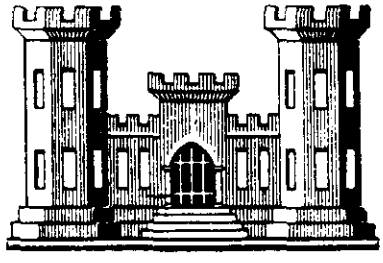
CONNECTICUT RIVER FLOOD CONTROL

CHICOPEE FALLS
LOCAL PROTECTION PROJECT

CHICOPEE RIVER, MASSACHUSETTS

DESIGN MEMORANDUM NO. 5

EMBANKMENTS AND FOUNDATIONS



U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS WALTHAM, MASS.

MARCH 1963

ENGCW-EM (6 Mar 63) 2d Ind

SUBJECT: Chicopee Falls Local Protection Project, Chicopee River, Massachusetts - Design Memorandum No. 1 - Embankments and Foundations

Corps of Engineers, Washington 25, D. C., 22 May 1963

TO: Division Engineer, U. S. Army Engineer Division, New England

The data and procedures presented in the preceding 2nd Indorsement are approved.

FOR THE CHIEF OF ENGINEERS:

MARSHALL S. JOHNSON
Chief, Engineering Division
Civil Works

NEDGE (6 Mar 63) 2nd Ind
SUBJECT: Chicopee Falls Local Protection Project, Chicopee River, Massachusetts - Design Memorandum No. 5 - Embankments and Foundations

U. S. Army Engr Div, New England, Waltham 54, Mass. 29 April 1963

TO: Chief of Engineers, ATTN: ENGCW-EZ, Department of the Army, Washington 25, D. C.

1. The Engineering Manuals mentioned in paragraphs 4 and 12 are:

ER 1110-2-1803 "Subsurface Investigations, Soils".
ER 1110-2-2300 "Earth Embankment".

Hereafter, this information will be inserted in similar Design Memoranda.

2. Comment as to the adequacy of the 6-foot bottom width of the foundation cut-off was inadvertently omitted in paragraph 13. It is planned to place the first layer of impervious fill with a thickness of 18 inches and compact it with 12 passes of the specified roller. In view of the relatively low heads and characteristics of the impervious fill, it is considered that this procedure will provide an adequate cut-off. Such construction eliminates the necessity for completely dewatering the bottom of the excavation prior to placement of the first lift and the need for using hand tampers or rollers to obtain compaction on smaller lifts.

3. Regarding the dike sections on Plates 17 and 17A, much thought was given to the zoning of these sections for ease of construction. The dikes as designed provide a cofferdam between the cut-off excavation and the river, which will aid in the dewatering and prevent erosion during construction. The dikes were designed to provide only two zones, each with sufficient width for satisfactory operation of spreading and compaction equipment. Such a design also does not require concurrent construction of the two fill zones.

FOR THE DIVISION ENGINEER:

JOHN WM. LESLIE
Chief, Engineering Division

ENGCW-EZ(6 Mar 63) 1st Ind
SUBJECT: Chicopee Falls Local Protection Project, Chicopee River, Massachusetts - Design Memorandum No. 5 - Embankments and Foundations

Office, Chief of Engineers, Washington 25, D. C. 21 March 1963

TO: Division Engineer, U. S. Army Engineer Division, New England

Design Memorandum No. 5, Embankment and Foundations for Chicopee Falls Project, Massachusetts, is approved subject to the following comments:

a. Paragraph 4 and Paragraph 12. The EM numbers of the particular Engineering Manuals for Civil Works Construction mentioned in these paragraphs should be given.

b. Paragraph 13, Plates 17 and 17A. Consideration should be given to making the bottom width of the cutoff at least 8 feet so that the fill can be compacted with standard compactors.

c. Plate 17 and 17A. Consideration should be given to simplifying the zoning of some of the sections shown on these plates. One suggestion would be a central core section instead of connecting the cutoff as shown with the riverside blanket since the cutoff cannot be made at the toe.

FOR THE CHIEF OF ENGINEERS:

Incls w/d

for WENDELL E. JOHNSON
Chief, Engineering Division
Civil Works

U. S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM 54, MASS.

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO.

NEDGW

6 March 1963

SUBJECT: Chicopee Falls Local Protection Project, Chicopee River, Massachusetts - Design Memorandum No. 5 - Embankments and Foundations

TO: Chief of Engineers
ATTENTION: ENGCW-E
Department of the Army
Washington 25, D. C.

There is submitted for review and approval Design Memorandum No. 5 - Embankments and Foundations, for the Chicopee Falls Local Protection Project, Chicopee River, Massachusetts, in accordance with EM 1110-2-1150. The contract award for construction of this project is scheduled for April 1963, and an early receipt of your review comments will be appreciated in order that the plans and specifications may be completed on schedule.

FOR THE DIVISION ENGINEER:

John Wm. Leslie

JOHN WM. LESLIE
Chief, Engineering Division

Incl (10 cys)
Design Memc No. 5

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FLOOD PROTECTION
CHICOPEE FALLS
LOCAL PROTECTION PROJECT
CHICOPEE RIVER, MASSACHUSETTS
DESIGN MEMORANDUM NO. 5
EMBANKMENTS AND FOUNDATIONS

February 1963

A. INTRODUCTION

1. Location and Description of Project. - The Chicopee Falls Local Protection Project is located on the Chicopee River in the City of Chicopee, Hampden County, Massachusetts approximately two miles from its confluence with the Connecticut. The proposed local protection project extends from the Deady Memorial Bridge, westerly approximately one mile to a point downstream of the United States Rubber Company plant, and will protect a narrow, highly industrialized area which has been subjected to serious flooding in the past. The right bank has relatively high, natural slopes that do not require improvements, other than widening at certain portions to compensate for the loss in river section due to the proposed structures. The plan of protection consists of a continuous earth dike and flood wall system, about 4800 feet in length, along the left bank. Plan views, profiles and typical dike sections are shown on Plates Nos. 2 through 18.

2. Pertinent Data.

a. Purpose. - Flood Protection

b. River Elevations. - The Modified Standard Project Flood levels vary from approximately elev. 107 M.S.L. at the upstream end to 94 M.S.L. at the lower end of the project. The profiles are shown in the General Design Memorandum.

c. Earth Dikes.

1. Maximum height 28 feet
2. Length (2 sections) 740 feet and 2880 feet

3. General Notes. - Subsurface investigations and soils engineering studies undertaken for the design of this project are discussed in this memorandum. The subsurface investigations included programs of subsurface explorations and laboratory tests conducted to determine the distribution and characteristics of foundation and embankment materials, soil conditions pertinent to excavations and conditions affecting the design and construction of embankments and certain of the concrete structures. Soils engineering studies, based on the data obtained from these investigations, were carried out to develop safe and economical earthwork designs and construction methods. Specifically, this memorandum covers the design requirements for the earth dikes and their foundations, including seepage, stability, settlement and slope protection considerations. The details are shown on the typical dike sections. Also, studies were made of the right bank cut area from which earth fill materials will be selected for use in the dikes. Foundation studies were made for the pumping stations as well. Not included are the foundation studies and recommendations for the concrete flood walls, which are covered in Design Memorandum No. 7, "Flood Walls."

In connection with this project, separate special studies were made by the Architect-Engineer, in which the following specific problems were investigated:

(1) A condition survey of the brick chimney at the U. S. Rubber Company plant and recommendations for the design approach to be used for flood control structures in the vicinity of the chimney;

(2) A condition survey of the railroad embankment located on the left bank of the river, immediately downstream of the U. S. Rubber Company plant, together with a determination of the causes of existing settlement and erosion conditions and recommendations for correction and control of these problems;

(3) A condition survey of the right bank of the river throughout the entire length of the project with pertinent recommendations for measures to provide for stability and slope protection of the right bank where necessary.

The general conclusions and recommendations made in these studies are included in Section G, "Special Studies," of this memorandum.

(4) A condition survey of Mill Building No. 2, Chicopee Manufacturing Company, which is located close to the left bank in the vicinity of Station 22. Design requirements of the flood wall in the vicinity of this building are discussed in Design Memorandum No. 7, "Flood Walls".

B. SUBSURFACE INVESTIGATIONS

4. Subsurface Explorations. - Subsurface explorations were laid out and performed in accordance with the current criteria and practices described in the pertinent sections of the Engineering Manual for Civil Works Construction. The exploratory program completed to date consists of 49 drive sample borings, 12 uncased shallow drive-sample borings, 1 hand auger hole, 2 test trenches excavated by hand, 14 test trenches excavated by machine, 13 test pits excavated by hand and 4 test pits excavated by machine. The program completed to date is considered to be adequate for design purposes, with minor additional work anticipated. The geology of the site and area pertinent to the types and distribution of soils are described in Design Memorandum No. 2, "General". The location of all explorations completed to date are shown on Plate No. 21 of this report.

5. Laboratory Tests. - All laboratory soil tests, except as otherwise noted, were performed in accordance with the current laboratory test procedures for Civil Works Projects. All soil samples were classified visually according to the Unified Soil Classification System with the visual classification being confirmed by grain size analyses and Atterberg Limit determinations performed on samples considered to be representative of the major soil types encountered. Other tests performed on selected samples included determinations of permeability, natural moisture content, in-place density, and compaction tests. The compaction and permeability tests were performed on the components of the samples passing the No. 4 sieve.

6. Presentation of Data. - The results of subsurface investigations, except for Geological Sections, are presented in this memorandum. A summary of the results of the laboratory tests is presented in Appendix A. Compaction test reports are presented in Appendix B. Graphic logs of subsurface explorations completed to date are presented in Plates 22 thru 26. Work sheets were prepared showing soil

profiles based on the soils engineer's description of the soils and his interpretation of test results. For purposes of this report, however, the verbal presentation of the soil conditions along the project alignment was considered to be sufficient. Plates showing selected laboratory test data are included in this memorandum, one each for foundation soils and for impervious fill materials.

C. CHARACTERISTIC OF FOUNDATION MATERIALS

7. Foundation Bedrock. - A complete description of the foundation bedrock is included in the Geology Section of Design Memorandum No. 2, "General".

8. Description and Distribution of Earth Materials Along The Proposed Structures. -

a. General. - Filled land borders the left bank of the river the entire length of the project. The fill consists mostly of granular soils, intermixed with cinders, rubble masonry and wood. The portion of the earth dike from Sta. 9+57 to 16+94 and from Sta. 25+32 to 37+50± will be founded on this artifical fill. A foundation cutoff consisting of compacted impervious fill will be excavated as necessary to contact the underlying impervious natural soils. The remainder of the dike and the flood wall structures are to be founded on natural soil or rock as described below.

b. Sta. 4+00 to Sta. 8± (Flood Wall). - Along this section the bedrock, which is described in Design Memorandum No. 2, is generally exposed with little or no soil cover. Special requirements for treatment of the flood wall foundations are discussed in Design Memorandum No. 7, "Flood Walls". The flood walls will be founded on the bedrock.

c. Sta. 8+00 to Sta. 9+57 (Flood Wall). - Along this section the surface of the bedrock becomes progressively deeper in the downstream direction, such that it is not practical to found the flood wall structure on it. Also, the alignment of the wall projects into the higher filled land along the river bank. Overlying the bedrock is a stratum of compact red-brown glacial till, varying in thickness up to 18 feet. The flood wall will be founded on the undisturbed glacial till. This material is extremely well-graded, and classified in general as a gravelly, silty sand. Overlying the till is a man-made fill, 7 to 9 feet thick, generally consisting of compact gravelly sand and silty sandy gravel

materials, intermixed, usually in pockets or layers, with fragments of brick, concrete, coal cinders or metal. The percentage of foreign materials in the fill is estimated to be approximately 10 to 15 percent.

d. Sta. 9+57 to Sta. 16+94 (Earth Dike). - Along this section the top of bedrock varies approximately from El. 65 to El. 73. The rock is red-gray calcareous shale, moderately hard, with many open mud-filled cracks. Overlying the rock is a stratum of red-brown glacial till, the surface of which is fairly horizontal at El. 80±. This material was found to be compact and of very low permeability. The till is intermixed, in part, with weathered shale rock fragments. Overlying the till is a depth of approximately 10 to 12 feet of man-made fill, similar to the fill described in Paragraph C. In most test pits the interface between the fill and the underlying natural soil was fairly obvious due to the change in color from brown to red-brown, in addition to the gradation change.

e. Sta. 16+94 to Sta. 25+32 (Flood Wall). - Along this section the top of bedrock rises from El. 71± initially to El. 76± at Sta. 19+40. For the remainder of the distance downstream of this point the top of rock remains at approximately El. 76. The rock is a red calcareous shale with many weathered and fractured zones throughout the depths sampled. Five borings in this reach were cored to depths of 15 to 20 feet into the bedrock. Pressure tests were conducted in two of the holes, the results of which are indicated on the Record of Exploration sheets. Overlying the rock in the vicinity of Sta. 17 is approximately 7 feet of till containing a considerable amount of boulders and weathered rock fragments. In the downstream direction, as the underlying surface of the bedrock becomes shallower, the amount of till decreases. The borings indicate that from Sta. 19± to 25± there is little or no till present. A zone up to 3 feet in thickness, of silty sandy gravels and gravelly sands underlies the man-made fill, and is just above the highly weathered bedrock surface.

Although a laboratory permeability test was run on a sample from boring BH-25, indicating an average value of 8×10^{-4} centimeters per second, this is not considered to be typical for the stratum along the entire distance under discussion, which is generally more pervious. The general depth of fill along this section is 9 to 12 feet, and consists of silty and gravelly sands, intermixed with cinders, ashes,

brick, mortar, wood and other miscellaneous items. The change with depth from fill to the underlying natural soil is sometimes difficult to detect. It is, however, usually typified by a change in color from brown and gray to reddish-brown.

f. Sta. 25+32 to Sta. 37+50+ (Earth Dike). - The centerline of this portion of the dike runs along the top of the land fill parallel to the shoreline. In the vicinity of Sta. 37+50, the alignment shifts riverward, such that the full dike section is located on the river side of the existing concrete retaining wall in the vicinity of the industrial buildings.

In this section the top of bedrock becomes progressively deeper, from El. 77± to El. 50± within these limits. The bedrock is a red, calcareous shale, becoming somewhat more sound as the depth of overburden becomes greater. In the vicinity of Sta. 28, the dike alignment crosses a filled penstock. Along the riverside edge of this area, within the limits of the dike, there are up to 4 feet of soft river deposits which will have to be excavated.

The foundation soils of the dike upstream of the filled penstock consist of approximately 10 feet of man-made fill, generally composed of compact silty sandy gravel with pockets and layers of brick, coal, concrete, metal and wood, which comprise up to an estimated 20 per cent of the total volume of fill; underlying the fill is a stratum of compact glacial till, to which the foundation cutoff will be excavated. Downstream of the filled penstock, the man-made fill is similar in description and includes a portion of an existing low earth dike which parallels the alignment. The surface of the underlying compact glacial till to which the foundation cut-off will be constructed maintains a fairly constant grade at Elevation 80, with the thickness becoming greater in the downstream direction. However, downstream of Sta. 35, as the alignment starts to move outward toward the river, the surface of the till becomes lower. At Sta. 37, it is at El. 70± and the bedrock is at El. 56. In the river, beyond the toe of the fill, a layer of silty, gravelly sand overlies the till.

g. Sta. 37+50 to Sta. 54+15 (Earth Dike). - Along this final section of earth dike, the alignment of the centerline parallels the shoreline, at a distance of approximately 50 feet away from the existing concrete retaining wall in the riverside direction. The top of the bedrock is generally at or below El. 50, and becomes considerably deeper at the downstream portion of this section. The material is a continuation of the calcareous shale, found further upstream, with the color changing to gray. The rock appears to be more sound than found elsewhere on the project, inasmuch as it has not been subjected to the same amount of weathering. The overburden consists of surficial river gravels underlain by 15 to 35 feet of compact red-brown glacial till consisting generally of gravelly, silty sand. Some portions of the till were found to be clayey and others sandy. In addition, in the vicinity of Sta. 48 to 50 there is a zone of stratified silts and clays below El. 50. This would not affect the stability or support capacity of the proposed structures. The surface of the till layer remains at a fairly constant level, downstream of Sta. 42, varying between El. 72 and 75. There is some indication that the till surface drops off with distance riverside of the left bank, as evidenced by BH-15, which indicated the top to be at El. 62±.

The riverbed material overlying the till is a sandy gravel, silty in part, which is quite loose and is fairly pervious as evidenced by the permeability tests performed. The thickness varies from a maximum of 15 feet to an average of 5 feet, becoming thinner downstream.

9. Shear Strength. - No shear tests were performed on samples of foundation materials for this project. On the basis of examination of samples and their grain-size distribution curves, the exploration logs and experience with similar materials, the following minimum values of shear strength are estimated for the various foundation soils as follows:

	Angle of Internal Friction, "ϕ"	Cohesion "C"
	Degree	P.S.F.
Miscellaneous granular fill	25	0
Silty and sandy GRAVEL (GP and GP-GM) (River bottom, downstream of Sta. 37+50±)	32	0
Gravelly, silty, clayey, SAND and Gravelly silty SAND (SM-SC&SM) (Glacial Till)	*35	*0

*These values are for the assumed "consolidated-drained" conditions.

10. Permeabilities. - Falling-head type permeability tests were run on representative samples of the glacial till as well as the overlying sandy gravels and silty sandy gravels. The samples were selected at locations along the proposed earth dike in order to establish the required minimum depths of foundation cutoff and to estimate the quantity of underseepage. Tests were not performed on man-made fill materials, inasmuch as the foundation cutoff will be required to penetrate through any fill to natural glacial till or bedrock.

Based on these tests sample examination and grain-size tests, the following average values of permeability are adopted for purposes of design.

	Avg. Permeability, "k" (cm/sec)
Man-made fill	$>100 \times 10^{-4}$
Loose to mod. compact Sandy GRAVEL (River bed)	$>100 \times 10^{-4}$
Loose to mod. compact Silty Sandy GRAVEL (River bed and below fill)	$> 5 \times 10^{-4}$
Glacial Till	$<0.5 \times 10^{-4}$

11. Consolidation Characteristics. - No consolidation tests were performed on samples of foundation materials for this project. All materials recovered from the foundation soils for the proposed features have either very little or no compressibility. The soft compressible materials in the filled penstock area will be removed.

D. DESIGN OF EMBANKMENTS

12. Design Criteria. - Current design criteria, as set forth in the pertinent sections of the Engineering Manual for Civil Works Construction, have been followed in the design of the embankments for this project.

13. Embankments Section. - The typical embankment sections are shown on Plate No. 17. The sections selected for the dikes have been developed from investigations and studies of foundation conditions and of the characteristics of available construction materials. Gravel bedding and stone slope protection are provided on the river slope and seeded topsoil on the land slope. The weight of stone is selected to meet the minimum requirements consistent with the design flow velocities. Side slopes of 1 on 2 for the land side and 1 on $2\frac{1}{2}$ for the river side are selected for overall stability.

The design river slope is considered to be the steepest on which the outer protective layers can be placed by practical methods. With reference to Plates 3 through 16, the grades of the bottom of the foundation cutoff are indicated. The foundation cutoff will be excavated through all man-made fills and pervious natural soils to form an impervious contact, at least 6 feet in width, with the underlying glacial till or bedrock. Where till is encountered the excavation will be advanced a minimum of 18 inches into the till. Where bedrock is encountered all loose materials which can be removed by hand or small machine methods will be removed prior to placing the compacted impervious fill. Any additional depth of excavation below the grades shown on the drawings will be as directed in the field.

Along portions of the dike, gravel fill is required to be placed below the existing river level to build up the dike section below the stone slope protection. For the reach of dike which is founded entirely on the river bed, downstream of Station 37+50, the gravel fill zone below the riverside slope is designed, as discussed in Paragraph 18, to provide a cofferdam during construction to permit unwatering and allow excavation of the foundation cutoff trench in the dry. Compaction will be required for that gravel material which is to be placed above water level.

14. Characteristics of Embankment Materials.

a. General. - Impervious and random fill materials will be obtained from required excavations. A borrow area adjacent to the required channel relocation excavation will be provided to supply random and impervious materials in the event that a shortage occurs. The impervious fill will consist of glacial till which is located within the zone of excavation for the required river widening and channel downstream of Sta. 30±. The random fill will be obtained from the sandy materials overlying the till, from selected portions of the river-widening excavation at the bend further downstream and from the various foundation and cutoff trench excavations along the dikes and flood walls. Gravel fill will be provided by the contractor from approved sources.

b. Compacted Impervious Fill. - The glacial till is a well graded gravelly, silty, clayey sand (SM-SC) with at least 20 per cent by weight passing the No. 200 sieve. Typical gradations and other test data on this material are summarized on Plate No. 20. The results of two Standard Proctor Compaction tests on typical samples indicate the average maximum dry density of the minus No. 4 portion to be 127.5 pounds per cubic foot at an optimum moisture of 10.3

per cent. The natural moisture content of total samples of this material was found to vary from 7 to 12 per cent. The deposit becomes more clayey below Elev. 80± (approximate river level) with a corresponding increase in moisture content. Therefore, some difficulty may be encountered in using this deepest material directly. It is estimated that the till, when compacted, will have a coefficient of permeability in-place equal to or less than $1x10^{-4}$ cm/sec. and will develop an angle of internal friction of at least 35 degrees.

c. Compacted Random Fill Sections. - A relatively wide range of natural soils and fill will be obtained from the required excavation on the project, the major sources of which will be the right bank river widening and channel relocation and the foundation and cutoff trench excavations. They range in gradation from sandy gravels to sandy silts. Any granular materials which contain no organic or decaying matter, are essentially non-plastic in nature, and contain no gravel sizes larger than 2/3 the allowable lift thickness will be usable. Where necessary, the contractor will be required to separate the unsuitable portions of materials obtained from required excavations in order that as much as possible can be utilized for the random fill. During placement of these materials the contractor will be required to spread the materials in such a way that a reasonably well-graded mixture of grain sizes will be obtained.

d. Dumped Gravel Fill, Compacted Gravel Fill and Gravel Bedding. - Gravel fill and bedding materials to be placed on the riverside slope, including portions to be placed below water, will consist of bank-run gravelly sand and/or sandy gravel containing from 40 to 60 per cent by weight passing the No. 4 mesh sieve and no more than 15 per cent (of the fraction passing the No. 4 sieve) passing the No. 200 sieve. This material will be provided by the contractor from approved sources.

e. Slope Protection. - Although there will be rock excavation required for the foundations of the flood walls on this project, none of this material is considered suitable for use as slope protection stone. Therefore, the contractor will have to provide materials from approved sources. The river design flood average velocities range from 8 feet per second to an extreme of 23 feet per second in the vicinity of Station 23. The latter occurs at a point which is to be protected by a flood wall.

In the process of selecting the proper stone slope protection sizes, three separate size ranges, with layer thicknesses of 12, 15 and 18 inches, were initially selected as required to fulfill the design criteria for corresponding velocity ranges as given in the Civil Works Engineer Bulletin No. 52-15. However, upon investigation of local sources of stone it was concluded that the production of these specific size ranges would involve the setting up of special crushing and screening operations which, for relatively small quantities required, would not be justified economically.

A sound, angular quarry-run stone which can be placed in an 18-inch layer has been selected for dike slope protection throughout the total length of the project, except for special areas where heavier stone is required. The stone must be well-graded from fine to maximum sizes. The maximum allowable through dimension will be 18 inches, and not more than 15 per cent by weight shall pass a 6 inch opening.

15. Seepage Control.

a. Embankment Seepage. - During the relatively short periods of high water levels, no significant seepage is likely to develop. Although the compacted till blanket is relatively thin, it will be of low permeability. In order to decrease the possibility of emergence of seepage flow at the landslide toe, a perforated drain and filter is provided to intercept and control it.

b. Foundation Seepage. - Upstream of Sta. 37± the earth dikes are founded on artificial fill with the remainder downstream on natural soils. In most cases the artificial or natural soils exhibit varying degrees of permeability in ranges which cannot be tolerated. Inasmuch as relatively impervious glacial tills are usually located at depths of 5 to 10 feet below the surface, foundation cutoff trenches will be excavated to penetrate the underlying soils approximately 18 inches and will be backfilled with compacted impervious fill. The resulting seepage will be of no significance.

16. Embankment Stability. - In view of the low height of the dikes, the conservative side slopes, and function of these structures, detailed stability analyses were not considered necessary. Experience with similar glacial till materials indicate that the design sections will be stable under all river stage conditions.

17. Embankment Settlement. - It is anticipated that any settlement of the embankment foundation and the embankment materials will not be significant.

18. Construction Considerations.

a. Dikes on Land. - Upstream of Sta. 37± the dikes are to be placed essentially on top of the filled land along the shore, with the slope protection extending over the existing slope to the river bottom. During excavation of the cutoff trench, it will be dewatered as necessary by open pumping. A small amount of slope trimming and excavation at the toe of slope will be required below water. Gravel fill materials which are to be placed at the toe below water level will require no compaction.

b. Dike in the River. - Downstream of Sta. 37± the dike alignment shifts outward into the river bed. In order to permit excavation for the foundation cutoff and placement of impervious materials in the dry, a cofferdam is required. In this reach, the gravel fill zone below the riverside slope will serve as the cofferdam, and is to be placed initially in the wet. Compaction will be required above the river water level. After constructing temporary transverse cofferdams, the enclosed area will be dewatered by means of wellpoints placed along the gravel fill, supplemented as necessary by sump pumping procedures. The discharge from existing sewer lines will be intercepted and carried outside the work area during this period. Excavation and compaction of the cutoff will then be performed in the dry, and the remainder of the dike constructed in the usual manner. The cofferdam will be incorporated into the final dike section.

c. Right Bank Cut Area. - The major portion of all earth materials excavated from this area will be utilized in the dike construction. After stripping and wasting the existing topsoil and forest debris, the upper 5 to 10 feet of overburden will generally be suitable for use in the random fill sections. The underlying glacial till will be used for the impervious sections of the dike. Both materials will be excavated and transported across the river bed by means of a construction causeway to be provided by the contractor.

No appreciable amount of stockpiling is anticipated, except for those materials which may be excavated in the wet. Waste areas will be designated on the adjacent low land downstream of the main cut area.

In order to prevent the advance of the direct river flow into the cut area as excavation is carried to full depth, the contractor will be required to leave an unexcavated barrier of soil along the existing toe of slope as necessary, until such time as the major portion of the material usable for dike fill has been excavated and removed from below the river water level.

19. Distribution of Earth Fill Materials. - The distribution of on-site earth materials is estimated to be as follows:

Source	Est. Available Volume (C.Y.)	Balance Factor	Design In-place Volume (CY)
Glacial Till material for impervious dike fill:			
1. Channel relocation, right bank	112,000*	2/3	95,000
2. On-site borrow area			12,000
		Req'd Vol.	87,000

*Does not include 30,000 C.Y. below elevation 78.0 probably too wet for use.

