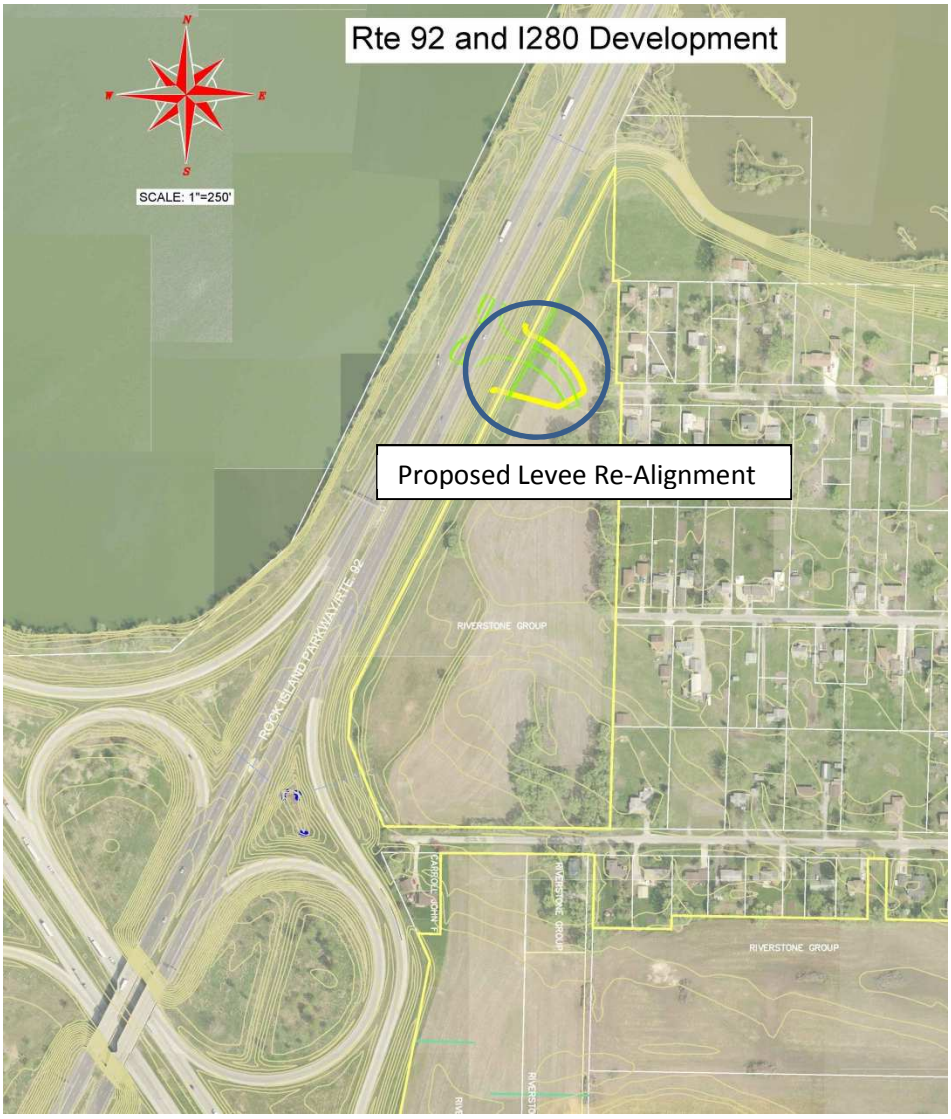
City of Rock Island Commercial Development
Milan/Big Island LFP modifications
Section 408 Permit - Project Summary Report
30% Draft – August 2012



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1. INTRODUCTION

1.1 Levee Project Description and History

The Milan-Big Island Flood Protection project is an urban flood damage reduction project which is federally authorized and non-federally operated and maintained. It is located between river miles 0.8 and 5.6 above the mouth of the Rock River into the Mississippi River. The project consists of stages IIA, IIIB, IIB/IIIA, IIIC and IIID along the left descending bank of the Rock River and the right descending bank of Mill Creek in Illinois and protects the Village of Milan, Big Island River Conservancy District, City of Rock Island, and portions of unincorporated Rock Island County. The project consists of 10.6 miles of levees, 1,120 feet of floodwall with appurtenant closures, ramps, and interior drainage facilities consisting of a number of gatewells, pump stations and ponding areas. The construction was completed in the mid 1980's.

The specific segment of levee where the levee re-alignment modification is proposed is within the Stage IIIC segment. This segment is referred to as the downstream tie-off levee. The semi-compacted impervious levee begins on Big Island along the Interstate 280 highway embankment which is used as a tie-off from flooding on the Rock and Mississippi Rivers. This 0.97 mile long levee follows along Interstate 280 to the intersection with Illinois 92, and then along the east side of Illinois 92 and then turns to the east. The levee reaches a maximum height of 13 feet and the top of the levee is at a maximum height of 5 feet above the highway pavement surface. The levee grade has 3 feet of freeboard above the design flood. There is a small ponding area (Ponding Area B-1) and Gatewell 30 (formerly A) which drains this ponding area. See Figure 1 of the project area.

The project was designed to provide protection to the Milan-Big Island area against concurrent 200-year flooding on the Mississippi River (422,000 cubic feet per second (cfs)) and 200-year flooding on the Rock River (89,700 cfs), 100-year flooding on Mill Creek (27,500 cfs), 200-year flooding on Kyte Creek (3,100 cfs), and 200-year flooding on Eckhart Creek (2,450 cfs).

The project was authorized by Public Law 90-483 approved 13 August 1968, substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 348, 90th Congress, 2nd Session. The United States Army Corps of Engineers (USACE) Rock Island District designed and constructed the authorized system. The project is operated and maintained by the Village of Milan and Big Island River Conservancy District. The levee system was certified by FEMA in October 2010.

1.2 Purpose and Need

The City of Rock Island plans to facilitate the development of 92 acres of undeveloped land for commercial and retail investment. The land is currently owned by RiverStone Group, Inc. and is located in the northeast quadrant of Interstate 280 and Illinois 92. The land is located within the Big Island River Conservancy District and is protected from flooding via the Milan-Big Island Flood Protection Project, specifically Stage IIIC levee. As part of the proposed development a modification to a portion of the Stage IIIC Levee project is required to accommodate a new city street off of Illinois 92 into the proposed development. Access off Illinois 92 keeps the adjacent residential community isolated from the proposed development which is a concern of the Big Island community. It also provides access into the development from a major thoroughfare serving multiple communities making it accessible to the general population area. In addition, an improved levee access road and temporary pump pad is also proposed at the existing Ponding Area B-1 and Gatewell 30 (A) for drainage. As such, a Section 408 permit is required for the proposed modifications to the existing Federal project. Title 33 Code of Federal Regulations (CFR) Section 408 authorizes the Secretary of the Army to permit alterations/modifications to existing Corps projects including degradations, raisings, and realignments. This report documents the technical analyses and provides the environmental documents required for approval.

The City of Rock Island retained the services of HNTB to perform the necessary engineering and environmental assessment for the proposed modifications and prepare the necessary compliance documentation.

1.3 Proposed Project Modification

The proposed modification consists of removing approximately 300 feet of existing levee and constructing approximately 600 feet of realigned levee along the east side of Illinois 92 just north of the I-280/IL 92 interchange. This will occur between approximate existing levee stations 301+50N to 305+00N. The realigned levee is to accommodate a proposed city street from off of the east side of Illinois 92 into the site development area. This access road will cross the existing levee project. In order to meet IDOT roadway vertical profile and horizontal alignment design requirements, the current levee needs to be degraded in the location of the access road and the levee routed to the east and across the city street alignment and back to the west to tie back into the existing levee. See Figure 1 for an overview of proposed project.

The proposed levee section will be similar to the existing design and will be approximately 10 feet high with a 10 foot crest width and 3H:1V side slopes and a small inspection trench on the

landward toe. It will consist of semi-compacted impervious material. In addition to the levee re-alignment, a storm water analysis was completed to accommodate changes in land use and associated interior drainage system at this location, specifically Ponding Area B-1 and Gatewell 30 (formerly A).

In order to meet IDOT requirements, the proposed project also includes a realignment of Ramp F which is the ramp from west bound I-280 to northbound Illinois 92. The realignment of ramp F does not impact the local flood protection project. A copy of the detailed design drawings are included in Appendix B.

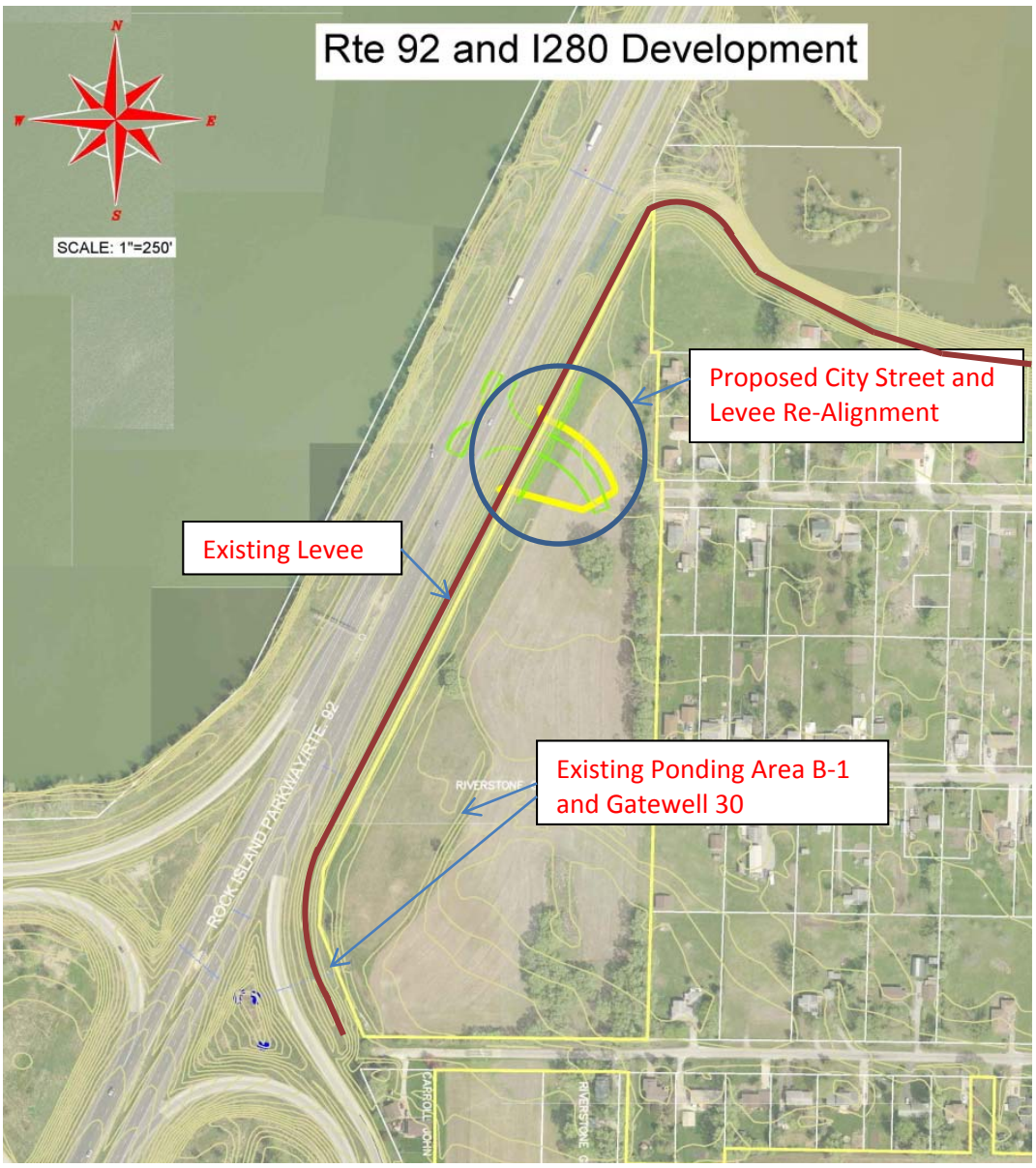

Figure 1 – Proposed Levee Re-alignment

1.4 Non-Federal Request for Modification Authorization

Permission is requested to alter the Milan/Big Island Local Flood Protection Project Stage III C, approximate Station 301+50 to Station 305+00 portion of the Federal project levee system. This Project Summary Report has been prepared and submitted in accordance within the requirements of 33 USC 408. This report and technical appendices demonstrate the proposed modification measures for the Milan/Big Island Local Flood Protection Project are not injurious to the public interest and will not impair the levees' usefulness as required by Section 408.

The Village of Milan and the Big Island River Conservancy District, for the City of Rock Island, are requesting the USACE review this Section 408 Application in accordance with Section 14 of the Rivers and Harbors Act of 1899 as amended (33 USC 408) under the authority of the Chief of Engineers as described in CECW-PB's guidance dated October 23, 2006 and November 17, 2008.

A copy of the written request by the _____ for Section 408 approval is included in Appendix A.

2. TECHNICAL ANALYSIS

The following sections document the technical analysis for the proposed levee modification to show that it will not adversely affect the function of the existing Federal project. The information and data from the following documents were utilized as applicable:

- *US Army Corp of Engineers, Rock Island District. Milan, Illinois, Phase 1 General design memorandum (Phase 1 GDM) for Flood Protection, Flood Protection, dated 31 January 1975.*
- *US Army Corp of Engineers, Rock Island District. Local Flood Protection, Rock River, Milan, Illinois, Phase II General Design Memorandum (Phase II GDM), Volume 1 of 2 dated July 1977 and revised April 1978.*
- *US Army Corp of Engineers, Rock Island District. Local Flood Protection, Rock River, Milan, Illinois, Phase II General Design Memorandum (Phase II GDM), Volume 2 of 2 Appendices dated July 1977 and revised April 1978.*
- *US Army Corp of Engineers, Rock Island District. Local Flood Protection, Rock River, Milan, Illinois, Phase II General Design Memorandum Supplement No. 1 Interior Drainage Facilities (Phase II GDM Supp. 1 Interior Drainage Facilities), dated February 1982.*
- *Rock River, Milan, Illinois, Local Flood Protection, Stage III-C As-Built Drawings, August 26, 1986*
- *US Army Corps of Engineers, Rock Island District. Local Flood Protection, Rock River, Milan, Illinois, Manual for Operation and Maintenance, dated October 1989*
- *Upper Mississippi River System Flow Frequency Study (UMRSFFS), Upper Mississippi River System Flow Frequency Task Force, January 2004*
- *Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS), Rock Island County, Illinois and Incorporated Areas*, 5 April 2010

The analyses completed in the above referenced documents for the original project were evaluated to determine if the existing project meets current USACE criteria. It is assumed that if the existing levee design meets current criteria, then no new analyses will be required for the proposed modification as long as it follows the same design as the original levee. However, updated analyses will be performed where original analyses are not applicable, do not meet current standards, or other analyses are required as part of the design. This evaluation includes geotechnical, and hydrology and hydraulics. There are no structural features and therefore there is no structural analysis.

2.1 Geotechnical Evaluation

This section provides a summary of the geotechnical analysis performed on the applicable proposed modified levee section as applicable. The levee is designed to match the existing levee

in terms of slopes, crest width and materials. A review of the existing levee design was evaluated to see if it meets current design criteria for slope stability, seepage, and settlement. New borings were also obtained for evaluation of seepage as part of the overall storm water analysis for the proposed development. One boring was taken in the vicinity of the proposed relocated levee and one near Gatewell 30 (A). These new borings, as well as the original borings from the *1978 Phase II GDM*, will be utilized for any additional analysis. Refer to Appendix C-1, Geotechnical Analyses, for the supporting geotechnical documentation.

2.1.1 Foundation

Per the *1978 Phase II GDM*, the project area is in part of the flood plain of the Rock River near its mouth. The soils in the project area are mainly alluvium underlain by thick sand and gravelly sand strata over bedrock. The bedrock ranges from 10 feet to 50 feet deep. For this project modification area, the bedrock is closer to 50 feet deep. The area has been heavily quarried for these materials at nearby locations which have subsequently filled with water. These water-filled former quarries along with the sandy subsurface soils have resulted in significant seepage through the foundation of portions of the levee system including Stage IIIC. Historically, the Milan-Big Island levee system has performed well. Considering the seepage, no issues or sand boil activity have been observed or reported over the life of the system. Recent Corps of Engineers inspection reports (2002 through 2008) have not indicated any deficiencies as a result of foundation seepage.

Original borings in the proposed modification area were hand augered approximately 10 feet deep. Others were drilled to bedrock. The closest drilled boring to the proposed modification area was approximately 3,000 feet away, near station 273+00. The hand augered borings, A-31 and A-32 from the *1978 Phase II GDM* are near the proposed levee modification. These borings indicate mostly sandy soils with some clay/clayey sands on top. Supplemental borings have subsequently been obtained in June 2012. One was taken near Gatewell 30 (A) and one was taken very near the proposed re-aligned levee. The borings were taken to a depth of 25 feet. These borings also indicate all sandy soils the entire depth. Water was encountered at approximately seven feet deep. Original and new boring locations and boring log information are included in Appendix C-1.

2.1.2 Stability

The original 1980's engineered levees were generally constructed on 3H:1V side slopes and 10 foot crown width and either consisted of partial semi-compacted random fill and impervious fill or all semi-compacted impervious fill. According to the as-built plans dated August 1986, the existing levee in the location of the proposed modification was constructed partially of semi-

compacted random and partially of semi-compacted impervious fill. The geometry of this levee system conforms to current design criteria using *EM 1110-2-1913, Design and Construction of Levees*, dated April 2000. For the proposed levee, the geometry will be the same but it will consist entirely of semi-compacted impervious fill.

Slope Stability analysis for the original design consisted of circular arc analysis in accordance with *EM 1110-2-1902 Slope Stability*, dated April 1970. Studies were completed to ensure a minimum factor of safety of 1.3 was satisfied. The stability analysis was performed on two sections that were considered most critical with respect to riverside slope stability. These sections were analyzed because of their embankment height and/or the thickness of the clay foundation. The sections utilized were Station 26+00M to represent stations 6+50K to 33+50M, and station 28l+00N, representing 278+50N to 286+00N. No undisturbed shear strength was available in the project area and shear strengths were based on data from other projects designed by the USACE Rock Island District. Data from other projects was utilized to make a correlation between undrained shear strength and water content. A generalized trend between cohesion and water content was determined. Curves were drawn through the averaged data and then this relationship was used to estimate the strength of the foundation soils. The analysis was completed for the end of construction condition. It should be noted that the original sections analyzed were only those representing the levee along the river bank and do not represent the area of the proposed levee re-alignment. No additional slope stability analyses were performed for other reaches.

Per the Phase II GDM, no slope stability analyses were performed with seepage for the long-term and rapid drawdown conditions for the original levees. Current slope stability and levee slope design criteria can be found in *EM 1110-2-1913, Design and Construction of Levees*, dated April 2000. Table 6-1b of EM 1110-2-1913 provides minimum required factors of safety for the existing levee. The minimum required factors of safety for the long-term (steady seepage) condition, end-of-construction case, and rapid drawdown case are 1.4, 1.3, and 1.0 to 1.2, respectively. In order to confirm that the proposed levee meets current slope stability design criteria and to evaluate risk to the levee system, slope stability analyses in conjunction with seepage analyses (as discussed above) will be performed based on the foundation conditions from the recent borings. The original design results are included in Appendix C-1.

2.1.3 Under Seepage

Seepage in the levee segment where the modification to the levee is proposed has underseepage due to the sandy soils and the water filled sand quarry on the west side of IL Rte. 92. Per the *Phase II GDM Volume 2, Appendices*, dated April 1978, underseepage control measures were

based on a combination of thickness and characteristics of the impervious and pervious sub stratums. An underseepage and berm analysis was performed following the criteria in "*Relief Well Design, Civil Works Bulletin 55-11*, dated 28 June 1955 and *USACE Waterways Experiment Station publication Technical Memorandum 3-424 "Investigation of Underseepage and its Control, Lower Mississippi River Levees"* dated October 1956. A *"Report on Conference on Underseepage for Agricultural Levees*," NCRGT letter to OCE, Rock Island District, dated 11 October 1960 and "*Tentative Criteria for Use of Underseepage Control Measures on Agricultural Levees," Office, Chief of Engineers*, dated 3 June 1958, established empirical limitations on such items as maximum length of berms and permeability ratios. A further modification of this criteria resulted from the "*Minutes of Geotechnical Conference"* held at RID on 29-30 April 1976. This methodology of the underseepage berm analysis is the result of continuing documentation of performance of existing levees during high water in 1965 through 1975 from Dubuque, Iowa, to Hamburg, Illinois, by Rock Island District USACE personnel. This documentation includes periods when the river rose to the top of the existing levees while the levee performed satisfactorily with respect to underseepage and through seepage. Methodology was further established in *Supplement No. 1 to Design Memorandum No. 1 for Fulton, Illinois Local Flood Protection Project*, Draft Dec 76. Berms were recommended for areas where factor of safety (FS) is less than one.

The original underseepage/berm analysis for reach 297+00N to 319+00N is included in Appendix C-1. The analysis concluded that a seepage berm was required from Station 297+00N to 300+00N which is at the corner of the levee where it turns to the east away from IL Rte. 92. This was to protect against three dimensional seepage at this location. The berm design consisted of a 3-foot thick and 45-foot wide sand berm to control underseepage for a head of 12 feet. Per the design analysis, the rest of the levee segment (where modification is proposed) to Station 319+00N did not require a seepage berm because the base width of the levee appeared to be greater than 10xH (Total Head). However, E*TL 1110-2-569, Design Guidance for Levee Underseepage*, dated May 2005, recommends that the allowable factor of safety for use in evaluations and/or design of seepage control measures should correspond to an exit gradient at the toe of the levee of i=0.5. In general, this would provide a factor of safety of about 1.6. Landside drainage ditches (along the toe of the levee), seepage berms, and relief wells should all be designed to the same exit gradient of 0.5, but should also incorporate *Appendix C-3b of EM 1110-2-1913*. In order for the proposed levee design to meet current criteria, seepage analysis will be performed per design criteria listed above.

The total underseepage was also calculated to determine amount of water coming under the levee that needed to be addressed along with the amount of surface runoff. This is discussed in the

Interior Drainage/Storm Water Design section as part of the Hydrology/Hydraulics Section. The detailed underseepage analysis is included in Appendix C-3.

2.1.4 Erosion Control

The impervious levees will be covered with topsoil and then seeded. Topsoil from stripping operations will be utilized if it meets the material requirements. Riprap erosion protection may be required within the ditch between the levee and access road embankments. This will be determined during the detailed design. Temporary erosion control measures will be implemented during construction as part of the Storm Water Pollution Prevention Plan to meet NPDES Phase II permit requirements. These will be designed during detailed design and will generally consist of silt fence, culvert inlet protection, erosion control blankets, potential check dams etc.

2.1.5 Materials Usage/Handling

Compacted impervious fill will be utilized for the re-aligned levee segment. Material requirements will follow USACE specifications for impervious embankments. The material will be obtained from the existing levee as applicable and then the Contractor will be required to obtain the rest from the Contractor furnished borrow source. The foundation of the re-aligned levee will be stripped of vegetation and other unsatisfactory material. Topsoil will be stripped and stockpiled as applicable for use on top of proposed levee embankment. An inspection trench will be excavated to 6 feet deep or to the water table or rock if shallower (not expected in this area). The inspection trench will be filled with compacted impervious material. Unsatisfactory materials will be disposed of in accordance with all federal, state and local requirements. A stabilized construction entrance will be required as part of the Storm Water Pollution Prevention Plan to meet NPDES Phase II permit requirements.

2.2 Structural

There are no structural components associated with the proposed modification.

2.3 Levee Penetrations

There are no levee penetrations associated with the proposed modification.

2.4 Hydrology &Hydraulics

The original hydrology and hydraulic design of the levee system is discussed in the *1978 Phase II GDM Appendix A, Hydrology and Hydraulics*. However it should be noted that the frequency

of flooding on this reach of the Mississippi River was re-evaluated as part of the *2004 Upper Mississippi River Flow Frequency Study*.

2.4.1 Flows and Water Surface Profiles

The proposed levee re-alignment is of very short length compared to the thousands of feet of levee in the existing project. The proposed modification consists of degrading approximately 300 feet of existing levee and constructing new levee landward for a total length of approximately 600 feet. The new levee will be constructed to the same elevation as the design of the original levee. This small levee modification will have no impact on the hydraulics of the system. There will be no changes in water surface elevations, flows or any impacts downstream. However, the design elevation of the new levee must meet current hydraulic design criteria. Therefore, the existing levee system was evaluated against the latest flows and elevations for the level of protection for which it was originally designed.

The original hydraulic analysis per the *1978 Phase II GDM* indicates that the levee was based on the design flood of a 0.5 percent chance of exceedance or 200-year frequency flood occurring on the Rock River (89,700 cfs) coincident with the backwater from a 0.5 percent chance exceedance or 200-year frequency flood on the Mississippi River (422,000 cfs). The levees were designed to the corresponding flood elevations with three feet of free board. From the as-built drawings, at the location of the proposed modification, the design flood elevation is 568.2 feet MSL 1912 and the existing levee elevation was designed to 571.2 feet MSL 1912. These elevations correspond to 567.51 feet and 570.51 feet NAVD88 respectively. Original flood profiles are included in Appendix C-2.

Subsequent to the original hydraulic design of the levee system, in January 2004 the USACE published the *Upper Mississippi River System Flow Frequency Study* (UMRSFFS) that updated discharge-frequency relationships and water surface elevations for over 1,900 miles of the Upper Mississippi, Lower Missouri, and Illinois Rivers. The UMRSFFS was developed by five Corps of Engineer Districts (St. Paul, Rock Island, Omaha, Kansas City, and St. Louis) and coordinated through representatives from seven federal agencies and seven states. The study addresses flooding of the Illinois River from Lockport to the mouth, the Missouri River below the Gavins Point Dam to the mouth, and the Mississippi River from St. Paul to the confluence with the Ohio River. The St. Louis District conducted the study of the Mississippi River from the confluence with the Ohio to Lock and Dam 22 tailwater (river mile 301.2) and the Illinois River from the confluence with the Mississippi River to the La Grange Lock and Dam tailwater (river mile 80.2). The Rock Island District conducted the study of the Mississippi River from river mile 301.2 to 614.9 and the Illinois River from river mile 80.2 to Lockport, Illinois.

A *Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS), Rock Island County, Illinois and Incorporated Areas,* dated 5 April 2010, was completed utilizing the data from the UMRSFFS.

Table 2-1 shows the discharges for the Mississippi River and Rock River for various flood events from the 2010 FIS Study.

Table 2-1 Summary of Discharges From 2010 FIS Study

	Drainage Area (Sq. Mi.)	10% Chance Exceedance	2% Chance Exceedance	1% Chance Exceedance	0.2% Chance Exceedance
Mississippi River @ confluence of Rock River (RM 479.1)	99,400	227,000	290,000	317,000	377,000
Rock River @ Mouth of Mississippi	10,903	43,000	65,000	76,000	108,000
Rock River Downstream of US Route 6	10,821	43,000	65,000	76,000	108,000
Rock River Downstream of US Route 92	9,551	41,000	62,000	71,300	97,000

Per the FIS study, the 1-percent-annual-chance backwater computed at Mississippi River Cross Section 479 (river mile 479, confluence with Rock River) has been applied to the Rock River. Although the 0.5% chance exceedance (200-year) was not included in the above, the table does show that the 0.2% chance exceedance (500-year) flows for the Mississippi River are lower than the previously determined 0.5% flows from the *1978 Phase II GDM* report. It also shows that the flows for the Rock River appear to be close to what was determined for the original design.

Table 2-2 compares the water surface elevations for the various conditions. Information was taken from the *1978 Phase II GDM* appendix and the *2010 FIS study*.

Table 2-2 Water Surface Elevations Comparison

	GDM Design .5% Chance Exceedance	GDM 1% Chance Exceedance	FIS 1% Chance Exceedance	FIS 0.2% Chance Exceedance
Mississippi River @ confluence of Rock River (RM 479.1)	567.0	565.3	563.8	566.2
Rock River @ Mouth of Mississippi			563.8*	566.2*
Rock River Downstream of US Route 92	567.51**	566.0**	563.7*	566.2*

All elevations converted to feet NAVD88 .

* Includes 1% Chance Exceedance Backwater effect on the Mississippi River.
** Coincident flooding on the Mississippi River.

Table 2-2 shows that the backwater effect of the Mississippi River is clearly the controlling factor on high water elevations in the Rock River in the project area for higher flooding events. The current analysis shows that the 0.2% chance exceedance (500-year) flood elevation on the Mississippi River is lower than the original design of coincident 0.5% chance exceedance (200-year) floods on the Mississippi and Rock Rivers. Thus the design elevation of the proposed relocated levee is adequate based on current water surface elevations. Therefore, the design of the modified levee built to the same elevation as the original design will be in compliance with the current design criteria and analysis. A copy of the information taken from the various design documents is included in Appendix C-2.

2.4.2 Interior Drainage/Storm Water Design

The proposed levee modification along with the proposed site development impacts a localized area of the levee interior drainage system. A storm water analysis was conducted to: account for the increase in storm water runoff from the proposed increased impervious area; account for seepage; and design drainage features to accommodate the site modifications. The northeast quadrant area of the intersections of I-280 and Illinois 92 where the levee modification, new site development access road and a portion of the proposed development was evaluated.

The existing interior drainage components in this project area consists of overland flow and a drainage ditch along the landside toe of the levee from station 305+00 to Station 309+00 which all outfall into a small ponding area (Ponding Area B-1). Under gravity conditions this ponding area is drained through a 48-inch gatewell. During flood events a small portable pump is utilized to drain the interior area as necessary. Detailed analysis of the interior area is included in the *Rock River, Milan, Illinois Local Flood Protection, Supplement No. 1, Interior Drainage Facilities, Phase II General Design Memorandum,* dated February 1982.

The evaluation of the storm water was conducted to determine if the small ponding area/ gatewell and temporary pumping solution were still adequate to meet the needs of the increased runoff and updated seepage quantities. Analysis of levee underseepage included review of parameters used in the original design of the levee and the operational history of pumping during blocked gravity drainage conditions. It was concluded that the methodology used in the original design is still valid and that available pumping history is within the original design parameters.

Storm water runoff was determined for pre- and post- project conditions and the runoff difference was used to determine a volume for storm water detention. The analysis has indicated that the seepage quantity of water is much more significant than the runoff. The existing Ponding Area B-1, which accepts storm water runoff and levee underseepage, is sufficient for the post development conditions, provided that adequate pumping is provided when the gatewell is closed and gravity drainage is blocked. Pumping is expected to be required only 0.5% of the time. Paving of the access road and a concrete pad for the portable pump and tractor will be accomplished to allow pumping during inclement weather conditions. A copy of the storm water analysis is included in Appendix C-3.

The detailed drainage design will include drainage plans for site grading, ditches and culverts in accordance with the City of Rock Island Storm Water Ordinance. A storm water pollution prevention plan will be developed to meet NPDES Phase II permit requirements. The preliminary roadway drainage design is included on the plans in Appendix B.

2.4.3 Local and System Wide Impacts

Based on the analysis above, the project has no system wide impact. The project impacts are very localized. The levee re-alignment affects approximately 3 acres of property consisting of existing levee easement and property owned by RiverStone Group, Inc. The levee will be rerouted through an existing open area. The interior drainage impacts are also very localized as discussed above.

2.4.4 Upstream and Downstream Impacts

As previously indicated, the proposed modification will have no upstream or downstream impacts. The proposed modification actually increases the floodplain area albeit very slightly.

2.4.5 Floodplain Management Impacts

The proposed modifications to the Milan/Big Island LFP project will have insignificant impacts to floodplain management, since all the construction is outside the current floodplain.

2.5 Operations and Maintenance Requirements

The current project operations and maintenance requirements are shared by the non-federal sponsors, the Village of Milan and the Big Island River Conservancy District. As part of the permit requirements, the non-federal sponsors will perform all operations, maintenance, repair, replacement and rehabilitation of the approved project alterations. In addition, the Operation and Maintenance Manual will be updated to incorporate the alterations.

The facilities involved in this modification are an existing levee, a portion of which will be degraded and new levee re-aligned to join the ends of the degraded section. The re-aligned section length of levee will have increased by about 300 feet. It is not expected that the operations and maintenance will be any different than that prior to the levee modification. Pre flood preparation will consist of the normal maintenance activities for the new levee including periodic inspection of levee, ponding area and existing gatewell, and vegetation control. Along with flood warning, there will be a pre-event inspection of the levee. Flood fighting during a flood event will be the same as that required for the existing levee in the district. Post flood activities will consist of inspection of the levee, ponding area and gatewell for damage after flood waters recede.

