Engineering Services
3rd Street Dam Bridge
3rd Street
Media, Pennsylvania

(SEA Reference 985130)

Schnabel Engineering

Schnabel Engineering

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September 25, 1998

Mr. Frank Daly
Solicitor
Media Borough
Media Borough Government Center
3rd and Jackson Streets
Media, PA 19063

Subject: Engineering Services for 3rd Street Dam Bridge, (PA Dam No. 23-009), 3rd Street, Media, Pennsylvania (Our Contract 985130)

Dear Mr. Daly:

We are pleased to submit our report on design alternatives for the 3rd Street Dam Bridge, also known as Broomalls Lake Dam.

Schnabel Engineering Associates, Inc., analyzed spillway upgrading measures and estimated costs for improvements to the 3rd Street Dam Bridge to meet regulatory criteria and accepted engineering practice. This report presents the findings of project items, including:

- Increased spillway capacity
- Energy dissipation at the downstream toe of the dam
- Increasing the downstream slope to 3H:1V
- Evaluation of crest wall repair or replacement
- Raising of dam crest from EL 193 to EL 195 (i.e., raise upstream wall)
- Cost estimates of each alternative
- Recommendations

BACKGROUND

The 3rd Street Dam Bridge is approximately 29 ft high and 500 ft long, located on Broomalls Run, a tributary of Ridley Creek. The dam crest is a road/bridge known as 3rd Street, which serves as a major traffic link between Upper Providence Township and Media, Pennsylvania. The dam is classified as a Class C (small), Category 1 (high) hazard dam. The dam was reportedly constructed circa 1884 as an earth and rock fill dam for the purpose of harvesting ice from the impounded water. In 1920, the lake was acquired for recreational purposes by the Media Swimming and Rowing Club.

Around 1930, stone masonry walls were constructed along the upstream and downstream edges of the dam crest by a Government WPA Project to support the bridge and road.

Around 1996, a section of the stone masonry wall at the downstream edge of the bridge crest failed due to undermining. The failure was related to concentrated stormwater runoff flowing through the openings in the bridge crest wall. The Borough of Media closed the bridge and road after the failure.

The spillway capacity of the dam/bridge has been previously reported as seriously inadequate and in an unsafe, nonemergency condition. The Pennsylvania Department of Environmental Protection (PADEP) Division of Dam Safety has requested upgrades to the dam/bridge so that it will meet current requirements for spillway capacity, as described below.

HYDROLOGY AND HYDRAULICS

The 3rd Street Dam Bridge is required by the PADEP Division of Dam Safety to safely pass the ½ PMF. The present spillways have been estimated to safely pass approximately 13% of the PMF. The Phase I Inspection Report describes the spillway capacity as "seriously inadequate" and in an "unsafe, nonemergency condition".

The existing spillway conduits at the site consist of a box culvert and three eliptical corrugated metal pipes (CMP). The box culvert has a mouth opening of 9.5 ft wide by 5.2 ft high, which tapers to 7.75 ft wide by 5.5 ft high at about 6 ft from the culvert face. The floor of the culvert drops an estimated 0.8 ft over the six foot tapered section, and about 0.2 ft over the remaining culvert length, for a total drop of about one foot over its length. The three CMPs measure 43 inches wide by 27 inches high, and slope from about EL 186.4 at the upstream inverts to about EL 180 at the downstream inverts.

PADEP Division of Dam Safety estimated the ½ PMF inflow to the dam using the HEC-1 computer model. The outflow from the reservoir was computed at approximately 2200 cfs, which compares well with the value contained in Applied Geotechnical and Environmental Services Corporation's (AGES) report titled, *Broomalls Dam Hydrologic Study,* July 1981. An outflow of 2,200 cfs was used as the design flow for the spillway alternatives analyzed in this report.

To meet regulatory criteria, various methods to increase bridge spillway capacity were evaluated. Also, by raising the effective top-of-dam/bridge, greater head can be directed over the spillway, which can result in reduction in the physical size of the spillway. Three alternative spillway options were evaluated for two top-of-dam elevations (EL 193 & EL 195), for a total of six spillway options. Each alternative assumed one foot of freeboard. The evaluated scenarios were as follows:

> **Alternative 1:** Maintain the existing masonry culvert spillway beneath the roadway, and construct a new secondary drop-inlet spillway and culvert alongside of the existing spillway, at the location of the three existing corrugated metal pipes (Figures 1 & 2).

Alternative 2: Abandon the existing masonry culvert, remove the CMP pipes, and replace with a new drop inlet and culvert system (Figures 3 & 4). (It was originally anticipated that the new drop inlet could be constructed at the location of the present masonry culvert, but it is likely that the masonry extends to a considerable depth. We now believe that the culvert can be more economically constructed away from the existing culvert.)

Alternative 3: Construction of a straight concrete spillway and terminal energy dissipator, with spillway length as needed for passing the design flood for two top-of-dam elevations. This alternative assumes the existing culverts, roadway, and utilities would be abandoned (Figures 5 & 6).

The HY-8 computer model, developed by the Federal Highway Administration, was used to calculate flow through the existing culverts, and to analyze various size culverts for use with the drop inlet structure. Drop inlets and ogee weir lengths were computed with the weir equation using discharge coefficients of 3.1 and 3.6, respectively.

A top-of-dam/bridge at EL 193 (approximate top of existing crest wall at low point) and EL 195 (raised 2 ft) were analyzed for each alternative. For Alternative Nos. 1 and 2, the dimensions of the drop inlet structures were effectively unchanged and provided no cost savings. However, in Alternative No. 3 the ogee spillway length changed from 42 ft to 27 ft when the top of dam elevation was changed from 193 to 195. The reason for this is the type of flow control in each scenario. Culvert sizes remained essentially unchanged since orifice flow increases only nominally with increases in head, which in this instance is only increased by two feet. For weir flow, discharge increases much more dramatically; therefore, significant reduction in structure size can be accomplished with a relatively small increase in head. The following table describes the dimensions of the spillway for each alternative.