Granular soils for random dike fill:			
1. Channel relocation right bank	61,000	2/3	41,000
2. Foundation excavations	43,000	3/4	32,000
3. Downstream channel widening	22,000	1/5	4,000
		Total =	77,000
		Req'd Volume	68,000

In addition, the following off-site borrow materials will be required:

Gravel Fill and Gravel Bedding	-	44,200 C.Y.
18" Stone Slope Protection	-	20,000

E. PERMANENT CUT SLOPES

20. Slope Design. - The cut slopes along the right bank, downstream of Sta. 33±, are generally excavated in compact glacial till, except for the upper 5 to 8 feet of excavation in silty, sandy materials. The design includes a 15 foot wide berm at Elev. 81, five feet above the adjacent excavated channel bottom. The design slope below this berm is 1 on 2 carried to the bottom of the channel, and a 1 on 2½ slope extends upward, the full height of slope. The maximum height of slope is approximately 45 feet above the berm in the vicinity of Dike Sta. 42. The berm provides access along the river edge, slightly above normal flow levels, for maintenance purposes and also serves as a shelf for retention of materials in the event that minor sloughing occurs on the slope. The surface of the berm is pitched slightly toward the river to facilitate runoff.

21. Slope Protection. - Topsoiling and seeding will be included for all slopes and the berm above normal river level. Throughout most of the cut areas exposed material below maximum flood levels will be the compact glacial till. It is considered that these slopes, particularly after establishment of vegetation, will resist the design stream erosion forces. Further protection is not justified in this area.

Further downstream, slopes up to a height of 10 feet above the berm will be cut through relatively loose sandy materials. This area will also be topsoiled and seeded. However, even though these slopes will be considerably less resistive to the design stream flows, and some losses of materials may be expected, no further protection appears warranted in view of the fact that no appreciable blockage of the stream or danger to life or property is anticipated.

At specific locations along the cut area, conduits or stone paved ditches will carry concentrated surface runoff over the face of the slope.

F. FOUNDATIONS FOR PUMPING STATIONS

22. Oak Street Station. - This structure is located adjacent to the river side of the existing retaining wall opposite dike Station 49±. It spans the width of the 20-foot berm and the westerly wall intersects the land side dike slope approximately 10 feet below the crest. The foundation has overall dimensions of 29 by 29 feet at Elev. 71±. At this level, the box type foundation will bear on natural granular soil, and will be approximately three feet above the surface of the compact glacial till stratum. The height of the structure will be approximately 30 feet, about half of which will be below final grade.

In view of the depth of embedment of the structure and the fact that the bearing capacity of these natural foundation soils is far in excess of the design loadings, no stability or settlement problem exists. The surrounding backfill material will be the gravel and the random fill, as required for the dike section, compacted by hand methods in the immediate vicinity of the structure.

23. Main Street Station. - This structure is located adjacent to the land side of the flood wall at Sta. 24±. The overall dimensions of the foundation at the sump floor are 21 by 30 feet, bearing at Elev. 70±. The base slab will be widened riverward as necessary for overall stability and to match adjacent wall footings. The height of structure is approximately 30 feet, the lower half of which is below final grade. The foundation extends approximately five feet into highly fractured shale to sound shale bedrock.

There are no bearing capacity or settlement problems. It is anticipated that stability requirements of the flood wall monolith of which the station is a part will require rock anchors for the foundation.

G. SPECIAL STUDIES

24. Existing Brick Chimney. - A separate Special Study was made by the Architect-Engineer to evaluate the effects, if any, of the proposed construction on the foundation support for the existing 220-foot high brick chimney at the U.S. Rubber Company plant, opposite dike station 49+20. In addition to the earth dike, the centerline of which is approximately 70 feet

from the chimney base, the Oak Street Pumping Station will be located some 25 feet away, on the river side of the existing retaining wall. The effects of excavation required for these structures, the additional soil stresses in the foundation, vibratory construction forces and groundwater level changes were considered.

It was concluded that none of these factors would be expected to affect the supporting capacity of the chimney foundation, provided that precautionary measures are taken in the event that sheet piling is driven to support the excavation for the pump station. A formal report is under preparation.

25. Railroad Embankment. - A separate Special Study Report, entitled "Special Study of Railroad Embankment," dated October, 1962, was prepared by the Architect-Engineer to evaluate the condition of the railroad embankment, immediately downstream of the U. S. Rubber Company plant, and determine the effects, if any, of the proposed construction. The embankment has had a history of settlement and loss of materials due to erosion. Three borings were made in the area to investigate the subsurface conditions.

It was concluded that the problems consist of settlement which is attributable to the presence of soft materials in the track fill; to marginal stability, which is attributable to compressible natural soils approximately 15 feet below the track; and to poor surface drainage, which causes slope erosion. None of these conditions will be worsened by the project. Stream erosion, which has in the past resulted in extensive slope failures, would be considerably lessened by the project due to channel widening and reduced velocities in this vicinity.

26. Natural Slopes Along Right Bank. - A separate Special Study Report, entitled "Special Study, Slope Protection In Project Limits," dated October 1962, was prepared by the Architect-Engineer to evaluate the condition of the right bank throughout the project limits and to make pertinent design recommendations regarding slope protection measures, if necessary. The areas of cut slopes downstream of Station 33+ are discussed elsewhere in this memorandum. Upstream of this point, the height of natural slope is generally 50 to 75 feet above the river bottom, and varies from 1 (vertical) on 1.3 (horizontal) to 1 on 1.6 with a few somewhat steeper slopes near the river edge due to stream erosion. Specific comments were made for typical areas and stability checks were made at a representative critical section.

It was concluded that, although sloughing and erosion may occur at certain areas, there is no apparent overall stability problem which would result in any major blockage of the river or damage to existing property. No slope protection measures are considered to be warranted or necessary. These conclusions are confirmed by the fact that these slopes have endured severe floodings up to the levels indicated for the 1955 flood.

27. Mill Building No. 2, Chicopee Manufacturing Company. - A fourth separate Special Study covering the condition of the building, and pertinent design requirements for the flood wall in the vicinity of this structure was made by the Architect-Engineer, and is discussed in Design Memorandum No. 7, "Flood Walls." A formal report is under preparation.

TEST DATA SUMMARY - CHICOPEE FALLS LOCAL PROTECTION

EXPL. NO.	TOP ELEV. FT.	SAMPLE NO.	DEPTH FT.	SOIL SYMBOL	MECHANICAL ANALYSIS				ATT. LIMITS		SPECIFIC GRAVITY	NAT WATER CONTENT % DRY WT		COMPACTION DATA STND AASHO			NAT DRY DENSITY LBS/CUFT		OTHER TESTS		
					GRAVEL %	SAND %	FINES %	D_{10} mm	LL	PL		TOTAL	- NO4	OPT. WATER % DRY WT	MAX DRY DENS LBS/CU FT	* PVD LBS/CUFT	TOTAL	- NO4	SHEAR	CONSOL	PERM.
BH-18	94±	J-5	10.0-15.0	SC	8	64	28	.005													
BH-19	99±	J-4	5.0-10.0	SM	30	44	26	.007													
		B-9	15.0-19.0	SM	35	45	20	.020													
BH-20	109±	B-6	7.5-10.0	SM	13	62	25	.010													
		B-12	20.0-25.0	SM	19	57	24	.011													
BH-21	87.9	J-3	8.5-10.0	SP-SM	44	49	7	.13													
BH-22	89.7	J-5	10.0-13.2	GP	48	48	4	.30													
BH-23	88.5	J-3	10.0-11.8	SP-SM	42	50	8	.11													
BH-25	88.1	J-4	7.2-10.0	SM	30	53	17	.022													
		J-5	10.0-12.1	GP-GM	51	40	9	.12													x
BH-26	89.5	J-7	16.7-18.9	GC	42	38	20	.006													
BH-27	91.1	J-4	8.8-10.0	SM	8	48	44	-													
		J-5	10.0-12.0	SM	16	51	33	.011													x
		J-7	15.0-16.0	SM	16	53	31	.015													
		J-9	19.0-19.8	SM	18	57	25	.010													
BH-31	71.6	J-3	1.3-5.0	CL	13	36	51	.0017													x
		J-4	5.0-8.6	SM-SC	17	47	36	.0015	19	13		7.4									
BH-37	74.4	J-3	5.0-8.0	GP-GM	59	30	11	-													
		J-4	8.0-10.0	SC	6	49	45	<.001													
		J-5	10.0-13.0						-	-		11.2									
		J-6	13.0-15.0	CL	0	12	88	<.001	36	20		16.7									
		J-7	15.0-17.5	ML					-	-		19.0									

* PROVIDENCE VIBRATED DENSITY TEST.

x See Plate V-5

TEST DATA SUMMARY - CHICOPEE FALLS LOCAL PROTECTION

EXPL NO	TOP ELEV FT	SAMPLE NO	DEPTH FT	SOIL SYMBOL	MECHANICAL ANALYSIS % GRAVEL	% SAND	% FINES	D10 MM	ATT LIMITS LL	PL	SPECIFIC GRAVITY	NAT WATER CONTENT % DRY WT TOTAL	NO4	COMPACTION DATA STNO AASHO OPT WATER % DRY WT	MAX DRY DENS. LBS/CU FT	* PVD LBS/CU FT	NAT DRY DENSITY LBS CU FT TOTAL	NO4	OTHER TESTS SHEAR	CONSO.	PERM
BH-39	73.2	J-2	5.0- 7.8	GP	52	46	2	.32													
		J-3	7.8-10.0	GP-GM	53	40	7	.15													x
		J-4	10.0-13.5	SM	27	49	24	-													x
BH-40	104.7	J-7	10.5-11.6	ML					28	24		27.8									
		J-9	15.0-18.2	ML					31	27		37.4									
BH-41	75.0	J-2	1.2- 5.0	GP	58	41	1	.49													x
		J-4	5.3- 7.4	SM	16	48	36	.0025													
		J-6	8.1-10.0	SM								7.1									
		J-7	10.0-15.0	SM	16	48	36	.004	17	14		6.6									
		J-8	15.0-20.0	SM								5.9									
BH-42	103.2	J-5	15.0-20.0	ML					35	26		24.0									
		J-7	20.8-25.0	ML	18	23	59	.0025	31	24		26.8									
BH-44	83.7	J-3	10.0-14.0	GP	56	41	3	.32													x
		J-4	14.0-15.0	SP	8	88	4	.19													
		J-5	15.0-18.8	SM-SC	14	50	36	.0016													
		J-6	18.8-20.0	ML-CL	7	30	63	.0011	20	15		11.9									
		J-7	20.0-22.0	SM-SC	28	44	28	-													
BH-45	104.5	J-4	10.0-14.5	CL	7	23	70	<.001	29	19		21.6									
		J-6	15.0-17.9						NP			31.5									

Page No. A-2

* PROVIDENCE VIBRATED DENSITY TEST.

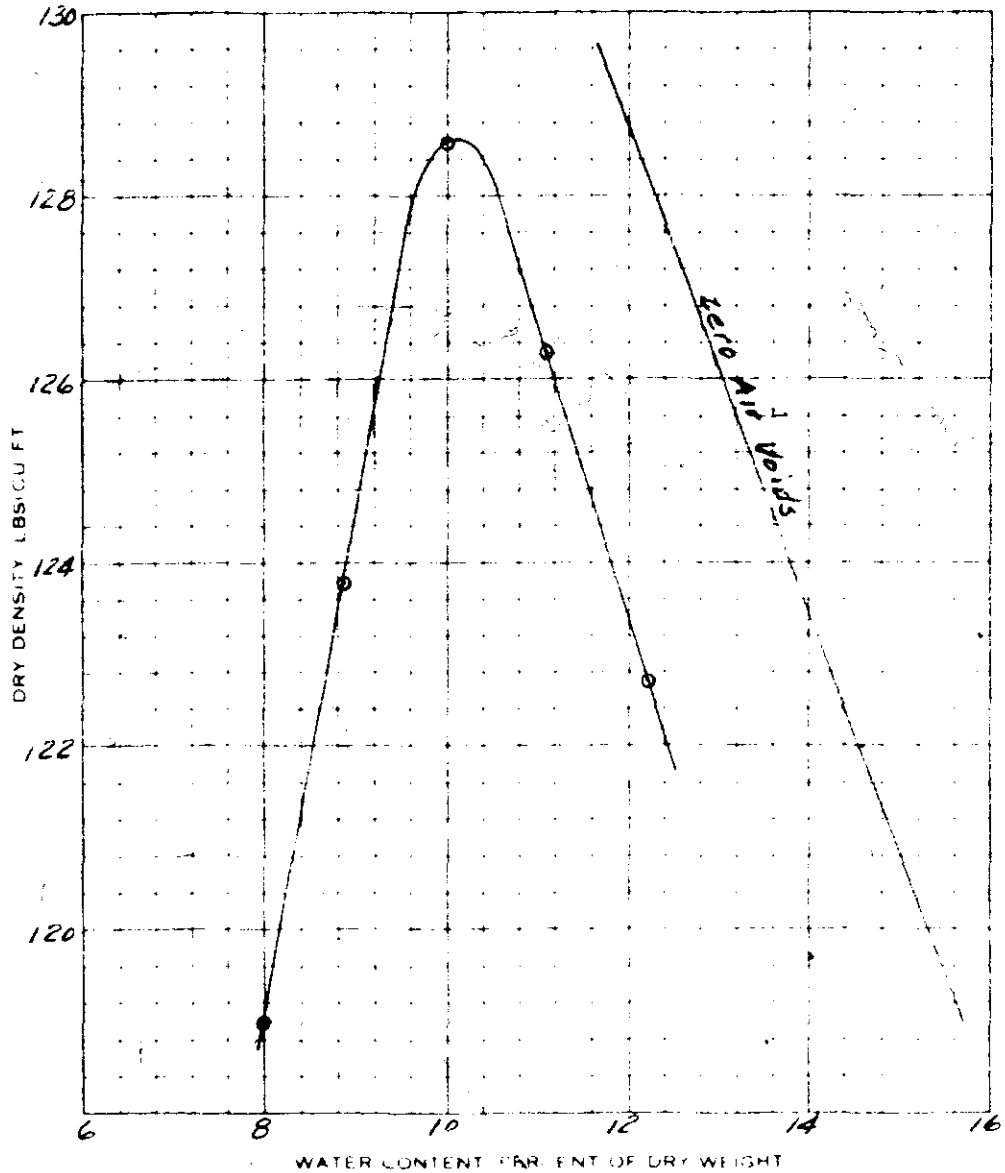
x See Plate V-5

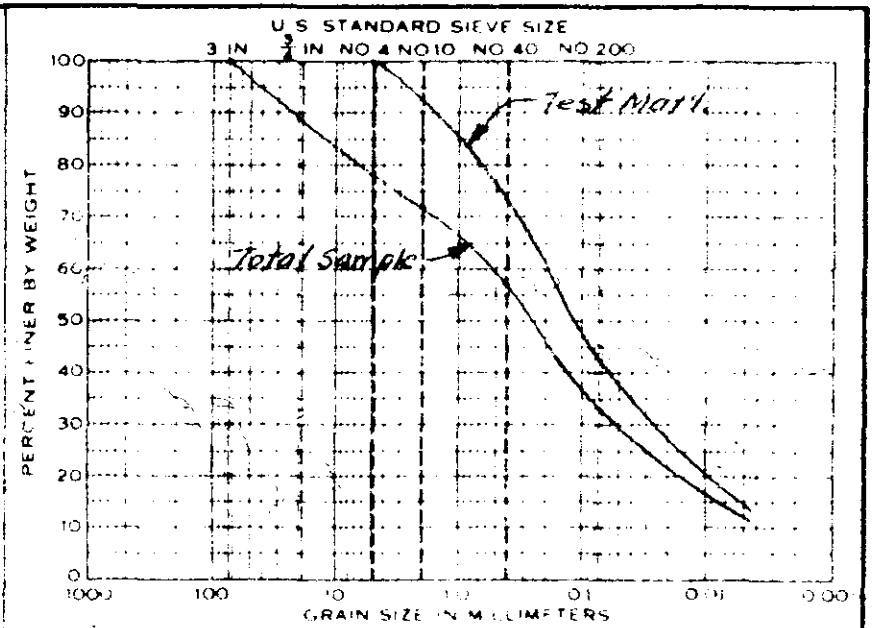
TEST DATA SUMMARY - CHICOPEE FALLS LOCAL PROTECTION

EXPL NO	TOP ELEV FT	SAMPLE NO	DEPTH FT	SOIL SYMBOL	MECHANICAL ANALYSIS GRAVEL %	SAND %	FINES %	D10 MM	ATT LIMITS LL	PL	SPECIFIC GRAVITY	NAT WATER CONTENT % DRY WT TOTAL	NO 4	COMPACTION DATA STND AASHO OPT WATER % DRY WT	MAX DRY DENS LBS/CU FT	* PVD LBS/CU FT	NAT DRY DENSITY LBS. CU FT TOTAL	NO 4	OTHER TESTS SHEAR	CONSOL	PERM
BD-2	109.2	J-4	5.4-10.0	SM-SC	15	38	47	.001				8.2			**						
		J-11	15.0-17.5	SM	5	63	32	.003				7.9									
		J-19	25.0-27.0	SM	8	60	32	.001				7.6									
BD-3	114.5	J-6	10.0-13.5	SM	8	57	35	.001				7.4									
		J-10	15.0-18.0	SM	7	57	36	<.001				7.1									
		J-18	25.0-29.0	ML	9	35	56	<.001				7.1									
		J-22	30.0-32.0	SM	0	80	20	.030													
		J-25	33.6-35.0	GC								6.4									
		J-27	35.0-36.0	GC								7.0									
		J-28	36.0-38.0	CL	0	6	94	<.001				22.6									
BT-2A	112.8	B-9	4.0-4.4	SM-SC	22	44	34	.003	19	14	2.74			10.2	128.6						
		J-6R	4.0-4.4									13.2	15.2				120.0				
		J-8R	4.0-4.4									11.0	13.6				137.5				
BT-10	98.7	B-9	5.8-6.2	SM-SC	16	52	32	.003	20	15	2.71			10.4	126.9						
		J-6R	5.8-6.2									9.8	11.2				120.8				
		J-8R	5.8-6.2									15.2	16.6				122.3				
BTT-1	114.5	J-2R	8.8-9.2	SM-SC								8.8	10.7				132.4				
		J-4R	8.8-9.2									7.8	8.6				138.5				
BTT-2	97.5	J-2R	10.1-10.5	SM-SC								8.8	8.1				140.3				
		J-4R	10.1-10.5									11.7	9.2				137.4				

* PROVIDENCE VIBRATED DENSITY TEST.

** Minus No. 4 Material





COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Sample Nr	Elev or Depth	Classification	C	LL	P.
B-9	4.0'-4.4'	Gravelly silty clayey SAND (SM-SC)	c.74	19	14

Sample No		B-9
Optimum Water Content	%	10.2
Max Dry Density	Lbs Cu Ft	128.6
Optimum Water Content Corr for +	%	
Max Density Corr for	Lbs Cu Ft	

Project Chicopee Falls Local Protection

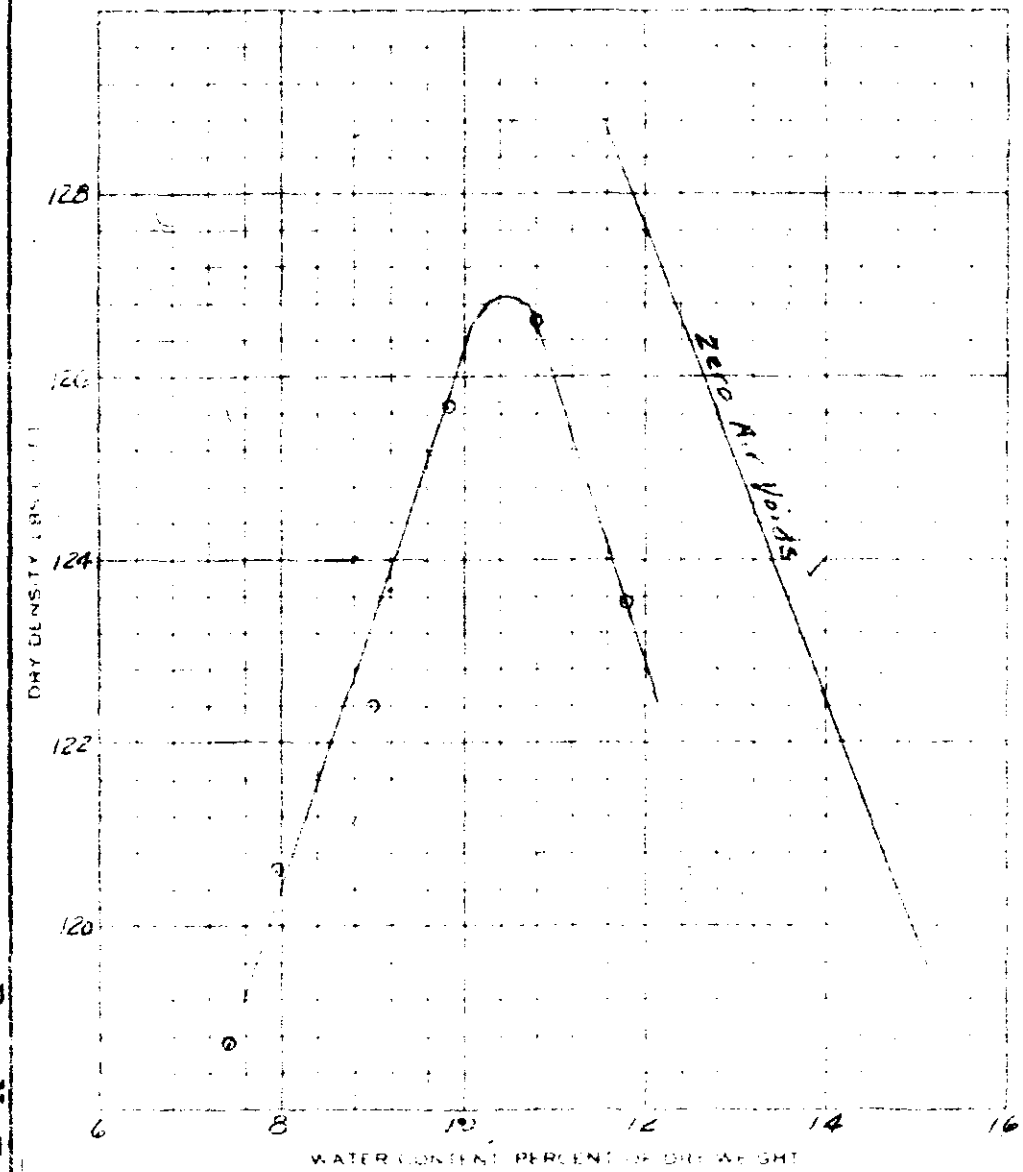
Area

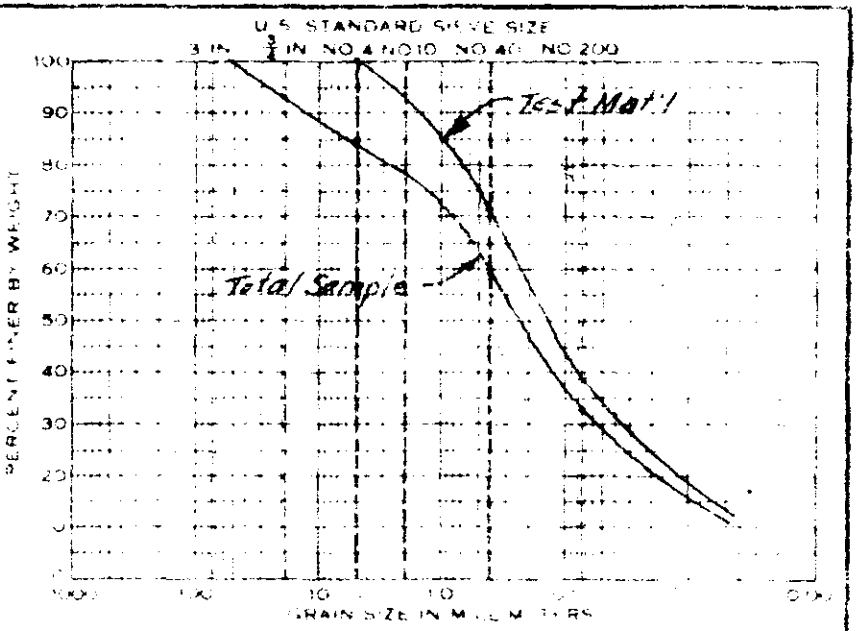
Boring No BT-2A | Sample No B-9

Elev or Depth 4.0'-4.4' | Date 30 October 1962

COMPACTION TEST REPORT

Page No. B-1





COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Sample No.	Elev or Depth	Classification	G	LL	PI
B-9	5.8'-6.2'	gravelly silty clayey SAND (SM-SC)	2.11	20	15

Sample No		B-9
Optimum Water Content	%	10.4
Max. Dry Density	Lbs Cu Ft	126.9
Optimum Water Content Correction	%	
Max. Density Correction	Lbs Cu Ft	