2.6 Risk Analysis

The project will not alter the existing level of risk to life and property as a result of the modification. The new levee section will be to the same elevation as the existing levee. The proposed modification will generate minor increased inflows from storm water runoff due to the proposed development. However, the existing underseepage inflow is much greater than the proposed increased runoff. The project will increase floodplain storage negligibly. There will be no increase in flood elevations. Construction of the new levee will not increase the risk of overtopping the levee system since the new levee section will not be overtopped before sections of the existing levee system. The risk of failure by slope failure, seepage or settlement for the new levee segment will be less likely than for the existing levee system due to geotechnical calculations that will be completed to current standards.

The existing levee system was constructed in 1984-1985 to USACE standards at that time. The proposed levee will be constructed to current USACE specifications. The new levee segment will either be constructed prior to the existing segment being removed or temporary levee protection requirements will be required to ensure adequate protection during a potential flood event.

3. SUPPORTING DOCUMENTATION

3.1 Real Estate Analysis

This section describes the real estate requirements for construction of the modification to the Milan/Big Island Flood Protection System.

The local sponsors, the Village of Milan and Big Island River Conservancy District, have permanent easements for the levee embankment and ponding area. The adjacent property where the new road, levee re-alignment and site development will be constructed is owned by RiverStone Group, Inc. Base existing real estate data was provided by Missman, Inc. Professional Engineers and Land Surveyors. A survey of the property limits of the area was completed in Spring 2012.

The existing, permanent platted levee right-of-way information was obtained from hard copy information stated on USACE plans titled *Rock River, Milan Illinois, Flood Control Project Right Of Way*, dated 5 December 1983. Coordinates and bearings on these drawings are referred to the Illinois State Plane Coordinate System West Zone.

The existing and proposed rights of way are shown on the design plans (see Appendix B). Upon final design, a real estate drawing will be prepared to show the existing levee right of way, the proposed levee right of way, temporary construction easements and platting information including coordinate identifiers at line vertices, bearing and length information. The temporary construction easements are required to allow access to staging areas, transport of materials and clearance for construction of features. Temporary easements will be in effect until final acceptance of the work. An access road off of IL 92 (reason for levee re-alignment) will cross the levee at the high point.

The proposed levee right-of-way will create a corridor which will have a minimum width of the levee, floodwall, embankment dam (including all appurtenant structures) plus 15 feet on each side measured from the outer edges of the outermost critical structure per guidance in Section 2-2 of ETL 1110-2-571.

3.2 Administrative Record

The following table is a summary of documents that have contributed to the development of the City of Rock Island Commercial Development Project and the levee modification component.
(To be inserted later)

3.3 Executive Order 11988 Considerations

Executive Order (EO) 11988, Floodplain Management (May 24, 1977) directs Federal agencies to issue or amend existing regulations and procedures to ensure that the potential effects of any action that may take place in a floodplain are evaluated and that its planning programs and budget requests reflect consideration of flood hazards and floodplain management. The purpose of this directive is "to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of 100-year floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative." Guidance for implementation of EO 11988 is provided in the floodplain management guidelines of the U.S. Water Resources Council (40 CFR 6030; February 10, 1978) and in A Unified National Program for Floodplain Management, prepared by the Federal Interagency Floodplain Management Taskforce.

The Environmental Assessment documents the requirements of EO 11988 in Section 5.5.4. In summary, the proposed measures have no effect on the risk of flood loss and no impact of flooding on human health, safety, and welfare.

3.4 Environmental Protection Compliance

This project is subject to and is in compliance with all applicable local, state, and federal laws governing restoration and flood control improvement projects. The full environmental compliance record has been included in the Section 408 application as Appendix D.

3.4.1 Background

The project area lies in the Rock River Valley and is partially urbanized and partially rural. It has been developed for residential and agricultural uses. The project area has been altered from construction of the Illinois and Mississippi Canal, Interstate 280 and Illinois 92. The 1972 report indicates that portions of the Federal project area are returning to a more natural state particularly in narrow bands adjacent to the canals, creeks and Rock River. However the current project modification area is outside these narrow band areas. The following sections provide documentation that has been completed as well as what will be completed as part of the detailed design.

3.4.2 National Environmental Policy Act (NEPA)

An environmental analysis was conducted as part of the original Federal project design and documented in the *1977 Phase II GDM*. A complete final Environmental Impact Statement (FEIS) dated March 1975 was filed with the Council on Environmental Quality on 12 April 1976. For the proposed modification, an Environmental Assessment (EA) will be prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and USACE ER 200-2-2, Procedures for Implementing NEPA. Three alternatives will be analyzed in the EA, the No-Action Alternative, Recommended Plan, and Alternative 3. Under the Recommended Plan, the City of Rock Island would relocate a portion of the levee to accommodate a new access road to a site development. The No-Action Alternative represents the baseline condition for comparison to the Recommended Plan and Alternative 3. It is expected that a Finding of No Significant Impact (FONSI) will be obtained.

A copy of the entire Environmental Assessment is included as Appendix D.

3.4.3 Endangered Species Act (ESA)

Coordination with the US Fish and Wildlife Service (USFWS) will be completed. Based on the documentation for the original Federal project, it is expected that only a letter from the US Fish & Wildlife indicating no ESA protected species or habitats are in the project impact area. Coordination with National Oceanic Atmospheric Association is not applicable to this project.

3.4.4 Fish and Wildlife Coordination Act

Coordination with the USFWS will be conducted. However based on the review of the original environmental documents prepared for the overall Federal project and that no water bodies will be impacted, a letter is expected from the USFWS stating that a FWCA Report is not required.

3.4.5 Marine Protection, Research and Sanctuaries Act (MPRSA)

No marine spoils disposal will take place and the project is not regulated by the MPRSA.

3.4.6 Wild and Scenic Rivers Act (WRSA)

The Rock River is not a Wild and Scenic River regulated under the WRSA.

3.4.7 Coastal Zone Management Act (CZMA)

The project is not in a coastal zone and therefore project is not regulated by the CZMA.

3.4.8 Clean Air Act (CAA)

Per the NEPAssisst website http://nepassisttool.epa.gov/nepassist/ for the project site, there are currently no non-attainment areas for ozone, lead or particulate matter. The existing air quality will be affected by vehicle emissions from traffic on the new access road. Per the Clean Air Act of 1990, transportation projects must not cause or contribute to new violations of the air quality standards, worsen existing violations, or delay attainment of air quality standards. However, the proposed access road and subsequent traffic emissions will not violate these standards. In addition, air quality impacts of this project will result from the exhaust from operation of construction equipment. These will be minor and temporary. There will be no permanent air quality impacts as a result and is not regulated by the CAA.

3.4.9 Hazardous, Toxic, Radioactive Waste (HTRW)

A review of all EPA Facilities on the NEPAssisst website http://nepassisttool.epa.gov/nepassist/ including brownfields, superfund, toxic releases, water discharges, air emissions and hazardous waste was completed. There are no sites within the project vicinity and the closest are across the Rock River in Rock Island approximately one mile away. Further coordination with the USEPA and state EPA will be conducted during the detailed design.

3.4.10 National Historic Preservation Act

It is not expected that the project will have any impact on existing historical or archaeological features. Per the original 1977 Phase II GDM, a comprehensive cultural inventory and assessment was undertaken in 1975 by the Environmental Research Center, Iowa City, Iowa. A review of the National Register of Historic Places was made and no sites in the Milan-Big Island area were listed. Subsequently, the Hennepin (Illinois & Mississippi (I&M)) Canal was determined to be eligible in 1976. Because of this eligibility, Section 106 procedures of the Historic Preservation Act of 1966 were implemented. This was completed and the Federal project was approved. The proposed levee modification project is not near the Hennepin Canal and therefore will have no impact on the historic canal.

In addition to the historic features, the original Federal project archaeological impacts were coordinated with the State Historic Preservation Officer, the Heritage Conservation and Recreation Service and the Advisory Council on Historic Preservation, Lands and Historic Sites Division, Illinois Department of Conservation, the Office of Archaeology and Historic Preservation, and the National Park Service. A reconnaissance survey was completed by the Environmental Research Center in 1976 which identified five previously unrecorded and twenty recorded sites within the vicinity of the project area. Based on this initial research, an intensive

archaeological testing program was undertaken by the Great Lakes Archaeological Research Center to conduct a determinative archaeological assessment of the National Register eligibility of archaeological sites known to be in the project rights-of-way. Nine sites were examined and the State Historic Preservation Officer recommended further testing of three of the sites and a determination of eligibility for inclusion of site 11 Ri 217 in the National Register.

No further information was provided on the additional testing. However, it is assumed that since the project has been constructed, there were no issues or that any issues were addressed during construction in accordance with the procedures set forth in 36 CFR Part 800. Although it is not anticipated the proposed levee modification will have any archaeological impact, coordination with appropriate agencies will be conducted during the detailed design.

3.4.11 Noise Control Act

The Noise Control Act of 1972 establishes the authority for federal agencies to regulate noise emissions from specific sources, such as commercial products, aircraft, railroads and motor vehicles. Noise emission standards are regulated by the U.S. Environmental Protection Agency (USEPA). The project is expected to generate traffic noise where there currently is none. Noise analysis per IDOT Highway Traffic Noise Assessment Manual, 20 June 2011 may be required. If the predicted noise levels approach or exceed FHWA's noise abatement criteria, noise abatement measures are considered. In Illinois, traffic noise impacts are interpreted to occur in the following situations:

- Design year traffic noise levels are predicted to approach (within 1 dB(A)), meet, or exceed the Noise Abatement Criteria (NAC).

OR

- Design year traffic noise levels are predicted to substantially increase (greater than 14 dB(A)) over existing noise levels.

The other noise impacts will be from the operation of equipment during construction. These will be minor and temporary and not regulated by the Noise Control Act.

4. REVIEWS

4.1 Independent External Peer Review (IEPR)/Safety and Assurance Review (SAR) Plan

As part of the permit application a Type II Independent External Peer Safety Assurance Review will be conducted to ensure that good science, sound engineering and public health, safety and welfare are the most important factors that determine a projects' fate. This is achieved by an independent and impartial review. Per *EC 1165-2-209, Civil Works Review Policy*, dated 3 January 2012, a Type II IEPR (SAR) shall be conducted on design and construction activities for hurricane and storm risk management and flood risk management projects, as well as other projects where potential hazards pose a significant threat to human life. This applies to new projects and to the major repair, rehabilitation, replacement, or modification of existing facilities.

The SARs are used to inform the USACE Chief of engineers on the adequacy, appropriateness, and acceptability of the design and construction activities for the purpose of assuring public health, safety and welfare. The SAR is performed by independent external peers consisting of a panel of experts. The terms of the SAR and Type II IEPR for the purposes of this document are interchangeable.

To ensure the SAR is completed in accordance with regulations a SAR Plan will be developed. The plan will include a summary of the project, an overview of the regulation and requirements, how the review will be performed, panel of experts listing, their qualifications and responsibilities, schedule and documentation. The SAR plan will be submitted to the USACE for approval.

4.2 Agency Technical Review

The USACE will conduct a technical review of the documents. Upon receipt of the letter from sponsor requesting Section 408 approval, the USACE will form a Product Review Team (PDT) and will develop a Review plan in accordance with *EC 1165-2-209.* The plan will describe the purpose and scope of the review, establish review requirements and schedule. The plans will be posted to the District website to reach broad array of stakeholders and customers and allow input into review.

The USACE District will conduct the review to assure environmental compliance, engineering standards and regulations compliance, real estate compliance and legal sufficiency.

APPENDIX A

Section 408 Approval Request Letter

APPENDIX B
Levee Design Plans

NOTE:
1. SEE ROADWAY PLANS FOR PROP. ROAD AND DRAINAGE LAYOUT

N

0′ 50′ 100′
SCALE: 1″ = 50′

53RD AVENUE WEST
SHADY LANE
PROP. R.O.W.
EX. R.O.W.
PROP. R.O.W. 15′ FROM TOE OF LEVEE SLOPE
PROP. LEVEE ℄
PROP. LEVEE TOE OF SLOPE TO MEET DITCH 3:1 SIDE SLOPES
PROP. LEVEE TOE OF SLOPE 3:1 SIDE SLOPES
EX. LEVEE ℄
EX. EASEMENT
EX. ACCESS CONTROL/R.O.W.
PROP. LEVEE MATCH EX. LEVEE
PROP. LEVEE STA. 5+95.53 =
EX. LEVEE STA. 104+71.00
EAST-BOUND ILL. 92
WEST-BOUND ILL. 92
PROP. ROAD TOE OF SLOPE 3:1 SIDE SLOPES
PROP. ROAD ℄
PROP. LEVEE TOE OF SLOPE TO MEET PROP. ROAD SIDE SLOPES
PROP. LEVEE TOE OF SLOPE 3:1 SIDE SLOPES
PROP. LEVEE TOE OF SLOPE TO MEET DITCH 3:1 SIDE SLOPES
PROP. R.O.W. 15′ FROM TOE OF LEVEE SLOPE
PROP. LEVEE 10′ WIDE FLAT TOP ELEV. 570.61
PROP. LEVEE MATCH EX. LEVEE
PROP. LEVEE STA. 00+00 =
EX. LEVEE STA. 106+90.00
EX. LEVEE TOE OF SLOPE 3:1 SIDE SLOPES
EX. EASEMENT
EX. LEVEE ℄
EX. EASEMENT
EX. ACCESS CONTROL/R.O.W.
L100+00
105+00
00+0
110+00
475+00
0+00
480+00
485+00
WEST-BOUND ILL. 92

PLAN	BY	DATE
SURVEYED		
PLOTTED		
ALIGNMENT CHECKED		
RT. OF WAY CHECKED		
CADD FILE NAME		
NOTE BOOK NO.		

PROFILE	BY	DATE
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BM. NOTED		
STRUCTURE NOTAT'NS CHK'D		
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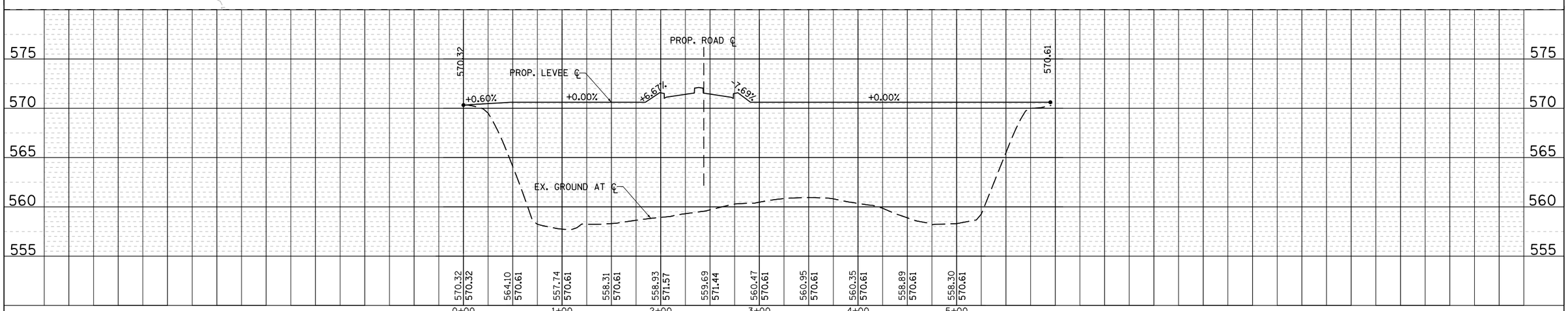

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CITY OF ROCK ISLAND, ILLINOIS

PROPOSED LEVEE PLAN AND PROFILE

SCALE: SHEET NO. OF SHEETS STA. TO STA.

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CONTRACT NO.

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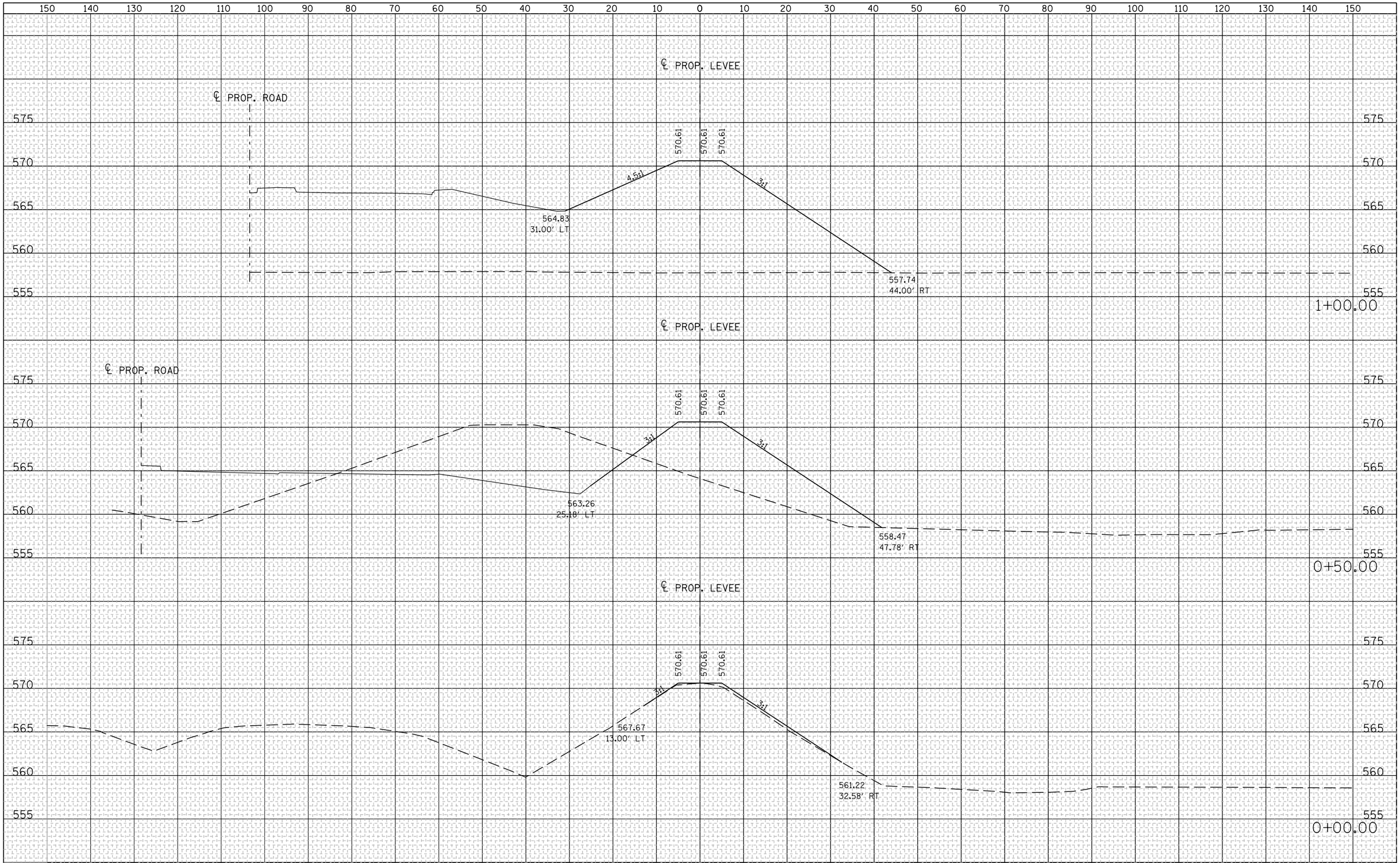

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PLOT DATE = 15-AUG-2012	DATE -	REVISED -

CITY OF ROCK ISLAND, ILLINOIS

PROPOSED LEVEE

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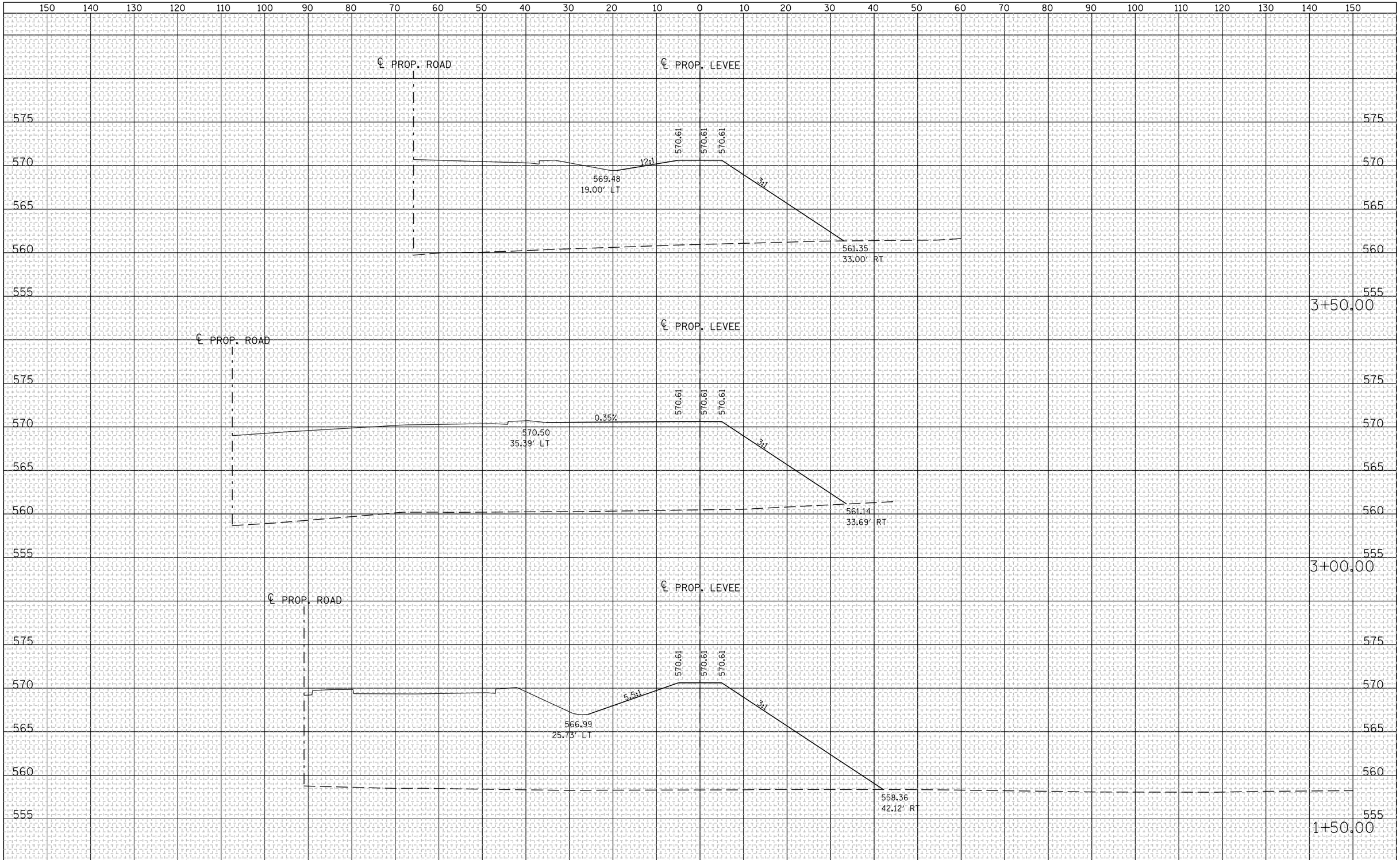

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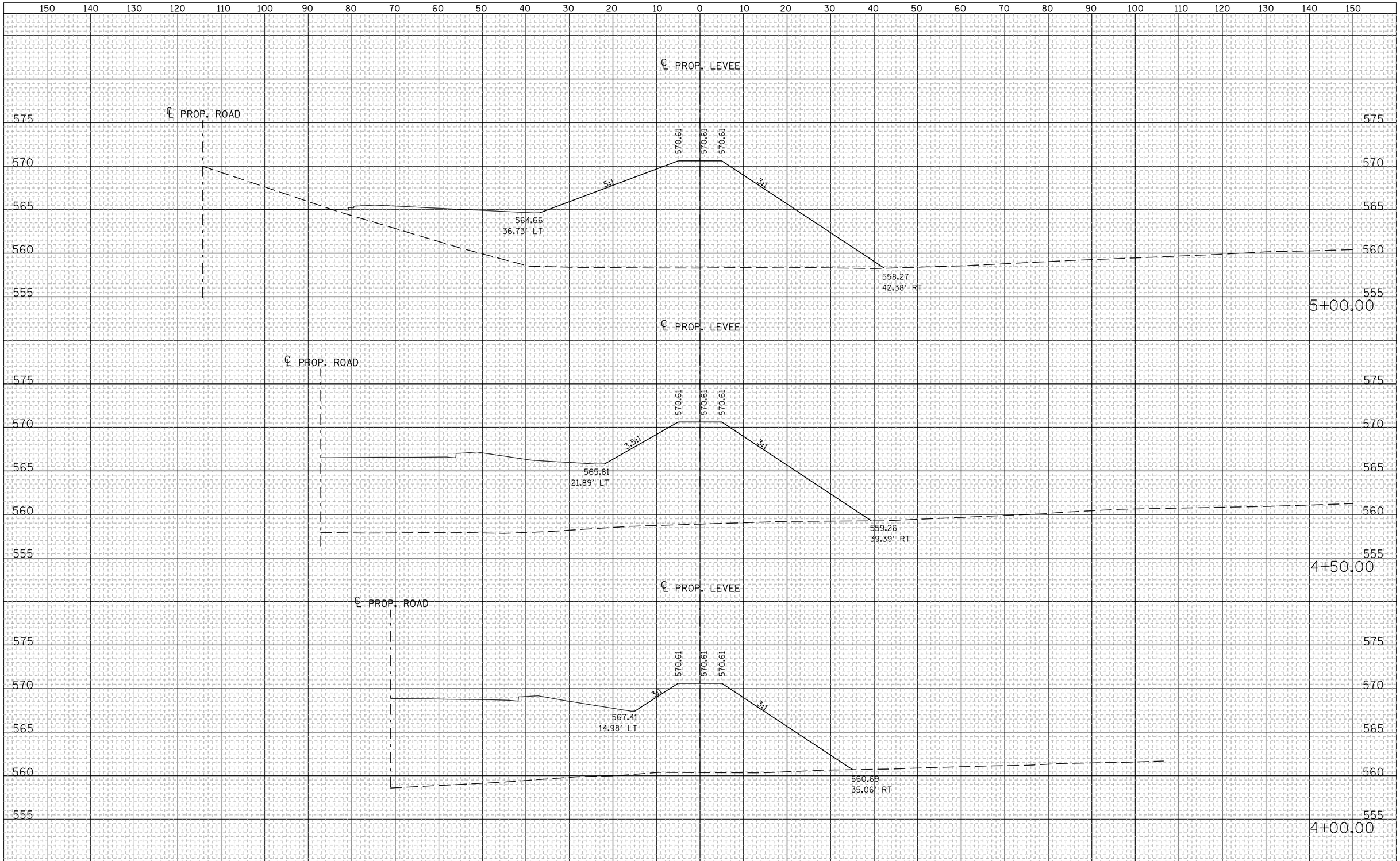

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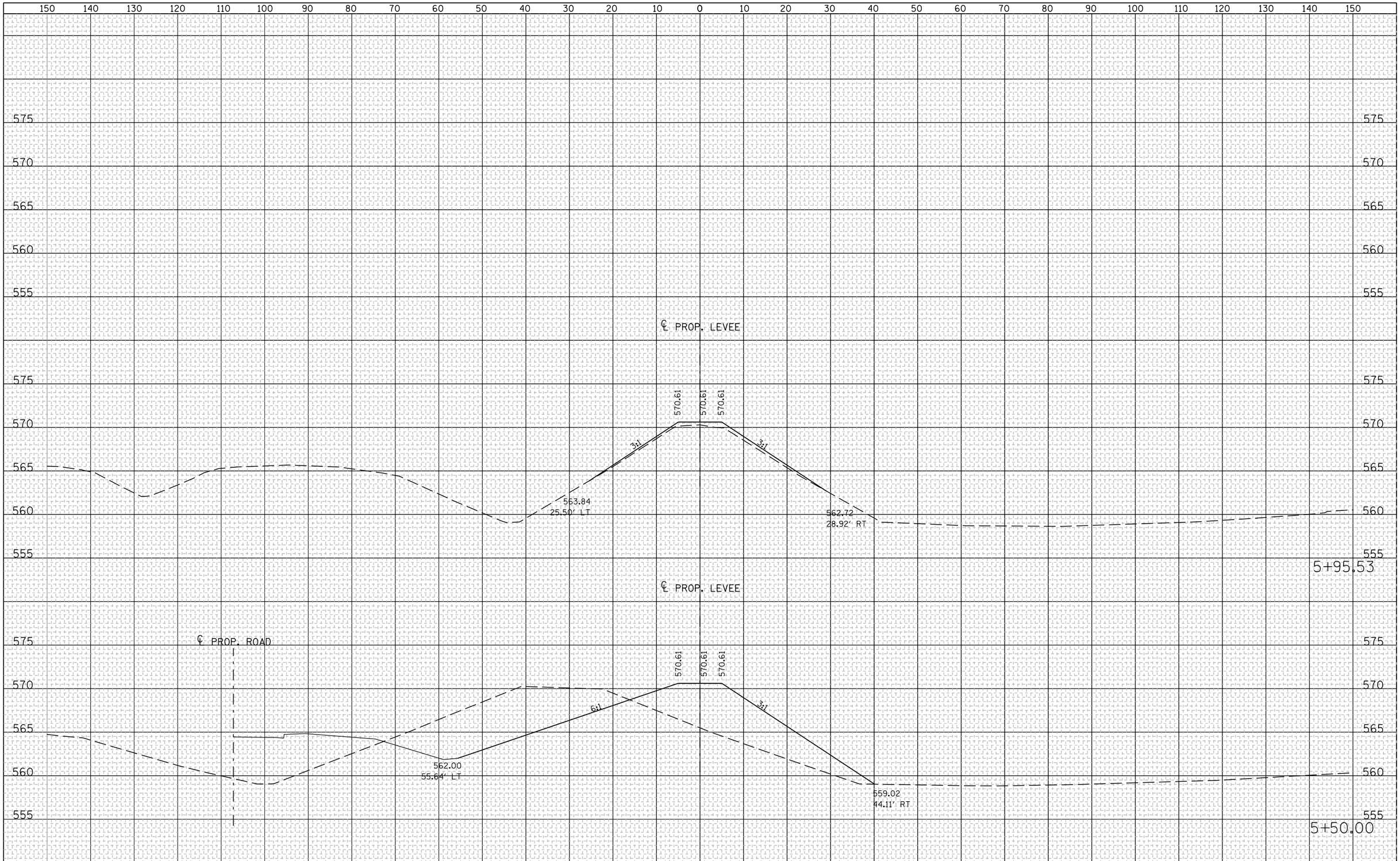

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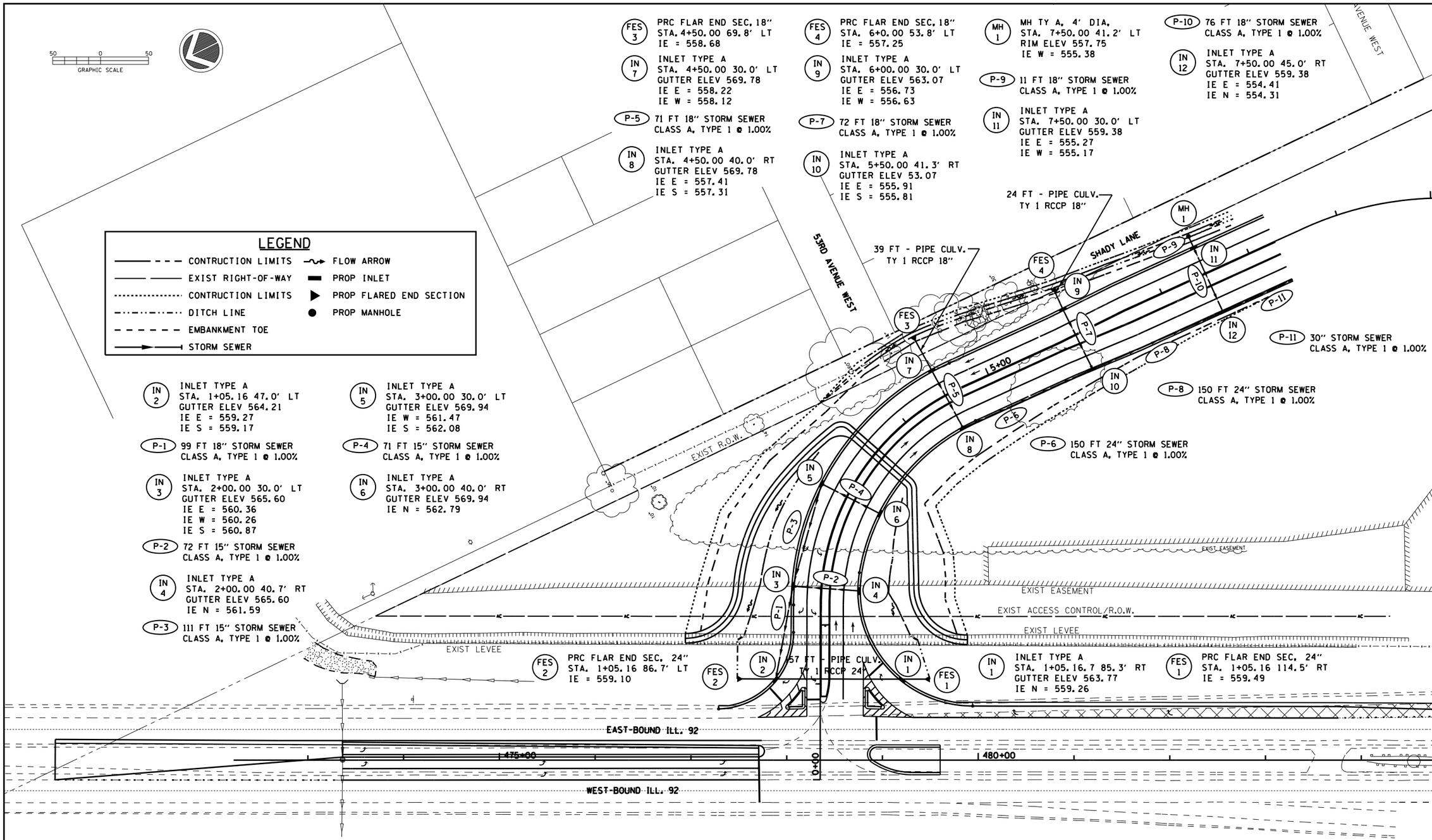