Table 1
Alternative Spillway Dimensions

Alternative	Dimensions
1. Drop Inlet Structure (Top-of-Dam EL 193 & 195)	22' x 12' inlet; 14'x 6' culvert
2. Drop Inlet Structure (Top-of-Dam EL 193 & 195)	23' x 11.5' inlet; 15'x 6' culvert
3. Ogee Spillway (Top-of-Dam EL 193)	Ogee Spillway Length – 42 ft
3. Ogee Spillway (Top-of-Dam EL 195)	Ogee Spillway Length – 27 ft

Using the developed rating curves, the HEC-1 computer model, developed by the US Army Corps of Engineers, was used to compute reservoir elevations during the 2, 5, 10, 25, 50, and 100 year floods for the various design alternatives. The following table presents the results of the analyses:

Table 2
Lake Elevation vs. Return Period Storm
for Various Bridge Spillway Alternatives

Return Period	Existing Culvert & CMPs (EL)	Drop Inlet Structures and Top of Crest Wall at EL 193 or 195 (EL)	Ogee Spillway and Top of Crest Wall at EL 195 (EL)
2 yr	186.4	186.3	186.4
5 yr	187.6	187.1	187.3
10 yr	189.2	187.8	188.2
25 yr	189.9	188.2	188.7
50 yr	192.5	189.4	190.2
100 yr	193.8	190.1	191.1

As can be seen from the above table, water surface elevations for all of the evaluated options resulted in lake water levels lower than those computed for the existing spillway system. Therefore, any of the evaluated options would result in less frequent impacts to structures surrounding the lake. It should be noted that for the "ogee spillway and top of crest wall at EL 193" option, lake levels were up to one foot lower than those shown for the higher crest wall.

OVERVIEW OF OTHER DESIGN ISSUES

In addition to the various spillway options described above, other necessary improvements to the dam were also evaluated. Based on discussions with Mr. Donald Martino of the PADEP Division of Dam Safety, all trees on the bridge embankment must be removed, and the downstream slope of the bridge embankment must be flattened to provide adequate margins of safety for slope stability. After the removal of trees and brush, but prior to placement of fill, a filter drain (medium to coarse sand) should be placed over the slope. The filter will collect any seepage which may occur, particularly from along the root systems of the removed trees. Fill to flatten the downstream slope would be placed over the filter drain, and the slope topsoiled and seeded (see Figure 7). During final design, it should also be evaluated whether an erosion control mat should be utilized to prevent erosion of the downstream slope resulting from roadway runoff from the abutment areas.

As previously noted, Schnabel also evaluated the economic advantages of raising the top of dam level to increase the head over the spillway. By raising the effective top-of-dam/bridge, greater head is directed over the spillway, which can result in reduction in spillway size. It quickly became apparent that raising the *entire* roadway crest by any amount would be more expensive than just raising the upstream wall, since raising of the roadway still requires a retaining structure at the upstream edge of crest. Raising of the effective top-of-dam/bridge was assumed to be accomplished by increasing the elevation of the upstream wall between Stations 4+25 and 6+00. Since the existing wall is in a state of failure, it could not be relied upon to support a raised section of wall. For the of wall. For the raised top-of-dam/bridge scenarios, we assumed that a new concrete cantilever retaining wall would be constructed to EL 195 between the above stations.

COST ESTIMATES

Cost estimates were developed based on estimated quantities derived from conceptual layout drawings prepared for this report. It should be noted that downstream topography presented on the attached figures is approximate only, and was derived from USGS topographic mapping and measurements obtained during site visits. Individual cost items likely to be included in a construction contract are described below.

Mobilization and Demobilization: The cost for mobilization and demobilization includes the contractor's cost to mobilize equipment and personnel, acquire bonds and insurance, provide erosion and sediment control, and other miscellaneous costs. The cost to mobilize and demobilize was estimated to be about 10 % of the total cost of construction.

Clearing and Grubbing: Clearing and grubbing of trees and vegetation pertains primarily to the downstream face of the bridge embankment which is heavily overgrown. Grubbing of the root systems to an adequate depth (to be later filled with filter material) is required to lessen the potential for seepage traveling along root systems. Stripping of topsoil is also necessary to remove organic material from the slope surface prior to placement and compaction of fill material. This cost was assumed to be the same for all three alternatives.

Demolition: Demolition of existing structures for Alternative No. 1 includes removal of the existing timber walkway at the location of the new drop inlet, removal of a portion of the downstream crest wall, and removal of the 3 elliptical pipes. Demolition of existing structures for Alternative No. 2 includes total removal of the timber walkway, removal of the upper two feet of the upstream and downstream crest walls, removal of the 3 elliptical pipes, and removal of the existing bridge (culvert) deck. Alternative No. 3 includes removal of the same structures as Alternative No. 2 plus the removal of the entire upstream crest wall between stations previously described.

Control of Water: Maintaining normal pool during construction will be considerably more expensive than draining the lake to the existing bottom (about -8 ft). Given that rock is located at a relatively shallow depth (EL 162), the use of steel sheeting for use as cofferdam material was discounted. For the purposes of these cost estimates, we assumed that the lake would be drained by means of pumps or siphons, a diversion channel cut through the embankment to the present lake bottom, and an earth-berm cofferdam constructed around the excavation area. For Alternative No. 1, the diversion channel was located at about Station 5+50, and was assumed to extend well downstream to allow for construction of the new drop inlet adjacent to the existing masonry culvert. For Alternative Nos. 2 and 3, the proposed excavated channel could be economically situated at the location of the existing CMPs, since the CMPs must be removed anyway, and the existing concrete slope protection would assist with erosion resistance during construction. The portion of the diversion channel through the embankment would be lined with riprap to prevent erosion. For each alternative, we assumed that an earth cofferdam would be constructed in the vicinity of the proposed drop inlet or ogee spillway construction to prevent surface water from entering the excavation. The earth cofferdam was estimated to be constructed 10 ft upstream of the top-of-cut slope, with a crest at about EL 182 and with side slopes at 2H:1V. It is likely that some removal of soft sediments would be required for berm construction.

Excavation: This cost includes excavation of areas around the drop inlet/culvert or ogee spillway as well as the CMPs for Alternative No. 1. Excavation for CMP removal in Alternative Nos. 2 and 3, is included in the Control of Water cost.

Earthfill: The cost of earthfill will include the flattening of the downstream face from its approximate 1.5H:1V slope to a more stable 3H:1V slope by placing additional fill material. Slope stability analyses would be performed for final design and may justify the design of a steeper downstream slope. However, for maintenance purposes, the slope should not be steeper than about 2.5H:1V. We estimated the slope to be 3H:1V for planning purposes based on subsurface information provided in the *Phase II Inspection Soils Report* by McCormick, Taylor & Associates, Inc. Also included in the earthfill cost is the backfill material over the drop inlet structures in Alternative Nos. 1 and 2. In addition, the earthfill is required for backfill around the removed CMP in Alternative No. 1. For Alternative Nos. 2 and 3, the excavation and backfill of CMP area is addressed under the Control of Water cost.

Concrete: The cost of concrete was subdivided into several categories. The cost of cast-in-place concrete includes concrete, formwork, steel reinforcement, and miscellaneous related items. For Alternative No. 1, concrete costs have been broken out separately for the proposed drop inlet, proposed culvert, stilling basin for the proposed culvert, raising of the walls of existing culvert, and construction of new retaining walls downstream of the existing culvert. Raising of the walls of the existing culvert was assumed to have a lower unit cost because the walls would be predominantly mass concrete and would require little steel reinforcement. For Alternative No. 2, concrete costs have been broken out for the proposed drop inlet, proposed culvert, and stilling basin. Alternative No. 3 includes cost break-outs for spillway chute and walls, ogee weir, and cutoff trench.