Project Chicopee Falls Local Protection

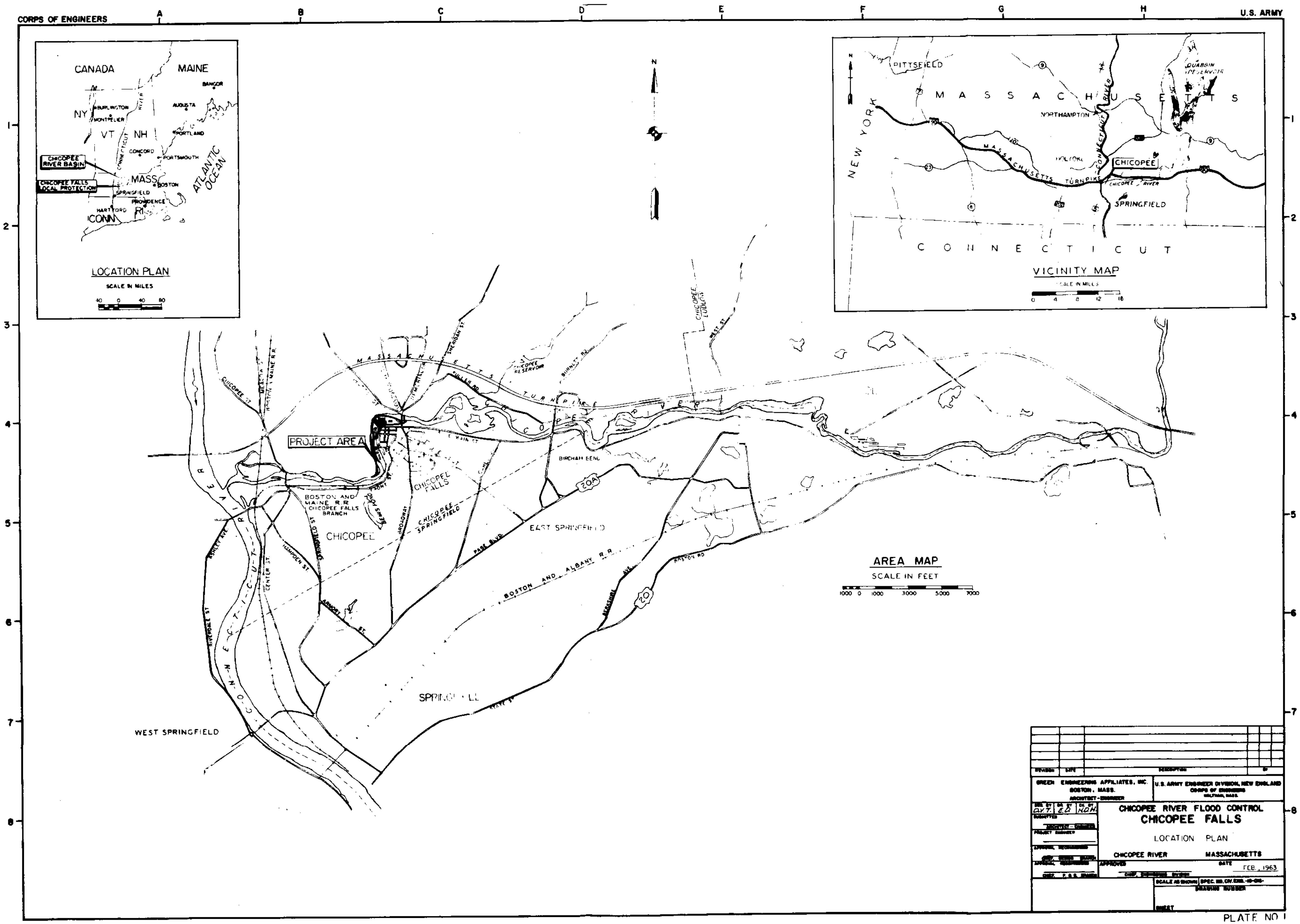
Area

Boring No. ET-10 | Sample No. B-9

Elev or Depth 5.4'-6.2' | Date 30 October 1962

COMPACTION TEST REPORT

Page No. B-2


CORPS OF ENGINEERS
U.S. ARMY
CANADA
MAINE
NY
VT
NH
MASS
CONN
RI
ATLANTIC OCEAN
BURLINGTON
MONTPELIER
AUGUSTA
BANGOR
PORTLAND
CONCORD
PORTSMOUTH
BOSTON
SPRINGFIELD
PROVIDENCE
HARTFORD
CHICOPEE RIVER BASIN
CHICOPEE FALLS LOCAL PROTECTION
LOCATION PLAN
SCALE IN MILES
PITTSFIELD
M A S S A C H U S E T T S
NEW YORK
NORTHAMPTON
HOLYOKE
MASSACHUSETTS TURNPIKE
CHICOPEE
CHICOPEE RIVER
SPRINGFIELD
QUABBIN RESERVOIR
C O N N E C T I C U T
VICINITY MAP
SCALE IN MILES
PROJECT AREA
BOSTON AND MAINE R.R. CHICOPEE FALLS BRANCH
CHICOPEE FALLS
CHICOPEE
BIRCHAM BEND
EAST SPRINGFIELD
BOSTON AND ALBANY R.R.
SPRINGFIELD
WEST SPRINGFIELD
AREA MAP
SCALE IN FEET
GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT - ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
LOCATION PLAN
CHICOPEE RIVER
MASSACHUSETTS
FEB., 1963
PLATE NO. I

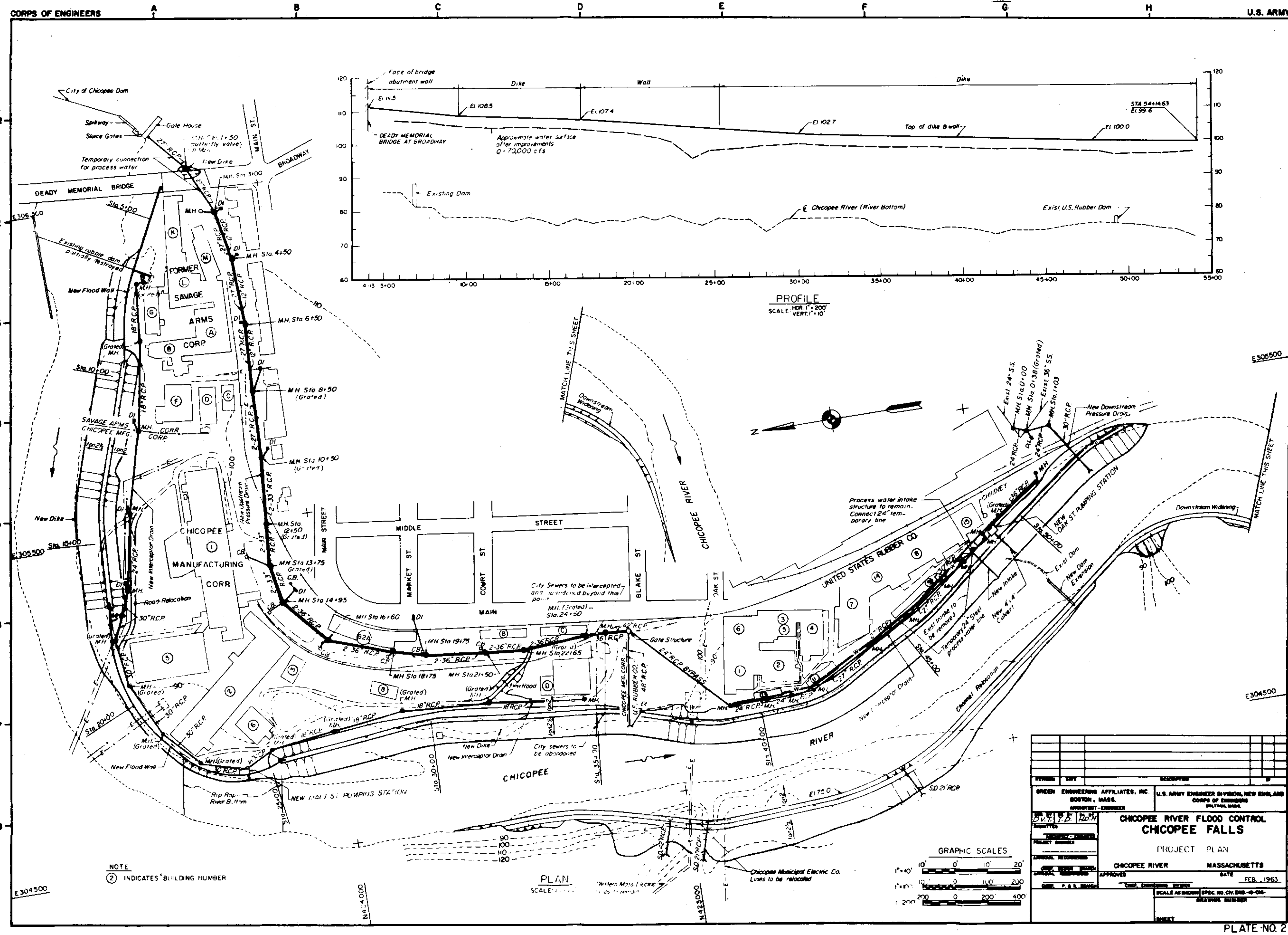
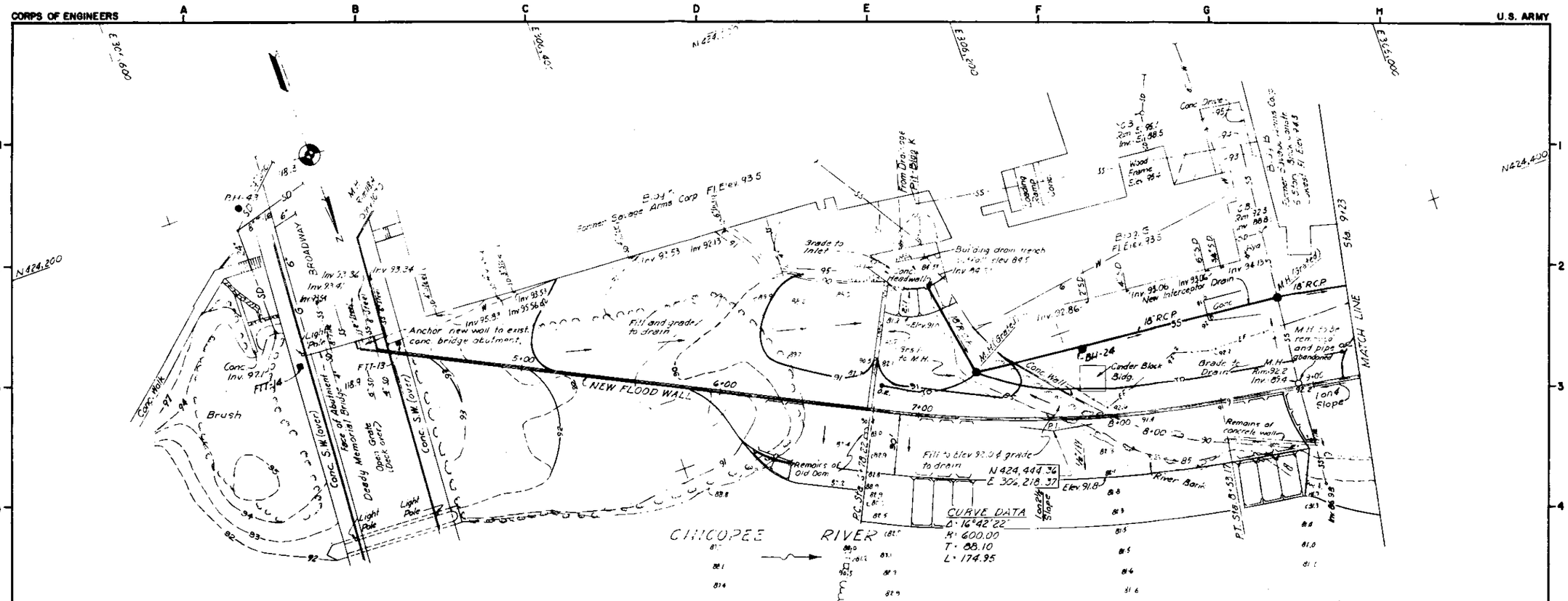

CORPS OF ENGINEERS
U.S. ARMY
PROFILE
SCALE: HOR. 1" = 200' VERT. 1" = 10'
Face of bridge abutment wall
Dike
Wall
Dike
El 111.5
El 108.5
El 107.4
El 102.7
El 100.0
STA 54+14.63 El 99.6
Top of dike & wall
DEADY MEMORIAL BRIDGE AT BROADWAY
Approximate water surface after improvements Q = 70,000 c.f.s.
Existing Dam
℄ Chicopee River (River Bottom)
Exist. U.S. Rubber Dam
City of Chicopee Dam
Spillway
Sluice Gates
Gate House
Temporary connection for process water
New Dike
DEADY MEMORIAL BRIDGE
MAIN ST.
BROADWAY
Existing rubble dam partially destroyed
New Flood Wall
FORMER SAVAGE ARMS CORP
SAVAGE ARMS CHICOPEE MFG. CORP.
New Dike
CHICOPEE MANUFACTURING CORP.
Roads Relocation
New Flood Wall
Rip Rap River Bottom
NEW DALE ST. PUMPING STATION
MIDDLE STREET
MAIN STREET
MARKET ST.
COURT ST.
BLAKE ST.
OAK ST.
MAIN
City Sewers to be intercepted and abandoned beyond this point
Gate Structure
24" RCP BYPASS
CHICOPEE MFG. CORP. U.S. RUBBER CO. 48" RCP
CHICOPEE RIVER
Downstream Widening
MATCH LINE THIS SHEET
UNITED STATES RUBBER CO.
Process water intake structure to remain. Connect 24" temporary line
NEW OAK ST PUMPING STATION
New Intake
New 4'x4' Culvert
Exist. Intake to be removed
Temporary 24" Steel process water line
Exist. Dam
New Dam Extension
New Downstream Pressure Drain
Channel Relocation
New Interceptor Drain
City sewers to be abandoned
CHICOPEE
RIVER
Chicopee Municipal Electric Co. Lines to be relocated
Western Mass. Electric Lines to remain
E305500
E304500
NOTE
(2) INDICATES BUILDING NUMBER
PLAN
GRAPHIC SCALES
GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
PROJECT PLAN
CHICOPEE RIVER
MASSACHUSETTS
FEB. 1963

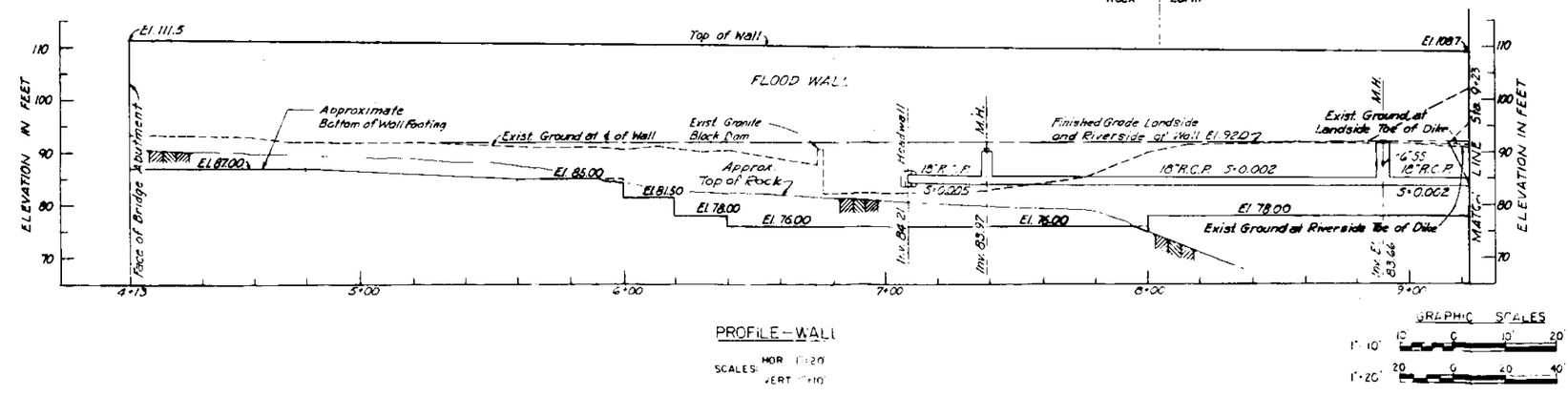
PLATE NO. 2

CORPS OF ENGINEERS — U.S. ARMY



PLAN

SCALE 1" = 20'



PROFILE — WALL

SCALES: HOR 1" = 20'
VERT 1" = 10'

LEGEND		
NEW	EXISTING	DESCRIPTION
—SD—	—SD—	STORM DRAIN
—SS—	—SS—	SANITARY SEWER OR COMBINED SEWER
		EARTH CUT
		EARTH FILL
		STONE SLOPE PROTECTION OR RIP-RAP
—TD—		TOE DRAIN
O.R.		OBSERVATION RISER
—SS—		24" PIPE AND OVER

GENERAL NOTES

1. Elevations refer to Mean Sea Level Datum.
2. Coordinates refer to Massachusetts State Plane Coordinate System.
3. All sewers, drains, and drainage structures are to be connected to the new interceptor on the land side of the line of flood walls and dikes.
4. Abandoned portions of utilities, penstocks, conduits etc. shall be removed at least between points 5 feet beyond the extreme foundation limits of the earth sections of dikes, the remaining ends of utilities shall be plugged in an approved manner.
5. Toe drains to be 8" perforated AB ACCMP.

GRAPHIC SCALES

1" · 10' — 10 0 10 20

1" · 20' — 20 0 20 40

REVISED	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
O.V.T.	H.M.	W.O.H.

SUBMITTED — ARCHITECT - ENGINEER — PROJECT ENGINEER — APPROVED — CHIEF, POWER BRANCH — CHIEF, E. & D. BRANCH — CHIEF, ENGINEERING DIVISION

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN AND PROFILE
STA 4+13 TO STA. 9+23
CHICOPEE RIVER MASSACHUSETTS

APPROVED DATE Feb., 1963

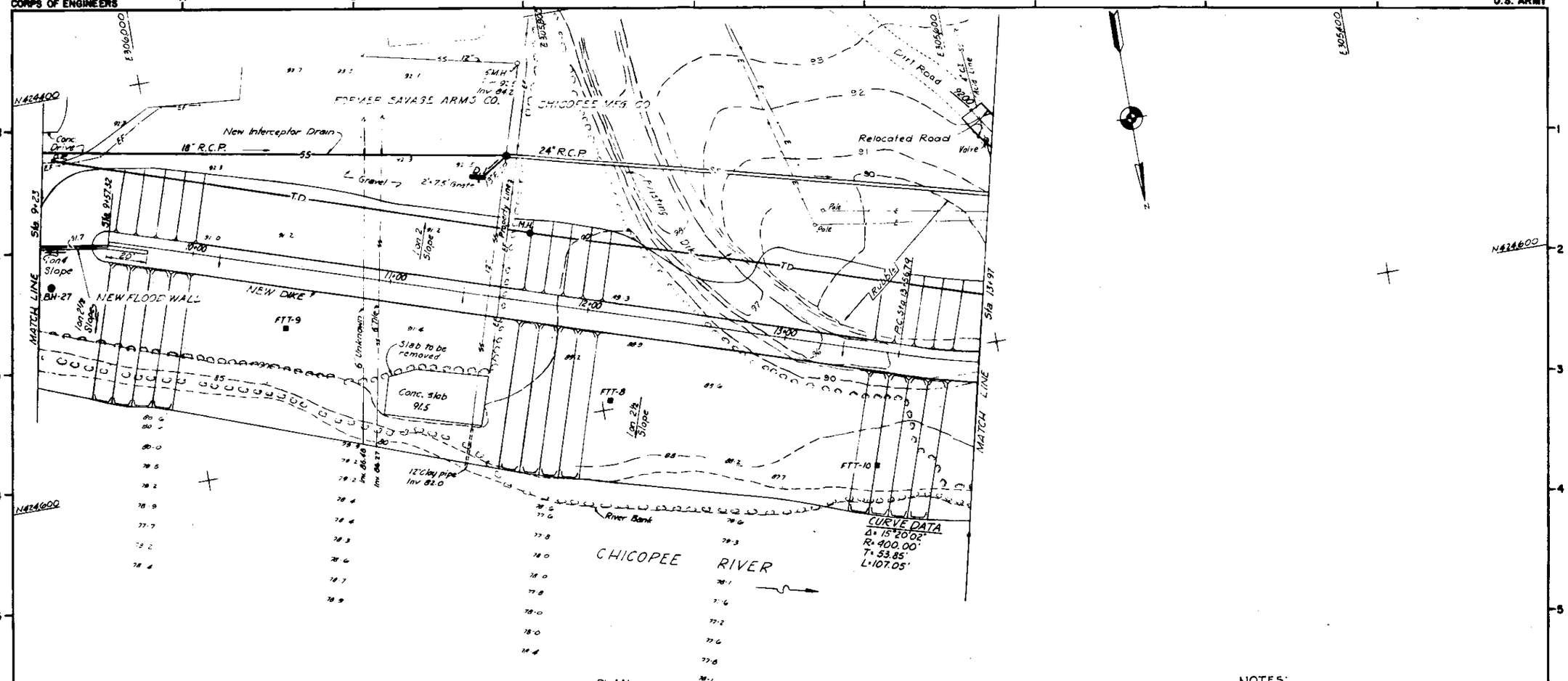
SCALE AS SHOWN | SPEC. NO. CIV. ENG.-10-010-

DRAWING NUMBER

SHEET

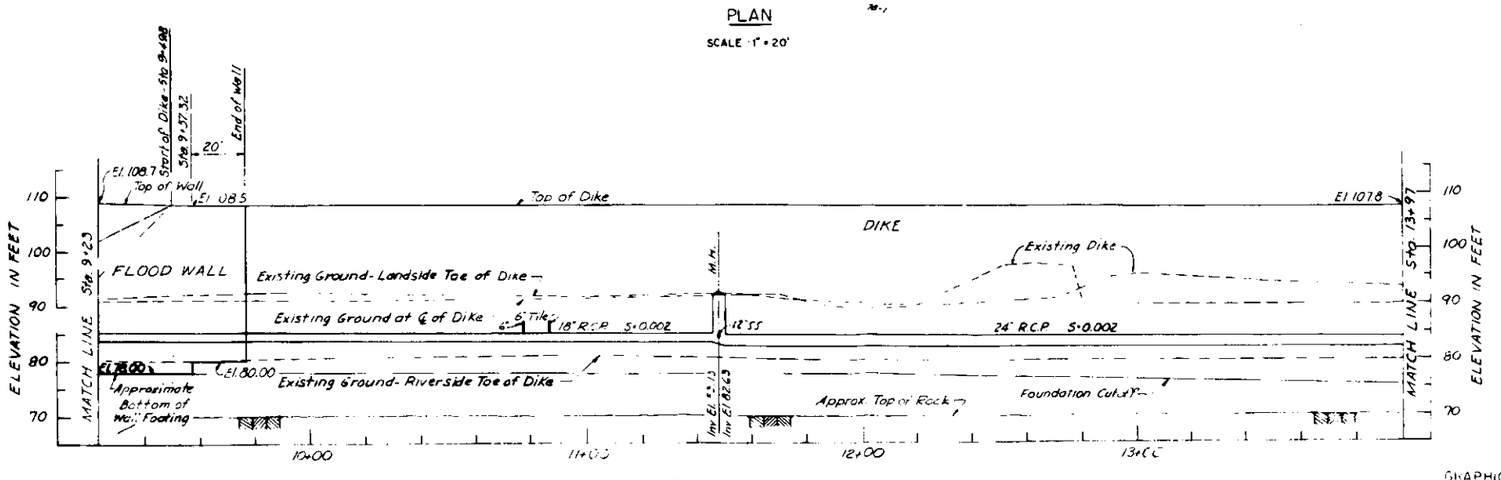
PLATE NO. 3

CORPS OF ENGINEERS — U.S. ARMY



PLAN

SCALE 1" = 20'



PROFILE - WALL AND DIKE

SCALES HOR 1"=20'
VERT 1"=10'

GRAPHIC SCALES

1"=10' 0 10' 20'

1"=20' 20' 0 20' 40'

NOTES:

1. For General Notes and Legend see Plate No. 3.

REVISION	DATE	RECOMMENDED	BY

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. — ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND, CORPS OF ENGINEERS, WALTHAM, MASS.

DES. BY D.V.T. | DR. BY H.M. | CH. BY W.C.H.

SUBMITTED

CHIEF, ENGINEERING DIVISION

PROJECT ENGINEER

APPROVAL RECOMMENDED

CHIEF, PLANS BRANCH

APPROVAL RECOMMENDED

CHIEF, P.B.S. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN AND PROFILE
STA 9+23 TO STA 13+97
CHICOPEE RIVER MASSACHUSETTS

APPROVED

CHIEF, ENGINEERING DIVISION

DATE FEB., 1963

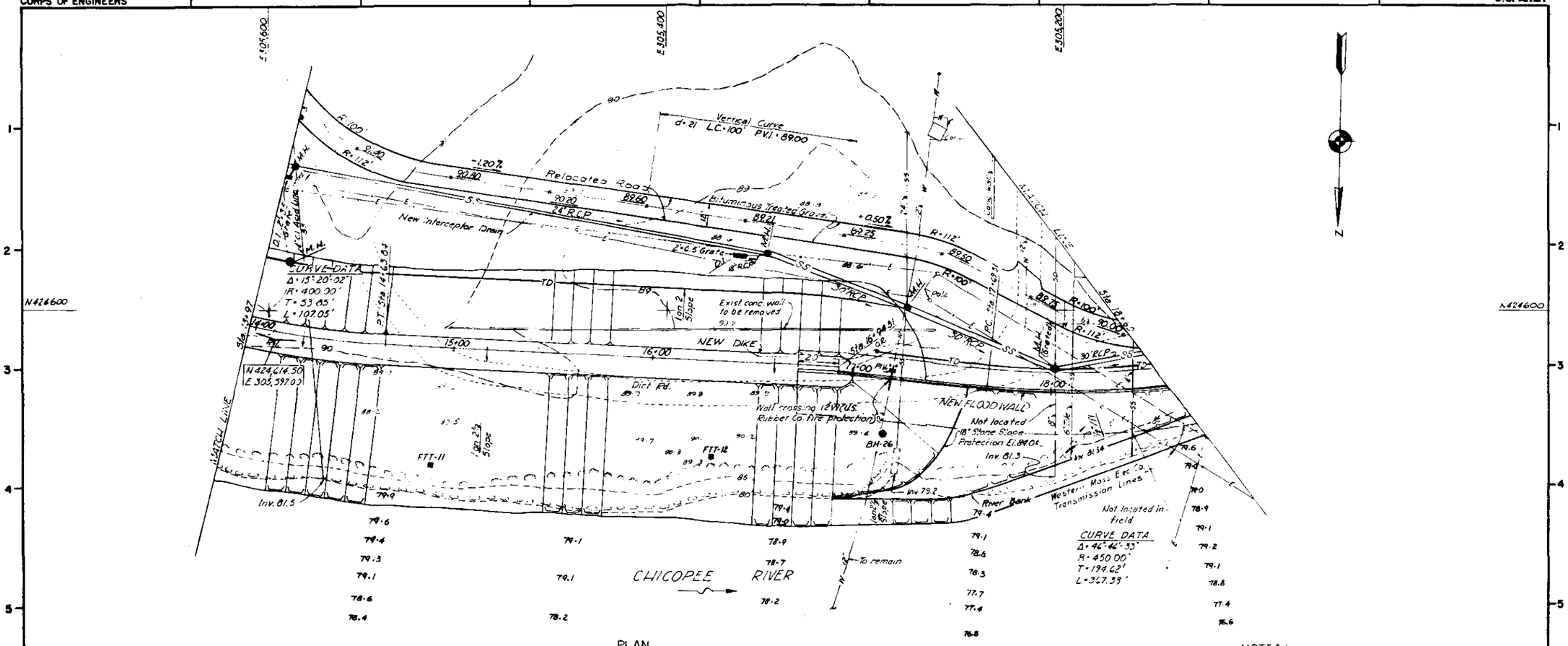
SCALE AS SHOWN | SPEC. NO. CIV. ENG.-19-060

DRAWING NUMBER

SHEET

PLATE NO. 4

CORPS OF ENGINEERS — U.S. ARMY

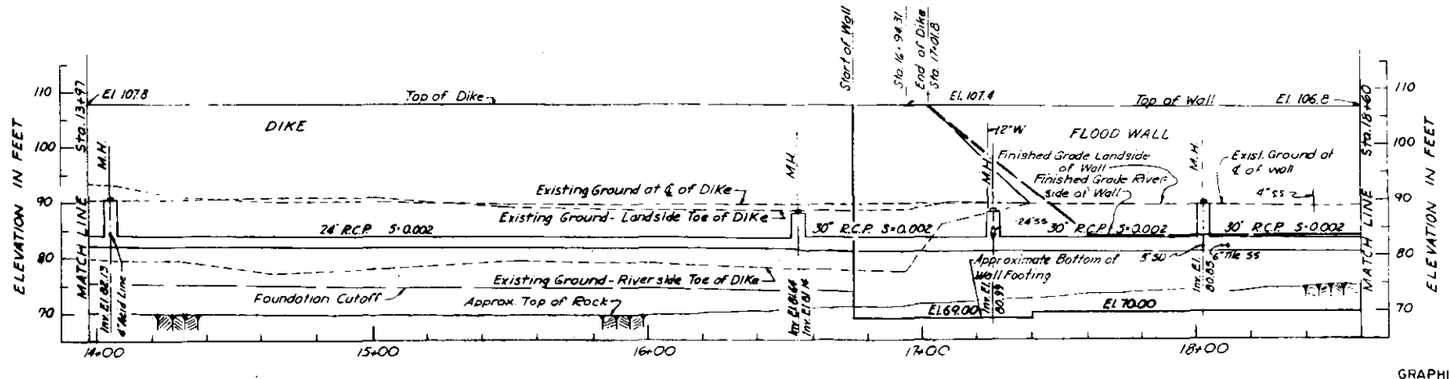


PLAN

SCALE 1" = 20'

NOTES:

1. For General Notes and Legend see Plate No. 3.
2. Stone slope protection at wall to extend 10' beyond heel of footing or to toe of slope, whichever is further.



