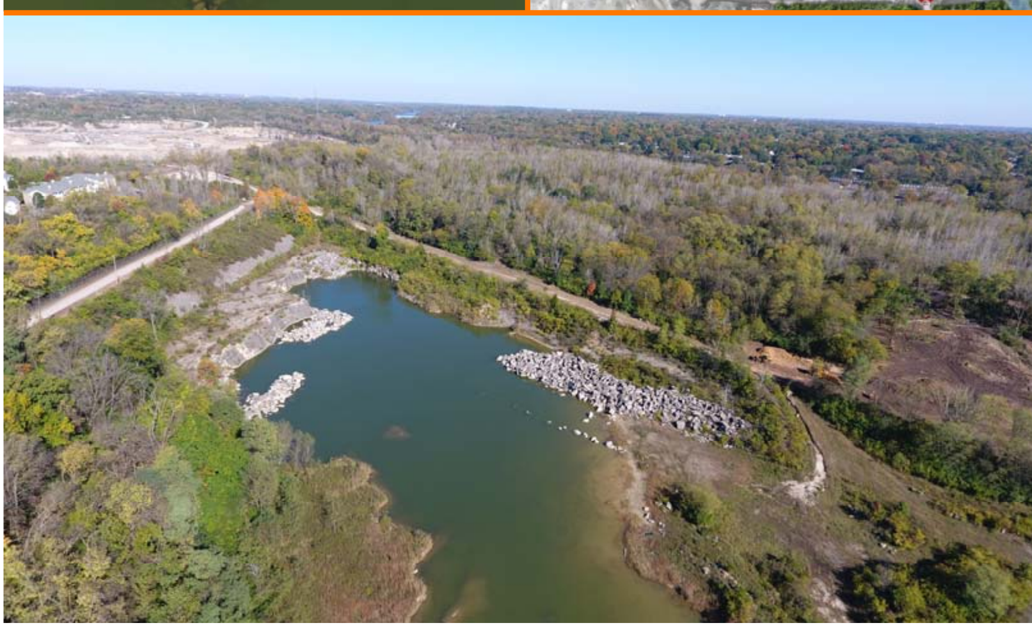
Marble Cliff Quarry Development & Quarry Trails Metro Park

Type II & III
Variance Request
Package

Dublin Road, Columbus, OH
43204

PID: 560-298027, 560-298029,
560-298030, 560-298033



E.P. Ferris & Associates, Inc.

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wagenbrenner DEVELOPMENT

Metro Parks

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February 1, 2019

City of Columbus
John Newsome, P.E. Administrator, DOSD
Attn: Greg Fedner, P.E., Private Development Section Manager
Stormwater and Regulatory Management Section
111 N. Front Street
Columbus, Ohio 43215

Re: Type II & III Variance Requests
Marble Cliff Quarry Property

Project Name: Marble Cliff Quarry Development & Quarry Trails Metro Park
Property Address: Dublin Road, Columbus, Ohio 43204
PID: 560-298027, 560-298029, 560-298030, 560-298033
Site Disturbance: 114 Ac.
Total Site Area: 143 Ac.
Primary Contact: E.P. Ferris & Associates, Inc.
Attn: Brian Saunders, P.E.
(614) 299-2999
Email: bsaunders@epferris.com

Dear Mr. Fedner,

On behalf of Marble Cliff Canyon, LLC (MCC) and the Columbus and Franklin County Metro Park District, E.P. Ferris and Associates, Inc. and Burgess and Niple, Inc. are seeking approval of Type II and III variances from the City of Columbus Stormwater Drainage Manual (SWDM) Sections 1.4, 3.2, and 1.3. These variances are being requested for the purpose of completing site improvements related to a new Metro Park and mixed-use development throughout a former quarry and landfill site located northeast of Dublin Road between Trabue Road and Old Dublin Road, adjacent to the Scioto River. The proposed site will support a variety of multi-family, single-family, retail, and commercial properties as well as a dedicated public Metro Park that will create numerous recreational opportunities for the community. The project boundary, which includes the Quarry Trails Metro Park, was master planned to maximize the recreational space. This initial phase has set aside 62 Ac. of its 143 Ac. for a public park, which is 43% of its total area.

The removal and mining of material throughout this quarry's life significantly altered its surface features and created an additional, man-made floodplain area within the site. A Type II variance will allow the Marble Cliff Quarry Development Project to fill approximately 170,000 cubic yards of material within this non-intentional/man-made 100-year floodplain to adequately prepare the site without providing compensatory floodplain mitigation. Reasoning for the project's inability to mitigate this fill through compensatory storage includes restrictions from providing such storage in existing solid waste areas and in areas of preserved parkland. Additionally, if compensatory storage is introduced through the site's remaining unrestricted areas, this would require excavation through shallow limestone resulting in substantial hardship to the development and the loss of the land's reasonable use.

A Type II variance is also being requested for stormwater quantity controls as required by SWDM Section 3.2. Following the project's Voluntary Action Plan (VAP) to clean up former landfill sections throughout the project site, and in accordance with the approved VAP with the Ohio Environmental Protection Agency (OEPA), deep dynamic compaction has already been performed and a clean clay cap is being installed across areas of existing trash within MCC sections. Thus, providing stormwater quantity controls within the project footprint would introduce substantial hardship by breaching the installed environmental controls and potentially creating storage within contaminated soils. Additional hardship associated with providing stormwater quantity in these areas would include necessary excavation through shallow limestone. Within the project site, the majority of the subsurface conditions are made up of either trash or unharvested limestone.

The requested hardship exemption from SWDM Section 3.2 also considers the inability to provide stormwater quantity for Metro Park developments within this project. This is due to the lack of sufficient land within the future park that is above the 100-year floodplain, as stormwater quantity controls are prohibited from being located within the 100-year floodplain per Section 3.1 of the manual or outside of the limestone limits. This part of our team's request for hardship exemption is driven by the recreational opportunities that will be provided by the proposed Quarry Trails Metro Park and the deed restrictions that are currently in place over this property. These restrictions were made a requirement from the public grant that funded the 62 Ac. park's acquisition.

Regarding the Type III variances, preferred development plans for the mixed-use portions and Metro Park areas in the site require encroachments to the Scioto River and Roberts Millikin Ditch Stream Corridor Protection Zones (SCPZ), which conflicts with Section 1.3 of the SWDM. These are outlined separately as Burgess and Niple, Inc. formally prepared the variance request for the Metro Park District's impacts on Millikin Ditch (Appendix A1) and E.P. Ferris and Associates, Inc. organized the request for MCC's encroachment to the Scioto River and Millikin Ditch. However, both serve the shared purpose of supporting preferred development of the site and future Metro Park. All encroachments outlined in these Type III variance requests will also be adequately mitigated within this site whether through stream health and functionality improvements or new protected and dedicated SCPZ areas.

Our team respectfully requests approval of these variances for this project's preferred alternatives. These will not only benefit the overall development plan for this site, but also the future Quarry Trails Metro Park plan and this community's overall enhancement. Please find enclosed our technical request in support of the variances briefly mentioned above.

Very truly yours,
E. P. FERRIS & ASSOCIATES, INC.

Brian Saunders, P.E.
Project Engineer

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Appendices

Introduction

On behalf of MCC and the Columbus and Franklin County Metro Park District, E.P. Ferris and Associates, Inc. and Burgess and Niple, Inc. are seeking approval of Type II and III variances from the City of Columbus SWDM Sections 1.4, 3.2, and 1.3. These variances are being sought in order to redevelop the existing limestone quarry and former landfill site and relieve the potential constructability hardship its unique conditions present to the project.

Type II, SWDM Section 1.4 Variance – Section 1.4 prohibits the filling of Federal Emergency Management Agency (FEMA) designated floodplains without compensation due to potential for challenges associated with flooding, erosion, and environmental impact. It specifically states that fill within the FEMA 100-year floodplain outside of the Stream Corridor Protection Zone must be compensated by removing an equivalent volume of material or greater. However, the proposed site plans for the Marble Cliff Quarry Development Project are unable to adhere to this requirement due to the constructability and land use hardships that would be created.

This proposed project incorporates over 140 Ac. of mixed-use and recreational (passive and active park) development. The site's entire footprint resides on a former limestone quarry and landfill. According to the OEPA approved VAP for this project, one of the requirements is to place a 4 ft. cap of clean material over the existing trash layer. Based on the existing ground levels, the requirement for a 4 ft. cap, and the proposed grades needed for development, there is approximately 605,000 cubic yards of fill needed to fulfill the VAP requirements and development needs. 170,000 cubic yards of the 605,000 fall within the non-intentional/man-made 100-year floodplain. Also included within anticipated fill is approximately 340,000 cubic yards that will be used to cap solid waste areas on site, 35,100 cubic yards of which is material to cap shallow solid waste below the 100-year flood elevation.

There are several conditions that factor into why the development is unable to remove an equivalent volume of material, which are presented in this report. These include the presence of shallow limestone rock formations, the existence of landfill material under a majority of the proposed project site, land use restrictions within the dedicated Metro Park, and the inability to provide off-site storage due to limited potential mitigation areas within the same reach of the Scioto River. The said fill associated with this project is also within an unnatural floodplain that results from man-made conditions and through hydraulic analyses it has been found that such fill will not cause a rise in the Scioto River 100-year floodplain, as confirmed in a study completed by Doyle Hartman, PE (Appendix G).

Type II, SWDM Section 3.2 Variance – Section 3.2 of the SWDM states that stormwater quantity control facilities shall be designed to control runoff from small, moderate, and large storm events before it is discharged offsite. However, with this site's unique conditions, a hardship exemption from this requirement is being requested. As previously described the project is within the boundaries of an abandoned landfill, nearly half of the Metro Park parcel is within the 100-year floodplain, and both project areas have limestone present at various depths. The development will provide all necessary controls to meet water quality requirements prior to routing runoff to the Scioto River and existing Metro Park ponds, but additional storage will not be provided to avoid substantial hardship to the proposed development and destruction of the VAP required 4 ft. earthen cap.

If detention were provided per the manual, over one million cubic feet of storage could be required across the site. This would involve filling in the Metro Park's property to raise it out of the 100-year floodplain resulting in a massive reduction to the park footprint and would introduce significant interruption to the development's OEPA approved VAP across the former landfill sections. Above ground or underground storage systems could compromise the design integrity of the VAP, which was designed to not only create a 4 ft. point of contact from human activity but is also meant to keep surface water from infiltrating into the trash layer. The introduction of water to the trash layer will create an unwanted environmental/biologic condition resulting in negative byproducts and impacts. As part of the design experience for the Metro Parks, we are proposing a control structure (weir) at the outlet of the existing ponds. This control structure will be effective for the more frequent storms as its main function is to control the water levels to a manageable height throughout the year. With approximately half of the MCC development site being directed to these ponds, there will be a period of extended detention for the more frequent events. This however, takes place within the FEMA delineated man-made 100-year floodplain so it can't be counted, but will be in practice.

Type III, SWDM Section 1.3 Marble Cliff Quarry Development Variance – Section 1.3.2 of the City of Columbus SWDM states that the SCPZ shall be kept in as natural state as possible so that it can perform its inherent ecological and hydraulic functions. As part of this policy, various activities are prohibited such as filling and construction that results in direct impacts to an existing stream. However, it is necessary to impact the SCPZ for both the Scioto River and Roberts Millikin Ditch in order to complete the OEPA approved VAP and to maximize the recreational footprint of the Metro Park.

In order to develop the site's intended mixed-use and recreational areas and clean up an environmental nuisance, an OEPA Rule 13 authorization agreement was acquired by the project due to existing solid waste areas that result from a former landfill. To follow the plan outlined in this permit and the project's VAP, all areas within the site's Rule 13 boundary are to be capped to obtain a minimum cover of 4 ft., including those found within the Scioto River's SCPZ. This variance will allow necessary capping and grading to improve these former landfill areas in addition to adjacent areas either with deeper trash or without contaminated materials for future development. It will also ultimately promote environmental safety and will accept the development plan's incorporation of newly dedicated SCPZ sections along the Scioto River. This project is committed to providing a preservation type easement along the Scioto River corridor and providing more mitigation area than the minimum required 1:1 ratio north of the phase 1 development.

Type III, SWDM Section 1.3 Columbus and Franklin County Metro Park Variance – As previously discussed, an additional variance from Section 1.3 is being sought on behalf of the Columbus and Franklin County Metro Park District. This variance will allow additional encroachments to the Roberts Millikin Ditch SCPZ to support amenities within the proposed Quarry Trails Metro Park. Burgess and Niple, Inc. prepared this request, but it is being included within this variance package due to its direct relation to the Marble Cliff Quarry Development Project. Details regarding this request can be found in Appendix A1, which outlines how these encroachments will support the new park's various recreational features, while sufficiently mitigating all channel and SCPZ impacts on site.

Project and Site Information

The proposed project site is located in a mixed commercial, industrial, and residential area east of Dublin Road and north of Trabue Road in the west central portion of the City of Columbus. The site consists of over 100 Ac. of land previously used as a limestone quarry and landfill, which is identified by Franklin County parcel identification numbers 560-298027, 560-298029, 560-298030, and 560-298033. The Scioto River borders the site to the east and the approximate latitude/longitude coordinates at the center of the site are 40.000732/-83.085820.

Historical records indicate that the site was developed as a limestone quarry in the 1850's as part of a larger area known as the Marble Cliff Quarry that encompassed nearly 2,000 Ac. When the Marble Cliff Quarry began along the banks of the Scioto River, it was considered one of the largest limestone deposits in the world. The stone from this quarry was used in building multiple Columbus area landmarks, such as the Ohio Statehouse, Ohio Stadium, and LeVeque Tower. Prior to June 1974, much of the site's eastern portion was used as a landfill. After the sale of the Marble Cliff Quarry Co. in approximately 1985, mining operations extended into its northern sections. Land around the site was developed into tracts of residential and commercial property as quarry operations ceased. Significant development in this area has continued in recent years and follows the City of Columbus 2011 "Trabue/Roberts Area Plan" that established guidelines for new commercial, industrial, and residential development (Figure 1).

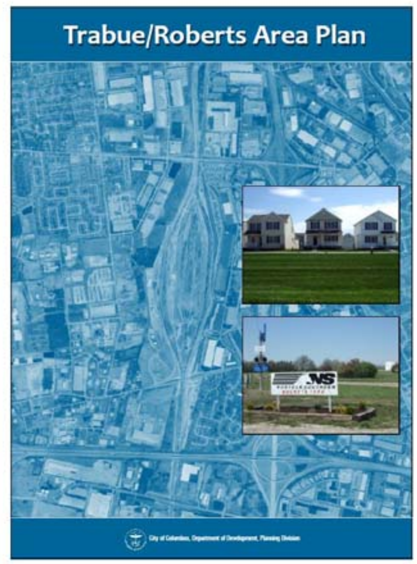

Figure 1: City of Columbus 2011 Trabue/Roberts Area Plan.

Throughout the western side of the site are areas of shallow water with a thin silty substrate, underlain by rock and gravel from previous quarry activities. The eastern portion of the site consists of former landfill areas with a surface cover of rock, boulders, and loose limestone aggregate with a thin cover of previously stripped topsoil overburden. The majority of the site is vegetated by various trees and shrubs, consisting of bush honeysuckle, invasive pear trees (callery pear), buckeye, cottonwood, ash, box elder, and hackberry.

Investigation of the site's current conditions revealed that approximately 42 Ac. contain solid waste. These areas are located on the eastern side of the site, adjacent to the Scioto River and have been identified to fall within OEPA Rule 13 property boundaries. The total area includes approximately 19 Ac. of solid waste with a minimum of 4 ft. of existing loose material cover and

23 Ac. of solid waste with 2 ft. or less of existing loose material cover. After mapping out waste locations, 2.5 Ac. with 2 ft. or less of cover were found to overlap the 100-year floodplain that extends throughout the site. Proposed development does not intend to excavate within these solid waste areas, but approximately 35,100 cubic yards of material will be used for capping the shallower waste zones that overlap the 100-year floodplain. Exhibits of these solid waste areas can be seen below in Figure 2 and found in Appendix I.

Figure 2: Approximate solid waste locations within site.

The current site contains two large quarry ponds within the Metro Parks parcel that have a combined surface water area of approximately 17 Ac. These ponds were created by former limestone quarry operations and were not created by the impoundment of a jurisdictional stream. There are no observed inflow (other than the discharge hose from dewatering pumps) or outflow structures associated with these ponds, the upper pond overflows through a series of shallow channels into the lower pond, and the lower pond has no outlet to the Scioto River. Based on the review of historical topographic maps for the site, it appears a drainage channel previously crossed the central portion of the site in a general east/west direction. This drainage is identified as Roberts Millikin ditch west of the site and is carried through a culvert beneath Dublin Road, where it then enters the site near its west central portion (Figure 3). Mapping indicates drainage through the site was altered or eliminated before 1955 due to limestone quarry activities, then re-routed sometime between 1989 and 1995 to direct water flow from areas west of the site to outside the limits of the mining areas before discharging to the Scioto River through a concrete culvert. According to a "Report of Jurisdictional Determination" prepared by Geotechnical Consultants Inc. (GCI) and an

"Approved Jurisdictional Determination" issued by the United States Army Corps of Engineers (Corps), both ponds and the constructed drainage channel through the site are not considered to be jurisdictional waters of the United States. GCI's report also did not observe any areas throughout the site exhibiting wetland characteristics. Each of these documents can be referenced in Appendix E in addition to property location maps, a GIS Mapping, USGS (Northwest Columbus, Ohio and Southwest Columbus, Ohio) various topographic maps, and aerial photographs showing historical development of the approximate site. Photographs showing representative vegetation, site features, and views from several locations around the site are also included in Appendix E.

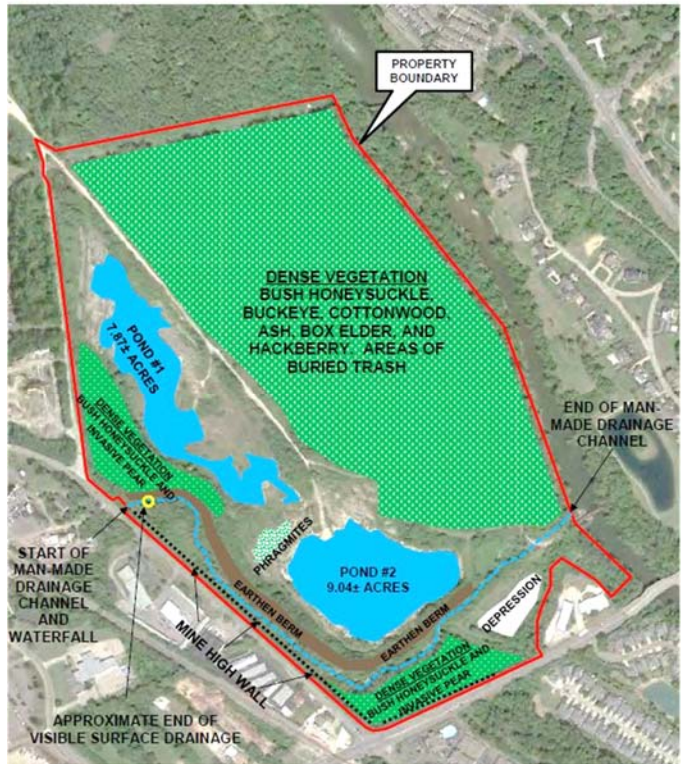

Figure 3: Map of existing site features.

Upon reviewing the Federal Emergency Management Agency (FEMA) mapping for flood information in the site area, several flood zones were identified. According to the most recent flood insurance rate mapping, the northeast portion of the site is within Zone X. The western and southern portions of the site were determined to be in Zone AE. These are areas where the base flood elevation has been determined. The eastern portions of the site, bordering the Scioto River, were determined to be in areas designated as Floodway Areas in Zone AE. This designation is described as the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. These designated flood zones have evolved over time due to development around the site in addition to the substantial quarry operations. Fill associated with the project has been proposed in Zone AE, within the 100-year flood elevation of 744.00 near the central and southwestern areas of the site. Several exhibits describing these areas and the fill associated with each one are provided in Appendix I.

As noted in the City of Columbus' 2011 "Trabue/Roberts Area Plan", the reuse of existing quarries should involve a manner of restoration that is compatible with the community and maximizes recreational potential. This is exactly how the MCC development group intends to use this site and why collaborative efforts have been made with Columbus and Franklin County Metro Parks to provide an opportunity for the new Quarry Trails Metro Park. Proposed development within the

Marble Cliff quarry site will include a variety of multi-family, single-family, retail, and commercial uses and included within close to half of the overall site will be parks and recreational areas developed by Columbus and Franklin County Metro Parks (Figure 4). Throughout the development will be over 15,000 linear feet of new roadway serving the entire community and connecting it to the adjacent River Oaks Apartments, future Gateway Lofts Development, and neighborhoods directly to the west and south. Additionally, over 5,000 linear feet of new trails will be built for local residents, Metro Park users, and the entire Central Ohio community as trails built along the Scioto River and across a former railroad bridge are intended to connect to Columbus' regional trail system as well as Hilliard's Heritage Rail Trail.

Figure 4: Preferred alternative development plan.

Proposed recreational portions of the site will occur throughout the new Quarry Trails Metro Park and will incorporate numerous areas for Columbus community members to share. As previously discussed, this project was master planned to maximize recreational space and its initial phase has set aside 62 Ac. for this park that is protected through multiple deed restrictions (Appendix C). The park areas will cover a large amount of the site's western side around the two existing quarry ponds and will promote a variety of activities such as kayaking, biking, running, hiking, paddle boarding, ice-skating, and fishing. Recreational features will include multiple trail systems, picnic areas, a dog park, pavilions/shelters, fitness zones, and several docking/portage sites. The park also has the opportunity to provide a unique water sports adventure complex for paddle craft and others that would connect the two, currently isolated quarry ponds to both Roberts Millikin Ditch and the Scioto River, creating a continuous, multi-faceted water "trail". This amenity would be unique to Quarry Trails Park and would offer recreational opportunities currently not available elsewhere in the Columbus and Franklin County Metro Parks System. A conceptual exhibit outlining the potential park associated with this site can be seen in Figure 4 and further details regarding proposed park features are provided in Appendices H, I, and L.

Section 1 – Reason Variances are Requested

Type II, SWDM Section 1.4 Variance:

Through the process of creating various conceptual drawings, proposed grading plans, and site development plans, the MCC project team attempted to minimize all environmental impacts this project introduces. However, in order to complete the OEPA approved VAP and prepare a site that adequately supports the new community, roadways, and Metro Park previously described, fill is necessary within the 100-year floodplain. Please note the presence of trash within the development footprint and within the 100-year floodplain as shown in Figure 2 and Appendix I. Section 1.4 of The City of Columbus SWDM prohibits filling of FEMA designated floodplains without equivalent compensation, but this project faces unusual design challenges and undue hardships by providing such storage. Due to these challenges, the Marble Cliff Quarry site is not able to adhere to this policy and meet its specific development goals, which includes maximizing the recreational footprint for pubic use. For this reasoning, E.P. Ferris and Associates, Inc. on behalf of MCC is seeking a Type II (Non-Stream protection) variance from the City of Columbus SWDM.

The project's site condition presents its first unusual design challenge that prohibits our team from providing equivalent compensatory storage. This site (acquired on February 28th, 2018) resides on what was formerly one of the largest limestone deposits in the world that encompasses nearly 2,000 Ac. (Figure 5). This subsurface condition creates a situation where removing material will be substantially more difficult than on a site with typical diggable subgrade material that can be simply excavated. Providing adequate storage within or around the site would involve blasting operations into the underlying limestone or exposed rock faces, which would introduce considerable constructability challenges, both monetarily and physically.

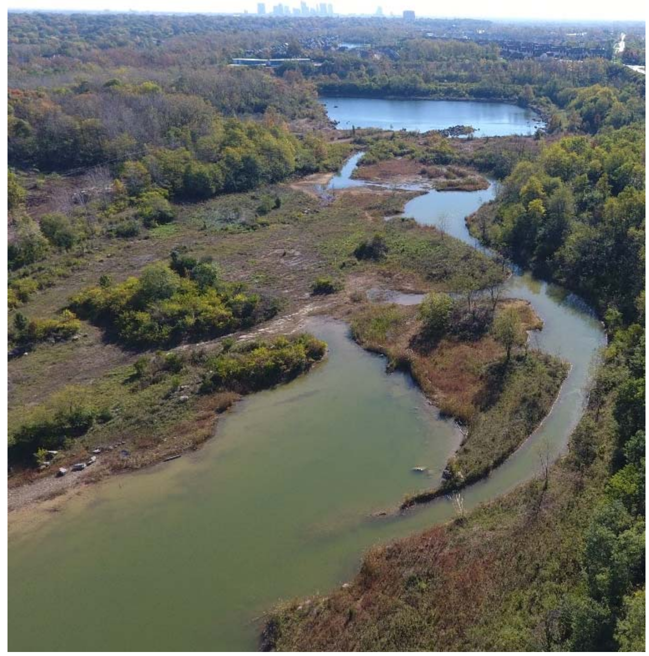

Figure 5: Existing quarry conditions.

Another unusual design challenge to providing compensatory storage is due to the fact that much of the developable footprint is within an abandoned landfill that is currently made up of layers of trash beneath the surface. Excavating trash at this time would not be a prudent step towards environmental compliance since the excavation would breech environmental controls installed under a VAP and Rule 13 authorization agreement with the OEPA (Appendix F). Additionally, the entire western side of the project has been dedicated to parkland for the Quarry Trails Metro Park, which makes a majority of the site unavailable for additional storage. With these special and unusual site characteristics and burdens, providing compensatory storage for the filling of a man-made/non-intentional 100-year floodplain would result in substantial hardship.

The preferred alternative will place a minimum 4 ft. clay cap over solid waste areas and prepare them for our intended development that will also support a new Columbus and Franklin County Metro Park. Part of this capping operation involves filling over an area where waste was found with two feet or less of cover, which also overlaps the 100-year floodplain. Filling in this area will not only adequately prepare the site's foundation, but it will eliminate direct exposure to waste and prevent contamination of surface and ground water. This will be performed in accordance with the approved VAP.

With the majority of the site preserved for a public park or filled with trash and the entire site containing limestone subgrade, viable mitigation is not possible. Even in areas without trash or land-use restriction and despite excavation through limestone, these would still have adverse effects to the private development and recreational opportunities of the site. In order to meet this project's goal to restore the quarry in a manner that is compatible with the community and that maximizes recreational use, on-site storage equivalent to fill within the 100-year floodplain cannot be met.

Due to restrictions within the project site, our team reviewed possible mitigation sites in the surrounding corridor that are within reasonable reach of the Scioto River. In this review, many undeveloped, potential mitigation sites in the corridor were found to be owned by public entities. Additionally, privately owned sites that could be potential candidates for floodplain mitigation are generally already highly developed or include utilized properties. Other potential sites lack area outside of the SCPZ or floodway to create meaningful compensatory storage.

The project's final unique circumstance is that it intends to place fill within a 100-year floodplain that results from significant mining operations and altered surface features. It can be projected based on research of the site's conditions and aerial photographs that millions of cubic yards of material were mined around the proposed fill locations, which directly impacted the 100-year floodplain within this site (Figure 6). According to conservative projections, the proposed fill back into the current 100-year floodplain only replaces a fraction of what has been mined out over the quarry's operation. The relatively minor amount of fill required by this site within the current floodplain is essentially replacing mined material and cannot be expected to significantly alter flood conditions as substantial landfilling and mining operations have in the past.

Figure 6: Surface feature comparison between 1957 and 2004.

Since the intended placement of fill relates to loss of upstream floodplain storage and to confirm that there would be no impacts to the 100-year peak flows or Scioto River flood elevation, hydraulic analyses were conducted to investigate post-hydrologic conditions. This analysis and proposed condition modeling indicated no increase in peak flood elevation of the Scioto River. Based the parameters of the HEC-RAS analyses and its results, fill within the floodplain as previously described cannot be interpreted as provoking negative impacts on the local hydraulic system. This analysis and its results are provided in Appendix G.

Due to these unique conditions, strict adherence to the compensatory storage requirements of the Stormwater Drainage Manual cannot be achieved without inducing significant hardship to this project's recreational goals and depriving site development and infrastructure opportunities. We hope that this variance request will allow for the approval of the project's preferred alternative plan, which will ensure practical use of the site and maximize its recreational potential.

Type II, SWDM Section 3.2 Variance:

As required by the City of Columbus SWDM Section 3.2, stormwater quantity control facilities shall be designed for new development to control runoff from various storm events before being discharged offsite. For multiple reasons, a variance is being requested from this policy, specifically to be exempt from stormwater quantity controls due to various restrictive site conditions that create unusual design challenges. These include areas of existing trash actively being capped, areas of unharvested limestone, deed restrictions in place over the Metro Park Property, a lack of sufficient park land above the 100-year floodplain, and specific hydraulic conditions needed to sustain reasonable recreational opportunities.

Following the project's VAP, which was previously approved through the OEPA, this project intends to clean up the former landfill sections throughout the site within a designated Rule 13 boundary. This is being completed in an operation that involves deep dynamic compaction and the installation of a clean clay cap across areas of existing trash. The active plan will not only adequately prepare this site for development, but also help eliminate the local environment's direct exposure to waste and reduce potential contamination of surface or ground waters.

Due to the site's former landfill sections previously described and shown in Figure 2, stormwater quantity controls within these areas would risk contamination and would induce hardship to the project by breeching the installed environmental controls as required by its VAP. There are also limited areas outside of the designated Rule 13 boundary that are above the 100-year floodplain and not associated with restricted park property. However, these would also introduce hardship since they include an unharvested limestone subgrade where installing stormwater quantity would involve significant constructability challenges.

As this project also includes 62 Ac. of land previously set aside for the Columbus and Franklin County Metro Parks, a variance from SWDM Section 3.2 would also allow for a stormwater quantity control exemption for the 62 Ac. parcel. Part of the reasoning for this exemption is due to the park's lack of sufficient land that is above the 100-year floodplain where stormwater quantity controls are required to be placed per SWDM Section 3.1.

The Quarry Trails Metro Park proposed within the 62 Ac. property will involve use for recreational activities for park visitors and will include the creation of a formal channel between the upper and lower quarry ponds to allow active recreational activities within the pond system. The pond system will also be connected to the Scioto River through the creation of a weir to allow flow to discharge from the lower pond to the Scioto River. However, in order to receive enough flow through the pond system to sustain reasonable recreational opportunities year-round, it is proposed that the Metro Park accepts un-detained stormwater from the 62 Ac., the adjacent MCC property, and Gateway Lofts.

Gateway Lofts, an extended stay hotel on a 9-acre parcel, has already received a Type II variance from the City of Columbus to allow stormwater quantity control for runoff from the site to be handled by the Quarry Metro Park's pond system. Additionally, a stormwater drainage easement has already been recorded with the Franklin County Recorder, which establishes six points of possible stormwater discharge from the MCC property to the Park property (Appendix D). Stormwater from the park itself would also be directed into the ponds and all contributing sites would provide stormwater quality control for their respective stormwater in accordance with City of Columbus and OEPA requirements for redevelopment prior to discharge to the Park's ponds. Quarry Trails Metro Park would provide quality control via swales and/or filter strips for its proposed buildings and parking lots and MCC's development would utilize individual water quality pre-treatment units, vegetative swales, bioretention facilities, pervious pavers, or filters strips for quality control.

By granting this variance request, both the MCC and Columbus and Franklin County Metro Parks properties within this project would be exempt from stormwater quantity controls. Despite the various hardship conditions this project faces, this exemption would allow for the preferred development plan of the entire site and for the project to maximize use of its recreational space.

Type III, SWDM Section 1.3 Marble Cliff Quarry Development Variance:

The project site's existing conditions present an additional unusual design challenge that requires our team to obtain a variance from Section 1.3 of the SWDM and encroach upon the Scioto River's SCPZ on the eastern side of the site. Despite this section's restrictions from certain construction activities within a stream's SCPZ, this site resides on a formerly active landfill with areas of existing trash under less than two feet of cover that currently overlap the Scioto's SCPZ. Due to this overlap and in accordance with an active VAP, the project's preferred plan incorporates capping this area and grading its surrounding sections in preparation for future development in addition to new trails intended to connect to Columbus' regional trail system as well as Hilliard's Heritage Rail Trail.

Figure 5: Evidence of buried trash in eastern section of site.

Filling within waste areas overlapping the Scioto SCPZ will not only adequately prepare the site, but it will also help eliminate the local environment's direct exposure to waste and reduce potential contamination of surface and ground water. By granting this Type III variance, the project will be able to significantly improve conditions within the Scioto River's SCPZ and will mitigate these necessary encroachments by dedicating new SCPZ directly adjacent to these areas, on-site at a ratio greater than 1 to 1.

A Type III Variance from the SWDM Section 1.3 is also being requested for the Marble Cliff Quarry Development due to the project's preferred alternative on the south side of the site adjacent to Roberts Millikin Ditch. These areas are depicted in the preferred alternative plan in Appendix J and occur directly south of the site's lower quarry pond and proposed Metro Park. If granted, this variance will allow the project to encroach upon the non-jurisdictional, designated stream's SCPZ for the purpose of building mixed-use development and related roads. These encroachments will not impact enhancements to the stream by this project as described in Appendix A1 or the preferred plan to redirect its flow to create a more vibrant ecological and recreational environment within the Metro Park. Encroachments to Roberts Millikin Ditch will be mitigated at a ratio greater than 1:1, but in the same Scioto River SCPZ dedication areas previously discussed rather than along this non-jurisdictional stream.

If full compliance with the SWDM was required, this project would not be permitted to complete the clean clay capping plan per its VAP along the eastern side of this site currently within the Scioto River's SCPZ. Additionally, if these landfill sections within the existing Scioto SCPZ were not capped, then development along the entire eastern side of the site as depicted in Figure 4 would not be possible due to OEPA Solid Waste Regulations and the site's potential negative health impacts. These conditions would certainly deprive our team of the reasonable use of this land and of the team's original intent to improve the site's poor environmental conditions.

In regards to the Roberts Millikin Ditch SCPZ encroachment, full compliance with the SWDM would involve removing all preferred development along the south side of the project. Due to existing steeper grades throughout this side of the site, grading is necessary within the existing SCPZ to adequately develop these areas. If this is not completed, then development here would not be possible, depriving reasonable use of this land.

For these various reasons, the Marble Cliff Quarry Development is requesting this Type III Variance from SWDM Section 1.3 to encroach upon the Scioto River and Roberts Millikin Ditch SCPZ. As previously explained, these encroachments will be mitigated at a ratio greater than what is required and the variance will grant the project's reasonable use of this land to adequately complete the VAP and maximize its developable/recreational potential.

Type III, SWDM Section 1.3 Columbus and Franklin County Metro Park Variance:

See Appendix A1.

Section 2 – Site Development Alternatives

Type II, SWDM Section 1.4 Variance

No Impact & Minimal Impact/Degradation Development Alternative Plans:

The no impact and minimal impact options related to the SWDM Section 1.4 variance for this site involve eliminating potential development across the site and reducing public park planning. By introducing compensatory storage to account for preferred fill within the 100-year floodplain, mixed-use and Metro Park plans would be significantly disrupted across all sections of the project to a point where effective development is no longer possible.

In a no impact plan, the site would unfortunately remain dormant and the project's VAP would not be completed, leaving an existing landfill unsuitable for mixed-use or recreational development. Through a minimal impact plan, storage accounting for approximately 170,000 cubic yards of fill within the non-intentional/man-made 100-year floodplain would be provided in a central location of the site free of existing solid waste or preserved park areas. This would require mitigation through areas with either unharvested limestone subgrades or cliff faces of existing quarry canyon walls. This operation would introduce planning, programming, and constructability hardship to the redevelopment of this project and comes with significant negative impacts to its plan for providing an improved site that the entire community can benefit from. It would also deter from maximizing recreation space as developable areas lost to providing compensatory storage would need to be accounted for by reducing the size of preferred park planning.

Preferred Development Plan:

This project's preferred alternative will include the site features previously described in this report without providing compensatory storage for fill placed within the current 100-year floodplain. The site will maximize its recreational potential, develop the site to its full potential, and completely cap areas of existing solid waste. This plan will adequately prepare the site to support multi-family, single-family, retail, and commercial properties, over 15,000 linear feet of new roadway, over 5,000 linear feet of new trails connecting to Columbus' regional trail system as well as Hilliard's Heritage Rail Trail, and the new Quarry Trails Metro Park. Necessary fill within the 100-year floodplain in this plan will also not increase the Scioto River's peak flood elevation as shown in Appendix G.

This plan will follow recommendations established in the City of Columbus 2011 "Trabue/Roberts Area Plan" by restoring the existing quarry in a manner that is compatible with the community and maximizes recreational potential. More detailed exhibits of our preferred development plan that indicate proposed grading plans and provide detailed renderings are provided in Appendices H and I.

