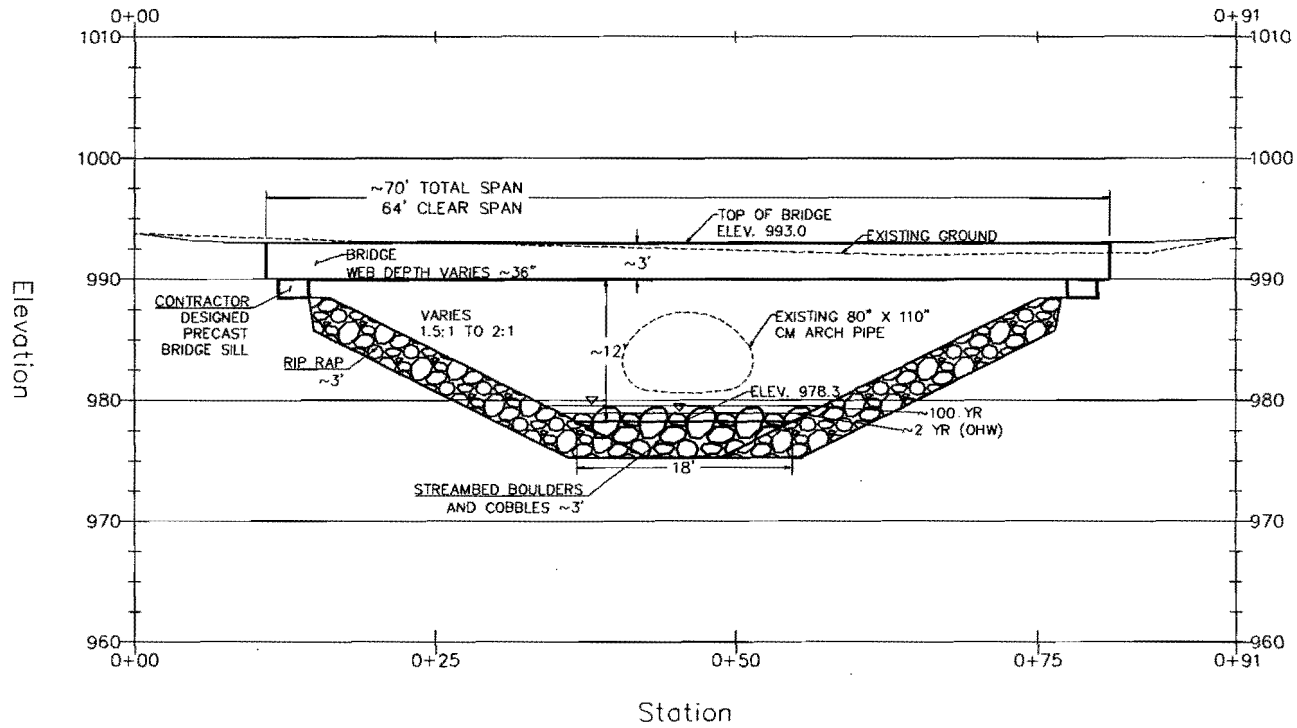


Drawn By: [Redacted]  
 Designed By: [Redacted]  
 Checked By: [Redacted]

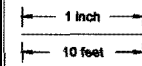
Date: 09/24/2012  
 Date: 09/24/2012  
 Date: x/x/x