PRELIMINARY

ROADWAY DRAINAGE PLAN

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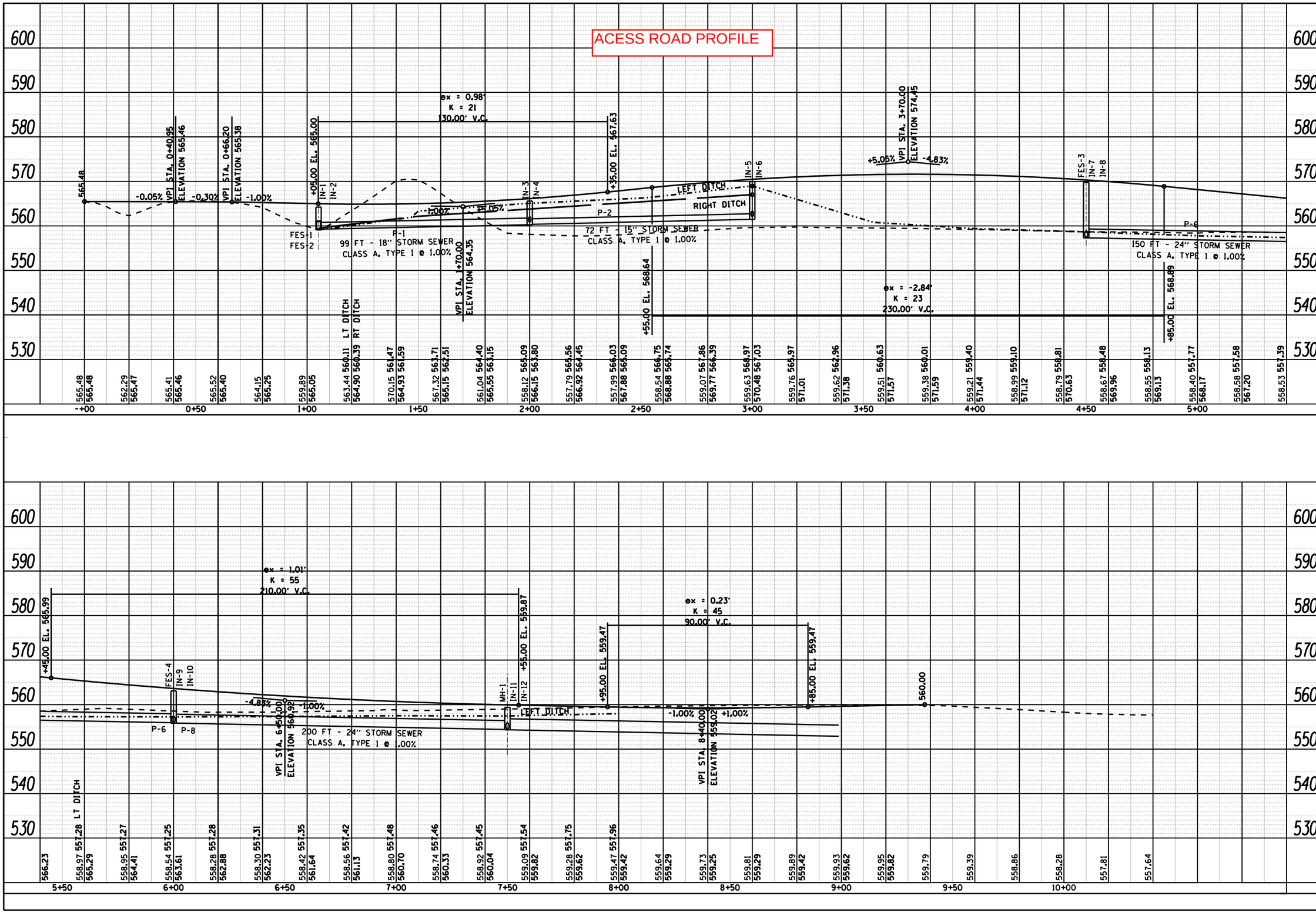

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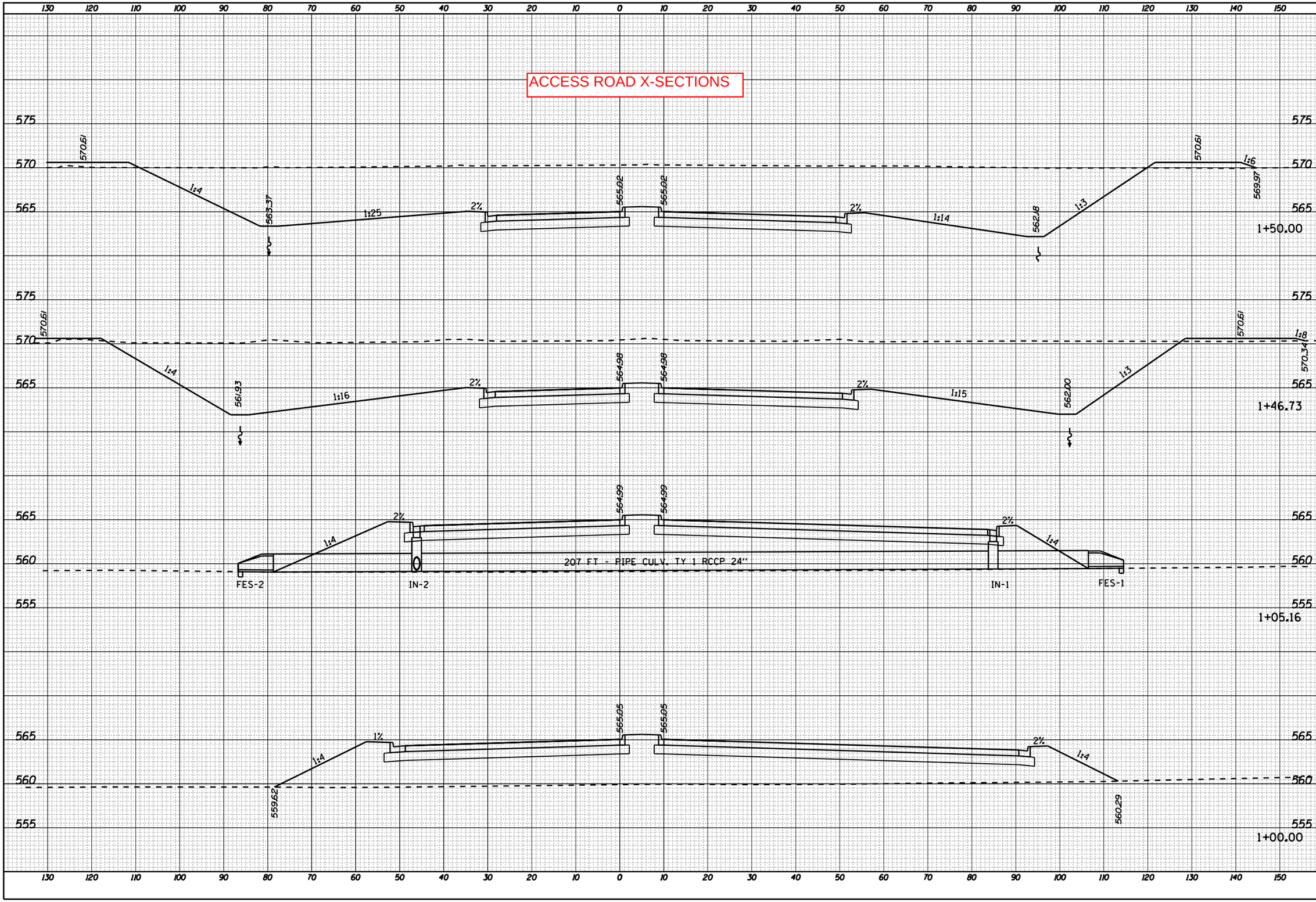

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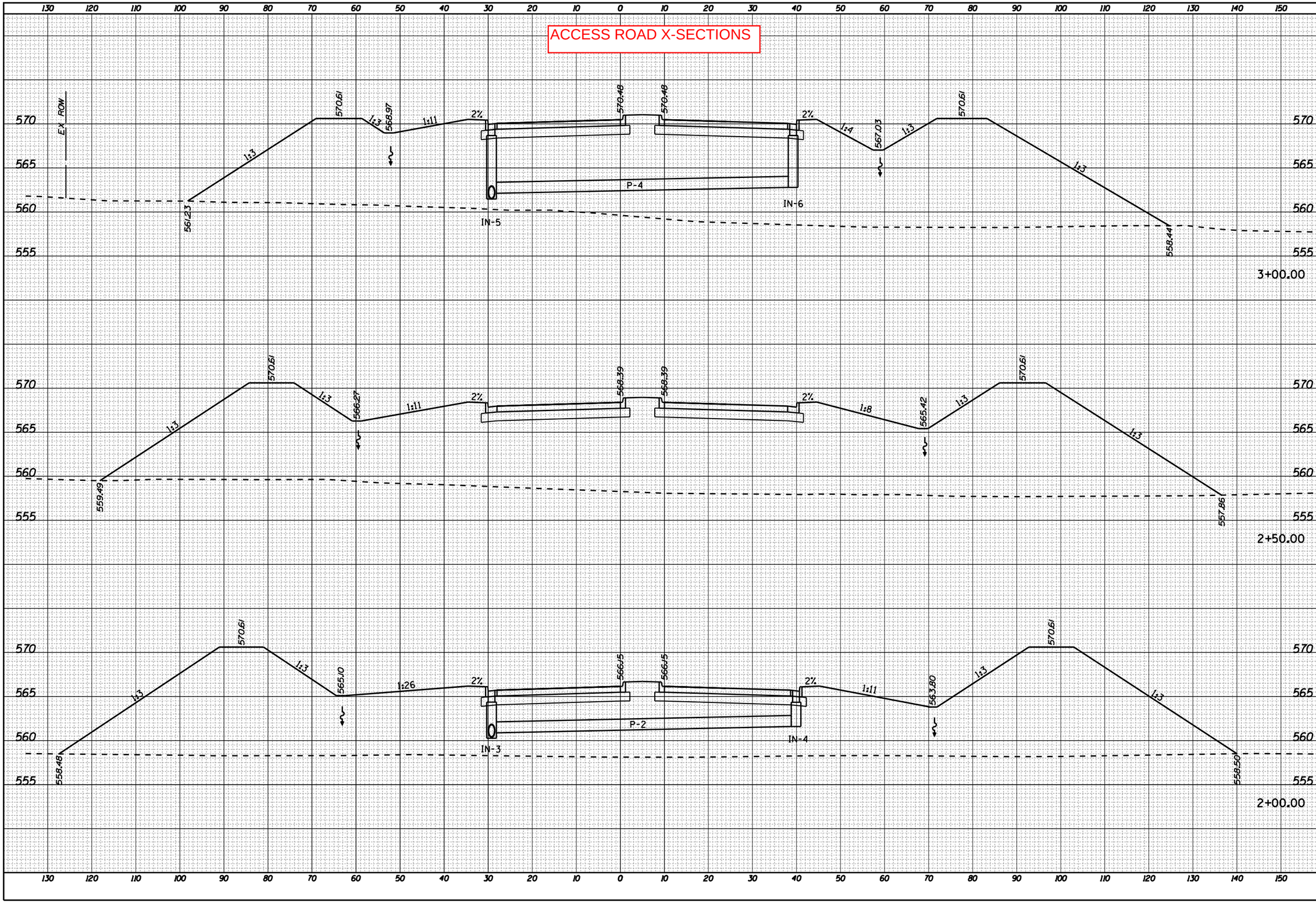

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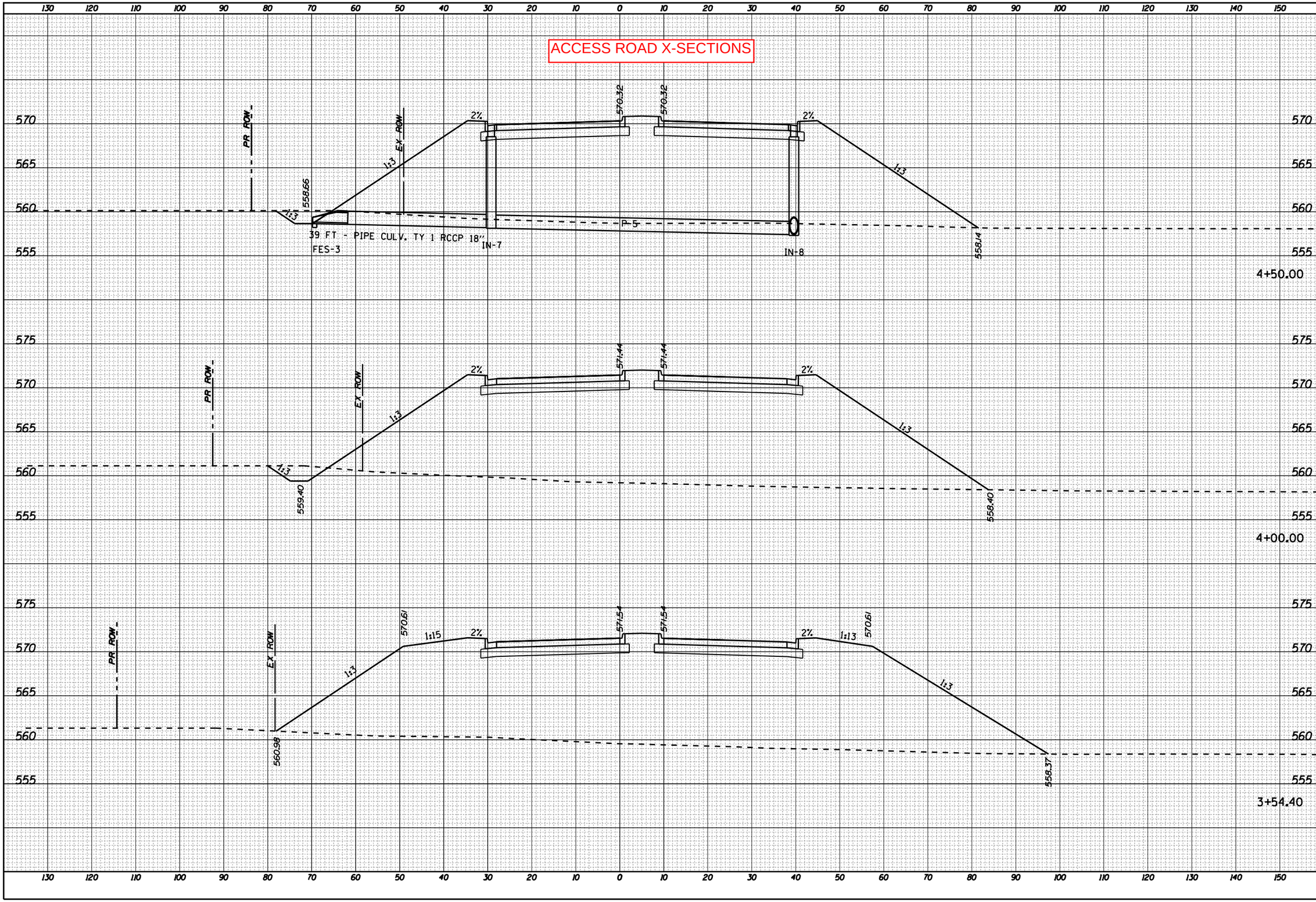

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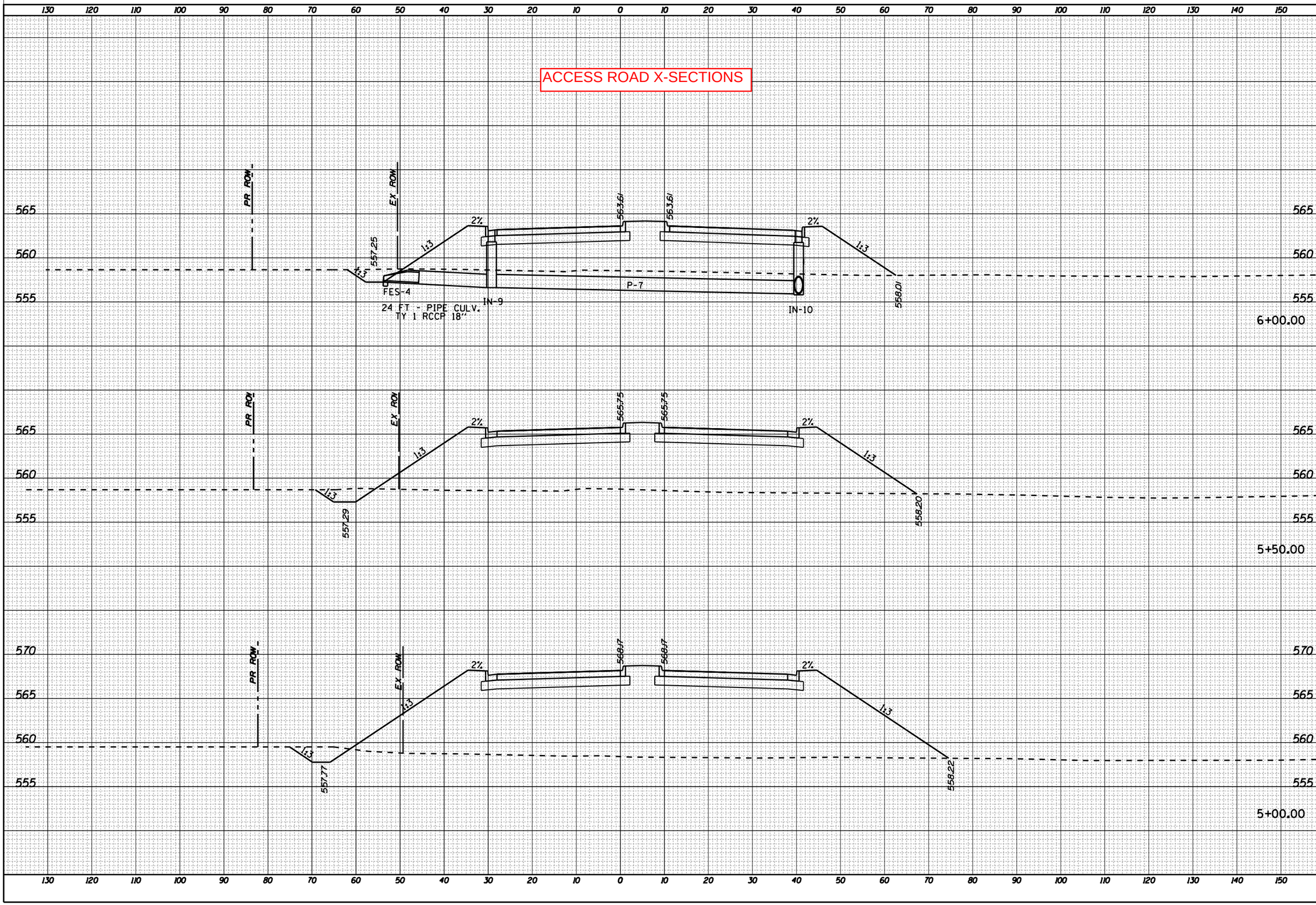

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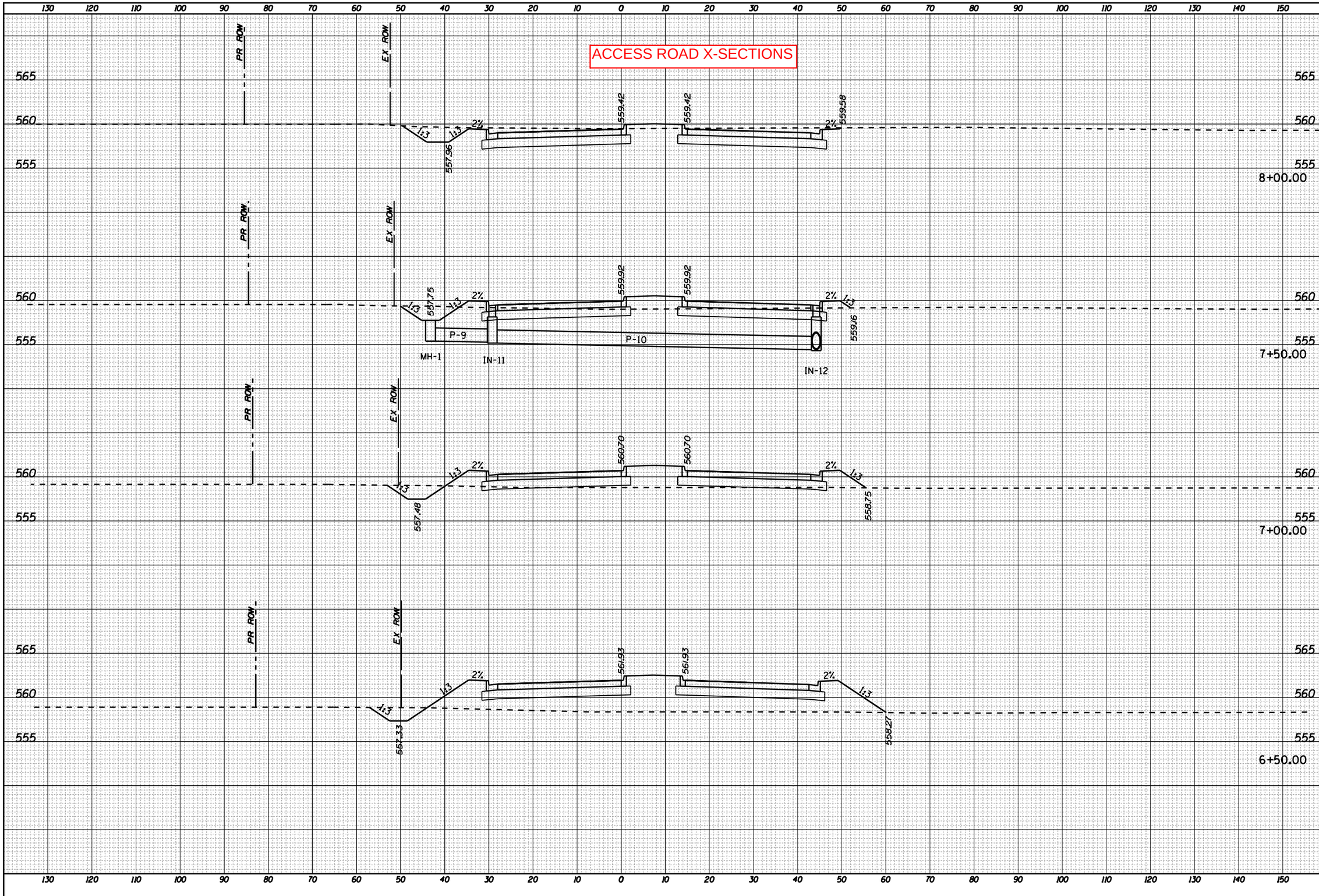

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APPENDIX C

Supporting Technical Design Documentation

Appendix C Index

Appendix C-1 – Geotechnical Analysis

Phase II GDM Boring Plan and Logs

2012 Boring Plan and Logs

Phase II GDM Analysis Data

Proposed Modification Geotechnical Calculations

Appendix C-2 – Hydrology & Hydraulics Analysis Data

Phase II GDM Water Surface Profiles

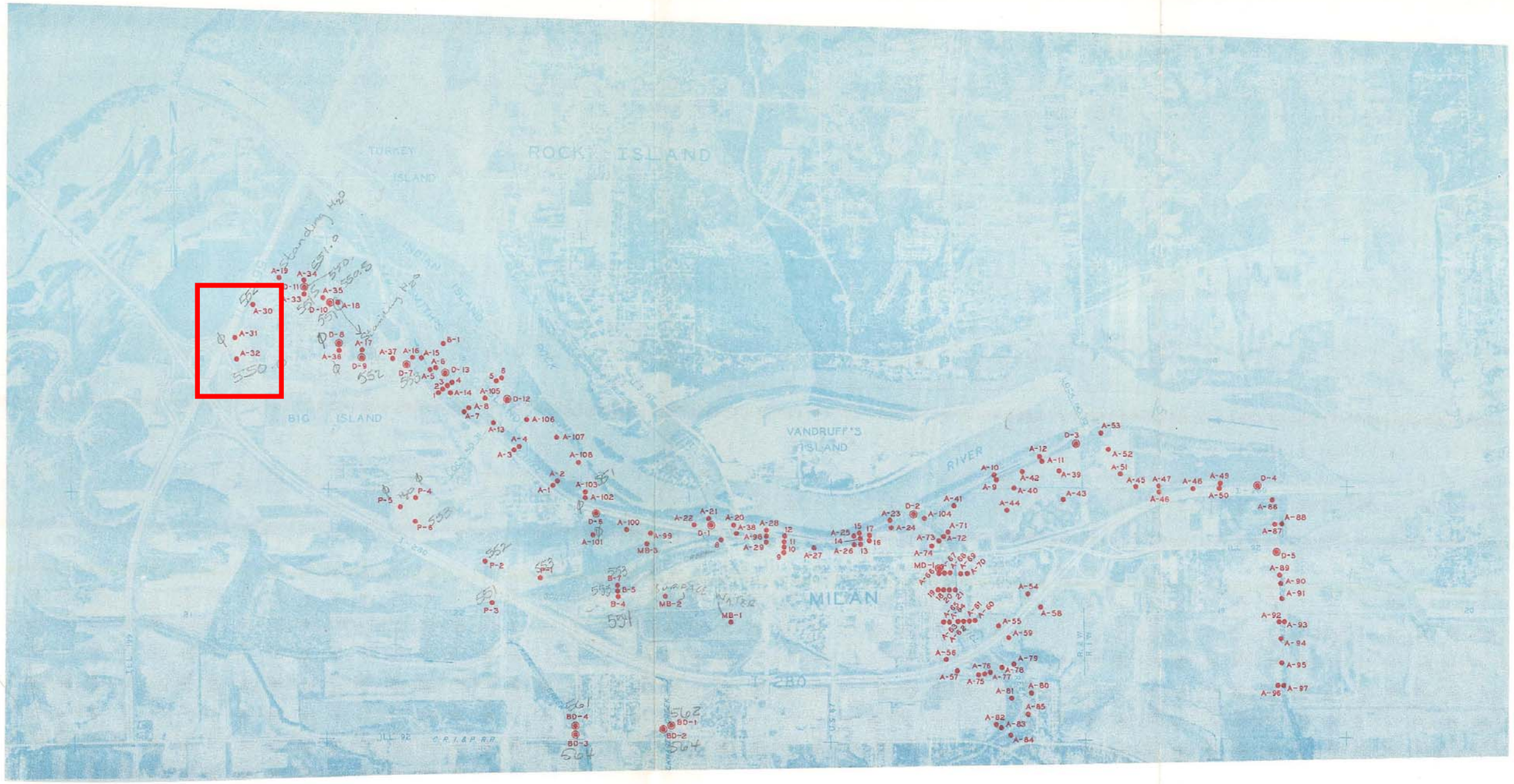
2010 FIS Water Surface Profiles, Stage & Flows

2004 UMRSFFS Water Surface Profiles, Stage & Flows

Appendix C-3 – Storm Water/Underseepage Analysis

APPENDIX C-1
Geotechnical Analysis

Phase II GDM Boring Plan and Logs



NOTE:

BORING LOGS ARE SHOWN ON PLATES 48 THROUGH 56

LEGEND

- HAND AUGER
- DRILL BORING

REVISION	DATE	DESCRIPTION	BY

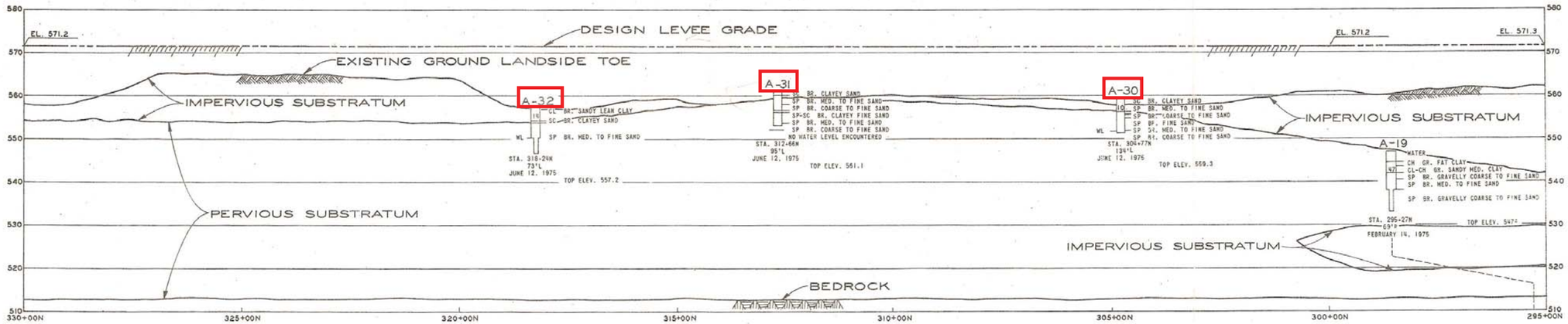
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
ROCK ISLAND, ILLINOIS

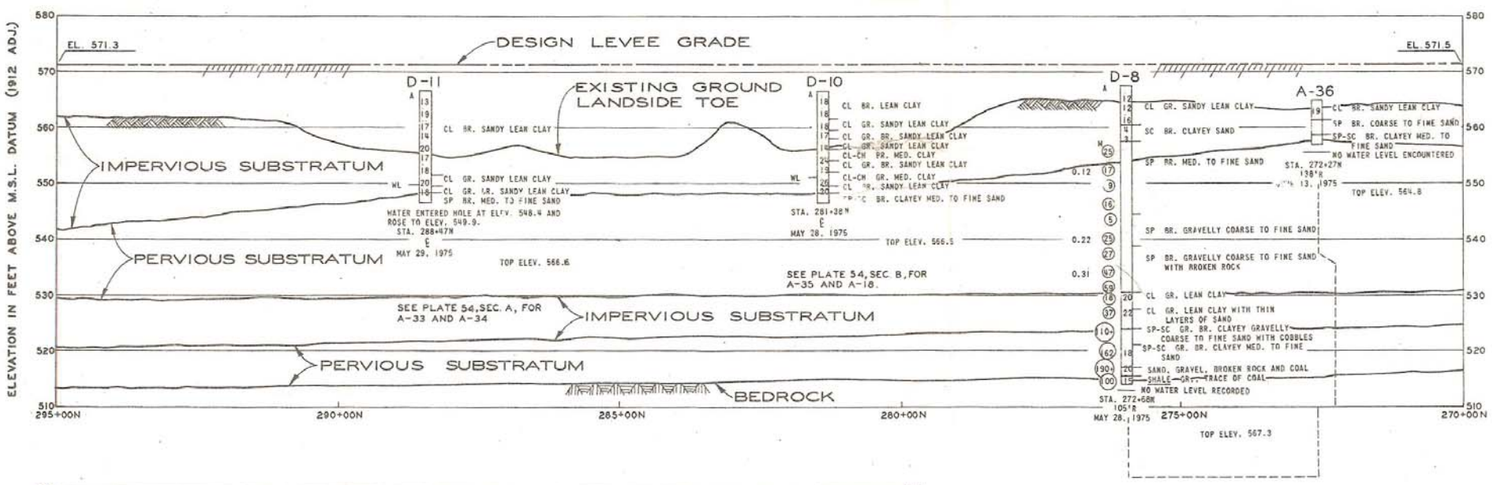
DRAWN BY:
TRACED BY:
CHECKED BY:
SUBMITTED:
CHIEF, DESIGN BRANCH
RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVED:
COL., CORPS OF ENGINEERS
DISTRICT ENGINEER
ROCK ISLAND DISTRICT
DATE:

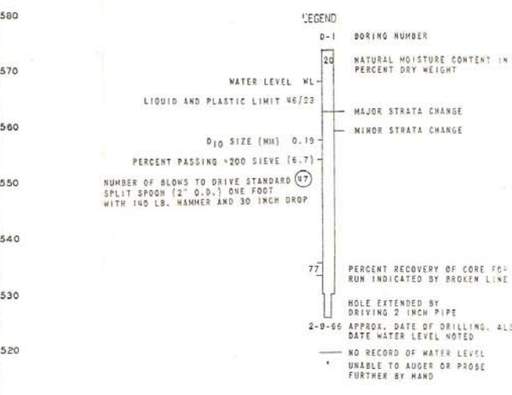
ROCK RIVER
MILAN, ILLINOIS
LOCAL FLOOD PROTECTION

SOIL BORING LOCATION PLAN

SHEET DRAWING NO
INVITATION NO DACW25- -B-

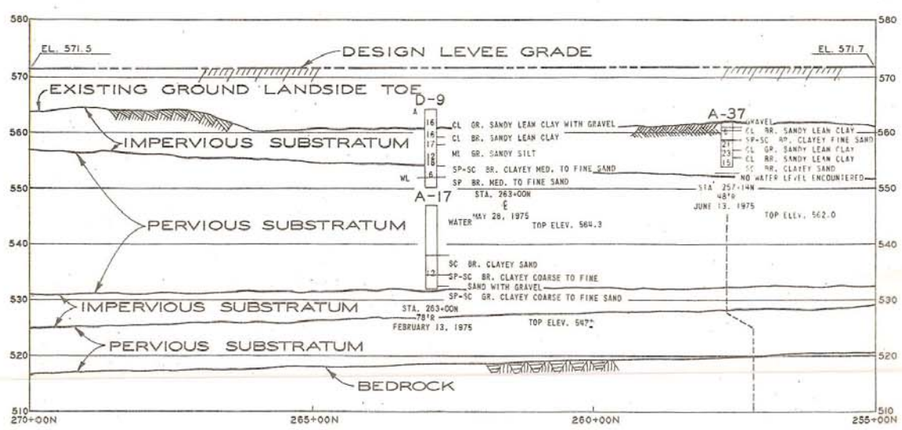






NOTE:

1. THE PLAN LOCATION OF THE SPOIL BORINGS IS SHOWN ON PLATE 48



*UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION		TYPE	LETTER SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS >50% OF MATERIAL IS RETAINED ON #200 SIEVE	GRAVELS >50% OF COARSE FRACTION IS RETAINED ON #4 SIEVE	CLEAN GRAVELS	GW	GRAVEL, WELL GRADED, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	GRAVEL, POORLY GRADED, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURES
	SANDS >50% OF COARSE FRACTION PASSES #4 SIEVE	CLEAN SANDS	SW	SAND, WELL GRADED, GRAVELLY SANDS
			SP	SAND, POORLY GRADED, GRAVELLY SANDS
		SANDS WITH FINES	SM	SILTY SAND, SAND-SILT MIXTURES
			SC	CLAYEY SAND, SAND-CLAY MIXTURES
FINE GRAINED SOILS >50% OF MATERIAL PASSES #200 SIEVE		SILTS AND CLAYS LL<50	ML	SILT A VERY FINE SAND, SILTY OR CLAYEY FINE SAND OR CLAYEY SILT
			CL	LEAN CLAY, SANDY CLAY, SILTY CLAY, OF LOW TO MEDIUM PLASTICITY
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
		SILTS AND CLAYS LL>50	MH	SILT, FINE SANDY OR SILTY SOIL WITH HIGH PLASTICITY
			CH	FAT CLAY, INORGANIC CLAY OF HIGH PLASTICITY
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, AND HIGHLY ORGANIC SOIL

* THE CLASSIFICATION OF SOILS IS IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM BRIEFLY PRESENTED IN THE TABLE ABOVE. FOR A COMPLETE DESCRIPTION OF THE UNIFIED SOIL CLASSIFICATION SYSTEM REFER TO: "TECHNICAL MEMORANDUM NO. 3-357 PREPARED BY THE U. S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS, VICKSBURG, MISSISSIPPI.