Filter Drain: This cost item was assumed to be the same for all three alternatives, and consists of placing a medium sand on the stripped downstream slope of the dam prior to placement of the new earthfill.

Repair or Replacement of Upstream Crest Wall: For maintaining the top-of-dam/bridge at EL 193, four alternatives were analyzed for stabilization of the upstream crest wall between Stations 4+25 and 6+00. Alternative A includes the construction of a riprap buttress upstream of the wall. Alternative B involves the construction of a low geogrid buttress wall upstream of the existing masonry wall and protection of the toe of the geogrid wall by riprap. Both Alternatives A and B involve repair of the top two feet of the existing wall, and complete rebuilding of the wall where its removal is required for removal of the CMPs and for diversion during construction. Alternative C involves removal of the existing wall and construction of a new concrete cantilever retaining wall between Stations 4+25 and 6+00. This alternative also includes the placement of backfill around the wall after it has been constructed. Alternative D involves the installation of tie-backs to the existing masonry wall. For raising the effective top-of-dam/bridge to EL 195, a new concrete cantilever wall would be required to resist the forces imparted by the greater hydrostatic loading. The following table summarizes the cost for each alternative.

Table 3
Summary of Wall Repair Options for
Top-of-Dam/Bridge at EL 193

Alternative	Cost
Alternative A - Riprap Buttress	$35,000
Alternative B - Geogrid Wall	$45,000
Alternative C – New Concrete Wall	$60,000
Alternative D – Tie Backs	$100,000

Note:For top-of-dam at EL 195, it was assumed a new concrete wall would be required at a cost of $70,000.

The riprap buttress (Alternative A) is believed to be the most cost-effective solution for alternatives with the top-of-dam/bridge at EL 193. However, it should be noted that much of the failing wall will be demolished upon removal of the existing CMPs and upon excavation of the diversion trench through the embankment, and for Alternative 1, upon excavation for new culvert construction. Therefore, for each alternative, it is likely that at least 50 feet of wall will need to be completely rebuilt. For this reason, a new cantilever concrete wall may prove to be a more attractive option during the final design process.

Storm Sewer: A storm sewer will be necessary to drain stormwater trapped by the bridge crest wall, and to prevent damage to the wall. The sewer line would discharge into the box culvert or ogee spillway chute for conveyance to the toe of the dam.

Pavement: The pavement reconstruction item assumes costs associated with the repaving of Third Street upon completion of Alternative Nos. 1 and 2. Alternative No. 3 assumes the roadway across the dam will be abandoned; therefore, only patching of disturbed areas was assumed for this alternative.

Topsoil and Seeding: The topsoil and seeding item reflects costs associated with placing topsoil and seed on the downstream slope after the downstream slope has been flattened.

Contingency: A contingency cost of 20% was included in the total cost to account for numerous smaller items, some of which have been identified (e.g., sluice gates, riprap at outlets, increased cost for working around utilities, etc.) and some of which have not.

Engineering Cost: A line item was included to account for engineering costs for the project. Engineering costs include design, permitting, bid, and construction phase services. For this project, it was assumed that full-time construction oversight would be provided. Engineering costs were assumed to be approximately 15 percent of the total construction cost.

Cost estimates for each alternative were developed and are tabulated below. Itemized breakouts for each alternative are included in Attachment 2.

Table 4
Estimated Total Construction & Engineering Costs

Alternative	Top-of-Dam EL 193	Top-of-Dam EL 195
1	$955,000	$980,000
2	$782,000	$807,000
3	$900,000	$829,000

RECOMMENDATIONS

Based on the analyses performed for this report, we recommend the design of Alternative No. 2. This includes the construction of a drop inlet structure, abandonment of the existing culverts, and construction of other improvements as outlined herein. It should be noted that construction of Alternative No. 3 with top-of-dam/bridge at EL 195 was only 6% higher in cost to that for Alternative No. 2 with top-of-dam at EL 193. Several factors not quantified in this report would impact the Alternative No. 3 cost. These would include the relocation or abandonment of the existing utilities in the roadway, and the loss of 3rd Street as a public roadway. Consideration of these factors further supports the selection of Alternative No. 2 as the preferred alternative for construction.

Please contact us if you have any questions regarding this report.

Very truly yours,

SCHNABEL ENGINEERING ASSOCIATES, INC.

John P. Harrison, P.E.
Senior Engineer

CMK:JPH:DBC:cml

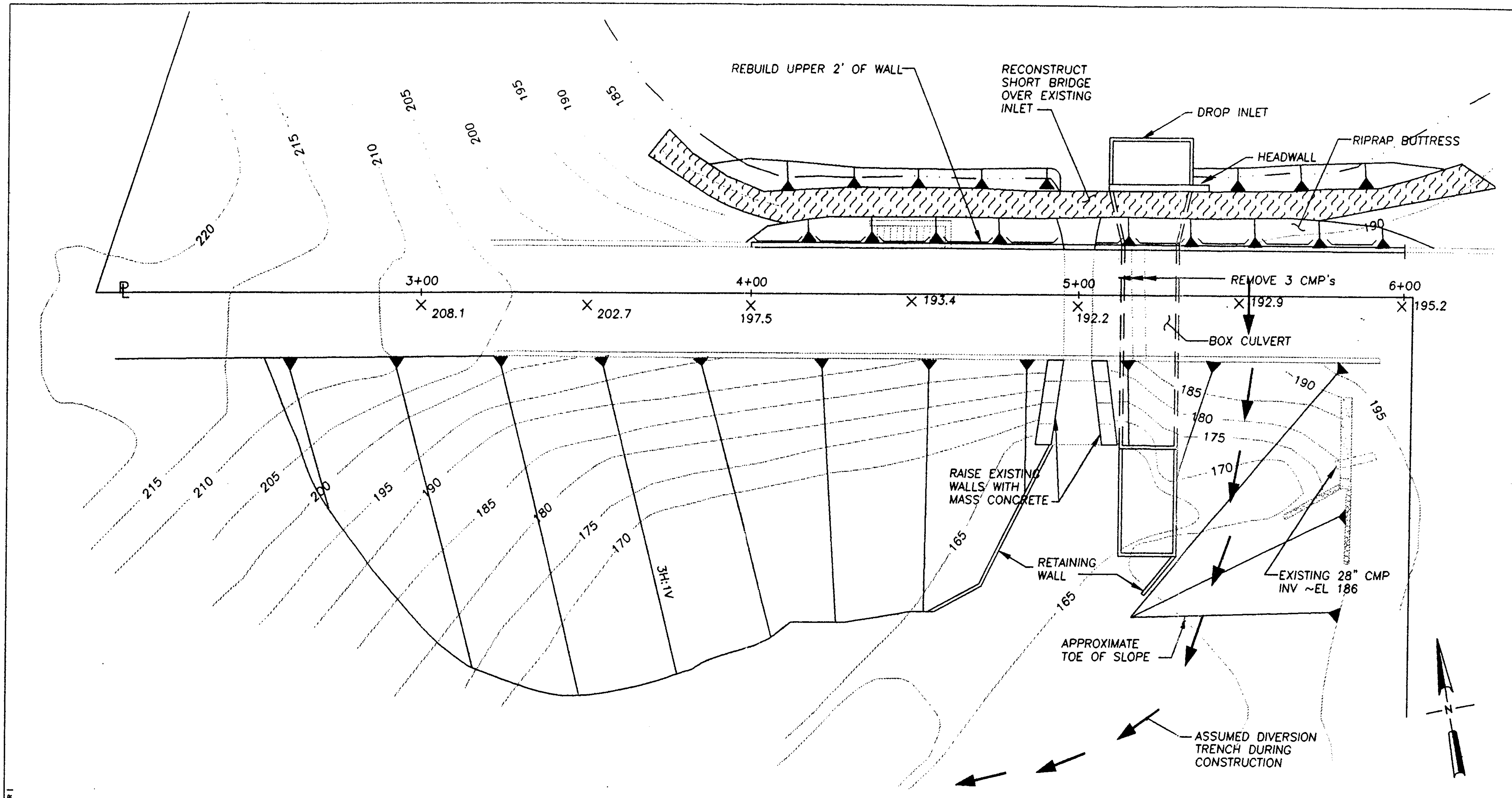
Attachments:
(1) Figures (9)
(2) Tabulated Cost Estimates (4)