Due to fill projections below the 100-year flood elevation being based on actual topography and not on FEMA FIRM mapping, this project intends to file the required LOMR application to update FEMA mapping accordingly. This will be completed upon acceptance of this variance and once the filling operation is completed.

Type II, SWDM Section 3.2 Variance

No Impact & Minimal Impact/Degradation Development Alternative Plans:

Similar to the SWDM Section 1.4 variance, the no impact and minimal impact options for this project related to providing storm water quantity will significantly affect planning goals of maximizing opportunities for public recreation and creating an integrated mixed-use development within a park setting. Unfortunately, providing for stormwater quantity controls would reduce the size of the public park and developable footprint as well as impact the execution of the OEPA approved VAP. The only area available for stormwater quantity would be in a central section of the site absent of existing trash and outside/above of the 100-year floodplain.

As previously discussed, the request for hardship exemption is driven by the recreational opportunities that can be provided by the Quarry Trails Metro Park within this project. If the proposed hardship exemption is not granted and stormwater facilities for the project were required, development of the proposed Quarry Trails Metro Park will not occur since there is insufficient space for the establishment of any stormwater quantity control within the park area that is outside or above the 100-year floodplain. The proposed connection of the lower quarry pond to the Scioto River would also not be constructed, which would cause requirements of the manual to reduce flows to “pre-developed” conditions to not be practically met as the lower pond does not have a discharge point to the Scioto River. Following the manual, all runoff entering the quarry ponds in the developed condition would have to be retained on site up to the 100-year storm event in order to match “pre-developed” conditions. The volume of runoff retained within the pond from the undeveloped site currently results in water level fluctuations of up to six feet that will only increase with development of the Park and MCC parcels. Therefore, without relief from stormwater quantity control requirements, an outlet from the pond cannot be constructed and the park will be subject to frequent flooding, further hindering the ability for development of the park’s amenities and reducing recreational opportunities for the public.

Additionally, without establishing an outlet to the Scioto River, Roberts Millikin Ditch will not be rerouted into the pond system as preferred and described in Appendix A1. The proposed improvements to the quality of the Millikin Ditch (QHEI and HHEI) that would result from this relocation will subsequently not occur. The recreational opportunities provided by the Quarry Trails Metro Park will also be severely diminished due to lack of flow through the pond system, lack of subsequent park development that can occur, and the subsequent inundation of the park from stormwater runoff without a Scioto River outlet.

Preferred Development Plan:

The preferred development plan resulting from this project's stormwater quantity control variance would reflect the site renderings provided in Appendices H and L. With un-detained stormwater runoff being discharged through quality controls, then directly to the Quarry Trails Metro Park, its unique recreational features including the kayak run would be possible. The connection to the Scioto River would also be built, allowing for Roberts Millkin Ditch to be rerouted and ultimately improved. With the new Metro Park being built, adjacent development on MCC's parcels would also be effectively built, all areas of existing trash would be completely capped per the project's VAP, and significant trail opportunities would be followed along the entire eastern side of the site as previously discussed. This plan has numerous, significant positive impacts on the Columbus community and will support full use of this site's developmental potential.

Type III, SWDM Section 1.3 Marble Cliff Quarry Development Variance

No Impact/Degradation Development Alternative Fully Complying with SWDM:

An alternative development plan for this project that fully complies with the SWDM would involve avoiding any encroachments to the Scioto River or Roberts Millikin Ditch SCPZ. This would drastically reduce all mixed-use development proposed across the MCC parcels in the project and would effectively diminish planning for the new Quarry Trails Metro Park as shown in Appendix J, Exhibit A.

Restricting encroachment into the Scioto River SCPZ would not allow capping of shallow landfill areas currently spread across the eastern edge of the site, which would significantly limit any potential development due to OEPA Solid Waste Regulations. These regulations require strict waste management to protect public and environmental health and the isolation of contaminated materials to prevent their exposure when development is proposed. These conditions are why the project is following a VAP through the OEPA to provide 4 ft. capping of solid waste areas prior to development. Failing to properly cap all areas of solid waste would breach this plan, effectively preventing our team from developing the site as previously stated.

Additionally, a lack of development across the project's eastern MCC parcels would eliminate the opportunity to provide unique recreational opportunities throughout its remaining trash-free, former quarry sections. The unique nature of the preferred plan would be reduced to a point where park programming would be limited and the potential for providing an adequately developed site to support features throughout a newly dedicated Columbus and Franklin County Metro Park would not be possible.

This alternative would certainly introduce planning, programming, and constructability hardship to the redevelopment of this site. It would also prevent efforts to contain contaminated materials within the Scioto River SCPZ to avoid their potential spread into the surrounding environment. Absence of landfill capping in this plan would allow rain and snowmelt to continue seeping through contaminants to the groundwater, runoff to carry contaminated material offsite or into the Scioto River, waste gas to be released, and surrounding residents/wildlife to potentially come into contact with hazardous material.

Further project impacts in a plan that fully complies with the SWDM would involve restricting improvements to the south side of the site adjacent to Roberts Millikin Ditch. Our team would not encroach upon the ditch's SCPZ and therefore would not be able to adequately grade this section of the site for proposed development. Overall, the no impact alternative for this project comes with substantial negative effects to its plan for providing an improved site that the entire community can benefit from.

Minimal Impact/Degradation Development Alternative Plan:

The minimal impact plan alternative for this project involves limiting SCPZ encroachments only to the Scioto River as shown in Appendix J, Exhibit B. This plan would allow capping of all trash filled sections within the site, which would follow the project's VAP and adequately prepare the property for intended mixed-use development across its eastern side. However, encroachments would not be made to Roberts Millikin Ditch, eliminating the possibility for development on the site's south side. This side of the site would remain undeveloped, additional preferred Scioto River SCPZ dedication would not be possible, and practical utilization of MCC's property here would be deprived.

In this plan, all encroachments to the Scioto River would be mitigated at a ratio greater than 1:1 on site directly north of proposed development along the river. This mitigation would result in a dedication of 5.42 Ac. of new SCPZ, while the Scioto River encroachment would amount to 4.85 Ac., which accounts for the construction of new leisure paths on the eastern edge of this site. These are not considered additional SCPZ encroachments in accordance with SWDM Section 1.3.4 that permits the construction of paved trails to further passive recreation uses. As previously discussed, these trails will provide an opportunity to connect to Columbus' regional trail system as well as Hilliard's Heritage Rail Trail.

With development across the eastern side of the site possible, the proposed Quarry Trails Metro Park within the western side of the site would be developed and partial recreational potential of the site would be achieved. Millikin Ditch encroachments by the park's development would not be accounted for in this plan or in the preferred development plan as this part of the project will manage its SCPZ impacts separately through stream enhancement detailed in Appendix A1.

Preferred Development Plan:

The preferred plan for this project involves encroaching upon the Scioto River SCPZ in addition to the Roberts Millikin Ditch SCPZ as shown in Appendix J, Exhibit C. These preferred encroachments will allow our team to complete the OEPA approved VAP by capping existing shallow landfill areas within the Scioto River's SCPZ and to complete grading adjacent to these areas in preparation for future mixed-use development. They will also enable the preferred development of the Quarry Trails Metro Park, which will effectively enhance Millikin Ditch's streambed, channel morphology, and outlet conditions. The overall, preferred development plan is also shown through a rendering depicting the site and its proposed features in Appendix H.

As previously stated, former landfill sections within the Scioto River SCPZ are being capped not only for the preferred development of the site's eastern side, but to contain contaminated materials along the River's banks that can harm the environment. Their thorough containment is critical since this site plans to serve as the future location of a new Metro Park that will occupy 62 dedicated acres as well as over 80 acres of mixed-use development. Capping in the Scioto River SCPZ will also prepare the eastern side of the site to support new paved trails that are intended to provide connections to the Columbus' regional trail system and to Hilliard's Heritage Rail Trail.

Encroachments to the Scioto River SCPZ in the preferred plan will amount to 4.85 Ac. (accounts for leisure paths) and encroachments to the Roberts Millikin Ditch SCPZ will be 1.47 Ac. for a total of 6.32 Ac. of SCPZ encroachment. The non-jurisdictional, Roberts Millikin Ditch will not be directly impacted and its encroachments will allow for adequate grading and development of the site's south side. Total SCPZ dedication to mitigate these encroachments will occur directly north of the site directly adjacent to the Scioto River at a ratio greater than 1:1 and will result in 7.03 Ac. of new SCPZ to be protected from future development and work around this project.

Type III, SWDM Section 1.3 Columbus and Franklin County Metro Park Variance

See Appendix A1.

Section 3 – Demonstration of Adequate Mitigation

Impact to SCPZ:

As previously discussed, this project's preferred alternative directly impacts the Scioto River and Roberts Millikin Ditch SCPZ by proposing landfill capping along the eastern edge of the site and the necessary grading along the southern side of the site. Landfill capping within the SCPZ is necessary to adhere to an active VAP with the OEPA and to adequately improve this project's environment for future development. Impacts to the non-jurisdictional ditch's SCPZ are included within our preferred plan to improve grading on the south side of the site to utilize and develop its areas in the project. Both of these disturbances will be accomplished while providing proper mitigation within the site.

Based on conceptual plans, approximately 4.85 Ac. of the Scioto River's existing SCPZ along the eastern side of the site will be impacted for necessary landfill capping and development grading. In regards to impacts on Roberts Millikin Ditch, approximately 1.47 Ac. of its SCPZ will be encroached upon for site grading and preparation related to development on the south side of the site. Together, these encroachments will be mitigated at a ratio of approximately 1:1.1 in a joint location depicted in Appendix J, Exhibit C. This area dedicated to new SCPZ will remain on site and directly north of the SCPZ capping areas on the site's eastern side. It is our team's intent when dedicating this new SCPZ to provide areas that will perform the same function as the disturbed SCPZ, but in a more environmentally preferable location.

Section 4 – Executive Summary

Unique conditions of the Marble Cliff Quarry site present various unusual design and constructability challenges to be considered. However, by granting the Type II and III Stormwater Drainage Manual variances sought by this request, the City of Columbus will allow improvements to be completed through this project's preferred alternative plan. This plan will fill within the man-made/non-intentional 100-year floodplain to adequately cap and grade the site and comply with the OEPA approved VAP, maximize the public park footprint creating an active recreational destination for the central Ohio community to enjoy, and improve the corridors of the Scioto River and Roberts Millikin Ditch SCPZ by enhancing their environmental conditions, increasing the QHEI of Millikin Ditch, and setting aside more SCPZ acreage than the SWDM currently requires. Repurposing this brownfield site into an active public park and park like mixed-use development is only possible with the approval of the requested variances. The unusual design challenges that this site possesses warrants the request of the above-mentioned variances from the SWDM.

APPENDIX A1

COLUMBUS & FRANKLIN COUNTY METRO PARKS QUARRY TRAILS METRO PARK TYPE III VARIANCE REQUEST (BURGESS & NIPLE, INC.)

Type III Variance Request

VIEW C: LOOKING WEST TOWARDS WEIR

Columbus & Franklin County Metro Parks Quarry Trails Metro Park

Trabue and Old Dublin Roads
Columbus, Ohio 43204

Prepared for:

Columbus & Franklin County Metro Park District
1069 West Main Street
Westerville, Ohio 43081

January 2018

BURGESS & NIPLE

TYPE III VARIANCE REQUEST

QUARRY TRAILS METRO PARK
TRABUE AND OLD DUBLIN ROADS
COLUMBUS, OHIO 43204

PREPARED FOR:

COLUMBUS & FRANKLIN COUNTY METRO PARK DISTRICT
1069 WEST MAIN STREET
WESTERVILLE, OHIO 43081

JANUARY 2018

PREPARED BY:

BURGESS & NIPLE, INC.
ENGINEERS • ENVIRONMENTAL SCIENTISTS • GEOLOGISTS
5085 REED ROAD
COLUMBUS, OHIO 43220

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EXECUTIVE SUMMARY

The Columbus & Franklin County Metro Parks (Metro Parks) is proposing a new park, Quarry Trails Metro Park, at a former quarry site located northeast of Dublin Road between Trabue Road and Old Dublin Road, near the Scioto River. The purpose of the proposed park is to create additional recreational opportunities for the community, including development of a proposed new water sports adventure complex for paddle craft and others that would connect two existing, currently isolated quarry ponds – an upper and a lower pond - to both Roberts Millikin Ditch (Millikin Ditch) and the Scioto River, creating a continuous, multifaceted water "trail" available to park visitors. This amenity would be unique to Quarry Trails Metro Park, and offer recreational opportunities currently not available elsewhere in the Columbus & Franklin County Metro Parks system.

To accomplish the proposed improvements, a portion of flow will need to be redirected from a manmade drainage channel historically constructed to convey flow from Millikin Ditch around formerly quarried areas of the site to the Scioto River. The U.S. Army Corps of Engineers (USACE) has determined this channel and the former quarry ponds to be non-jurisdictional features for regulatory purposes under the Clean Water Act (CWA). However, the City of Columbus, Division of Sewerage and Drainage (DOSD) has determined that the channel meets the definition of a "stream" for purposes of applying City stream protection requirements pursuant to the *City of Columbus Stormwater Drainage Manual*. Therefore, Metro Parks is seeking a Type III Variance for proposed impacts to this portion of Millikin Ditch and its associated Stream Corridor Protection Zone (SCPZ).

A portion of the flow from Millikin Ditch would be diverted through the new water sports adventure complex to include a waterfall, kayak run, the lower pond, and an enhanced outlet channel to the Scioto River. As proposed, the Preferred Alternative is the only feasible alternative that will allow sufficient water flow to consistently support this important amenity.

Specifically, Metro Parks is requesting a Type III Variance (Stream Protection) in order to:

1) Allow construction of a flow diversion weir at the head of the affected segment of Millikin Ditch to capture and redirect a portion of the flows through the proposed kayak run and lower pond. Flow redirection from Millikin Ditch is necessary to provide adequate flow to consistently support recreational use of the kayak run. The

existing Millikin Ditch channel will remain, and high flows in excess of the approximate 10-year storm event flow would be directed to this existing channel by the diversion weir;

2) Allow construction of a spillway weir and outlet channel at the downstream end of the lower pond. The outlet channel will connect the lower pond back into Millikin Ditch, allowing it to outlet to the Scioto River. Millikin Ditch is currently not connected to the lower pond. The lower pond currently has no outlet to the Scioto River.

3) Allow construction of proposed channel and other improvements to approximately 545 linear feet (lf) of Millikin Ditch at the downstream end of the project, to its confluence with the Scioto River, including a culvert to allow paved trails for passive use to connect over the existing Millikin Ditch.

4) Allow riparian zone impacts necessary for park development in the SCPZ of Millikin Ditch totaling an estimated 3.35 acres.

Total estimated channel impacts associated with the Preferred Alternative are **552 lf**. Total estimated impacts to associated riparian SCPZ areas are **3.35 acres**. All proposed channel and riparian SCPZ impacts will be mitigated onsite.

1.0 REASON FOR VARIANCE REQUEST

1.1 Type of Variance Requested

The Columbus & Franklin County Metro Parks (Metro Parks) is requesting a Type III Variance (Stream Protection) from certain provisions in Section 1.3 of the Columbus Stormwater Drainage Manual (CSWDM)[1] for aspects of the proposed Quarry Trails Metro Park. Type III Variance approval is required in order to:

1) Allow construction of a flow diversion weir at the head of the affected segment of Roberts Millikin Ditch (Millikin Ditch) to capture and redirect a portion of flow through the proposed kayak run and lower pond. Flow redirection from Millikin Ditch is necessary to provide adequate flow to consistently support recreational use of the kayak run. The existing Millikin Ditch channel will remain, and high flows in excess of the approximately 10-year storm event flow would be directed to this existing channel by the diversion weir;

2) Allow construction of a spillway weir and outlet channel at the downstream end of the lower pond. The outlet channel will connect the lower pond back into Millikin Ditch, allowing it to outlet to the Scioto River. Millikin Ditch is currently not connected to the lower pond.

3) Allow construction of proposed channel and other improvements to approximately 545 linear feet (lf) of Millikin Ditch at the downstream end of the project, to its confluence with the Scioto River, including a culvert to allow paved trails for passive use to connect over the existing Millikin Ditch.

4) Allow riparian zone impacts necessary for park development in the Stream Corridor Protection Zone (SCPZ) of Millikin Ditch totaling an estimated 3.35 acres.

All proposed channel and riparian SCPZ impacts will be mitigated on site.

[1] *City of Columbus Stormwater Drainage Manual,* Department of Public Utilities, Division of Sewerage and Drainage, Columbus, Ohio, August 2012.

1.2 Project Description

The Quarry Trails Metro Park is proposed to be constructed on a 62-acre parcel (Parcel No. 560-298033) acquired by Metro Parks in February 2018. A site location map is included in **Appendix A.** The existing parcel includes two ponds – an upper and a lower pond – that were formed through historical site quarrying operations. Currently, the upper pond periodically overflows through a series of diffuse, shallow surface channels into the lower pond, but otherwise, the two ponds are not connected. The lower pond currently has no outlet to the Scioto River. Accumulated site storm water runoff is temporarily stored above the typical dry weather surface elevation of 719.0±, gradually infiltrating into the ground following each precipitation event. The existing parcel also contains Millikin Ditch, which is hydrologically separated from the ponds, and flows in from the west side of the property through a constructed ditch around the south perimeter of the property before discharging to the Scioto River through a concrete culvert.

The proposed project involves development of Quarry Trails Metro Park to offer a variety of recreational opportunities for park visitors, including the creation of a water sports adventure complex that will include a constructed kayak run. The proposed project also includes connecting the existing quarry ponds to the Scioto River through construction of a spillway and enhanced outlet channel at the downstream end of the lower pond. A site overview map is included in **Appendix B.**

In order to maintain enough flow through the kayak run channel to sustain reasonable recreational opportunities throughout the year, the following flow sources are proposed to be directed to the upper pond and proposed kayak run:

- Local stormwater runoff from the park itself;
- Stormwater from Gateway Lofts, an extended stay hotel on an adjacent 9-acre parcel, which has already received a Type II variance from the City of Columbus to allow stormwater quantity control for runoff from the site to be handled by the pond system within the Quarry Trails Metro Park;
- Stormwater from proposed new residential developments by the Wagenbrenner Development Company (Wagenbrenner) to be located adjacent to the park; and
- A portion of flow from Millikin Ditch.

Gateway Lofts and the Wagenbrenner residential developments will be responsible for quality control of their respective stormwater inputs in accordance with City requirements. Quarry Trails Metro Park will provide quality control for its portion via swales and/or filter strips for proposed buildings and parking lots within the park itself. The existing Millikin Ditch channel will remain and high flows in excess of the approximately 10-year storm event flow will be directed through the existing channel, such that it bypasses the ponds and the proposed kayak system.

Principal proposed project elements affecting Millikin Ditch and its associated SCPZ include:

- Capture and redirection of a portion of existing flows in Millikin Ditch in order to route them through the proposed kayak run channel and lower pond before directing them back into Millikin Ditch prior to its outlet to the Scioto River. Flow redirection will be accomplished by installation of a flow diversion weir in Millikin Ditch at the departure point for flow rerouting. Flows within the Millikin Ditch channel higher than the established weir crest elevation of 753± will continue to flow through the existing Millikin Ditch channel.

- Construction of a spillway and outlet channel at the downstream end of the lower pond. The purpose of these features is to connect the kayak run and lower pond to Millikin Ditch and provide an outlet for flows through these recreational elements to the Scioto River. Millikin Ditch is currently not connected to the lower pond. The outlet weir crest elevation will be set at a level sufficient to maintain adequate water levels in the kayak run and lower pond for paddle craft.

- Construction of approximately 545 lf of channel and other improvements to Millikin Ditch at the downstream end of the project. Proposed improvements include removal of an existing culvert beneath a former quarry haul road; channel substrate, morphology, and riparian vegetation enhancements; construction of a pedestrian bridge to allow trail crossing over Millikin Ditch; construction of an approximately 80-ft length culvert to allow paved trails for passive use to connect over the existing Millikin Ditch; and construction of dock facilities at the Millikin Ditch/Scioto River confluence to allow portage access from the Scioto River for paddle craft.

Metro Parks purchased the 62-acre parcel that the proposed Quarry Trails Metro Park is to be constructed on through a grant received from the Ohio Public Works Commission

(OPWC). By accepting the grant received by OPWC, Metro Parks agreed to permanent restrictions that involves using the funds for open space acquisition and protecting and enhancing riparian corridors. These restrictions include:

- The property shall only be used as a public park, public forest, public natural area, or public conservation area;
- The property shall be preserved and managed by Metro Parks to benefit present and future generations;
- Mature forest cover shall be preserved and enhanced;
- Metro Parks may restore and enhance native plant and animal communities and habitats;
- No buildings or structures may be erected on the property except for those to be used for public park purposes;
- No power or transmission lines are permitted; and
- No residential, commercial, or industrial uses are permitted on the property.

These restrictions apply to Metro Parks or any future owners or managers of the property. Metro Parks is restricted on selling, transferring, or leasing the property without written consent of OPWC. Hence, the property is to remain a public open space area for the foreseeable future. A copy of the parcel deed restriction is presented in **Appendix C.**

1.3 Affected Stream Resources

As described in **Section 1.2** above, development of the proposed recreational water sports adventure facilities at Quarry Trails Metro Park will require redirection of flows from a portion of a manmade drainage channel historically constructed to convey flow from Millikin Ditch around formerly quarried areas of the site to the Scioto River. Millikin Ditch does not have consistent flows through the channel and is frequently dry during periods without precipitation. A 2016 jurisdictional investigation by Geotechnical Consultants, Inc. (GCI) and subsequent U.S. Army Corps of Engineers (USACE) Approved Jurisdictional

Determination (AJD) have classified this channel to be a non-jurisdictional feature for regulatory purposes under the Clean Water Act (CWA). The two former quarry ponds on the property were also determined by USACE to be non-jurisdictional resources. However, the City of Columbus Division of Sewerage and Drainage (DOSD) has determined that Millikin Ditch meets the definition of a "stream" for purposes of applying City stream protection requirements pursuant to the *City of Columbus Stormwater Drainage Manual*.

Historical records indicate the property has been quarried for limestone dating back to at least the early 1900s. A 1903 historical U.S. Geological Survey (USGS) topographic map indicates a stream approximating the current course of Millikin Ditch entering the site from the west, then crossing the approximate center of the site to the Scioto River. This appears to be the original course of Millikin Ditch. Mapping from 1955 and subsequent historical topographic maps show Millikin Ditch terminating shortly after entering the site from beneath Dublin Road. This is consistent with where the current constructed channel begins, at the base of a former high wall along the west rim of the quarry.

The constructed channel is markedly different in character than upstream segments of Millikin Ditch, which are naturalized and founded largely on limestone bedrock. The constructed channel is relatively wide, shallow, and uniform in morphology, and lacks sinuosity. Channel bed material consists of unconsolidated, predominantly gravel-sized limestone materials. The channel is constructed between rock high walls and manmade berms of overburden and was clearly intended to direct flow around the south perimeter of the property, thus rendering more areas accessible for quarrying. Flow regime in the constructed channel is ephemeral, as verified by GCI during their 2016 jurisdictional investigation. Even though flow in the upstream segment of Millikin Ditch is perennial, flow appears to dissipate and percolate into the unconsolidated bed materials shortly after it enters the constructed channel, except in response to extreme precipitation events. The channel bed is normally dry for most of its length. Therefore, it does not support aquatic life. The channel flows through a concrete culvert under a former quarry haul road before it outlets to the Scioto River at the southeast corner of the site. Millikin Ditch has not been designated by the Ohio Environmental Protection Agency (EPA) for water quality purposes per Chapter 3745-1 of the Ohio Administrative Code (OAC).

A Qualitative Habitat Evaluation Index (QHEI) assessment of Millikin Ditch was conducted by GCI in March 2017. The existing QHEI assessment resulted in an overall score of 32. Substrate types included sand, gravel, and silt. Substrate embeddedness was rated normal.

Instream cover was nearly absent, consisting solely of undercut banks. Sinuosity was rated low, and morphological development poor. Bank erosion was rated heavy to severe throughout the reach, and functional riparian width was very narrow. Maximum pool depth observed was 0.2 to 0.4 meters (m) (8 to 16 inches [in.]). Best riffle areas were 5 to 10 centimeters (cm) (2 to 4 in.), and maximum run depth observed was < 50 cm (< 20 in.). Riffle/run embeddedness was rated low. Average channel gradient was determined to be 33.5 foot per mile, which equates to a very low channel slope of 0.006 feet per foot (ft/ft) or 0.6 percent. Existing QHEI metrics and the overall low score of 32 are consistent with the constructed and channelized character of Millikin Ditch in the project area.

Based on a drainage area of 3.26 square miles (sm) at its confluence with the Scioto River, the calculated total SCPZ width for Millikin Ditch is 230 feet (115 feet each side). **Table 1** below summarizes existing channel and riparian SCPZ values for Millikin Ditch in the project area.

Table 1
Millikin Ditch - Existing SCPZ Values in Project Area

Channel (lf)	Riparian (acre)	Total SCPZ Width (ft)
3,380	18.0	230

An exhibit showing the affected segment of Millikin Ditch and its associated SCPZ, copies of existing QHEI scoring forms, a copy of GCI's jurisdictional evaluation report, including site photographs, a copy of the USACE AJD, and SCPZ determination calculations are provided in **Appendix E.**

1.4 Proposed Stream and SCPZ Impacts

The need for adequate flow through the kayak run channel will require the capture and redirection of a portion of flows from existing Millikin Ditch to the proposed kayak run and pond system. A flow diversion weir will be constructed in Millikin Ditch at the flow diversion point to allow flows from approximately 10-year storms and smaller to be routed through the proposed water sports adventure complex. Excess high flows exceeding the diversion weir crest height will overflow into the existing Millikin Ditch channel. The majority of the existing Millikin Ditch channel will remain unimpacted. Details of the flow diversion weir are included in **Appendix K**.

An estimated 545 lf of Millikin Ditch will be impacted by proposed channel improvements at the downstream end of the project. These improvements include removal of the existing concrete culvert (approximately 150 feet in length) through which Millikin Ditch currently flows, installation of a pedestrian bridge over Millikin Ditch to connect paved trails for passive recreational uses, installation of a vehicular bridge over Millikin Ditch to provide access from Trabue Road to the proposed Wagenbrenner residential development, grading/filling/excavation associated with stream modifications and removal of the existing 150 ft culvert and installation of the bridges, installation of a new 80 ft culvert to allow connection of paved trails for passive use over existing Millikin Ditch, and placement of rock and planting of trees to enhance the stream channel and prevent erosion.

In addition to channel impacts and improvements, this application includes a request for approval of associated impacts to adjacent riparian areas within the Millikin Ditch SCPZ. The purpose of these activities is to enhance the existing quarry ponds, install pedestrian trail features, and allow for recreational opportunities for the community. These activities include:

- Excavation of an existing manmade berm (a portion of which is located within existing Millikin Ditch's SCPZ) and associated grading to create an outlet channel connecting the lower pond to Millikin Ditch and its outlet to the Scioto River;

- Construction of a proposed outlet spillway weir at the downstream end of the lower pond;

- Grading/filling/excavation around the stream channel to improve the existing Millikin Ditch channel downstream of the proposed lower pond spillway weir to the Scioto River and for installation of the proposed bridges across Millikin Ditch;

- Grading for paved trails for passive recreational uses; and

- Selective tree cutting, where necessary, for construction activities described in this document.

Metro Parks is proposing to mitigate these impacts on-site by enhancing the quality of both the proposed channel and riparian SCPZ zones at the downstream end of the project. **Table 2** below summarizes anticipated stream and SCPZ impacts associated with the Preferred Alternative.

Table 2
Proposed Stream and SCPZ Impacts – Preferred Alternative

Activity	Stream (lf)	Riparian (ac)
Millikin Ditch Overflow Weir (Approximately 3′ wide & 50′ long)	3	0.003
New Millikin Ditch Channel (Portion located within SCPZ)	n/a	0.22
Excavation of Manmade Berm (Portion located within SCPZ)	n/a	0.37
Lower Pond Weir (Approximately 4′ wide & 60′ long)	4	0.006
Grading for Passive Use Paved Trails	n/a	0.44
Existing Millikin Ditch Channel Improvements (including 80′ culvert)	545	2.31
Total	**552**	**3.35**

1.5 Permitted Uses in the SCPZ

In addition to the SCPZ impacts stated above in the **Section 1.4**, the proposed Quarry Trails Metro Park design concept includes several permitted uses within the SCPZ per Section 1.3.3 and 1.3.4 of the CSWDM. The permitted uses include:

- Revegetation with plantings of native species;
- Paved trails for passive uses;
- Pedestrian bridges (to connect paved trails for passive recreational uses at surface water crossings);
- Vehicular bridge (to provide access to the proposed Wagenbrenner residential development and Quarry Trails Metro Park from Trabue Road); and
- Installation of a sanitary sewer crossing over Millikin Ditch (via the pedestrian bridge) to provide services to the proposed Wagenbrenner residential development.

1.6 Statement of Hardship

A key concept in the vision for Quarry Trails Metro Park is the establishment of a proposed water sports adventure complex, consisting of a proposed waterfall, kayak run channel, water recreation opportunities in the lower pond, and an enhanced outlet channel to the Scioto River. These amenities are not available elsewhere in the Metro Parks system, and will be a unique feature and attraction for Quarry Trails Metro Park visitors.

The Preferred Alternative, which relies on being able to capture and redirect ordinary and a portion of high flows from the existing course of Millikin Ditch, is the only alternative that will provide adequate flow to consistently support the proposed new water sports adventure complex. While stormwater from the proposed new Wagenbrenner residential development, Gateway Lofts, and the park itself will also be captured and directed to the water sports complex, the flow from these sources is not sufficient to maintain the kayak run channel consistently throughout the year. Without supplemental flow from Millikin Ditch, this important and much anticipated amenity cannot reasonably be sustained, leaving this key park development concept unrealized, and unavailable as a recreational opportunity to the public.

Associated benefits to water quality and aquatic life resulting from proposed downstream channel enhancements and establishment of a continuous connection to the Scioto River, would also remain unrealized. Metro Parks believes anticipated project benefits to visitors, water quality, and aquatic life warrant granting of a Type III variance for proposed SCPZ impacts.

2.0 PROJECT ALTERNATIVES

2.1 Preferred Alternative

The Preferred Alternative consists of the following principal project elements affecting Millikin Ditch and its associated SCPZ:

- Capture and redirection of a portion of existing flows in Millikin Ditch in order to route them through the proposed kayak run channel and lower pond before directing them back into Millikin Ditch prior to its outlet to the Scioto River. Flow redirection will be accomplished by installation of a flow diversion weir in Millikin Ditch at the departure point for flow rerouting. Flows exceeding the established weir crest elevation of 753± within Millikin Ditch will overflow the weir and continue to flow through the existing Millikin Ditch channel.

- Construction of a spillway and outlet channel at the downstream end of the lower pond. The purpose of these features is to connect the kayak run and lower pond to Millikin Ditch and provide an outlet to the Scioto River. Millikin Ditch is currently not connected to the lower pond. The outlet weir crest elevation will be set at a level designed to maintain adequate water levels in the kayak run and lower pond for paddle craft.

- An approximately 545 lf of channel and other improvements to Millikin Ditch at the downstream end of the project. Proposed improvements include removal of an existing culvert beneath a former quarry haul road, channel substrate, morphology, and riparian vegetation enhancements, construction of a pedestrian bridge to allow trail crossing over Millikin Ditch, construction of an approximately 80 ft length culvert to allow paved trails for passive use to connect over existing Millikin Ditch, and construction of dock facilities at the Millikin Ditch/Scioto River confluence to allow portage access from the Scioto River.

The Preferred Alternative is the only alternative that will provide adequate flow through the proposed kayak run channel and lower pond sufficient to support this important amenity for recreational paddle craft use. The majority of the existing Millikin Ditch channel will remain unimpacted, and continue to carry flow during excess high flow events. As discussed in **Section 1.3** above, ordinary existing flows in Millikin Ditch appear to dissipate and percolate into the unconsolidated bed materials shortly after they enter the constructed channel, leaving it dry most of the time, and; therefore, unable to support aquatic life. Connection of the kayak run and lower pond back into Millikin Ditch, and proposed channel and other improvements at the downstream end of the project will significantly enhance the last approximately 545 lf of Millikin Ditch prior to its confluence with the Scioto River. All mitigation for this alternative will occur on site, including removal of an existing culvert, as well as substrate, channel morphology, and riparian zone enhancements. Proposed mitigation measures for the Preferred Alternative are further discussed in **Section 3.0.**

2.2 Minimal Impact Alternatives

In an attempt to further minimize impacts to Millikin Ditch and its associated SCPZ, the feasibility of operating the kayak run channel without flow from Millikin Ditch was considered. In the Minimal Impact Alternative, the diversion weir at the head of Millikin Ditch would not be constructed, and flow from Millikin Ditch would not be diverted to the kayak run and pond system. The kayak run, lower pond spillway weir, and connecting outlet channel to Millikin Ditch would be constructed as proposed. Proposed channel and other improvements to the last 545 lf of Millikin Ditch would also be constructed as proposed in the Preferred Alternative. Without supplemental flow from Millikin Ditch, flows in the kayak run would be limited to those generated by local stormwater runoff and stormwater inputs from adjacent developments (Wagenbrenner development and Gateway Lofts). These flows alone would be inadequate to consistently support this amenity. Flows from Millikin Ditch will supply approximately 65 percent of the total flow through the kayak channel and without these flows, the kayak channel cannot reasonably be supported even during a 1-year storm event. All mitigation for this alternative would occur on site.

2.3 No Impact Alternative

In order to avoid all SCPZ-prohibited activities in Millikin Ditch and its associated SCPZ, no features supporting the proposed water sports adventure complex could be constructed. Flows in Millikin Ditch could not be redirected, hence limiting flow to the proposed pond system. The diversion weir, lower pond spillway, and connecting outlet channel cannot be constructed without SCPZ impacts. The pedestrian bridges and vehicular bridge also cannot be constructed without SCPZ impacts, hence severely limiting access into and around the property. Proposed channel and other improvements in the downstream 545 lf of Millikin Ditch also could not be constructed. Park amenities would be limited to pedestrian trails and other permitted passive recreational uses. Agreements with Gateway Lofts have already been made to allow stormwater quantity control for runoff from the site to be handled by the pond system within the Quarry Trails Metro Park. If no outlet from the lower pond to the Scioto River is created, much of the park will flood from stormwater from the park and Gateway Lofts during storm events, rendering much of the park space unusable. While it would not result in impacts to Millikin Ditch or its associated SCPZ, the No Impact Alternative would not allow for development of proposed water sports adventure features, which would leave this key park development concept unrealized, and unavailable as a recreational opportunity to the public.

2.4 Alternatives Summary

The Preferred Alternative represents the only alternative that allows the proposed water sports adventure complex features at Quarry Trails Metro Park to be accessed by the recreational community consistently throughout the year. Under the Preferred Alternative, Millikin Ditch would be relocated and the riparian impacts to the SCPZ would be mitigated on site. **Table 3** below compares impacts and proposed mitigation quantities of all three alternatives.

Table 3
Comparison of Alternatives – SCPZ Impacts & Proposed Mitigation

Alternative	SCPZ Impacts		SCPZ Mitigation	
	Stream (lf)	Riparian (ac)	Stream (lf)	Riparian (ac)
Preferred	552	3.35	545	3.35
Minimal	549	3.13	545	3.13
No Impact	0	0	0	0

Exhibits depicting principal features of the Preferred, Minimal, and No Impact Alternatives are provided in **Appendix K.**

3.0 MITIGATION

3.1 Mitigation Requirements

Guidance established by the City of Columbus DOSD requires adequate mitigation to be provided for SCPZ and channel impacts as a condition of granting Type III Variance requests[2]. Adequate mitigation for SCPZ and channel impacts generally consists of the following:

Channel Impacts: Demonstrate channel health and functionality will not be impaired, as measured by equivalent or greater projected post-construction QHEI or Headwater Habitat Evaluation Index (HHEI) score and relevant supporting documentation.

SCPZ Impacts: Restoration or replacement of disturbed SCPZ area outside the channel with functionally equivalent area at the following minimum ratios:

- On site: 1 to 1
- Adjacent site: 1 to 1.5
- Same watershed assessment unit: 1 to 2
- Same County: 1 to 3
- Contiguous County: 1 to 5.

3.2 Proposed Mitigation for Channel Impacts

As discussed in **Sections 1.0 and 2.0** above, proposed channel impacts to Millikin Ditch consist of:

- Construction of a flow diversion weir at the head of Millikin Ditch to capture and redirect "normal" flows through the proposed water sports adventure complex. Excess high flows would overtop the weir and continue to flow into Millikin Ditch.

[2] *Guidance Document for Applying for a Variance from the Stormwater Drainage Manual*, Department of Public Utilities, Division of Sewerage and Drainage, Columbus, Ohio, September 2012.