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
ROCK ISLAND, ILLINOIS

DRAWN BY: J.W.C.
TRACED BY:
CHECKED BY: M.L.P.
SUBMITTED:
CHIEF, DESIGN BRANCH
APPROVED:
CHIEF, ENGINEERING DIVISION
DATE:

ROCK RIVER
MILAN, ILLINOIS
LOCAL FLOOD PROTECTION

BORING LOGS

STA. 330+00N TO STA. 255+00N

SCALE AS SHOWN

SHEET DRAWING NO
INVITATION NO DACW25- -B-

2012 Boring Plan and Logs

No Scale

Approximate boring location

N

TEAM *Services*, Inc. **717 SE 6th Street** **Des Moines, IA 50309**	**Rock River Levee Evaluation** Milan, Illinois BORING PLAN (1)	Project No. 1-3115 July 5, 2012

LOG OF BORING NO. 2

OWNER	ARCHITECT/ENGINEER
SITE: **Milan, IL**	PROJECT: **Rock River Levee Evaluation**

GRAPHIC LOG	DESCRIPTION	DEPTH (ft.)	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	TESTS: MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
	1.0 **Granular Alluvium** -- Silty SAND, trace gravel, brown		SM	1	AS					
	Granular Alluvium -- Fine SAND, trace silt, yellowish brown		SP	2	SS	12"	12			
					HS					
		5	SP	3	SS	15"	8			
	6.0				HS					
	Granular Alluvium -- Fine to medium SAND, trace gravel and silt, yellowish brown and dark yellowish brown		SP	4	SS	16"	7			
					HS					
		10	SP	5	SS	16"	7			
					HS					
			SP	6	SS	11"	13			
					HS					
		15	SP	7	SS	9"	8			
	17.5				HS					
	Granular Alluvium -- Medium to coarse SAND, with gravel, trace silt, yellowish brown and dark yellowish brown	20	SP	8	SS	6"	24			
					HS					
	25.0		SP	9	SS		29			
	Bottom of Boring E 0699520 N 4593542	25								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS				
WL	▽ 7'	WD	▼ 9'	AD
WL				
WL				

TEAM Services, Inc.

BORING STARTED	6-19-12		
BORING COMPLETED	6-19-12		
RIG	ATV	FOREMAN	DC
APPROVED	SGB	JOB #	1-3115

LOG OF BORING NO. 3

OWNER	ARCHITECT/ENGINEER
SITE: **Milan, IL**	PROJECT: **Rock River Levee Evaluation**

GRAPHIC LOG	DESCRIPTION	DEPTH (ft.)	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	TESTS: MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
	1.0 **Granular Alluvium** -- Silty SAND, trace gravel, dark grayish brown		SM	1	AS					
	Cohesive Alluvium -- Sandy lean CLAY, trace gravel, very dark grayish brown		CL	2	SS	11"	19			
	3.5				HS					
	Granular Alluvium -- Fine to medium SAND, trace gravel and silt, yellowish brown and dark yellowish brown	5	SP	3	SS	14"	24			
					HS					
			SP	4	SS	18"	7			
					HS					
		10	SP	5	SS	15"	9			
					HS					
			SP	6	SS	16"	12			
			SP	7	SS	11"	14			
		15			HS					
	17.5									
	Granular Alluvium -- Medium to coarse SAND, trace gravel and silt, yellowish brown and dark yellowish brown		SP	8	SS	9"	9			
		20			HS					
			SP	9	SS	9"	13			
	25.0	25								
	Bottom of Boring E 0699417 N 4593217									

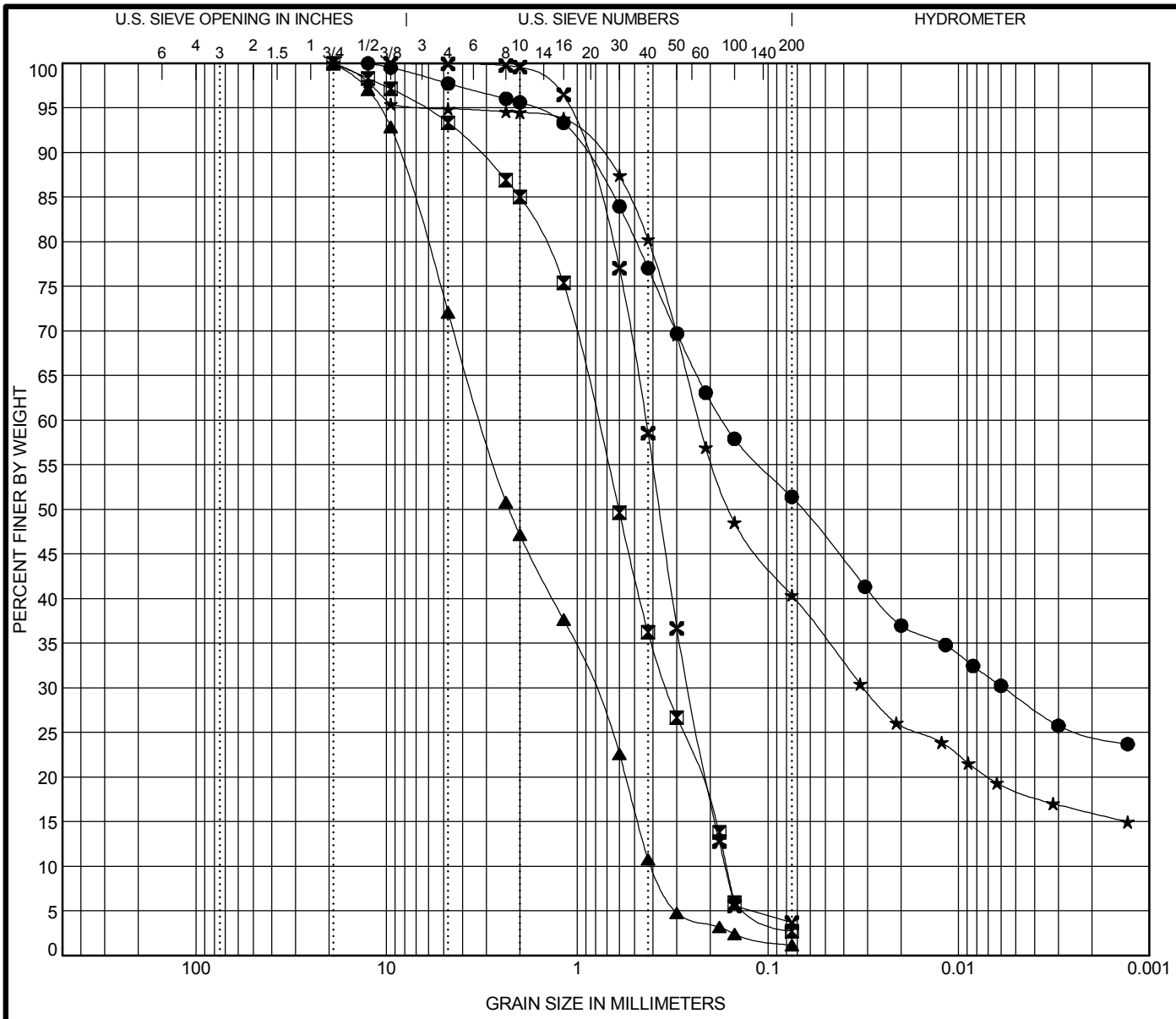
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS					
WL	∇ 6.5'	WD	▼ 10'	AD	
WL					
WL					

TEAM Services, Inc.

BORING STARTED	6-19-12		
BORING COMPLETED	6-19-12		
RIG	ATV	FOREMAN	DC
APPROVED	SGB	JOB #	1-3115



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	1	0.0							
⊠	1	9.0		**POORLY GRADED SAND(SP)**				**0.88**	**4.78**
▲	1	19.0		**POORLY GRADED SAND with GRAVEL(SP)**				**0.54**	**7.86**
★	2	0.0							
✕	2	1.5		**POORLY GRADED SAND(SP)**				**0.92**	**2.60**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	1	0.0	**12.5**	**0.172**	**0.006**		**2.3**	**46.3**	**26.6**	**24.8**
⊠	1	9.0	**19**	**0.788**	**0.339**	**0.165**	**6.7**	**90.6**	**2.7**	
▲	1	19.0	**19**	**3.191**	**0.836**	**0.406**	**27.9**	**70.9**	**1.2**	
★	2	0.0	**19**	**0.231**	**0.031**		**5.1**	**54.5**	**24.4**	**16.0**
✕	2	1.5	**9.5**	**0.436**	**0.26**	**0.168**	**0.1**	**96.2**	**3.7**	

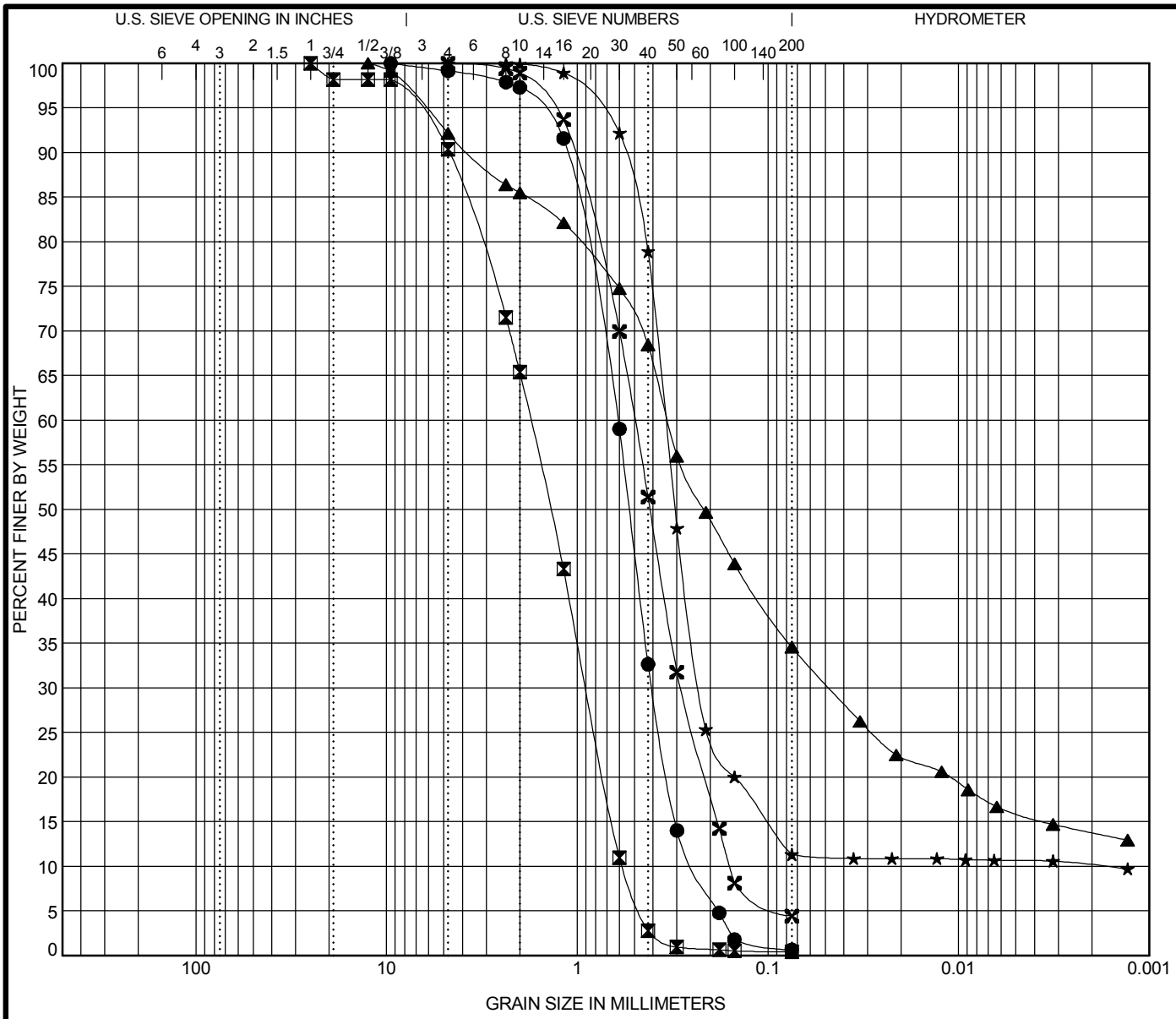
TEAM Services
717 SE 6th Street
Des Moines, IA 50309

GRAIN SIZE DISTRIBUTION

Project: Rock River Levee Evaluation

Location: Milan, IL

Number: 1-3115



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	2	6.5	**POORLY GRADED SAND(SP)**				**1.11**	**2.55**
⊠	3	18.5	**POORLY GRADED SAND(SP)**				**0.79**	**3.05**
▲	4	0.0						
★	4	4.0					**87.51**	**199.23**
✕	4	9.0	**POORLY GRADED SAND(SP)**				**1.03**	**3.14**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	2	6.5	**9.5**	**0.612**	**0.404**	**0.24**	**0.9**	**98.5**	**0.6**	
⊠	3	18.5	**25**	**1.758**	**0.894**	**0.576**	**9.6**	**90.0**	**0.4**	
▲	4	0.0	**12.5**	**0.336**	**0.048**		**7.9**	**57.6**	**20.8**	**13.8**
★	4	4.0	**9.5**	**0.344**	**0.228**	**0.002**	**0.0**	**88.6**	**1.2**	**10.1**
✕	4	9.0	**4.75**	**0.499**	**0.285**	**0.159**	**0.0**	**95.6**	**4.4**	

TEAM Services
717 SE 6th Street
Des Moines, IA 50309

GRAIN SIZE DISTRIBUTION

Project: Rock River Levee Evaluation

Location: Milan, IL

Number: 1-3115

UNIFIED SOIL CLASSIFICATION SYSTEM

TEAM *Services*

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]		GW	Well-graded gravel[F]
			Cu < 4 and/or 1 > Cc > 3[E]		GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F, G, H]
			Fines classify as CL or MH		GC	Clayey gravel[F, G, H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[E]	Cu ≤ 6 and 1 ≤ Cc ≤ 3[E]		SW	Well-graded sand[I]
			Cu < 6 and/or 1 > Cc > 3[E]		SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G, H, I]
			Fines classify as CL or CH		SC	Clayey sand[G, H, I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K, L, M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K, L, M]
		organic	Liquid limit – oven dried	< 0.75	OL	Organic clay[K, L, M, N]
			Liquid limit – not dried			Organic silt[K, L, M, O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K, L, M]
			PI plots below "A" line		MH	Elastic silt[K, L, M]
		organic	Liquid limit – oven dried	< 0.75	OH	Organic clay[K, L, M, P]
			Liquid limit – not dried			Organic silt[K, L, M, Q]
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols:

GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12% fines require dual symbols:

SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

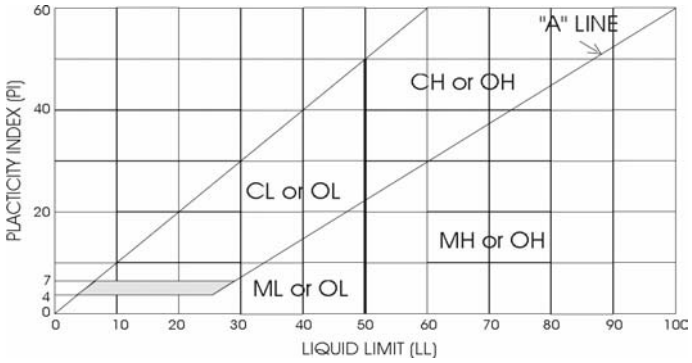
For classification of fine-grained soils and fine grained fraction of coarse-grained soils.

Equation of "A" Line:
Horizontal at PI = 4 to LL + 25.5.
then PI = 0.73 (LL-20)

[E]
$Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

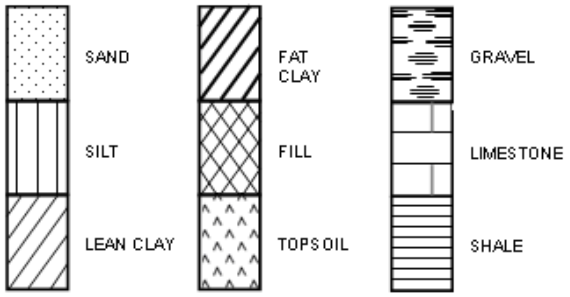
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains > 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plots in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



GENERAL NOTES

SOIL and ROCK TYPES



DRILLING & SAMPLING SYMBOLS

SS	Split Spoon - 1 1/2" I.D., 2" O.D., unless otherwise noted
ST	Thin-Walled Tube - 3" O.D., unless otherwise noted
PA	Power Auger
HA	Hand Auger
DB	Diamond Bit - 4", N, B
AS	Auger Sample
HS	Hollow Stem Auger
WS	Wash Sample
RB	Rock Bit
BS	Bulk Sample
DC	Dutch Cone
WB	Wash Bore
AR	Air Rotary

CONSISTENCY OF FINE-GRAINED SOILS
(major portion passing No. 200 sieve)

Consistency	Unconfined Compressive Strength, Qu, psf	N-Blows/ft* (Approx. Correlation)
Very Soft	< 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,001 - 2,000	5 - 8
Stiff	2,001 - 4,000	9 - 15
Very Stiff	4,001 - 8,000	16 - 30
Hard	8,001 - 16,000	31 - 50
Very Hard	> -16,000	50 +

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N-Blows/ft. *
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	50 - 80
Extremely Dense	80 +

* Standard "N" Penetration Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch OD split spoon, except where noted.

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) (of components also present in sample)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of components also present in sample)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Size Range
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300 mm to 4.75 mm)
Gravel	3 in. to #4 sieve (75 mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75 mm to 0.075 mm)
Silt or Clay	Passing #200 sieve (0.075 mm)

WATER LEVELS: WD = While Drilling AD = After Drilling

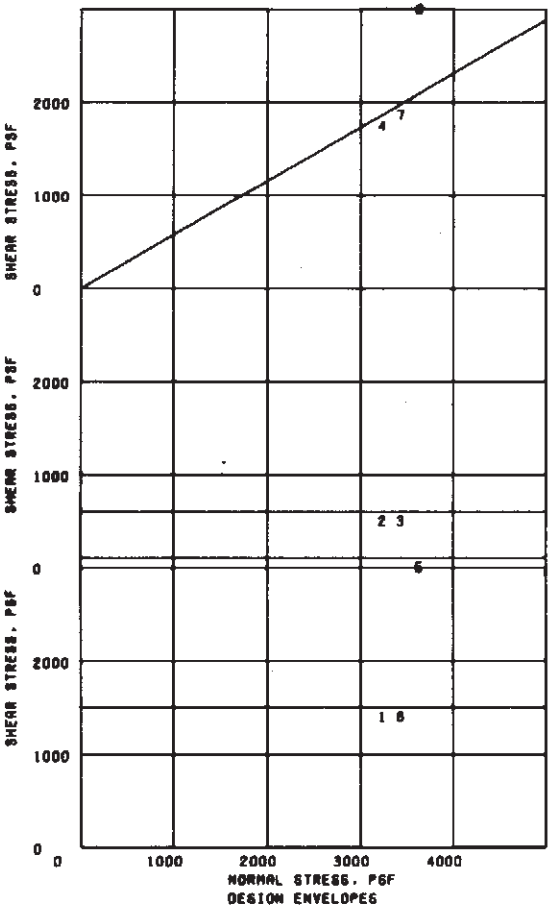
Depth groundwater first encountered during drilling

Groundwater level after 24 hours (unless otherwise noted, i.e. "AD" -- after drilling)

TERMS DESCRIBING SOIL STRUCTURE

Parting:	paper thin in size	Fissured:	containing shrinkage cracks, frequently filled with fine sand or silt, usually more or less vertical.
Seam:	1/8" to 3" in thickness		
Layer:	greater than 3" in thickness	Interbedded:	composed of alternate layers of different soil types.
Ferrous:	containing appreciable quantities of iron	Laminated:	composed of thin layers of varying color and texture.
Well-Graded:	having wide range in grain size and substantial amounts of all intermediate sizes.	Slickensided:	having inclined planes of weakness that are slick and glossy in appearance.
Poorly-Graded:	predominately one grain size or having a range of sizes with some intermediate sizes missing.	NOTE:	Clays possessing slickensided or fissured structure may exhibit lower unconfined strength than indicated above. Consistency of such soil is interpreted using the unconfined strength along with pocket penetrometer results.

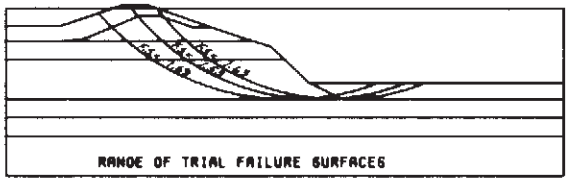
Phase II GDM Analysis Data



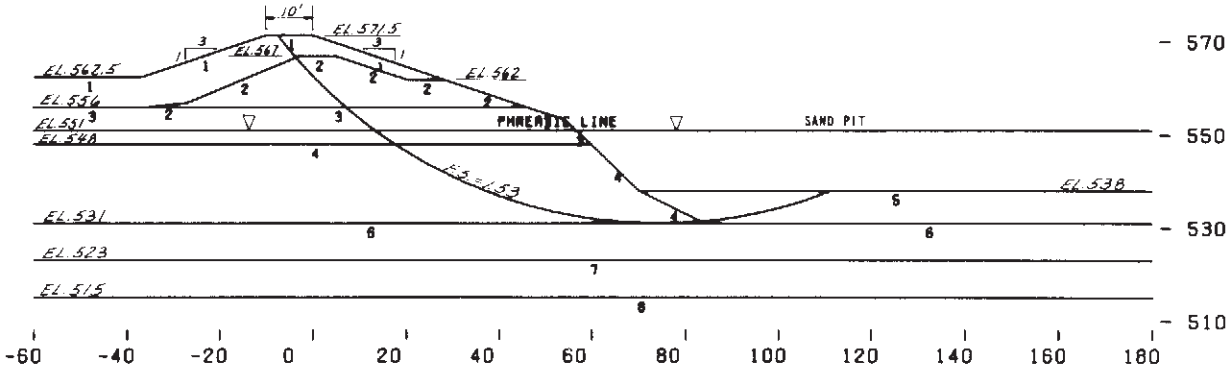
MATERIAL		SOIL WT. LBS./CUFT		SHEAR STRENGTH							
				Q		R		S		(R+S)/2	
		MOIST	SAT.	PHI DEGREES	COHESION PSF	PHI DEGREES	COHESION PSF	PHI DEGREES	COHESION PSF	PHI DEGREES	COHESION PSF
COMPACTED IMPERV FILL EL556 TO EL571.5	1	125.00	130.00	0.00	1500.00	0.00	0.00	0.00	0.00	0.00	0.00
EXISTING IMPERV FILL EL. 556 TO EL. 567	2	115.00	120.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	0.00
UPPER IMPERV FOUND EL. 548 TO EL. 556	3	115.00	120.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	0.00
UPPER PERVIOUS FOUND EL. 531 TO EL. 548	4	130.00	135.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RECENT SOFT SEDIMENT EL. 531 TO EL. 538	5	100.00	100.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
LOWER IMPERV FOUND EL. 523 TO EL. 531	6	120.00	120.00	0.00	1500.00	0.00	0.00	0.00	0.00	0.00	0.00
LOWER PERVIOUS FOUND EL. 515 TO EL. 523	7	135.00	135.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BEDROCK BELOW EL. 515	8	150.00	150.00	45.00	3000.00	0.00	0.00	0.00	0.00	0.00	0.00

CIRCLE FAILURE SURFACE
RESULTS BY UNIVAC-1108
COMPUTER PROGRAM 741-VV-F424A
TANGENT TO ELEV 531.00
TRIAL ARCS

RADIUS OF CIRCLE	CENTER OF CIRCLE DISTANCE FROM ℄	CENTER OF CIRCLE ELEV	F.S. Q V=0.00	F.S. Q V=0.05	
102.00	74.00	633.00	1.63	1.24	CRITICAL FAILURE SURFACE
108.00	81.00	639.00	1.88		
98.00	83.00	629.00	1.63		
81.00	41.00	629.00	2.09		CRITICAL FAILURE SURFACE - TANGENT TO ELEVATION 548
68.00	49.00	591.00	2.22		CRITICAL FAILURE SURFACE - TANGENT TO ELEVATION 523
99.00	71.00	614.00	2.28		CRITICAL FAILURE SURFACE - TANGENT TO ELEVATION 515



NOTES
(1) ANALYSES WERE RUN ACCORDING TO EM 1110-2-1902 DATED APRIL 1970
(2) THE SIDE EARTH FORCE DIRECTION WAS TAKEN AS THE AVERAGE OF THE EMBANKMENT SLOPES IMMEDIATELY ADJACENT TO THE SLICE INTERFACE
(3) PSI=SEISMIC COEFFICIENT USED IN ANALYSES



MILAN, ILLINOIS LOCAL
CIRCLE SLOPE STABILITY ANALYSIS
END OF CONSTRUCTION CONDITION
RIVERSIDE SLOPE STATION 281+00 N
22 FEBRUARY 1977

PROJECT MILAN, ILLINOIS LOCAL Date 17 SEPTEMBER 1975

Computed by PHS & DHB Checked by _____

Revised 23-28 June 1976
Revised 7-10 February 1977
Revised 22 March 1977

SUMMARY UNDERSEEPAGE ANALYSIS DATA BERM ANALYSIS

Sheet 2 of 3

STATIONS		34+50N to 40+00N	40+00N to 196+00N	196+00N to 227+50N	227+50N to 249+50N	249+50N to 254+00N	254+00N to 260+50N	260+50N to 266+00N	266+00N to 272+50N	272+50N to 278+50N	278+50N to 286+00N	286+00N to 292+00N	292+00N to 297+50N	297+50N to 319+00N	319+00N to 327+00N	327+00N to 333+00N	333+00N to 350+00N		
LEVEE DESIGN GRADE		572		572	572	572		571.5	571.5	571.5	571	571	571	571	571	571	571		
ELEV. L.S. TOE or TAILWATER		562		551(n)	551(n)	551(n)		561.5(p)	564	563	558	560	562	559	564	558	562		
GROSS HEAD	H	10		21	21	21		10	7.5	8.5	13	11	9	12	7	13	9		
TRANS. PERVIOUS FOUNDATION	D	None		< 5	10	10		30	30	30	20	20	20	50	50	50	50		
TRANS. BLANKET THICKNESS L.S.	D_{bL}	8		5/7(x)	1/8(x)	None(o)		7	7	10	10(u)	12(w)	12	1	1	1	1		
TRANS. BLANKET THICKNESS R.S.	D_{bR}			6	4	None(o)		0	5	0	0	5	0	0	3	3	3		
NAT. BLANKET LENGTH L.S.	L_L			75(l)	90(l)			∞	2000	2000	∞	∞	∞	∞	∞	2500	2500		
NAT. BLANKET LENGTH R.S.	L_R			100(m)	100(m)			0	50	0	0	60	0	0	1000	2000	2000		
K_f/K_{bL} LANDSIDE	A			200	200			200	200	200	200	200	200	100	100	100	100		
K_f/K_{bR} RIVERSIDE	B			800	400			-	800	-	-	800	-	-	400	400	400		
$C_L = \sqrt{A \cdot D_{bL} \cdot D}$	C_L			71	45			205	205	245	200	219	219	71	71	71	71		
$C_R = \sqrt{B \cdot D_{bR} \cdot D}$	C_R			155	126			0	346	-	-	283	-	-	245	245	245		
$L_1 = C_R(t_R) \tan h\, L_R/C_R$	L_1			88	83			0	50	-	-	59	-	-	245	245	245		
$L_3 = 0.44D$	L_3			2	4			0	13	-	-	9	-	-	22	22	22		
L_2 = BASE WIDTH LEVEE	L_2	100		110	110	160		70	55	60	90	75	65	250	250	250	250		
$L_s = L_1 + L_2 + L_3$	L_s			200	197			70	118	60	90	143	65	250	517	517	517		
$L_e = C_L(t_L) \tan h\, L_L/C_L$	L_e			56	43			205	205	245	200	219	219	71	71	71	71		
$L_s + L_e$				256	240			275	323	305	290	362	284	321	588	588	588		
$\Delta H = H \cdot L_e/L_s + L_e$	ΔH			4.6	3.8			7.5	4.8	6.8	9.0	6.7	6.9	2.7	0.8	1.6	1.1		
$F.S. = 0.85\, D_{bL}/\Delta H$	F.S.			1.3	1.8			0.8	1.2	1.3	0.9	1.5	1.5	0.3	1.1	0.5	0.8		
PROBABLE CONTROL		None		None			x(t)	Berm(s)	None(t)	None(t)	Berm(s)		None(t)	None(z)	None (z)(t)	None(z)	None (z)(t)		
BERM WIDTH, $W_o = 10H - L_e$	W_o	(k)				60		30			40			-		-	-		
COMPUTED $t_o = \frac{\Delta H - \phi_{bL} \cdot D_{bL}}{\phi_{bL} + \phi_{bR}}$	t_o			0.4				2.3	0.5	0.7	2.1			1.4	0.2	0.7	0.3		
SELECTED t	t	(k)		None		EL. 558		3.0(q)	None(t)	None(t)	3.0(v)			None(y)	None	None	None		

Station of Typical Section 35+00N 46+00N 201+00N 238+00S 250+00N 264+00N 270+00N 277+00N 281+00N 289+00N 295+00N 306+00N 323+00N 329+00N 336+00N

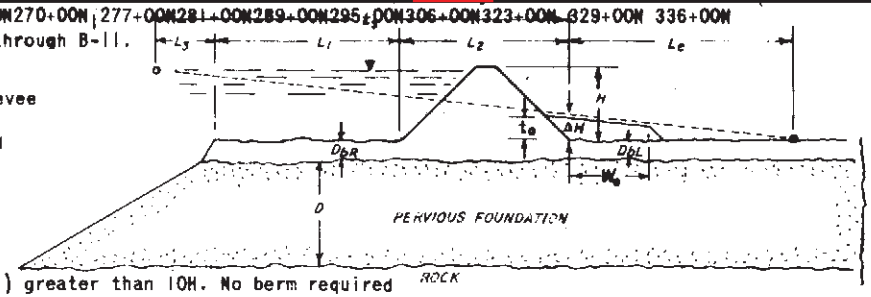
REMARKS:

Note: Typical sections shown on plates B-5 through B-11.