Distribution: Media Borough (2)
Attn: Mr. Frank Daly

ATTACHMENT 1

Figures

Schnabel Engineering Associates



GRAPHIC SCALE

0 15.0 30.0

1 inch = 30 ft.

NOTES: 1.) UPSTREAM TOPOGRAPHY OBTAINED FROM PLAN ENTITLED PLAN OF PROPERTY OF MEDIA SWIMMING AND ROWING CLUB G. D. HOUTMAN & SON, REVISED MARCH 15, 1968

2.) DOWNSTREAM TOPOGRAPHY WAS ESTIMATED BASED ON USGS TOPOGRAPHIC MAPPING AND MEASUREMENTS DURING SITE VISITS.

BM: WEIR CREST EL185.9

3RD STREET DAM BRIDGE
MEDIA, PENNSYLVANIA
ALT. 1 – PLAN VIEW

SCHNABEL ENGINEERING ASSOCIATES INCORPORATED [redacted] ENGINEERING CONSULTANTS

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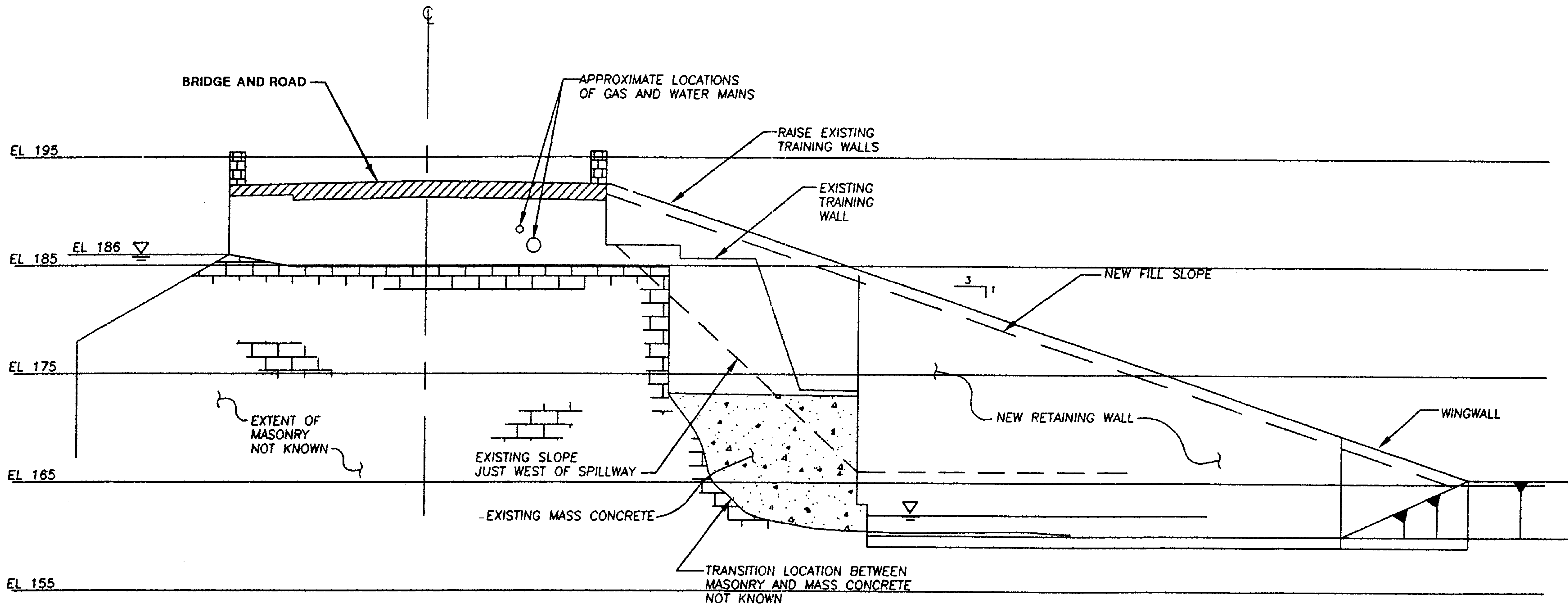

PROFILE OF EXISTING SPILLWAY MODIFICATIONS

GRAPHIC SCALE

0 5.0 10.0

1 inch = 10 ft.