- Construction of a spillway and outlet channel at the downstream end of the lower pond to connect the kayak run and lower pond back into Millikin Ditch and provide an outlet to the Scioto River. The outlet weir crest elevation will be set at a level designed to maintain adequate water levels in the kayak run and lower pond for paddle craft.

- Approximately 545 lf of channel and other improvements to Millikin Ditch at the downstream end of the project. Proposed improvements include removal of an existing culvert beneath a former quarry haul road; channel substrate, morphology, and riparian vegetation enhancements; construction of a pedestrian bridge to allow trail crossing over Millikin Ditch; and construction of dock facilities at the Millikin Ditch/Scioto River confluence to allow portage access from the Scioto River.

When assessed by GCI in March 2017, Millikin Ditch was assigned a **baseline QHEI score of 32**, which is consistent with its current constructed and channelized condition. The majority of the existing Millikin Ditch channel will remain unimpacted, and will continue to receive excess high flows diverted to it by the flow diversion weir at the head of the project reach.

Metro Parks is proposing to mitigate the above channel impacts on site through implementation of the above described enhancements in the downstream reach. Detailed construction plans for the project are not yet available, and are contingent on obtaining necessary permits, licenses, and variances, including this Type III Variance Request. Based on available conceptual plans and renderings depicting proposed future conditions in the approximate 545 lf downstream reach of Millikin Ditch to be enhanced, this segment of the ditch is conservatively anticipated to achieve a **projected future QHEI score of 54,** which represents an increase of 22 points relative to existing conditions. Proposed enhancements are expected to result in modest increases in all QHEI metrics, most notably in those addressing substrate composition, channel morphology, bank erosion, and pool/riffle quality. In addition to the above projected QHEI metric increases, implementation of proposed water sports adventure features and downstream channel enhancements may also be expected to improve prospects for supporting aquatic life by establishing a continuous surface connection between the upper reaches of Millikin Ditch, the existing quarry ponds, and the Scioto River. Small fish that may be carried downstream into the park from the upstream reaches of Millikin Ditch could now potentially access suitable habitat in the proposed kayak run, lower pond, enhanced downstream reach of Millikin Ditch, or the

Scioto River. Flow in Millikin Ditch currently tends to dissipate and percolate into the unconsolidated bed materials of the existing constructed channel, offering no potential to support aquatic life. The Scioto River is also projected to back up into Millikin Ditch and exceed the low crest height of the proposed spillway weir in the lower pond approximately six times annually, providing another route by which aquatic life could reach suitable habitat in the lower pond or other features in the water sports adventure complex. The lowest crest height of the proposed multilevel spillway weir is expected to be approximately 1 foot above the downstream outlet channel bed. This is not expected to create an impassable barrier to fish under normal flow conditions.

The proposed downstream channel enhancements will also provide primary recreation and educational opportunities for park visitors. The enhanced segment will not be passable to paddle craft, and will be designed to promote and facilitate pedestrian contact with the stream environment and the Scioto River waterfront. Trails, rock steps, shallow riffle zones, and a dock at the Scioto River are among the features proposed to encourage and enable visitors to safely explore the stream environment. The lower pond will also offer opportunities for shoreline exploration and water contact.

Total estimated linear extent of proposed channel mitigation enhancements is **545 lf**.

3.3 Proposed Mitigation for Riparian SCPZ Impacts

Proposed impacts to riparian areas within the SCPZ of Millikin Ditch include:

- Riparian zone impacts associated with the above channel impacts;
- Grading/filling/excavation around the stream channel to improve the existing Millikin Ditch and for installation of the proposed bridges across Millikin Ditch;
- Grading associated with construction of paved trails for passive recreational use in the SCPZ; and
- Selective tree cutting, where necessary for construction of proposed activities in the SCPZ.

Metro Parks is proposing to mitigate riparian SCPZ impacts on site in the channel enhancement segment of Millikin Ditch at the downstream end of the project. Proposed riparian mitigation measures include:

- Invasive species removal;
- Seed and mulch unavoidably disturbed riparian areas with appropriate native herbaceous species; and
- Plant appropriate native riparian tree and shrub species in unavoidably disturbed riparian areas.

The estimated total extent of proposed riparian SCPZ mitigation resulting from the above proposed activities is **3.35 acres.**

Projected QHEI scoring forms, conceptual renderings of proposed downstream channel enhancements and improvements, and other supporting mitigation materials are provided in **Appendix L.**

3.4 Summary of Proposed SCPZ Mitigation Measures

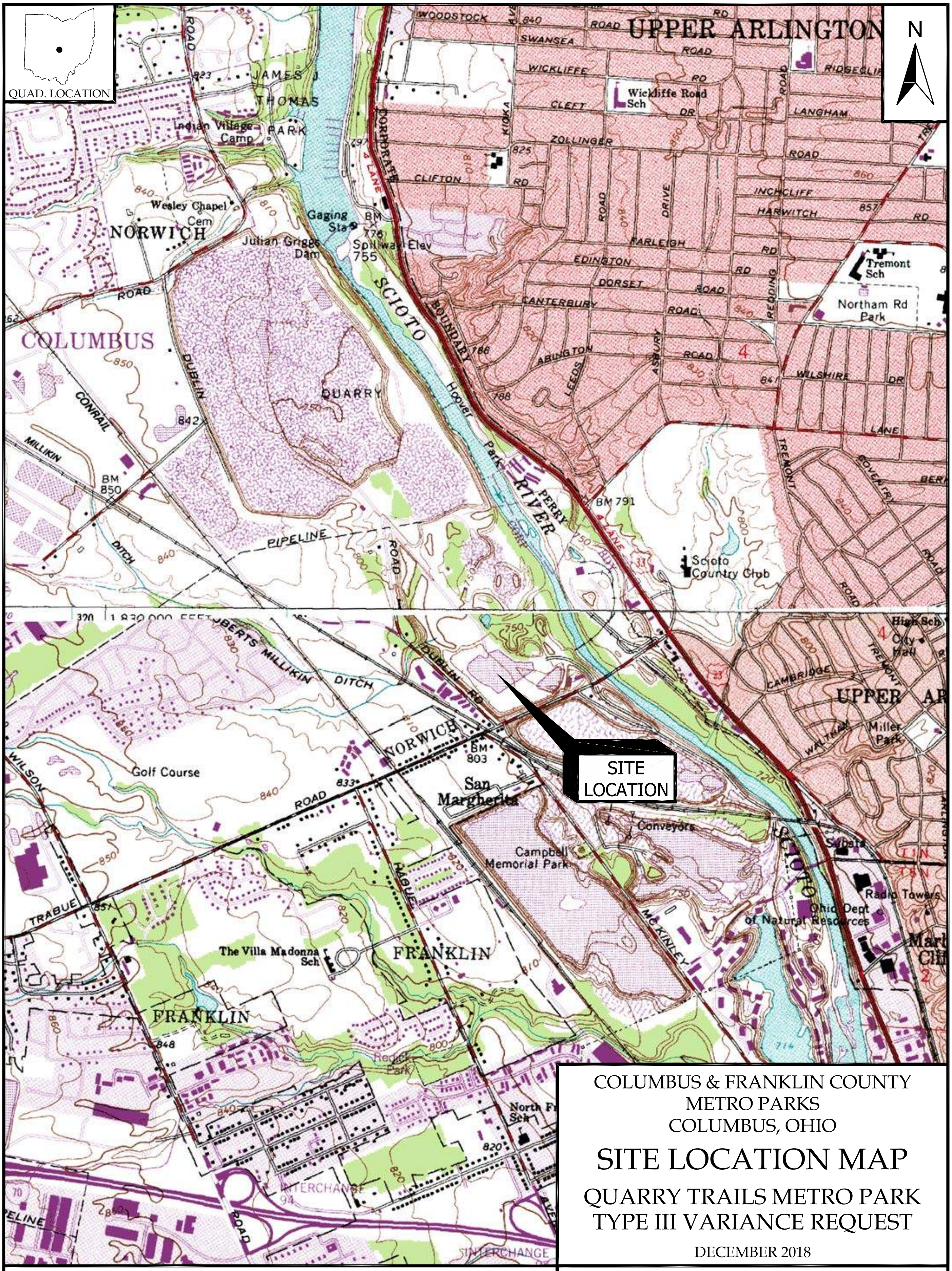
Table 4 below summarizes proposed channel and SCPZ mitigation measures for the Preferred Alternative.

Table 4
Summary of Proposed SCPZ Mitigation - Preferred Alternative

	SCPZ Impacts			SCPZ Mitigation		
	Stream (lf)	QHEI (Existing)	Riparian (ac)	Stream (lf)	QHEI (Proposed)	Riparian (ac).
Preferred Alternative	**552**	**32**	**3.35**	**545**	**54**	**3.35**

APPENDIX A

SITE LOCATION MAP



COLUMBUS & FRANKLIN COUNTY
METRO PARKS
COLUMBUS, OHIO

SITE LOCATION MAP

QUARRY TRAILS METRO PARK
TYPE III VARIANCE REQUEST

DECEMBER 2018

SOURCE:
7.5 MINUTE NW & SW COLUMBUS U.S.G.S. QUADRANGLE MAP

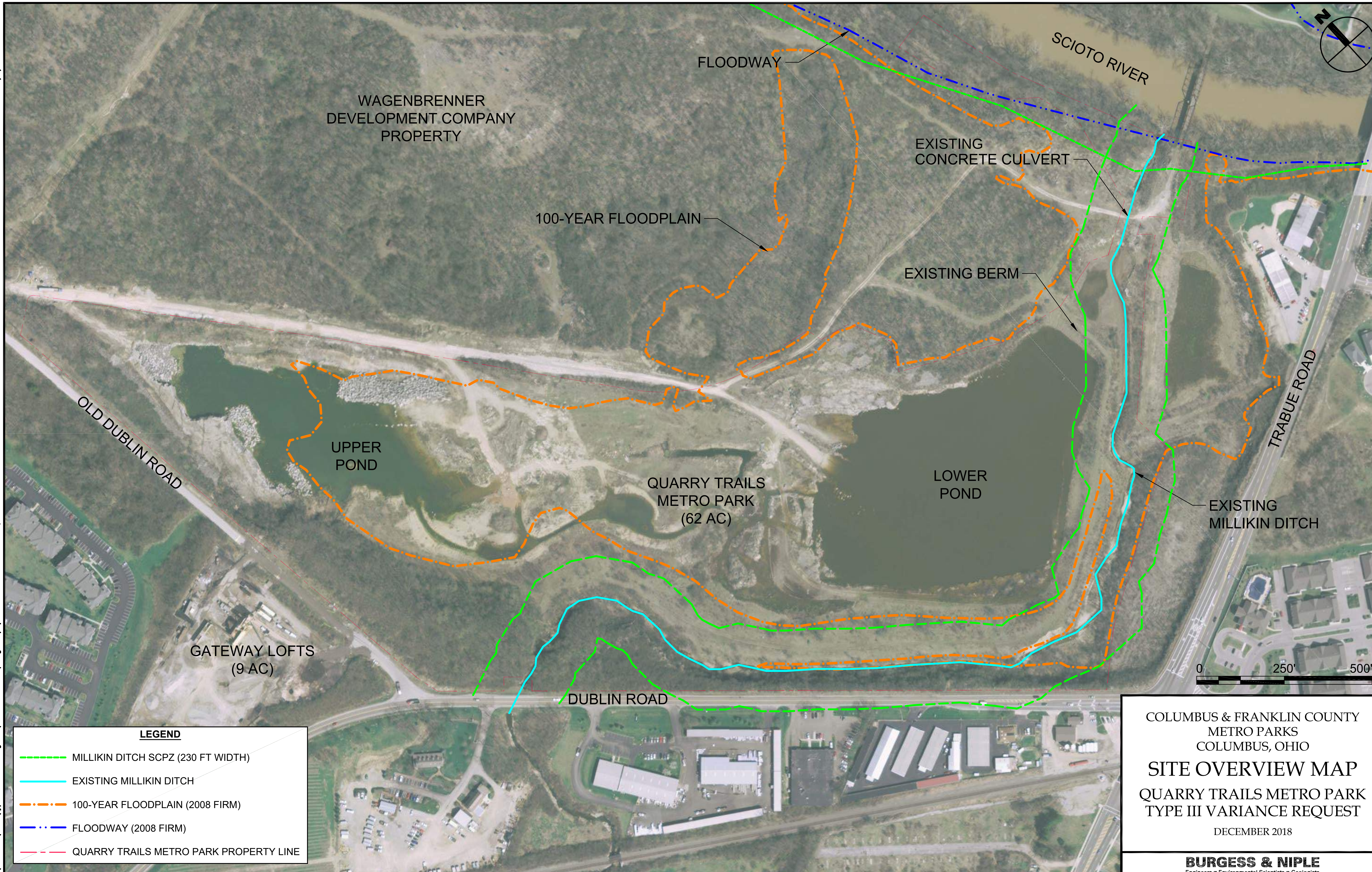
BURGESS & NIPLE
Engineers ■ Environmental Scientists ■ Geologists

PLOTTED: 12/7/2018 12:29:59 PM

P:\PR56762\Cadd\Type 3 Variance Figures\Site Location Map.dwg 11/26/2018 1:23:25 PM Disario, Sarah

APPENDIX B

SITE OVERVIEW MAP



COLUMBUS & FRANKLIN COUNTY METRO PARKS
COLUMBUS, OHIO

SITE OVERVIEW MAP

QUARRY TRAILS METRO PARK
TYPE III VARIANCE REQUEST

DECEMBER 2018

BURGESS & NIPLE
Engineers ■ Environmental Scientists ■ Geologists

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APPENDIX C

PARCEL DEED DECLARATION

DO NOT DETACH

Instrument Number: 201803150035074 Recorded Date: 03/15/2018 3:06:04 PM Daniel J. O'Connor Jr. Franklin County Recorder 373 South High Street, 18th Floor Columbus, OH 43215 (614) 525-3930 http://Recorder.FranklinCountyOhio.gov Recorder@FranklinCountyOhio.gov	**Return To (Mail Envelope):** METRO PARKS Mail Envelope
Transaction Number: T20180016259 **Document Type:** DECLARATION **Document Page Count:** 4	
Submitted By (Mail): METRO PARKS Mail	
First Grantor: BOARD OF PARK COMMISSIONERS OF THE COLUMBUS AND FRANKLIN COUNTY METROPOLITAN PARK DISTRICT	**First Grantee:** BOARD OF PARK COMMISSIONERS OF THE COLUMBUS AND FRANKLIN COUNTY METROPOLITAN PARK DISTRICT
Fees: Document Recording Fee: $28.00 Additional Pages Fee: $16.00 **Total Fees:** $44.00 **Amount Paid:** $44.00 **Amount Due:** $0.00	**Instrument Number:** 201803150035074 **Recorded Date:** 03/15/2018 3:06:04 PM

OFFICIAL RECORDING COVER PAGE

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THIS PAGE IS NOW PART OF THIS RECORDED DOCUMENT

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If an error on the cover page appears on our website after review please let our office know.

COVER PAGE DOES NOT INCLUDE ALL DATA, PLEASE SEE INDEX AND DOCUMENT FOR ANY ADDITIONAL INFORMATION.

4
4

Deed Declaration

(Scioto River Parkland Preservation)

The Board of Park Commissioners of the Columbus and Franklin County Metropolitan Park District ("Metro Parks"), acquired title to the property described in Exhibit A, attached hereto and made a part hereof, (the "Property") on February 27, 2018.

Metro Parks applied for and has received a grant from the State of Ohio, acting by and through the Director of the Ohio Public Works Commission ("OPWC"), pursuant to Ohio Revised Code §164.20 et seq. (the "Grant"). In connection with Metro Parks application for the Grant, Metro Parks proposed to use the Grant funds for open space acquisition and to protect and enhance riparian corridors, as set forth more specifically in its application.

As a condition to Metro Parks' receipt of the Grant, Metro Parks has agreed to restrict the use of the Property as set forth in this Declaration, with the intent that such restrictions run with the land.

NOW, THEREFORE, for valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Metro Parks, for itself and its successors and assigns as owners of the Property, hereby agrees as follows:

1. The restrictions set forth in this Declaration shall be perpetual and shall run with the land for the benefit of, and shall be enforceable by, OPWC. This Declaration and the covenants and restrictions set forth herein shall not be amended, released, extinguished or otherwise modified without the prior written consent of OPWC, which consent may be withheld in its sole and absolute discretion.
2. The Property shall be used for public conservation and public open space purposes and may only be used as a public park, public forest, public natural area, or public conservation area, and shall be preserved and managed as such by Metro Parks in such a manner to accommodate public park visitation in accordance with standard operations employed by Metro Parks and to benefit present and future generations.

Mature forest cover shall be preserved and enhanced by means of standard Metro Parks' non-harvest, let-alone policies. Metro Parks may restore, enhance and manage native plant and animal communities and habitat types.

3. If Metro Parks or its successors or assigns as owner of the Property, as described in Exhibit A, should fail to observe the covenants and restrictions set forth herein the Metro Parks or its successors or assigns, as the case may be, shall pay to the OPWC upon demand both: 1) all grant funds disbursed to the Metro Parks, and 2) liquidated damages equal to one hundred percent (100%) of the funds disbursed by the OPWC together with interest accruing at the rate of six percent (6%) per annum from the date of Metro Parks receipt of the Grant. Metro Parks acknowledges that such sum is not intended as, and shall not be deemed, a penalty, but is intended to compensate for damages suffered in the event a breach or violation of the covenants and restrictions set forth herein, the determination of which is not readily ascertainable. OPWC shall have the right to enforce, by any proceedings at law or in equity, all restrictions, conditions and covenants set forth herein. Failure by OPWC to proceed with such enforcement shall in no event be deemed a waiver of the right to enforce at a later date the original violation or a subsequent violation.
4. No buildings or other structures of any kind shall be placed or erected on the Property except buildings or structures specifically used for public park purposes including trails, parking lots, nature interpretation, and habitat management. No residential, commercial, or industrial use of the Property shall be permitted.
5. Herbicides or pesticides may only be used within the prescribed methods approved by Metro Parks and must be applied by a properly licensed applicator. Metro Parks may also manage and control vegetation using techniques including controlled succession in accordance with the resource management plan developed for this Property. Metro Parks reserves the exclusive right to manage fish and wildlife populations on the Property.
6. No power or transmission lines may be erected, nor any interests in the Property shall be granted for this purpose. Metro Parks shall have the right to maintain and repair existing telephone, electric, water, wells, or other utility lines or mains or to install additional utilities underground as may be needed to provide for the needs of Metro Parks, its successors or assigns for uses permitted herein.
7. OPWC may periodically enter upon and inspect said Property for violations of the deed restrictions, and if upon sixty (60) days advance written notice the Property owner has not eliminated said violations, OPWC may remove or eliminate, at the expense of the owner, any violation of the deed restrictions.
8. Metro Parks acknowledges that the Grant is specific to Metro Parks and that OPWC's approval of Metro Parks' application for the Grant was made in reliance on Metro Parks continued ownership and control of the Property. Accordingly, Metro Parks shall not voluntarily or involuntarily sell, assign, transfer, lease, exchange, convey or otherwise encumber the Property without the prior written consent of OPWC, which consent may be withheld in its sole and absolute discretion.
9. Each provision of this Declaration and the application thereof to the Property are hereby declared to be independent of and severable from the remainder of this

Declaration. If any provision contained herein shall be held to be invalid or to be unenforceable or not to run with the land, such holding shall not affect the validity or enforceability of the remainder of this Declaration.

10. Notices or other communication hereunder shall be in writing and shall be sent certified or registered mail, return receipt requested, or by other national overnight courier company, or personal delivery. Notice shall be deemed given upon receipt or refusal to accept delivery. Each party may change from time to time their respective address for notice hereunder by like notice to the other party. The notice addresses of the parties are as follows:

    Metro Parks, 1069 W. Main Street, Westerville, Ohio 43081.
    Attn: Executive Director

    OPWC: Ohio Public Works Commission, 65 East State Street, Suite 312, Columbus, Ohio 43215. Attn: Director

11. This Declaration shall be governed by, and construed in accordance with the laws of the State of Ohio.

IN WITNESS WHEREOF, the Grantor has caused this instrument to be executed by its duly authorized representative as of this 1st day of MARCH, 2018.

Signed and acknowledged in the presence of:

Board of Park Commissioners of the
Columbus and Franklin County
Metropolitan Park District:

[signature]
Tim Moloney
Executive Director

State of Ohio, Franklin County,

The foregoing instrument was acknowledged before me this 1st day of March 2018 by Tim Moloney, the Executive Director of the Board of Park Commissioners of the Columbus and Franklin County Metropolitan Park District, an Ohio park district, on behalf of the park district.

K. RENEE TELFER
NOTARY PUBLIC
STATE OF OHIO
My Commission Expires
April 16, 2021

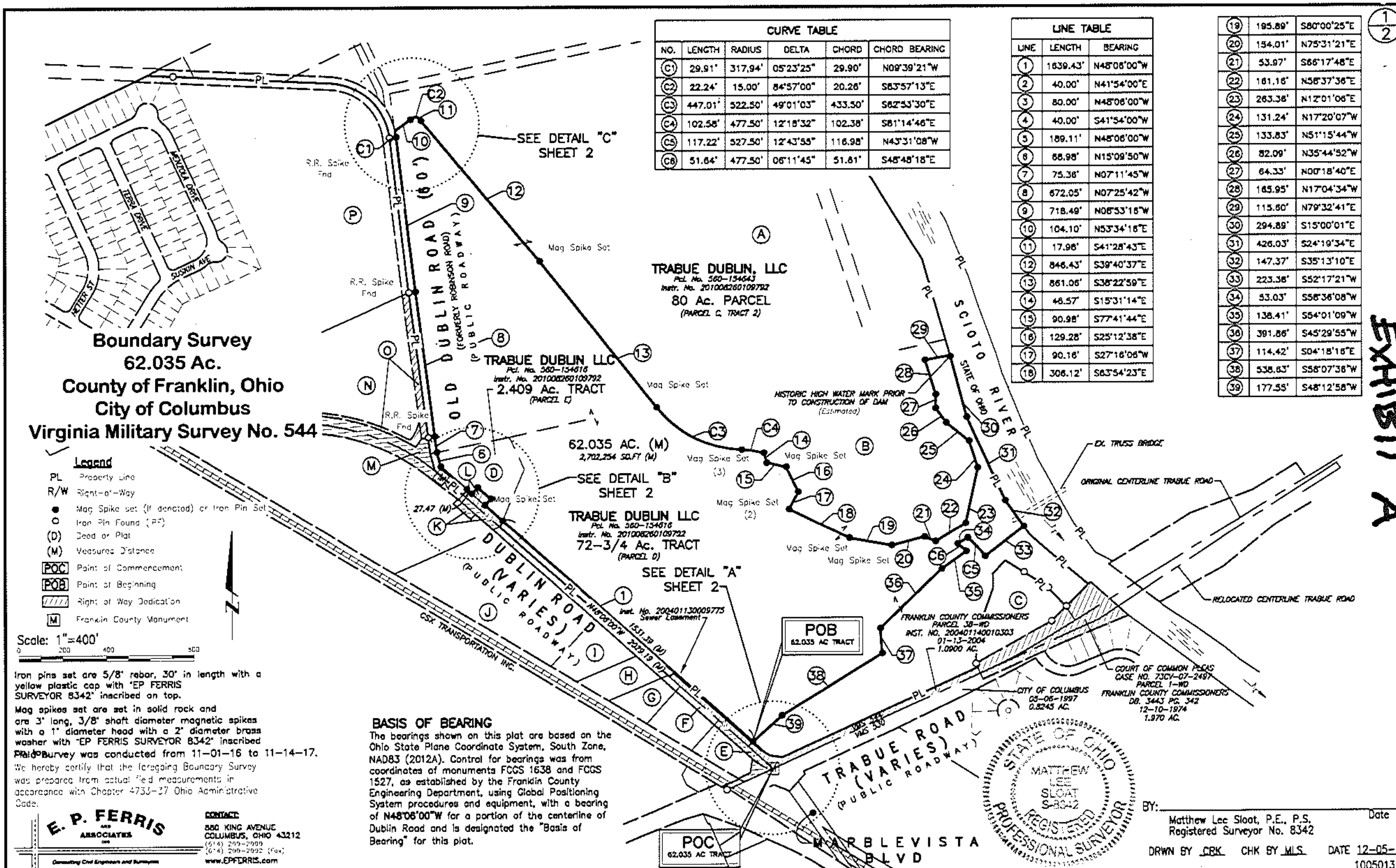
K. Renee Telfer
Notary Public
My commission expires: April 16, 2021

This instrument prepared by: Metro Parks, 1069 W. Main Street, Westerville, Ohio 43081

EXHIBIT A

1/2

Boundary Survey
62.035 Ac.
County of Franklin, Ohio
City of Columbus
Virginia Military Survey No. 544



CURVE TABLE

NO.	LENGTH	RADIUS	DELTA	CHORD	CHORD BEARING
C1	29.91'	317.94'	05°23'25"	29.90'	N09°39'21"W
C2	22.24'	15.00'	84°57'00"	20.26'	S83°57'13"E
C3	447.01'	522.50'	49°01'03"	433.50'	S62°53'30"E
C4	102.58'	477.50'	12°18'32"	102.38'	S81°14'46"E
C5	117.22'	527.50'	12°43'55"	116.98'	N43°31'08"W
C6	51.64'	477.50'	06°11'45"	51.61'	S48°48'18"E

LINE TABLE

LINE	LENGTH	BEARING
1	1639.43'	N48°06'00"W
2	40.00'	N41°54'00"E
3	80.00'	N48°06'00"W
4	40.00'	S41°54'00"W
5	189.11'	N48°06'00"W
6	88.98'	N15°09'50"W
7	75.36'	N07°11'45"W
8	672.05'	N07°25'42"W
9	718.49'	N08°53'16"W
10	104.10'	N53°34'16"E
11	17.98'	S41°28'43"E
12	846.43'	S39°40'37"E
13	861.06'	S38°22'59"E
14	46.57'	S15°31'14"E
15	90.98'	S77°41'44"E
16	129.28'	S25°12'38"E
17	90.16'	S27°16'06"W
18	306.12'	S63°54'23"E
19	195.89'	S80°00'25"E
20	154.01'	N75°31'21"E
21	53.97'	S66°17'48"E
22	161.16'	N56°37'36"E
23	263.38'	N12°01'06"E
24	131.24'	N17°20'07"W
25	133.83'	N51°15'44"W
26	82.09'	N35°44'52"W
27	64.33'	N00°18'40"E
28	165.95'	N17°04'34"W
29	115.60'	N79°32'41"E
30	294.89'	S15°00'01"E
31	426.03'	S24°19'34"E
32	147.37'	S35°13'10"E
33	223.38'	S52°17'21"W
34	53.03'	S58°36'08"W
35	138.41'	S54°01'09"W
36	391.86'	S45°29'55"W
37	114.42'	S04°18'16"E
38	538.63'	S58°07'38"W
39	177.55'	S48°12'58"W

Legend

- PL — Property Line
- R/W — Right-of-Way
- ● — Mag Spike set (if denoted) or Iron Pin Set
- ○ — Iron Pin Found (PF)
- (D) — Deed or Plat
- (M) — Measured Distance
- POC — Point of Commencement
- POB — Point of Beginning
- ▨ — Right of Way Dedication
- M — Franklin County Monument

Scale: 1"=400'
0 200 400 800

Iron pins set are 5/8" rebar, 30" in length with a yellow plastic cap with "EP FERRIS SURVEYOR 8342" inscribed on top.

Mag spikes set are set in solid rock and are 3" long, 3/8" shaft diameter magnetic spikes with a 1" diameter head with a 2" diameter brass washer with "EP FERRIS SURVEYOR 8342" inscribed on top.

Field Survey was conducted from 11-01-16 to 11-14-17.

We hereby certify that the foregoing Boundary Survey was prepared from actual field measurements in accordance with Chapter 4733-37 Ohio Administrative Code.

BASIS OF BEARING

The bearings shown on this plat are based on the Ohio State Plane Coordinate System, South Zone, NAD83 (2012A). Control for bearings was from coordinates of monuments FCGS 1638 and FCGS 1527, as established by the Franklin County Engineering Department, using Global Positioning System procedures and equipment, with a bearing of N48°06'00"W for a portion of the centerline of Dublin Road and is designated the "Basis of Bearing" for this plat.

E. P. FERRIS AND ASSOCIATES INC.
Consulting Civil Engineers and Surveyors

CONTACT:
880 KING AVENUE
COLUMBUS, OHIO 43212
(614) 299-2999
(614) 299-2992 (Fax)
www.EPFERRIS.com

STATE OF OHIO — MATTHEW LEE SLOAT S-8342 — REGISTERED PROFESSIONAL SURVEYOR

BY: ______________________ Date

Matthew Lee Sloat, P.E., P.S.
Registered Surveyor No. 8342

DRWN BY CBK CHK BY MLS DATE 12-05-17

1005013

APPENDIX D

STORMWATER DRAINAGE EASEMENT DECLARATION

DO NOT DETACH

Instrument Number: 201802050015528 **Recorded Date: 02/05/2018 11:09:48 AM** Daniel J. O'Connor Jr. Franklin County Recorder 373 South High Street, 18th Floor Columbus, OH 43215 (614) 525-3930 http://Recorder.FranklinCountyOhio.gov Recorder@FranklinCountyOhio.gov	**Return To (Box):** STEWART TITLE AGENCY OF COLS LTD Box
Transaction Number: T20180007043 **Document Type:** EASEMENT **Document Page Count:** 17	
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First Grantor: TRABUE DUBLIN LLC	**First Grantee:** TRABUE DUBLIN LLC
Fees: Document Recording Fee: $28.00 Additional Pages Fee: $120.00 **Total Fees:** $148.00 **Amount Paid:** $148.00 **Amount Due:** $0.00	**Instrument Number:** 201802050015528 **Recorded Date:** 02/05/2018 11:09:48 AM

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COVER PAGE DOES NOT INCLUDE ALL DATA, PLEASE SEE INDEX AND DOCUMENT FOR ANY ADDITIONAL INFORMATION.

17
7'8

TRANSFER
NOT NECESSARY

FEB 05 2018

CLARENCE E. MINGO II
AUDITOR
FRANKLIN COUNTY, OHIO

CONVEYANCE TAX
EXEMPT P MC

CLARENCE E. MINGO II
FRANKLIN COUNTY AUDITOR

DECLARATION OF STORMWATER DRAINAGE EASEMENT

THIS DECLARATION OF STORMWATER DRAINAGE EASEMENT (this "Declaration") is made and entered into to be effective on the date of signature and acknowledgment below (the "Effective Date") by **TRABUE DUBLIN, LLC**, an Ohio limited liability company having its address at 8191 E. Kaiser Boulevard, Anaheim, CA 92808 ("Declarant").

Prior Instrument Reference:	Instrument Number 201008260109792, Recorder's Office, Franklin County, Ohio.
Concerning Franklin County Auditor Parcel No.:	Portions of 560-154655-00

RECITALS:

A. Declarant is the owner of that certain real property containing 62.035± acres, being legally described on **Exhibit A** attached hereto and incorporated herein by reference (the "Burdened Property"). The owner of the Burdened Property from time to time is referred to herein as the "Owner of the Burdened Property".

B. Declarant is also the owner of certain real property containing 69.989± acres and 9.601± acres, being legally described on **Exhibit B** attached hereto and incorporated herein by reference (collectively, the "Benefited Property"). The Burdened Property and the Benefited Property are sometimes individually referred to herein as a "Parcel" or collectively as the "Parcels". The owner of the Benefited Property from time to time is referred to herein as the "Owner of the Benefited Property".

C. In order to establish a general plan for the development of the Parcels, Declarant desires to create an easement for storm water drainage, discharge and conveyance, together with construction and maintenance of the related drainage facilities, which will burden the Burdened Property and will benefit the Benefited Property (the "Easement"), as more particularly described herein. Stewart Title Columbus 01032-19581

EAL

NOW, THEREFORE, Declarant, intending to impose certain obligations on the Burdened Property, and to provide certain rights for the benefit of the Benefited Property, hereby declares as follows:

DECLARATION

1. Declaration of Easement. Declarant, as the present Owner of the Burdened Property, for the benefit of the Benefited Property, hereby declares the Easement as an appurtenant (as to the Benefited Property), perpetual, non-exclusive easement over, on, upon, under, through and across the Burdened Property. The Easement is being declared for the purposes of installing, constructing, maintaining, repairing, replacing and operating up to six storm sewer pipes each with a width not to exceed 48", which will convey storm water from the Benefited Property to the Burdened Property ("Improvements") on the portion of the Burdened Property depicted on **Exhibit C** ("Permanent Easement Area") or such other locations with a design reasonably acceptable to the Owner of the Burdened Property in light of the contemplated or completed development of the Burdened Property. In addition, the Easement shall include a temporary construction easement over the 15' area adjacent to and surrounding the perimeter of the Permanent Easement Area ("Construction Easement Area") to permit the installation of the Improvements within the Permanent Easement Area.

2. Restoration. Upon entry onto the Burdened Property for the purpose of construction, installation, reconstruction, replacement, removal, repair, maintenance and operation of Improvements, the Owner of the Benefited Property will restore the Burdened Property to its former condition as nearly as and as soon as is reasonably practicable. Acknowledging the sensitive nature of the Burdened Property, the Owner of the Benefited Property shall conduct such restoration in the manner reasonably requested by the Owner of the Burdened Property, provided that the restoration shall not include the repair or replacement of any unauthorized improvements located on or within the Permanent Easement Area.

3. Maintenance. It is not intended that the Owner of the Benefited Property provide post-construction storm water quantity best management practices ("BMPs") on the Burdened Property as part of the development of the Benefited Property. Accordingly, the Owner of the Burdened Property shall provide, at the expense of the owners of the various Parcels as provided in Section 5, all necessary post-construction storm water quantity BMPs required for the Benefited Property in accordance with the Storm Water Drainage Manual ("SWDM") requirements on the Permanent Easement Area, including but not limited to, the installation, maintenance, and operation of any additional improvements required by the City of Columbus SWDM on the Permanent Easement Area to convey storm water from the Benefited Property and installation, maintenance, and operation of BMPs to control storm water discharged from the Permanent Easement Area. The Owner of the Burdened Property shall correct any deficiencies in post-construction storm water quantity BMPs installed to comply with SWDM requirements within 30 days of notification by the City of Columbus of any such deficiencies, at the expense of the owners of the various Parcels as provided in Section 5. With at least one business days' prior written notice, the Owner of the Benefited Property may enter upon the Permanent Easement Area to restore proper operation and functionality of the Improvements or to replace the Improvements.

The Owner of the Benefited Property shall not extend the right to any other person to drain storm water onto the Permanent Easement Area; provided that the Owner of the Benefited Property shall specifically have the right to extend the benefits of the Declaration to the approximately 4.04-acre "Additional Development Area" depicted on Exhibit C, if it acquires said parcel. Additionally, the Owner of the Benefitted Property shall be responsible for installing and maintaining on the Benefitted Property, and the Additional Development Area if acquired, any and all controls necessary for compliance with the storm water quality requirements of the SWDM prior to the discharge of storm water onto the Burdened Property.

4. Use of Burdened Property. The perpetual easement rights granted in this Declaration are "non-exclusive". The Owner of the Burdened Property retains the rights to use the Burdened Property for all purposes that do not materially impair the use or interfere with the construction, operation, maintenance, repair, removal, replacement, or reconstruction of the Improvements or access thereto. The Owner of the Burdened Property is prohibited from causing or allowing any permanent or temporary building(s), or vertical structure(s), to be constructed in, on, over, under, or upon the Permanent Easement Area, except utility service lines and asphalt or concrete parking, driveways, curbs, boardwalks, decks, trails and sidewalks. If the Owner of the Burdened Property makes any permanent or temporary improvement(s) in, on, over, under, or upon the Permanent Easement Area, except as described in this section, then (i) the Owner of the Burdened Property agrees to assume full responsibility for any damage or destruction of the unauthorized improvement(s) by the Owner of the Benefited Property, and (ii) the Owner of the Benefited Property, its employees, agents, representatives and contractors, shall not be liable for any damage or destruction of the unauthorized improvement(s) during such owner's good faith exercise of the rights granted and described in this Declaration.

5. Sharing of Discharge Control Facilities Costs. Declarant acknowledges that the Owner of the Burdened Property may be required by the City of Columbus ("City") to install certain facilities to control the amount of storm water discharged from the Permanent Easement Area ("Discharge Control Facilities") or may otherwise decide to install Discharge Control Facilities. If the City requires the Owner of the Burdened Property to install Discharge Control Facilities or the Owner of the Burdened Property otherwise decides to install Discharge Control Facilities, then each future Owner of the Benefited Property shall pay its share of the cost of installing the Discharge Control Facilities based upon the percentage of storm water deposited into the Permanent Easement Area from the Benefited Property, as reasonably estimated by the engineer for the Owner of the Burdened Property. Provided, however, that the Owner of the Benefitted Property shall be afforded the opportunity to review and approve the design of the Discharge Control Facilities, with such approval to not be unreasonably withheld. Promptly following a determination by the Owner of the Burdened Property of the actual cost of installing the Discharge Control Facilities, the Owner of the Burdened Property will provide written notification to the Owner of the Benefited Property of such actual cost and within thirty (30) days of provision of that written notification, the Owner of the Benefited Property will remit to the Owner of the Burdened Property payment in an amount equal to such owner's share of the actual cost of installing the Discharge Control Facilities. In addition to the foregoing, the Owner of the Benefited Property shall bear all costs associated with (a) any installation, maintenance, and/or operation of any additional improvements or (b) modification of the Improvements required by the

City, in each case as a result of the insufficiency of the Improvements to convey storm water from the Benefited Property.