PROFILE—WALL AND DIKE

SCALES HOR 1"=20'
VERT 1"=10'

GRAPHIC SCALES

1"=10' 10' 0 10' 20'

1"=20' 20' 0 20' 40'

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. — ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY D.V.T. | DR. BY H.M. | CK. BY H.D.H.

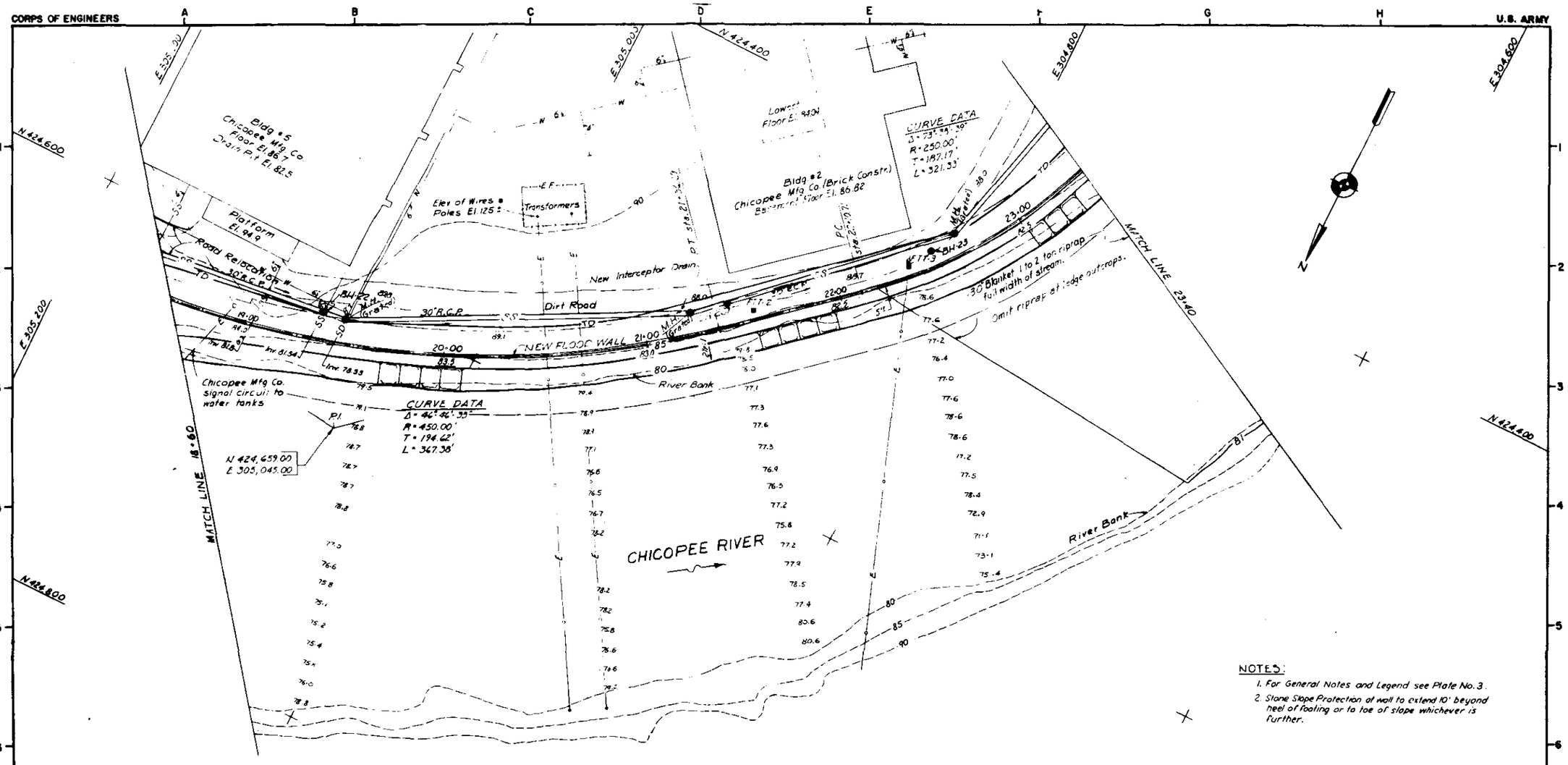
SUBMITTED — PROJECT ENGINEER — APPROVED — DATE FEB., 1963

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN AND PROFILE
STA. 13+97 TO STA. 18+60
CHICOPEE RIVER MASSACHUSETTS

SCALE AS SHOWN — SPEC. NO. CIV. ENG.-19-020 — DRAWING NUMBER — SHEET

PLATE NO. 5

CORPS OF ENGINEERS — U.S. ARMY

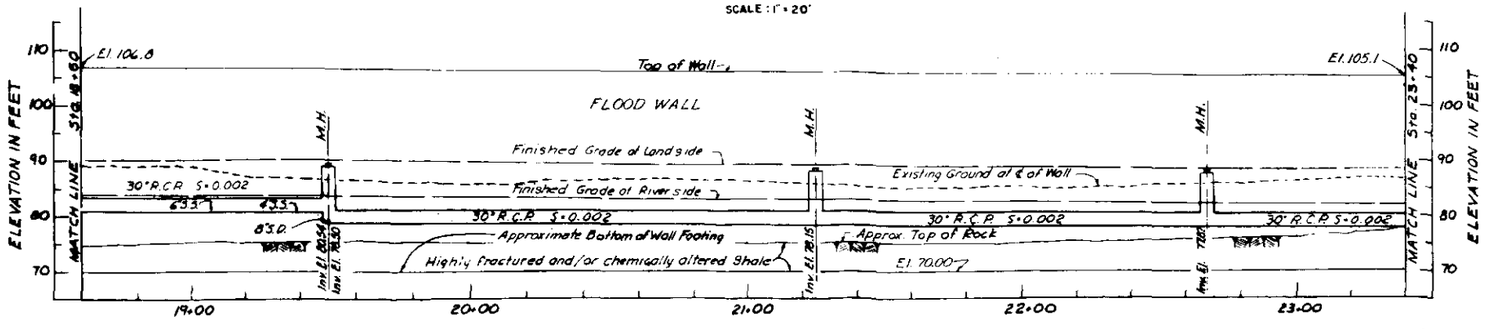


NOTES:

1. For General Notes and Legend see Plate No. 3.
2. Stone Slope Protection at wall to extend 10' beyond heel of footing or to toe of slope whichever is further.

PLAN

SCALE: 1" = 20'



PROFILE — WALL

SCALES: HOR: 1"=20'
VERT: 1"=10'

GRAPHIC SCALES

1" = 10': 10' 0 10' 20'

1" = 20': 20' 0 20' 40'

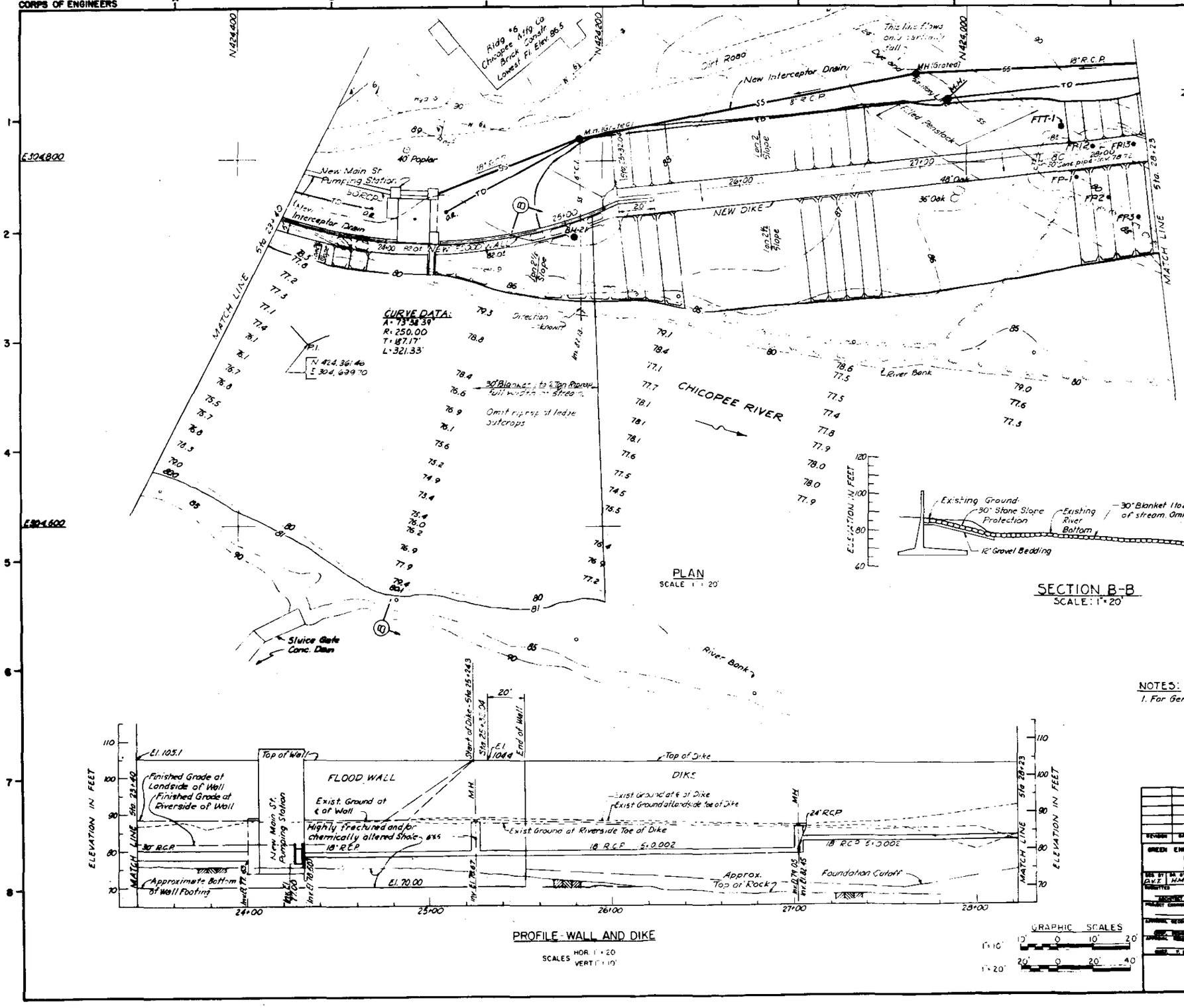
GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. — ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND, CORPS OF ENGINEERS, WALTHAM, MASS.

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN AND PROFILE
STA. 18+60 TO STA 23+40
CHICOPEE RIVER — MASSACHUSETTS
DATE: FEB., 1963

PLATE NO.6

CORPS OF ENGINEERS — U.S. ARMY



NOTES:

1. For General Notes and Legend see Plate No. 3

GRAPHIC SCALES

1" = 10' — 10' 0 10' 20'

1" = 20' — 20' 0 20' 40'

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT - ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

CHICOPEE RIVER FLOOD CONTROL

CHICOPEE FALLS

GENERAL PLAN AND PROFILE

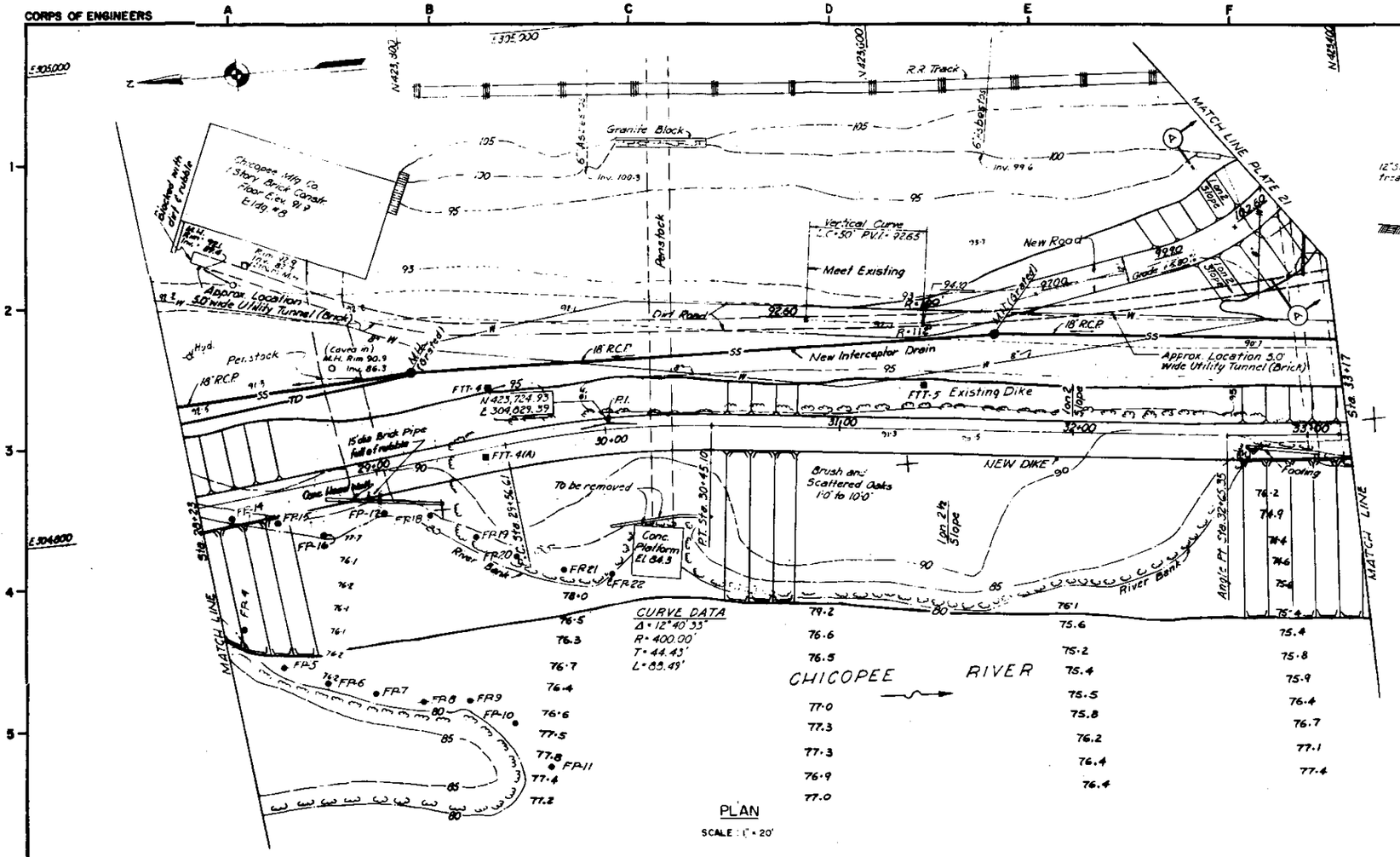
STA 23+40 TO STA 28+23

CHICOPEE RIVER MASSACHUSETTS

DATE FEB., 1963

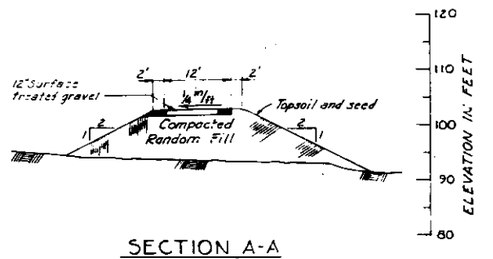
PLATE NO. 7

CORPS OF ENGINEERS — U.S. ARMY



PLAN

SCALE : 1" = 20'

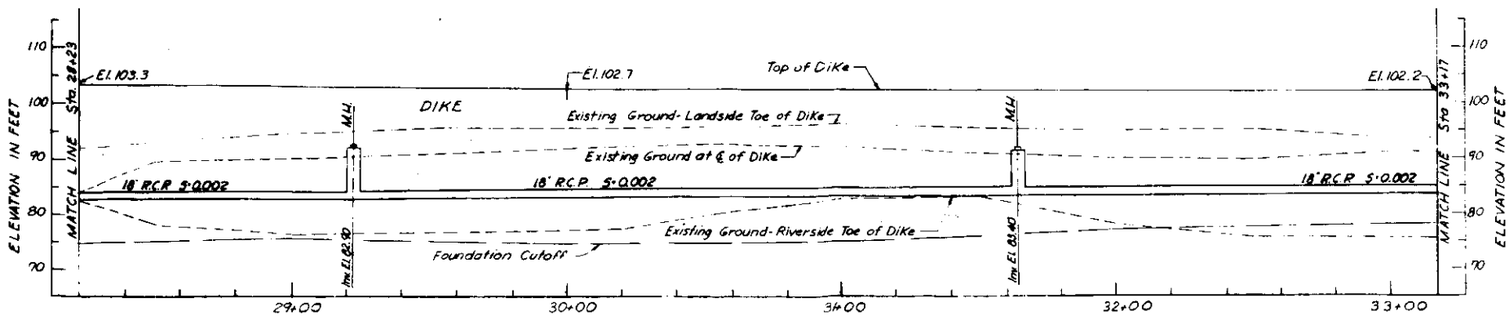


SECTION A-A

Scale: 1" = 10'

NOTES:

1. For General Notes and Legend see Plate No 3



PROFILE — DIKE

SCALES: HOR 1"=20'
VERT 1"=10'

GRAPHIC SCALES

1" = 10' — 10' 0 10' 20'

1" = 20' — 20' 0 20' 40'

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY D.V.T. | DR. BY M.J.F. | CH. BY M.O'H.