NOTE: PROFILE OF ADJACENT NEW DROP INLET SIMILAR TO THAT SHOWN FOR ALT. 2

3RD STREET DAM BRIDGE
MEDIA, PENNSYLVANIA
ALT. 1 – PROFILE

SCHNABEL ENGINEERING ASSOCIATES INCORPORATED [redacted]
ENGINEERING CONSULTANTS

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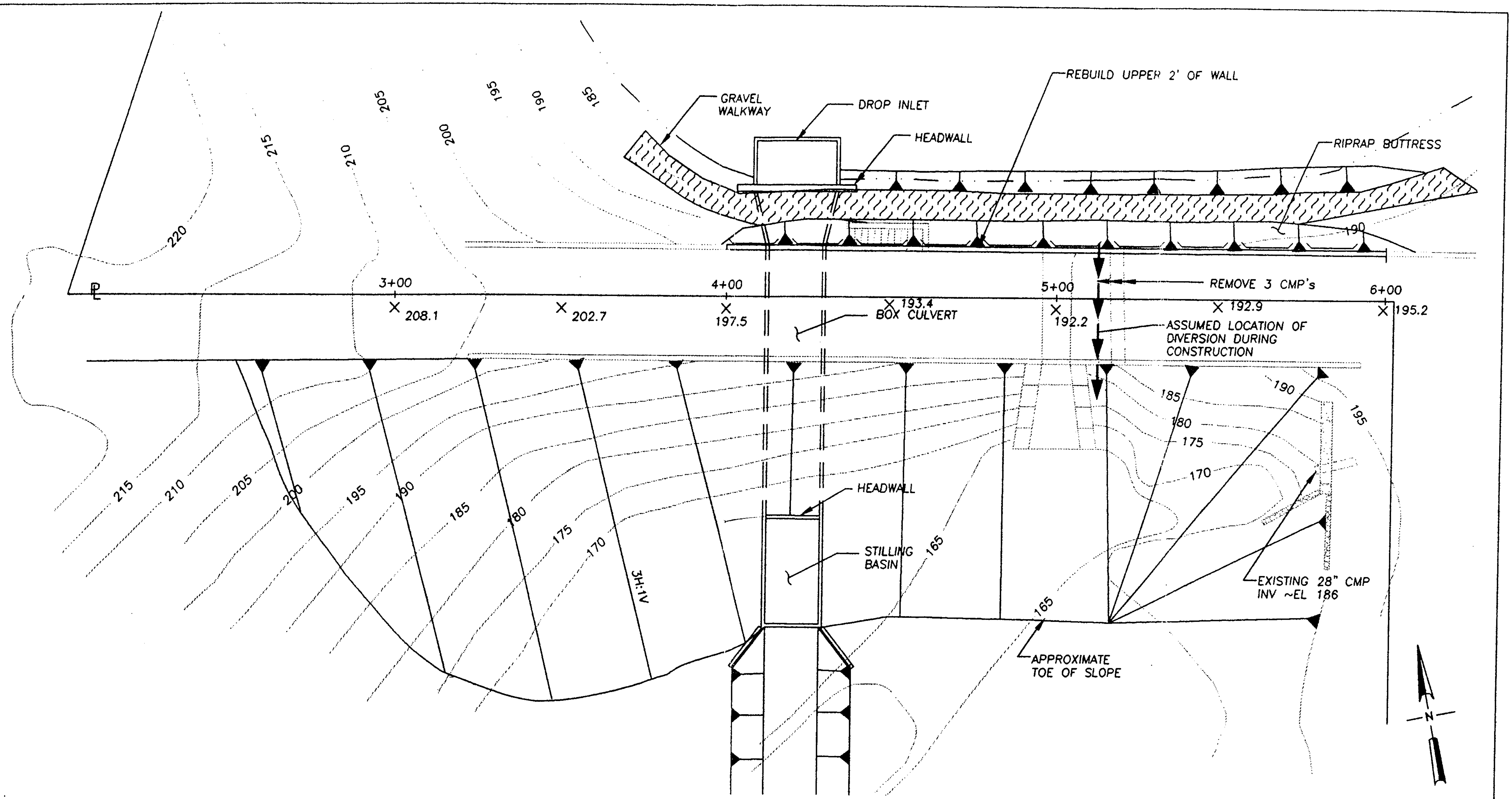

GRAPHIC SCALE

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1 inch = 30 ft.

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2.) DOWNSTREAM TOPOGRAPHY WAS ESTIMATED BASED ON USGS TOPOGRAPHIC MAPPING AND MEASUREMENTS DURING SITE VISITS.

BM: WEIR CREST EL185.9

3RD STREET DAM BRIDGE
MEDIA, PENNSYLVANIA

ALT. 2 – PLAN VIEW

SCHNABEL ENGINEERING ASSOCIATES INCORPORATED [redacted]
ENGINEERING CONSULTANTS

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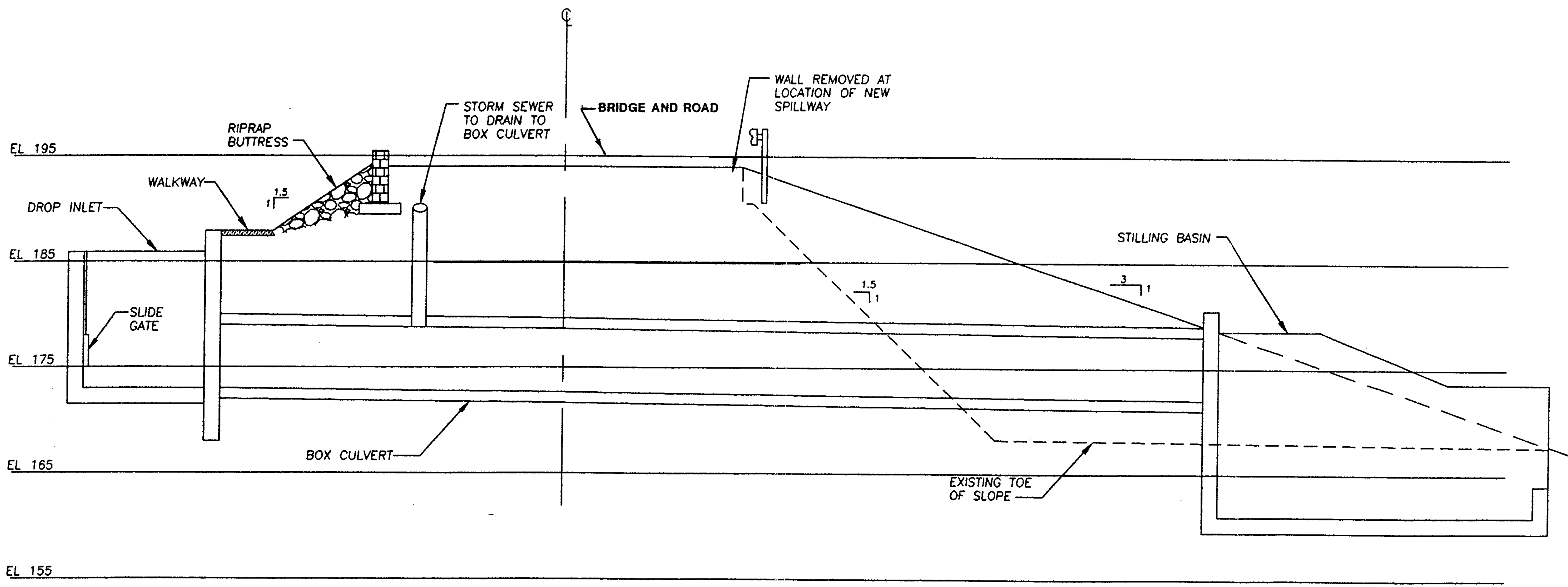

PROFILE OF DROP INLET SPILLWAY AND BOX CULVERT

GRAPHIC SCALE

0 5.0 10.0

1 inch = 10 ft.