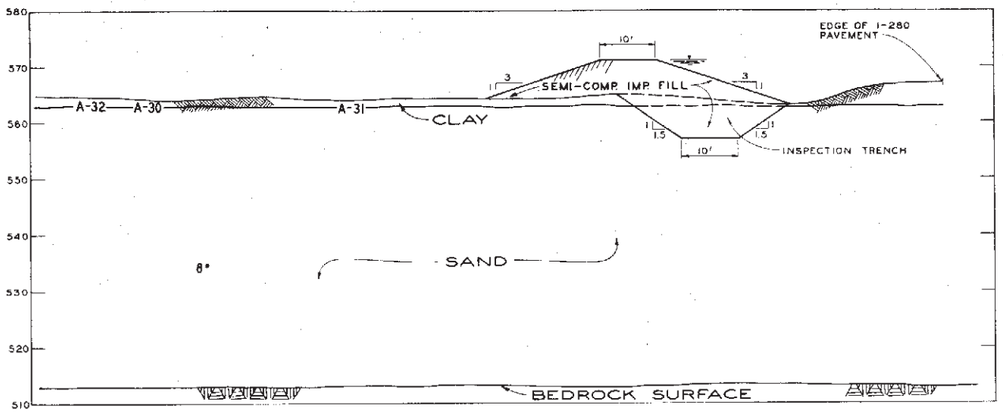
(k) Satisfactory by inspection
(l) I & M Canal assumed as exit
(m) Smith's Island borrow not permitted within 100 feet of riverside toe of levee
(n) I & M Canal water surface minimum ponding
(o) Soft clay in I & M Canal to be removed under levee and berm and backfilled with sand above water level
(p) Shoulder of Big Island road
(q) 24" toe drain will replace the required berm

(s) Alternate solution would be I-Wall with sheet piling
(t) No underseepage control required. Head less than 10 feet
(u) Depression fill with clay to elevation 558
(v) Extend road raise to sta. 279+50N. Road ramp to act as berm
(w) Depression fill with clay to elevation 560

(z) L2 (250') greater than 10H. No berm required
(x) Depression fill with sand to elevation 556
(y) Berm to EL. 564 in corner

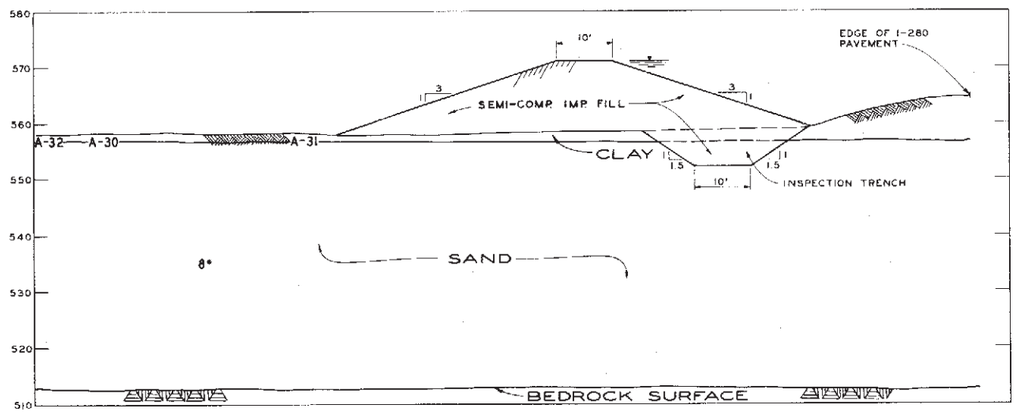


TRANSFORMED SOIL SECTION



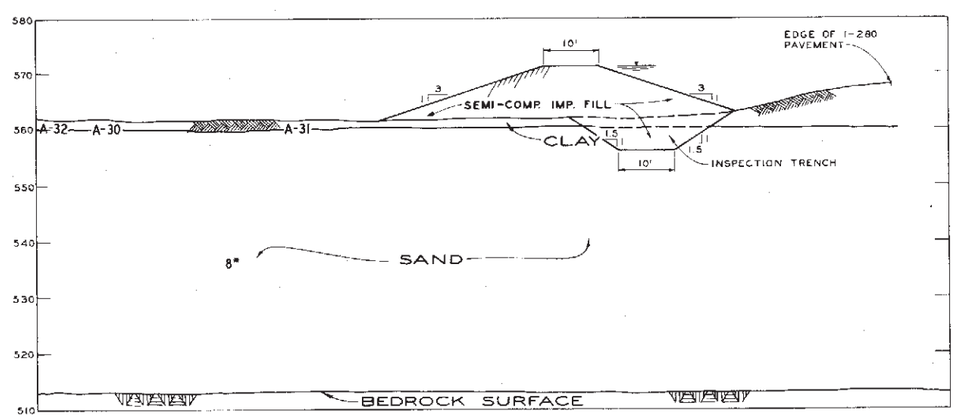
STA. 327+00N TO STA. 319+00N

(STA. 323+00N SHOWN)



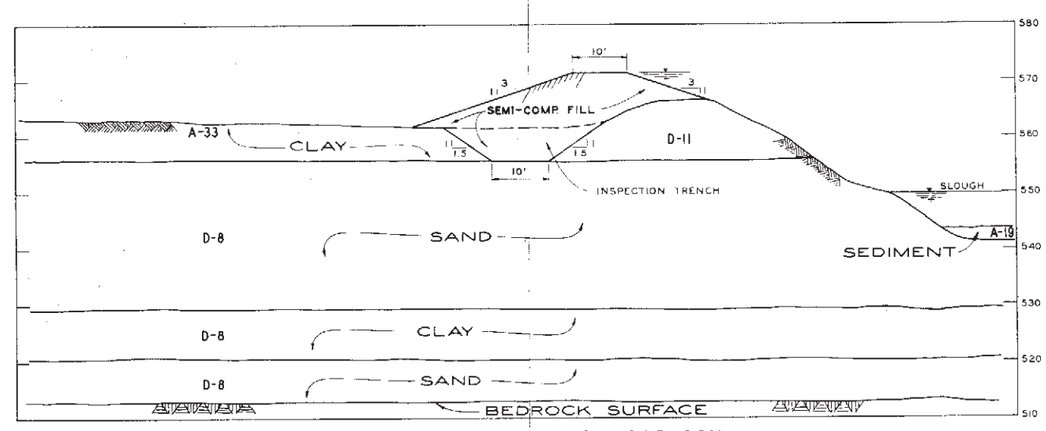
STA. 333+00N TO STA. 327+00N

(STA. 329+00N SHOWN)



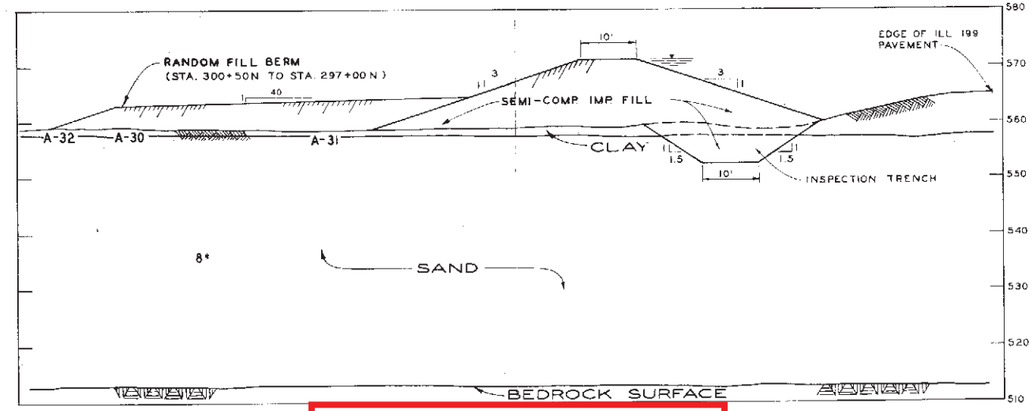
STA. 350+00N TO STA. 333+00N

(STA. 336+00N SHOWN)



STA. 297+50N TO STA. 292+00N

(STA. 295+00N SHOWN)



STA. 319+00N TO STA. 297+50N

(STA. 306+00N SHOWN)

* BORING BY STATE OF ILLINOIS AT INTERSECTION OF INTERSTATE 280 & ILL 199.

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
ROCK ISLAND, ILLINOIS

DRAWN BY:
TRACED BY:
CHECKED BY:
SUBMITTED
CHIEF, DESIGN BRANCH
APPROVED:
CHIEF, ENGINEERING DIVISION
DATE

ROCK RIVER
MILAN, ILLINOIS
LOCAL FLOOD PROTECTION

TYPICAL SECTIONS
STA. 350+00N TO STA. 292+00N

10 0 10 20 30
SCALE IN FEET

SHEET DRAWING NO
INVITATION NO DACW25 - - B -

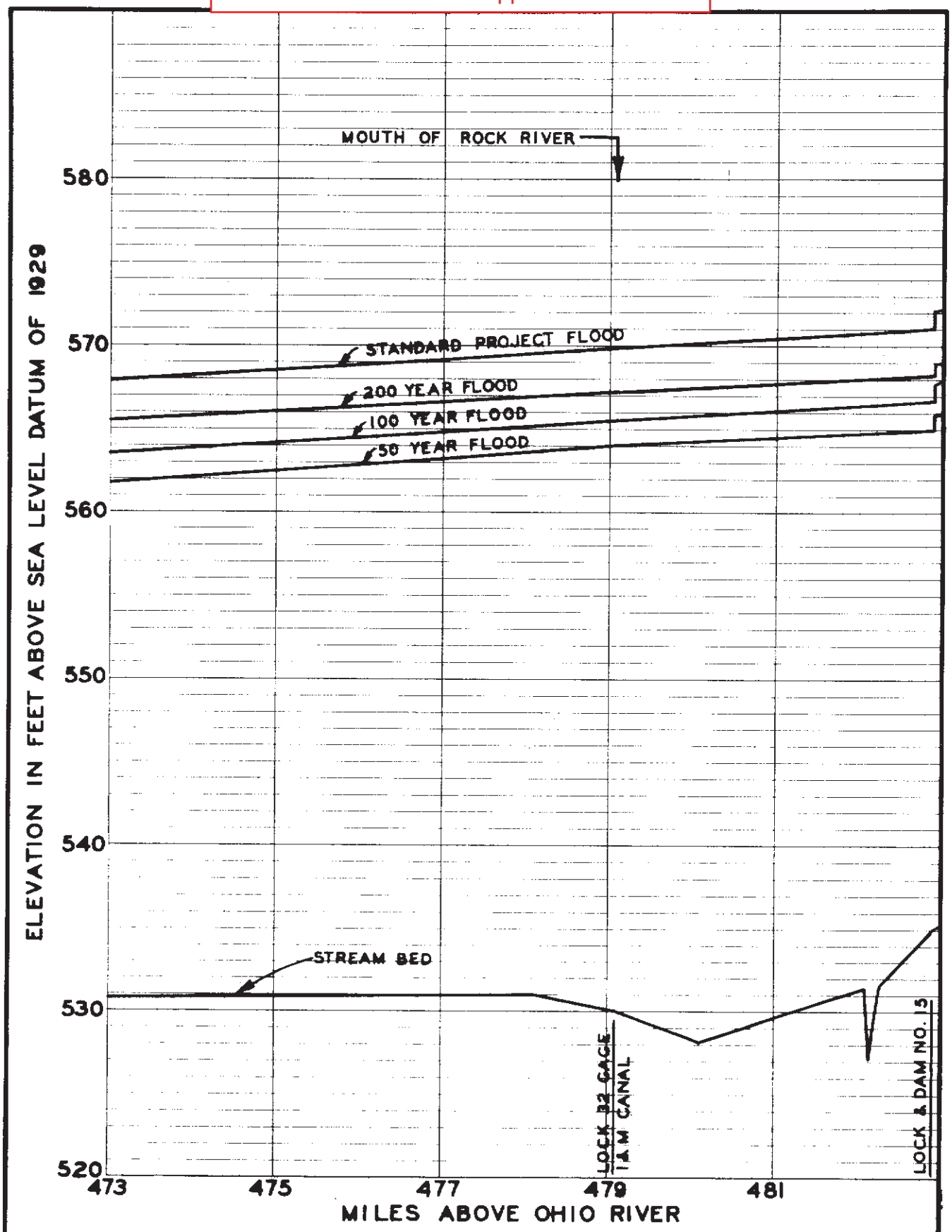
Proposed Modification Geotechnical Calculations

APPENDIX C-2

Hydrology & Hydraulics Analysis Data

Phase II GDM Water Surface Profiles

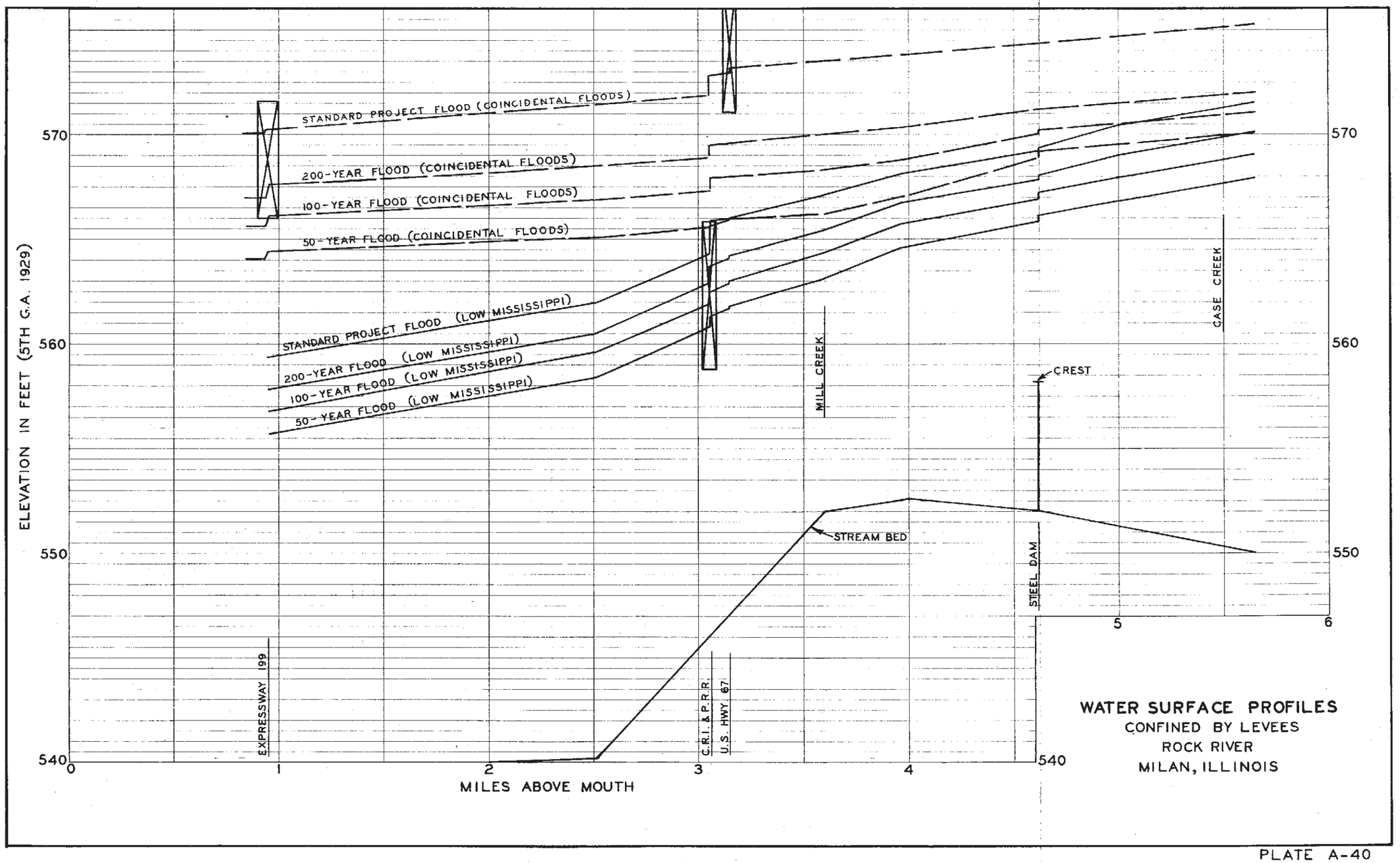
1978 Phase II GDM Mississippi River Profiles



WATER SURFACE PROFILES
MISSISSIPPI RIVER
MILE 473 TO MILE 483

PLATE A-39

1978 Phase II GDM Rock River Profiles

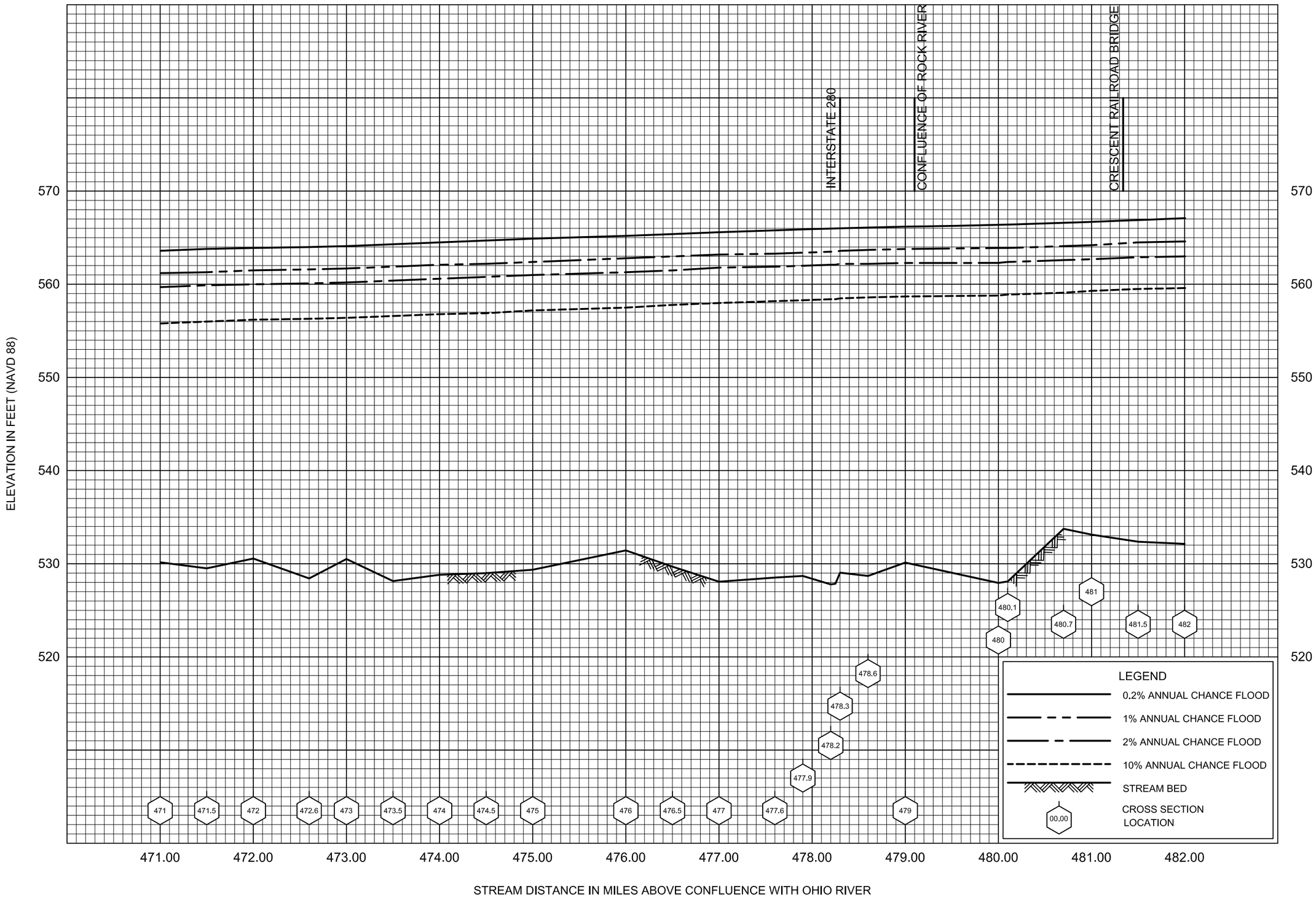


WATER SURFACE PROFILES
CONFINED BY LEVEES
ROCK RIVER
MILAN, ILLINOIS

PLATE A-40

2010 FIS Water Surface Profiles, Stage & Flows

2010 FIS Study Mississippi River Flood Profiles



FLOOD PROFILES

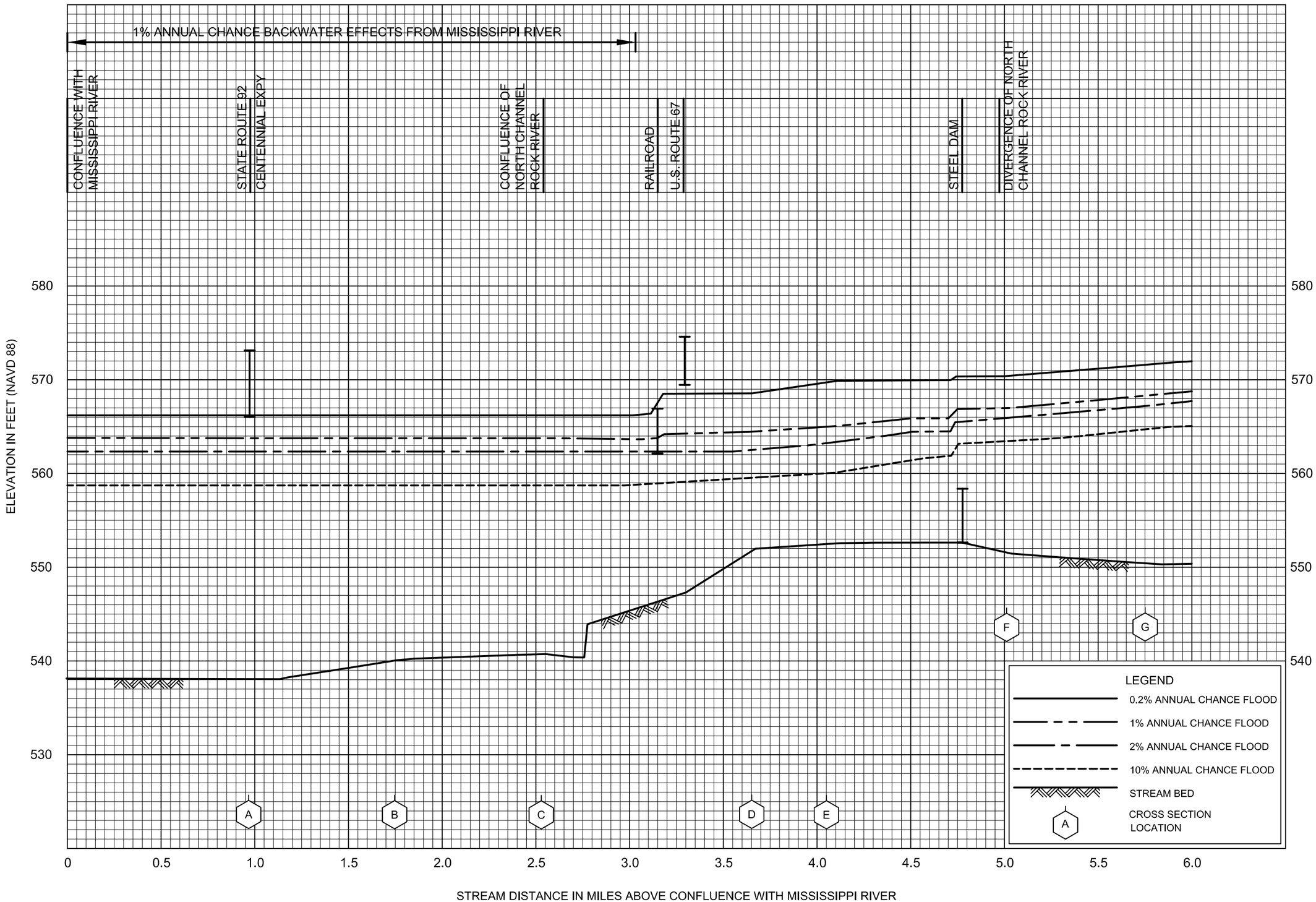
MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCK ISLAND COUNTY, IL

AND INCORPORATED AREAS

2010 FIS Study Rock River Profiles



FLOOD PROFILES

ROCK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCK ISLAND COUNTY, IL

AND INCORPORATED AREAS

2010 FIS Study Mississippi River Data

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET) WITHIN ILLINOIS	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH[2] (FEET) TOTAL	REGULATORY FROM UNET MODEL	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Mississippi River (Continued)									
473	473.0	2,788	N/A	N/A	3,959	561.7	N/A	N/A	N/A
473.5	473.5	3,091	N/A	N/A	4,298	561.9	N/A	N/A	N/A
474	474.0	3,647	N/A	N/A	4,910	562.1	N/A	N/A	N/A
474.5	474.5	4,199	N/A	N/A	4,909	562.2	N/A	N/A	N/A
475	475.0	4,775	N/A	N/A	5,658	562.4	N/A	N/A	N/A
476	476.0	5,157	N/A	N/A	6,520	562.8	N/A	N/A	N/A
476.5	476.5	5,610	N/A	N/A	7,492	563.0	N/A	N/A	N/A
477	477.0	7,257	N/A	N/A	9,248	563.2	N/A	N/A	N/A
477.6	477.6	7,295	N/A	N/A	8,714	563.3	N/A	N/A	N/A
477.9	477.9	7,047	N/A	N/A	8,070	563.4	N/A	N/A	N/A
478.2	478.2	6,232	N/A	N/A	7,452	563.5	N/A	N/A	N/A
478.3	478.3	6,430	N/A	N/A	7,726	563.6	N/A	N/A	N/A
478.6	478.6	6,003	N/A	N/A	8,150	563.7	N/A	N/A	N/A
479	479.0	4,910	N/A	N/A	7,633	563.8	N/A	N/A	N/A
480	480.0	3,209	N/A	N/A	7,470	563.9	N/A	N/A	N/A
480.1	480.1	873	N/A	N/A	4,688	563.9	N/A	N/A	N/A
480.7	480.7	1,435	N/A	N/A	3,251	564.1	N/A	N/A	N/A
481	481.0	1,171	N/A	N/A	2,426	564.2	N/A	N/A	N/A
481.5	481.5	1,237	N/A	N/A	2,375	564.5	N/A	N/A	N/A
482	482.0	1,247	N/A	N/A	2,267	564.6	N/A	N/A	N/A
482.1	482.1	1,089	N/A	N/A	2,094	564.6	N/A	N/A	N/A
482.3	482.3	975	N/A	N/A	2,030	564.7	N/A	N/A	N/A
482.7	482.7	1,721	N/A	N/A	2,850	564.9	N/A	N/A	N/A
482.9	482.9	357	N/A	N/A	1,479	565.6	N/A	N/A	N/A

[1]Miles above confluence with Ohio River
[2]Widths are reported as widths to state line and composite width from USACE floodway model
*Floodway Data Tables for the Mississippi River are a special case. See Flood Insurance Study text for full explanation.
N/A – Not applicable

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCK ISLAND COUNTY, IL AND INCORPORATED AREAS

FLOODWAY DATA

MISSISSIPPI RIVER*

2010 FIS Study Rock River Data

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
North Channel Rock River								
A	5,211[1]	490	4,833	6.5	564.7	564.7	564.8	0.1
B	7,017[1]	650	6,763	4.7	565.7	565.7	565.8	0.1
C	10,517[1]	550	6,198	5.1	566.6	566.6	566.7	0.1
Rock River								
A	0.98[2]	4,100[3]	15,720	4.8	563.8	559.4[5]	559.5	0.1
B	1.76[2]	3,360	28,071	2.7	563.8	561.1[5]	561.2	0.1
C	2.54[2]	1,730	18,636	4.1	563.8	562.1[5]	562.0	0.1
D	3.64[2]	1,100[4]	9,587	4.6	564.4	564.4	564.5	0.1
E	4.05[2]	1,050	7,769	5.7	564.8	564.8	564.9	0.1
F	5.01[2]	2,450	14,535	5.2	566.7	566.7	566.7	0.0
G	5.75[2]	1,620	17,295	4.4	567.9	567.9	568.0	0.1
H	6.32[2]	2,230	21,624	3.5	568.7	568.7	568.8	0.1
I	6.92[2]	1,600	17,815	4.3	569.5	569.5	569.6	0.1
J	7.51[2]	840	12,270	6.2	570.4	570.4	570.5	0.1
K	7.57[2]	840	12,367	6.1	570.5	570.5	570.5	0.0
L	7.77[2]	2,845	25,447	3.1	571.0	571.0	571.1	0.1
M	8.38[2]	2,620	26,291	2.9	571.7	571.7	571.8	0.1
N	8.82[2]	2,360	23,417	3.2	571.9	571.9	572.0	0.1
O	9.44[2]	2,830	28,000	2.7	572.3	572.3	572.4	0.1
P	10.02[2]	4,060	34,858	2.2	572.6	572.6	572.7	0.1
Q	10.84[2]	4,020	40,072	1.9	572.8	572.8	572.9	0.1
R	11.44[2]	4,490/3,550[6]	47,585	1.6	573.2	573.2	573.3	0.1

[1]Feet above confluence with Rock River
[2]Miles above confluence with Mississippi River
[3]Floodway width reflects model width, see FIRM panel for regulatory floodway
[4]Width includes high ground not included in floodway conveyance calculation
[5]Elevation computed without consideration of backwater effects from Mississippi River
[6]Total width/width within Rock Island County