6. Covenants Run with Land; Non-Merger. This Declaration shall be perpetual in nature, shall run with and shall be appurtenant to the Burdened Property and the Benefited Property, and shall be binding upon and benefit the Owner of the Burdened Property and the Owner of the Benefited Property, and their respective successors and assigns. This Declaration shall be recorded with the Recorder's Office of Franklin County, Ohio. The Easement provided under this Declaration is intended to facilitate the efficient development of and operation of the Parcels. No easement granted or enjoyed hereunder shall be eliminated through the doctrine of merger as the result of a single party holding title to or ownership of the Burdened Property and the Benefited Property. On the Effective Date, Declarant owns the Burdened Property and the Benefited Property. The Easement between and affecting the Parcels has been created with the intent that it shall benefit not only Declarant but also all future owners of the Parcels.

7. Miscellaneous.

(a) No Modification. This Declaration shall not be released or modified without the prior written approval of the City, by and through the Director of the Department of Public Utilities, which approval shall not be unreasonably withheld, delayed or conditioned.

(b) No Dedication to Public; No Implied Easements. Nothing contained in this Declaration shall be deemed to be a gift or dedication of any portion of any real property to the general public or for any public use or purpose whatsoever, it being the intention of Declarant that this Declaration shall be for the exclusive benefit of the Owner of the Burdened Property and the Owner of the Benefited Property and their successors and assigns in interest. Nothing herein, express or implied, shall confer upon any other person any rights or remedies under or by reason of this Declaration.

(c) No Waiver. No delay or omission of an Owner of the Burdened Property or an Owner of the Benefited Property in the exercise of any right accruing upon the default by any other owner shall impair any such right or be construed to be a waiver thereof. A waiver of a breach or a default of any of the terms and conditions of this Declaration by an Owner of the Burdened Property or an Owner of the Benefited Property shall not be construed to be a waiver of subsequent breaches or defaults of any other provisions hereof.

(d) No Termination for Breach. No breach hereunder shall entitle any Owner of the Burdened Property or Benefited Property to cancel, rescind, or otherwise terminate this Declaration.

(e) Severability. If any provision of this Declaration or the application thereof to any person or circumstances shall, to any extent, be held invalid, inoperative or unenforceable, the remainder of this Declaration, or the application of such provision, to any other person or circumstance shall not be affected thereby and shall be given effect as if such invalid or inoperative portion had not been included.

(f) Applicable Law. This Declaration shall be construed in accordance with the laws of the State of Ohio. The parties hereby consent to the jurisdiction of the courts located in Franklin County, Ohio in the event any action or claim is brought pursuant to this Declaration.

(g) Notices. All notices, approvals, consents or requests given or made pursuant to this Declaration shall be made in writing and shall be deemed given upon receipt by personal delivery; or United States certified mail, return receipt requested, with postage prepaid; or one (1) day after deposit with a recognized overnight carrier, charges prepaid. Notices shall be addressed to the addresses for the owner of each Parcel as set forth on the Franklin County Auditor's website.

(h) Interpretation. Wherever herein the singular number is used, the same shall include the plural, and the masculine gender shall include the feminine and neuter genders, and vice versa, as the context shall require. The section headings used herein are for reference and convenience only, and shall not enter into the interpretation hereof.

(i) Entire Agreement. This Declaration and the exhibits attached hereto set forth the entire agreement governing the matters contemplated herein. There are no statements, promises, representations or understandings, oral or written, not herein expressed.

[No more text on this page; signature page follows]

Declarant has executed this Declaration as of the date written below.

TRABUE DUBLIN, LLC,
an Ohio limited liability company

By: ______________________
John D. Tallichet, Manager

Date: 1/29/18

STATE OF CALIFORNIA)
) ss.
COUNTY OF ORANGE)

The foregoing instrument was acknowledged before me, the undersigned Notary Public in and for said State and County, on this 29th day of Jan., 2018, by John D. Tallichet, the Manager of Trabue Dublin, LLC, an Ohio limited liability company, on behalf of the limited liability company.

ROSIE CANTILLO
Commission No. 2114429
NOTARY PUBLIC-CALIFORNIA
ORANGE COUNTY
My Comm. Expires JUNE 7, 2019
NCC1

____
Notary Public
My Commission Expires: 6-7-19

Instrument prepared by:
Underhill & Hodge LLC
8000 Walton Parkway, Suite 260
New Albany, Ohio 43054
(614) 335-9320

EXHIBIT A – Legal Description of Burdened Property

LEGAL DESCRIPTION
62.035 ACRES

Situated in the State of Ohio, County of Franklin, in the City of Columbus, Virginia Military Survey 544, and being a part of a 608.923 acre tract, as conveyed to ____________________, as recorded in Instrument No. _______________, all records being of the Recorder's Office, Franklin County, Ohio and being more particularly bounded and described as follows:

Commencing at Franklin County Monument 1638 at the intersection of the centerlines of Trabue Road (Width Varies), and Dublin Road (Width Varies), being the southerly corner of a 1.090 acre tract, as conveyed to the Franklin County Commissioners in Instrument No. 200401140010303, designated parcel 38-WD in Franklin County Engineers roadway plans for Trabue Road Widening, and easterly corner of a 0.3948 acre tract, as conveyed to the Franklin County Commissioners in Instrument No. 200212200328021, designated parcel 37-WD-2 in said Franklin County Engineers roadway plans for Trabue Road Widening.

Thence, along the centerline of Dublin Road, and along the southwesterly line of said 1.090 acre tract, and northeasterly line of said 0.3948 acre tract, North 48 degrees 06 minutes 00 seconds West, 150.57 feet to a point on said centerline;

Thence leaving said centerline perpendicularly, across said 1.090 acre tract and across said 608.923 acre tract, and across a 72 ¾ acre tract, as conveyed to Trabue Dublin, LLC, as recorded in Instrument No. 201008260109792, which is a part of said 608.923 acre tract, North 41 degrees 54 minutes 00 seconds East, passing the northeasterly line of said 1.090 acre tract at 25.00 feet, a total distance of 30.00 feet to an iron pin set on the northeasterly line of said Dublin Road, said pin being the **TRUE POINT OF BEGINNING** for the parcel herein described;

> Thence continuing along said northeasterly line of said Dublin Road, and continuing across said 72 ¾ and 608.923 acre tracts, and along the northeasterly line of a 0.226 acre tract as conveyed to Franklin County Commissioners by Franklin County Court of Common Pleas in Case No. 93CVH07-4909, Judgment Entry recorded in O.R.V. 25622 Page J06, designated parcel 2-WD in Franklin County Right-of-Way plans for Dublin Road Bridge Replacement NOR-10-3.40, also along the southwesterly line of the remainder of a 2.409 acre tract, as conveyed to Trabue Dublin, LLC, as recorded in Instrument No. 201008260109792, which is a part of said 608.923 acre tract, North 48 degrees 06 minutes 00 seconds West, passing an iron pin set at 1531.39 feet, a total distance of 1639.43 feet to an iron pin set;
>
> Thence continuing along said southeasterly line of said Dublin Road, and along the northwesterly line of said 2.409 acre tract, and southeasterly line of said 0.226 acre tract, North 41 degrees 54 minutes 00 seconds East, 40.00 feet to a mag nail set;
>
> Thence continuing along said northeasterly line of said Dublin Road, and along the southwesterly line of the remainder of said 2.409 acre tract, and northeasterly line of said 0.226 acre tract, North 48 degrees 06 minutes 00 seconds West, 80.00 feet to an iron pin set;
>
> Thence continuing along said northerly line of said Dublin Road, and along the southeasterly line of the remainder of said 2.409 acre tract, and northwesterly line of said 0.226 acre tract, South 41 degrees 54 minutes 00 seconds West, 40.00 feet to an iron pin set;
>
> Thence continuing along said northeasterly line of said Dublin Road, and along the southwesterly line of the remainder of said 2.409 acre tract, then across said 2.409 acre tract, and along the northeasterly line of said 0.226 acre tract, North 48 degrees 06 minutes 00 seconds West, passing an iron pin set at 27.47 feet, a total distance of 189.11 feet to an iron pin set, being at the intersection of the northeasterly line of Dublin Road and the easterly line of old Dublin Road;
>
> Thence continuing along said easterly line of said old Dublin Road, and across said remainder of said 2.409 acre tract, North 15 degrees 09 minutes 50 seconds West, 68.98 feet to an iron pin set on the northerly line of the remainder of said 2.409 acre tract, and on the southerly line of an 80 acre tract, as conveyed to Trabue Dublin, LLC, as recorded in Instrument No. 201008260109792, which is a part of said 608.923 acre tract;
>
> Thence continuing along said easterly line of said old Dublin Road, and across the said 80 acre tract, the following four (4) courses:
>
> > North 07 degrees 11 minutes 45 seconds West, 75.36 feet to an iron pin set;
> >
> > North 07 degrees 25 minutes 42 seconds West, 672.05 feet to an iron pin set;
> >
> > North 06 degrees 53 minutes 16 seconds West, 718.49 feet to an iron pin set;

Along a curve to the left having a radius of 317.94 feet, a central angle of 05 degrees 23 minutes 25 seconds, an arc length of 29.91 feet, and a chord which bears North 09 degrees 39 minutes 21 seconds West, 29.90 feet to a set iron pin;

Thence leaving said northeasterly line of old Dublin Road, and across said 608.923 acre tract, the following twenty-three (23) courses:

North 53 degrees 34 minutes 16 seconds East, 104.10 feet to a mag spike set;

Along a curve to the right having a radius of 15.00 feet, a central angle of 84 degrees 57 minutes 00 seconds, an arc length of 22.24 feet, and a chord which bears South 83 degrees 57 minutes 13 seconds East, 20.26 feet to a mag spike set;

South 41 degrees 28 minutes 43 seconds East, 17.98 feet to a mag spike set;

South 39 degrees 40 minutes 37 seconds East, 846.43 feet to a mag spike set;

South 38 degrees 22 minutes 59 seconds East, 861.06 feet to a mag spike set;

Along a curve to the left having a radius of 522.50 feet, a central angle of 49 degrees 01 minutes 03 seconds, an arc length of 447.01 feet, and a chord which bears South 62 degrees 53 minutes 30 seconds East, 433.50 feet to a mag spike set;

Along a curve to the right having a radius of 477.50 feet, a central angle of 12 degrees 18 minutes 32 seconds, an arc length of 102.58 feet, and a chord which bears South 81 degrees 14 minutes 46 seconds East, 102.38 feet to a mag spike set;

South 15 degrees 31 minutes 14 seconds East, 46.57 feet to a mag spike set;

South 77 degrees 41 minutes 44 seconds East, 90.98 feet to a mag spike set;

South 25 degrees 12 minutes 38 seconds East, 129.28 feet to a mag spike set;

South 27 degrees 16 minutes 06 seconds West, 90.16 feet to a mag spike set;

South 63 degrees 54 minutes 23 seconds East, 306.12 feet to a mag spike set;

South 80 degrees 00 minutes 25 seconds East, 195.89 feet to a mag spike set;

North 75 degrees 31 minutes 21 seconds East, 154.01 feet to an iron pin set;

South 66 degrees 17 minutes 48 seconds East, 53.97 feet to an iron pin set;

North 58 degrees 37 minutes 36 seconds East, 161.16 feet to an iron pin set;

North 12 degrees 01 minutes 06 seconds East, 263.36 feet to an iron pin set;

North 17 degrees 20 minutes 07 seconds West, 131.24 feet to an iron pin set;

North 51 degrees 15 minutes 44 seconds West, 133.83 feet to an iron pin set;

North 35 degrees 44 minutes 52 seconds West, 82.09 feet to an iron pin set;

North 00 degrees 18 minutes 40 seconds East, 64.33 feet to an iron pin set;

North 17 degrees 04 minutes 34 seconds West, 165.95 feet to an iron pin set;

North 79 degrees 32 minutes 41 seconds East, 115.60 feet to an iron pin set, being on the easterly line of said 608.923 acre tract, and being on the westerly high water mark of the Scioto River(as estimated prior to construction of the Columbus Storage Dam renamed Griggs Dam);

Thence along the easterly line of said 608.923 acre tract, and westerly line of said high water mark, South 15 degrees 00 minutes 01 seconds East, 294.89 feet to an iron pin set;

Thence continuing along the easterly line of said 608.923 acre tract, and westerly line of said high water mark, South 24 degrees 19 minutes 34 seconds East, 426.03 feet to an iron pin set;

Thence continuing along the easterly line of said 608.923 acre tract, and westerly line of said high water mark, South 35 degrees 13 minutes 10 seconds East, 147.37 feet to an iron pin set;

Thence leaving said easterly line of said 608.923 acre tract, and westerly line of said high water mark, and across said 608.923 acre tract, the following nine (9) courses:

South 52 degrees 17 minutes 21 seconds West, 223.38 feet to an iron pin set;

Along a curve to the left having a radius of 527.50 feet, a central angle of 12 degrees 43 minutes 55 seconds, an arc length of 117.22 feet, and a chord which bears North 43 degrees 31 minutes 08 seconds West, 116.98 feet to an iron pin set;

South 58 degrees 36 minutes 08 seconds West, 53.03 feet to an iron pin set;

Along a curve to the right having a radius of 477.50 feet, a central angle of 06 degrees 11 minutes 45seconds, an arc length of 51.64 feet, and a chord which bears South 48 degrees 48 minutes 18 seconds East, 51.61 feet to an iron pin set;

South 54 degrees 01 minutes 09 seconds West, 138.41 feet to an iron pin set;

South 45 degrees 29 minutes 55 seconds West, 391.86 feet to an iron pin set;

South 04 degrees 18 minutes 16 seconds East, 114.42 feet to an iron pin set;

South 58 degrees 07 minutes 36 seconds West, 538.63 feet to an iron pin set;

South 48 degrees 12 minutes 58 seconds West, 177.55 feet to an iron pin set, said pin being the **POINT OF BEGINNING,** containing 62.035 acres (2,702,254 Sq. Ft.), more or less.

Subject to all legal rights-of-way and/or easements, if any, of previous record.

The bearings shown on this plat are based on the Ohio State Plane Coordinate System, South Zone, NAD83 (2012A). Control for the bearings was from coordinates of monuments FCGS 1638 and FCGS 1527, as established by the Franklin County Engineering Department, using Global Positioning procedures and equipment, with a bearing of N48'06'00"W for a portion of the centerline of Dublin Road and is designated the "basis of bearing" for this description.

All monuments found are in good condition unless otherwise noted.

Iron pins set are 5/8" rebar, 30" in length with a yellow plastic cap with "EP FERRIS SURVEYOR 8342" inscribed on top.

Mag spikes set are set in solid rock and are 3" long, 3/8" shaft diameter magnetic spikes with a 1" diameter head with a 2" diameter brass washer with "EP FERRIS SURVEYOR 8342" inscribed on top.

This description was prepared by Matthew Lee Sloat, Ohio Registered Professional Surveyor 8342 and is based on field surveys conducted by E. P. Ferris & Associates, Inc. from November 1, 2017 through November 14, 2017 under the direct supervision of Matthew Lee Sloat, Ohio Registered Professional Surveyor 8342.

Matthew Lee Sloat 12/11/17

Matthew Lee Sloat, PS Date
Registered Surveyor No. 8342

EXHIBIT B – Legal Description of Benefited Property

Parcel I:

LEGAL DESCRIPTION
69.989 ACRES

Situated in the State of Ohio, County of Franklin, in the City of Columbus, Virginia Military Survey 544, and being a part of a 608.923 acre tract, as conveyed to ______________________, as recorded in Instrument No. ________________, all records being of the Recorder's Office, Franklin County, Ohio and being more particularly bounded and described as follows:

Commencing at Franklin County Monument 1638 at the intersection of the centerlines of Trabue Road (Width Varies), and Dublin Road (Width Varies);

Thence, along the centerline of Dublin Road, and along the southwesterly line of said 608.923 acre tract, North 48 degrees 06 minutes 00 seconds West, 2067.88 feet to a mag spike set, passing Franklin County Monument 1527 at 2029.19 feet;

Thence leaving the centerline of Dublin Road and along the centerline of old Dublin Road, and the westerly line of said 608.923 acre tract, North 15 degrees 09 minutes 50 seconds West, 79.94 feet to a mag spike set;

Thence continuing along the centerline of old Dublin Road, and the westerly line of said 608.923 acre tract, North 07 degrees 11 minutes 45 seconds West, 76.71 feet to a railroad spike found;

Thence continuing along the centerline of old Dublin Road, and the westerly line of said 608.923 acre tract, North 07 degrees 25 minutes 42 seconds West, 672.81 feet to a railroad spike found;

Thence continuing along the centerline of old Dublin Road, and the westerly line of said 608.923 acre tract, North 06 degrees 53 minutes 16 seconds West, 718.60 feet to a railroad spike found;

Thence continuing along the centerline of old Dublin Road, and the southwesterly line of said 608.923 acre tract, along a curve to the left having a radius of 287.68 feet, a central angle of 80 degrees 23 minutes 55 seconds, an arc length of 403.68 feet, and a chord which bears North 47 degrees 05 minutes 13 seconds West, 371.36 feet to a mag spike set;

Thence continuing along the centerline of old Dublin Road, and the southerly line of said 608.923 acre tract, North 87 degrees 18 minutes 38 seconds West, 589.52 feet to a point;

Thence perpendicularly across old Dublin Road and said 608.923 acre tract, North 02 degrees 41 minutes 22 seconds East, 30.00 feet to an iron pin set on the northerly line of said old Dublin Road, said pin being the **TRUE POINT OF BEGINNING** for the parcel herein described;

Thence across the 5, 33.33, 57, 80, and 72 ¾ acre tracts, as conveyed to Trabue Dublin, LLC, as recorded in Instrument No. 201008260109792, which are a part of said 608.923 acre tract, the following thirty-eight (38) courses:

North 42 degrees 56 minutes 22 seconds East, 509.34 feet to a mag spike set;

North 14 degrees 46 minutes 05 seconds East, 92.08 feet to a mag spike set;

Along a curve to the right having a radius of 540.61 feet, a central angle of 50 degrees 46 minutes 18 seconds, an arc length of 479.05 feet, and a chord which bears South 50 degrees 03 minutes 27 seconds East, 463.53 feet to a mag spike set;

Along a curve to the left having a radius of 1142.05 feet, a central angle of 18 degrees 36 minutes 32 seconds, an arc length of 370.92 feet, and a chord which bears South 32 degrees 50 minutes 50 seconds East, 369.29 feet to a mag spike set;

North 68 degrees 39 minutes 31 seconds East, 62.95 feet to an iron pin set;

North 78 degrees 41 minutes 33 seconds East, 1392.33 feet to an iron pin set, passing an iron pin set at 1266.40 feet;

South 55 degrees 48 minutes 56 seconds East, 75.90 feet to an iron pin set;

South 33 degrees 35minutes 42 seconds East, 109.48 feet to an iron pin set;

South 60 degrees 13 minutes 18 seconds West, 63.37 feet to an iron pin set;

Along a curve to the right having a radius of 230.00 feet, a central angle of 47 degrees 50 minutes 36 seconds, an arc length of 192.06 feet, and a chord which bears South 33 degrees 43 minutes 42 seconds East, 186.52 feet to an iron pin set;

Along a curve to the left having a radius of 732.83 feet, a central angle of 27 degrees 32 minutes 24 seconds, an arc length of 352.24 feet, and a chord which bears South 23 degrees 34 minutes 36 seconds East, 348.86 feet to an iron pin set;

South 39 degrees 54 minutes 20 seconds East, 388.60 feet to an iron pin set;

Along a curve to the right having a radius of 1380.00 feet, a central angle of 27 degrees 56 minutes 58 seconds, an arc length of 673.18 feet, and a chord which bears South 25 degrees 55 minutes 50 seconds East, 666.53 feet to an iron pin set;

Along a curve to the left having a radius of 773.78 feet, a central angle of 21 degrees 04 minutes 35 seconds, an arc length of 284.64 feet, and a chord which bears South 22 degrees 29 minutes 39 seconds East, 283.03 feet to an iron pin set;

North 69 degrees 21 minutes 37 seconds East, 78.71 feet to an iron pin set;

South 35 degrees 44 minutes 52 seconds East, 14.68 feet to an iron pin set;

South 51 degrees 15 minutes 44 seconds East, 133.83 feet to an iron pin set;

South 17 degrees 20 minutes 07 seconds East, 131.24 feet to an iron pin set;

South 12 degrees 01 minutes 06 seconds West, 263.36 feet to an iron pin set;

South 58 degrees 37 minutes 36 seconds West, 161.16 feet to an iron pin set;

North 66 degrees 17 minutes 48 seconds West, 53.97 feet to an iron pin set;

South 75 degrees 31 minutes 21 seconds West, 154.01 feet to a mag spike set;

North 80 degrees 00 minutes 25 seconds West, 195.89 feet to a mag spike set;

North 63 degrees 54 minutes 23 seconds West, 306.12 feet to a mag spike set;

North 27 degrees 16 minutes 06 seconds East, 90.16 feet to a mag spike set;

North 25 degrees 12 minutes 38 seconds West, 129.28 feet to a mag spike set;

North 77 degrees 41 minutes 44 seconds West, 90.98 feet to a mag spike set;

North 15 degrees 31 minutes 14 seconds West, 46.57 feet to a mag spike set;

Along a curve to the left having a radius of 477.50 feet, a central angle of 12 degrees 18 minutes 32 seconds, an arc length of 102.58 feet, and a chord which bears North 81 degrees 14 minutes 46 seconds West, 102.38 feet to a mag spike set;

Along a curve to the right having a radius of 522.50 feet, a central angle of 49 degrees 01 minutes 03 seconds, an arc length of 447.01 feet, and a chord which bears North 62 degrees 53 minutes 30 seconds West, 433.50 feet to a mag spike set;

North 38 degrees 22 minutes 59 seconds West, 861.06 feet to a mag spike set;

North 39 degrees 40 minutes 37 seconds West, 846.43 feet to a mag spike set;

North 41 degrees 28 minutes 43 seconds West, 17.98 feet to a mag spike set;

Along a curve to the left having a radius of 15.00 feet, a central angle of 84 degrees 57 minutes 00 seconds, an arc length of 22.24 feet, and a chord which bears North 83 degrees 57 minutes 13 seconds West, 20.26 feet to a mag spike set;

South 53 degrees 34 minutes 16 seconds West, 104.06 feet to an iron pin set on the easterly line of old Dublin Road;

Along the northeasterly line of old Dublin Road and Along a curve to the left having a radius of 317.67 feet, a central angle of 75 degrees 02 minutes 31 seconds, an arc length of 416.07 feet, and a chord which bears North 49 degrees 48 minutes 45 seconds West, 386.96 feet to an iron pin set;

Along the northerly line of old Dublin Road, North 87 degrees 18 minutes 38 seconds West, 589.52 feet to an iron pin set, said pin being the **POINT OF BEGINNING,** containing 69.989 acres (3,048,721 Sq. Ft.), more or less.

Subject to all legal rights-of-way and/or easements, if any, of previous record.

The bearings shown on this plat are based on the Ohio State Plane Coordinate System, South Zone, NAD83 (2012A). Control for the bearings was from coordinates of monuments FCGS 1638 and FCGS 1527, as established by the Franklin County Engineering Department, using Global Positioning procedures and equipment, with a bearing of N48'06'00"W for a portion of the centerline of Dublin Road and is designated the "basis of bearing" for this description.

All monuments found are in good condition unless otherwise noted.

Iron pins set are 5/8" rebar, 30" in length with a yellow plastic cap with "EP FERRIS SURVEYOR 8342" inscribed on top.

Mag spikes set are set in solid rock and are 3" long, 3/8" shaft diameter magnetic spikes with a 1" diameter head with a 2" diameter brass washer with "EP FERRIS SURVEYOR 8342" inscribed on top.

This description was prepared by Matthew Lee Sloat, Ohio Registered Professional Surveyor 8342 and is based on field surveys conducted by E. P. Ferris & Associates, Inc. from November 1, 2017 through November 14, 2017 under the direct supervision of Matthew Lee Sloat, Ohio Registered Professional Surveyor 8342.

STATE OF OHIO
MATTHEW LEE SLOAT S-8342
REGISTERED PROFESSIONAL SURVEYOR

12/14/17

Matthew Lee Sloat, PS Date
Registered Surveyor No. 8342

Parcel II:

LEGAL DESCRIPTION
9.601 ACRES

Situated in the State of Ohio, County of Franklin, in the City of Columbus, Virginia Military Survey 544, and being a part of a 608.923 acre tract, as conveyed to ______________________, as recorded in Instrument No. ________________, all records being of the Recorder's Office, Franklin County, Ohio and being more particularly bounded and described as follows:

Commencing at Franklin County Monument 1638 at the intersection of the centerlines of Trabue Road (Width Varies), and Dublin Road (Width Varies), being referenced by Franklin County Monument 1527 at North 48 degrees 06 minutes 00 seconds West, 2029.19 feet, also being the southerly corner of a 1.090 acre tract, as conveyed to the Franklin County Commissioners in Instrument No. 200401140010303, designated parcel 38-WD in Franklin County Engineers roadway plans for Trabue Road Widening, and easterly corner of a 0.3948 acre tract, as conveyed to the Franklin County Commissioners in Instrument No. 200212200328021, designated parcel 37-WD-2 in said Franklin County Engineers roadway plans for Trabue Road Widening.

Thence, along the centerline of Dublin Road, and along the southwesterly line of said 1.090 acre tract, and northeasterly line of said 0.3948 acre tract, North 48 degrees 06 minutes 00 seconds West, 150.57 feet to a point on said centerline;

Thence leaving said centerline perpendicularly, across said 1.090 acre tract and across said 608.923 acre tract, and across a 72 ¾ acre tract, as conveyed to Trabue Dublin, LLC, as recorded in Instrument No. 201008260109792, which is a part of said 608.923 acre tract, North 41 degrees 54 minutes 00 seconds East, passing the northeasterly line of said 1.090 acre tract at 25.00 feet, a total distance of 30.00 feet to an iron pin set on the northeasterly line of said Dublin Road, said pin being the **TRUE POINT OF BEGINNING** for the parcel herein described;

Thence across said 72 ¾ acre tract, and said 608.923 acre tract the following nine (9) courses:

North 48 degrees 12 minutes 58 seconds East, 177.55 feet to an iron pin set

North 58 degrees 07 minutes 36 seconds East, 538.63 feet to an iron pin set;

North 04 degrees 18 minutes 16 seconds West, 114.42 feet to an iron pin set;

North 45 degrees 29 minutes 55 seconds East, 391.86 feet to an iron pin set;

North 54 degrees 01 minutes 09 seconds East, 138.41 feet to an iron pin set;

Along a curve to the left having a radius of 477.50 feet, a central angle of 06 degrees 11 minutes 45seconds, an arc length of 51.64 feet, and a chord which bears North 48 degrees 48 minutes 18 seconds West, 51.61 feet to an iron pin set;

North 58 degrees 36 minutes 08 seconds East, 53.03 feet to an iron pin set;

Along a curve to the right having a radius of 527.50 feet, a central angle of 12 degrees 43 minutes 55 seconds, an arc length of 117.22 feet, and a chord which bears South 43 degrees 31 minutes 08 seconds East, 116.98 feet to an iron pin set;

North 52 degrees 17 minutes 21 seconds East, 223.38 feet to an iron pin set, said pin being on the westerly high water mark of the Scioto River(as estimated prior to construction of the Columbus Storage Dam renamed Griggs Dam);

Thence continuing along the said high water mark, and easterly line of the said 608.923 and 72 ¾ acre tracts, South 35 degrees 13 minutes 10 seconds East, 49.12 feet to an iron pin set;

Thence continuing along the said high water mark, and easterly line of the said 608.923 and 72 ¾ acre tracts, South 49 degrees 04 minutes 54 seconds East, 350.88 feet to an iron pin set on the northerly line of a 1.970 acre tract, as conveyed to Franklin County

Commissioners by Franklin County Court of Common Pleas in Case No. 73CV-07-2497, Judgment Entry recorded in Deed Book 3443 Page 342, designated parcel 1-WD in Franklin County Engineers Right-of-Way plans for Trabue Road Relocation, also being the northerly line of Trabue Road;

Thence along the northerly line of said 1.970 acre tract, and said Right-of-Way, and southerly line of said 608.923 acre tract and the remainder of said 72 ¾ acre tract, South 44 degrees 38 minutes 27 seconds West, 144.22 feet to a ¾" hollow pipe found, also being the southeasterly corner of a 2.299 acre tract, as conveyed to Wagenbrenner Marble Cliff Canyon, LLC in Instrument No. 201702280027548;

Thence continuing along the northerly line of said 2.299 acre tract, and southerly line of said 608.923 acre tract and the remainder of said 72 ¾ acre tract the following six (6) courses:

North 42 degrees 45 minutes 33 seconds West, 120.12 feet to a ¾" hollow pipe found;

North 57 degrees 02 minutes 51 seconds West, 133.55 feet to a ¾" hollow pipe found;

North 56 degrees 57 minutes 12 seconds West, 99.89 feet to an iron pin set;

South 42 degrees 47 minutes 32 seconds West, 83.04 feet to an iron pin set;

South 00 degrees 39 minutes 39 seconds East, 66.87 feet to an iron pin set;

South 19 degrees 12 minutes 53 seconds West, 226.26 feet to an iron pin set;

South 02 degrees 02 minutes 40 seconds West, 134.43 feet to a ¾" hollow pipe found on the northwesterly corner of said 1.970 acre tract, and the southwesterly corner of said 2.299 acre tract, and the northerly line of said Trabue Road Right-of-Way;

Thence along the westerly line of said 1.970 acre tract, and said Right-of-Way, and the easterly line of the remainder of said 72 ¾ acre tract, South 24 degrees 29 minutes 44 seconds East, 20.00 feet to an iron pin set on the northeasterly corner of said 1.090 acre tract;

Thence continuing along the northerly line of said 1.090 acre tract, and said Right-of-Way, and southerly line of said 608.923 acre tract and the remainder of said 72 ¾ acre tract, South 65 degrees 30 minutes 16 seconds West, 978.32 feet to an iron pin set;

Thence continuing along the northerly line of said 1.090 acre tract, and said Right-of-Way, and southerly line of said 608.923 acre tract and the remainder of said 72 ¾ acre tract, North 82 degrees 40 minutes 41 seconds West, 56.58 feet to an iron pin set;

Thence continuing along the northerly line of said 1.090 acre tract, and said Right-of-Way, and southerly line of said 608.923 acre tract and the remainder of said 72 ¾ acre tract, North 59 degrees 23 minutes 11 seconds West, 25.55 feet to an iron pin set;

Thence continuing along the northerly line of said 1.090 acre tract, and said Right-of-Way, and southerly line of said 608.923 acre tract and the remainder of said 72 ¾ acre tract, North 48 degrees 06 minutes 00 seconds West, 75.52 feet to an iron pin set, said pin being the **POINT OF BEGINNING,** containing 9.601 acres (418,216 Sq. Ft.), more or less.

Subject to all legal rights-of-way and/or easements, if any, of previous record.

The bearings shown on this plat are based on the Ohio State Plane Coordinate System, South Zone, NAD83 (2012A). Control for the bearings was from coordinates of monuments FCGS 1638 and FCGS 1527, as established by the Franklin County Engineering Department, using

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This description was prepared by Matthew Lee Sloat, Ohio Registered Professional Surveyor 8342 and is based on field surveys conducted by E. P. Ferris & Associates, Inc. from November 1, 2017 through November 14, 2017 under the direct supervision of Matthew Lee Sloat, Ohio Registered Professional Surveyor 8342.

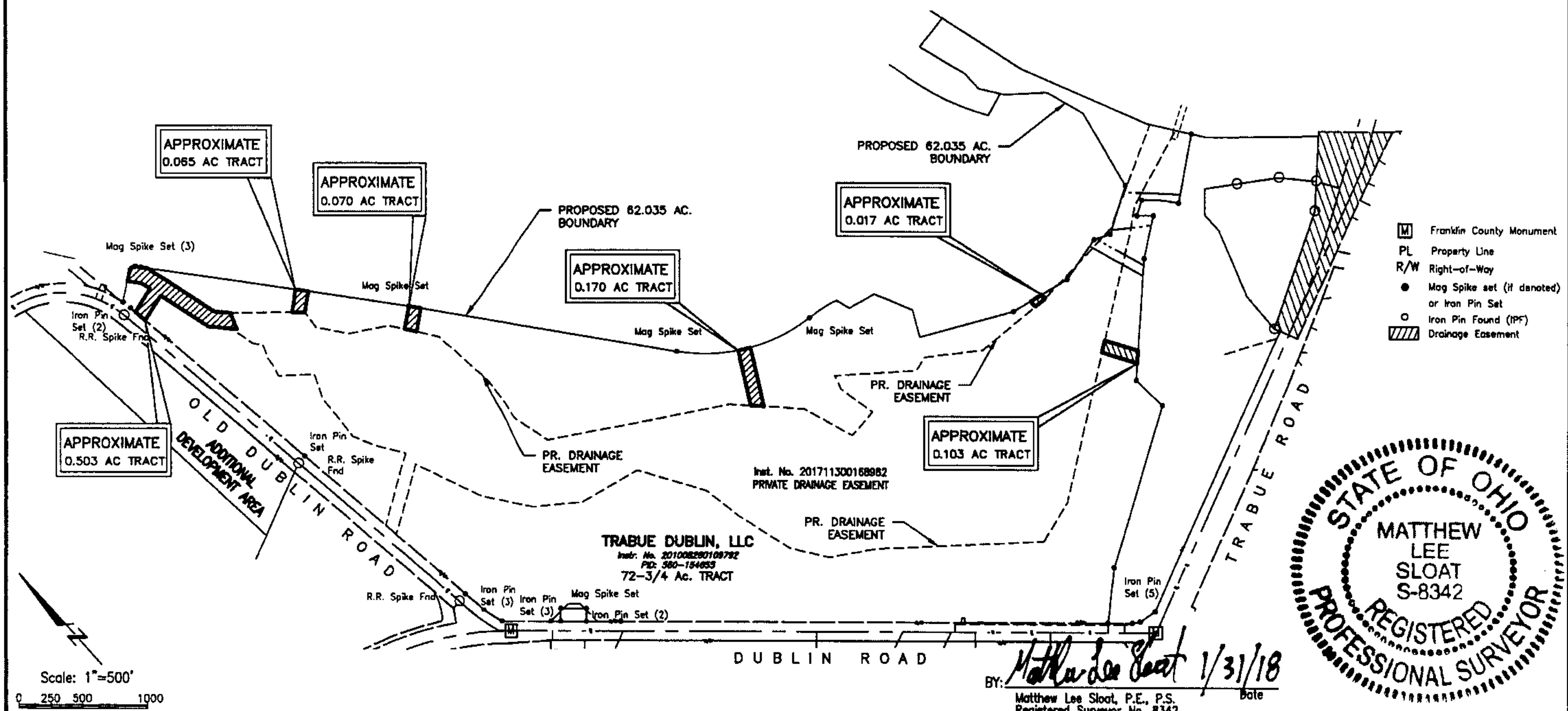
STATE OF OHIO
MATTHEW LEE SLOAT S-8342
REGISTERED
PROFESSIONAL SURVEYOR

12/14/17

Matthew Lee Sloat, PS — Date
Registered Surveyor No. 8342

EXHIBIT C – Depiction of Permanent Easement Area

The bearings shown on this plat are based on the Ohio State Plane Coordinate System, South Zone, NAD83 (2012A). Control for bearings was from coordinates of monuments FCGS 1638 and FCGS 1527, as established by the Franklin County Engineering Department, using Global Positioning System procedures and equipment, with a bearing of N48°06'00"W for a portion of the centerline of Dublin Road and is designated the "Basis of Bearing" for this plat.



BY: Matthew Lee Sloat 1/31/18
Matthew Lee Sloat, P.E., P.S.
Registered Surveyor No. 8342
Date

E. P. FERRIS AND ASSOCIATES INC
Consulting Civil Engineers and Surveyors
CONTACT:
880 KING AVENUE
COLUMBUS, OHIO 43212
(614) 299-2999
(614) 299-2992 (Fax)
www.EPFERRIS.com

DRAINAGE EASEMENTS
0.503 AC., 0.065 AC., 0.070 AC., 0.170 AC., 0.130 AC., 0.017 AC.
CITY OF COLUMBUS, COUNTY OF FRANKLIN, OHIO
Virginia Military Survey No. 544

JOB NO.	1005013
DRAWN BY:	JLC
CHECKED BY:	MLS
APPROVED BY:	MLS
DATE:	01-26-18

APPENDIX E

BASELINE STREAM INFORMATION

Ohio EPA — Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 32

Stream & Location: Roberts Millikin Ditch **RM:** .1 **Date:** 3 / 09 / 17

Matthew R. Kaminski **Scorers Full Name & Affiliation:** Geotechnical Consultants, Inc.