Sheet  
 2  
 Sheet 2 of 7

# Example #5: Culvert Removal and Bridge Installation Plan



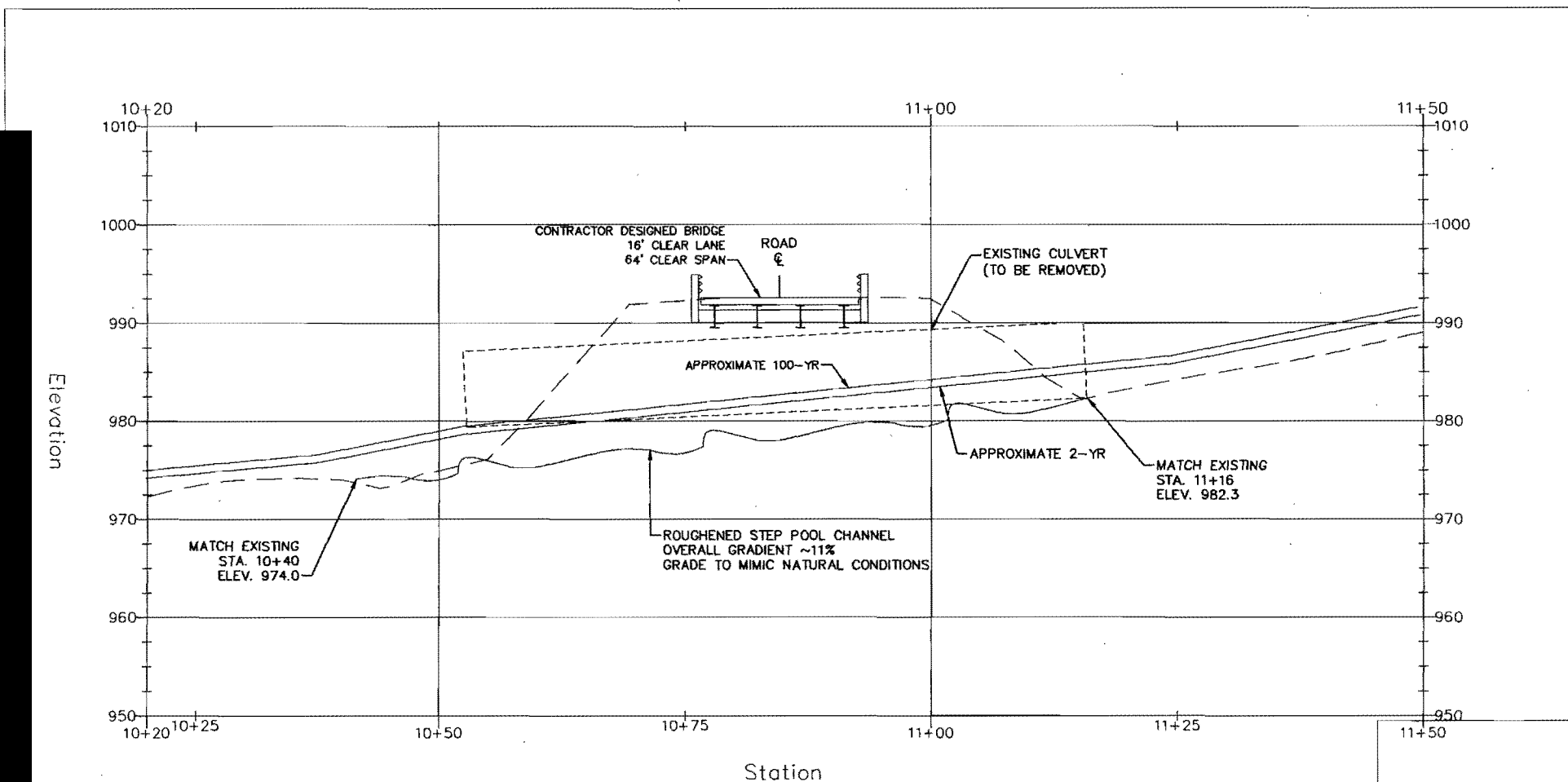
PRELIMINA



Drawn By: [Redacted]      Date: 09/24/2012  
 Designed By: [Redacted]      Date: 09/24/2012  
 Checked By: [Redacted]      Date: x/xx/xx

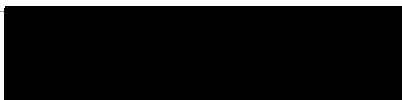
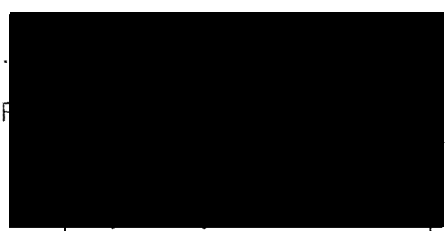
Sheet  
3  
Sheet 3 of 7

# Example #5: Culvert Removal and Bridge Installation Plan



**LEGEND**  
 Existing Thalweg   
 Proposed Thalweg

PRELIMINARY



1 inch  
 10 ft

Drawn By:  
 Designed By:  
 Checked By:

Date: 09/11/2012  
 Date: 09/11/2012  
 Date: x/xx/xx

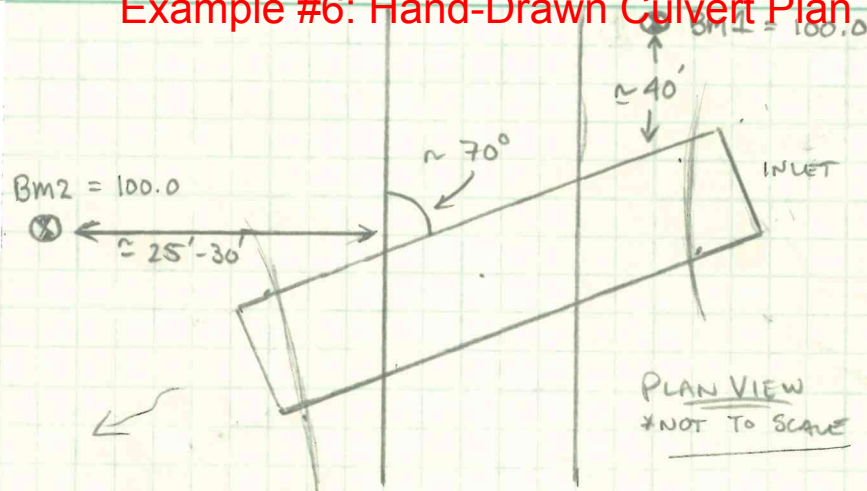


Sheet  
**4**  
 Sheet 4 of

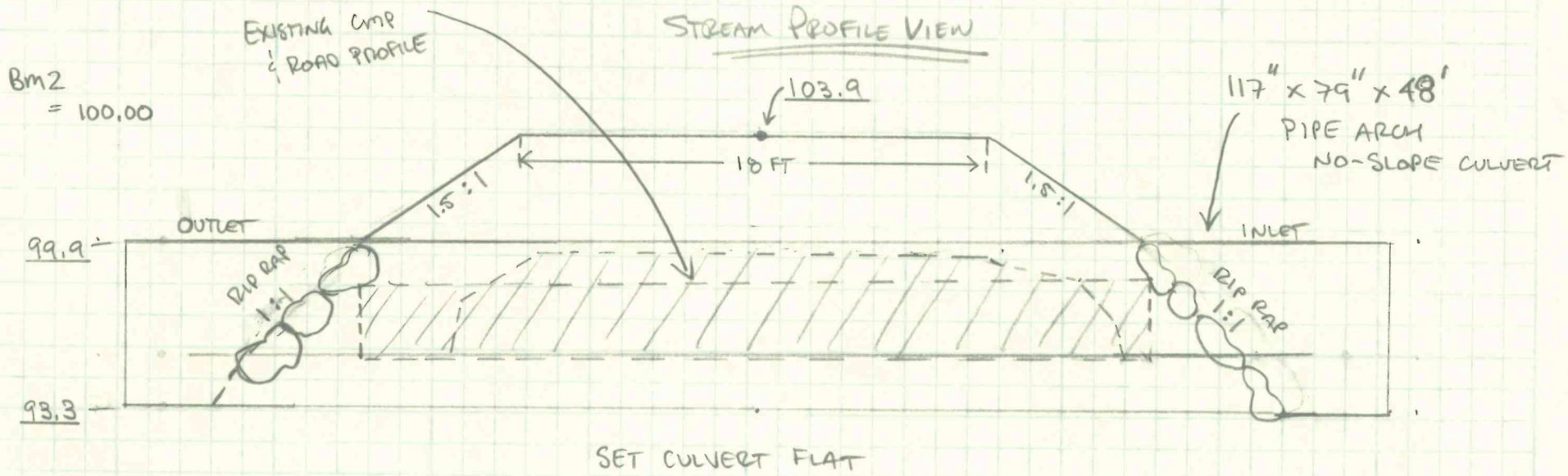


# Example #6: Hand-Drawn Culvert Plan

FISH PASSAGE CULVERT DESIGN PROFILE + PLAN



- $70^\circ$  SKEW SHOWN
- CHOOSE BEST FIT
- IN FIELD

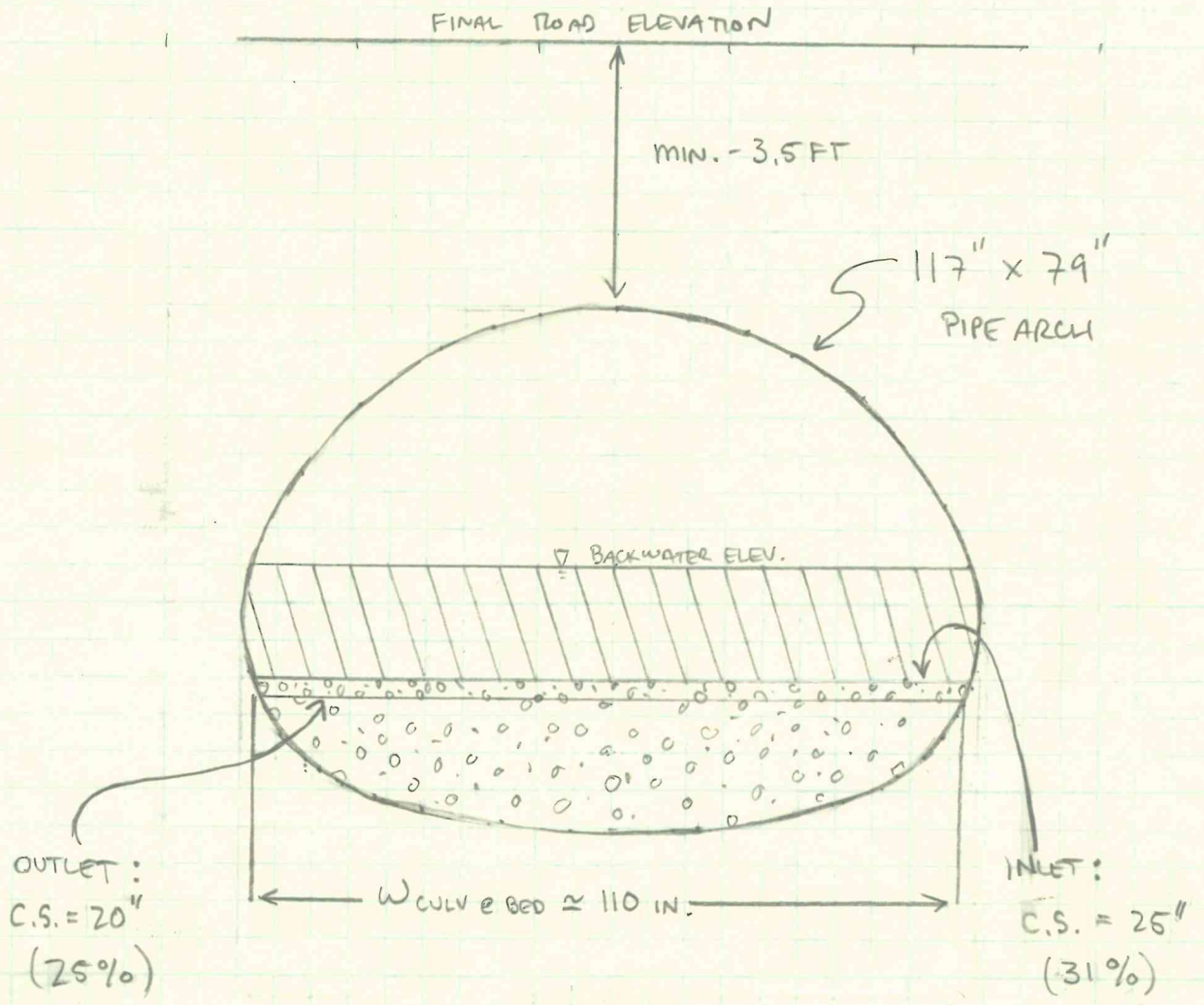




# Example #6: Hand-Drawn Culvert Plan

CULVERT SECTION  
+ SIZING

AMPAD



SCALE: 1" = 2.5'

## AREA CALCULATIONS

$A_{REQ} = 28.5 \text{ FT}^2 \rightarrow$  by physical meas. O/S:  $(W_1 + W_2) \times BFD = A_{REQ}$   
 $(7' + 12') \times 1.5' = 28.5 \text{ FT}^2$

$A_{BED} = (1 - 0.53) (76 \text{ FT}^2) = 35.7 \text{ FT}^2$

$A_{BED} (35.7 \text{ FT}^2) > A_{REQ} (28.5 \text{ FT}^2)$

## BANKFUL WIDTH

$BFW = 7.0 \text{ FT}$

$W_{CULV @ BED} = 9.2 \text{ FT} > BFW = 7 \text{ FT}$