TABLE 10

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROCK ISLAND COUNTY, IL AND INCORPORATED AREAS

FLOODWAY DATA

NORTH CHANNEL ROCK RIVER - ROCK RIVER

2004 UMRSFFS Water Surface Profiles, Stage & Flows

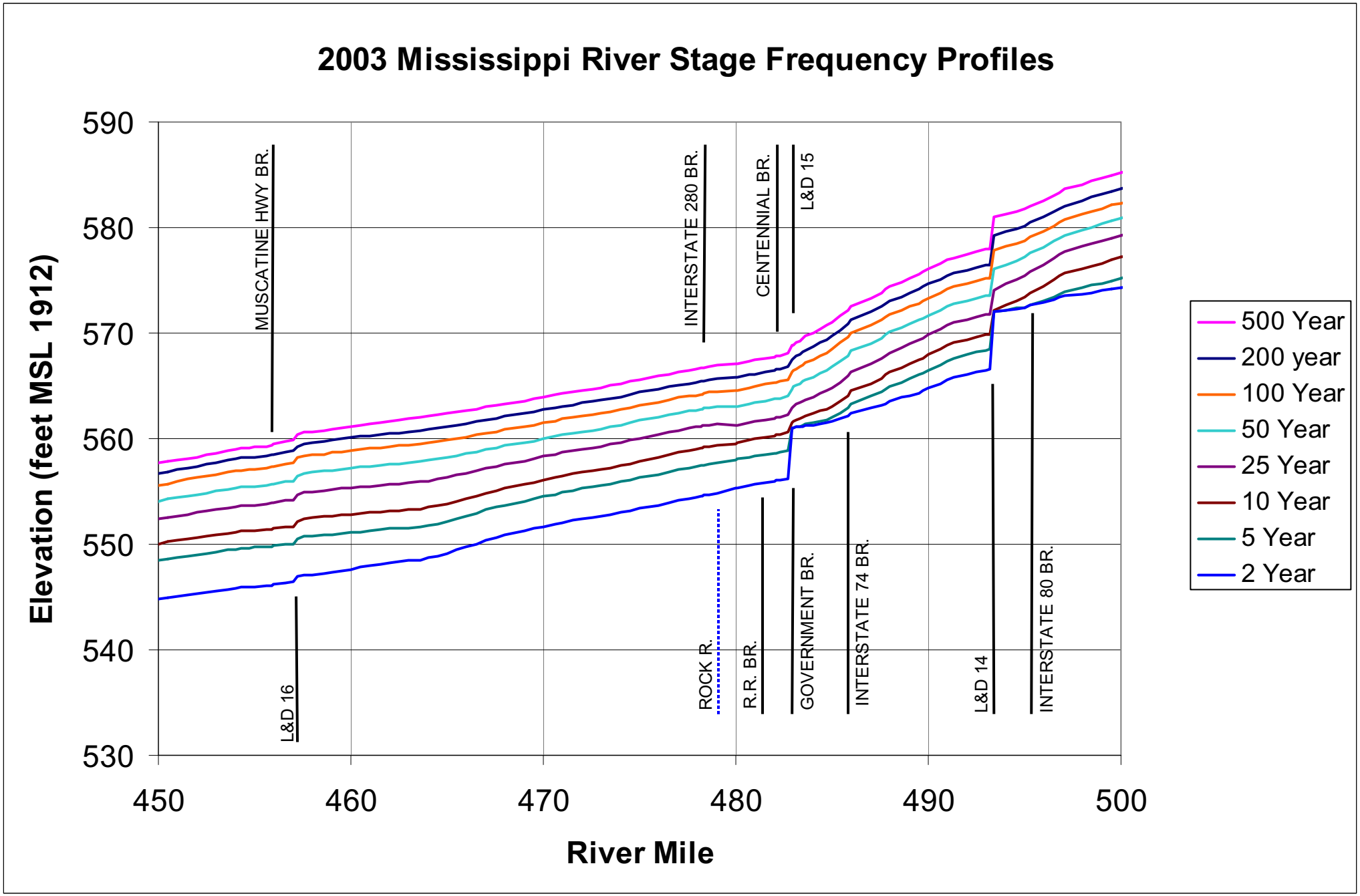

2003 Mississippi River Stage Frequency Profiles
Elevation (feet MSL 1912)
River Mile
590
580
570
560
550
540
530
450
460
470
480
490
500
MUSCATINE HWY BR.
INTERSTATE 280 BR.
CENTENNIAL BR.
L&D 15
L&D 16
ROCK R.
R.R. BR.
GOVERNMENT BR.
INTERSTATE 74 BR.
L&D 14
INTERSTATE 80 BR.
500 Year
200 year
100 Year
50 Year
25 Year
10 Year
5 Year
2 Year

Table C-M-6

2003 Mississippi River Stage and Flow Frequency Profiles (All elevations referenced to MSL 1912)

	Exceedance Probability															
River	**0.5**		**0.2**		**0.1**		**0.04**		**0.02**		**0.01**		**0.005**		**0.002**	
Mile	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**	**feet**	**cfs**
478.2	554.6	149,000	557.5	197,000	559.1	227,000	561.2	264,000	562.8	290,000	564.2	317,000	565.4	343,000	566.7	377,000
478.25	554.6	149,000	557.5	197,000	559.1	227,000	561.2	264,000	562.8	290,000	564.2	317,000	565.4	343,000	566.7	377,000
478.3	554.6	149,000	557.5	197,000	559.2	227,000	561.2	264,000	562.9	290,000	564.3	317,000	565.5	343,000	566.7	377,000
478.6	554.7	149,000	557.6	197,000	559.3	227,000	561.3	264,000	562.9	290,000	564.4	317,000	565.6	343,000	566.8	377,000
479	554.9	149,000	557.7	197,000	559.4	227,000	561.3	264,000	563.0	290,000	564.5	317,000	565.7	343,000	566.9	377,000
480	555.3	134,000	558.0	179,000	559.5	207,000	561.2	241,000	563.0	266,000	564.6	290,000	565.8	314,000	567.1	345,000
480.1	555.4	134,000	558.1	179,000	559.6	207,000	561.3	241,000	563.1	266,000	564.6	290,000	565.8	314,000	567.1	345,000
480.7	555.6	134,000	558.3	179,000	559.9	207,000	561.5	241,000	563.3	266,000	564.8	290,000	566.0	314,000	567.3	345,000
481	555.7	134,000	558.4	179,000	560.0	207,000	561.6	241,000	563.4	266,000	564.9	290,000	566.1	314,000	567.4	345,000
481.5	555.9	134,000	558.5	179,000	560.2	207,000	561.8	241,000	563.6	266,000	565.2	290,000	566.3	314,000	567.6	345,000
482	556.0	134,000	558.6	179,000	560.3	207,000	561.9	241,000	563.7	266,000	565.3	290,000	566.5	314,000	567.8	345,000
482.1	556.0	134,000	558.6	179,000	560.3	207,000	562.0	241,000	563.8	266,000	565.3	290,000	566.5	314,000	567.8	345,000
482.3	556.1	134,000	558.7	179,000	560.4	207,000	562.1	241,000	563.9	266,000	565.4	290,000	566.6	314,000	567.9	345,000
482.7	556.2	134,000	558.9	179,000	560.6	207,000	562.3	241,000	564.1	266,000	565.6	290,000	566.8	314,000	568.1	345,000
482.9	561.0	134,000	561.0	179,000	561.5	207,000	562.9	241,000	564.7	266,000	566.3	290,000	567.5	314,000	568.8	345,000
483	561.0	134,000	561.1	179,000	561.6	207,000	563.1	241,000	564.9	266,000	566.4	290,000	567.6	314,000	568.9	345,000
483.15	561.1	134,000	561.1	179,000	561.7	207,000	563.3	241,000	565.1	266,000	566.6	290,000	567.8	314,000	569.1	345,000
483.3	561.1	134,000	561.2	179,000	561.9	207,000	563.4	241,000	565.2	266,000	566.8	290,000	568.0	314,000	569.3	345,000
483.45	561.2	134,000	561.3	179,000	562.0	207,000	563.6	241,000	565.4	265,000	567.0	290,000	568.2	314,000	569.5	345,000
483.6	561.2	134,000	561.3	179,000	562.1	207,000	563.7	241,000	565.6	265,000	567.2	290,000	568.4	314,000	569.7	345,000
484	561.3	134,000	561.5	179,000	562.3	207,000	564.0	241,000	565.9	265,000	567.5	290,000	568.7	314,000	570.0	345,000
484.4	561.5	134,000	561.7	179,000	562.6	207,000	564.3	241,000	566.2	265,000	567.9	290,000	569.1	314,000	570.4	345,000
484.7	561.5	134,000	561.8	179,000	562.8	207,000	564.5	241,000	566.5	265,000	568.1	290,000	569.4	313,000	570.7	345,000
485	561.7	134,000	562.0	179,000	563.1	207,000	564.9	241,000	566.8	265,000	568.5	290,000	569.8	313,000	571.0	345,000
485.4	561.9	134,000	562.5	179,000	563.6	207,000	565.3	241,000	567.4	265,000	569.1	290,000	570.3	313,000	571.6	345,000
485.8	562.2	134,000	562.9	179,000	564.1	207,000	565.9	241,000	567.9	265,000	569.6	290,000	570.9	313,000	572.2	345,000
486	562.4	134,000	563.3	179,000	564.5	207,000	566.3	241,000	568.3	265,000	570.0	290,000	571.3	313,000	572.6	345,000
487	562.9	134,000	564.0	179,000	565.2	207,000	567.1	241,000	569.0	265,000	570.7	290,000	572.0	313,000	573.3	345,000
487.6	563.2	134,000	564.5	179,000	565.7	207,000	567.6	241,000	569.5	265,000	571.2	290,000	572.5	313,000	573.9	345,000
487.8	563.3	134,000	564.7	179,000	566.0	207,000	567.9	241,000	569.8	265,000	571.5	290,000	572.8	313,000	574.2	345,000
488	563.5	134,000	564.9	178,000	566.3	206,000	568.2	241,000	570.1	265,000	571.7	289,000	573.0	313,000	574.4	344,000
488.6	563.9	134,000	565.4	178,000	566.7	206,000	568.6	241,000	570.5	265,000	572.1	289,000	573.4	313,000	574.8	344,000
489	564.1	134,000	565.7	178,000	567.1	206,000	569.0	241,000	570.9	265,000	572.5	289,000	573.8	313,000	575.2	344,000
489.5	564.4	134,000	566.0	178,000	567.4	206,000	569.3	241,000	571.2	265,000	572.8	289,000	574.1	313,000	575.6	344,000
489.75	564.6	134,000	566.3	178,000	567.7	206,000	569.6	241,000	571.4	265,000	573.1	289,000	574.4	313,000	575.8	344,000
490	564.8	134,000	566.5	178,000	567.9	206,000	569.8	241,000	571.7	265,000	573.3	289,000	574.6	313,000	576.1	344,000
490.6	565.2	134,000	567.0	178,000	568.4	206,000	570.3	241,000	572.2	265,000	573.8	289,000	575.1	313,000	576.6	344,000
491	565.5	134,000	567.3	178,000	568.8	206,000	570.7	241,000	572.5	265,000	574.1	289,000	575.4	313,000	576.9	344,000

APPENDIX C-3

Storm Water/Underseepage Analysis

1.0 EXISTING CONDITIONS AND REVIEW OF ORIGINAL LEVEE DESIGN

The proposed Phase 1/North Development Area is located east of IL 92 and north of 56th Avenue West, near the I-280 and IL 92 interchange and is protected by the Milan-Big Island Flood Protection Project. The proposed development is shown on Exhibit C-3-1. Documents that describe the original levee design and existing condition of the levee, which were reviewed for this analysis, are listed below:

- *US Army Corp of Engineers, Rock Island District. Local Flood Protection, Rock River, Milan, Illinois, Phase II General Design Memorandum (Phase II GDM), Volume 1 of 2 dated July 1977 and revised April 1978.*
- *US Army Corp of Engineers, Rock Island District. Local Flood Protection, Rock River, Milan, Illinois, Phase II General Design Memorandum (Phase II GDM), Volume 2 of 2 Appendices dated July 1977 and revised April 1978.*
- *US Army Corp of Engineers, Rock Island District. Local Flood Protection, Rock River, Milan, Illinois, Phase II General Design Memorandum Supplement No. 1Interior Drainage Facilities (Phase II GDM Supp. 1 Interior Drainage Facilities), dated February 1982.*
- *Rock River, Milan, Illinois, Local Flood Protection, Stage III-C As-Built Drawings, August 26, 1986*
- *US Army Corps of Engineers, Rock Island District. Local Flood Protection, Rock River, Milan, Illinois, Manual for Operation and Maintenance, dated October 1989*
- *Flood Damage Reduction System Inspection Report, Village of Milan, Illinois and Big Island River Conservancy District, January 31, 2008*

1.1 INTERIOR DRAINAGE

The design of the interior drainage facilities for the development area as contained in the *Phase II GDM Supp. 1 Interior Drainage Facilities* for the original project is summarized below.

The Phase 1/North Development Area consists of parts of three interior drainage areas that were identified as Big Island Areas 2, 3 and 5 (See the attached Exhibit C-3-2, Plate A-1 Interior Drainage Study Area Plan). Most of the development area is within Big Island Areas 2 and 3 which is tributary to a 48-inch culvert that crosses the levee at Station 317+00N. A gatewell was constructed at this location along with Ponding Area B-1 (See location on Exhibit C-3-1). This gatewell was originally designated as Gatewell A and has since been given a new designation of Gatewell 30. During dry weather when the river water level is below the elevation of the 48-inch culvert, stormwater runoff flows by gravity through the culvert to the drainage system for the I-280 - IL 92 interchange. However when the river level raises above the culvert elevation, the sluice gate in Gatewell 30 is closed and any stormwater runoff as well as any seepage under the

levee is collected in the ponding area. If Ponding Area B-1 fills and the gate is still closed, portable pumps are used to drain the area into Gatewell 30. Ponding Area B-1 has a surface area of approximately two acres and a bottom elevation of 556.5 feet. Note all elevations in this report are in the NGVD 29 Datum. The zero damage elevation at this location was identified as 559.5 feet, which results in a pond water depth of three feet and a storage volume of approximately six acre-feet.

A small portion (less than one acre) of the Phase 1/North Development Area is located in Big Island Area 5, which flows to the east and is ultimately tributary to the West Milan Pumping Station.

1.2 SOIL ANALYSIS

An analysis of the geology and soils that was prepared for the design of the levee is included in Appendix B- Geology and Soils, which is part of *Phase II GDM Volume 2 of 2 Appendices*. The following is a summary of the soils and the recommended underseepage control measures for sections of the levee that are adjacent to the development area.

Station 292+00N to Station 297+50N (East of Highway 199, IL 92): The 20-foot natural sand aquifer and landside blanket thickness of 6 feet are sufficient to control underseepage for a head of 9 feet. No underseepage control is required with head less than 10 feet.

Station 297+50N to Station 319+00N (Along East Side of Highway 199, IL 92): A berm is wrapped around the corner to protect against three-dimensional seepage. The 50-foot natural sand aquifer and landside blanket thickness of 1 foot requires a 3-foot thick, 45-foot wide sand berm to control underseepage for a head of 12 feet. Since the base width appears to be greater than 10H, the berm for the remaining reach will be deleted. The seepage entrance is the sandpit on the west side of Highway 199. Ponding is located in this reach.

A key soils parameter used in calculating levee underseepage is the coefficient of permeability, k. As explained in the *GDM* Appendix B Geology and Soils, the coefficient of permeability was determined by reviewing the effective grain size (D_{10}) of the soil samples taken for the project and using reference material that related the coefficient of permeability to the effective grain size for Mississippi River Valley Sands. This comparison was presented in *GDM* Plate B-12 (Exhibit C-3-3), which is attached for reference and information, resulted in a weighted average coefficient of permeability for the project aquifer of 1200×10^{-4} cm/sec (0.24 ft/min).

Four additional soil borings were taken for this project on June 19, 2012 and the results were included in a report as prepared by Team Services, dated July 5, 2012, which is attached (Exhibit C-3-4). The borings identified as B-2 and B-3 were taken adjacent to the levee in the Phase 1/North Development Area. Boring B-2 is located near the proposed entrance to the development at approximate Levee Station 301+00N and Boring

B-3 is located near the south end of Ponding Area B-1 and the 48-inch culvert at approximately Levee Station 317+00N. Boring B-2 was indicated to have a blanket layer at the surface consisting of silty sand with a thickness of one foot, and Boring B-3 had a blanket layer of 3.5 feet consisting of silty sand and sandy lean clay. By comparison the *Phase II GDM* assumed a blanket thickness of one foot.

The following is a summary of the effective grain sizes (D_{10}) and coefficients of permeability as discussed in the above paragraphs. The design value for the coefficient of permeability of 0.24 ft/min is within the range of values estimated from the two borings that were taken in the Phase 1/North Development Area and it is recommended that it be used in the calculation of levee underseepage as present in the next section.

Item	Effective Grain Size (D_{10})	Coefficient of Permeability (k)	
	mm	cm/sec	ft/min
Levee Design Values	0.22	$1{,}200 \times 10^{-4}$	0.24
Average of Mississippi River Valley Sands	0.25	$1{,}500 \times 10^{-4}$	0.30
Boring B-2 @ 1.5' Depth	0.168	650×10^{-4}	0.13
Boring B-2 @ 6.5' Depth	0.24	$1{,}400 \times 10^{-4}$	0.28
Boring B-3 @18.5' Depth	0.576	$4{,}000 \times 10^{-4}$	0.79

1.3 UNDERSEEPAGE

Seepage beneath the levee was calculated as part of the *Phase II GDM* Appendix B Geology and Soils using the formula:

$$Q = (k_f \times D/(Ls + Le)) \times H \times 7.5$$

Where;

- R is the length of reach in feet
- k_f is the permeability of the pervious substratum in feet/minute
- D is transformed depth of the pervious substratum in feet
- Ls + Le is the total length of seepage path in feet
- H is the average head in feet throughout the reach
- Q is the seepage in gallons/minute/foot of reach of reach
- Qr is the total seepage in gallons/minute/reach of levee in feet
- Q/H is the total seepage in gpm/foot head/100 feet

A summary of the calculated underseepage for sections of the levee adjacent to the development area is presented in Table C-3-1. For each reach of levee, the seepage beneath the levee was computed using a flood stage equal to the design levee grade and estimated values of D, k_f, L_s, and L_e. The levee adjacent to the Phase 1/North Development

area has a total length of 2,700 feet and a calculated total underseepage of 7,150 gallons per minute (gpm) (15.9 cfs).

The methodology used to calculate levee underseepage in the *Phase II GDM* is also one of the methodologies as described in *ETL 1110-2-569, Design Guidance for Levee Underseepage,* dated May 1, 2005, and *EM 1110-2-1913, Design and Construction of Levees,* dated April 30, 2000, and thus is considered a valid approach to calculating levee underseepage.

For evaluation of pump station alternatives, levee underseepage was also calculated using the methodology described above, but with the assumption that the flood water is at the Design Flood Elevation of 568.2 feet, not at the top of levee at 571.2 feet as used in the original calculations. The revised calculations are presented in Table C-3-2 and resulted in a total underseepage of 5,310 gpm (11.8 cfs).

The original design included a ditch along the landside toe of the levee to collect the underseepage and direct it to the ponding area. No changes are proposed to this system of collecting the levee underseepage.

1.4 HISTORY OF FLOODING AND INTERIOR DRAINAGE PUMPING

Historic flood profiles for Pool 16 on the Mississippi River, which includes the confluence with the Rock River is presented on the attached Exhibit C-3-5, Mississippi River Historic Flood Profiles (Pool 16). The exhibit indicates that floods that occurred during the years 1993, 1965 and 2001 resulted in the highest flood elevations of between 563 and 564. The project site is near the Rock River approximately one mile from the confluence with the Mississippi River, just upstream of the IL 92 Bridge and thus water levels at the project site would be slightly higher than at the confluence of the two rivers. Maximum flood elevations occur when there are coincidental floods of the two rivers. By comparison the Design Flood Profile for the levee adjacent to the development area is 568.2 and the Design Levee Grade is 571.2.

Information on the use of portable pumps for interior drainage as provided by the Big Island River Conservancy District (BIRCD) is attached (Exhibit C-3-6). The information is not all inclusive, but it does indicate that at the West Ponding Area, which is understood to be pumping from Ponding Area B-1 into Gatewell 30, pumping occurred during the period of June 12, 2008 to July 7, 2008 using a diesel fueled tractor powered 12-inch pump as manufactured by Crisafulli and during the period March 27, 2011 to May 16, 2011 using a diesel fueled 8-inch pump as manufactured by Godwin. Pump capacities were not provided, but the capacity for an 8-inch pump was estimated to be approximately 2,200 gpm (4.9 cfs) and the capacity of a 12-inch pump was estimated to be 4,900 gpm (11 cfs). By comparison the *Phase II GDM* recommended that during blocked gravity drainage conditions, portable pumping should be provided with a capacity of 8,700 gpm (19.38 cfs). The *Phase II GDM* also indicated that the gatewell closure elevation should be 566 feet and that the gatewell would be closed 0.5% of the time.

For the pumping periods that occurred during 2008 and 2011 river water levels and precipitation data were reviewed and a summary is presented in Table C-3-3. Overall review of the data indicates that the pumping that has been experienced is within the parameters anticipated in the original design of the levee.

2.0 PROPOSED CONDITIONS

The proposed conceptual development is summarized below:
Phase 1/North Development Area

- 3,500 square feet (SF) convenience store
- 4,000 SF fast food
- 10,000 SF service/retail strip

Surface Type	Phase 1/North Development Area (acres)
Landscaped/Grass	10.8
Stormwater Basins	2.0
Impervious Surfaces (roof tops and pavement)	3.8
Total	16.6

For stormwater calculations, it was assumed that the site will be graded such that all of the drainage will be tributary to the 48-inch culvert.

3.0 STORMWATER RUNOFF ANALYSIS

A stormwater runoff analysis was performed for the proposed conceptual development to determine stormwater release rates and detention storage volumes based on the *City of Rock Island Regulations, Appendix D Storm Water Control* dated December 2007. Stormwater runoff was calculated for the existing pre-project conditions and for the post-project conditions to determine stormwater release rates and to identify the difference in the stormwater runoff as needed to calculate stormwater detention volumes.

The area tributary to the existing 48-inch culvert located at Station 317+00N includes the Phase 1/North Development Area and areas beyond the development area that as noted above are part of what was identified in the *GDM* as Big Island Areas 2 & 3. A summary of the areas by surface types along with runoff coefficients for both the pre-project and post-project conditions is presented in Table C-3-4. As calculated in Table C-3-4, the

proposed development will increase the composite runoff coefficient from 0.26 to 0.36 which will result in increased stormwater runoff.

Stormwater runoff for the pre-project and post-project conditions for the three rain events as defined in the stormwater ordinance are presented in Table C-3-5. The design stormwater release rate based on the pre-project runoff during a 100-year, 24-hour event is 3.76 cfs. In reality, the pre-project and post-project release rate would be higher because levee underseepage contributes to the same basin as stormwater runoff. The release rate from the basin will need to accommodate levee underseepage in addition to stormwater runoff.
The difference between the pre-project release rate of 3.76 cfs and runoff for the post-project conditions with no stormwater detention of 5.18 cfs, is the calculated runoff difference of 1.42 cfs.

Two methods were used to calculate stormwater detention volumes. The first method uses the calculated runoff difference of 1.42 cfs over the rain event duration of 24 hours to calculate a volume of 2.8 acre-feet. The other method, which is included in the *IDOT Drainage Manual*, is referred to the as the Modified Rational Method. This method calculates the runoff difference and the corresponding storage volume for a series of storm durations. The resulting storage volumes were reviewed and the maximum value was selected. This method is presented in Table C-3-6 and resulted in a storage volume of 6.0 acre-feet, based on a 100-year, 6-hour rain event. Given the small size of this drainage basin, the use of the Modified Rational Method which accounts for shorter duration storm events is recommended for design purposes.

It is recommended that the existing drainage pattern which consists of stormwater runoff and levee underseepage flowing into Ponding Area B-1 be maintained for the proposed development. The volume of the existing ponding area is approximately the same as the calculated stormwater detention volume.

4.0 DESIGN DISCHARGE AND STORAGE VOLUMES

The design discharge for water leaving the site is a combination of stormwater runoff and levee underseepage. Stormwater runoff was calculated to be 1,690 gpm (3.76 cfs). The stormwater detention storage volume of 6.0 acre-feet was based on restricting the stormwater runoff to pre-project conditions during a 100 year, 24 hour storm event. Levee underseepage was estimated based on two conditions. If flood water is at the Design Flood Elevation of 568.2 levee underseepage was estimated to be 5,310 gpm (11.8 cfs), if the flood water raises to the Design Levee Grade of 571.2 (i.e. to the top of the levee) the estimated levee underseepage increases to 7,150 gpm (15.9 cfs). Three options were considered for the design discharge as described below:

- Option 1 assumes that flood water is at the Design Flood Elevation, such that the levee underseepage is 5,310 gpm (11.8 cfs) and any stormwater runoff is being temporarily stored in the detention basin and not discharged from the site. This results in a design discharge of 5,310 gpm (11.8 cfs).

- Option 2 assumes that flood water is at the Design Levee Grade (i.e. at the top of the levee); such that the levee underseepage is 7,150 gpm (15.9 cfs) and any stormwater runoff is temporarily being stored in the detention basin and not discharged from the site. This results in a design discharge of 7,150 gpm (15.9 cfs).
- Option 3 assumes that flood water is at the Design Levee Grade (i.e. at the top of the levee), such that the levee underseepage is 7,150 gpm (15.9 cfs) and that stormwater is also being discharged at the design release rate of 1,690 gpm (3.8 cfs), which corresponds to the runoff from the pre-project conditions and 100 year 24 hour storm event. This results in a design discharge of 8,840 gpm (19.7 cfs).

5.0 STORMWATER PUMPING

During flood stage conditions when the sluice gate in Gatewell 30 is closed, stormwater and levee underseepage is drained by using portable pumps to pump water from the ponding area into the top of Gatewell 30. To accommodate the use of portable pumps, a gravel pad and a gravel access lane to the pad were provided in the original design of the levee. Pumping is expected to be required only 0.5% of the time. The recommended capacity of the portable pumps is a design discharge of 8,840 gpm (19.7 cfs). Concrete paving of the access road and pad for the portable pump and tractor will be accomplished to allow pumping during inclement weather conditions.

6.0 STORMWATER DETENTION BASIN

The recommended stormwater detention volume of 6.0 acre-feet approximately matches the volume of the existing Ponding Area B-1, and thus the existing ponding area could be used essentially as it is today.

Table C-3-1

Summary of Levee Underseepage Calculations for Phase 1/North Development Area (w/ Floodwater at Design Levee Grade)

Levee Reach	R	k_f	D	$L_s + L_e$	H	Q	Q_r	Q/H
	(Length of Reach)	(permeability of the pervious substratum)	(transformed depth of the pervious substratum)	(total length of seepage path in feet)	(average head throughout the reach)	(seepage in gallons/minute/foot of reach)	(total seepage for the reach of levee)	(total seepage in gpm/foot head/100 feet reach of levee))
	(feet)	(feet/minute)	(feet)	(feet)	(feet)	(gpm/ft)	(gpm)	(gpm/foot head/100 feet)
292N to 297+50N (East of IL-92)	550	0.24	20	275±	9	1.2	650	0.7
297+50N to 319N (Along East Side of IL-92)	2,150	0.24	50	357	12	3.0	6,500	5.4
Total	**2,700**						**7,150**	

Table C-3-2

Summary of GDM Levee Underseepage Calculations for Phase 1/North Development Area (w/Floodwater at Design Flood Elevation)

Levee Reach	R	k_f	D	$L_s + L_e$	H	Q	Q_r
	(Length of Reach)	(permeability of the pervious substratum)	(transformed depth of the pervious substratum)	(total length of seepage path in feet)	(average head throughout the reach)	(seepage in gallons/minute/foot of reach)	(total seepage for the reach of levee)
	(feet)	(feet/minute)	(feet)	(feet)	(feet)	(gpm/ft)	(gpm)
292N to 297+50N (East of IL-92)	550	0.24	20	275	6	0.8	432
297+50N to 319N (Along East Side of IL-92)	2,150	0.24	50	357	9	2.3	4,878
Total	**2,700**						**5,310**

Table C-3-3
Summary of River Levels and Precipitation During for 2008 & 2011 Pumping Periods at the West Ponding Area (B-1)

Year	Approximate Date Pumping Started	Approximate Date Pumping Stopped	Number of Days	Type of Pump	Estimated Pump Capacity	Mississippi River Level at Confluence with Rock River						Precipitation During Pumping Period	Design Gatewell Closing Elevation	Average Elevation at Landside Toe of Levee
						Pumping Period			Annual					
					cfs	Minimum	Maximum	Average	Minimum	Maximum	Average	inches		
2008	6/12/2008	7/18/2008	35	12" Crisafulli	11	549.89	562.84	555.37	546.17	562.84	550.10	7.56	556	559.2
2011	3/27/2011	5/16/2011	49	8" Godwin	5	554.70	561.88	557.91	554.70	561.88	550.84	5.86	556	559.2

Table C-3-4
Summary of Areas Tributary to 48-inch Culvert

Surface Type		Area (acres)	C, Runoff Coefficient
Pre-Project Conditions:			
	Undeveloped (1)	16.4	0.20
	Rural Housing (2)	29.9	0.30
	Total Area	46.3	
	Composite Runoff Coefficient		0.26
Post-Project Conditions			
	Undeveloped	0	0.20
	Rural Housing (2)	29.9	0.30
	Stormwater Basins (Ponding Area B-1)	2.0	0.90
	Landscaped/Grass	10.8	0.25
	Impervious Surfaces	3.8	0.90
	Total Area	46.5	
	Composite Runoff Coefficient		0.36

Notes:

(1) Undeveloped areas include 10.7 acres in Big Island Area 2 and 5.7 acres in Big Island Area 3.

(2) Rural Housing includes 7.2 acres in Big Island Area 2 and 22.7 acres in Big Island Area 3.