CHICOPEE RIVER FLOOD CONTROL

CHICOPEE FALLS

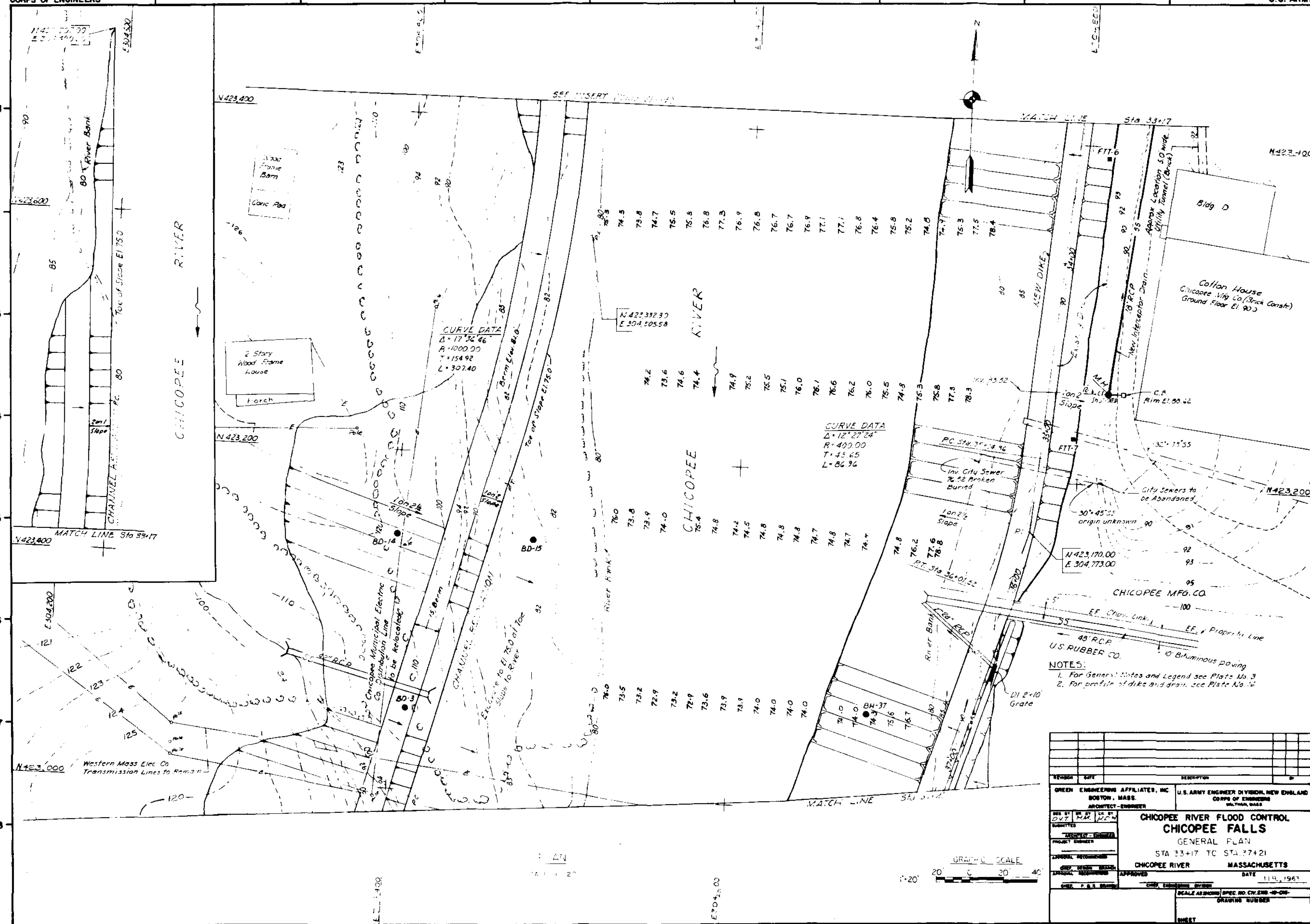
GENERAL PLAN AND PROFILE

STA 28+23 TO STA. 33+17

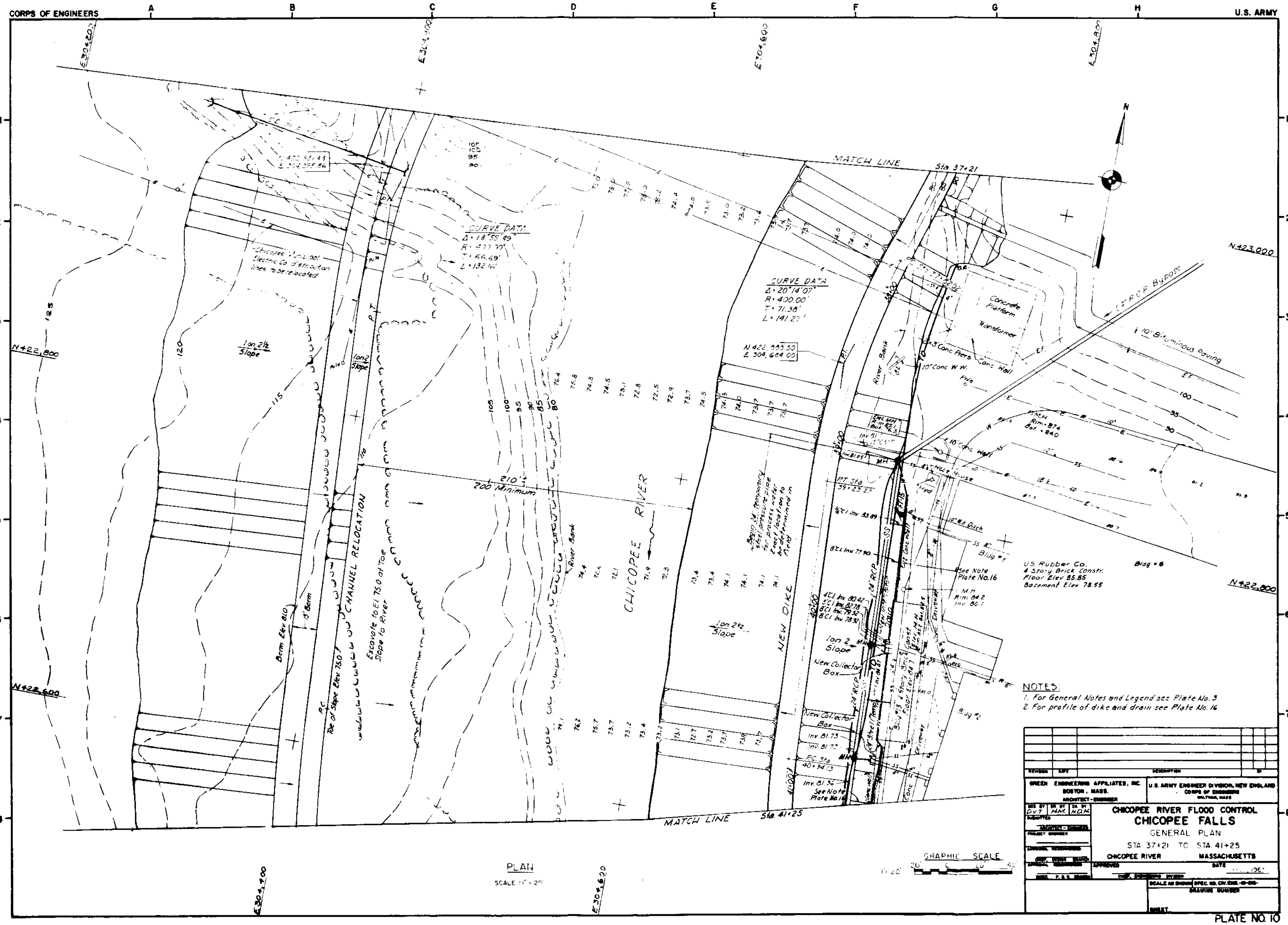
CHICOPEE RIVER MASSACHUSETTS

DATE FEB. 1963

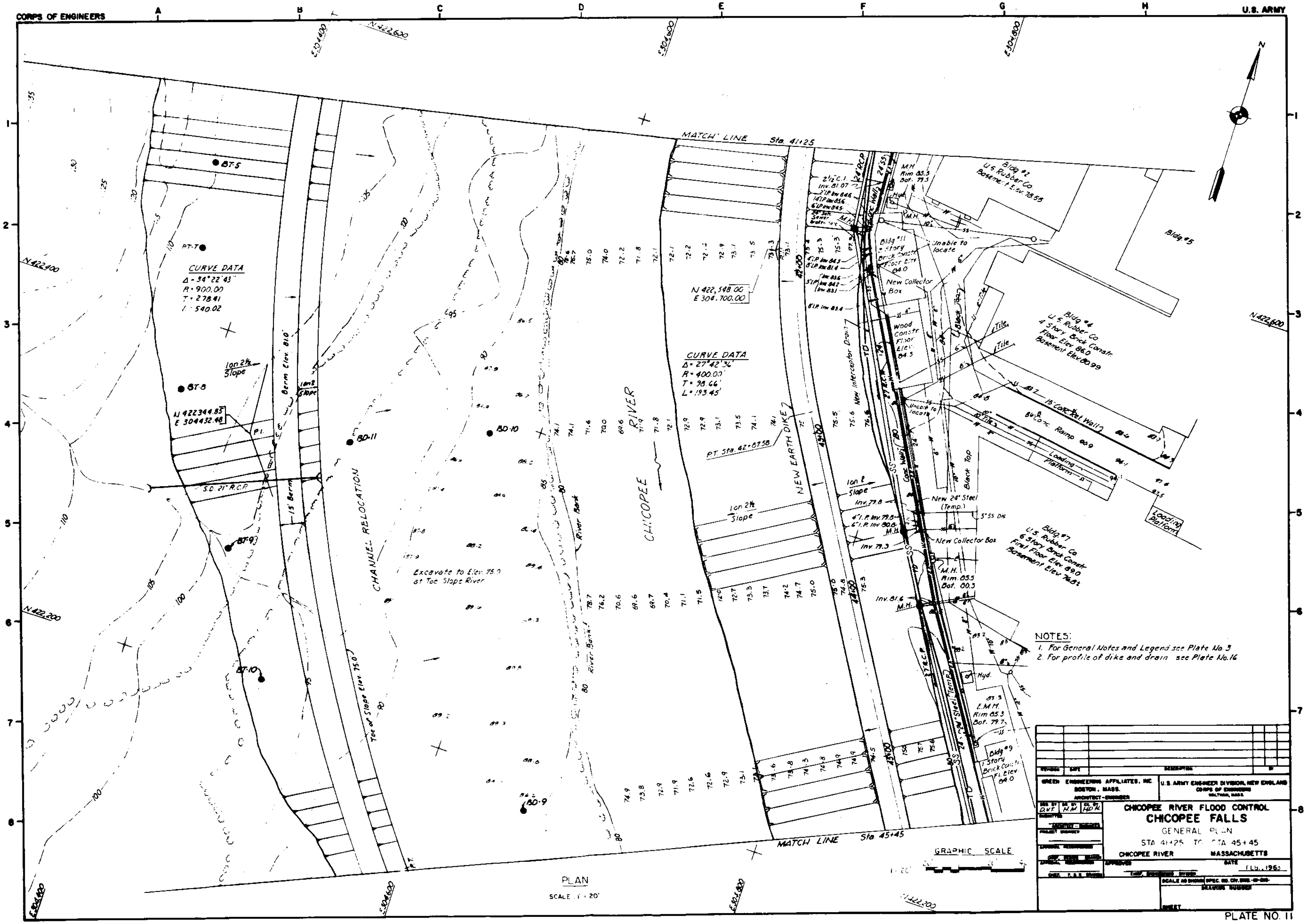
PLATE NO. 8



CHICOPEE RIVER
River Bank
Toe of Slope El. 75.0
CHANNEL
MATCH LINE Sta 33+17
N 423,400
N 423,600
N 423,200
N 423,000
E 304,200
2 Story Wood Frame House
Porch
Wood Frame Barn
Conc Pad
Pole
CURVE DATA
Δ = 17°36'46"
R = 1000.00
T = 154.92
L = 307.40
CURVE DATA
Δ = 12°27'24"
R = 400.00
T = 43.65
L = 86.96
Berm Elev 84.0
Toe of Slope El 75.0
1 on 2½ Slope
1 on 2 Slope
BD-14
BD-15
BD-3
BH-37
Chicopee Municipal Electric Co. Distribution Line to be Relocated
Excavate to El 75.0 at Toe Slope to River
Western Mass Elec Co Transmission Lines to Remain
N 423,332.30
E 304,505.58
N 423,170.00
E 304,773.00
P.C. Sta 34+74.96
P.T. Sta 36+01.92
Inv. City Sewer 76.52 Broken Buried
City Sewers to be Abandoned
30" 45°55' origin unknown
NEW DIKE
FTT-6
FTT-7
Bldg D
Cotton House Chicopee Mfg Co (Brick Constr) Ground Floor El. 90.0
New Interceptor Drain
Approx Location 5.0 wide Utility Tunnel (Brick)
C.B. Rim El. 88.62
CHICOPEE MFG. CO.
U.S. RUBBER CO.
E.F. Chain Link
E.F. & Property Line
48" RCP
10' Bituminous paving
DI 2x10' Grate
River Bank
NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of dike and drain see Plate No. 16
MATCH LINE
PLAN
GRAPHIC SCALE
1" = 20'
20' 0 20' 40'
GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA 33+17 TO STA 37+21
CHICOPEE RIVER
MASSACHUSETTS



CORPS OF ENGINEERS
U.S. ARMY
MATCH LINE Sta. 37+21
MATCH LINE Sta. 41+25
CURVE DATA
Δ = 18°55'49"
T = 66.69'
L = 132.16'
CURVE DATA
Δ = 20°14'07"
R = 400.00'
T = 71.38'
L = 141.27'
N 422,933.53
E 304,664.00
Chicopee Municipal Electric Co. distribution lines to be relocated
1 on 2½ Slope
1 on 2 Slope
CHANNEL RELOCATION
Excavate to El 75.0 at Toe Slope to River
Toe of Slope Elev 75.0
Berm Elev 81.0
15' Berm
210'±
200' Minimum
CHICOPEE RIVER
River Bank
NEW DIKE
1 on 2½ Slope
1 on 2 Slope
New Collector Box
Concrete Platform
Transformer
Conc Wall
10' Bituminous Paving
RCP Bypass
US Rubber Co.
4 Story Brick Constr.
Floor Elev 85.85
Basement Elev. 78.55
Bldg. #6
Bldg. #2
N423,000
N422,800
N422,600
E304,200
E304,400
E304,600
E304,620
E304,800
NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of dike and drain see Plate No. 16
PLAN
GRAPHIC SCALE
GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT - ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA 37+21 TO STA 41+25
CHICOPEE RIVER
MASSACHUSETTS
PLATE NO. 10


CORPS OF ENGINEERS
U.S. ARMY
MATCH LINE Sta. 41+25
MATCH LINE Sta 45+45
CURVE DATA
Δ = 34°22'43"
R = 900.00
T = 278.41
L = 540.02
CURVE DATA
Δ = 27°42'34"
R = 400.00
T = 98.66
L = 193.45
N 422,548.00
E 304,700.00
N 422344.83
E 304432.48
PT. Sta. 42+67.58
CHANNEL RELOCATION
CHICOPEE RIVER
NEW EARTH DIKE
New Interceptor Drain
Berm Elev. 81.0
15' Berm
Toe of Slope Elev. 75.0
Excavate to Elev. 75.0 at Toe Slope River
River Bank
S.D. 21" R.C.P.
1 on 2½ Slope
1 on 2 Slope
New Collector Box
New 24" Steel (Temp.)
Unable to locate
Bldg #2 U.S. Rubber Co Basement Elev. 78.55
Bldg #5
Bldg #4 U.S. Rubber Co 4 Story Brick Constr. Floor Elev. 86.0 Basement Elev. 80.99
Bldg #7 U.S. Rubber Co 6 Story Brick Constr. First Floor Elev. 89.0 Basement Elev. 76.81
Bldg #9 1 Story Brick Constr. Fl. Elev. 84.0
Bldg #11 2 Story Brick Constr. Floor Elev. 84.0
Wood Constr. Floor Elev. 84.5
Loading Platform
Conc. Ramp
15' Conc. Ret. Wall
Black Top
NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of dike and drain see Plate No. 16
GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA 41+25 TO STA 45+45
CHICOPEE RIVER MASSACHUSETTS
GRAPHIC SCALE
PLAN
SCALE 1" = 20'
PLATE NO. 11

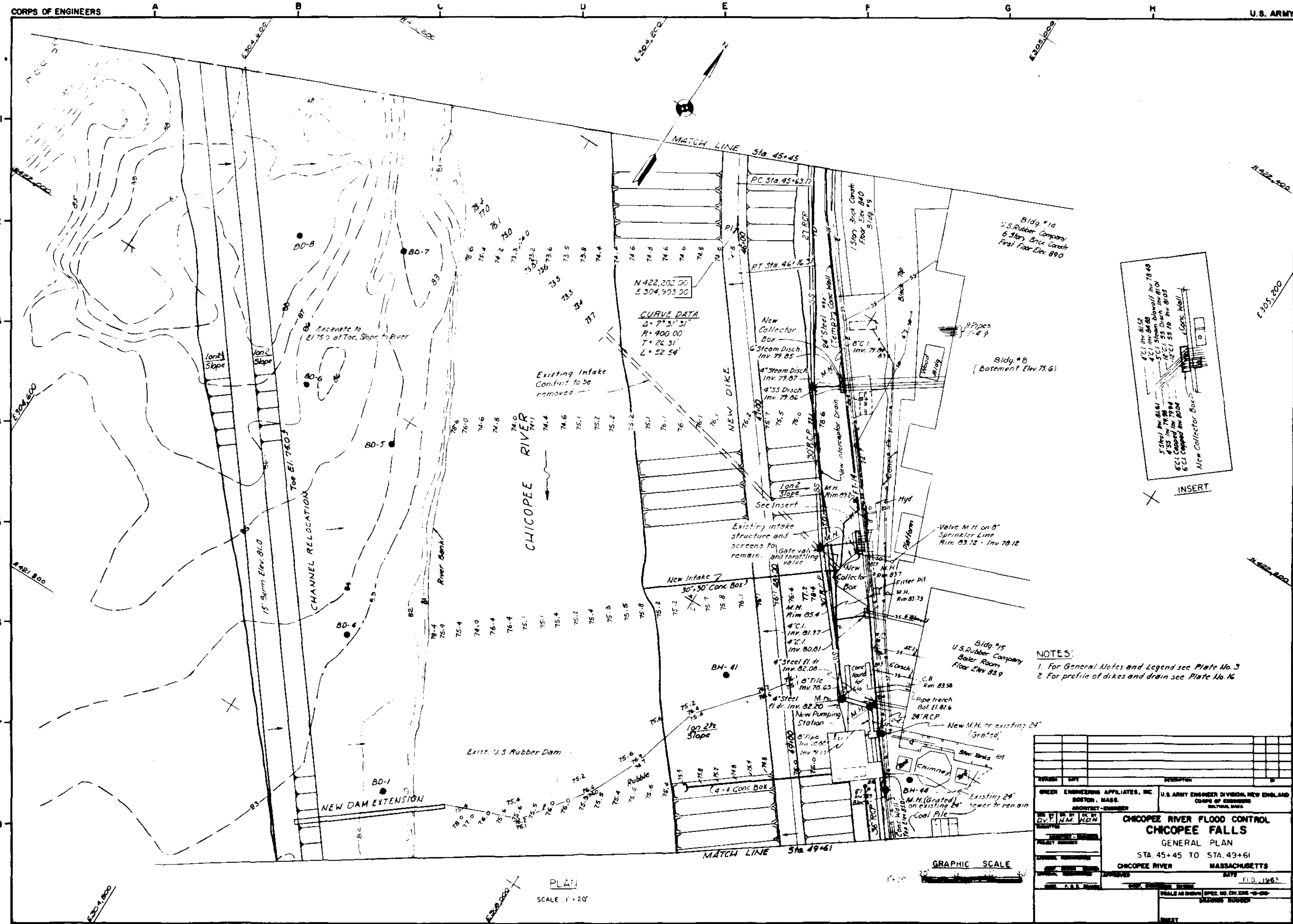

CORPS OF ENGINEERS
U.S. ARMY
MATCH LINE Sta. 45+45
MATCH LINE Sta. 49+61
CHICOPEE RIVER
CHANNEL RELOCATION
NEW DIKE
NEW DAM EXTENSION
Exist. U.S. Rubber Dam
River Bank
15' Berm Elev. 81.0
Toe El. 74.0
Excavate to El. 75.0 at Toe, Slope to River
Existing Intake Conduit to be removed
CURVE DATA
Δ = 7° 31' 31"
R = 400.00
T = 26.31'
L = 52.54'
N 422,202.00
E 304,903.00
PC Sta. 45+63.17
PT Sta. 46+16.31
New Collector Box
New Intake 30"x30" Conc. Box
New Pumping Station
New Interceptor Drain
See Insert
Existing intake structure and screens to remain
Bldg. #14 U.S. Rubber Company 6 Story Brick Constr. First Floor Elev. 89.0
Bldg. #8 (Basement Elev. 75.6)
Bldg. #15 U.S. Rubber Company Boiler Room Floor Elev. 83.9
Valve M.H. on 8" Sprinkler Line Rim 83.72 - Inv. 78.12
New M.H. on existing 24" (Grated)
Existing 24" sewer to remain
Coal Pile
Chimney
INSERT
NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of dikes and drain see Plate No. 16
PLAN
SCALE 1" = 20'
GRAPHIC SCALE
GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT - ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA. 45+45 TO STA. 49+61
CHICOPEE RIVER
MASSACHUSETTS
FEB. 1963

PLATE NO. 12

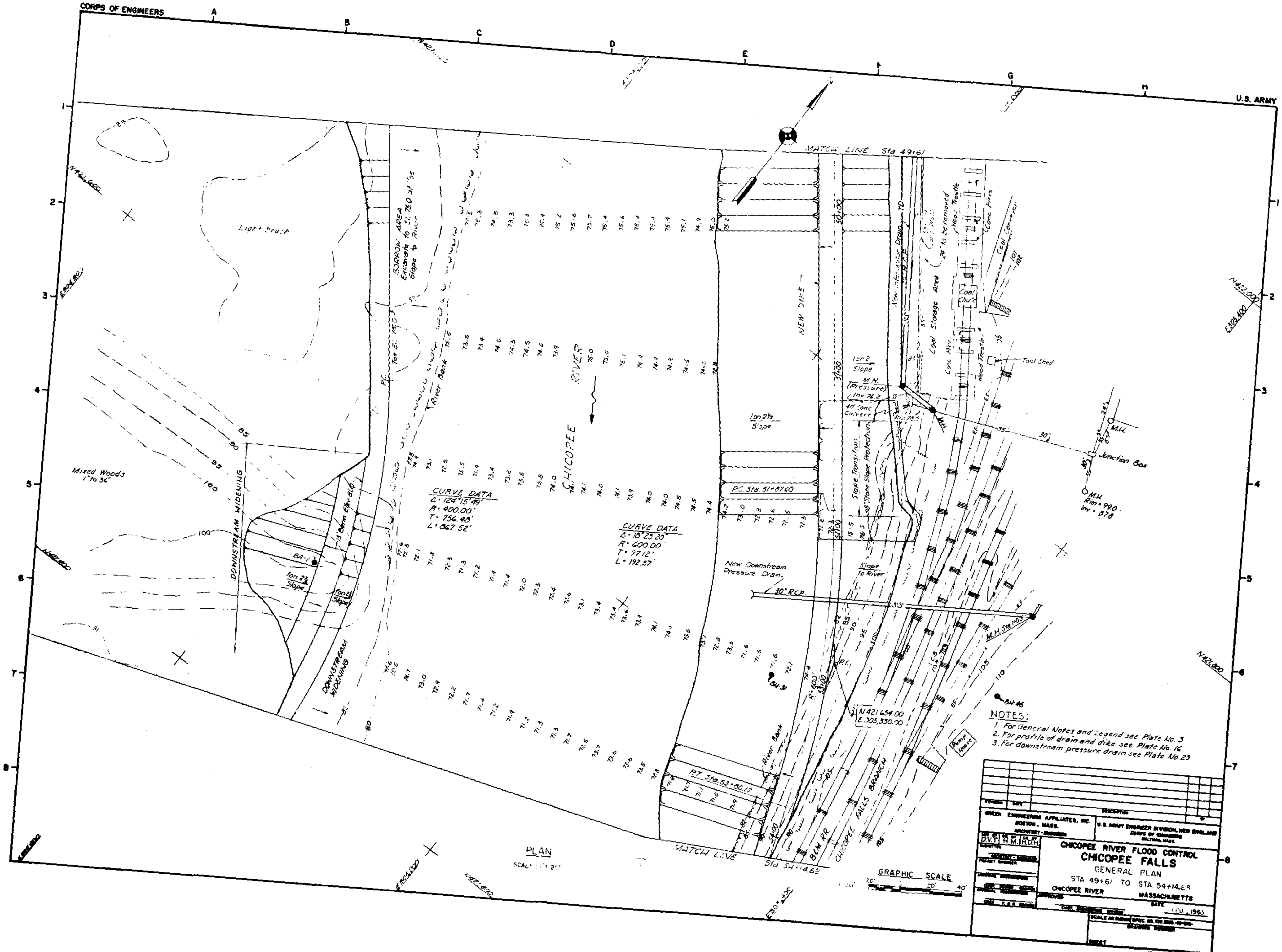

CORPS OF ENGINEERS
U.S. ARMY
MATCH LINE Sta 49+61
Light Brush
Mixed Woods
1" to 36"
BORROW AREA
Excavate to El. 75.0 at Toe
Slope to River
River Bank
CHICOPEE RIVER
NEW DIKE
Coal Storage Area
Coal Chute
Tool Shed
Junction Box
M.H. (Pressure)
40" Conc Culvert
Slope Transition
Stone Slope Protection
CURVE DATA
Δ = 124°15'49"
R = 400.00'
T = 754.48'
L = 867.52'
CURVE DATA
Δ = 18°23'20"
R = 600.00'
T = 97.12'
L = 192.57'
P.C. Sta. 51+87.60
P.T. Sta. 53+80.17
New Downstream Pressure Drain
30" RCP
DOWNSTREAM WIDENING
N 421,654.00
E 305,330.00
CHICOPEE FALLS BRANCH
B&M RR
Pump House
MATCH LINE Sta 54+14.63
PLAN
GRAPHIC SCALE
NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of drain and dike see Plate No. 16
3. For downstream pressure drain see Plate No. 23
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
STA 49+61 TO STA 54+14.63
CHICOPEE RIVER
MASSACHUSETTS
FEB. 1963

PLATE NO. 13

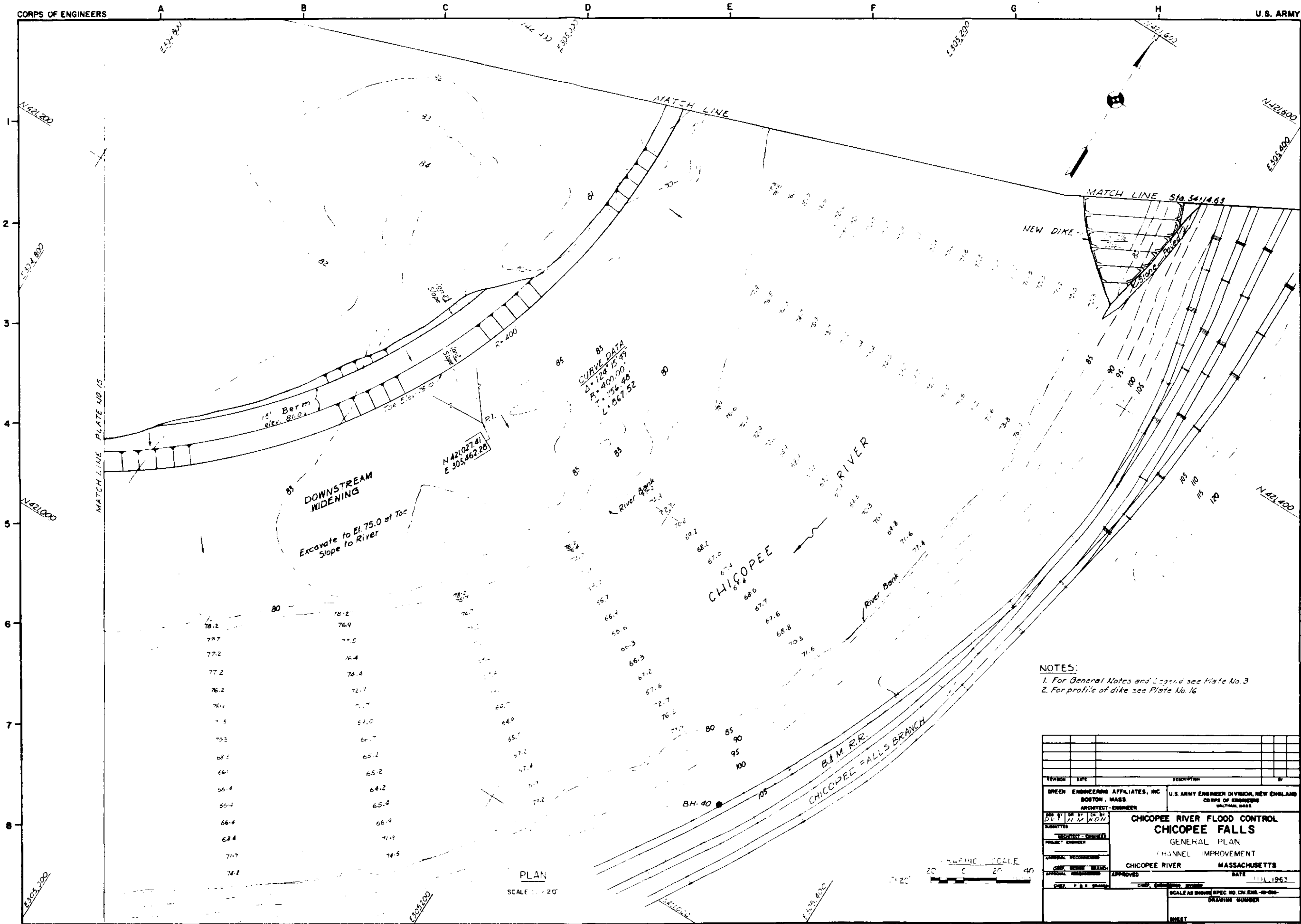

CORPS OF ENGINEERS
U.S. ARMY
MATCH LINE
MATCH LINE Sta. 54+14.63
NEW DIKE
Stone Paving
MATCH LINE PLATE NO. 15
15' Berm elev. 81.0±
R=400
CURVE DATA
Δ=124°15'49"
R=400.00'
T=756.48'
L=867.52'
P.I.
N 421,027.41
E 305,462.28
DOWNSTREAM WIDENING
Excavate to El. 75.0 at Toe Slope to River
River Bank
CHICOPEE RIVER
B.& M. R.R.
CHICOPEE FALLS BRANCH
BH-40
NOTES:
1. For General Notes and Legend see Plate No. 3
2. For profile of dike see Plate No. 16
PLAN
GRAPHIC SCALE
GREEN ENGINEERING AFFILIATES, INC
BOSTON, MASS.
ARCHITECT-ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
CHANNEL IMPROVEMENT
CHICOPEE RIVER
MASSACHUSETTS
FEB. 1963

PLATE NO. 14

CORPS OF ENGINEERS

U.S. ARMY

N 420,800

E 305,000

E 304,800

E 304,600

E 304,400

N 421,000

B&MRR
CHICOPEE FALLS BRANCH

River Bank

CHICOPEE RIVER

Excavate to El. 75.0 at Toe
Slope to River

DOWNSTREAM WIDENING

Toe Elev. 78.0

1on2 Slope

P.T.