River Code: _ _ _-_ _ _-_ _ _ **STORET #:** _ _ _ _ _ _ **Lat./ Long.:** (NAD 83 - decimal °) 39.997912 / -83.082547 Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE
☐ ☐ BLDR /SLABS [10]		
☐ ☐ BOULDER [9]		
☐ ☐ COBBLE [8]		
☒ ☐ GRAVEL [7]	10	90
☐ ☒ SAND [6]	70	10
☐ ☐ BEDROCK [5]		

OTHER TYPES	POOL	RIFFLE
☐ ☐ HARDPAN [4]		
☐ ☐ DETRITUS [3]		
☐ ☐ MUCK [2]		
☐ ☐ SILT [2]	10	0
☐ ☐ ARTIFICIAL [0]		

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☒ 3 or less [0]

Comments

ORIGIN (Check ONE (Or 2 & average)):
- ☒ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTRINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY:
- SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☒ NORMAL [0] ☐ FREE [1]
- EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☒ NORMAL [0] ☐ NONE [1]

Substrate: 14 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 1 UNDERCUT BANKS [1]
- 0 OVERHANGING VEGETATION [1]
- 0 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 0 POOLS > 70cm [2]
- 0 ROOTWADS [1]
- 0 BOULDERS [1]
- 0 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 0 LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONE (Or 2 & average)):
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☐ SPARSE 5-<25% [3]
- ☒ NEARLY ABSENT <5% [1]

Comments

Cover: 1 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☒ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☒ LOW [1]
☐ NONE [1]	☒ POOR [1]	☒ RECENT OR NO RECOVERY [1]	

Comments

Channel: 5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐ ☐ NONE / LITTLE [3]	☐ ☐ WIDE > 50m [4]	☐ ☐ FOREST, SWAMP [3]	☐ ☐ CONSERVATION TILLAGE [1]
☐ ☐ MODERATE [2]	☐ ☐ MODERATE 10-50m [3]	☒ ☒ SHRUB OR OLD FIELD [2]	☐ ☐ URBAN OR INDUSTRIAL [0]
☒ ☒ HEAVY / SEVERE [1]	☐ ☐ NARROW 5-10m [2]	☐ ☐ RESIDENTIAL, PARK, NEW FIELD [1]	☒ ☒ MINING / CONSTRUCTION [0]
	☒ ☒ VERY NARROW < 5m [1]	☐ ☐ FENCED PASTURE [1]	
	☐ ☐ NONE [0]	☐ ☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!)):
- ☐ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☒ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH (Check ONE (Or 2 & average)):
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☒ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY (Check ALL that apply):
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☒ FAST [1]
- ☐ MODERATE [1]
- ☐ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 3 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH:
- ☐ BEST AREAS > 10cm [2]
- ☒ BEST AREAS 5-10cm [1]
- ☐ BEST AREAS < 5cm [metric=0]

RUN DEPTH:
- ☐ MAXIMUM > 50cm [2]
- ☒ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE:
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☒ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS:
- ☐ NONE [2]
- ☒ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 4 (Maximum 8)

6] GRADIENT
(33.5 ft/mi) DRAINAGE AREA (3.26 mi²)

- ☒ VERY LOW - LOW [2-4]
- ☐ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: 5 %GLIDE: 0 %RUN: 79 %RIFFLE: 16

Gradient: 2 (Maximum 10)

A] SAMPLED REACH
Check ALL that apply

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

METHOD
- [X] BOAT
- [ ] WADE
- [ ] L. LINE
- [ ] OTHER

STAGE
1st -sample pass- 2nd
X
- [ ] HIGH [ ]
- [ ] UP [ ]
- [ ] NORMAL [ ]
- [ ] LOW [ ]
- [ ] DRY [ ]

DISTANCE
- [ ] 0.5 Km
- [X] 0.2 Km
- [ ] 0.15 Km
- [ ] 0.12 Km
- [ ] OTHER
- X 0.06

meters

CLARITY
1st --sample pass-- 2nd
- [ ] < 20 cm [ ]
- [ ] 20-<40 cm [ ]
- [ ] 40-70 cm X [ ]
- [ ] > 70 cm/ CTB [ ]
- [ ] SECCHI DEPTH [ ]

CANOPY
- [ ] > 85%- OPEN
- [ ] 55%-<85%
- [ ] 30%-<55%
- [ ] 10%-<30%
- [ ] <10%- CLOSED

pass 1st ______ cm
2nd ______ cm

B] AESTHETICS
- [ ] NUISANCE ALGAE
- [ ] INVASIVE MACROPHYTES
- [ ] EXCESS TURBIDITY
- [ ] DISCOLORATION
- [ ] FOAM / SCUM
- [ ] OIL SHEEN
- [ ] TRASH / LITTER
- [ ] NUISANCE ODOR
- [ ] SLUDGE DEPOSITS
- [ ] CSOs/SSOs/OUTFALLS

C] RECREATION AREA DEPTH
POOL: [ ] >100ft² [ ] >3ft

D] MAINTENANCE
Circle some & *COMMENT*

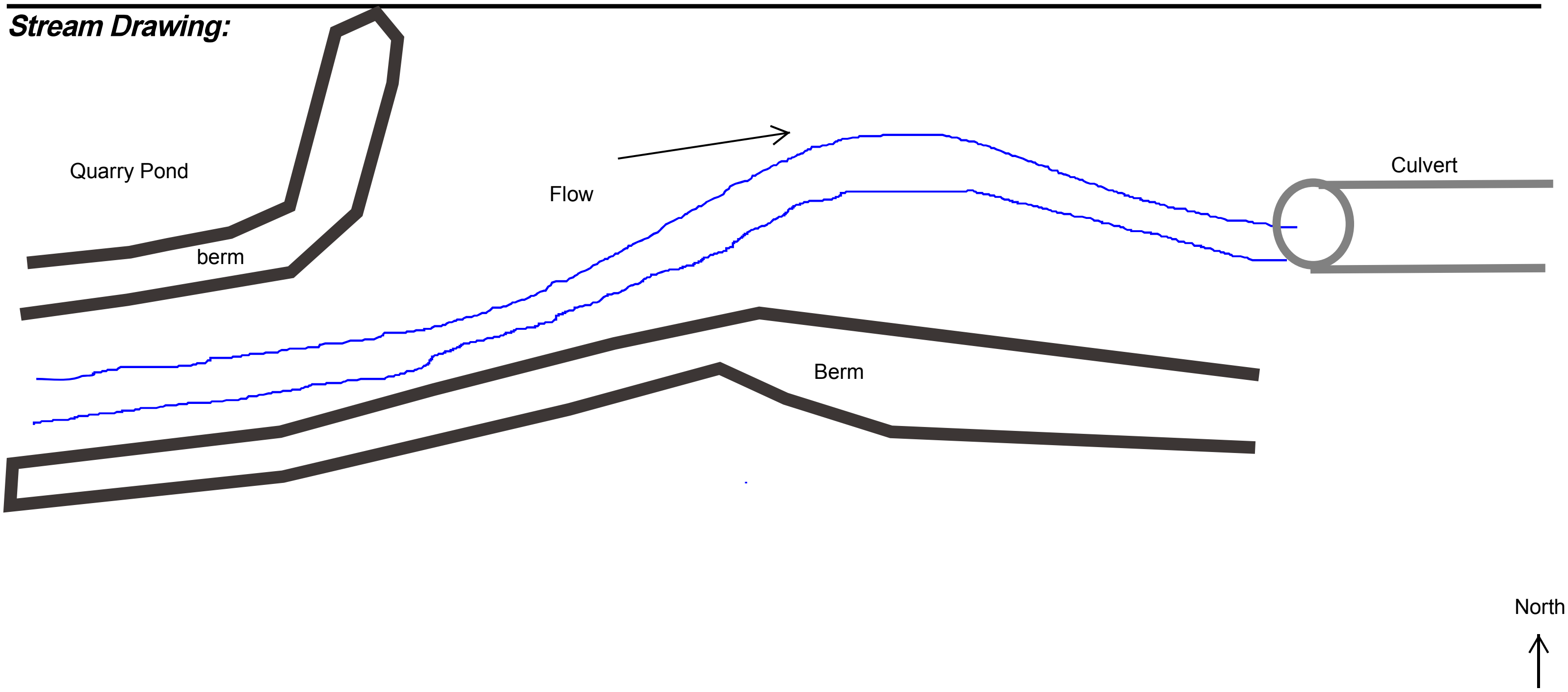
PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

E] ISSUES
WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

F] MEASUREMENTS
- $\bar{x}$ width
- $\bar{x}$ depth
- max. depth
- $\bar{x}$ bankfull width
- bankfull $\bar{x}$ depth
- W/D ratio
- bankfull max. depth
- floodprone x^2 width
- entrench. ratio

Legacy Tree:

Stream Drawing:



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www.gci2000.com

REPORT OF
JURISDICTIONAL DETERMINATION

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

GCI PROJECT NO. 16-E-19414-A

Prepared for:

Wagenbrenner Development, Inc.
c/o Mr. Gilbert Black
842 North 4th Street, Suite 200
Columbus, Ohio 43215

Prepared by:

GEOTECHNICAL CONSULTANTS, INC. (GCI)
720 Greencrest Dr.
Westerville, OH 43081

July 5, 2016

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APPENDIX INFORMATION

General Property Location Map
Property Location Map
Franklin County Auditor's GIS Map
Franklin County Auditor Parcel Information Sheets (8 pages)
1903/1925, 1955, 1965, 1973/82, 1982/84, 1995, and 2013 USGS Topographic Maps
USDA Web Soil Survey Map
National Wetland Inventory (NWI) Map
FEMA Flood Insurance Rate Map
Aerial Photographs Dated:

- 1938,
- 1957,
- 1964,
- 1971,
- 1979,
- 1986,
- 1989,
- 1995,
- 2004,
- 2007,
- 2009,
- 2013, and
- 2015

Site Features Map
Photo Key
Photographs (Photo 1 through Photo 54)
Approved Jurisdictional Determination Form (9 pages)

1.0 INTRODUCTION

Wagenbrenner Development, Inc. retained Geotechnical Consultants, Inc. (GCI) to perform an assessment to determine the presence or absence of jurisdictional waters at the Marble Cliff Quarry property on Dublin Road in Columbus, Franklin County, Ohio ("the property" or "site").

The assessment consisted of three parts: 1) preliminary off-site determination (research of existing published data), 2) on-site assessment, and 3) data compilation/report preparation.

The intent of this assessment was to determine if jurisdictional waters were present on the property. GCI performed this assessment for specific application to the property described herein, in accordance with the U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (1987) and the 2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region.

This report is an instrument of professional service prepared by GCI for the sole use of Wagenbrenner Development, Inc. and other parties that may be designated jointly by Wagenbrenner Development, Inc. and GCI. Any other party that wishes to use or rely upon this report, or that wishes to duplicate, otherwise reproduce or copy, or excerpt from, or quote this report must apply for authorization to do so. Any unauthorized use of or reliance on this report shall release GCI from any liability resulting from such use or reliance. Any unauthorized duplication, other reproduction or copying, or excerption or quotation of this report shall expose the violator to all legal remedies available to GCI. This report will become public information upon submittal to the USACE.

2.0 PROPERTY DESCRIPTION

The property is located in a mixed commercial, industrial, and residential area east of Dublin Road and north of Trabue Road in the west central portion of the City of Columbus. The property consists of 150± acres of land previously used as a limestone quarry and landfill. The property is identified by all of Franklin County parcel identification numbers 560-154669 and 560-154616, and parts of parcel numbers 560-154643 and 560-154658. The property is bordered to the east by the Scioto River. Approximate latitude / longitude coordinates for the center of the property are 40.000732 / -83.085820.

Historical records indicate the property was developed as a limestone quarry in the mid-1800s, and has also been utilized for landfilling operations. The property is not currently in use. The property contains large quarry ponds on the southwest and northwest portions. Between the two quarry ponds are areas of shallow water with a thin silty substrate, underlain by rock and gravel from previous quarry activities. The eastern portion of the property consists of former landfill areas with a surface cover of rock, boulders, and loose limestone aggregate with a thin cover of previously stripped topsoil overburden. The majority of the property is vegetated by various trees and shrubs, consisting of bush honeysuckle, invasive pear trees (callery pear), buckeye, cottonwood, ash, box elder, and hackberry.

Property location maps, a Franklin County Auditor's GIS Map, USGS (Northwest Columbus and Southwest Columbus, Ohio) topographic maps, and aerial photographs showing the approximate site area are attached to this report. Photographs showing representative vegetation, property features, and views from several locations around the site are also included.

GCI identified two (2) ponds and one (1) man-made drainage channel within the property boundary. Combined surface areas of the two ponds totaled **16.91± acres**. Total length of the man-made drainage channel was **3,366± linear feet**. GCI did not observe areas exhibiting wetlands characteristics on the property. Attached to the report is a **Site Features Map** showing the locations of the on-property ponds and the man-made drainage channel.

The following report provides additional information, and should be read entirely.

3.0 RECORDS REVIEW AND DETERMINATION

The preliminary off-site determination consisted of a desktop review of published information including United States Geological Survey (USGS) topographic maps, United States Department of Agriculture (USDA) soils map, United States Fish & Wildlife Service (USFWS) National Wetland Inventory (NWI) map, and aerial photographs from local governmental agencies. GCI used this information to determine the geo-morphological setting at the property, soil types present, whether disturbed conditions existed at the property, and to determine the appropriate field delineation method to be used.

3.1 TOPOGRAPHY

GCI reviewed the 1903 *Dublin, Ohio* and 1925 *West Columbus* USGS 15-minute series topographic maps. The northern-half of the property was located on the Dublin quadrangle, and the southern-half of the property was located on the West Columbus quadrangle. These maps indicated depressions on the southern portion of the property with rail spurs crossing the property in a general north/south direction. A rail spur was also shown on the southeast portion of the property, extending across the Scioto River. This information indicates the property was likely used as a limestone quarry during these years. An unnamed tributary of the Scioto River was shown crossing the central portion of the property in a general east/west direction. The Scioto River was shown bordering the east side of the property.

GCI also reviewed the 1955, 1965, 1982, 1995, and 2013 *Northwest Columbus, Ohio* and 1955, 1965, 1973, 1984, 1995, and 2013 *Southwest Columbus, Ohio* USGS 7.5-minute series topographic maps. The northern-half of the property was located on the Northwest Columbus quadrangle, and the southern-half of the property was located on the Southwest Columbus quadrangle.

The 1955 maps indicated a limestone quarry within the property boundary. Pits and depressions were indicated on the northern and southern portions of the property. Green tint, indicating wooded vegetation, was indicated on the southern, eastern, and west central portions of the property. High walls were indicated along the west and south property lines. Rail spurs were shown crossing the property in a general north/south direction, with an addition rail spur shown on the southeast portion of the property. Unimproved roads and trails were also indicated on the property, with several small structures shown on the northern, central, and western parts of the site. Roberts Millikin Ditch and a second unnamed tributary converged west of Dublin Road, approximately 600 feet southwest of the property. Roberts Millikin Ditch and the unnamed tributary were shown to enter and terminate on the west central portion of the property. The stream channel previously indicated on the property on the 1903/25 map was not shown on the 1955 map.

The 1965 maps were generally similar in appearance to the 1955 maps. However, pits and depressions previously apparent on the northeastern portion of the property appeared to have been filled, as indicated by changes in topographic contours. Several ponds were scattered on the southern and central parts of the property. Much of the site was indicated in green tint.

Site features on the 1973/82 and 1982/84 maps were similar in appearance to the 1965 maps. The exception was active or recent quarry operations indicated on the northeast portion of the property.

The 1995 maps indicated quarry operations on the northeast portion of the property. Two pits were shown in purple tint on the southern portion of the property. A small pond was indicated on the central portion of the site. Quarry areas were indicated on the northeast portion of the property with a depression or pit on the northwest portion of the property.

The 2013 maps indicated were similar in appearance to the 1995 maps, with the exception of additional pits and depressions on the western portion of the property.

Based on review of available topographic maps for the property, it appears a drainage previously crossed the central portion of the property in a general east/west direction. Mapping indicates this drainage was altered or eliminated before 1955 due to limestone quarry activities that have historically taken place on the property. Several pits, ponds, and depressions have been created on the property as a result of the extensive land disturbance associated with limestone quarry activities. The maps indicated no wetlands on the property. No mapped streams were indicated on the property in the 1955 through the 2013 topographic maps.

GCI used the USGS topographic map as an indicator of watershed characteristics on the property. USGS maps should not be relied upon to identify wetlands, ponds, or streams because the maps are created from widely scattered spot elevations averaged across an area. The maps may not identify small depressional areas or streams and are not updated frequently. The appendix of this report includes photocopies of portions of these USGS maps showing the property area.

3.2 SOILS

GCI reviewed the United States Department of Agriculture (USDA) Web Soil Survey website[1] for the property area, the USDA Natural Resources Conservation Service (NRCS) Hydric Soils website[2], and the list of Hydric Soils of the United States (published by NRCS in cooperation with the National Technical Committee for Hydric Soils). According to these sources, the property does not contain hydric soil units.

GCI reviewed the USDA Web Soil Survey website[3] for the property area. This publication indicated the mapping unit for the property as Pt-Pits, Quarry. According to soil survey, these are areas where limestone or shale bedrock have been surface mined. Most quarries have a high wall on one or more sides. Overburden, consisting of the original soils, is usually scalped and piled to the areas not used for quarrying.

[1] http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
[2] http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/
[3] http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

Two small areas on the west central portion of the property were indicated to have Ritchey silt loam (RhD2) and Milton silt loam (MoB) soils. These soils appeared to be outside the limits of quarry operations.

Mineral based soils (as opposed to carbon- or organic-based soils) generally contain significant amounts of iron and manganese. As the iron component of the soil matrix comes into contact with the atmosphere, the iron tends to oxidize giving soils a high "chroma" or rust-like color. This characteristic is typically observed in upland (i.e., non-wetlands) areas where oxygen is abundant. On the contrary, mineral soils that are saturated for extended periods (e.g., hydric soils) tend to have oxygen ions stripped, chemically reducing iron and giving these soils bluish-grayish coloring or low chroma. This reduced condition in mineral soils is known as "gleying" and is typically observed in wetlands, where soil oxygen contents are generally lower relative to upland soils. Low oxygen levels in reduced soils also tend to slow decomposition, leading to increased organic content. (Note: high organic levels in soils can present construction challenges and thus should be geotechnically assessed by a soils engineer for load bearing capacities if construction is planned in areas having organic soils.)

3.3 NATIONAL WETLANDS INVENTORY (NWI) MAP

GCI reviewed the NWI Map for wetlands information in the property area. The United States Fish and Wildlife Service (USFWS) produced NWI mapping as an attempt to document wetlands in the United States. The USFWS drafted NWI maps using high-altitude infrared aerial photography to identify areas with saturated or inundated soils. Areas that are saturated or inundated are typically lower in temperature than dryer areas, giving wet areas unique heat signatures compared with surrounding upland areas. The USFWS mapped these cooler areas as wetlands without field verification.

GCI uses NWI maps as a desk top determination tool. NWI maps may not reflect actual field conditions due to meteorological or seasonal conditions that may have existed at the time of data collection. GCI typically uses NWI maps to plan field reconnaissance and as an indicator of areas that may support wetlands; however, USACE-approved delineations often deviate significantly from the NWI Maps.

The NWI map indicated five wetland mapping symbols within the property boundary. Two of these symbols, indicated on the southwest and northwest portions of the property, were PUBGx, meaning these areas were palustrine, unconsolidated bottom, intermittently exposed, and excavated. These mapping symbols appear to be existing quarry ponds. Between these two apparent quarry ponds was a PUBG symbol, indicating an area which was palustrine, unconsolidated bottom, and intermittently exposed. Bordering the west side of the northern most PUBGx symbol was a PEM1F symbol, indicated an area which was palustrine, emergent, persistent, and semi permanently flooded. A wetland mapping symbol was also shown on the southeast portion of the property, along the western boundary of the Scioto River. This symbol was PFO1A, meaning the area was palustrine, forested, broad-leaved deciduous, and temporary flooded.

The appendix of this report includes a copy of the NWI map for the property area.

3.4 FEMA FLOOD INSURANCE RATE MAP (FIRM)

GCI reviewed information from The Federal Emergency Management Agency (FEMA) Map Service Center website[4] for flood information in the property area. According to this source, the northeast portion of the property is within Zone X. Zone X is defined as areas of the 0.2% annual chance flood; areas of 1% annual chance flood with average depth of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. The western and southern portions of the property were determined to be in Zone AE; areas where the base flood elevation has been determined. The eastern portions of the property, bordering the Scioto River, were determined to be in areas designated as Floodway Areas In Zone AE. This designation was described as the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

3.5 AERIAL PHOTOGRAPHS

Current regulations require that wetland delineations be performed in accordance with the 1987 USACE Wetland Delineation Manual and the 2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region. These manuals specify two primary methods of delineation: the *routine method* and the *disturbed condition method*. The *routine method* is used on undisturbed properties and is preferred by USACE because wetland boundaries can be accurately identified by a wetland professional based on actual field boundaries. The *disturbed condition method* is used on properties that have had previous land disturbance. Disturbed properties often require reliance on historical aerial photography, soil maps, and NWI maps, and can result in an over-estimation of jurisdictional water area size.

GCI reviewed historical aerial photographs dated 1938, 1957, 1964, 1971, 1979, 1986, 1989, 1995, 2004, 2007, 2009, 2013, and 2015. GCI used the aerial photographs as an indicator to determine whether the property had been significantly disturbed within the past few years.

Review of available aerial photographs indicated the property has been part of a large quarry operation since at least 1938. Apparent quarrying activities were also visible north, east, and south of the property. Landscape features on the property varied throughout the years. Ground surfaces throughout the property were significantly disturbed throughout these years.

The 1938 and 1957 aerial photographs indicate ground surface disturbance throughout much of the property. Roadways and/or railroad tracks were apparent crossing the property in a general north-south direction. A drainage apparently enters the west central portion of the property and crosses the central portion of the property in an east/west direction. Areas adjacent to the drainage appear wooded or vegetated. Areas to the north, east, and south also contain disturbed surface soils, indicative of mining activities. Areas to the west of the property consist of a mixture of agricultural, residential, and commercial properties.

The 1967 aerial photograph indicated the property was increasingly vegetated. The northeast and east central portions of the property appeared to contain numerous trenches and paths, representative of former landfilling activities that occurred in these

[4] https://msc.fema.gov/portal

areas. High walls were apparent along the west and south sides of the property during this year. An east/west linear drainage crossed the central portion of the property. A pond was apparent in-line with this drainage, near the center of the property. Ponds were also apparent on the southern and northwestern portions of the property.

The 1971 aerial photograph indicated significant ground surface disturbance on the northeast portion of the property. This disturbance appeared to be associated with fill and grading activities. The east/west drainage channel previously apparent crossing the central portion of the property was not discernable during this year due to the dense vegetation on the central part of the property.

Property features on the 1979 aerial photograph were similar in appearance to the 1971 aerial photograph. Some vegetation had been removed from the central portion of the property, making the east/west drainage visible once again.

The 1986 aerial photograph indicates the property in relatively unused land. An area of ground surface disturbance is apparent on the northeast portion of the property. Much of the property had become increasingly vegetated. Ponds or standing water were apparent on the northwest and southwest portions of the property. The east/west drainage crossing the central portion of the property is apparent during this year.

The 1989 aerial photograph shows the resurgence of mine activates on the southern portion of the property. Several large pits and disturbed surface soils are apparent on the southern portion of the property. Shadows indicate high walls along the south and west property boundary. The east-west drainage channel is not discernable during this year.

The 1995 indicates increased quarry activities on the northwest portion of the property. The southern and western-half of the property appear to be undergoing mining activities. The northeast and east central portions appear wooded and/or vegetated. The east/west drainage previously apparent crossing the central portion of the property has be re-routed to follow the west property boundary, along an apparent high wall, before turning east and traversing the southern portion of the property.

The 2004 through 2015 aerial photographs are representative of current site features. A drainage can clearly be seen entering the west central portion of the property, from the west, across Dublin Road. Upon entering the property, the drainage travels in a southerly direction along the west property boundary. Near the southwest corner of the property, the drainage is directed east/northeasterly, and crosses the southern portion of the property. The channel appears to connect to the Scioto River, which borders the east side of the property. A small pond is visible in-line with the drainage on the southeast portion of the property in several of these aerial photographs. A large quarry pond is apparent north and east of the channelized drainage. A quarry pond is also apparent on the northwest portion of the property. These two quarry ponds appeared to be connected by surface channels. The remainder of the property is wooded or vegetated by brush and shrubs. Areas to the west of the property, across Dublin Road, have become increasingly developed with residential, commercial, and light industrial properties during these years.

The 2013 and 2015 aerial photographs indicated the property was similar in appearance to what was observed during our site visits conducted in January, April, and June 2016.

Copies of the aerial photographs showing the assessed area are attached to this report.

3.6 RECORDS REVIEW DETERMINATION CONCLUSIONS

Review of published information indicates the property has historically been used as a limestone quarry. As such, surface features at the property have been significantly altered since the mid-1800's when the quarry first began operations. Maps and aerial photographs indicate several ponds created by quarry activities exist on the property. Much of the eastern portion of the property was also used as a landfill after quarry operations ceased. The maps and aerial photographs indicated a drainage, identified as Roberts Millikin Ditch (west of the property), previously crossed the central portion of the property in a general east/west direction. This drainage was re-routed sometime between 1989 and 1995 to direct water flow from areas west of the property to outside the limits of the mining areas. The NWI map also indicated the potential presence of wetlands on the northeast portion of the property, and along the eastern property boundary.

The potential for wetlands, ponds, and streams within an area cannot be determined solely from a records review determination; therefore, an on-property investigation is required to verify the on-property conditions.

4.0 JURISDICTIONAL WATERS DETERMINATION

GCI performs field visits for Jurisdictional Waters Determinations using criteria and guidance in the Corps of Engineers' Wetland Delineation Manual (USACE, 1987) and the 2010 Midwest Regional Supplement to the 1987 Wetland Delineation Manual. In this method, vegetation, hydrology, and soil criteria are used to identify jurisdictional wetlands. The delineation method and vegetation sampling methodology uses the procedures for Routine Determinations found in the 1987 and 2010 manuals.

On-property drainages (streams) were assessed in accordance with guidelines from the USACE pertaining to potential jurisdictional waters of the United States. Potential wetlands, streams, and drainage ditches were followed to determine the flow regime and whether a significant nexus to a jurisdictional water of the U.S. could be established.

The field investigation was conducted by walking and visually surveying the subject property and in the vicinity to collect wetland and stream data, as necessary.

Photographic documentation of the on-property drainages (streams), ponds, vegetation, and general landscape photographs are attached.

The published information reviewed indicated property conditions were generally unchanged for several years prior to this delineation, such that the property was considered undisturbed for data collection. Therefore, the routine method was used in this assessment.

5.0 PROPERTY VISIT AND ON-PROPERTY DETERMINATION

Mr. Matthew R. Kaminski with GCI conducted site visits on the following dates:

- January 19, 2016,
- April 12, 2016,
- April 15, 2016,
- April 20, 2016, and
- June 14, 2016.

GCI intentionally performed multiple site visits to determine flow characteristics of the drainage on the property and opine as to the jurisdictional status of the man-made drainage channel. The majority of the property is vegetated by bush honeysuckle. Access to the eastern portions of the property is difficult due to the dense vegetation rocky terrain.

Section 404 of the Clean Water Act requires a pre-discharge notification to the USACE for approval, prior to placing dredged or fill material into jurisdictional waters connected to navigable waters. Connection to navigable waters is characterized as any surface water connection with a defined bed and bank to streams or other open waters. House Bill 231 requires an Ohio Isolated Wetland Permit (OIWP) from Ohio EPA prior to impacting isolated wetlands not determined to be connected to navigable waters.

Three wetland criteria are required to be present to establish the presence of wetlands: hydric soils, hydrophytic vegetation, and wetland hydrology; and, all three criteria must be present for an area to be identified as wetland. These three criteria are defined and explained in detail in the Corps of Engineers' Wetland Delineation Manual (USACE, 1987) and the 2010 Midwest Regional Supplement to the 1987 Wetland Delineation Manual. The Wetlands Research Program of the USACE Waterways Experiment Station developed the manual in 1987. GCI followed the methods described in the manual in performing the delineation. No other warranty is expressed or implied.

After collecting pertinent information through the preliminary off-site determination, GCI used the routine method to determine if wetland areas existed on property. The approach used for the routine determination was the plant community assessment procedure. This approach required initial identification of representative plant community types in the subject area followed by characterization of vegetation, soils, and hydrology for each community type.

5.1 HYDRIC SOILS CRITERIA

GCI performed soil probes to evaluate hydric soil characteristics at the property. The presence of hydric soils is determined by comparing soil samples to a Munsell soil color chart, as soil colors often reveal whether a soil is hydric or non-hydric (see data forms). The standardized Munsell soil colors consist of three components: hue, value, and chroma. Soil in hydric soil areas typically show yellow-red hues, varying gray color values, and chromas of one or two. Chromas of two or less are considered low, and are often diagnostic of hydric soils.

Hydric mineral soils saturated for long periods of the growing season, but unsaturated for some time, often develop mottles and/or a low chroma matrix. GCI did not observe these soil characteristics at the property. Generally, the site has a thin layer of soil or overburden underlain by a rocky/gravel substrate associated with former mining activities. Therefore, the property does not satisfied the hydric soil criteria for jurisdictional wetlands.

5.2 WETLAND HYDROLOGY CRITERIA

Wetland hydrology is determined present in areas that are periodically inundated or have soils saturated to the surface sometime during the growing season. This is a dynamic characteristic and is usually not present during drier periods of the year. Primary wetland hydrology indicators include, but are not limited to, surface water, high water table, inundation, soil saturation in the upper 12 inches of the soil, water marks, sediment deposits, drift deposits, and water-stained leaves. Secondary wetland hydrology indicators include surface soil cracks, drainage patterns, dry-season water table, crayfish burrows, saturation visible on aerial imagery, stunted or stressed plants, geomorphic position, and FAC-Neutral Test of vegetation. One primary indicator or two or more secondary indicators are required to establish a positive indication of hydrology.

Wetland hydrology is present in areas that are periodically inundated or have soils saturated to the surface sometime during the growing season. This is a dynamic characteristic and is usually not present during drier periods of the year. GCI performed a site walkovers January 19, April 12, April 15, April 20, and June 14, 2016. During our April and June site visits, ground surfaces were generally dry. The unconsolidated material associated with former limestone mining operations at the property are generally not conducive for saturated conditions. With exception of the quarry ponds, GCI did not observe areas exhibiting primary or secondary wetland hydrology indicators. Therefore, the property does not satisfy the hydrology criteria for jurisdictional wetlands.

5.3 HYDROPHYTIC VEGETATION CRITERIA

Hydrophytic vegetation is present if more than 50 percent of plant species within a plant community have an indicator status of obligate wetland (OBL), facultative wetland (FACW), and/or facultative (FAC). The indicator status of plant species found in wetlands is listed in the Midwest 2012 Final Regional Wetland Plant List published by the USACE. GCI used this data, and determined hydrophytic vegetation dominance was present on the property. Dominant hydrophytic vegetation observed on the property consisted of Common Reed (*Phragmites australis).* Common Reed is an invasive species that can grow in disturbed moist/wet areas. GCI observed this vegetation on the central portion of the property, in shallow standing water between the two quarry ponds. Therefore, the property meets the hydrophytic vegetation criteria for wetlands in this area. GCI did not observe a dominance of hydrophytic vegetation in any other areas of the property. *Note* GCI was not able assess the floodplain areas of the Scioto River due to rocky, rough terrain, and dense vegetation.

5.4 ON-PROPERTY DETERMINATION CONCLUSIONS

The field investigations confirmed:

- Two (2) quarry ponds are located on the property; one on the northwest portion and one on the southwest portion.
- One (1) man-made, channelized drainage crosses the western and southern portions of the property from west to east.
- No areas exhibiting wetland characteristics are located on the property.

6.0 POTENTIALLY JURISDICTIONAL WATERS

According to Section 404 of the Clean Water Act (CWA), the USACE asserts jurisdiction over Traditional Navigable Waters, which includes all waters as outlined in 33 C.F.R. § 328.3(a)(I), and 40 C.F.R. § 230.3 (s)(I). This includes non-navigable tributaries of traditional navigable waters that flow relatively permanently for at least 3 months of the year. Moreover, the USACE will also assert jurisdiction over non-navigable, not relatively permanent tributaries, where such tributaries have a significant nexus to traditional navigable waters.

GCI identified two ponds within the property boundary. These ponds were **7.87± acres** and **9.04± acres** in size, and identified as Pond #1 and Ponds #2, respectively, on the attached Site Features Map. The calculated acreage of Pond #1 includes the shallow surface water areas between the two deep water quarry ponds. The coordinates for the center of Pond #1 are 40.000986 / -83.089575. The coordinates for the center of Pond #2 are 39.997504 / -83.085103. These ponds were created due to former limestone quarry operations, and were not created by impoundment of a jurisdictional stream. GCI did not observe inflow or outflow structures associated with these ponds. Wetland vegetation was not observed growing in the ponds or around the pond perimeters.

GCI identified one (1) drainage totaling **3,366± linear feet** within the property boundary. The approximate start coordinates for this drainage are 39.998577 / -83.089805. The approximate end coordinates for this drainage are 39.998594 / -83.081150. It is GCI's opinion that this drainage is considered non-jurisdictional. Below is our summary of this finding, based on review of published information and several site observations. Photo documentation correlating to our description of the drainage is included in the appendix of the report.

- USGS topographic maps reviewed and discussed previously indicated a drainage (Roberts Millikin Ditch) entered the site from the west, beneath Dublin Road. West of the property, Roberts Millikin Ditch is shown as a blue line stream on Northwest Columbus and Southwest Columbus quadrangles. Roberts Millikin Ditch and the blue line stream designation on the USGS map terminate shortly after entering the site east of Dublin Road. The original course of this drainage through the site cannot be determined, because the site has been an active quarry since the 1850s. The earliest USGS topographic maps available, dating from 1903, indicated the drainage previously crossed the central portion of the property in a general east/west direction.
- West of Dublin Road, Roberts Millikin Ditch appears to have perennial flow over exposed limestone (photos 1 & 2). The average width of the drainage, west of the site, is between 5 to 8 feet. The drainage flows beneath Dublin Road (photos 4 & 5), at which time it enters the property boundary. The drainage continues its flow over exposed limestone (photos 6, 7, & 8) for an additional 100± feet before the water flows over a mine high wall, creating a waterfall (photos 9, 11, & 13). The waterfall has been created by the elevation change associated with the native elevation of the drainage, and the previously quarried areas where stone has been removed. Water pools beneath the waterfall (photos 10, 11, & 12), while overflow is directed westerly, via a man-made channel (photos 13-32). The channel had been cut between quarry high-walls and man-made berms of topsoil and overburden (photos 22 & 23). The substrate of the channel consists of unconsolidated limestone materials or quarry overburden. Site observations indicate surface water flows in an easterly direction within the channel for as little as 175± linear feet before percolating into the unconsolidated substrate material of the channel and disappearing into the ground (photos 15-19). It is speculated that upon entering the ground, the water from the drainage enters fractured limestone associated with former quarry activities; hence becomes ground water. This ground water may responsible for the inundation of the former quarry pits to the west, which have previously identified as Pond #1 and Pond #2.
- Surveyed elevations conducted by EP Ferris & Associates indicates the surface water elevation of Pond #1 is 727.9± feet above mean sea level (AMSL) and the surface water elevation of Pond #2 is 719.5± feet AMSL. The man-made drainage channel has elevations ranging from 730.1± feet AMSL to 753.4± feet AMSL. The highest elevation of the drainage channel is located on the west central portion of the property, where it originates east of the waterfall. The difference in elevation of the constructed drainage channel and the quarry ponds, in conjunction with the unconsolidated substrate of the channel and underlying fractured limestone, indicates that surface water entering the

site from the west via Roberts Millikin Ditch may become ground water that has an influence on the adjacent quarry ponds (Pond #1 and Pond #2).

- The man-made drainage channel does not show evidence of year round flow and is not a relatively permanent water. The channel has been cut across the property with a final termination at the Scioto River (photo 33). Site observations indicate continuous flow throughout the entire channel exists only during, and directly after, a heavy rain or snow melt. Flow during and after rain events is swift and of short duration. Otherwise, the channel does not have continuous flow, even though flow coming into the site from the west is perennial.