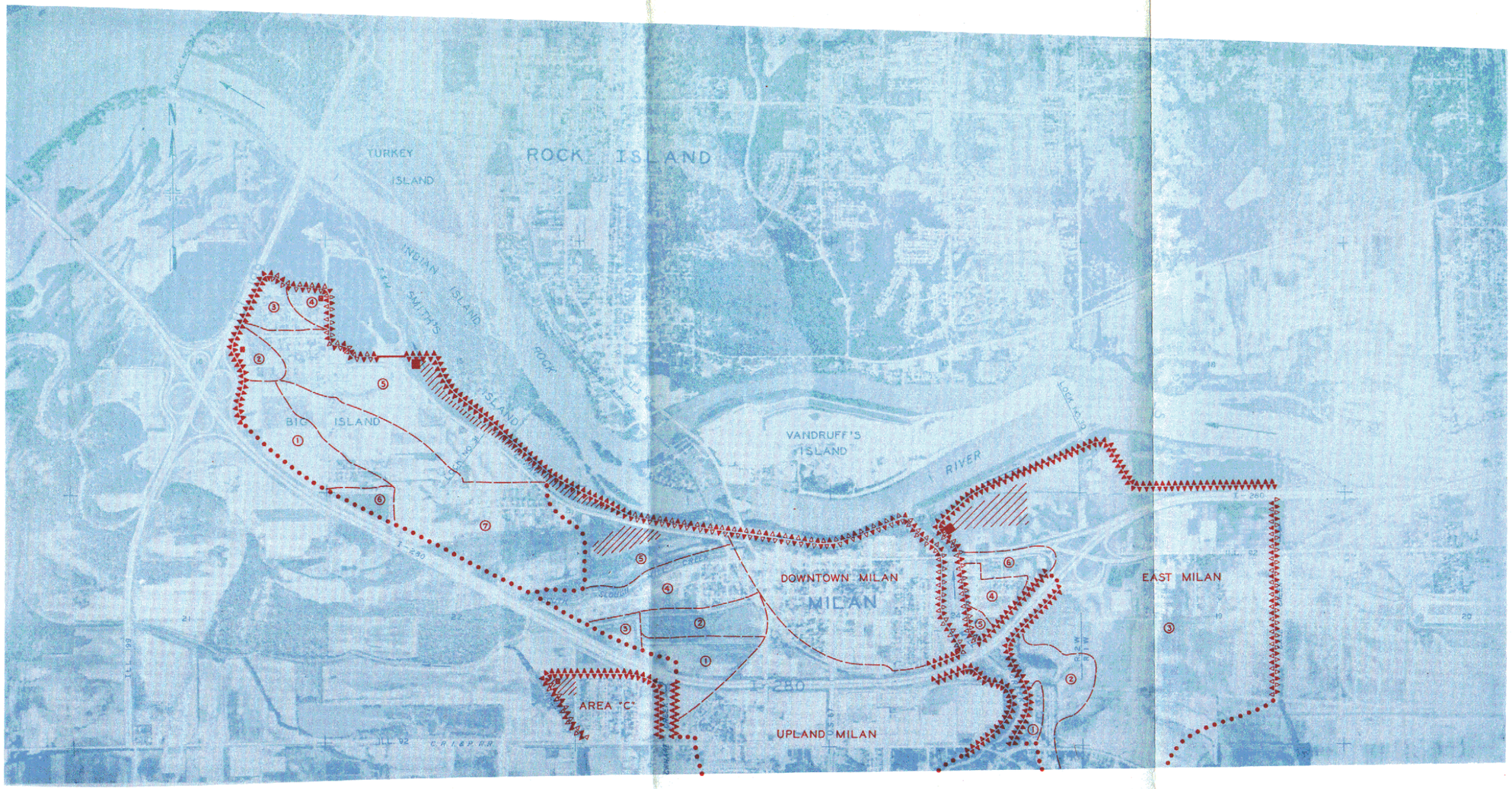
Table C-3-5
Summary of Stormwater Runoff Tributary to the 48-inch Culvert

Rain Event	Total Rain	Average Rainfall Intensity	Pre-Project Runoff, Q=CIA	Post-Project Runoff with no Detention, Q=CIA
	(inches)	(inches/hour)	(cfs)	(cfs)
2-year, 24-hour	3.11	0.13	1.59	2.19
10-year, 24-hour	4.63	0.19	2.36	3.26
100-year, 24-hour	7.36	0.31	3.76	5.18

Table C-3-6
Phase 1/North Development Area Stormwater Detention Storage
Modified Rational Method

	Runoff Coefficient, C	Storm Duration, T	Rain, 100-yr	Intensity I	Area A	Inflow Rate Qi	Release Rate Qo	Storage Rate (Qi-Qo)	Storage, (Qi-Qo)T x 60	
		(min)	(inches)	(in/hr)	(acres)	(cfs)	(cfs)	(cfs)	(cu. ft.)	(acre-feet)
1	0.36	5	0.89	10.68	46.5	178.78	3.76	175.02	52,507	1.2
2	0.36	15	1.99	7.96	46.5	133.25	3.76	129.49	116,541	2.7
3	0.36	30	2.77	5.54	46.5	92.74	3.76	88.98	160,163	3.7
4	0.36	60	3.51	3.51	46.5	58.76	3.76	55.00	197,991	4.5
5	0.36	120	4.47	2.24	46.5	37.41	3.76	33.65	242,308	5.6
6	0.36	360	5.69	0.95	46.5	15.88	3.76	12.12	**261,686**	**6.0**
7	0.36	720	6.51	0.54	46.5	9.08	3.76	5.32	229,887	5.3
8	0.36	1080	6.92	0.38	46.5	6.44	3.76	2.68	173,379	4.0
9	0.36	1440	7.36	0.31	46.5	5.13	3.76	1.37	118,679	2.7

Exhibit C-3-1: Phase 1/North Develpoment Area
Proposed Drainage Facilities
Milan Big Island Levee Centerline
Development Area
0
250
500
1,000 ft
Map Projection: NAD83 Illinois State Plane West (ft)
N
Rte 92
I-280
24"
Gatewell 29
Proposed Entrance and Levee Modification
Phase 1/North Development Area
Ponding Area B-1
48"
Gatewell 30
Proposed Concrete Pavement for Portable Pumping Pad and Access Road
56th Avenue West



LEGEND:

- IMPROVED LEVEE
- NEW LEVEE
- FLOODWALL
- PROPOSED PONDING AREA
- PROPOSED PUMPING STATION
- STUDY BOUNDARY
- DRAINAGE AREA
- DRAINAGE AREA NUMBER
- PORTABLE PUMP FACILITIES

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
ROCK ISLAND, ILLINOIS

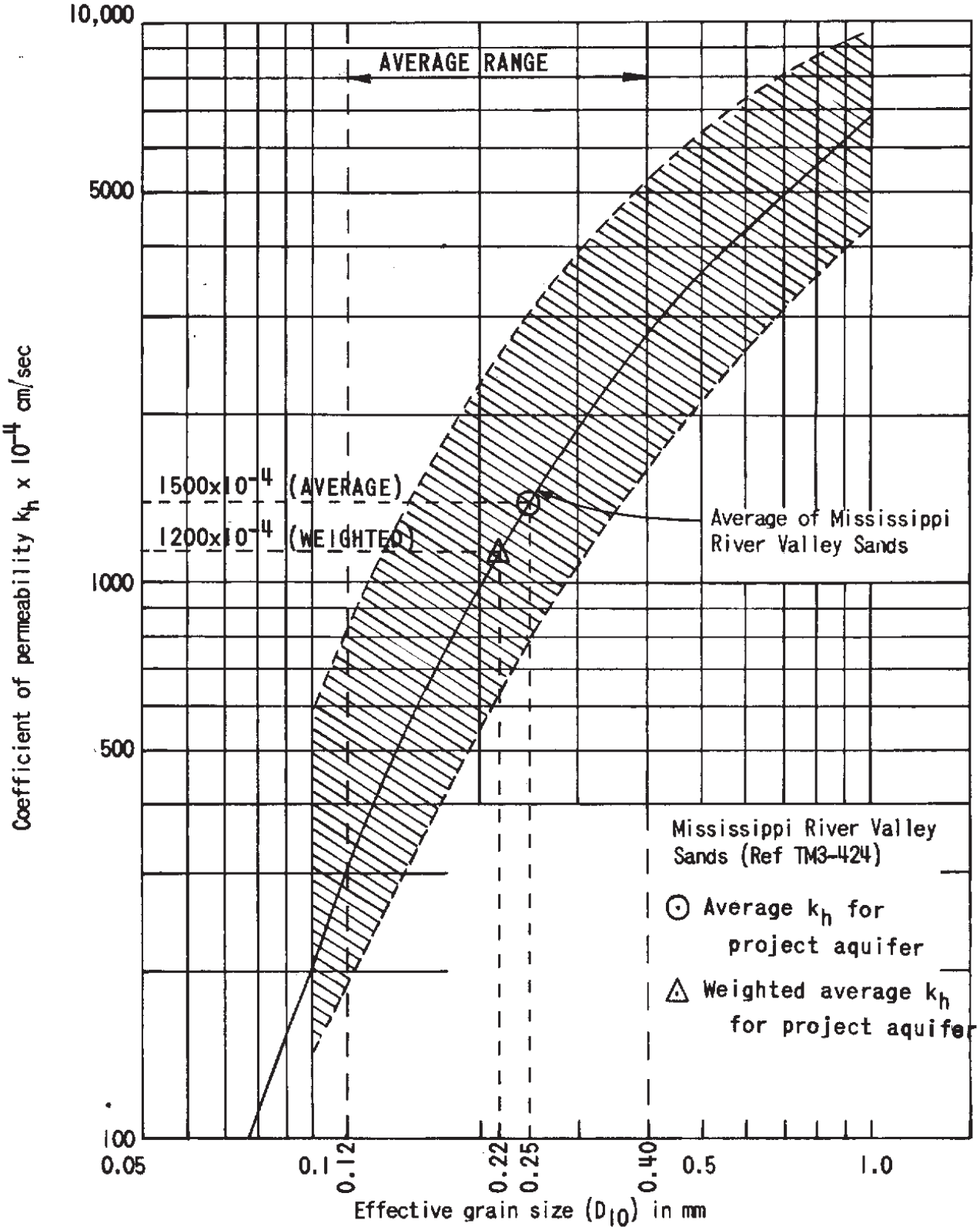
DRAWN BY:
TRACED BY:
CHECKED BY:
SUBMITTED:
CHIEF, DESIGN BRANCH
RECOMMENDED:
CHIEF, ENGINEERING DIVISION
APPROVED:
COL, CORPS OF ENGINEERS
DISTRICT ENGINEER
ROCK ISLAND DISTRICT
DATE:

ROCK RIVER
MILAN, ILLINOIS
LOCAL FLOOD PROTECTION

INTERIOR DRAINAGE
STUDY AREA PLAN

SHEET DRAWING NO
INVITATION NO DACW25 - - B -

EXHIBIT C-3-2



PERMEABILITY VS EFFECTIVE GRAIN SIZE

EXHIBIT C-3-3

TEAM *Services*
Geotechnical and Construction Material Consultants

July 5, 2012

HNTB Corporation
2603 East Geo Washington Blvd
Davenport, IA 52803

Attn: Gary Loss

Re: Contract Drilling and Laboratory Testing
Rock River Levee Evaluation
Milan, Illinois
Project No. 1-3115

Dear Mr. Loss:

At your request, TEAM Services conducted four soil borings with grain size testing for a storm water analysis to be conducted by HNTB. The project consists of a proposed commercial development landward of an earthen levee within the city of Milan, Illinois. The soil borings were conducted to depths of 25 feet below existing grades on June 19, 2012. The soil borings were located with a handheld GPS unit. The approximate boring locations are indicated on the Site Plans enclosed in the Appendix. Also, GPS coordinates of each boring our noted on the attached Boring Logs. Our drilling equipment consisted of an all-terrain auger drill rig. The borings were made by mechanically twisting a continuous flight hollow stem steel auger into the soil. At assigned intervals, the center drive bit of the auger was removed and soil samples were obtained.

Representative samples were obtained using a split-barrel sampling procedure in general accordance with ASTM Specifications D 1586. In the split-barrel sampling procedure, a standard 2-inch O.D. split-barrel sampling spoon is driven into the ground with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the standard penetration resistance value. These values are indicated on the Boring Logs at the depths of occurrence. The samples were tagged for identification, sealed and returned to the laboratory for testing and classification.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling, as well as the driller's interpretation of the subsurface conditions between samples. Final Boring Logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

LABORATORY TESTING

Based on the driller's field records and examination of the samples in the laboratory, a soil testing program was developed to collect more information about the soil conditions at the site. The following is a brief description of the specific tests completed for this project.

717 SE 6th Street • Des Moines, IA 50309 • ph: 515-282-8818 • fax: 515-282-8741 • email: staff@teamsvcs.com
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EXHIBIT C-3-4-1

Grain Size Distribution -- Grain size tests were performed on representative soil samples to determine the particle size distribution of these materials. After initial drying, the samples were washed over a U. S. standard No. 200 sieve to remove the fines (particles finer than a No. 200 mesh sieve). The samples were then dried and sieved through a standard set of nested sieves. This test was performed in a manner similar to that described by ASTM D 422. The results are presented as percent finer by weight versus particle size curves on the attached Grain Size Distribution sheets.

Hydrometer Tests -- Hydrometer tests were performed on representative cohesive soil samples to determine the particle size distribution of these materials in general accordance with ASTM D 422 and D421. In this procedure, the soil samples were first air dried and passed and washed through No. 10 Sieve. The passing materials of 50g were then mixed with 1000 ml sodium hexametaphosphate solution. The hydrometer was placed in the solution and the readings from the top of the meniscus were taken at certain time elapse. The particle size and its percentage were calculated according to Stoke's Law. The results are presented as percent finer by weight versus particle size curves on the attached Grain Size Distribution sheets.

As part of the testing program, the samples were classified in the laboratory based on visual observation, texture and plasticity. The descriptions of the soils indicated on the Boring Logs are in accordance with the enclosed *General Notes* and the *Unified Soil Classification System*. Estimated group symbols according to the *Unified Soil Classification System* are given on the Boring Logs. A brief description of this classification system is attached to this report.

SUBSURFACE CONDITIONS

Subsurface conditions encountered during this exploration are indicated on the individual Boring Logs. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows.

From the ground surface at all the borings alluvial deposits were encountered. The cohesive alluvium consisted of sandy lean clay and lean to fat clay, while the cohesionless alluvium consisted of silty sand, clayey sand, fine to medium sand, medium to coarse sand and fine sand with varying amounts of gravel and silt content. All borings were terminated in the alluvial deposits at about 25 feet below existing grades.

The above descriptions provide a general summary of the subsurface conditions encountered. The attached Boring Logs contain detailed information recorded at each boring location. These Boring Logs represent our interpretation of the field logs based on engineering examination of the field samples. The lines designating the interfaces between various strata represent approximate boundaries, and the transition between strata may be gradual. It should be noted that the soil conditions will vary between the boring locations.

QUALIFICATION OF REPORT

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranty is provided. In the event that any changes in the nature, design, or location

EXHIBIT C-3-4-2

of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the geotechnical engineer.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service to you in any way, please do not hesitate to contact us.

Sincerely yours,
TEAM Services

Isaac Drew, P.E.
Project Engineer

Stacy G. Brocka, P.E.
Sr. Geotechnical Engineer

LICENSED PROFESSIONAL ENGINEER Stacy G. Brocka 062-054200 STATE OF ILLINOIS	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Illinois. 7/5/12 Stacy G. Brocka, P.E. License Number 062.054200 Date: 7/5/12 My license renewal date is November 30, 2013. Pages covered by this seal: All Pages.

Enclosures:
- Site Plans (2)
- Boring Logs 1 - 4
- Grain Size Distrbution Sheets
- Unified Soil Classification System
- General Notes

EXHIBIT C-3-4-3

No Scale

Approximate boring location

N

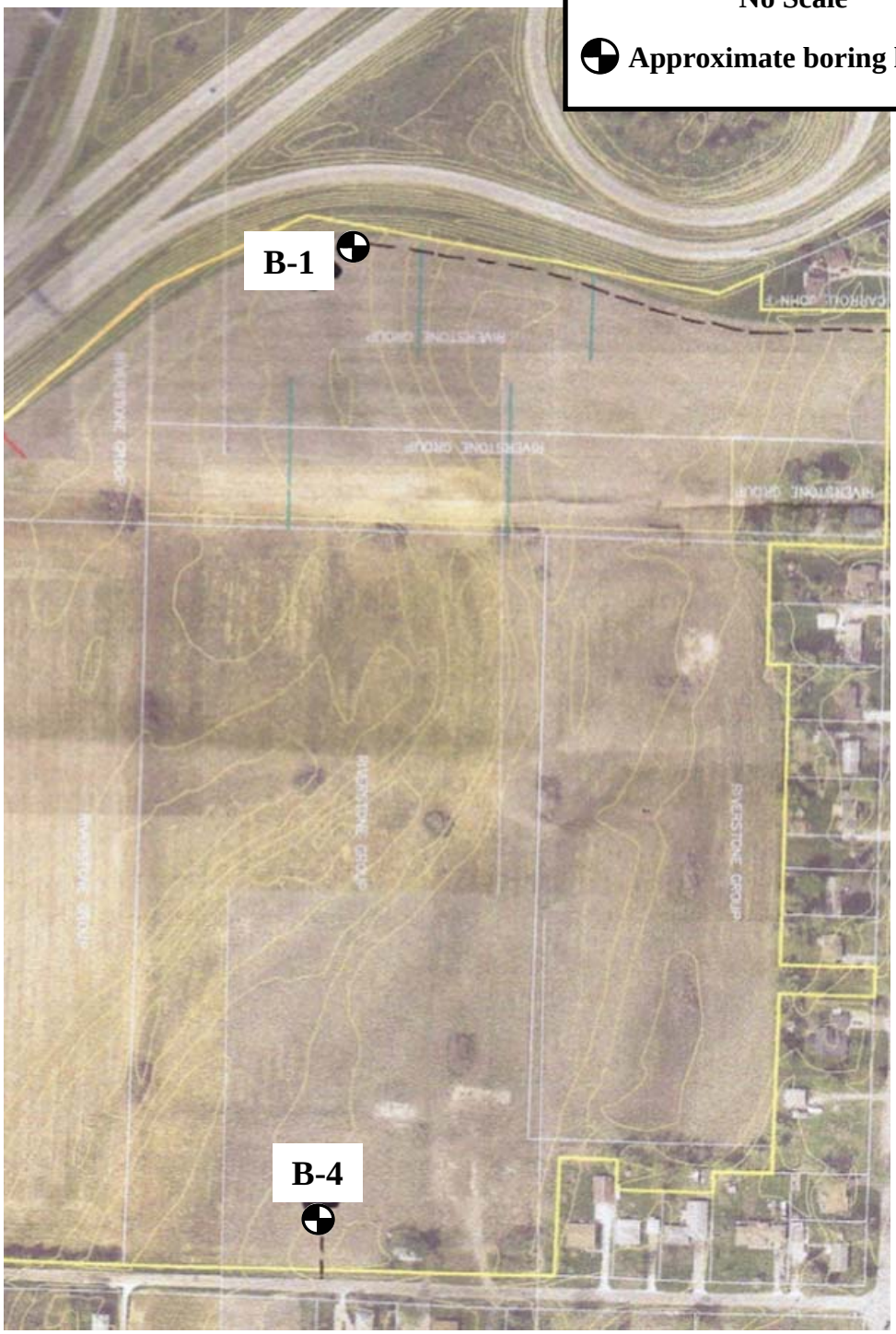
TEAM *Services*, Inc. **717 SE 6th Street** **Des Moines, IA 50309**	**Rock River Levee Evaluation** Milan, Illinois BORING PLAN (1)	Project No. 1-3115 July 5, 2012

EXHIBIT C-3-4-4

No Scale

N

Approximate boring location



TEAM *Services*, Inc. **717 SE 6th Street** **Des Moines, IA 50309**	**Rock River Levee Evaluation** Milan, Illinois BORING PLAN (2)	Project No. 1-3115 July 5, 2012

EXHIBIT C-3-4-5

LOG OF BORING NO. 1

OWNER	ARCHITECT/ENGINEER
SITE: **Milan, IL**	PROJECT: **Rock River Levee Evaluation**

GRAPHIC LOG	DESCRIPTION	DEPTH (ft.)	USCS SYMBOL	SAMPLES NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	TESTS MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
	Cohesive Alluvium -- Sandy lean CLAY, trace gravel and ferrous staining, very dark grayish brown		CL	1	AS					
			CL	2	SS	12"	13			
					HS					
	Cohesive Alluvium -- Lean to fat CLAY, trace sand, very dark grayish brown	5	CL-CH	3	SS	17"	9			
					HS					
	Granular Alluvium -- Fine to medium SAND, trace gravel and silt, yellowish brown and dark yellowish brown		SP	4	SS	11"	12			
					HS					
		10	SP	5	SS	13"	7			
					HS					
			SP	6	SS	12"	19			
			SP	7	SS	18"	11			
		15			HS					
	Granular Alluvium -- Medium to coarse SAND, with gravel, trace silt, yellowish brown and dark yellowish brown	20	SP	8	SS					
					HS					
	Bottom of Boring E 0699441 N 4592844	25								

3.5 — 6.0 — 17.5 — 25.0

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS			
WL	∇ 10'	WD ▼ 13'	AD
WL			
WL			

TEAM Services, Inc.

BORING STARTED	6-19-12		
BORING COMPLETED	6-19-12		
RIG	ATV	FOREMAN	DC
APPROVED	SGB	JOB #	1-3115

EXHIBIT C-3-4-6

LOG OF BORING NO. 2

OWNER	ARCHITECT/ENGINEER
SITE: **Milan, IL**	PROJECT: **Rock River Levee Evaluation**

GRAPHIC LOG	DESCRIPTION	DEPTH (ft.)	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	TESTS: MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
	1.0 **Granular Alluvium** -- Silty SAND, trace gravel, brown		SM	1	AS					
	Granular Alluvium -- Fine SAND, trace silt, yellowish brown		SP	2	SS	12"	12			
					HS					
		5	SP	3	SS	15"	8			
	6.0				HS					
	Granular Alluvium -- Fine to medium SAND, trace gravel and silt, yellowish brown and dark yellowish brown		SP	4	SS	16"	7			
					HS					
		10	SP	5	SS	16"	7			
					HS					
			SP	6	SS	11"	13			
					HS					
		15	SP	7	SS	9"	8			
	17.5				HS					
	Granular Alluvium -- Medium to coarse SAND, with gravel, trace silt, yellowish brown and dark yellowish brown	20	SP	8	SS	6"	24			
					HS					
	25.0		SP	9	SS		29			
	Bottom of Boring E 0699520 N 4593542	25								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS			
WL	▽ 7'	WD ▼ 9'	AD
WL			
WL			

TEAM Services, Inc.

BORING STARTED	6-19-12		
BORING COMPLETED	6-19-12		
RIG	ATV	FOREMAN	DC
APPROVED	SGB	JOB #	1-3115

EXHIBIT C-3-4-7

LOG OF BORING NO. 3

OWNER	ARCHITECT/ENGINEER
SITE: **Milan, IL**	PROJECT: **Rock River Levee Evaluation**

GRAPHIC LOG	DESCRIPTION	DEPTH (ft.)	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	TESTS: MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
	1.0 **Granular Alluvium** -- Silty SAND, trace gravel, dark grayish brown		SM	1	AS					
	Cohesive Alluvium -- Sandy lean CLAY, trace gravel, very dark grayish brown		CL	2	SS	11"	19			
	3.5 **Granular Alluvium** -- Fine to medium SAND, trace gravel and silt, yellowish brown and dark yellowish brown				HS					
		5	SP	3	SS	14"	24			
					HS					
			SP	4	SS	18"	7			
					HS					
		10	SP	5	SS	15"	9			
					HS					
			SP	6	SS	16"	12			
			SP	7	SS	11"	14			
		15			HS					
	17.5 **Granular Alluvium** -- Medium to coarse SAND, trace gravel and silt, yellowish brown and dark yellowish brown		SP	8	SS	9"	9			
		20			HS					
	25.0		SP	9	SS	9"	13			
	Bottom of Boring E 0699417 N 4593217	25								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS					
WL	∇ 6.5'	WD	▼ 10'	AD	
WL					
WL					

TEAM Services, Inc.

BORING STARTED	6-19-12		
BORING COMPLETED	6-19-12		
RIG	ATV	FOREMAN	DC
APPROVED	SGB	JOB #	1-3115

EXHIBIT C-3-4-8

LOG OF BORING NO. 4

OWNER	ARCHITECT/ENGINEER
SITE: **Milan, IL**	PROJECT: **Rock River Levee Evaluation**

GRAPHIC LOG	DESCRIPTION	DEPTH (ft.)	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY	SPT - N BLOWS / FT.	TESTS: MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH PSF
	Granular Alluvium -- Clayey SAND, trace gravel, very dark gray (2.0)		SC	1	AS					
	Granular Alluvium -- Fine SAND, with clay, brown		SC	2	SS	11"	4			
			SP-SC		HS					
		5	SP-SC	3	SS	17"	7			
					HS					
			SP-SC	4	SS	16"	7			
	(8.5)				HS					
	Granular Alluvium -- Fine to medium SAND, trace silt, yellowish brown and dark yellowish brown (11.0)	10	SP	5	SS	14"	15			
					HS					
	Granular Alluvium -- Fine to medium SAND, trace gravel and silt, yellowish brown and dark yellowish brown ▼		SP	6	SS	12"	12			
					HS					
		15	SP	7	SS	14"	5			
	(17.5)				HS					
	Granular Alluvium -- Medium to coarse SAND, with gravel, trace silt, yellowish brown and dark yellowish brown	20	SP	8	SS	9"	11			
					HS					
	(25.0)	25	SP	9	SS	9"	14			
	Bottom of Boring E 0687431 N 4592340									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

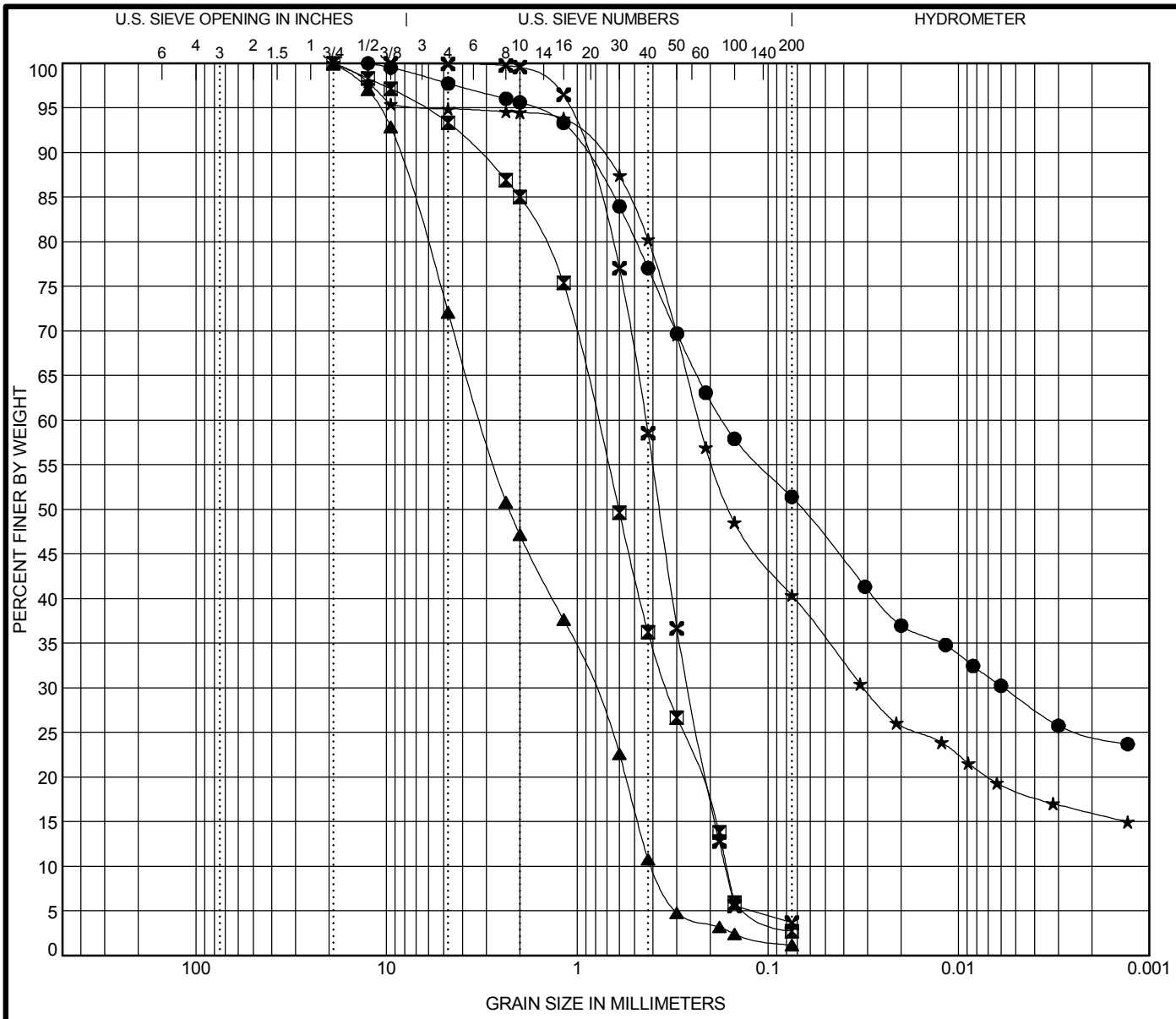
Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS					
WL	▽ 14'	WD	▼ 14'	AD	
WL					
WL					

TEAM Services, Inc.

BORING STARTED	6-19-12		
BORING COMPLETED	6-19-12		
RIG	ATV	FOREMAN	DC
APPROVED	SGB	JOB #	1-3115

EXHIBIT C-3-4-9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	1	0.0							
⊠	1	9.0		**POORLY GRADED SAND(SP)**				**0.88**	**4.78**
▲	1	19.0		**POORLY GRADED SAND with GRAVEL(SP)**				**0.54**	**7.86**
★	2	0.0							
✕	2	1.5		**POORLY GRADED SAND(SP)**				**0.92**	**2.60**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	1	0.0	**12.5**	**0.172**	**0.006**		**2.3**	**46.3**	**26.6**	**24.8**
⊠	1	9.0	**19**	**0.788**	**0.339**	**0.165**	**6.7**	**90.6**	**2.7**	
▲	1	19.0	**19**	**3.191**	**0.836**	**0.406**	**27.9**	**70.9**	**1.2**	
★	2	0.0	**19**	**0.231**	**0.031**		**5.1**	**54.5**	**24.4**	**16.0**
✕	2	1.5	**9.5**	**0.436**	**0.26**	**0.168**	**0.1**	**96.2**	**3.7**	

TEAM Services
717 SE 6th Street
Des Moines, IA 50309

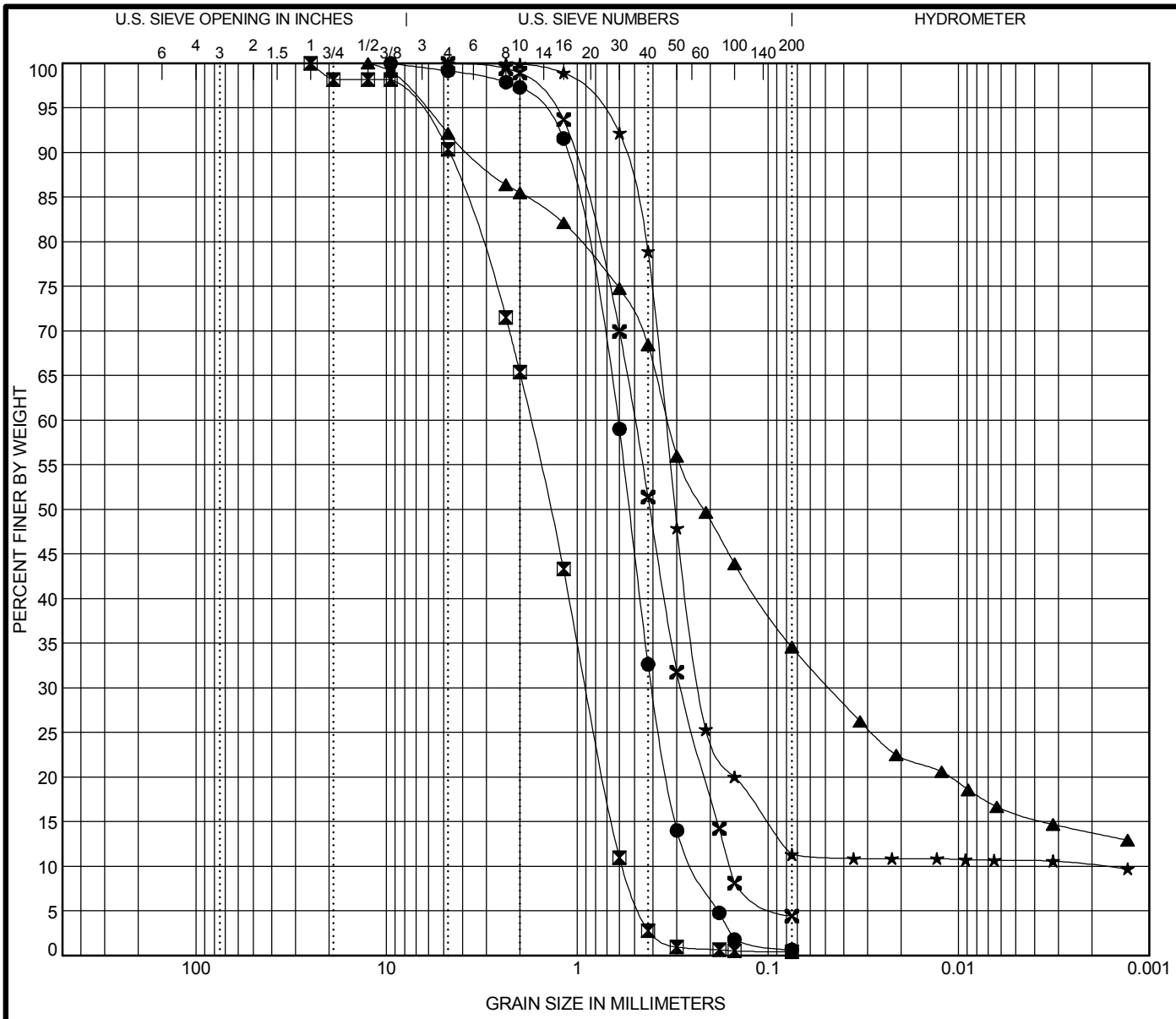
GRAIN SIZE DISTRIBUTION

Project: Rock River Levee Evaluation

Location: Milan, IL

Number: 1-3115

EXHIBIT C-3-4-10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	2	6.5	**POORLY GRADED SAND(SP)**				**1.11**	**2.55**
⊠	3	18.5	**POORLY GRADED SAND(SP)**				**0.79**	**3.05**
▲	4	0.0						
★	4	4.0					**87.51**	**199.23**
✕	4	9.0	**POORLY GRADED SAND(SP)**				**1.03**	**3.14**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	2	6.5	**9.5**	**0.612**	**0.404**	**0.24**	**0.9**	**98.5**	**0.6**	
⊠	3	18.5	**25**	**1.758**	**0.894**	**0.576**	**9.6**	**90.0**	**0.4**	
▲	4	0.0	**12.5**	**0.336**	**0.048**		**7.9**	**57.6**	**20.8**	**13.8**
★	4	4.0	**9.5**	**0.344**	**0.228**	**0.002**	**0.0**	**88.6**	**1.2**	**10.1**
✕	4	9.0	**4.75**	**0.499**	**0.285**	**0.159**	**0.0**	**95.6**	**4.4**	

TEAM Services
717 SE 6th Street
Des Moines, IA 50309

GRAIN SIZE DISTRIBUTION

Project: Rock River Levee Evaluation

Location: Milan, IL

Number: 1-3115

EXHIBIT C-3-4-11

UNIFIED SOIL CLASSIFICATION SYSTEM

TEAM *Services*

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]		GW	Well-graded gravel[F]
			Cu < 4 and/or 1 > Cc > 3[E]		GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel[F, G, H]
			Fines classify as CL or MH		GC	Clayey gravel[F, G, H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[E]	Cu ≤ 6 and 1 ≤ Cc ≤ 3[E]		SW	Well-graded sand[I]
			Cu < 6 and/or 1 > Cc > 3[E]		SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G, H, I]
			Fines classify as CL or CH		SC	Clayey sand[G, H, I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K, L, M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K, L, M]
		organic	Liquid limit – oven dried	< 0.75	OL	Organic clay[K, L, M, N]
			Liquid limit – not dried			Organic silt[K, L, M, O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K, L, M]
			PI plots below "A" line		MH	Elastic silt[K, L, M]
		organic	Liquid limit – oven dried	< 0.75	OH	Organic clay[K, L, M, P]
			Liquid limit – not dried			Organic silt[K, L, M, Q]
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols:
- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12% fines require dual symbols:
- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

For classification of fine-grained soils and fine grained fraction of coarse-grained soils.