MATCH LINE PLATE NO. 14

CURVE DATA
Δ = 124° 15' 49"
R = 400.00'
T = 756.48'
L = 867.52'

N 420,961.50
E 304,453.00

PLAN
SCALE : 1" = 20'

GRAPHIC SCALE
20' 0 20' 40'
1" = 20'

NOTES:
1. For General Notes and Legend see Plate No. 3

REVISION	DATE	DESCRIPTION	BY

GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
DVT	HM	HDH

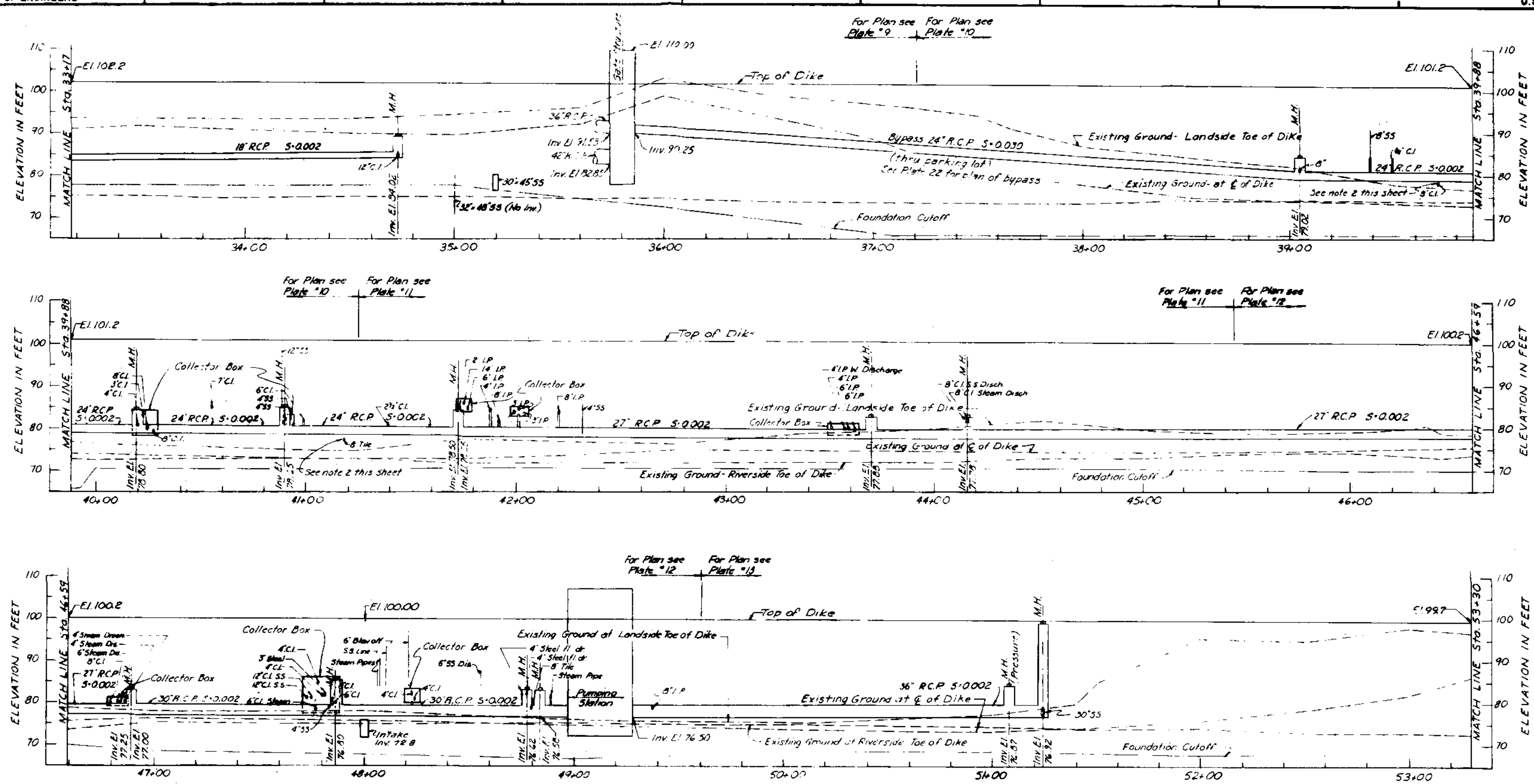
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PLAN
CHANNEL IMPROVEMENT
CHICOPEE RIVER MASSACHUSETTS

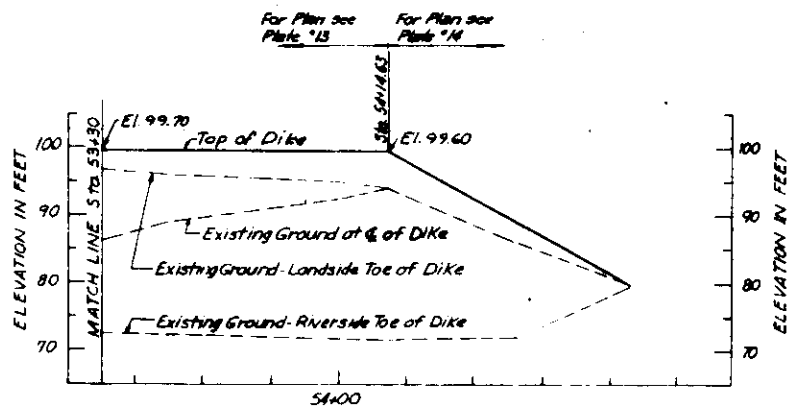
APPROVED DATE FEB., 1963

SCALE AS SHOWN SPEC. NO. CIV. ENG.-10-010-
SALISBURY MARSH

PLATE NO. 15

CORPS OF ENGINEERS — U.S. ARMY





NOTES:
1. For Plans see Plates [illegible]
2. Rework roofleader piping for gravity connections
Install sump pumps for basement pits at U.S. Rubber Bldgs

PROFILE — DIKE

SCALES HOR. 1"=20' VERT. 1"=10'

GRAPHIC SCALES
1"=10' 10' 0 10' 20'
1"=20' 20' 0 20' 40'

GREEN ENGINEERING AFFILIATES, INC
BOSTON, MASS.
ARCHITECT - ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY D.V.T. DR. BY H.M. CK. BY H.D.H.

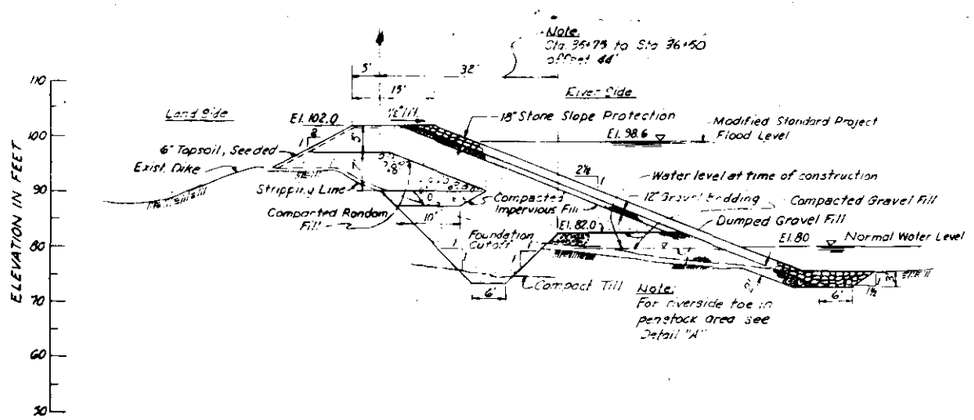
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
GENERAL PROFILE
STA. 33+17 TO STA. 54+14.63
CHICOPEE RIVER MASSACHUSETTS

DATE FEB. 1963

SCALE AS SHOWN SPEC. NO. CIV. ENG. -

PLATE NO. 16

CORPS OF ENGINEERS — U.S. ARMY

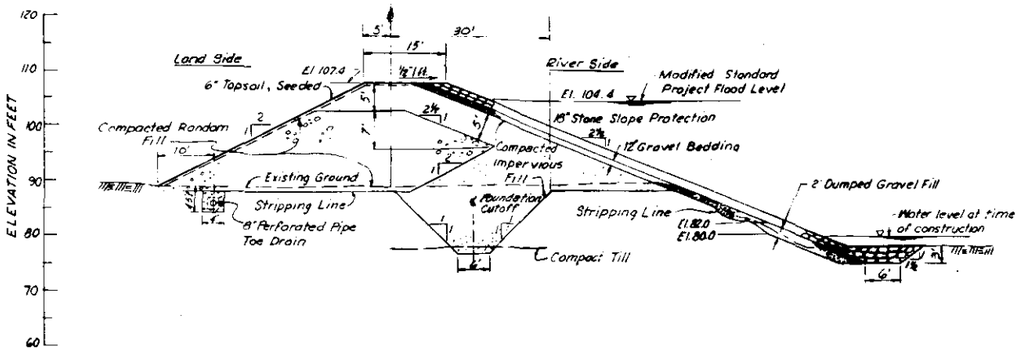


AT RIVER SECTION #34

TYPICAL FOR EARTH DIKE FROM

STA 28+00 TO STA 37+50

SCALE: 1" = 10'



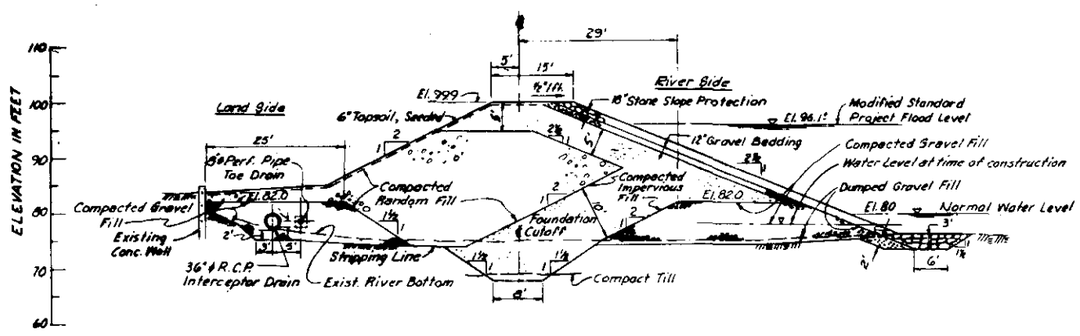
AT RIVER SECTION #16

TYPICAL FOR EARTH DIKE FROM

STA 9+57 TO STA 16+94

STA 25+32 TO STA 28+00

SCALE: 1" = 10'

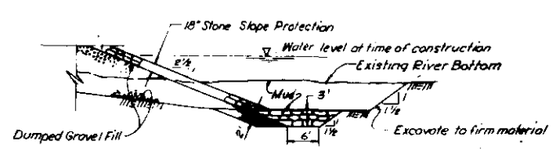


AT RIVER SECTION #49

TYPICAL FOR EARTH DIKE FROM

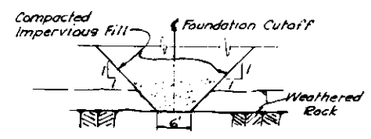
STA. 37+50 TO STA. 54+15

SCALE: 1" = 10'



DETAIL A

SCALE: 1" = 10'



FOUNDATION CUTOFF ON ROCK

SCALE: 1" = 10'

GRAPHIC SCALE

1" = 10'

10' 0 10' 20'

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. — ARCHITECT - ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

CHICOPEE RIVER FLOOD CONTROL

CHICOPEE FALLS

TYPICAL SECTIONS

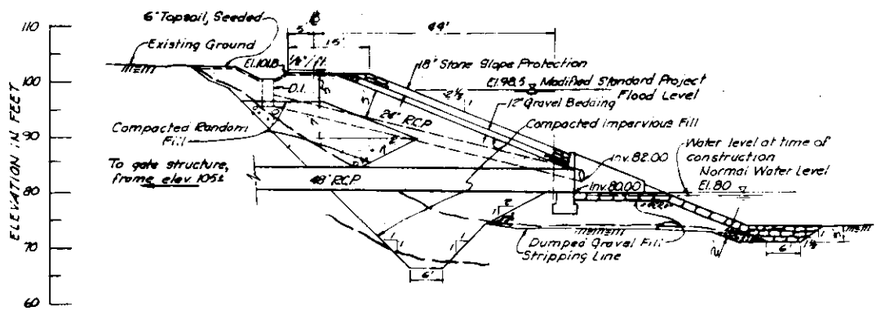
DIKE

CHICOPEE RIVER — MASSACHUSETTS

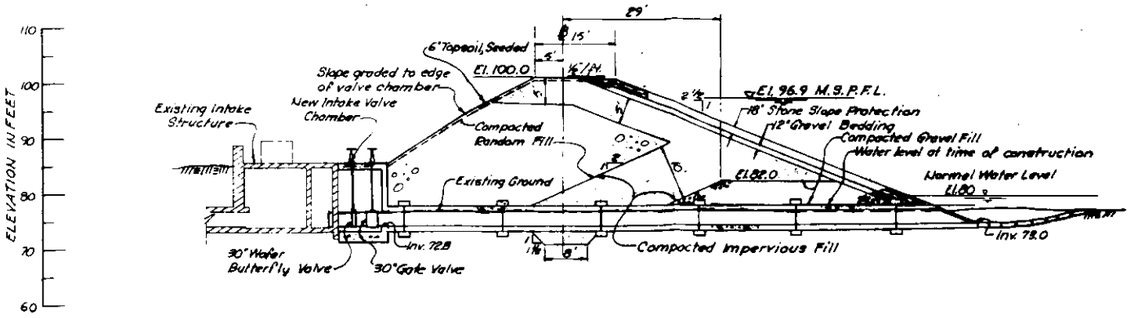
APPROVED — DATE FEB. 1963

PLATE NO. 17

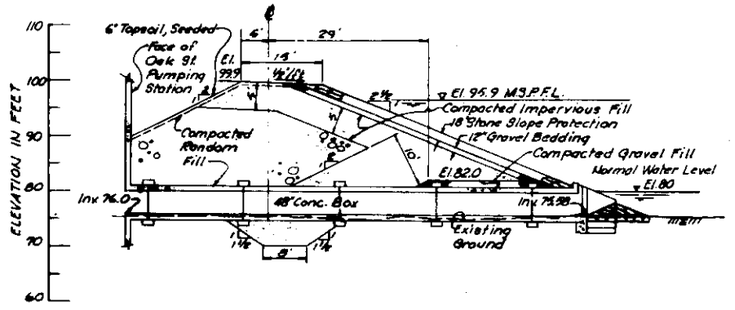
CORPS OF ENGINEERS — U.S. ARMY



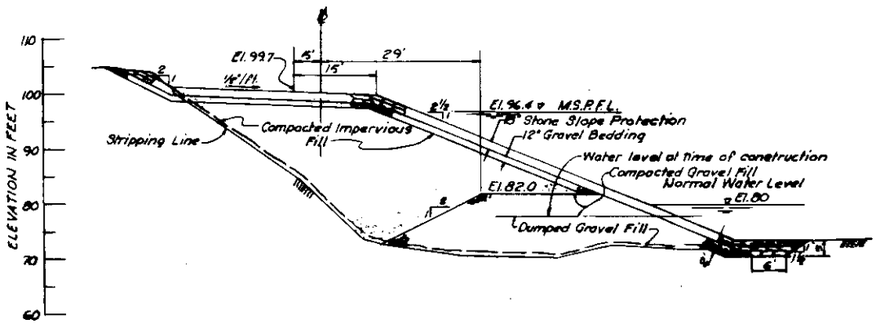
SECTION AT STA. 36+11
SCALE: 1"=10'



SECTION AT STA. 48+00
SCALE: 1"=10'



SECTION AT STA. 49+20
SCALE: 1"=10'



SECTION AT STA. 53+00
SCALE: 1"=10'

GRAPHIC SCALE
1"=10'
10' 0 10' 30'

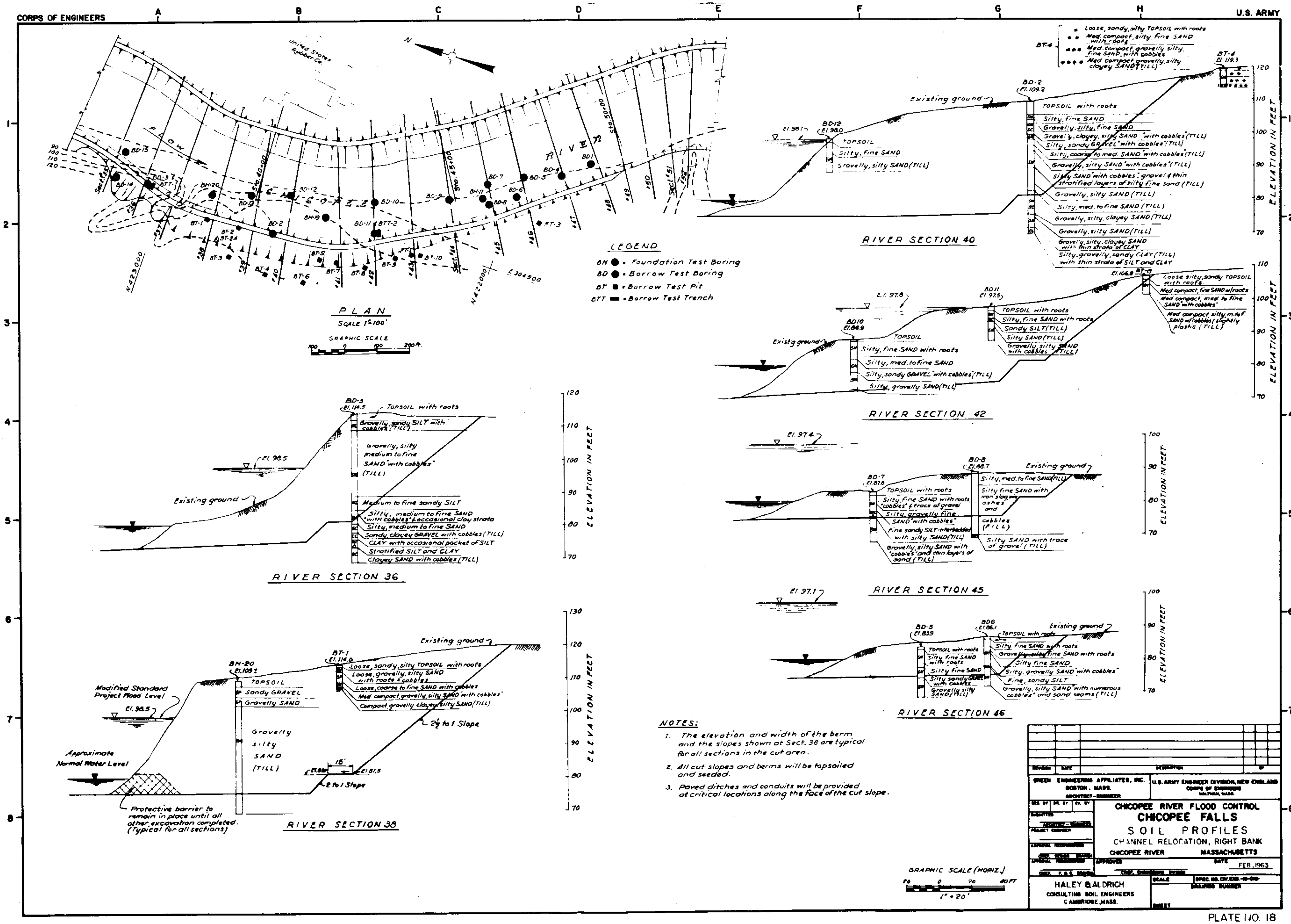
NUMBER	DATE	DESCRIPTION	BY

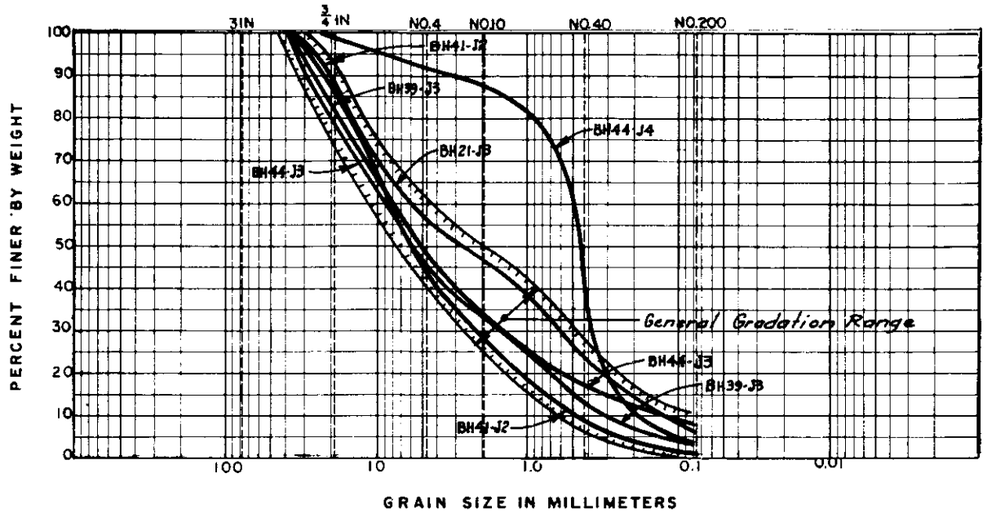
GREELEY ENGINEERING APPLIANCES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

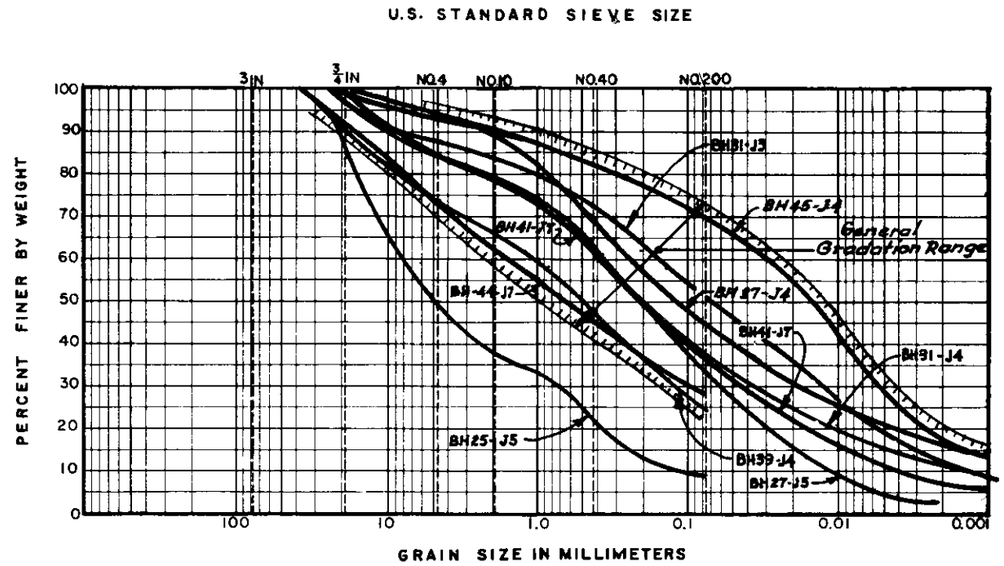
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
MISCELLANEOUS SECTIONS
CHICOPEE RIVER MASSACHUSETTS
DATE FEB. 1953

PLATE NO.17A

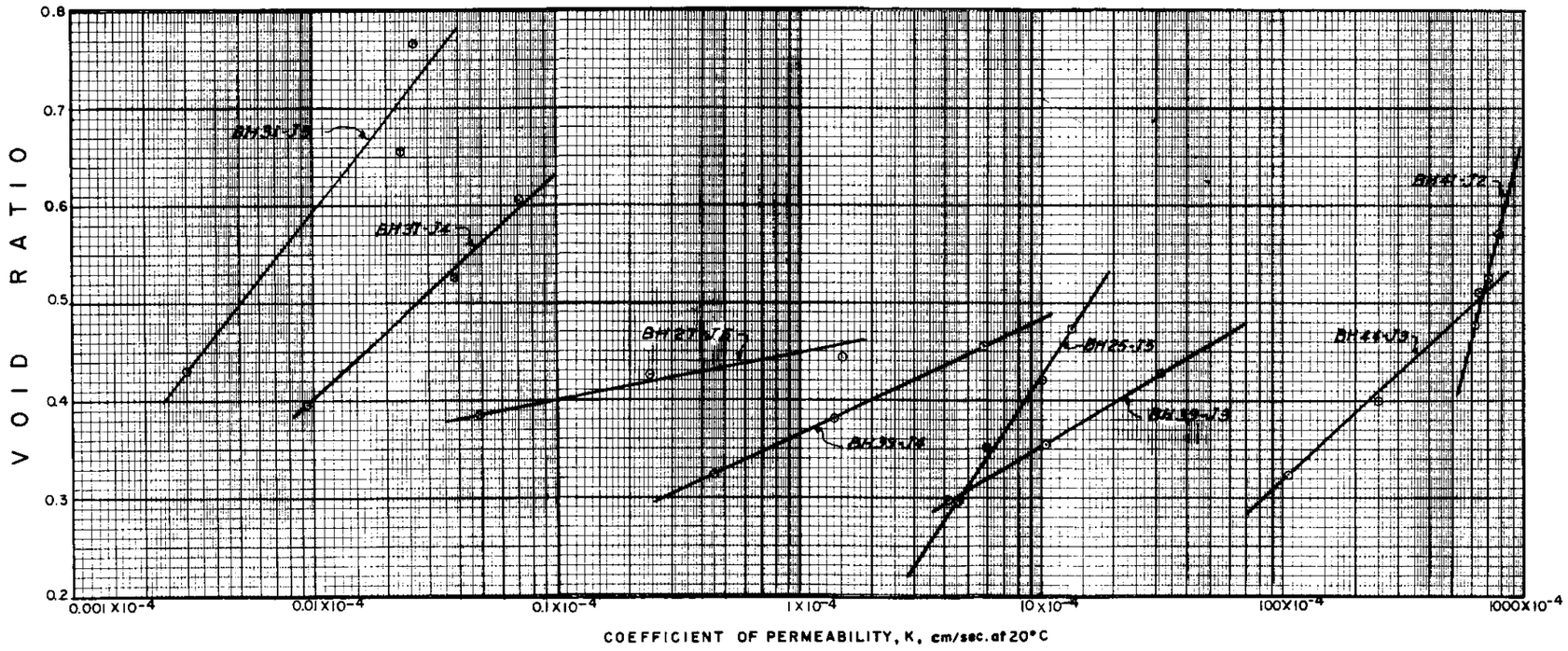

CORPS OF ENGINEERS
U.S. ARMY
PLAN
SCALE 1"=100'
GRAPHIC SCALE
LEGEND
BH ● Foundation Test Boring
BD ● Borrow Test Boring
BT ■ Borrow Test Pit
BTT ▬ Borrow Test Trench
United States Rubber Co.
FLOW
RIVER SECTION 40
RIVER SECTION 42
RIVER SECTION 36
RIVER SECTION 45
RIVER SECTION 38
RIVER SECTION 46
Existing ground
ELEVATION IN FEET
TOPSOIL with roots
Silty, fine SAND
Gravelly, silty SAND (TILL)
Modified Standard Project Flood Level
Approximate Normal Water Level
Protective barrier to remain in place until all other excavation completed. (Typical for all sections)
2½ to 1 Slope
2 to 1 Slope
NOTES:
1. The elevation and width of the berm and the slopes shown at Sect. 38 are typical for all sections in the cut area.
2. All cut slopes and berms will be topsoiled and seeded.
3. Paved ditches and conduits will be provided at critical locations along the face of the cut slope.
GRAPHIC SCALE (HORIZ.)
1" = 20'
GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
SOIL PROFILES
CHANNEL RELOCATION, RIGHT BANK
CHICOPEE RIVER
MASSACHUSETTS
FEB. 1963
HALEY & ALDRICH
CONSULTING SOIL ENGINEERS
CAMBRIDGE, MASS.