7.0 PERMITS

Ohio EPA issues section 401 permits of the Clean Water Act. Section 401 deals with how a specific activity will affect water quality. Parameters such as sedimentation and nutrients are considered in 401 permitting. Wetlands are able to trap sediment and convert nutrients; hence, negative wetland or stream impacts effectively may lower water quality downstream. The Ohio EPA has jurisdiction over wetlands or other waters the USACE has determined to be “isolated” and not connected to navigable waters by direct surface water drainage.

The USACE issues section 404 permits of the Clean Water Act. Section 404 deals with the physical aspects of ground modification or “impacts” (e.g., draining, dredging, and filling.) Mucking out a wetland and culverting a stream for a road crossing are examples of such impacts. The USACE must generally be involved in all jurisdictional wetland, pond, or stream related activities.

Individual section 401 and 404 permits generally are costly and often take several months to receive complete regulatory agency review. Under the Clean Water Act, Nationwide Permits (NWPs) were issued to speed up the permitting process for minor activities. Whether filling, re-routing, or enhancing, the USACE must be notified at a minimum under most NWPs.

Under the NWPs, stream impacts are generally limited to 300 linear feet, while wetland impacts are generally limited to ½ acre. Wetland and stream impacts exceeding the NWP thresholds will require Individual Permit review. Limitations and conditions vary from permit to permit and are dependent on property development plans. Mitigation may be necessary for impacts to jurisdictional waters. The NWPs cannot be used if any the following are to be impacted:

- high quality, isolated, or rare wetlands,
- wetlands within the 100 year flood plain,
- state or National Scenic Rivers,
- navigable waterways,
- areas where endangered species are known to exist,
- areas where historic or archeological sites or structures are known to exist,
- areas containing a large concentration of shellfish beds,
- areas where water quality will be significantly degraded, and
- Critical Resource Waters.

8.0 CLOSING

GCI identified one (1) drainage totaling **3,366± linear feet** and two ponds with a combined surface water area of **16.91± acres**. GCI did not observe areas exhibiting wetland characteristics on the property.

The ponds on the property were created by former limestone quarry operations, and were not created by impoundment of a jurisdictional stream. GCI did not observe inflow or outflow structures associated with these ponds. It is GCI's opinion that these ponds are isolated, non-wetland features, which would not be regulated by the USACE or Ohio EPA.

It is GCI's opinion that the man-made drainage channel traversing the west and south portions of the property is considered non-jurisdictional. However, a significant nexus finding may be required to determine if this drainage is jurisdictional under the Clean Water Act (CWA). GCI's review of the significant nexus definition indicates the drainage lacks a significant nexus to a Traditional Navigable Waterway (TNW) for the following reasons:

- The drainage does not have more than a speculative or an insubstantial effect on the chemical, physical, and/or biological integrity of a TNW (in this case, the Scioto River).
- The drainage lacks in volume.
- Continuous flow throughout the entire channel exists only during, and directly after, a heavy rain or snow melt. These flow events would be infrequent and of short duration. The channel lacks surface water flow (except for approximately 175 liner feet west of the waterfall and pool) during the majority of the year, even though flow coming into the site from the west is perennial.
- The proximity of the water source to the termination is approximately 3,266 linear feet (total length of man-made channel, minus 100 feet of channel between Dublin Road and the waterfall which is natural). This distance makes the effect on the TNW speculative or insubstantial.
- The channel does not support aquatic fish, amphibian, or vegetation.
- The man-made channel bed consists of a layer of limestone spoils and gravel over previously mined limestone bedrock.
- The drainage channel does not support wetlands; there are no wetlands adjacent to the drainage.
- The drainage channel was excavated/constructed in uplands and drains only uplands and does not carry a relatively permanent flow of water.
- The drainage does not support wildlife, does not transport sediment, does not support nutrient cycling, does not retain sediment, and does not trap pollutants or improve water quality of TNW.

Based on the above criteria, it is GCI's opinion that the man-made drainage channel located within the property boundary is non-jurisdictional and does not meet the minimum requirement under the significant nexus determination. Provided in the appendix of this report is a completed Approved Jurisdictional Determination Form supporting this conclusion.

With your authorization, we will issue a copy of this report to the USACE, Huntington, WV District Office for verification. With this reported information and/or a property visit, the USACE will make the official determination of jurisdiction for all waters on site.

GCI appreciates the opportunity to serve you on this project. Please contact our office with any questions or concerns regarding our report.

9.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

Prepared by: ______________________________
Matthew R. Kaminski, EP
Senior Project Manager – Environmental Services

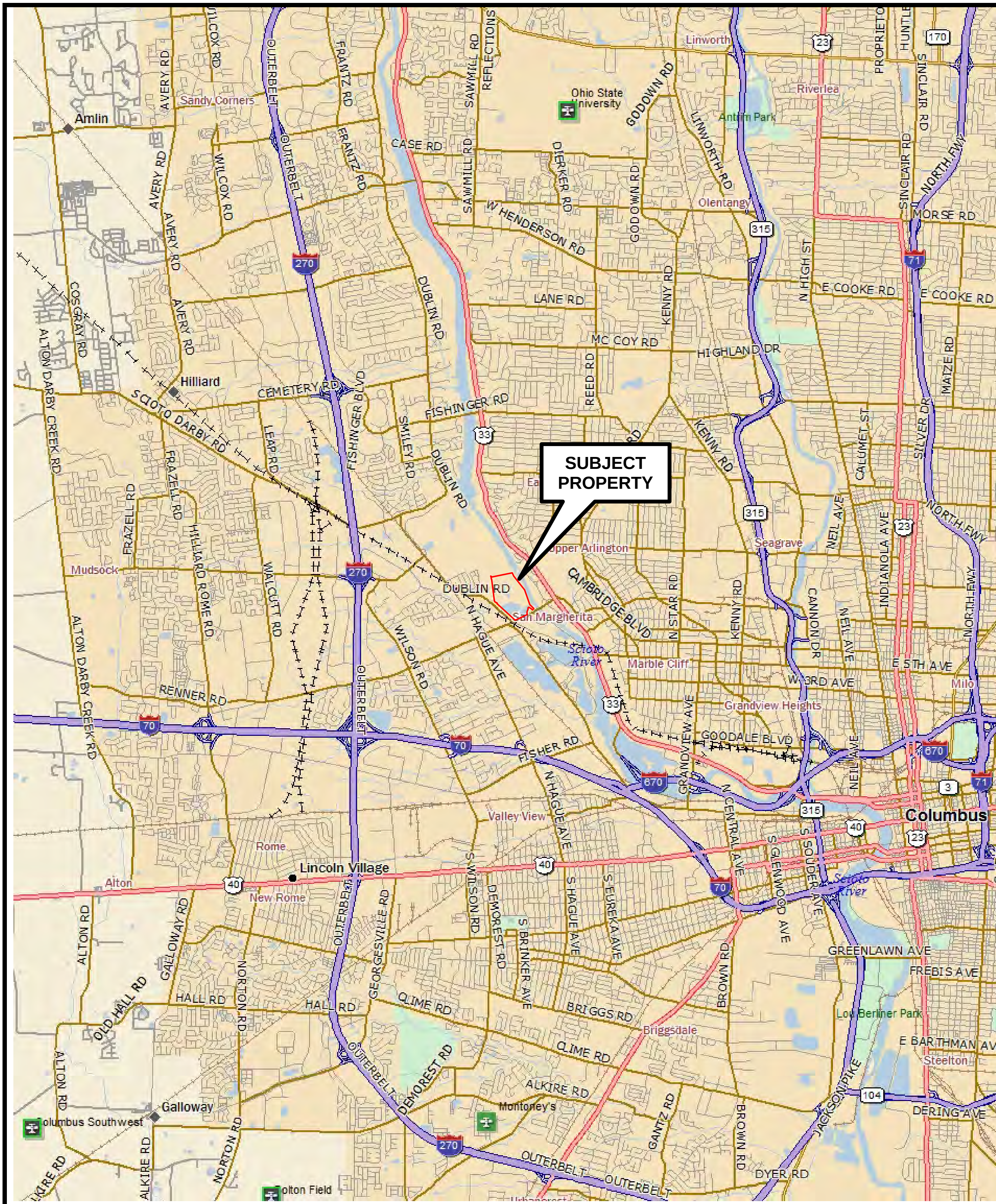
Reviewed by: ______________________________
Bruce A. Savage
Principal, Director Environmental Services

GEOTECHNICAL
CONSULTANTS INC.

APPENDIX INFORMATION

GENERAL PROPERTY LOCATION MAP

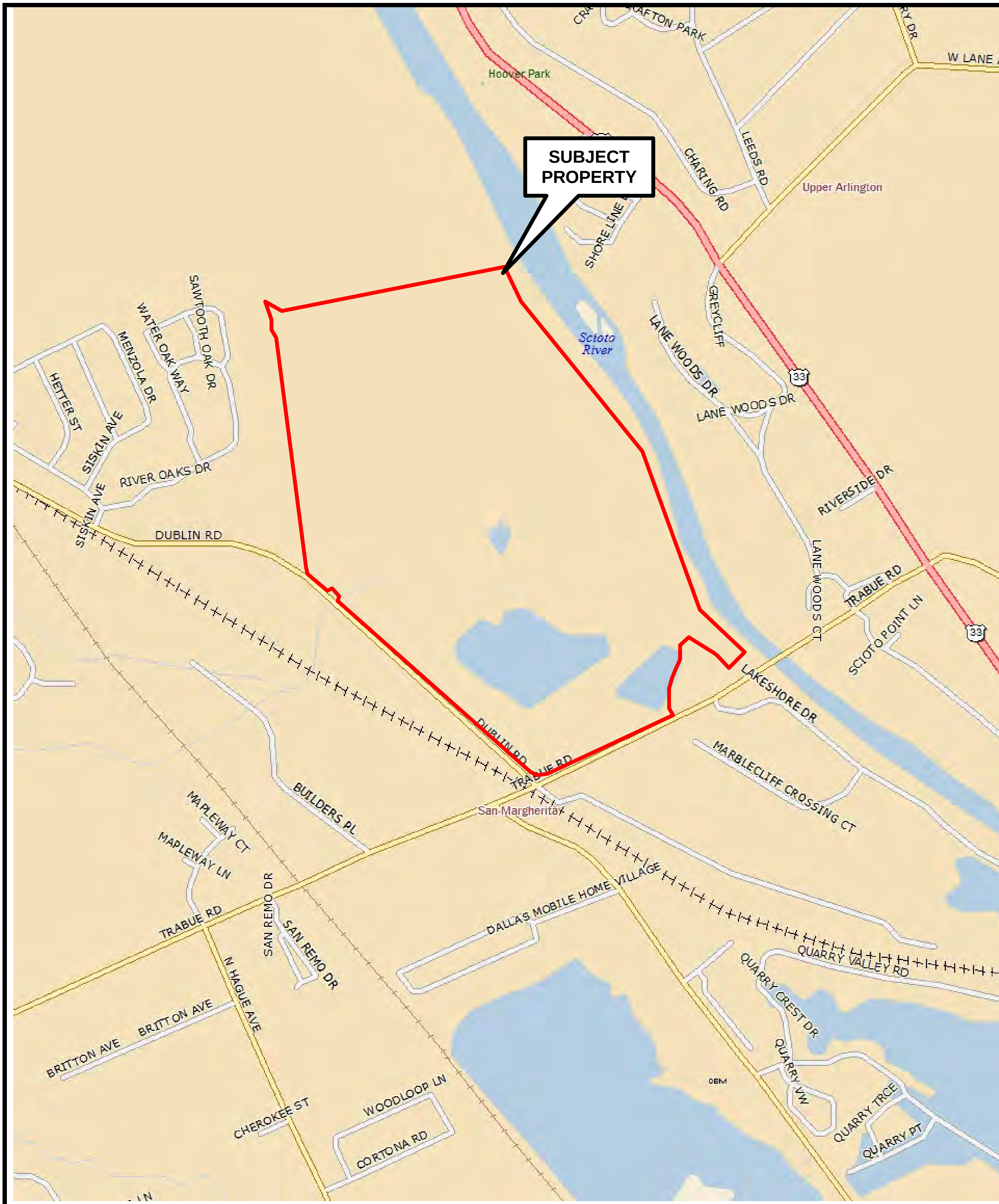
GCI PROJECT #16-E-19414-A



North

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

PROPERTY LOCATION MAP **GCI PROJECT #16-E-19414-A**



North

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

GEOTECHNICAL CONSULTANTS, INC.• 720 GREENCREST DRIVE• WESTERVILLE, OHIO 43081• 614-895-1400 • FAX 614-895-1171

FRANKLIN COUNTY AUDITOR'S GIS MAP **GCI PROJECT #16-E-19414-A**

North

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

GEOTECHNICAL CONSULTANTS, INC.• 720 GREENCREST DRIVE• WESTERVILLE, OHIO 43081• 614-895-1400 • FAX 614-895-1171

ParcelID: 560-154669-00 **Map-Rt: 560-O065D -035-00**
TRABUE DUBLIN LLC **TRABUE RD**

Owner

Owner	TRABUE DUBLIN LLC
Owner Address	8191 E KAISER BLVD ANAHEIM CA 92808
Legal Description	TRABUE RD OQ 1000 ENTRY 544 67.400 ACRES
Calculated Acres	67.19
Legal Acres	67.4
Tax Bill Mailing	TRABUE DUBLIN LLC ATTN TAX DEPT 8191 E KAISER BLVD ANAHEIM CA 92808
	View Google Map

Most Recent Transfer

Transfer Date	AUG-25-2010
Transfer Price	$0

2015 Tax Status

Property Class	I - Industrial
Land Use	380 - MINE OR QUARRY
Tax District	560 - COLUMBUS-HILLIARD CSD
School District	2510 - HILLIARD CSD
City/Village	COLUMBUS CITY
Township	
Appraisal Neighborhood	X0400
Tax Lien	No
CAUV Property	No
Owner Occ. Credit	2015: No 2016: No
Homestead Credit	2015: No 2016: No
Board of Revision	No
Zip Code	43228

2015 Current Market Value

	Land	Improvements	Total

Base	505,500	0	505,500
TIF			
Exempt			
Total	505,500	0	505,500
CAUV	0		

2015 Taxable Value

	Land	Improvements	Total
Base	176,930	0	176,930
TIF			
Exempt			
Total	176,930	0	176,930

2015 Taxes

Net Annual Tax	Taxes Paid	CDQ
16,219.18	16,653.76	2015

Site Data

Frontage	Depth	Acres	Historic District
		67.4	

ParcelID: 560-154616-00 **Map-Rt: 560-O065D -034-01**
TRABUE DUBLIN LLC **DUBLIN RD**

Owner

Owner	TRABUE DUBLIN LLC
Owner Address	8191 E KAISER BLVD ANAHEIM CA 92808
Legal Description	ROBINSON PIKE OQ1000 ENTRY 544 2.183 ACRES
Calculated Acres	1.92
Legal Acres	0
Tax Bill Mailing	TRABUE DUBLIN LLC ATTN TAX DEPT 8191 E KAISER BLVD ANAHEIM CA 92808
	View Google Map

Most Recent Transfer

Transfer Date	AUG-25-2010
Transfer Price	$0

2015 Tax Status

Property Class	I - Industrial
Land Use	380 - MINE OR QUARRY
Tax District	560 - COLUMBUS-HILLIARD CSD
School District	2510 - HILLIARD CSD
City/Village	COLUMBUS CITY
Township	
Appraisal Neighborhood	X0400
Tax Lien	No
CAUV Property	No
Owner Occ. Credit	2015: No 2016: No
Homestead Credit	2015: No 2016: No
Board of Revision	No
Zip Code	43228

2015 Current Market Value

	Land	Improvements	Total

Base	15,800	0	15,800
TIF			
Exempt			
Total	15,800	0	15,800
CAUV	0		

2015 Taxable Value

	Land	Improvements	Total
Base	5,530	0	5,530
TIF			
Exempt			
Total	5,530	0	5,530

2015 Taxes

Net Annual Tax	Taxes Paid	CDQ
506.94	520.52	2015

Site Data

Frontage	Depth	Acres	Historic District
		2.183	

ParcelID: 560-154643-00 **Map-Rt: 560-O065B -019-00**
TRABUE DUBLIN LLC **2650 DUBLIN RD**

Owner

Owner	TRABUE DUBLIN LLC
Owner Address	8191 E KAISER BLVD ANAHEIM CA 92808
Legal Description	ROBINSON PIKE ENTRY 544 OQ1000 WHITE CEMETERY
Calculated Acres	124.95
Legal Acres	132.657
Tax Bill Mailing	TRABUE DUBLIN LLC ATTN TAX DEPT 8191 E KAISER BLVD ANAHEIM CA 92808
	View Google Map

Most Recent Transfer

Transfer Date	AUG-25-2010
Transfer Price	$0

2015 Tax Status

Property Class	I - Industrial
Land Use	380 - MINE OR QUARRY
Tax District	560 - COLUMBUS-HILLIARD CSD
School District	2510 - HILLIARD CSD
City/Village	COLUMBUS CITY
Township	
Appraisal Neighborhood	X0400
Tax Lien	No
CAUV Property	No
Owner Occ. Credit	2015: No 2016: No
Homestead Credit	2015: No 2016: No
Board of Revision	No
Zip Code	43228

2015 Current Market Value

	Land	Improvements	Total

Base	987,600	14,100	1,001,700
TIF			
Exempt			
Total	987,600	14,100	1,001,700
CAUV	0		

2015 Taxable Value

	Land	Improvements	Total
Base	345,660	4,940	350,600
TIF			
Exempt			
Total	345,660	4,940	350,600

2015 Taxes

Net Annual Tax	Taxes Paid	CDQ
32,139.52	33,000.67	2015

Site Data

Frontage	Depth	Acres	Historic District
		132.66	

ParcelID: 560-154658-00 **Map-Rt: 560-O065B -020-00**
TRABUE DUBLIN LLC **TRABUE RD**

Owner

Owner	TRABUE DUBLIN LLC
Owner Address	8191 E KAISER BLVD ANAHEIM CA 92808
Legal Description	TRABUE RD ENTRY 544 4.62 ACS
Calculated Acres	4.36
Legal Acres	0
Tax Bill Mailing	TRABUE DUBLIN LLC ATTN TAX DEPT 8191 E KAISER BLVD ANAHEIM CA 92808
	View Google Map

Most Recent Transfer

Transfer Date	AUG-25-2010
Transfer Price	$0

2015 Tax Status

Property Class	I - Industrial
Land Use	380 - MINE OR QUARRY
Tax District	560 - COLUMBUS-HILLIARD CSD
School District	2510 - HILLIARD CSD
City/Village	COLUMBUS CITY
Township	
Appraisal Neighborhood	X0400
Tax Lien	No
CAUV Property	No
Owner Occ. Credit	2015: No 2016: No
Homestead Credit	2015: No 2016: No
Board of Revision	No
Zip Code	43026

2015 Current Market Value

	Land	Improvements	Total

Base	34,700	0	34,700
TIF			
Exempt			
Total	34,700	0	34,700
CAUV	0		

2015 Taxable Value

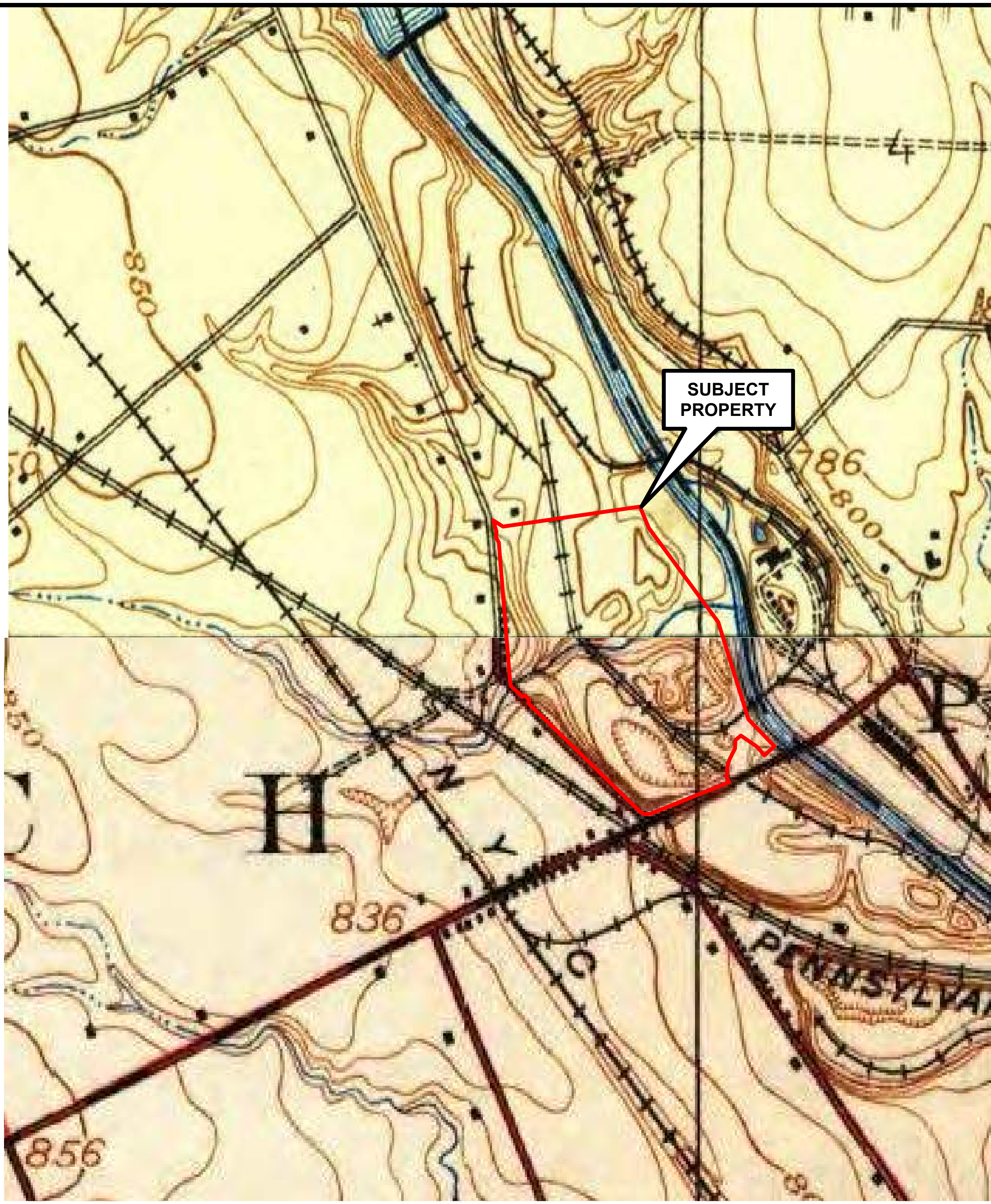
	Land	Improvements	Total
Base	12,150	0	12,150
TIF			
Exempt			
Total	12,150	0	12,150

2015 Taxes

Net Annual Tax	Taxes Paid	CDQ
1,113.80	1,143.65	2015

Site Data

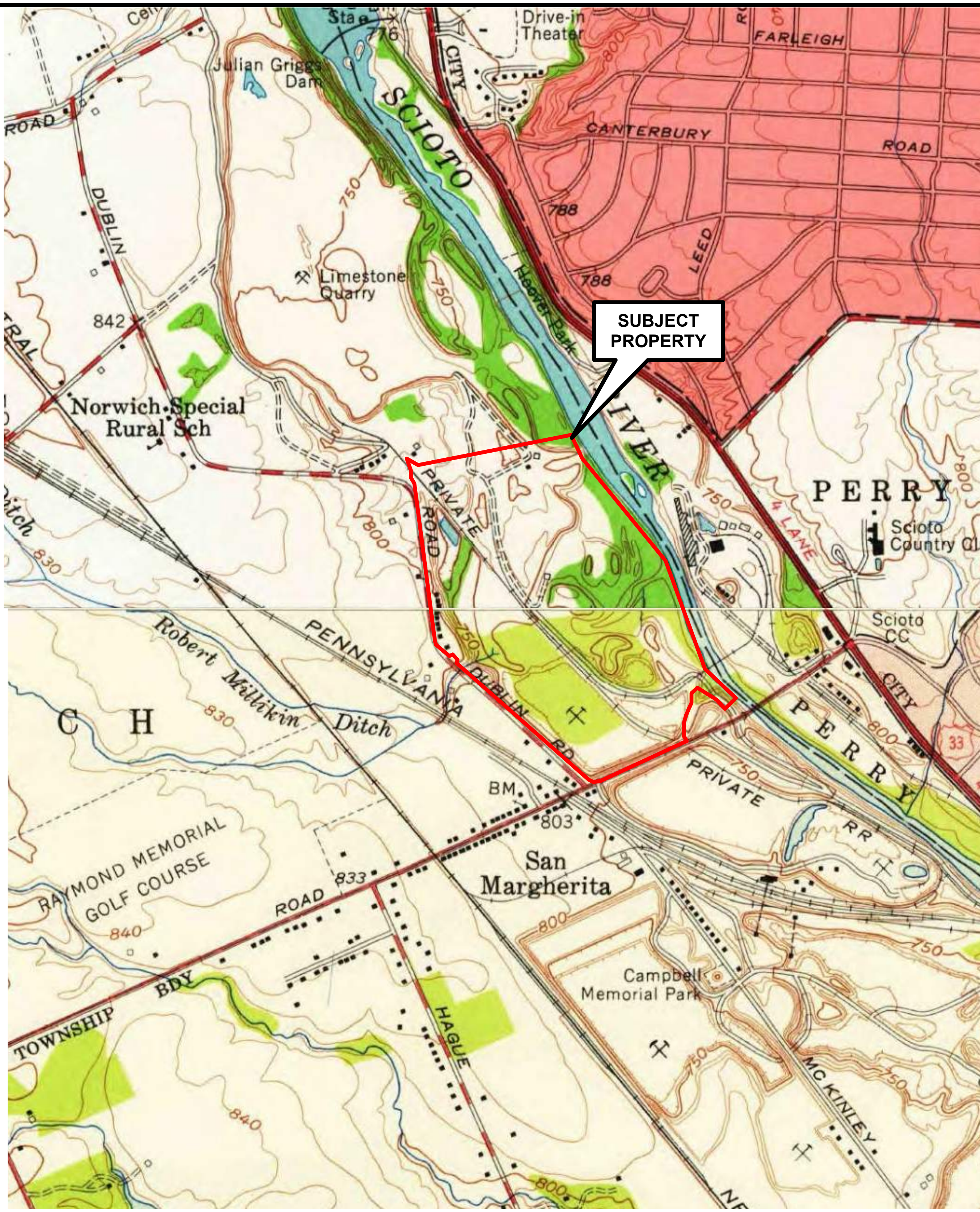
Frontage	Depth	Acres	Historic District
		4.62	



North

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

1955 USGS TOPOGRAPHIC MAP **GCI PROJECT #16-E-19414-A**



North

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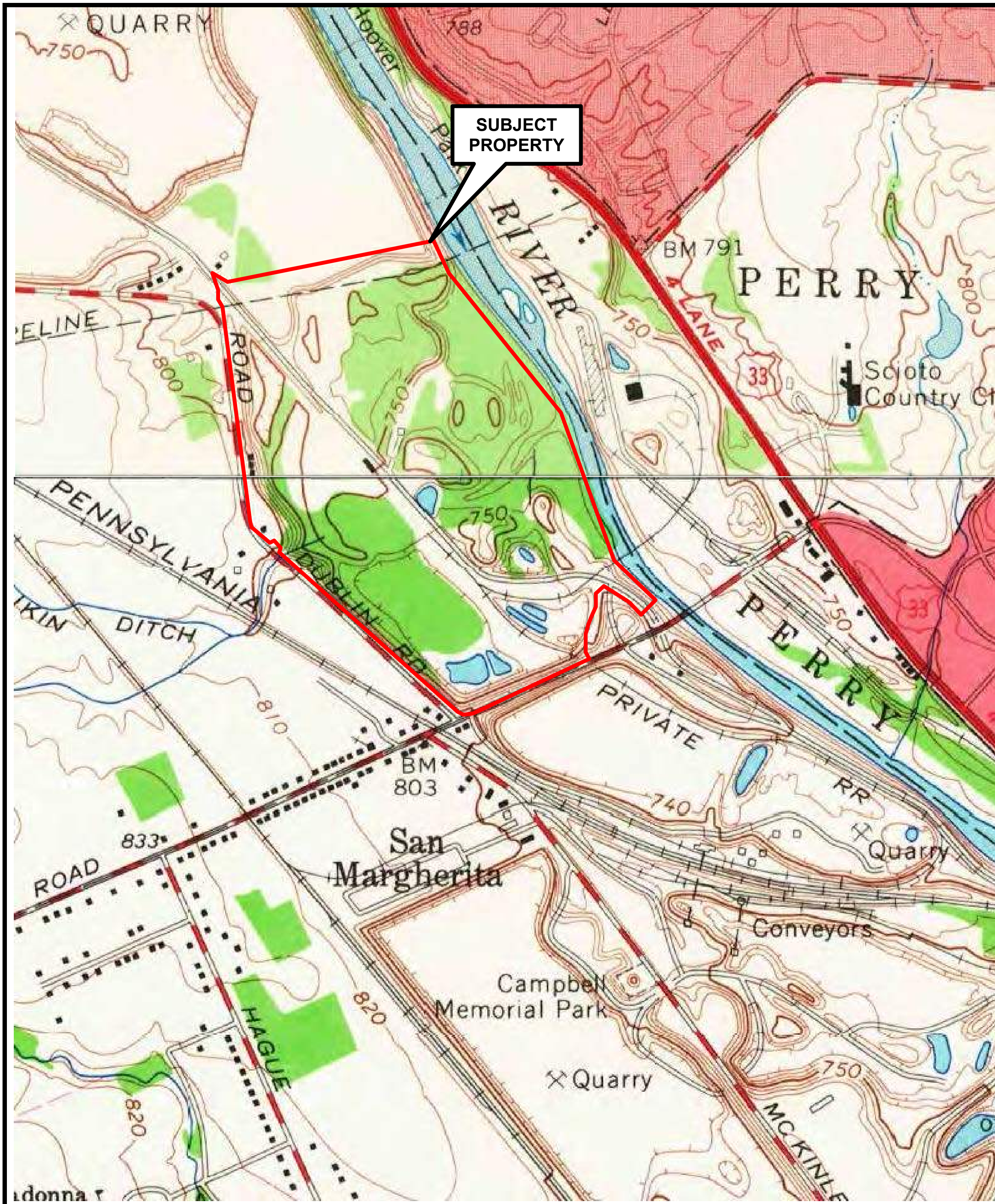
1965 USGS TOPOGRAPHIC MAP **GCI PROJECT #16-E-19414-A**



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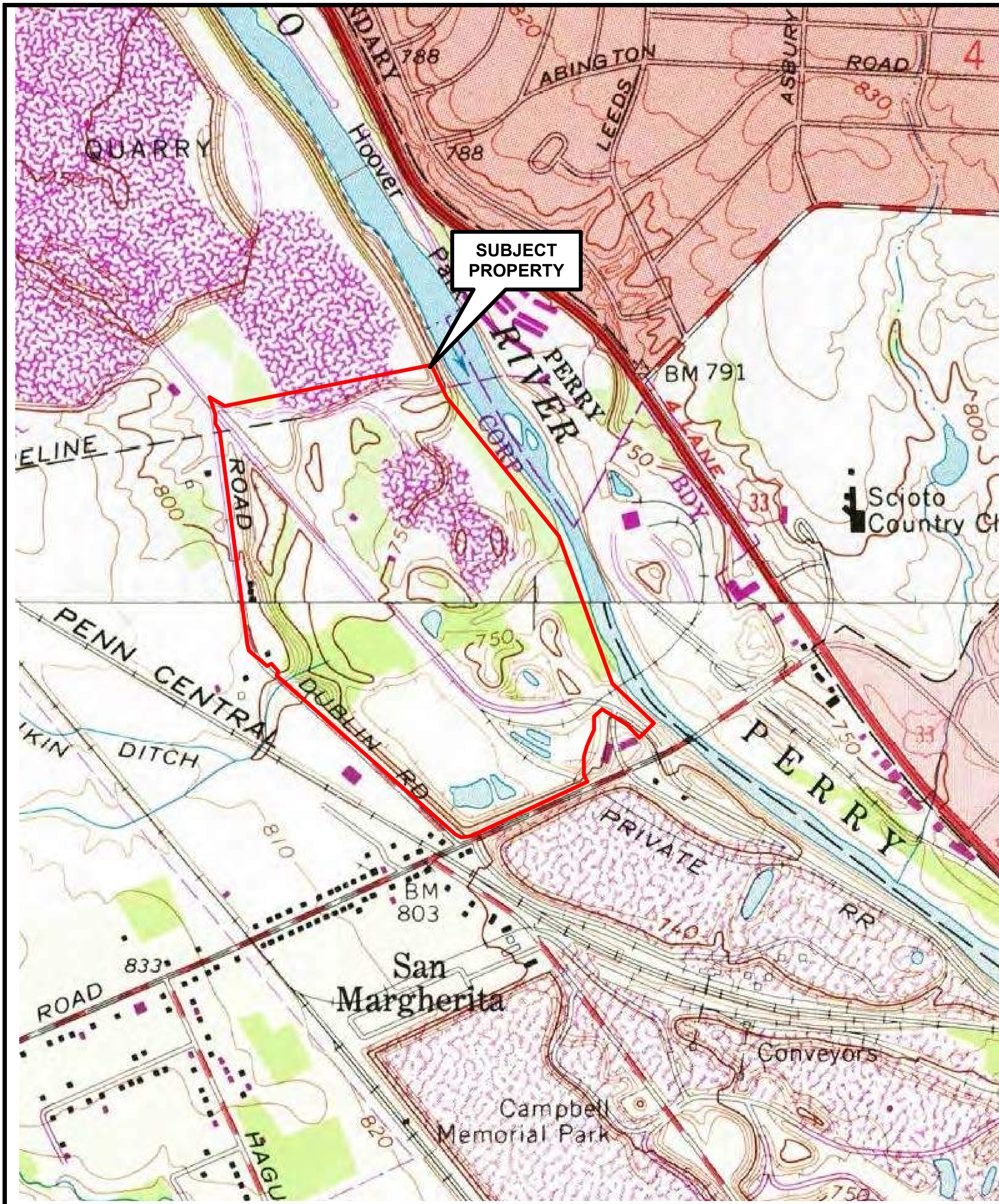
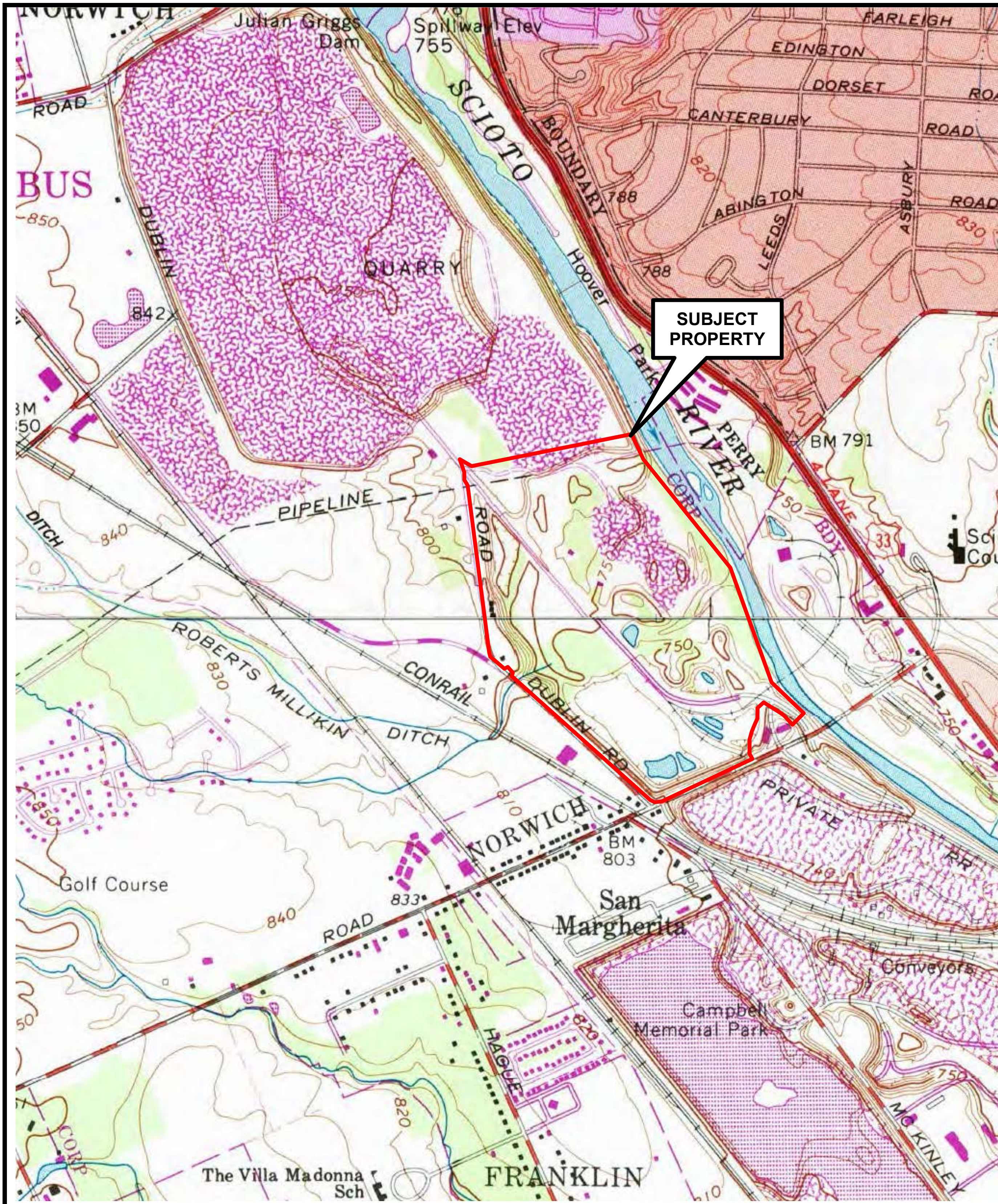