3RD STREET DAM BRIDGE
MEDIA, PENNSYLVANIA
ALT. 2 – PROFILE

SCHNABEL ENGINEERING ASSOCIATES INCORPORATED [redacted]
ENGINEERING CONSULTANTS

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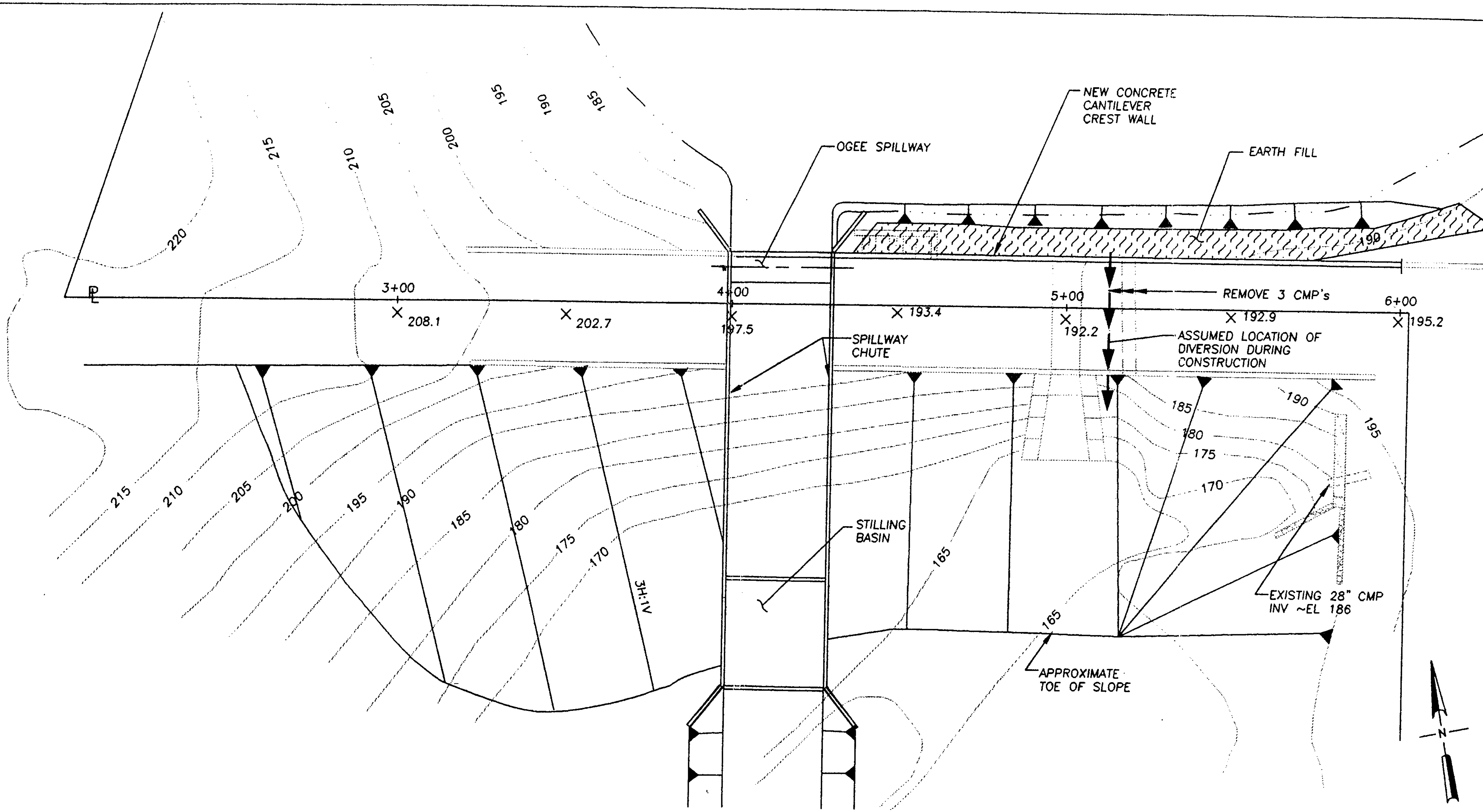

GRAPHIC SCALE

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1 inch = 30 ft.

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2.) DOWNSTREAM TOPOGRAPHY WAS ESTIMATED BASED ON USGS TOPOGRAPHIC MAPPING AND MEASUREMENTS DURING SITE VISITS.

BM: WEIR CREST EL185.9

3RD STREET DAM BRIDGE
MEDIA, PENNSYLVANIA
ALT. 3, TOP OF DAM EL 195– PLAN

SCHNABEL ENGINEERING ASSOCIATES INCORPORATED [redacted]
ENGINEERING CONSULTANTS

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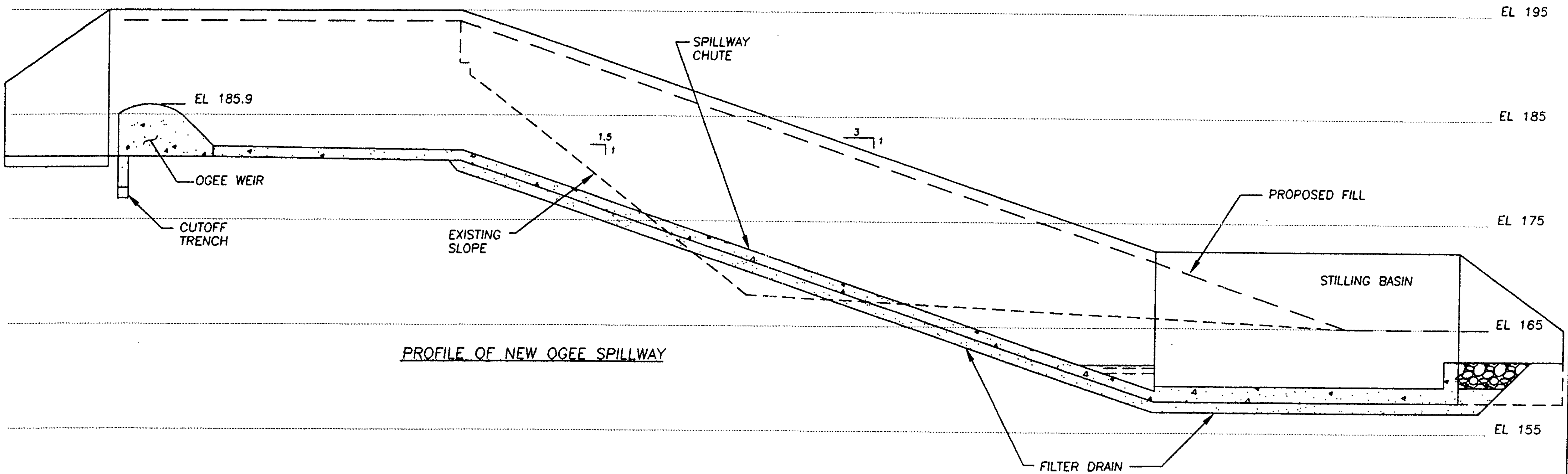

PROFILE OF NEW OGEE SPILLWAY

GRAPHIC SCALE

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1 inch = 10 ft.