TYPICAL GRADATIONS - NATURAL GRANULAR SOIL



TYPICAL GRADATIONS - GLACIAL TILL



PERMEABILITY Vs. VOID RATIO

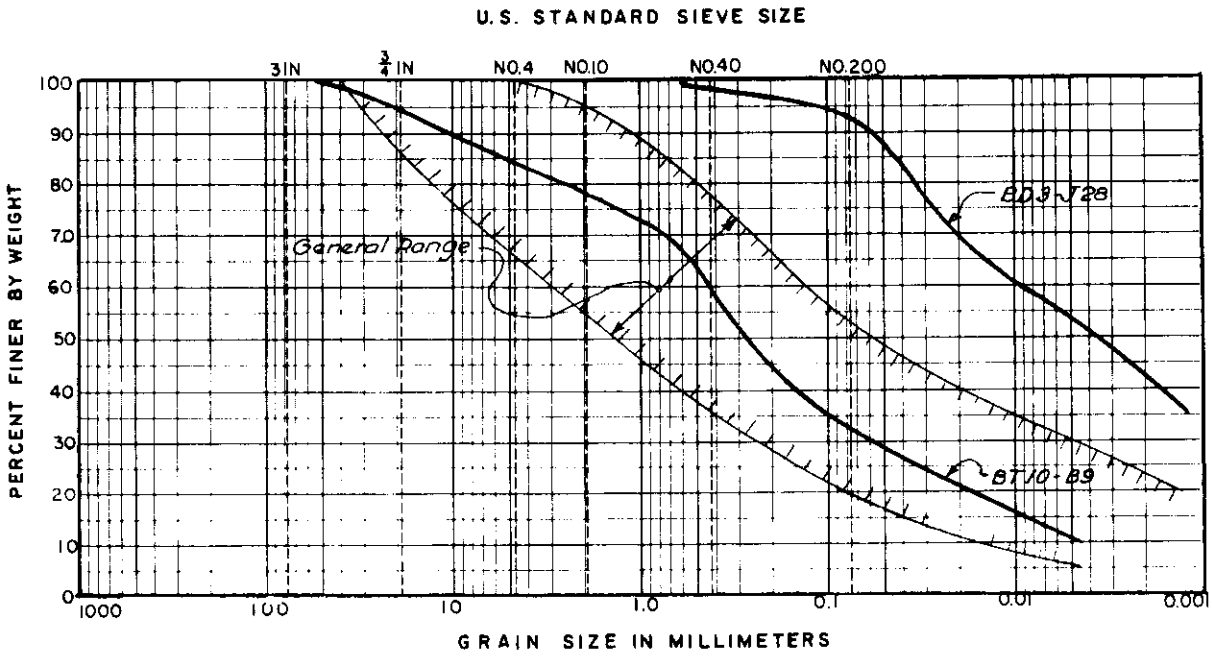
NOTES ON PERMEABILITY TESTS:

1. Samples BH41-J2, BH44-J3 and BH39-J3 are typical for the sandy gravels at the river bottom, downstream of Sta. 40.
2. Sample BH25-J5 is a loose silty, sandy gravel, immediately overlying the bedrock, Sta. 22.
3. The remaining samples are typical for the glacial tills below the dike foundations.

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS, MASS.

SELECTED LABORATORY TEST DATA FOUNDATIONS

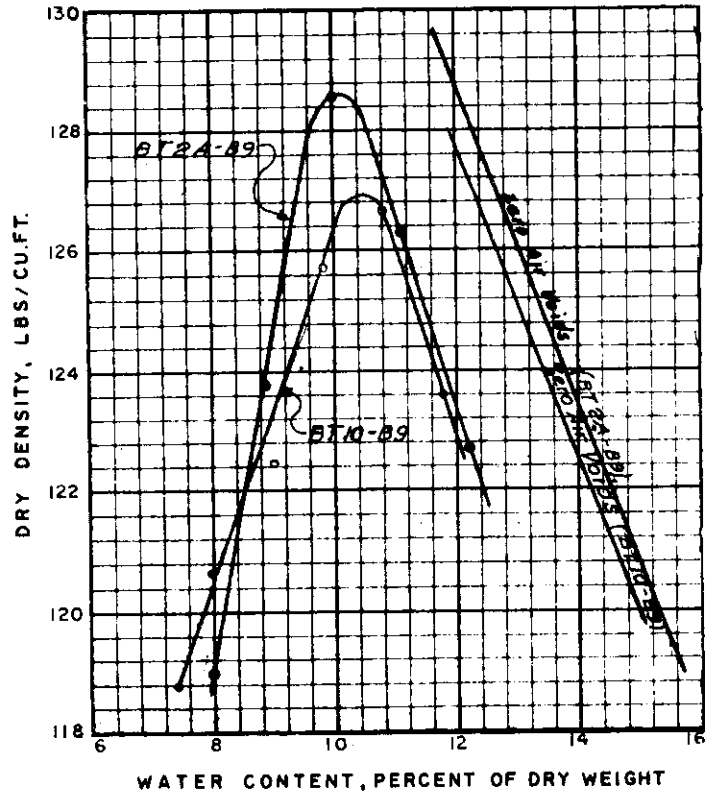
PLATE NO. 19



GRADATION RANGE

Test curves from the following samples of glacial till fall within the "General Range" of gradation :

Bor. No.	Sample No.	Depth (Ft.)
BH-19	J-4	5.0 - 10.0
BH-19	B-9	15.0 - 19.0
BH-20	B-6	7.5 - 10.0
BH-20	B-12	20.0 - 25.0
BD-2	J-4	5.4 - 10.0
BD-2	J-11	15.0 - 17.5
BD-2	J-19	25.0 - 27.0
BD-3	J-6	10.0 - 13.5
BD-3	J-10	15.0 - 18.0
BD-3	J-18	25.0 - 29.0
BD-3	J-22	30.0 - 32.0
BT-2A	B-9	4.0 - 4.4
BT-10	B-9	5.8 - 6.2



STANDARD AASHO COMPACTION TEST

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS, MASS.

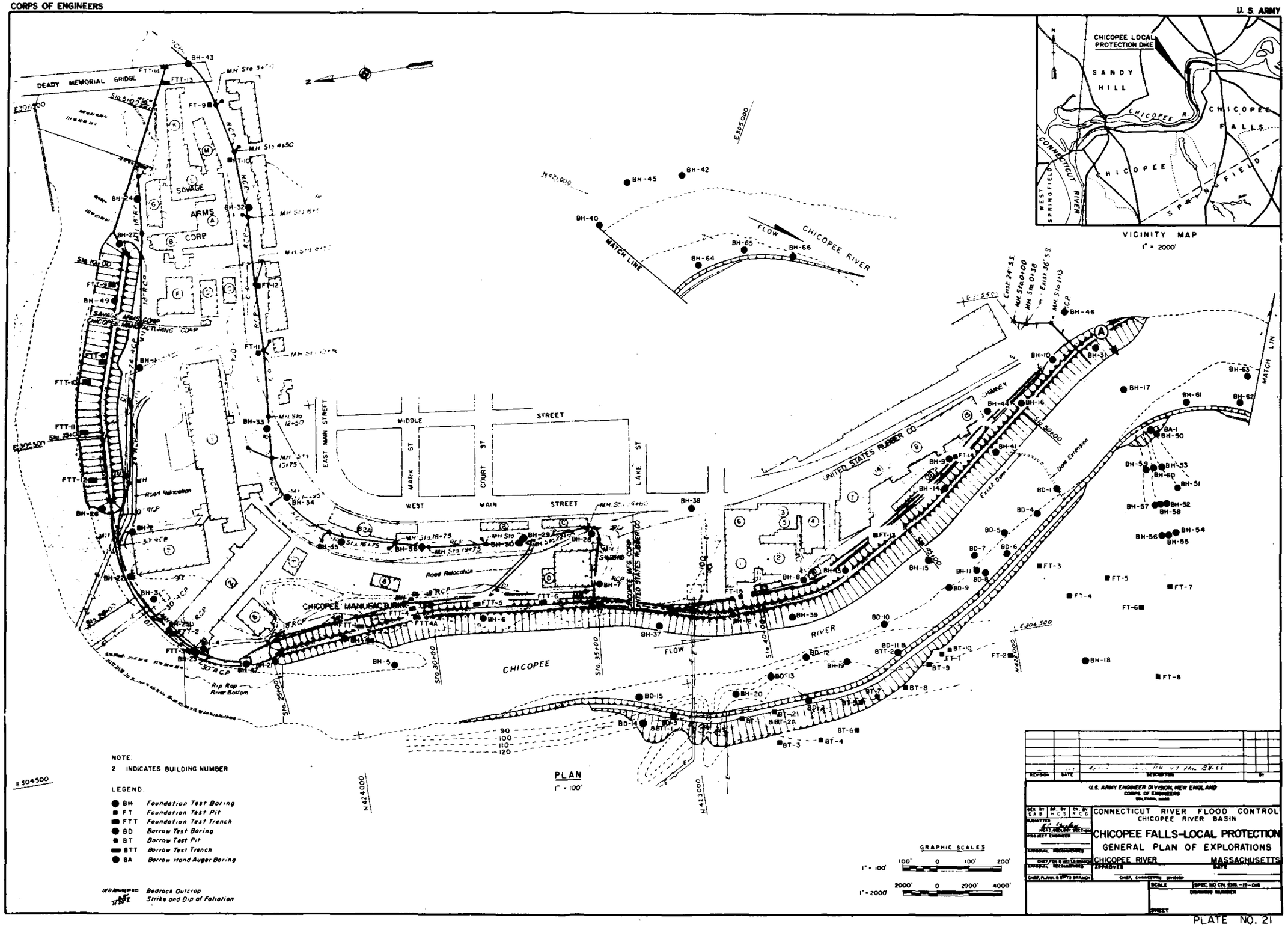
SELECTED LABORATORY TEST DATA

IMPERVIOUS DIKE FILL
(RIGHT BANK BORROW AREA)

PLATE NO. 20

CORPS OF ENGINEERS

U. S. ARMY



VICINITY MAP
1" = 2000'

NOTE:
2 INDICATES BUILDING NUMBER

LEGEND:

- BH Foundation Test Boring
- FT Foundation Test Pit
- FTT Foundation Test Trench
- BD Borrow Test Boring
- BT Borrow Test Pit
- BTT Borrow Test Trench
- BA Borrow Hand Auger Boring

Bedrock Outcrop
Strike and Dip of Foliation

PLAN
1" = 100'

GRAPHIC SCALES
1" = 100' 100' 0 100' 200'
1" = 2000' 2000' 0 2000' 4000'

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

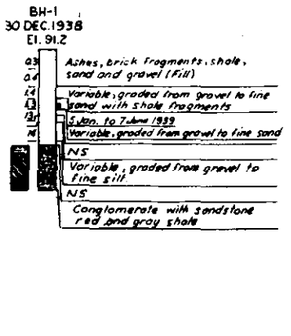
CONNECTICUT RIVER FLOOD CONTROL
CHICOPEE RIVER BASIN

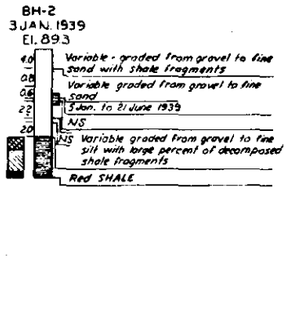
CHICOPEE FALLS-LOCAL PROTECTION
GENERAL PLAN OF EXPLORATIONS
CHICOPEE RIVER MASSACHUSETTS

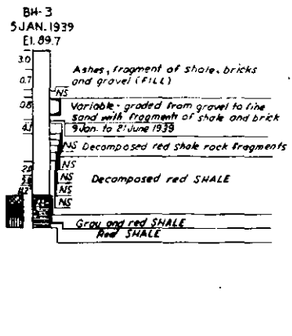
APPROVED DATE

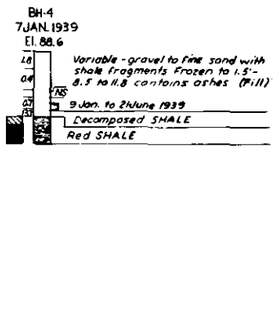
PLATE NO. 21

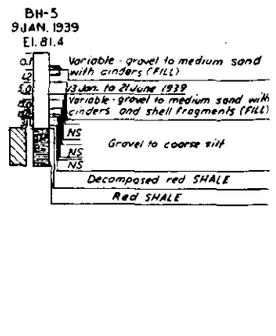
CORPS OF ENGINEERS — U.S. ARMY

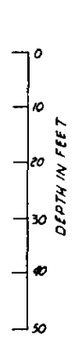


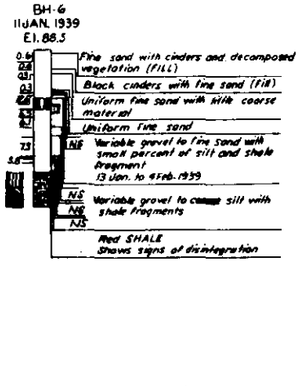


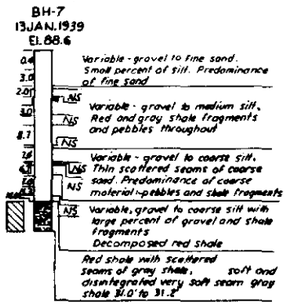


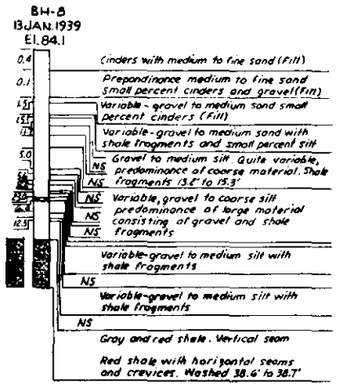


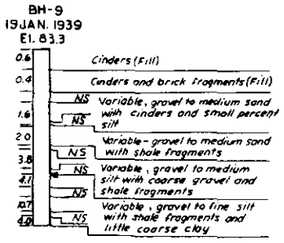


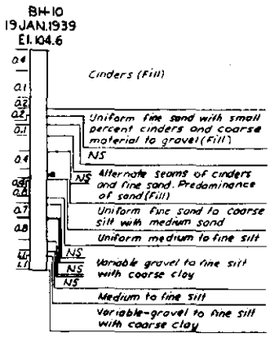


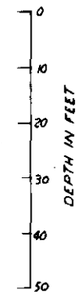












NOTES

For Graphic Logs appearing on this sheet Blow Count recorded as blows/inch using a 1⅜" or 1⅛" I.D. sample spoon. Weight of drop hammer and length of fall not given.

Soil and rock description based on field inspectors Log.

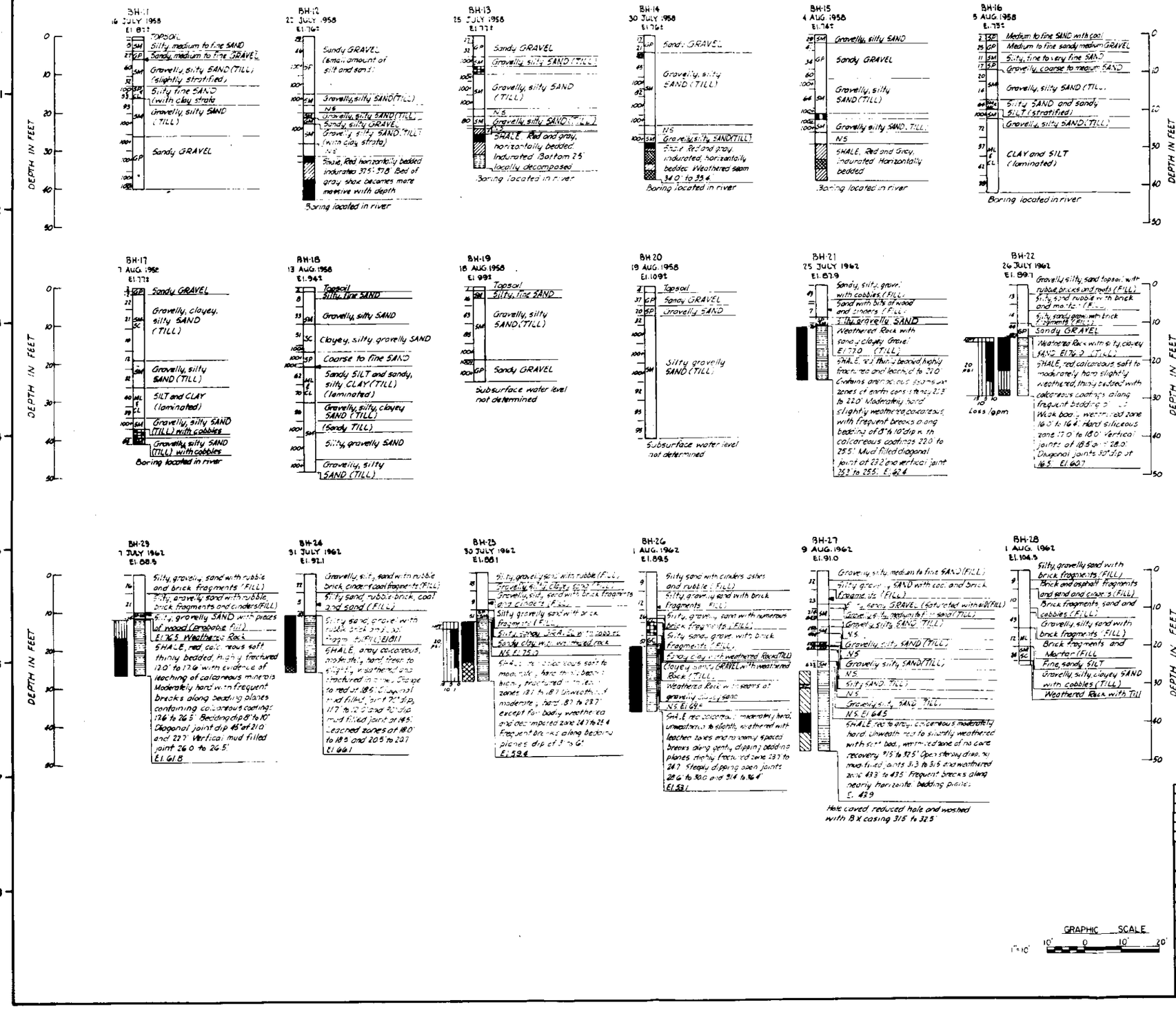
GRAPHIC SCALE
1" = 10'
10' 0 10' 20'

OWNER: CORPS OF ENGINEERS, U.S. ARMY
ENGINEER: EDWARD ENGINEERING ASSOCIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
E.V. | T.D. | M.D.W.

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
RECORD OF FOUNDATION EXPLORATIONS
CHICOPEE RIVER MASSACHUSETTS
DATE FEB. 1953

PLATE NO. 22

CORPS OF ENGINEERS — U.S. ARMY



REVISION	DATE	DESCRIPTION	BY

GREER ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES BY E.J. | DR BY T.D. | CH BY H.D.H.

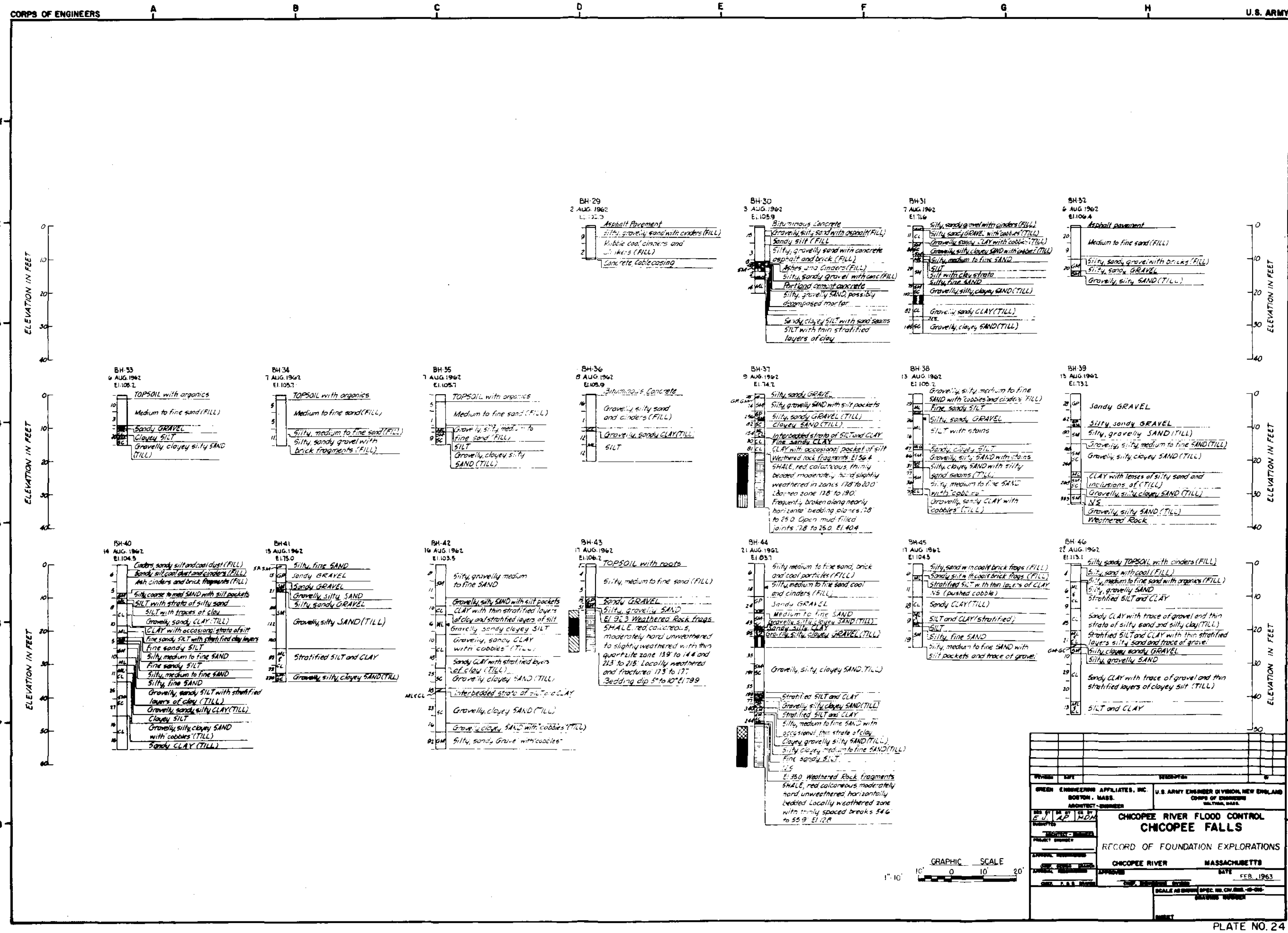
SUBMITTED — ENGINEER — PROJECT ENGINEER — APPROVAL RECOMMENDED — CHIEF, ENGINEERING DIVISION — APPROVED — CHIEF, P. & R. BRANCH