Equation of "A" Line:
Horizontal at PI = 4 to LL + 25.5.
then PI = 0.73 (LL-20)

[E]
$Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains > 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plots in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.

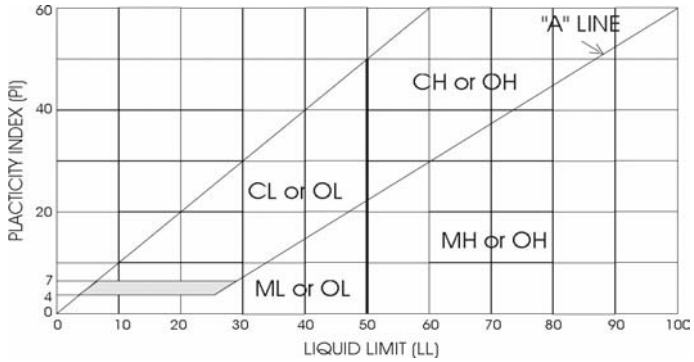
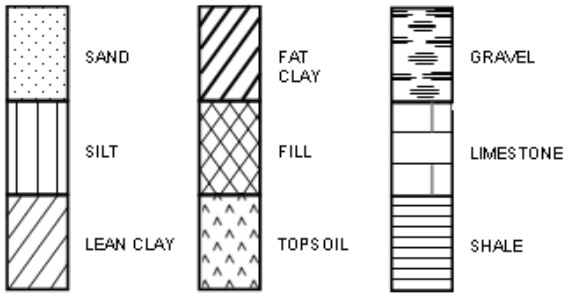


EXHIBIT C-3-4-12

GENERAL NOTES

SOIL and ROCK TYPES



DRILLING & SAMPLING SYMBOLS

SS	Split Spoon - 1 1/2" I.D., 2" O.D., unless otherwise noted
ST	Thin-Walled Tube - 3" O.D., unless otherwise noted
PA	Power Auger
HA	Hand Auger
DB	Diamond Bit - 4", N, B
AS	Auger Sample
HS	Hollow Stem Auger
WS	Wash Sample
RB	Rock Bit
BS	Bulk Sample
DC	Dutch Cone
WB	Wash Bore
AR	Air Rotary

CONSISTENCY OF FINE-GRAINED SOILS
(major portion passing No. 200 sieve)

Consistency	Unconfined Compressive Strength, Qu, psf	N-Blows/ft* (Approx. Correlation)
Very Soft	< 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,001 - 2,000	5 - 8
Stiff	2,001 - 4,000	9 - 15
Very Stiff	4,001 - 8,000	16 - 30
Hard	8,001 - 16,000	31 - 50
Very Hard	> -16,000	50 +

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N-Blows/ft. *
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	50 - 80
Extremely Dense	80 +

* Standard "N" Penetration Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch OD split spoon, except where noted.

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) (of components also present in sample)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of components also present in sample)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Size Range
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300 mm to 4.75 mm)
Gravel	3 in. to #4 sieve (75 mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75 mm to 0.075 mm)
Silt or Clay	Passing #200 sieve (0.075 mm)

WATER LEVELS: WD = While Drilling AD = After Drilling

Depth groundwater first encountered during drilling

Groundwater level after 24 hours (unless otherwise noted, i.e. "AD" -- after drilling)

TERMS DESCRIBING SOIL STRUCTURE

Parting:	paper thin in size	Fissured:	containing shrinkage cracks, frequently filled with fine sand or silt, usually more or less vertical.
Seam:	1/8" to 3" in thickness		
Layer:	greater than 3" in thickness	Interbedded:	composed of alternate layers of different soil types.
Ferrous:	containing appreciable quantities of iron	Laminated:	composed of thin layers of varying color and texture.
Well-Graded:	having wide range in grain size and substantial amounts of all intermediate sizes.	Slickensided:	having inclined planes of weakness that are slick and glossy in appearance.
Poorly-Graded:	predominately one grain size or having a range of sizes with some intermediate sizes missing.	NOTE:	Clays possessing slickensided or fissured structure may exhibit lower unconfined strength than indicated above. Consistency of such soil is interpreted using the unconfined strength along with pocket penetrometer results.

EXHIBIT C-3-4-13

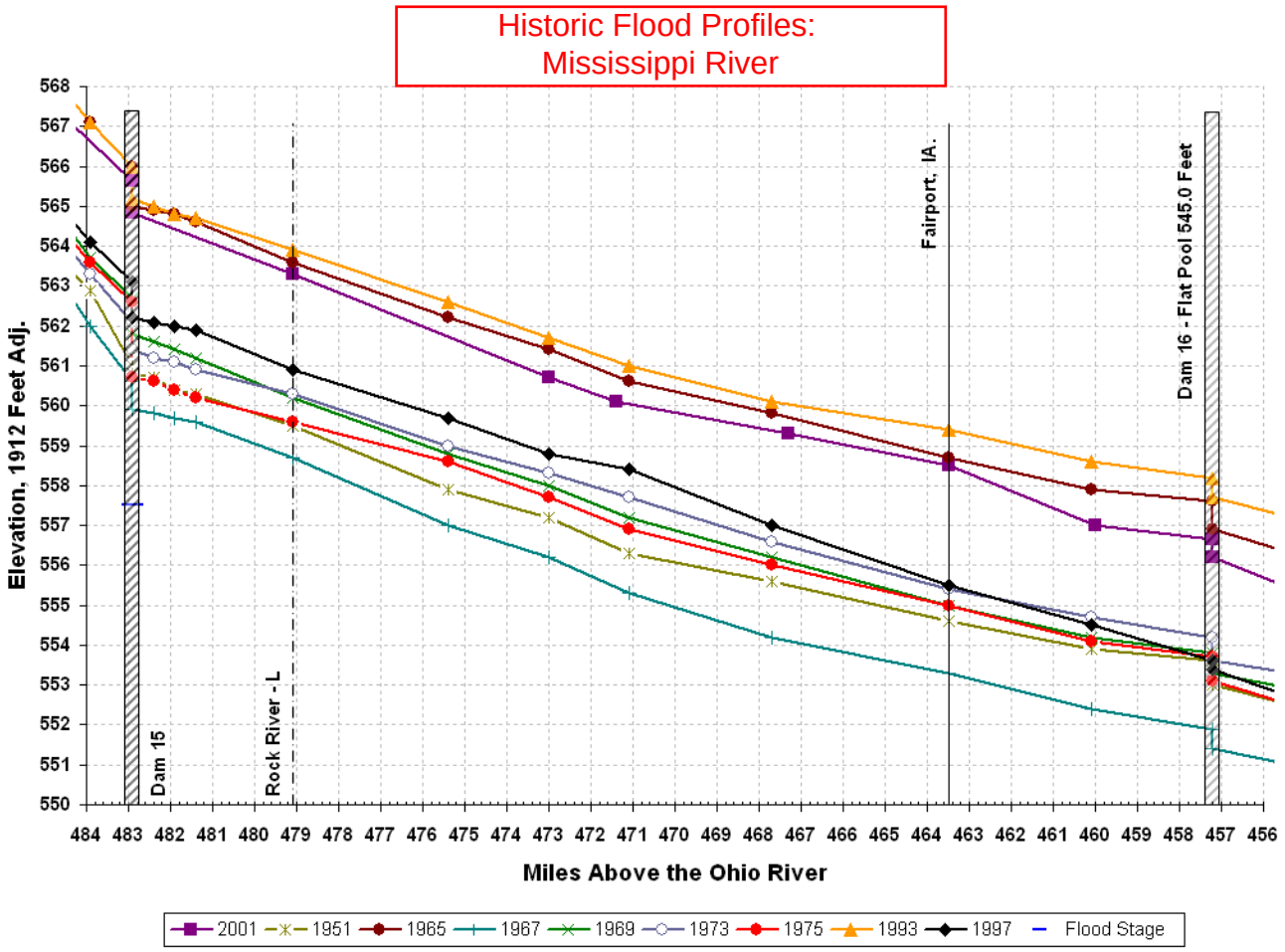

Historic Flood Profiles:
Mississippi River
Elevation, 1912 Feet Adj.
568
567
566
565
564
563
562
561
560
559
558
557
556
555
554
553
552
551
550
Dam 15
Rock River - L
Fairport, IA.
Dam 16 - Flat Pool 545.0 Feet
484 483 482 481 480 479 478 477 476 475 474 473 472 471 470 469 468 467 466 465 464 463 462 461 460 459 458 457 456
Miles Above the Ohio River
2001
1951
1965
1967
1969
1973
1975
1993
1997
Flood Stage

EXHIBIT C-3-5

Estimated Pumping Periods for BIRCD

This Report does not reflect the Village of Milan's efforts on Big Island, e.g. West Pump Station
Nor any other efforts that may have been made outside of BIRCD
This report is limited, is not all inclusive, and only includes approximate times, dates and materials used.
2011 & 2008 were two recently marked years for pumping.

Report For Years 2011 & 2008

Year	Approximate Date Started	Approximate Date Stopped	Pump Area	Type of Pump	Obtained from	Fuel Used
2012	Gravity Flow by BIRCD					
2011						
	3/27/2011	5/16/2011	Maintenance Facility	3" Sump Pump	BIRCD	Electric
			West Ponding Area	8" Godwin	IEMA/COE	Diesel
			West end of 56th Ave	2" Auxillary Pump	BHT	Gas
			Various as Needed	As available		
2008	6/12/2008	07/18/ 2008	Maintenance Facility	3" Sump Pump	BIRCD	Electric
				4" Pump	COE	Diesel
			West Ponding Area	12" Crisafulli	COE	Diesel
			Tractor Power		BIRCD	Gas
			West End of 56th Ave	4" Pump	COE	Gas
			Various as Needed	4" Pump	COE	Gas

EXHIBIT C-3-6-1

Page 2:
When the Rock and the Mississippi Rivers are concurrently high, this makes a significant increase in pumping needs. Daily river levels are monitored online and in the paper when High Water is anticipated. Water levels are monitored at various sites impacted by the Mississippi and or Rock Rivers. These sites include Rte 67 Bridge, Lock 31, RICC Quarry Lakes, and West Ponding Area. When Lock & Dam 15 is over flood stage, our pumping generally begins shortly thereafter. The Joslin gage located on the Rock River upstream of our project is among the gages we watch. Approximately two days after Dubuque reaches flood stage, Big Island can expect water is coming their way. Experience has shown it is critical to watch the water levels in Lacrosse, WI and on up the river. When the water rises in LaCrosse, WI, Big Island can expect it coming shortly thereafter. Pumping increases with duration of high water.

When we are not pumping, gravity flow is utilized.
The pumps generally reserved for BIRCD are –

- (1) One 12" Crisafulli pump placed in the West Ponding Area adjacent to Highway 92;
- (2) Two 4" Diesel Pumps plus 150' and 120' 4" hose, placing one pump at BIRCD's Maintenance Facility at 53rd Avenue & 27th St. W. and the other wherever else it is necessary.
- 3" Electric Sump Pump at the Maintenance Facility has a float. It maintains a certain level. This is monitored and auxiliary pumps are added if necessary.

EXHIBIT C-3-6-2

Appendix D-1

Environmental Assessment

City of Rock Island Commercial Development

Milan/Big Island LFP modifications

30% Draft – August 2012

US Army Corps of Engineers
Rock Island District

HNTB

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APPENDICES

Appendix 1 Agency Documentation

Note: This 30% Draft was prepared at the direction of the Corps of Engineers to determine whether the proposed modifications are considered major or minor. Once this determination is made, the Section 408 Permit Request will be finalized and will include more detailed technical information.

1. PURPOSE, NEED, AND AUTHORITY FOR THE PROPOSED PROJECT

1.1 Purpose and Need for the Proposed Project

The City of Rock Island plans to facilitate the development of 92 acres of undeveloped land for commercial and retail investment. The land is currently owned by RiverStone Group, Inc. and is located in the northeast quadrant of Interstate 280 and Illinois 92. The land is located within the Big Island River Conservancy District and is protected from flooding via the Milan-Big Island Flood Protection Project, specifically Stage IIIC levee. As part of the proposed development a modification to a portion of the Stage IIIC Levee project is required to accommodate a new access road off of Illinois 92 into the proposed development. Access off Illinois 92 keeps the adjacent residential community isolated from the proposed development which is a concern of the Big Island community. It also provides access into the development from a major thoroughfare serving multiple communities making it accessible to the general population area. In addition, an improved levee access road and temporary pump pad is also proposed at the existing Ponding Area B-1 and Gate Well 30 (A) for drainage. As such, a Section 408 permit is required for the proposed modifications to the existing Federal project. Title 33 Code of Federal Regulations (CFR) Section 408 authorizes the Secretary of the Army to permit alterations/modifications to existing Corps projects including degradations, raisings, and realignments. This report documents the technical analyses and provides the environmental documents required for approval.

The Milan-Big Island Flood Protection project is an urban flood damage reduction project which is federally authorized and non-federally operated and maintained. It is located between river miles 0.8 and 5.6 above the mouth of the Rock River into the Mississippi River. The project consists of stages IIA, IIIB, IIB/IIIA, IIIC and IIID along the left descending bank of the Rock River and the right descending bank of Mill Creek in Illinois and protects the Village of Milan, Big Island River Conservancy District, City of Rock Island, and portions of unincorporated Rock Island County. The project consists of 10.6 miles of levees, 1120 feet of floodwall with appurtenant closures, ramps, and interior drainage facilities consisting of a number of gatewells, pump stations and ponding areas. The construction was completed in the mid 1980's.

The project was authorized by Public Law 90-483 approved 13 August 1968, substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 348, 90th Congress, 2nd Session. The United States Army Corps of Engineers (USACE) Rock Island District designed and constructed the authorized system. The project is operated and maintained

by the Village of Milan and Big Island River Conservancy District. The levee system was certified by FEMA in October 2010.

An environmental analysis was conducted as part of the original Federal project design and documented in the *1977 Phase II GDM*. A complete final Environmental Impact Statement (FEIS) dated March 1975 was filed with the Council on Environmental Quality on 12 April 1976. For the proposed modification, this Environmental Assessment (EA) is being prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and USACE ER 200-2-2, Procedures for Implementing NEPA. It is expected that a Finding of No Significant Impact (FONSI) will be obtained.

The City of Rock Island retained the services of HNTB to perform the necessary engineering and environmental assessments for the proposed modifications and prepare the necessary compliance documentation to meet the Section 408 permit requirements.

1.2 Authority for the Proposed Project

The alteration and modification of the Milan, Illinois Local Flood Protection Project requires approval by the USACE. Section 14 of the Rivers and Harbors Act of 1899 (33 United States Code [USC] 408; hereinafter referred to as "Section 408") authorizes the Secretary of the Army to permit alterations and modifications to existing USACE projects in certain circumstances. The Secretary of the Army has delegated this approval authority to the Chief of Engineers of the USACE. The types of alterations and modifications under Section 408 that require approval by the Chief of Engineer include degradations, raisings, and realignments of levee systems. Nonfederal proposals to alter or modify existing USACE projects, such as the proposed re-alignment to a portion of the Milan, Illinois Local Flood Protection Project, must be evaluated as new construction of federal projects. The potential impacts of these changes, including system impacts, must be evaluated in accordance with USACE regulations and policy, including the regulatory requirements of the National Environmental Policy Act (NEPA).

2. PROPOSED PROJECT AND ALTERNATIVE ACTIONS

2.1 Proposed Project

The specific segment of levee where the levee re-alignment is proposed is within the Stage III-C segment. This segment is referred to as the downstream tie-off levee. The semi-compacted impervious levee begins on Big Island along the Interstate 280 highway embankment which is used as a tie-off from flooding on the Rock and Mississippi Rivers. This .97 mile long levee follows along Interstate 280 to the intersection with Illinois 92, and then along Illinois 92 and then turns to the east. The levee reaches a maximum height of 13 feet and the top of the levee is at a maximum height of 5 feet above the highway pavement surface. The levee grade has 3 feet of freeboard above the design flood. The existing project was designed to provide protection to the Milan-Big Island area against concurrent 200-year flooding on the Mississippi River (422,000 cubic feet per second (cfs)) and 200-year flooding on the Rock River (89,700 cfs), 100-year flooding on Mill Creek (27,500 cfs), 200-year flooding on Kyte Creek (3,100 cfs), and 200-year flooding on Eckhart Creek (2,450 cfs).

The proposed modification consists of removing approximately 300 feet of existing levee and constructing approximately 600 feet of realigned levee along the east side of Illinois 92 just north of the I-280/Illinois 92 interchange. The realigned levee is to accommodate a proposed city street from the east side of Illinois 92 into the site development area. This city street will cross the existing levee project. In order to meet IDOT roadway vertical profile and horizontal alignment design requirements, the current levee needs to be degraded in the location of the access road and the levee routed to the east and across the access road and back to the west to tie back into the existing levee. See Figure 1 for an overview of proposed project.

The proposed levee section will be similar to the existing design and will be approximately 10 feet high with a 10 foot crest width and 3H:1V side slopes and a small inspection trench on the landward toe. It will consist of semi-compacted impervious material. In addition to the levee re-alignment, a storm water analysis was completed to accommodate changes in land use and associated interior drainage system at this location, specifically Ponding Area B-1 and Gate well 30 (formerly A). The results of this analysis have concluded that the existing ponding area and temporary pumping during flood events is adequate for the additional storm water runoff and existing underseepage. The access to the gatewell/ponding area will be improved and a permanent concrete pad for the portable pump will be included as part of the project modification.

In order to meet IDOT requirements, the proposed project also includes a realignment of Ramp F which is the ramp from west bound I-280 to northbound Illinois 92. The realignment of ramp F does not impact the local flood protection project.

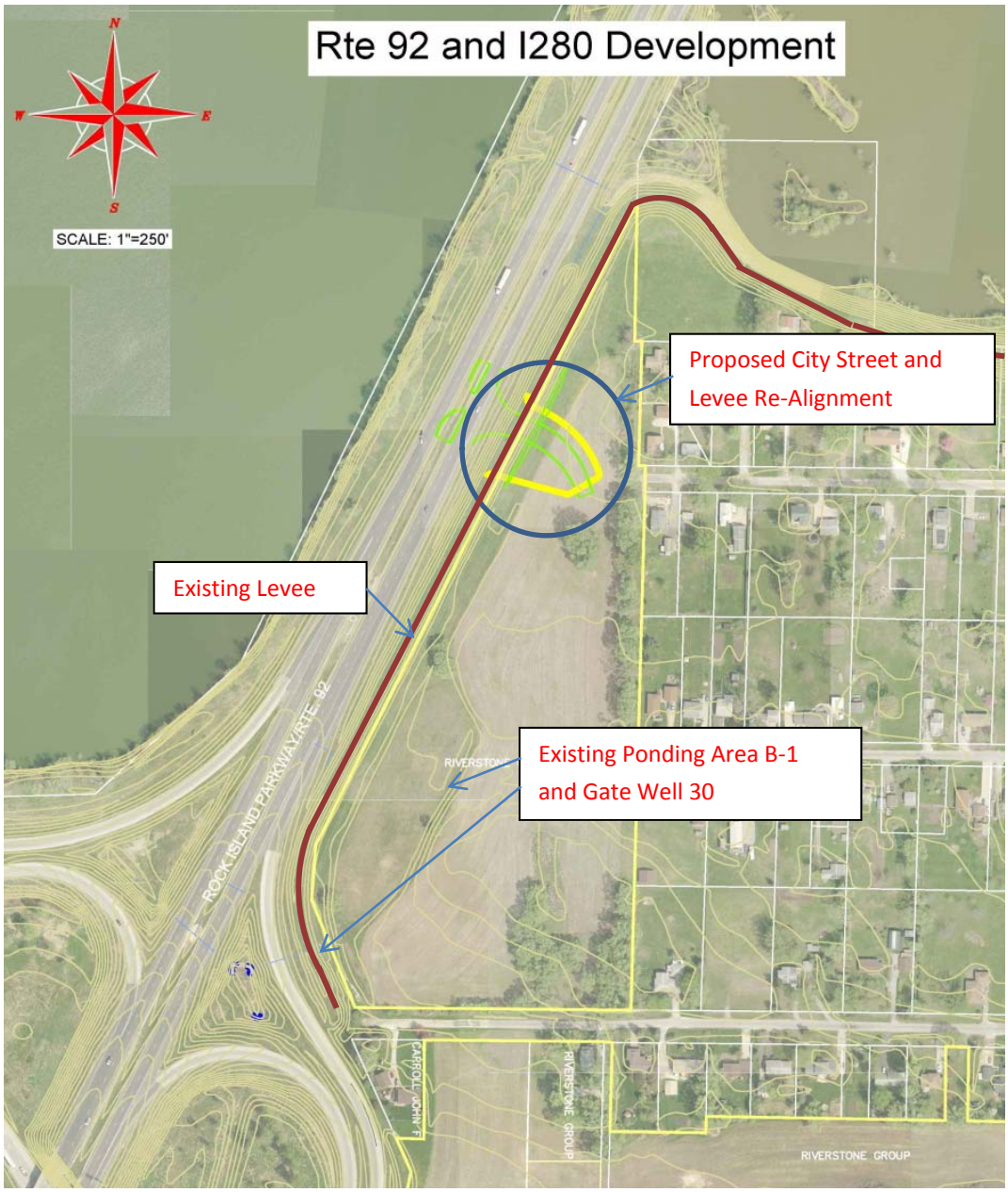

Figure 1 – Proposed Levee Re-alignment

2.2 Other Alternatives Considered

The following are the other alternatives considered as part of the overall evaluation.

2.2.1 No-Action Alternative

3 The No-Action alternative essentially consists of no change to the levee system and no access into the proposed site development area. This alternative would preclude the property owner from developing the site as the highest and best use of the property. The city and other local governments would consequently not realize potential tax revenues from the proposed commercial development.

3.1.1 Revised Access Alternative (Alternative 3)

Another alternative would provide access to the site development area via a different route. This alternative would provide access from US 67/Airport Road to Big Island Road to 56th Avenue West through the community of Big Island into the proposed site development. (See Figure 2 showing this alternative.) This route goes through residential and agricultural areas of the Big Island community which will result in potential social and community impacts and safety concerns. In addition the roads will require improvement to accommodate the increased traffic. Specifically 56th Avenue West will require improvement for access into and out of the proposed development. Potential impacts that may result from this alternative include noise impacts; air quality; transportation; and aesthetics and visual resources. The Big Island River Conservancy community has expressed their concern at keeping the area rural and isolated from the adjacent communities. This alternative will not meet the communities concerns. There would be increased traffic resulting in noise, potentially affecting the air quality, and increased safety concerns. These impacts to the affected community are undesirable therefore making this alternative not feasible. Additionally, the cost for this alternative would be greater that the proposed alternative due to the existing road improvements that would be required. . Potential developers would undoubtedly find this access route into the proposed commercial and retail site undesirable. Thus implementation of this alternative would also preclude the property owner from developing the site as the highest and best use of the property.

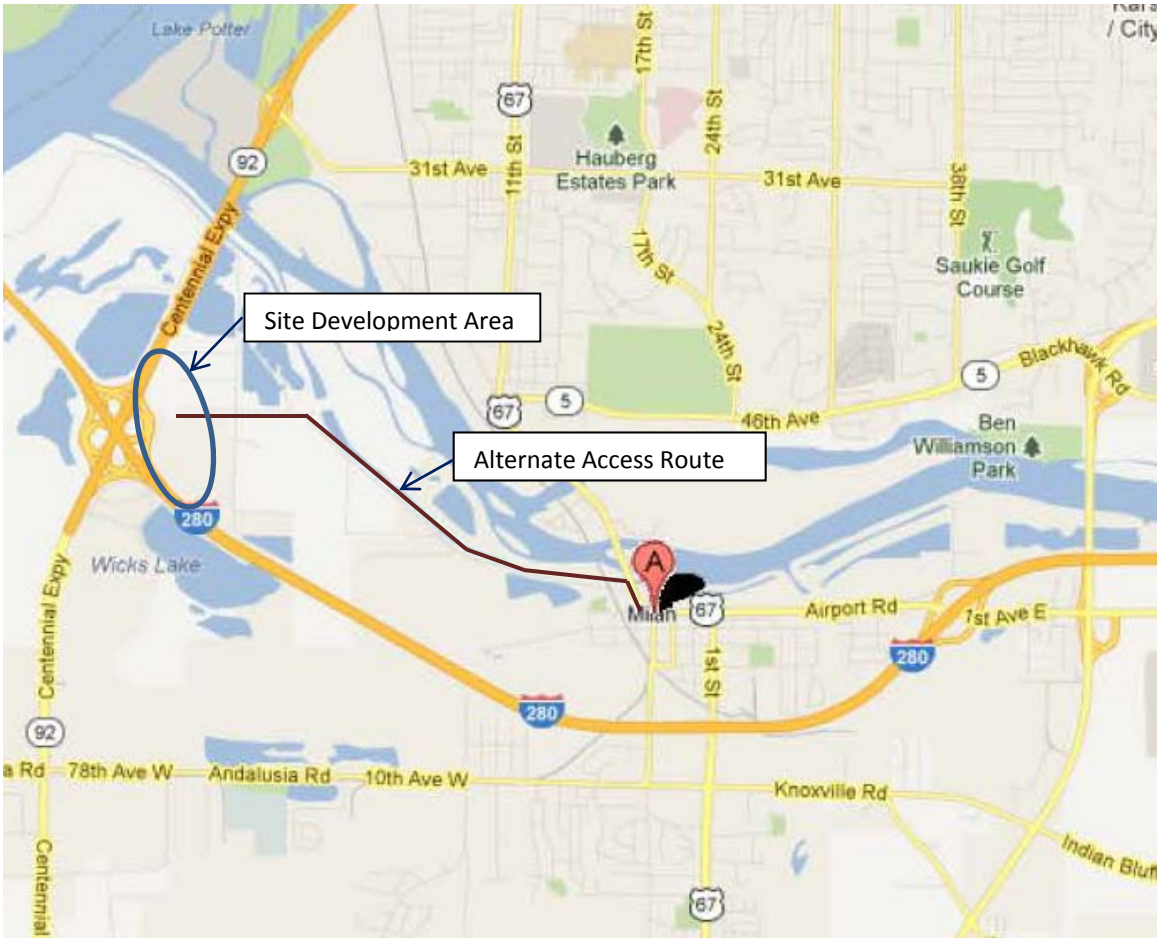

Figure 2. Alternate Site Development Access

3. AFFECTED ENVIRONMENT *(TO BE COMPLETED LATER)*

4.1 Geology and Soils

4.2 Water Resources

4.2.1 Floodplain

4.2.2 Drainage Ditches/Ponding

4.2.3 Wetlands

4.3 Biological Resources

4.3.1 Vegetation

Per the original Phase I GDM dated 1975, a variety of plant communities can be found in the project area including lowland woods, upland woods, wetlands, aquatic habitats, hedgerows, fields, and residential, commercial and industrial areas. Within the specific project reach along I-280 and Illinois 92, vegetation consists of local common species of trees, bushes, flowers and grasses as well as crops.

The construction of the Federal Project completed in 1988 resulted in the removal of long, narrow strips of vegetation and wildlife habitat along the Hennepin (Illinois &Mississippi (I&M)) Canal and Case, Mill, Eckhart and Kyte Creeks. The Stage IIIC area completed in 1986 consisted of the removal of grasses, forbs, trees in the highway right-of-way and crop field bordering the right-of-way. Removal of this vegetation for construction was expected to reduce wildlife populations to a small degree.

4.3.2 Fish and Wildlife

4.3.3 Threatened and Endangered Species

Coordination with the US Fish and Wildlife Service (USFWS) will be completed. Based on the documentation for the original Federal Project, it is expected that only a letter from the US Fish

& Wildlife indicating no ESA protected species or habitats are in the project impact area. Coordination with National Oceanic Atmospheric Association is not applicable to this project.

4.3.1 Fish and Wildlife Coordination Act

Coordination with the USFWS will be conducted. However based on the review of the original environmental documents prepared for the overall Federal project and that no water bodies will be impacted, a letter is expected from the USFWS stating that a FWCA Report is not required.

4.4 Land Use, Infrastructure, and Socioeconomic Resources

4.4.1 Land Use

4.4.2 Infrastructure

4.4.3 Socioeconomics

4.5 Aesthetics and Visual Resources

4.6 Historic and Cultural Resources

4.6.1 Archaeological Resources

The Area of Potential Effects (APE) for the archaeological assessment was defined as all lands where the ground could be disturbed as a result of construction of the proposed project.

The original Federal project archaeological impacts were coordinated with the State Historic Preservation Officer, the Heritage Conservation and Recreation Service and the Advisory Council on Historic Preservation, Lands and Historic Sites Division, Illinois Department of Conservation, the Office of Archaeology and Historic Preservation, and the National Park Service. A reconnaissance survey was completed by the Environmental Research Center in 1976 which identified five previously unrecorded and twenty recorded sites near the project area. Based on this initial research, an intensive archaeological survey program was undertaken by the Great Lakes Archaeological Research Center to conduct a determinative archaeological assessment of the National Register eligibility of archaeological sites known to be in the project rights-of-way. Nine sites were examined and the State Historic Preservation Officer

recommended further testing of three of the sites and a determination of eligibility for inclusion of site 11 Ri 217 in the National Register.

No further information was provided on the additional testing. However, it is assumed that since the project has been constructed that either no evidence was encountered during construction or the procedures set forth in 36 CFR Part 800 were implemented. Although it is not anticipated the proposed levee modification will have any archaeological impact, coordination with appropriate agencies will be conducted during the detailed design.

4.6.2 Aboveground Historical/Archaeological Resources

Historical documentation indicates that the Milan locality was occupied during the late 18th and early 19th Century by the Sauk and Fox Indians and several villages existed within the general area. The western terminus of the Great Sauk Trail was located near downtown Milan which was used by French fur traders. A large Indian Village was located across the Rock River from Milan, and the villagers used the floodplain for agriculture by commuting across the river to their fields. The research also noted that European settlers made use of the early routes through the Milan floodplain probably dating back to ca. 1690. Euro-American settlement of Milan began at the end of the Black Hawk War at which time the Indians were removed from the area.

Per the original 1977 Phase II GDM, a comprehensive cultural inventory and assessment was undertaken in 1975 by the Environmental Research Center, Iowa City, Iowa. A review of the National Register of Historic Places was made and no sites in the Milan-Big Island area were listed although at the time eligibility had been requested for the Hennepin Canal. The Hennepin Canal was determined to be eligible in 1976. Because of this eligibility, Section 106 procedures of the Historic Preservation Act of 1966 were implemented. This was completed and the Federal Project was approved. The levee modification is not near the Hennepin Canal and therefore will have no impact on the canal.

4.7 Air and Noise Quality

4.7.1 Air Quality

Per the NEPAssisst website http://nepassisttool.epa.gov/nepassist/ for the project site, there are currently no non-attainment areas for ozone, lead or particulate matter. The project area is typical of a small, rural community with relatively few air pollution sources, such as vehicle, lawn mower and or snow blower exhaust.

4.7.2 Noise

The current noise environment in the project area is typical of a small, rural community with relatively few noise sources, such as vehicular traffic noise from the streets and STH 1 and general residential noise (e.g., lawnmowers, trimmers, etc.).

4.8 Human Health and Safety

4.9 Environmental Protection Compliance

This project is subject to and is in compliance with all applicable local, state, and federal laws governing restoration and flood control improvement projects.

4. ENVIRONMENTAL CONSEQUENCES *(TO BE COMPLETED LATER)*

5.1 Geology and Soils

5.2 Water Resources

5.2.1 Floodplain

5.2.2 Drainage Ditches/Ponding

5.2.3 Wetlands

5.3 Biological Resources

5.3.1 Vegetation

5.3.2 Fish and Wildlife

5.3.3 Threatened and Endangered Species

5.4 Land Use, Infrastructure, and Socioeconomic Resources

5.4.1 Land Use

5.4.2 Infrastructure

5.4.3 Socioeconomics

5.5 Aesthetics and Visual Resources

5.6 Historic and Cultural Resources

5.6.1 Archaeological Resources

5.6.2 Aboveground Historical/Archaeological Resources

5.7 Air and Noise Quality

5.7.1 Air Quality

5.7.2 Noise

5.8 Human Health and Safety

5.9 Cumulative Impacts

5. COORDINATION *(TO BE COMPLETED LATER)*

6. MAJOR FINDINGS AND CONCLUSIONS *(TO BE COMPLETED LATER)*

The Proposed Action Alternative will meet the purpose and needs of the project to provide access to the proposed commercial development. Potential temporary impacts that may result from construction activities associated with the Proposed Action Alternative include impacts to geology; soils (soil disturbance); the noise environment; utilities; air quality; and aesthetics and visual resources. Analyses also indicate that there would be no anticipated impacts to climate, groundwater resources, floodplains, or federal- or state–listed threatened or endangered species or their habitat. As a result, the Proposed Action Alternative is the preferred alternative.

7. REFERENCES *(TO BE COMPLETED LATER)*

APPENDIX E
Reviews Documentation