North

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

1982/84 USGS TOPOGRAPHIC MAP

GCI PROJECT #16-E-19414-A

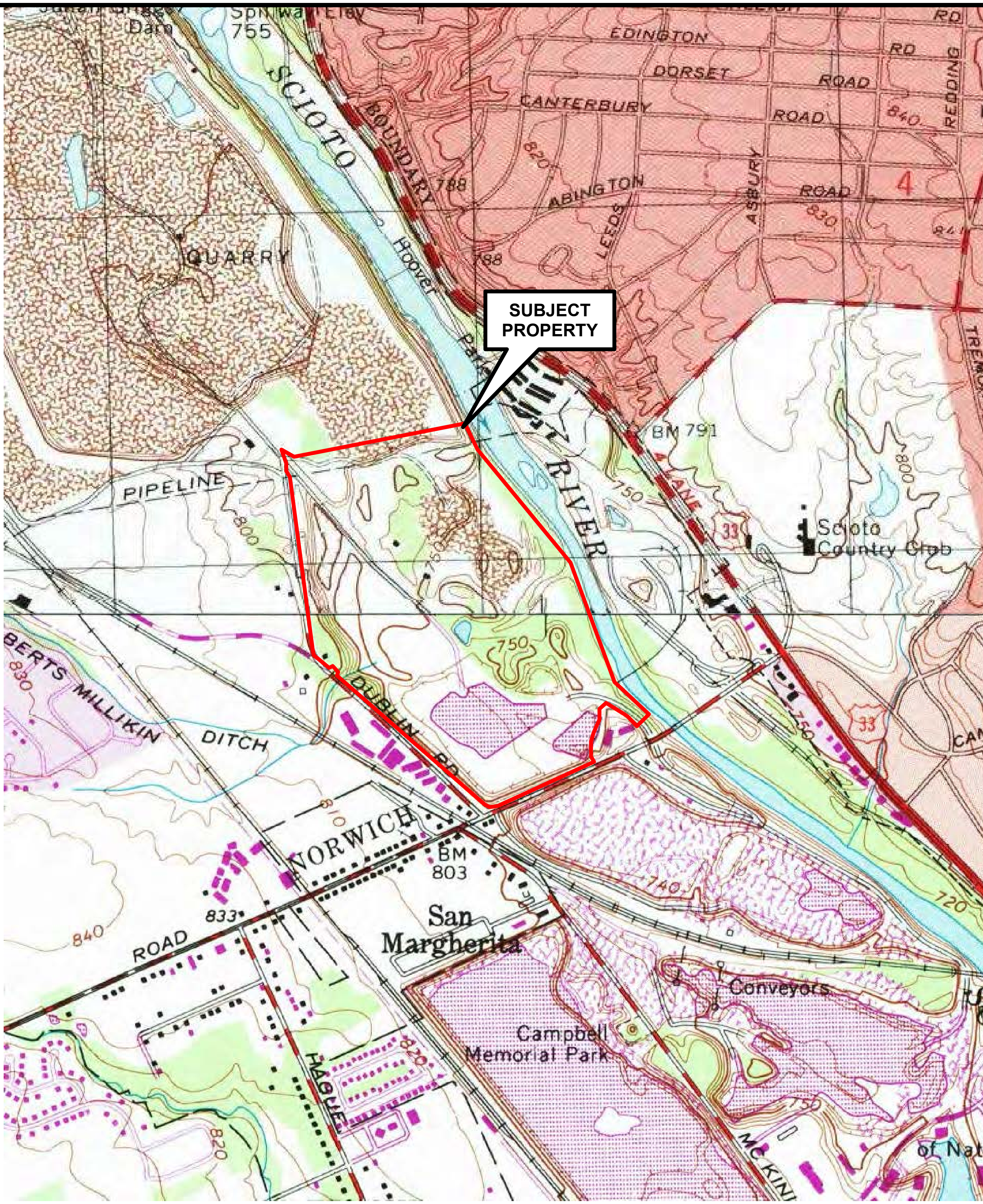


North

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

1995 USGS TOPOGRAPHIC MAP

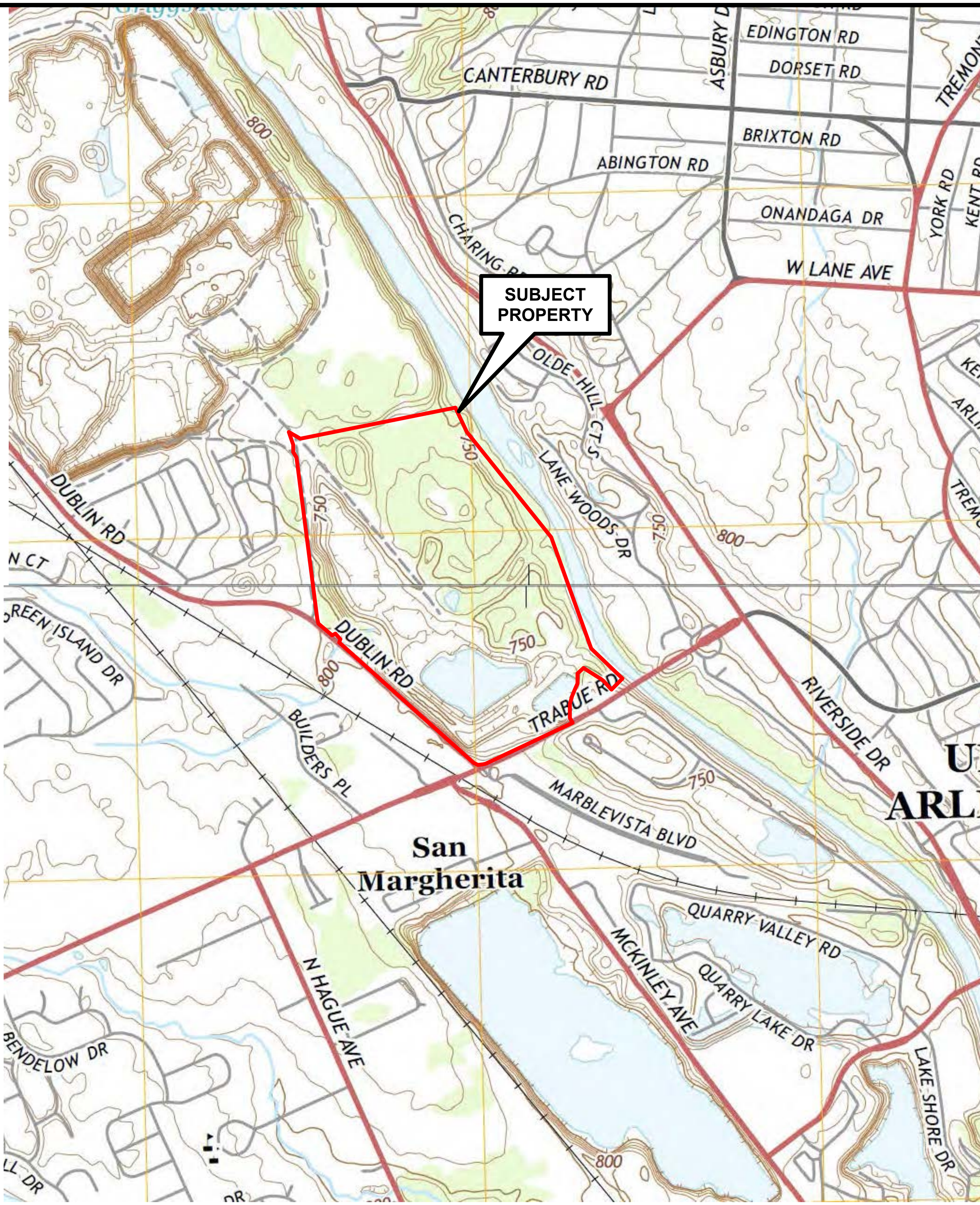
GCI PROJECT #16-E-19414-A



North

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

2013 USGS TOPOGRAPHIC MAP **GCI PROJECT #16-E-19414-A**



North

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North

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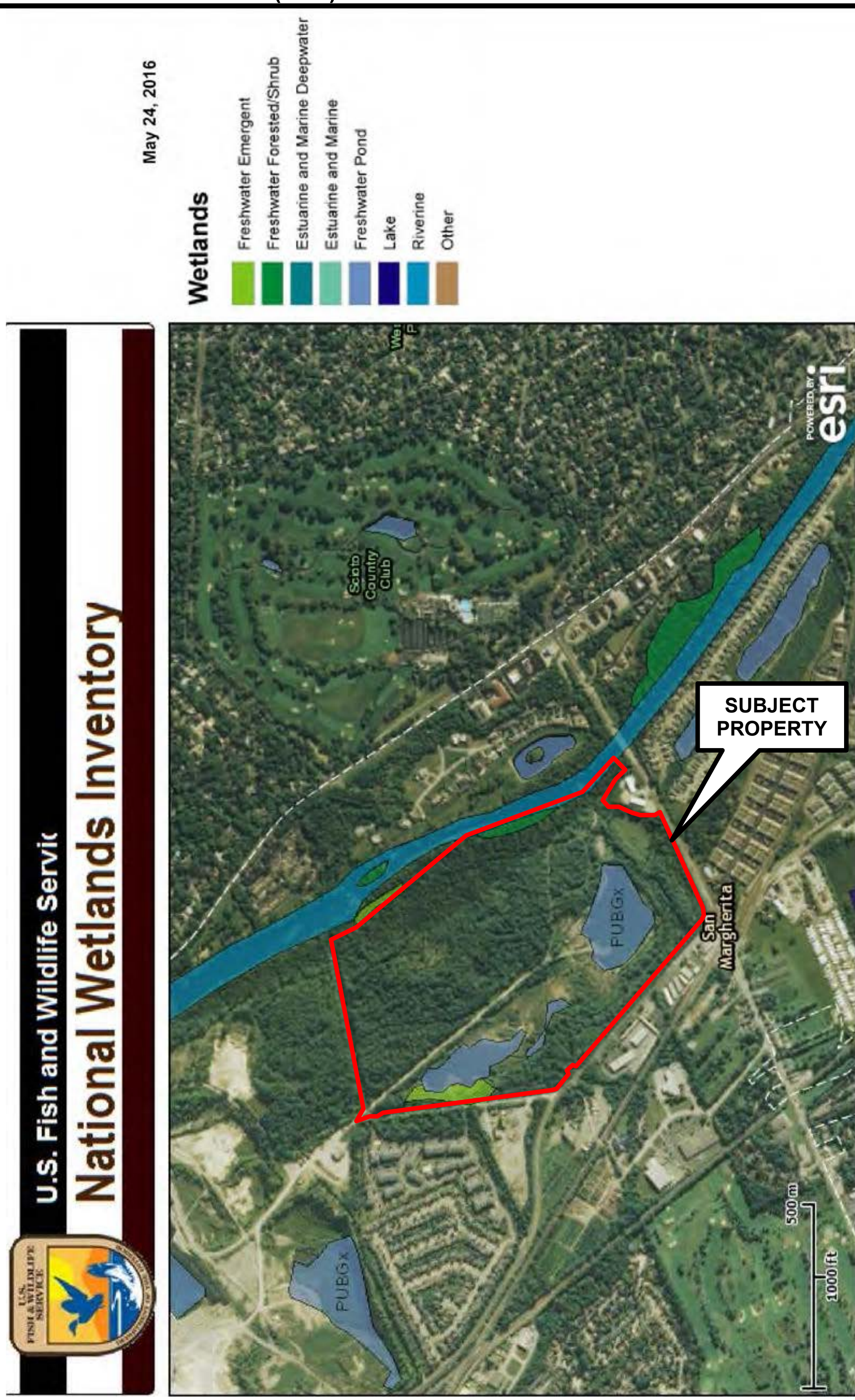
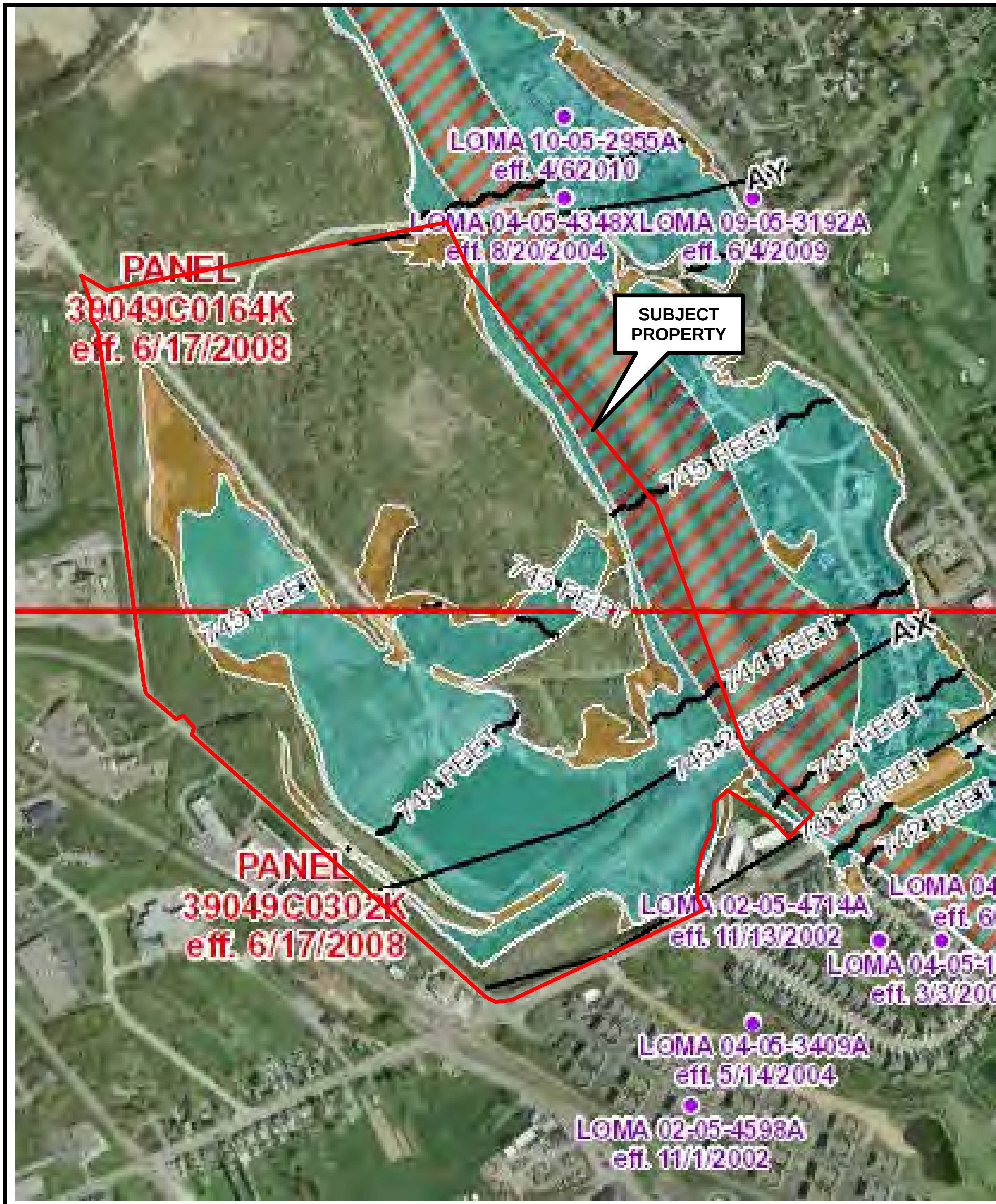
COLUMBUS, FRANKLIN COUNTY, OHIO



MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

FEMA FLOOD INSURANCE RATE MAP

GCI PROJECT #16-E-19414-A



North

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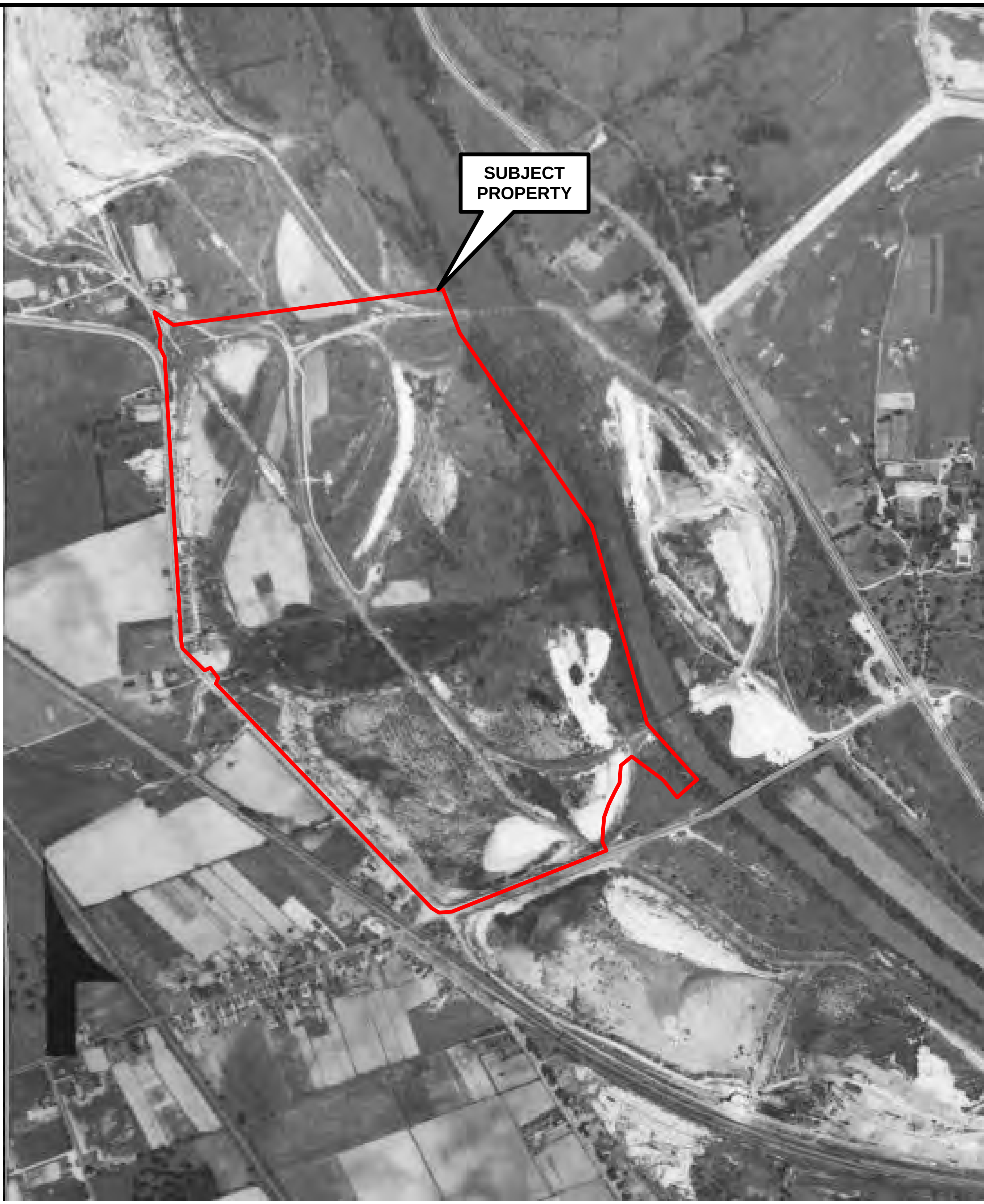

North

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

1957 AERIAL PHOTOGRAPH

GCI PROJECT #16-E-19414-A

North

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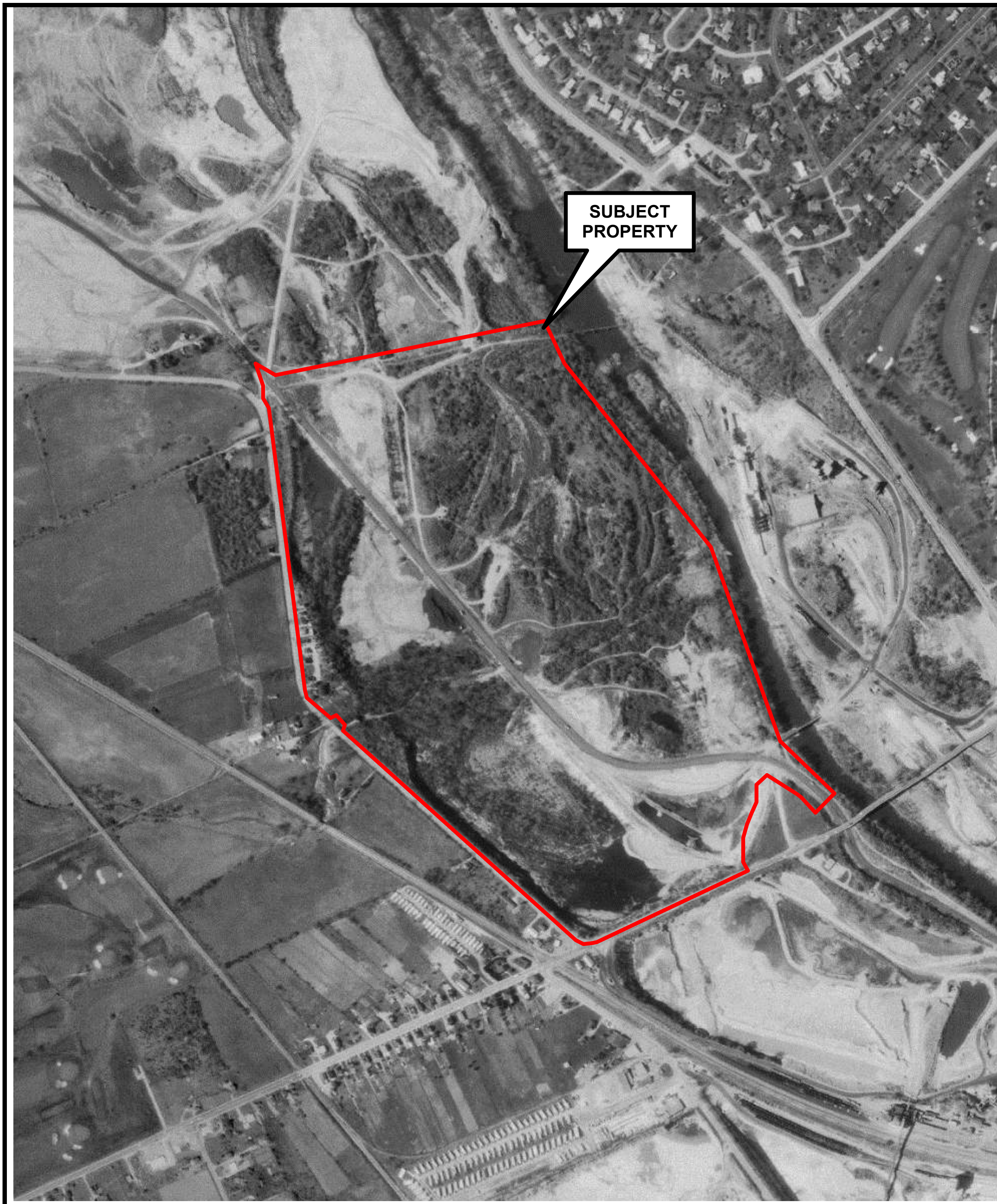

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1971 AERIAL PHOTOGRAPH **GCI PROJECT #16-E-19414-A**

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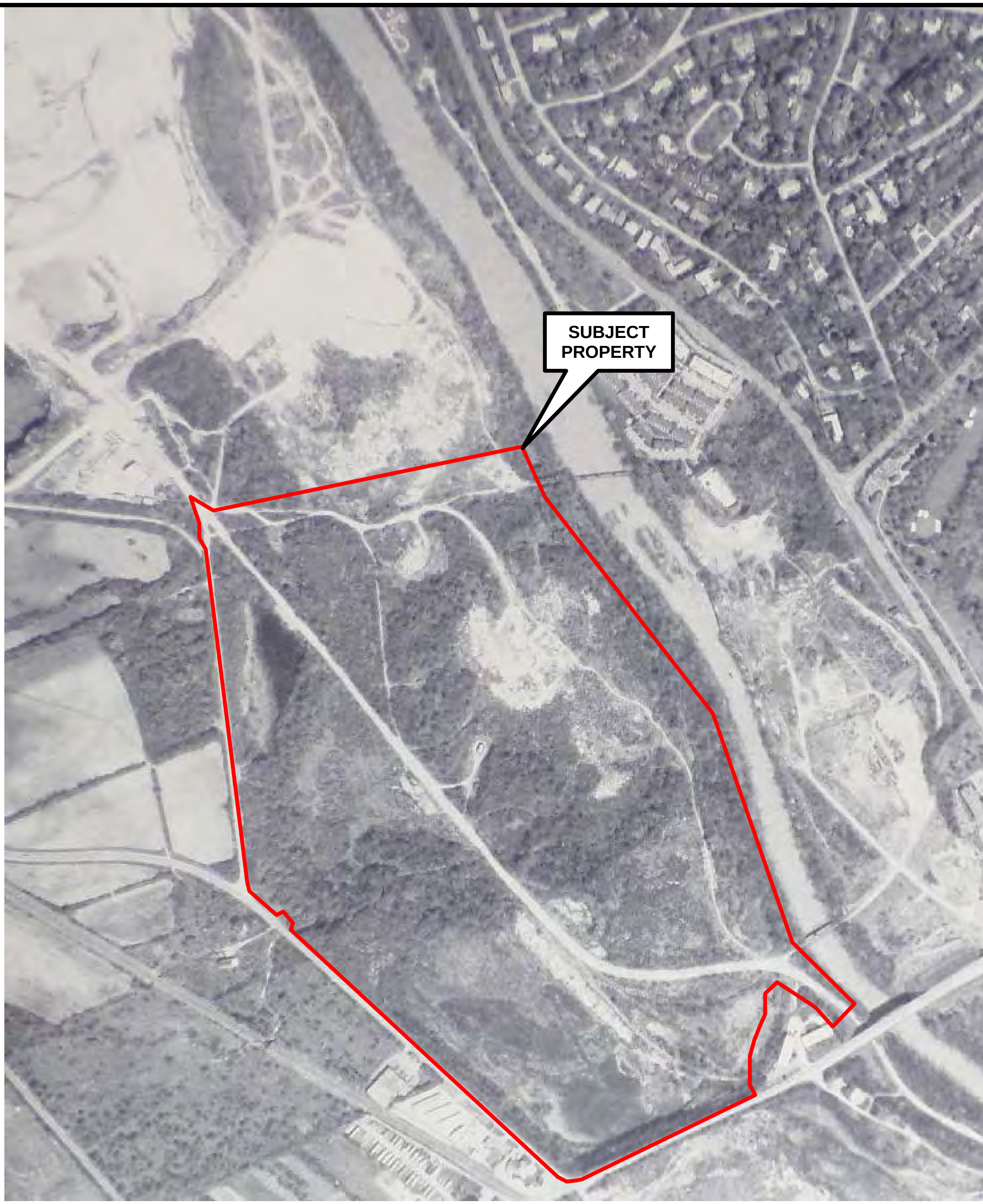

North

MARBLE CLIFF QUARRY PROPERTY
DUBLIN ROAD
COLUMBUS, FRANKLIN COUNTY, OHIO

1989 AERIAL PHOTOGRAPH

GCI PROJECT #16-E-19414-A

North

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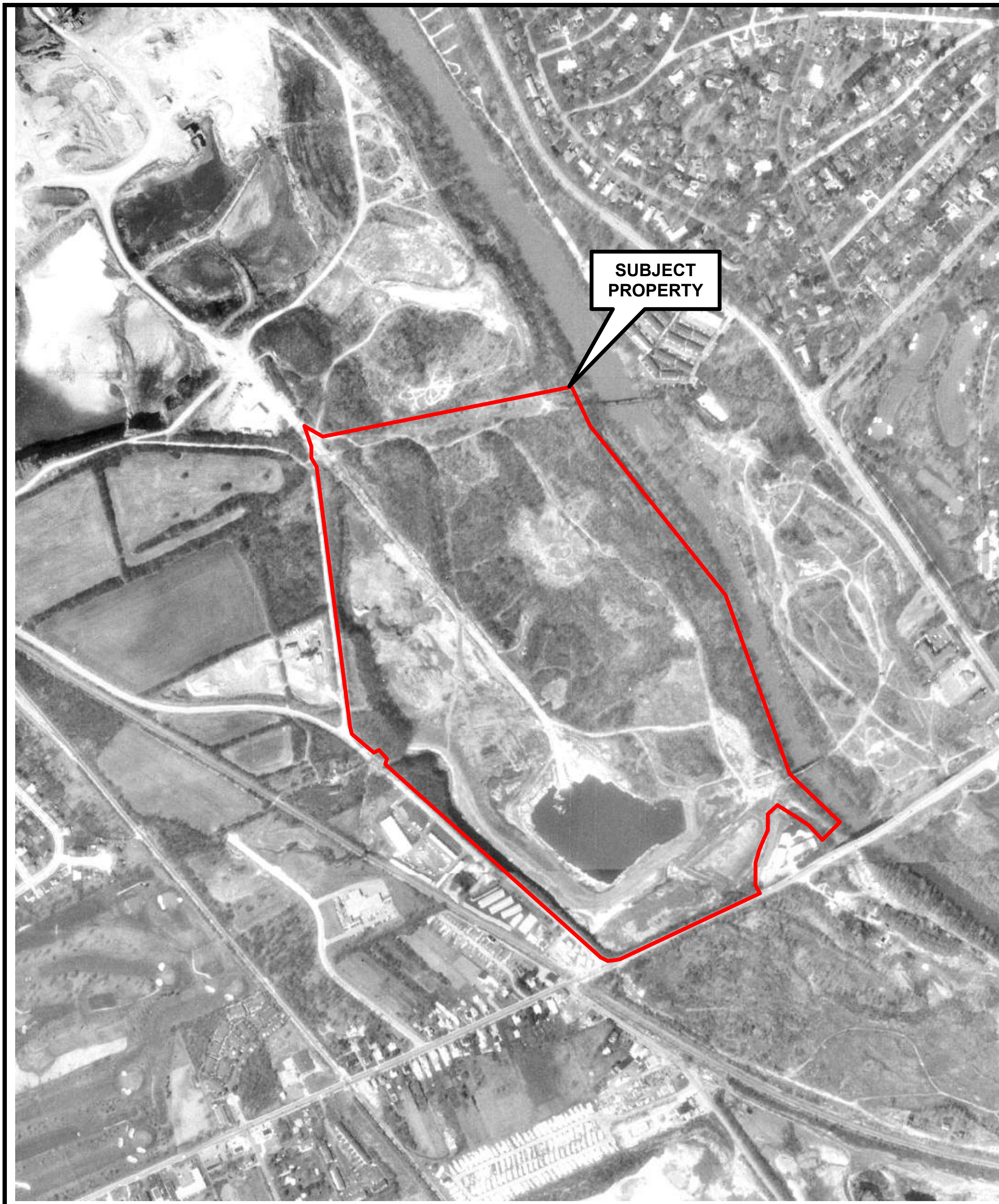

North

MARBLE CLIFF QUARRY PROPERTY
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North

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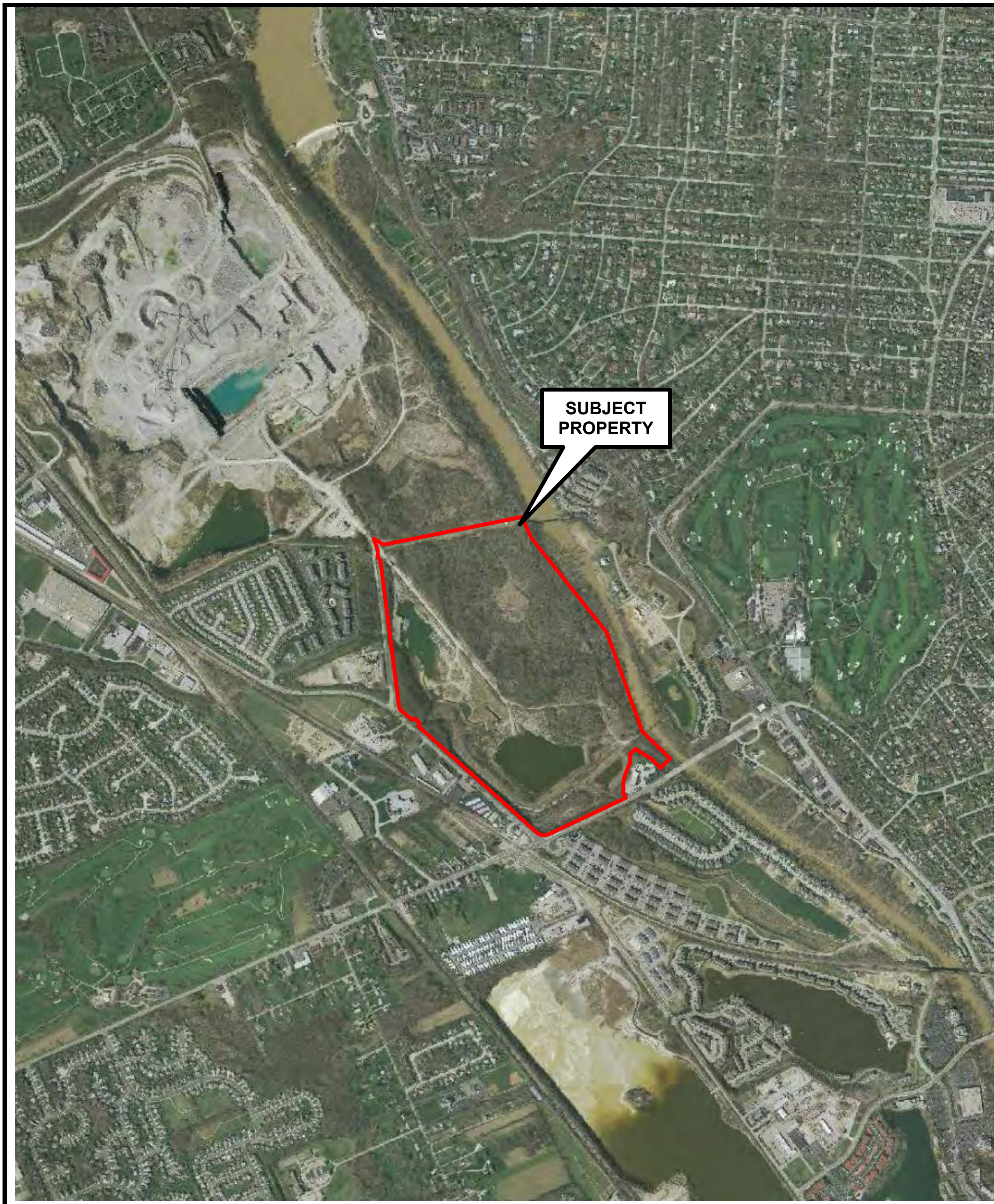

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2009 AERIAL PHOTOGRAPH

GCI PROJECT #16-E-19414-A

North

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2013 AERIAL PHOTOGRAPH **GCI PROJECT #16-E-19414-A**