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
RECORD OF FOUNDATION EXPLORATIONS
CHICOPEE RIVER MASSACHUSETTS

APPROVED — DATE FEB., 1963

SCALE AS SHOWN | SPEC. NO. CIV. ERS-10-206 | DRAWING NUMBER | SHEET

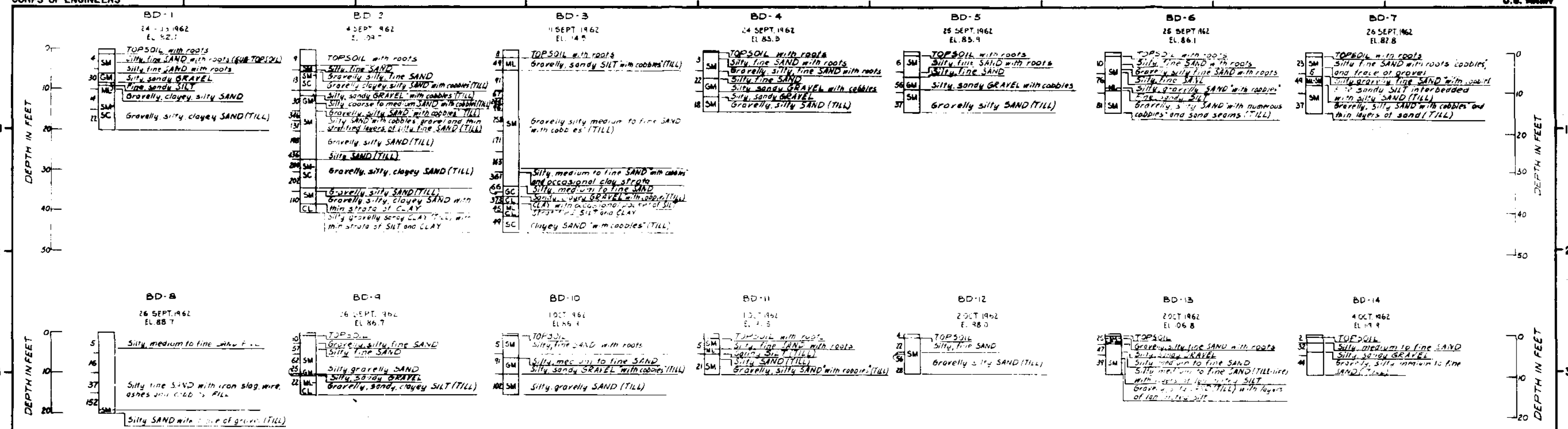
PLATE NO. 23

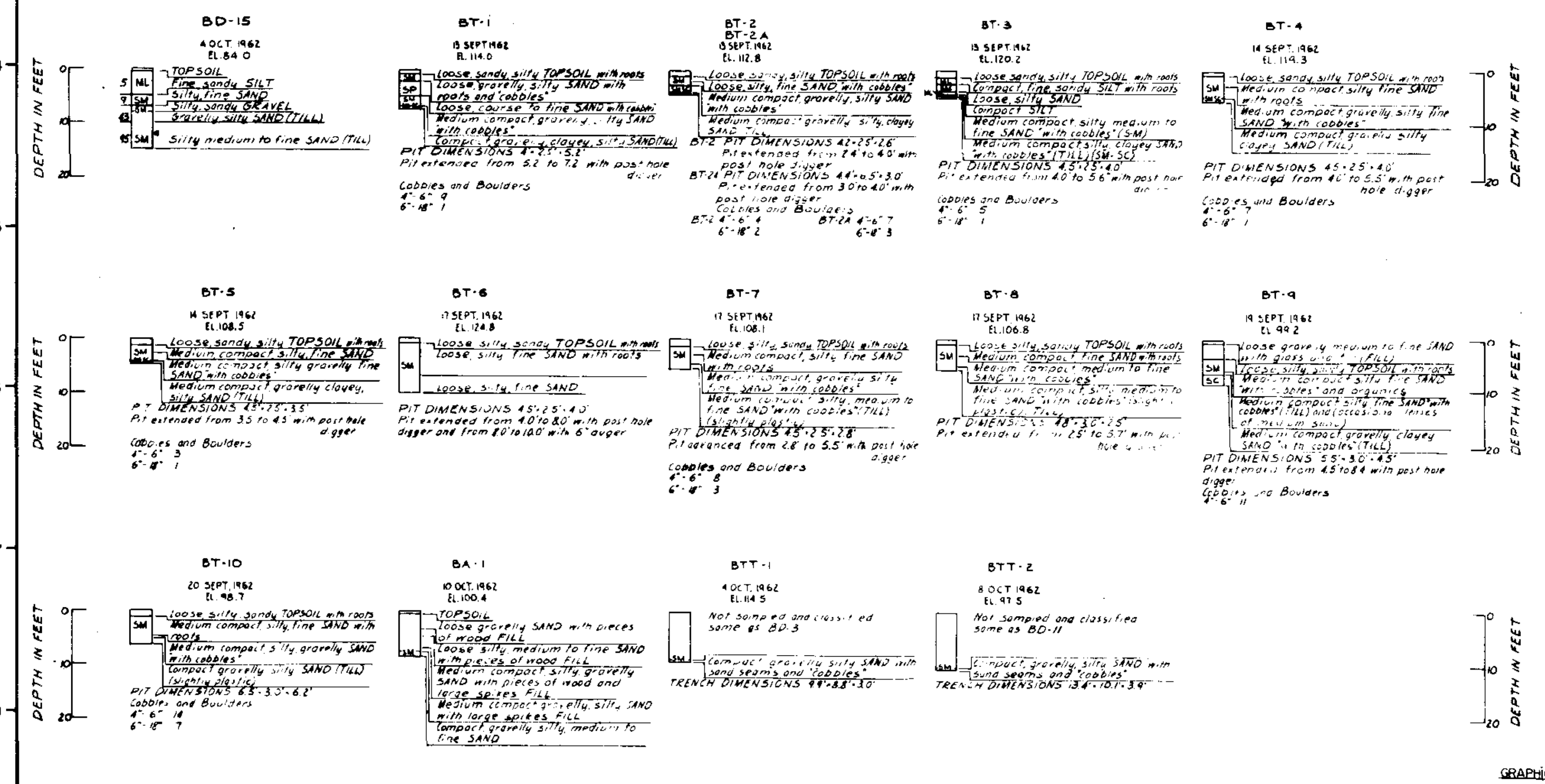


CORPS OF ENGINEERS
U.S. ARMY
ELEVATION IN FEET
BH-29
2 AUG. 1962
Asphalt Pavement
Silty, gravelly sand with cinders (FILL)
Rubble coal cinders and clinkers (FILL)
Concrete Cable casing
BH-30
3 AUG. 1962
El. 105.9
Bituminous Concrete
Gravelly, silty sand with asphalt (FILL)
Sandy silt (FILL)
Silty, gravelly sand with concrete asphalt and brick (FILL)
Ashes and Cinders (FILL)
Silty, sandy gravel with conc (FILL)
Portland cement concrete
Silty, gravelly SAND, possibly decomposed mortar
Sandy clayey SILT with sand seams
SILT with thin stratified layers of clay
BH-31
7 AUG. 1962
Silty, sandy gravel with cinders (FILL)
Gravelly, silty sandy CLAY with cobbles (TILL)
Silty, medium to fine SAND
SILT
Silt with clay strata
Silty fine SAND
Gravelly, silty, clayey SAND (TILL)
Gravelly, sandy CLAY (TILL)
Gravelly, clayey SAND (TILL)
BH-32
6 AUG. 1962
El. 106.4
Asphalt pavement
Medium to fine sand (FILL)
Silty, sandy gravel with bricks (FILL)
Silty, sandy GRAVEL
Gravelly, silty SAND (TILL)
BH-33
6 AUG. 1962
TOPSOIL with organics
Medium to fine sand (FILL)
Sandy GRAVEL
Clayey SILT
Gravelly clayey silty SAND (TILL)
BH-34
7 AUG. 1962
TOPSOIL with organics
Medium to fine sand (FILL)
Silty, medium to fine sand (FILL)
Silty, sandy gravel with brick fragments (FILL)
BH-35
7 AUG. 1962
TOPSOIL with organics
Medium to fine sand (FILL)
SILT
Gravelly, clayey silty SAND (TILL)
BH-36
8 AUG. 1962
Bituminous Concrete
Gravelly, silty sand and cinders (FILL)
Gravelly, sandy CLAY (TILL)
SILT
BH-37
9 AUG. 1962
Silty, sandy GRAVEL
Silty, gravelly SAND with silt pockets
Silty, sandy GRAVEL (TILL)
Clayey SAND (TILL)
Interbedded strata of SILT and CLAY
Fine sandy CLAY
CLAY with occasional pocket of silt
Weathered rock fragments
SHALE, red calcareous, thinly bedded, moderately hard, slightly weathered in zones
Frequently broken along nearly horizontal bedding planes
BH-38
13 AUG. 1962
Gravelly, silty medium to fine SAND with cobbles and cinders (FILL)
Fine sandy SILT
Silty, sandy GRAVEL
SILT with stains
Sandy, clayey SILT
Gravelly, silty SAND with stains
Silty, clayey SAND with silty sand seams (TILL)
Silty, medium to fine SAND
Gravelly, sandy CLAY with cobbles (TILL)
BH-39
13 AUG. 1962
Sandy GRAVEL
Silty sandy GRAVEL
Silty, gravelly SAND (TILL)
Gravelly, silty, medium to fine SAND (TILL)
Gravelly, silty, clayey SAND (TILL)
CLAY with lenses of silty sand and inclusions of (TILL)
Gravelly, silty, clayey SAND (TILL)
NS
Gravelly, silty SAND (TILL)
Weathered Rock
BH-40
14 AUG. 1962
El. 104.3
Cinders, sandy silt and coal dust (FILL)
Sandy silt coal dust and cinders (FILL)
Ash, cinders and brick fragments (FILL)
Silty, coarse to med SAND with silt pockets
SILT with strata of silty sand
SILT with traces of clay
Gravelly, sandy CLAY (TILL)
CLAY with occasional strata of silt
Fine sandy SILT
Silty, medium to fine SAND
Fine sandy SILT
Silty, medium to fine SAND
Silty, fine SAND
Gravelly, sandy SILT with stratified layers of clay (TILL)
Gravelly, sandy, silty CLAY (TILL)
Clayey SILT
Gravelly, silty clayey SAND with cobbles (TILL)
Sandy CLAY (TILL)
BH-41
15 AUG. 1962
Silty, fine SAND
Sandy GRAVEL
Sandy GRAVEL
Gravelly, silty SAND
Silty, sandy GRAVEL
Gravelly, silty SAND (TILL)
Stratified SILT and CLAY
Gravelly, silty, clayey SAND (TILL)
BH-42
16 AUG. 1962
Silty, gravelly medium to fine SAND
Gravelly, silty SAND with silt pockets
CLAY with thin stratified layers of clay and stratified layers of silt
Gravelly, sandy clayey SILT
Gravelly, sandy CLAY with cobbles (TILL)
Sandy CLAY with stratified layers of clay (TILL)
Gravelly clayey SAND (TILL)
Interbedded strata of silt and CLAY
Gravelly, clayey SAND (TILL)
Silty, sandy Gravel with cobbles
BH-43
17 AUG. 1962
TOPSOIL with roots
Silty, medium to fine sand (FILL)
Sandy GRAVEL
Silty, gravelly SAND
SHALE, red calcareous, moderately hard unweathered to slightly weathered with thin quartzite zone
BH-44
21 AUG. 1962
Silty medium to fine sand, brick and coal particles (FILL)
Silty, medium to fine sand coal and cinders (FILL)
Sandy GRAVEL
Medium to fine SAND
Gravelly, silty clayey SAND (TILL)
Gravelly, silty, clayey SAND (TILL)
Stratified SILT and CLAY
Gravelly silty clayey SAND (TILL)
Stratified SILT and CLAY
Silty, medium to fine SAND with occasional thin strata of clay
Clayey gravelly silty SAND (TILL)
Silty clayey medium to fine SAND (TILL)
Fine sandy SILT
NS
Weathered Rock fragments
SHALE, red calcareous moderately hard unweathered, horizontally bedded. Locally weathered zone with thinly spaced breaks
BH-45
17 AUG. 1962
Silty sand with coal brick frags (FILL)
Sandy silt with coal brick frags (FILL)
Stratified SILT with thin layers of CLAY
NS (pushed cobble)
Sandy CLAY (TILL)
SILT and CLAY (stratified)
SILT
Silty, fine SAND
Silty, medium to fine SAND with silt pockets and trace of gravel
BH-46
22 AUG. 1962
Silty sandy TOPSOIL with cinders (FILL)
Silty, sand with coal (FILL)
Silty, medium to fine sand with organics (FILL)
Silty, gravelly SAND
Stratified SILT and CLAY
Sandy CLAY with trace of gravel and thin strata of silty sand and silty clay (TILL)
Stratified SILT and CLAY with thin stratified layers silty sand and trace of gravel
Silty, clayey sandy GRAVEL
Silty, gravelly SAND
Sandy CLAY with trace of gravel and thin stratified layers of clayey silt (TILL)
SILT and CLAY
GRAPHIC SCALE
1" = 10'
GREEN ENGINEERING AFFILIATES, INC.
BOSTON, MASS.
ARCHITECT - ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS
RECORD OF FOUNDATION EXPLORATIONS
CHICOPEE RIVER
MASSACHUSETTS
FEB. 1963

PLATE NO. 24

CORPS OF ENGINEERS — U.S. ARMY





PROBING NO.	PENETRATION OF 3/4" PIPE WEIGHT OF 1 MAN	WEIGHT OF 2 MEN	DEPTH AND BLOWS/FT. USING 8 LB. HAMMER							
FP-1	0.0 - 1.0	1.0 - 1.0	1.0 - 6.0	30	14	9	16	46	—	—
FP-2	0.0 - 4.4	4.4 - 4.4	4.4 - 5.5	24/6	150/5	—	—	—	—	—
FP-3	0.0 - 3.7	—	3.7 - 4.5	22/3	120/5	—	—	—	—	—
FP-4	0.0 - 4.0	4.0 - 4.0	4.0 - 5.0	76	130/9	—	—	—	—	—
FP-5	0.0 - 4.1	4.1 - 4.1	4.1 - 5.0	130/9	—	—	—	—	—	—
FP-6	0.0 - 3.5	3.5 - 3.5	3.5 - 5.0	109/5	89	—	—	—	—	—
FP-7	0.0 - 3.0	3.0 - 3.0	3.0 - 3.6	140/6	—	—	—	—	—	—
FP-8	0.0 - 3.1	3.1 - 3.1	3.1 - 3.5	125/4	—	—	—	—	—	—
FP-9	0.0 - 2.8	2.8 - 2.8	2.8 - 3.5	100/2	150/5	—	—	—	—	—
FP-10	0.0 - 2.5	2.5 - 2.5	2.5 - 3.4	64/5	200/4	—	—	—	—	—
FP-11	0.0 - 2.8	2.8 - 2.8	2.8 - 3.4	90/2	150/4	—	—	—	—	—
FP-12	0.0 - 4.2	4.2 - 4.2	4.2 - 5.4	37/8	110/4	—	—	—	—	—
FP-13	0.0 - 4.3	4.3 - 4.3	4.3 - 5.2	69/7	100/2	—	—	—	—	—
FP-14	0.0 - 3.0	3.0 - 3.4	3.4 - 5.2	17/6	42	150/2	—	—	—	—
FP-15	0.0 - 4.0	4.0 - 4.0	4.0 - 5.4	51	100/4	—	—	—	—	—
FP-16	0.0 - 3.6	3.6 - 3.6	3.6 - 5.2	30/4	44	125/2	—	—	—	—
FP-17	0.0 - 2.5	2.5 - 2.5	2.5 - 3.6	46/5	180/6	—	—	—	—	—
FP-18	0.0 - 1.2	1.2 - 1.2	1.2 - 3.2	13/8	68	100/2	—	—	—	—
FP-19	0.0 - 3.0	3.0 - 3.0	3.0 - 5.0	24	94	—	—	—	—	—
FP-20	0.0 - 3.0	3.0 - 3.0	3.0 - 3.8	46/8	—	—	—	—	—	—
FP-21	0.0 - 1.5	1.5 - 1.5	1.5 - 2.6	49/5	110/6	—	—	—	—	—
FP-22	0.0 - 0.8	0.8 - 0.8	0.8 - 3.0	35/6	40	85	—	—	—	—

Fractional foot of penetration indicated as follows: Blows per foot / tenths of a foot 23/5

GRAPHIC SCALE 1"=10' 10' 0 10' 20'

GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

DES. BY E.J. DR. BY A.P. CK. BY H.O.H.

CHICOPEE RIVER FLOOD CONTROL
CHICOPEE FALLS

RECORD OF FOUNDATION EXPLORATIONS

CHICOPEE RIVER — MASSACHUSETTS

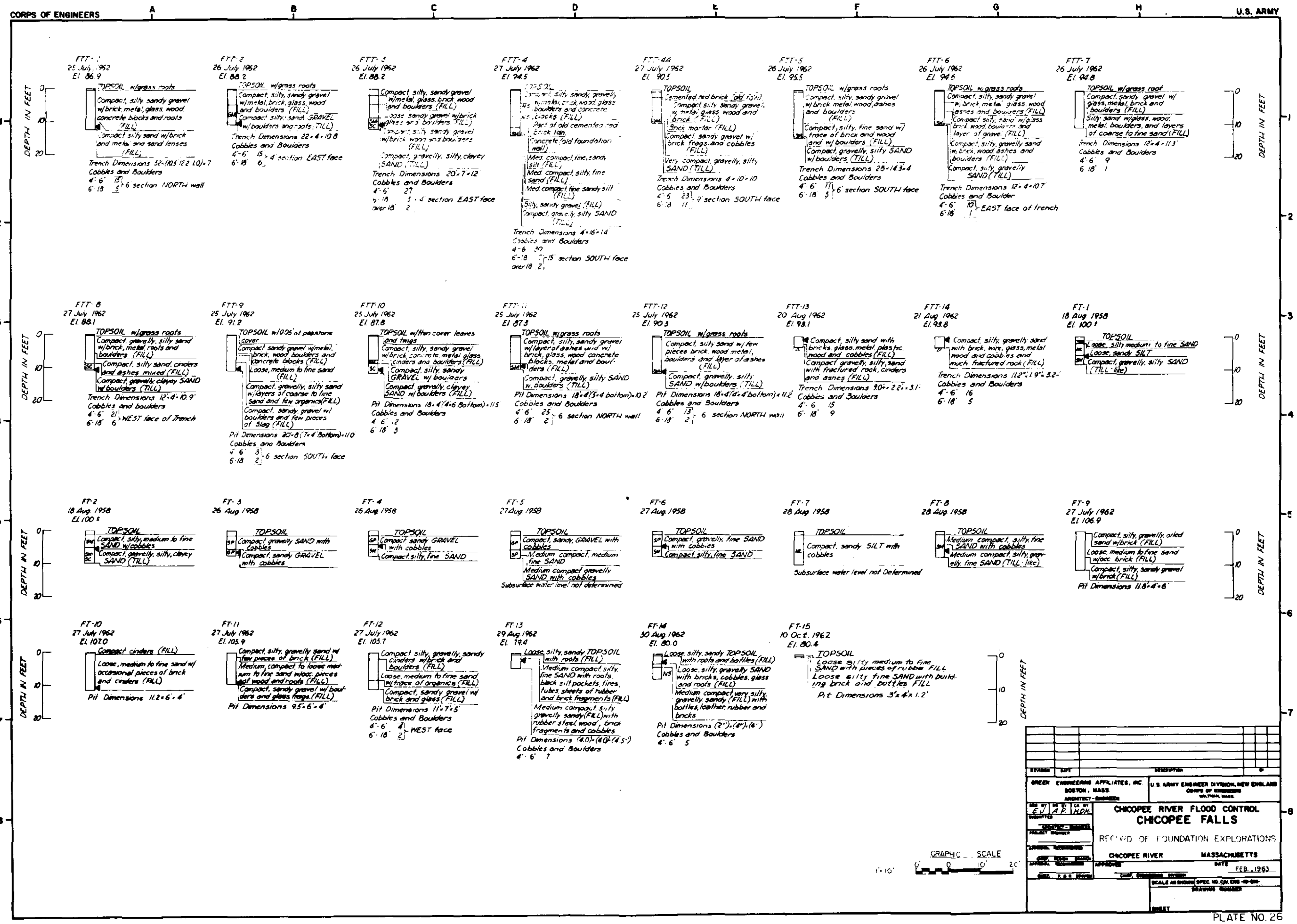
DATE FEB., 1963

SCALE AS SHOWN — SPEC. NO. CIV. ENG.-19-016-

DRAWING NUMBER

SHEET

PLATE NO. 25



CORPS OF ENGINEERS
U.S. ARMY
A B C D E F G H
DEPTH IN FEET
FTT-1 25 July 1962 El. 86.9
TOPSOIL w/grass roots
Compact, silty sandy gravel w/brick, metal, glass, wood, concrete blocks and roots (FILL)
Compact silty sand w/brick and metal and sand lenses (FILL)
Trench Dimensions 52×(10.5-12.2-1.0)×7
Cobbles and Boulders 4'-6' 15, 6'-18' 5, 6 section NORTH wall
FTT-2 26 July 1962 El. 88.2
TOPSOIL w/grass roots
Compact, silty, sandy gravel w/metal, brick, glass, wood and boulders (FILL)
Compact silty sand GRAVEL w/boulders and roots (TILL)
Trench Dimensions 22×4×10.8
Cobbles and Boulders 4'-6' 15, 6'-18' 6, 4 section EAST face
FTT-3 26 July 1962 El. 88.2
Compact, silty, sandy gravel w/metal, glass, brick, wood and boulders (FILL)
Loose sandy gravel w/brick glass and boulders (FILL)
Compact silty sandy gravel w/brick wood and boulders (FILL)
Compact, gravelly, silty, clayey SAND (TILL)
Trench Dimensions 20×7×12
Cobbles and Boulders 4'-6' 27, 6'-18' 5, over 18 2, 4 section EAST face
FTT-4 27 July 1962 El. 94.5
TOPSOIL
Compact silty, sandy, gravelly w/metal, brick, wood, glass, boulders and concrete blocks (FILL)
Part of old cemented red brick fdn.
Concrete (old foundation wall)
Med. compact, fine, sandy silt (FILL)
Med. compact, silty, fine sand (FILL)
Med. compact fine, sandy silt (FILL)
Silty, sandy gravel (FILL)
Compact, gravelly, silty SAND (TILL)
Trench Dimensions 4×16×14
Cobbles and Boulders 4'-6' 30, 6'-18' 7, over 18 2, 15' section SOUTH face
FTT-4A 27 July 1962 El. 90.5
TOPSOIL
Cemented red brick (old fdn)
Compact silty sandy gravel w/metal, glass, wood and brick (FILL)
Brick mortar (FILL)
Compact, sandy gravel w/brick frags. and cobbles (FILL)
Very compact, gravelly, silty SAND (TILL)
Trench Dimensions 4×10×10
Cobbles and Boulders 4'-6' 23, 6'-18' 11, 9 section SOUTH face
FTT-5 26 July 1962 El. 95.5
TOPSOIL w/grass roots
Compact, silty, sandy gravel w/brick, metal, wood, ashes and boulders (FILL)
Compact, silty, fine sand w/trace of brick and wood and w/boulders (FILL)
Compact, gravelly, silty SAND w/boulders (TILL)
Trench Dimensions 28×14.3×4
Cobbles and Boulders 4'-6' 11, 6'-18' 5, 6 section SOUTH face
FTT-6 26 July 1962 El. 94.6
TOPSOIL w/grass roots
Compact, silty, sandy gravel w/brick, metal, glass, wood, ashes and boulders (FILL)
Compact silty, sand w/glass, brick, wood, boulders and layer of gravel (FILL)
Compact, silty, gravelly sand w/brick, wood, ashes and boulders (FILL)
Compact, silty, gravelly SAND (TILL)
Trench Dimensions 12×4×10.7
Cobbles and Boulder 4'-6' 10, 6'-18' 1, EAST face of trench
FTT-7 26 July 1962 El. 94.8
TOPSOIL w/grass root
Compact, sandy gravel w/glass, metal, brick and boulders (FILL)
Silty sand w/glass, wood, metal, boulders, and layers of coarse to fine sand (FILL)
Trench Dimensions 12×4×11.3
Cobbles and Boulders 4'-6' 9, 6'-18' 1
FTT-8 27 July 1962 El. 88.1
TOPSOIL w/grass roots
Compact, gravelly, silty sand w/brick, metal, roots and boulders (FILL)
Compact, silty sand, cinders and ashes mixed (FILL)
Compact, gravelly, clayey SAND w/boulders (TILL)
Trench Dimensions 12×4×10.9
Cobbles and boulders 4'-6' 21, 6'-18' 6, WEST face of Trench
FTT-9 25 July 1962 El. 91.2
TOPSOIL w/0.05' of peastone cover
Compact sandy gravel w/metal, brick, wood, boulders and concrete blocks (FILL)
Loose, medium to fine sand (FILL)
Compact, gravelly, silty sand w/layers of coarse to fine sand and few organics (FILL)
Compact, sandy, gravel w/boulders and few pieces of slag (FILL)
Pit Dimensions 20×8(7×4 Bottom)×11.0
Cobbles and Boulders 4'-6' 8, 6'-18' 2, 6 section SOUTH face
FTT-10 25 July 1962 El. 87.8
TOPSOIL w/thin cover leaves and twigs
Compact, silty, sandy gravel w/brick, concrete, metal, glass, cinders and boulders (FILL)
Compact, silty, sandy GRAVEL w/boulders
Compact, gravelly, clayey SAND w/boulders (TILL)
Pit Dimensions 18×4(4×6 Bottom)×11.5
Cobbles and Boulders 4'-6' 2, 6'-18' 3
FTT-11 25 July 1962 El. 87.3
TOPSOIL w/grass roots
Compact, silty, sandy gravel w/layer of ashes and w/brick, glass, wood, concrete blocks, metal and boulders (FILL)
Compact, gravelly, silty SAND w/boulders (TILL)
Pit Dimensions (18×4(5×4 bottom)×10.2
Cobbles and Boulders 4'-6' 25, 6'-18' 2, 6 section NORTH wall
FTT-12 25 July 1962 El. 90.3
TOPSOIL w/grass roots
Compact, silty sand w/few pieces brick, wood, metal, boulders and layer of ashes (FILL)
Compact, gravelly, silty SAND w/boulders (TILL)
Pit Dimensions 16×4(4×4 bottom)×11.2
Cobbles and Boulders 4'-6' 13, 6'-18' 2, 6 section NORTH wall
FTT-13 20 Aug 1962 El. 93.1
Compact, silty sand with bricks, glass, metal, plastic, wood and cobbles (FILL)
Compact gravelly, silty sand with fractured rock, cinders and ashes (FILL)
Trench Dimensions 10.0×2.2×3.1
Cobbles and Boulders 4'-6' 15, 6'-18' 9
FTT-14 21 Aug 1962 El. 93.8
Compact, silty, gravelly sand with brick, wire, glass, metal, wood and cobbles and much fractured rock (FILL)
Trench Dimensions 11.2'×1.9'×3.2'
Cobbles and Boulders 4'-6' 16, 6'-18' 5
FT-1 18 Aug 1958 El. 100±
TOPSOIL
Loose, silty medium to fine SAND
Loose, sandy SILT
Compact, gravelly, silty SAND (TILL-like)
FT-2 18 Aug. 1958 El. 100±
TOPSOIL
Compact, silty, medium to fine SAND w/cobbles
Compact, gravelly, silty, clayey SAND (TILL)
FT-3 26 Aug 1958
TOPSOIL
Compact gravelly SAND with cobbles
Compact, sandy GRAVEL with cobbles
FT-4 26 Aug 1958
TOPSOIL
Compact sandy GRAVEL with cobbles
Compact, silty, fine SAND
FT-5 27 Aug 1958
TOPSOIL
Compact, sandy, GRAVEL with cobbles
Medium compact, medium fine SAND
Medium compact gravelly SAND with cobbles
Subsurface water level not determined
FT-6 27 Aug. 1958
TOPSOIL
Compact, gravelly, fine SAND with cobbles
Compact, silty, fine SAND
FT-7 28 Aug 1958
TOPSOIL
Compact, sandy SILT with cobbles
Subsurface water level not Determined
FT-8 28 Aug 1958
TOPSOIL
Medium compact, silty, fine SAND with cobbles
Medium compact, silty, gravelly, fine SAND (TILL like)
FT-9 27 July 1962 El. 106.9
Compact, silty, gravelly, oiled sand w/brick (FILL)
Loose, medium to fine sand w/occ. brick (FILL)
Compact, silty, sandy gravel w/brick (FILL)
Pit Dimensions 11.6×4×6
FT-10 27 July 1962 El. 107.0
Compact cinders (FILL)
Loose, medium to fine sand w/occasional pieces of brick and cinders (FILL)
Pit Dimensions 11.2×6×4
FT-11 27 July 1962 El. 105.9
Compact, silty, gravelly sand w/few pieces of brick (FILL)
Medium compact, to loose medium to fine sand w/occ. pieces of wood and roots (FILL)
Compact, sandy gravel w/boulders and glass frags. (FILL)
Pit Dimensions 9.5×6×4
FT-12 27 July 1962 El. 105.7
Compact, silty, gravelly, sandy cinders w/brick and boulders (FILL)
Loose, medium to fine sand w/trace of organics (FILL)
Compact, sandy gravel w/brick and glass (FILL)
Pit Dimensions 11×7×5
Cobbles and Boulders 4'-6' 4, 6'-18' 2, WEST face
FT-13 29 Aug 1962 El. 79.4
Loose, silty, sandy TOPSOIL with roots (FILL)
Medium compact silty fine SAND with roots, black silt pockets, tires, tubes, sheets of rubber and brick fragments (FILL)
Medium compact silty gravelly sandy (FILL) with rubber, steel, wood, brick fragments and cobbles
Pit Dimensions (4.0)×(4.0)×(4.5)
Cobbles and Boulders 4'-6' 7
FT-14 30 Aug 1962 El. 80.0
Loose silty, sandy TOPSOIL with roots and bottles (FILL)
Loose, silty, gravelly SAND with bricks, cobbles, glass and roots (FILL)
Medium compact, very silty, gravelly sandy (FILL) with bottles, leather, rubber and bricks
Pit Dimensions (2')×(4')×(4')
Cobbles and Boulders 4'-6' 5
FT-15 10 Oct. 1962 El. 80.4
TOPSOIL
Loose silty medium to fine SAND with pieces of rubber FILL
Loose silty fine SAND with building brick and bottles FILL
Pit Dimensions 5'×4'×1.2'
GRAPHIC SCALE
GREEN ENGINEERING AFFILIATES, INC. BOSTON, MASS. ARCHITECT-ENGINEER
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
CHICOPEE RIVER FLOOD CONTROL
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RECORD OF FOUNDATION EXPLORATIONS
CHICOPEE RIVER MASSACHUSETTS
FEB. 1963
PLATE NO. 26