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3RD STREET DAM BRIDGE MEDIA, PENNSYLVANIA ALTERNATIVE 3 – PROFILE			
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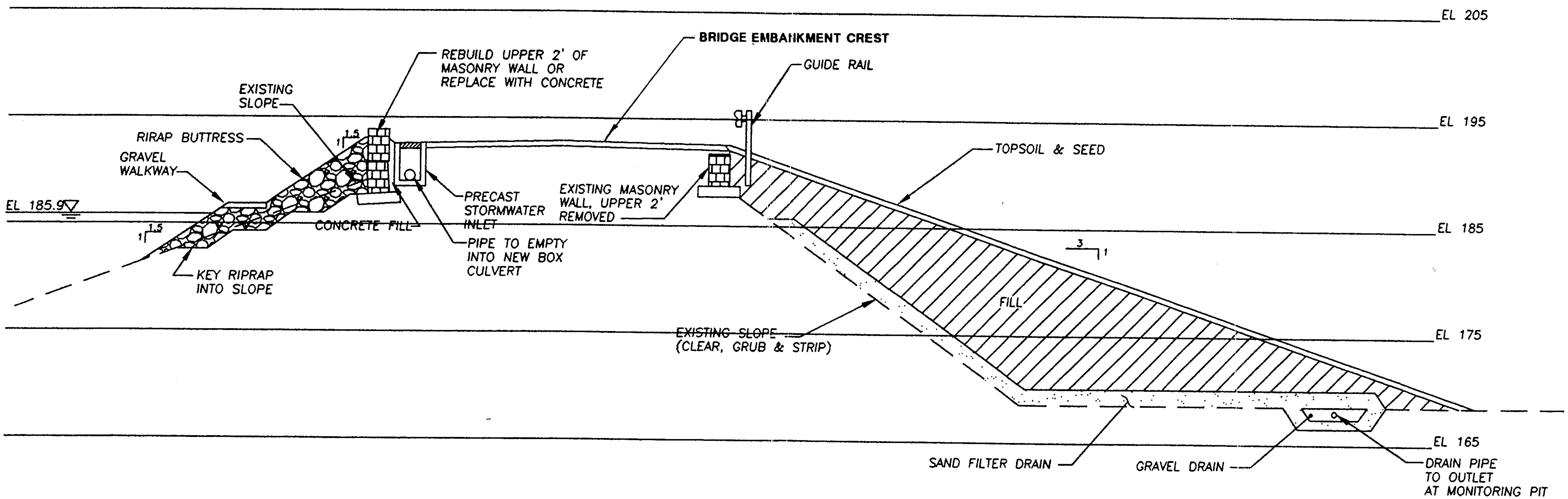

TYPICAL CROSS SECTION STATION 4+00 TO 6+00

GRAPHIC SCALE

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1 inch = 10 ft.

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3RD STREET DAM BRIDGE MEDIA, PENNSYLVANIA EMBANKMENT CROSS SECTION – ALL ALTERNATIVES			
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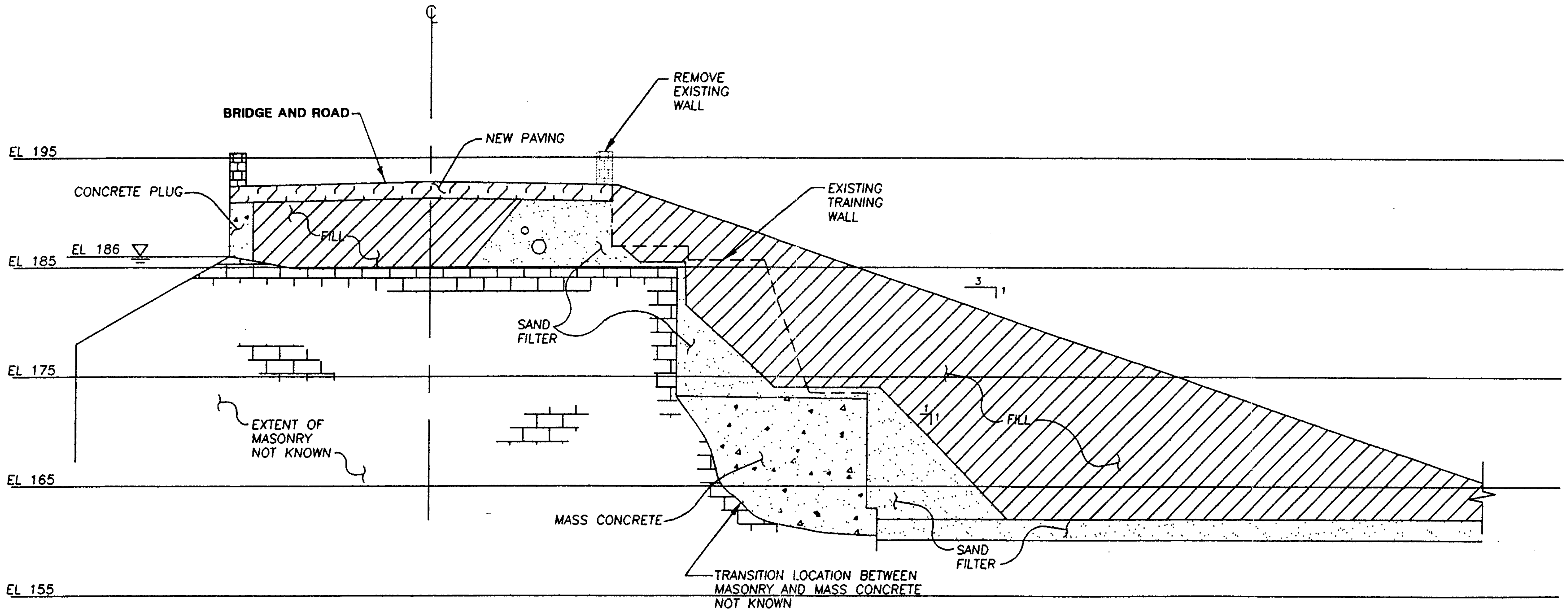

PROFILE OF ABANDONED CULVERT

GRAPHIC SCALE

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1 inch = 10 ft.

3RD STREET DAM BRIDGE
MEDIA, PENNSYLVANIA
EXISTING SPILLWAY ABANDONMENT – ALT. 2 & 3

SCHNABEL ENGINEERING ASSOCIATES INCORPORATED [redacted]
ENGINEERING CONSULTANTS

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ATTACHMENT 2

Tabulated Cost Estimates

3rd Street Dam Bridge
Alternative 1 - Maintain Existing Spillway and Construct New Drop Inlet
Top of Dam - EL 193
Cost Estimate

Item	Unit	Unit Cost	Quantity	Total Cost
1. Mobilization/Demobilization	LS	$65,000	1	$65,000
2. Clearing and Grubbing	LS	$10,000	1	$10,000
3. Demolition	LS	$10,000	1	$10,000
4. Control of Water	LS	$70,000	1	$70,000
5. Excavation	cy	$10	2100	$21,000
6. Earthfill	cy	$15	9500	$142,500
7. Concrete	-	-	-	-
7.a Proposed Drop Inlet	cy	$550	65	$35,750
7.b Proposed Culvert	cy	$550	125	$68,750
7.c Stilling Basin	cy	$550	140	$77,000
7.d Raise Walls of Existing Culvert	cy	$450	40	$18,000
7.e Retaining Walls for Existing Culvert	cy	$550	135	$74,250
8. Filter Drain	cy	$20	1000	$20,000
9. Repair of Upstream Crest Wall	LS	$35,000	1	$35,000
10. Storm Sewer	LS	$10,000	1	$10,000
11. Pavement	sy	$25	760	$19,000
12. Topsoil and Seeding	sy	$5	3000	$15,000
			Subtotal	$691,250
			Contigency - 20%	$138,250
			Total Estimated Construction Cost	$829,500
			Engineering Costs - 15%	$124,425
			Total Construction and Engineering Costs	**$953,925**

Notes:
1. Add $25,000 to Total Construction & Engineering Costs for Top of Dam at EL 195
2. Engineering Costs include design, permitting, bid, and construction phase services

3rd Street Dam Bridge
Alternative 2 - Remove Existing Spillway and Construct New Drop Inlet
Top of Dam - EL 193
Cost Estimate

Item	Unit	Unit Cost	Quantity	Total Cost
1. Mobilization/Demobilization	LS	$55,000	1	$55,000
2. Clearing and Grubbing	LS	$10,000	1	$10,000
3. Demolition of Existing Structures	LS	$15,000	1	$15,000
4. Control of Water	LS	$40,000	1	$40,000
5. Excavation	cy	$10	1700	$17,000
6. Earthfill	cy	$15	9650	$144,750
7. Concrete	-	-	-	-
7.a Proposed Drop Inlet	cy	$550	70	$38,500
7.b Proposed Culvert	cy	$550	160	$88,000
7.c Stilling Basin	cy	$550	105	$57,750
8. Filter Drain	cy	$20	1000	$20,000
9. Repair of Upstream Crest Wall	LS	$35,000	1	$35,000
10. Storm Sewer	LS	$10,000	1	$10,000
11. Pavement	sy	$25	760	$19,000
12. Topsoil and Seeding	sy	$5	3200	$16,000
			Subtotal	$566,000
			Contigency - 20%	$113,200
			Total Estimated Construction Cost	$679,200
			Engineering Costs - 15%	$101,880
			Total Construction and Engineering Costs	**$781,080**

Notes:
1. Add $25,000 to Total Construction & Engineering Costs for Top of Dam at EL 195
2. Engineering Costs include design, permitting, bid, and construction phase services

3rd Street Dam Bridge
Alternative 3 - Remove Existing Spillway and Construct New Ogee Spillway
Top of Dam - EL 193
Cost Estimate

Item	Unit	Unit Cost	Quantity	Total Cost
1. Mobilization/Demobilization	LS	$60,000	1	$60,000
2. Clearing and Grubbing	LS	$10,000	1	$10,000
3. Demolition	LS	$15,000	1	$15,000
4. Control of Water	LS	$35,000	1	$35,000
5. Excavation	cy	$10	1500	$15,000
6. Earthfill	cy	$15	8000	$120,000
7. Concrete	-	-	-	-
7.a Spillway Chute and Walls	cy	$550	450	$247,500
7.b Ogee Weir	cy	$550	85	$46,750
7.c Cutoff Trench	cy	$450	40	$18,000
8. Filter Drain	cy	$20	1000	$20,000
9. Repair of Upstream Crest Wall	LS	$35,000	1	$35,000
10. Storm Sewer	LS	$10,000	1	$10,000
11. Pavement	sy	$25	200	$5,000
12. Topsoil and Seeding	sy	$5	3000	$15,000
			Subtotal	$652,250
			Contigency - 20%	$130,450
			Total Estimated Construction Cost	$782,700
			Engineering Costs - 15%	$117,405
			Total Construction and Engineering Costs	**$900,105**

Notes:
1. Engineering Costs include design, permitting, bid, and construction phase services

3rd Street Dam Bridge
Alternative 3 - Remove Existing Spillway and Construct New Ogee Spillway
Top of Dam - EL 195
Cost Estimate

Item	Unit	Unit Cost	Quantity	Total Cost
1. Mobilization/Demobilization	LS	$55,000	1	$55,000
2. Clearing and Grubbing	LS	$10,000	1	$10,000
3. Demolition	LS	$15,000	1	$15,000
4. Control of Water	LS	$32,000	1	$32,000
5. Excavation	cy	$10	1350	$13,500
6. Earthfill	cy	$15	8500	$127,500
7. Concrete	-	-	-	-
7.a Spillway Chute and Walls	cy	$550	350	$192,500
7.b Ogee Weir	cy	$550	45	$24,750
7.c Cutoff Trench	cy	$450	20	$9,000
8. Filter Drain	cy	$20	1000	$20,000
9. Replacement of Upstream Crest Wall	LS	$70,000	1	$70,000
10. Storm Sewer	LS	$10,000	1	$10,000
11. Pavement	sy	$25	200	$5,000
12. Topsoil and Seeding	sy	$5	3100	$15,500
			Subtotal	$599,750
			Contigency - 20%	$119,950
			Total Estimated Construction Cost	$719,700
			Engineering Costs - 15%	$107,955
			Total Construction and Engineering Costs	**$827,655**

Notes:
1. Engineering Costs include design, permitting, bid, and construction phase services