North

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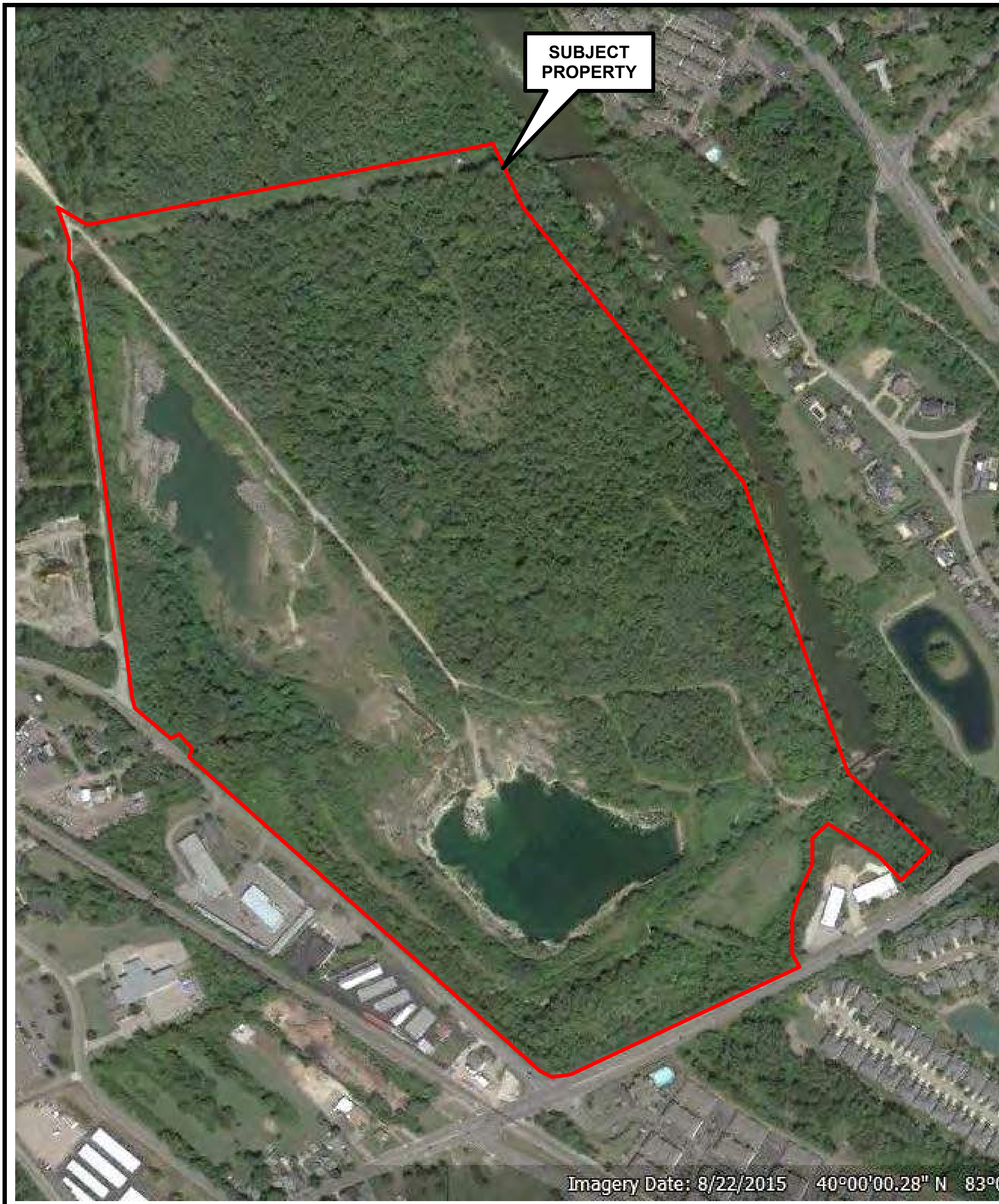

North

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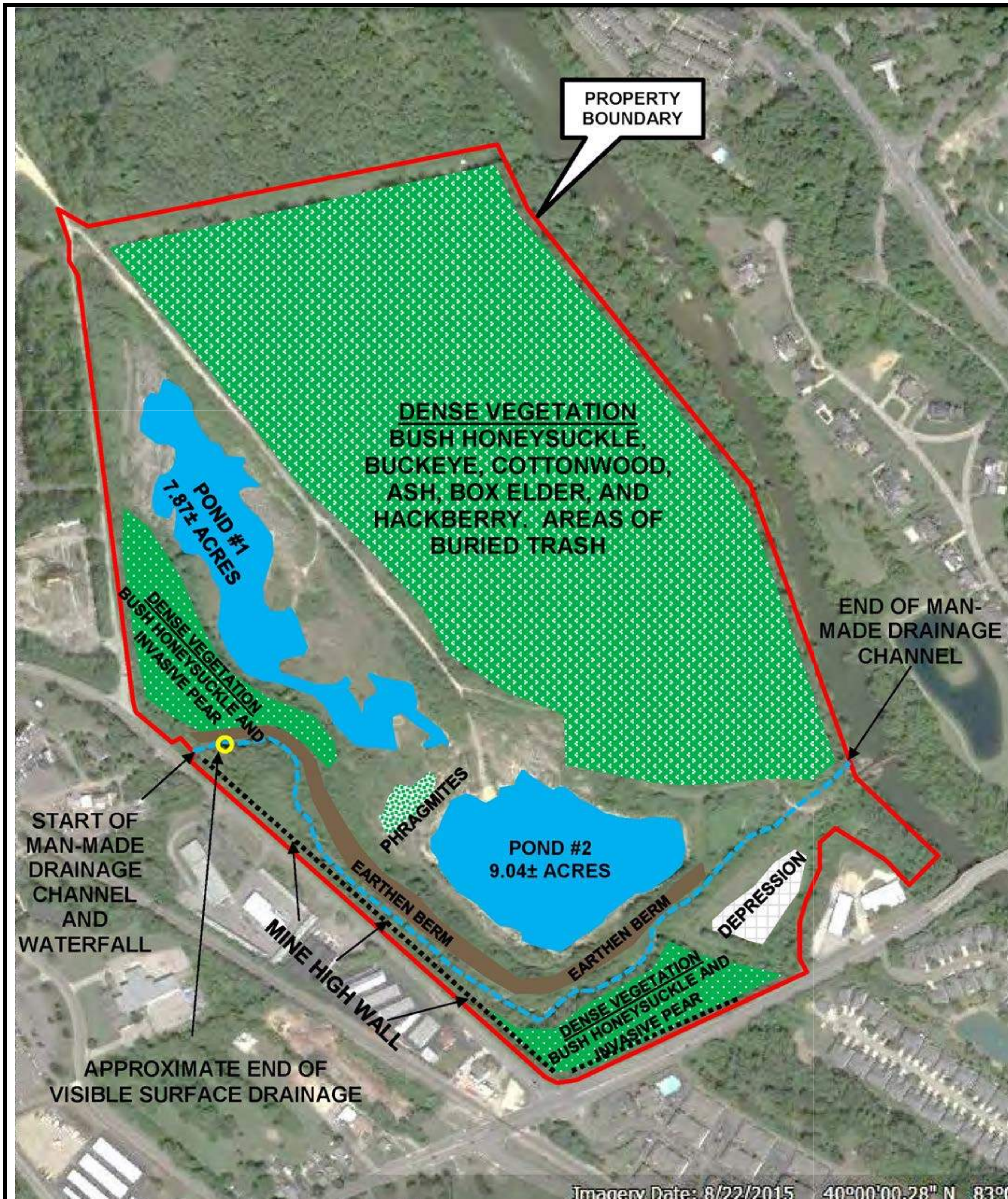

North

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PHOTO KEY

GCI PROJECT #16-E-19414-A

North

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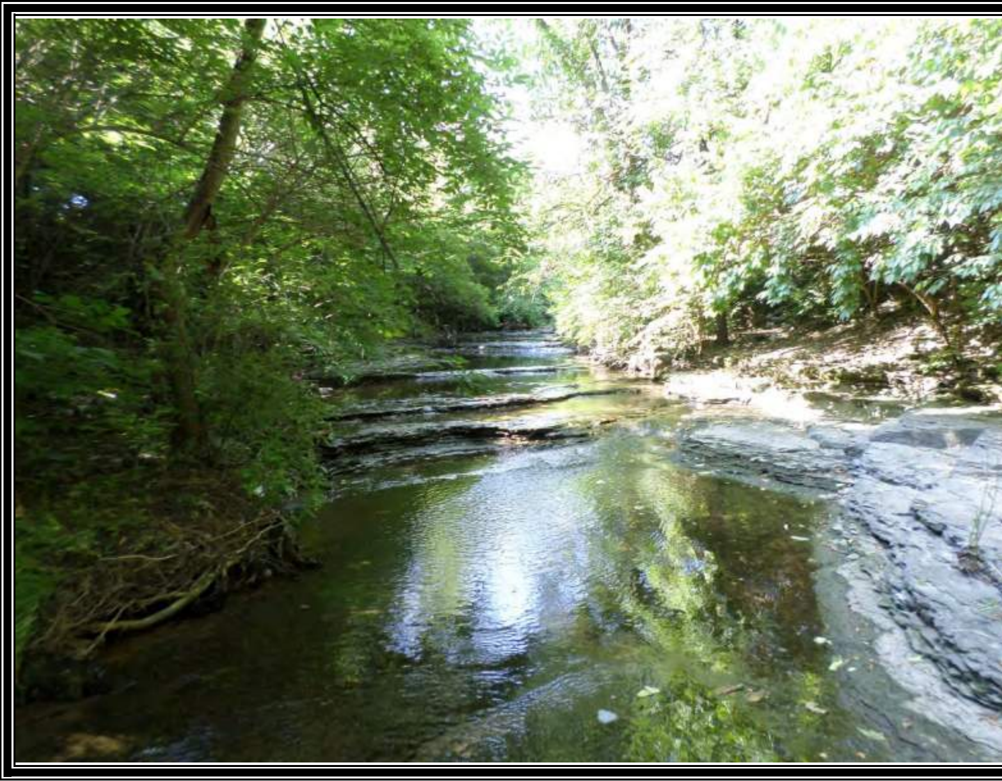


Photo 1 (6/14/16): View of Roberts Millikin Ditch, as seen from the west side of Dublin Road (off property). This ditch appears to have perennial flow in this location, even during sparse and infrequent rainfall events.

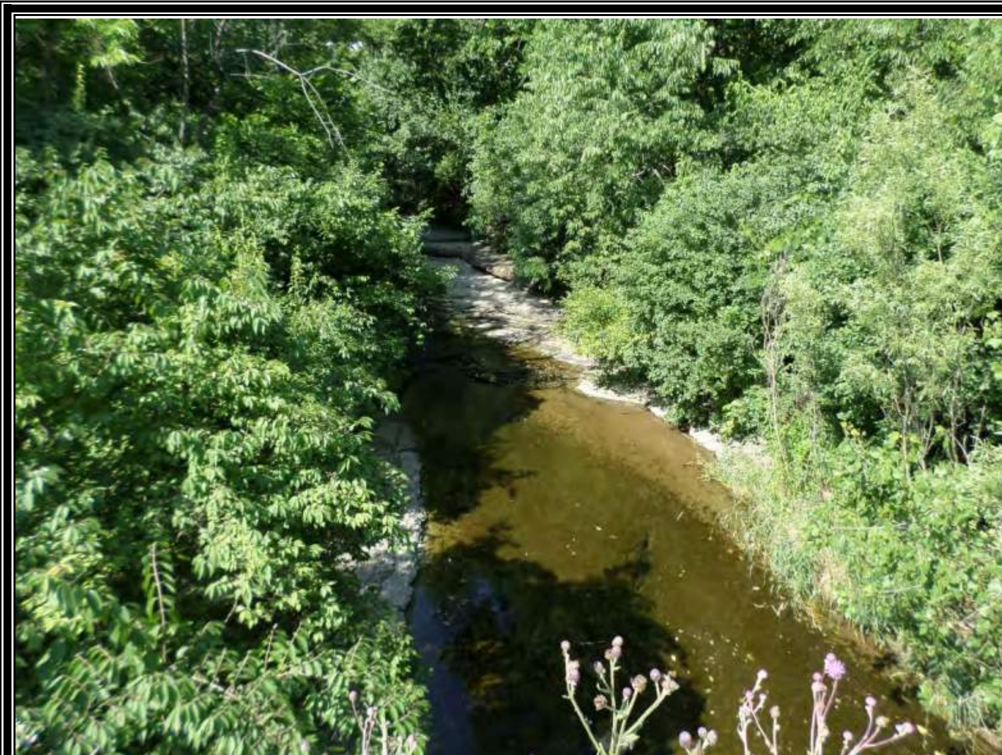


Photo 2 (6/14/16): View of Roberts Millikin Ditch, as seen from Dublin Road (off property).

Photo 3 (6/14/16): Westerly view across Dublin Road. Roberts Millikin Ditch enters the site from beneath Dublin Road.

Photo 4 (6/14/16): Easterly view along Roberts Millikin Ditch and the culvert beneath Dublin Road. This photo is from off-site, west of Dublin Road.

Photo 5 (6/14/16): Easterly view towards the site from the culvert beneath Dublin Road.

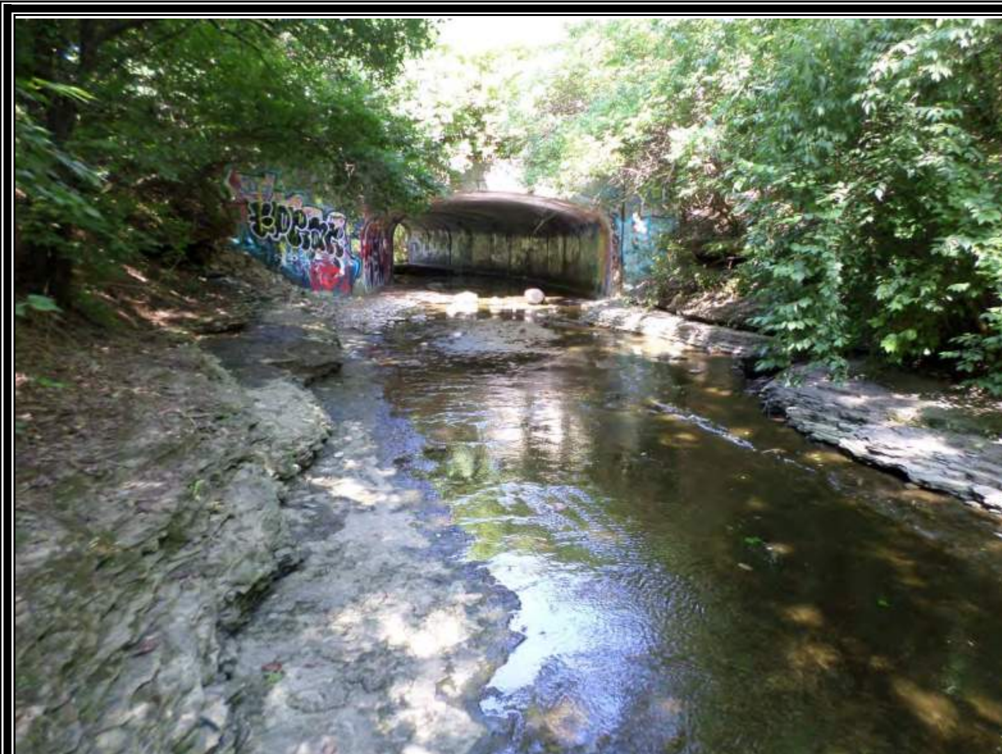


Photo 6 (6/14/16): Westerly (upstream) view of Roberts Millikin Ditch as it enters the site. Flow is over exposed limestone bedrock.

Photo 7 (6/14/16): Easterly view along Roberts Millikin Ditch as the flow approaches the quarried rock face, creating a waterfall.

Photo 8 (6/14/16): View of the flow of water just before the quarried rock face.

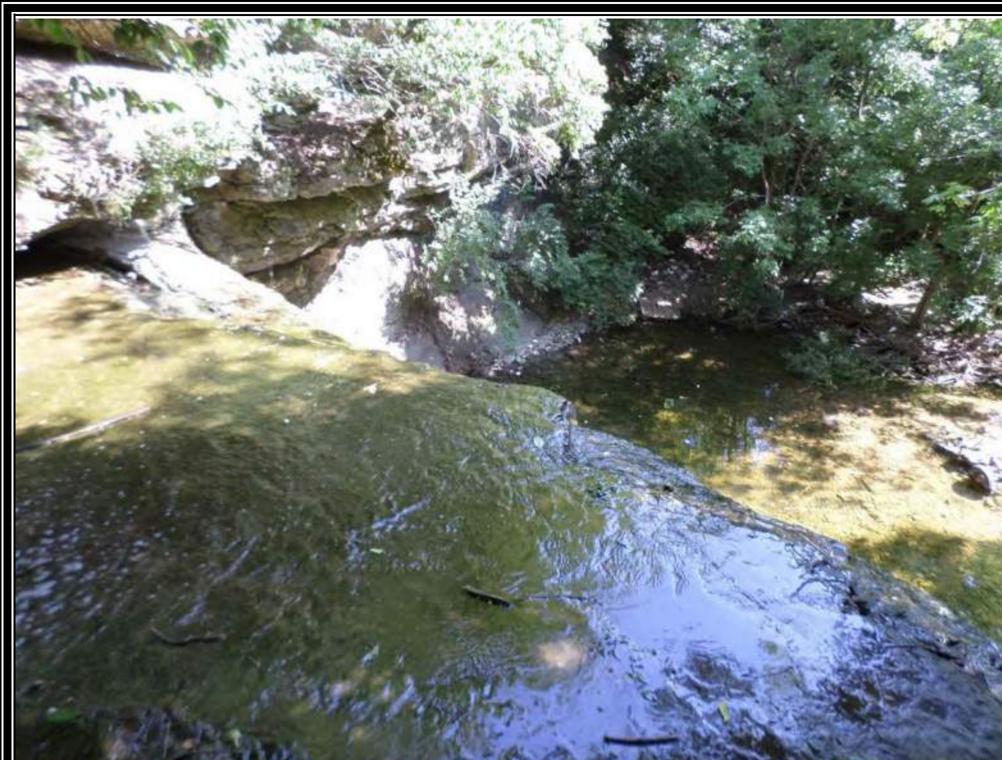


Photo 9 (6/14/16): View of the flow of water as it reaches the precipice.

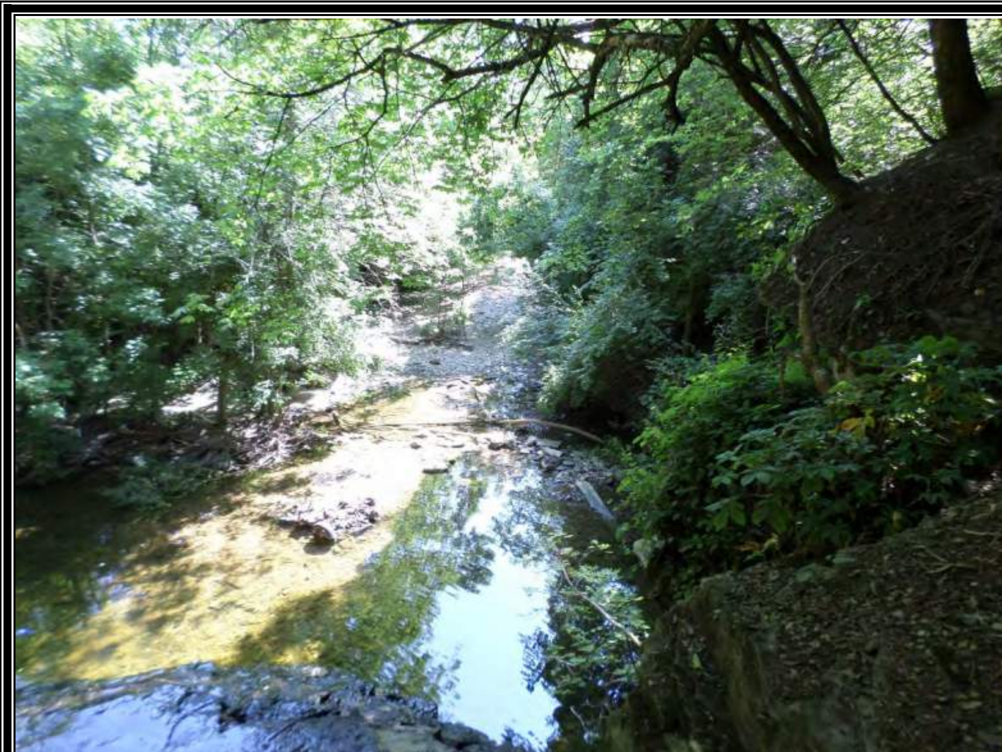


Photo 10 (6/14/16): Easterly view from the precipice at the pool beneath.

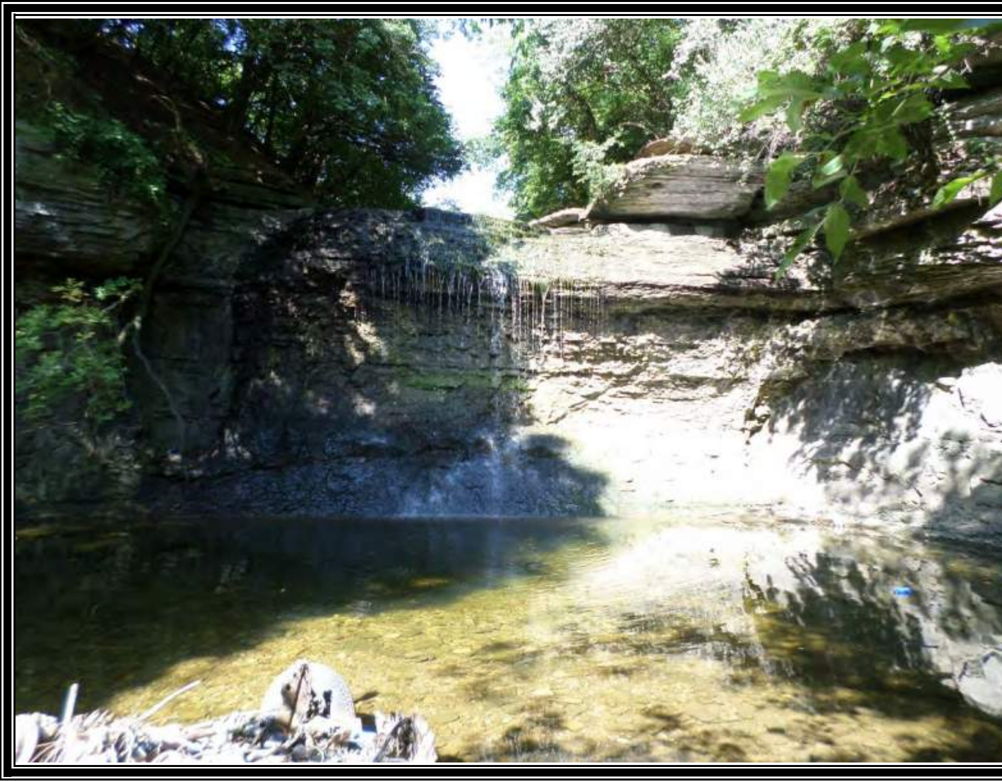


Photo 11 (6/14/16): Westerly view at the waterfall created by the drainage from the west falling over a quarried rock face. Note the change in elevation of approximately 20 feet.

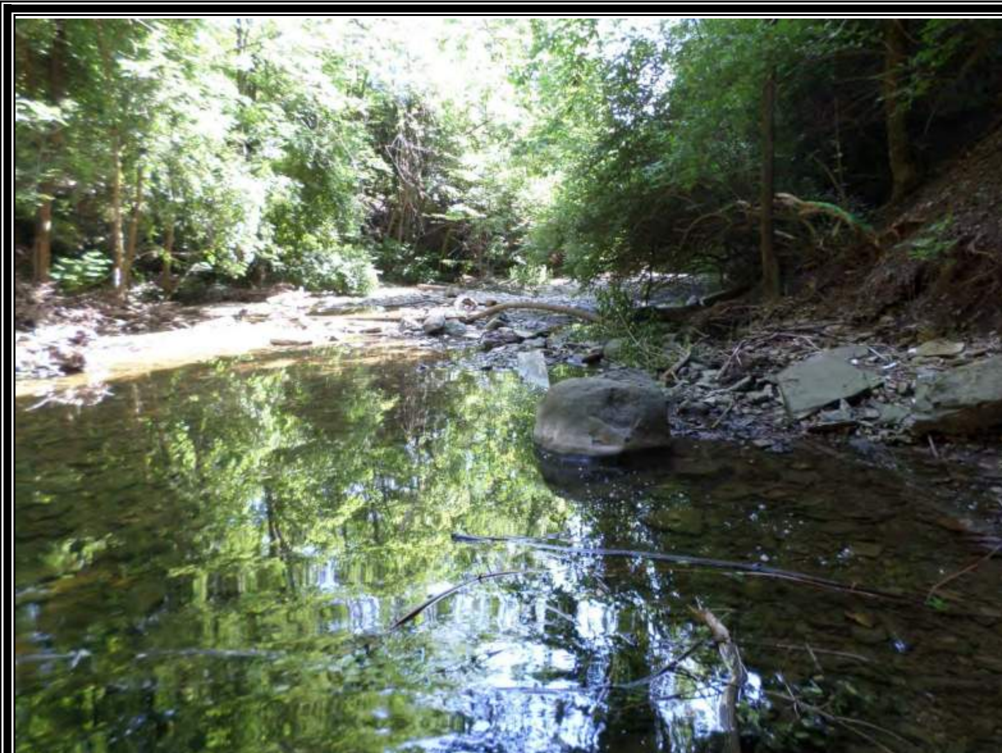


Photo 12 (6/14/16): Easterly view along the drainage exiting the plunge pool beneath the waterfall.

Photo 13 (6/14/16): Westerly view towards the waterfall at the man-made drainage channel directing water away from the plunge pool. The channel is widest at this location.

Photo 14 (6/14/16): View of surface water drainage just east of the plunge pool. The drainage is limited to a 2-3 feet wide area at this point.

Photo 15 (6/14/16): Visible surface flow from the area seen in photo 14. Note the unconsolidated material comprising the bed of the man-made channel.

Photo 16 (6/14/16): Westerly view toward the waterfall. This photo was taken approximately 175 feet from the falls. The notebook has been placed for reference. Note the high wall on the left side of the photo.

Photo 17 (6/14/16): Northerly view from the location as photo 16.

Photo 18 (6/14/16): Southwesterly view from the location as photo 16. Note visible flow.

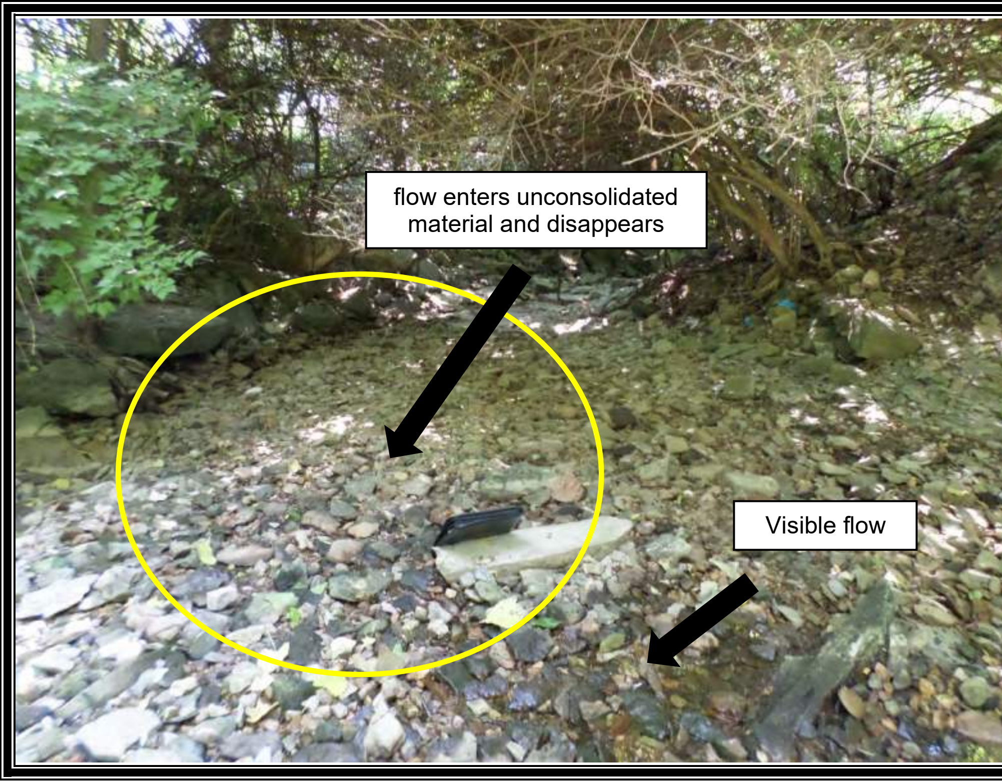


Photo 19 (6/14/16): Southeasterly view from the same general location as photo 16-18. Note visible flow in the bottom right of the picture. The flow enters unconsolidated material and disappears approximately 175 feet from the waterfall.

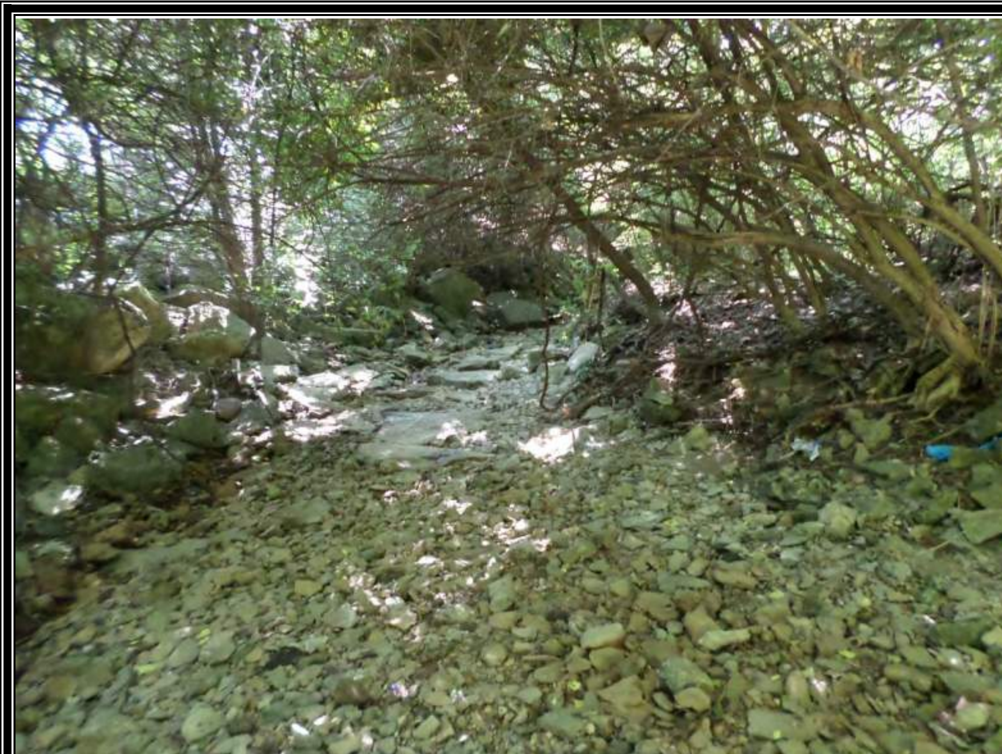


Photo 20 (6/14/16): Southeasterly view of the man-made drainage channel further down-gradinet from the location of photos 16 through 19. Although perennial flow enters the property, this drainage channel does not carry surface water flow throughout. Flow enters unconsolidated material and becomes ground water.

Photo 21 (4/20/16): View of the man-made channel on the west central portion of the property. This channel is located between a mine high wall and a steep berm.

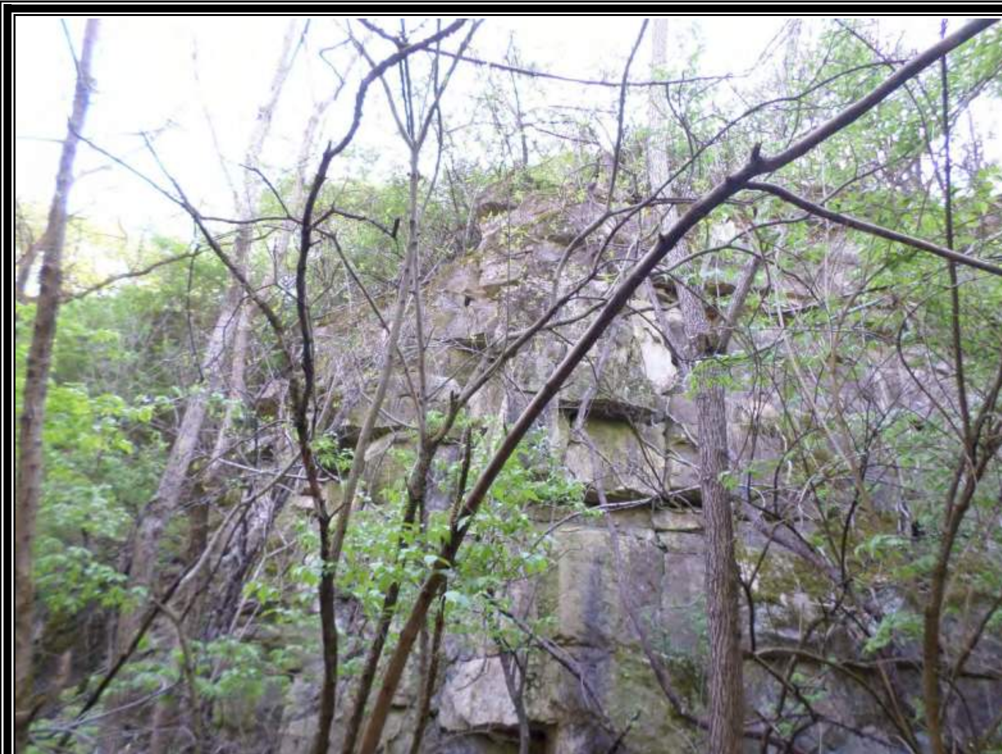


Photo 22 (4/20/16): Typical view of the mine high wall along the west side of the man-made drainage channel as it crosses the southwest portion of the property.

Photo 23 (4/20/16): Typical view of the steep sidewalls of the berm along the eastern side of the man-made drainage channel.

Photo 24 (4/20/16): Northwesterly view of the drainage channel on the southwest portion of the property.

Photo 25 (4/20/16): Southeasterly view of the drainage channel on the southwest portion of the property.

Photo 26 (4/20/16): Northeasterly view along the drainage channel as it traverses the southern portion of the property.

Photo 27 (4/20/16): Southwesterly view of the drainage channel on the south central portion of the property.

Photo 28 (4/20/16): View of the berm along the north side of the drainage channel on the south central portion of the property.

Photo 29 (4/20/16): View of drift deposits visible along the edge of the channel on the south central portion of the property. The drift deposits indicate the channel does accept heavy, fast flow of short duration during significant rain events.

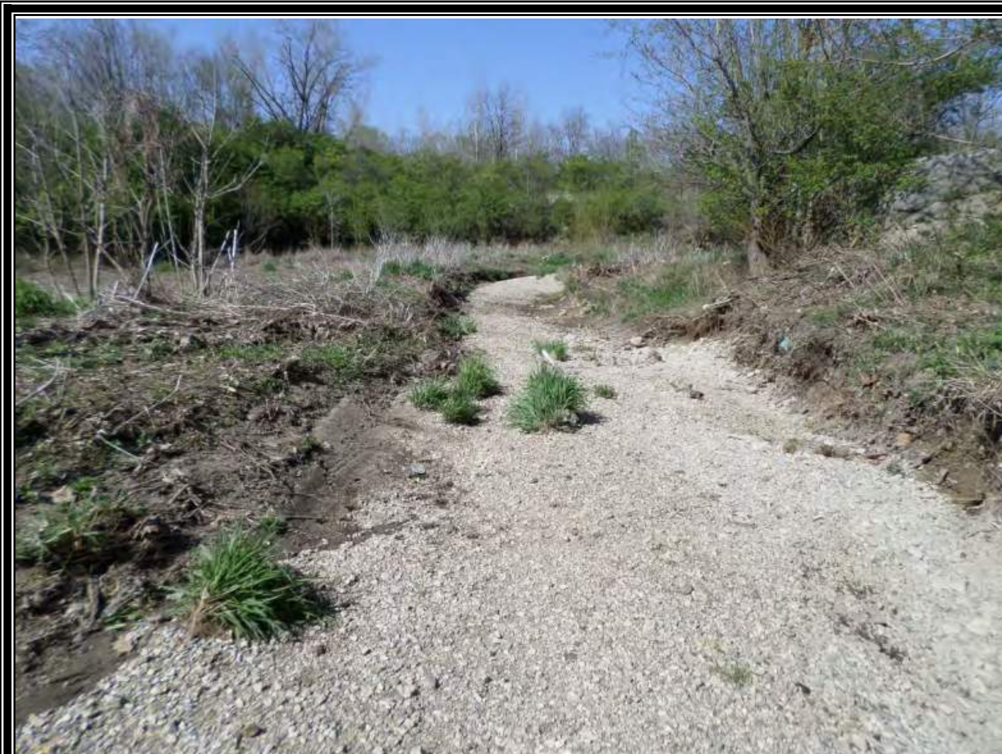


Photo 30 (4/20/16): Northeasterly view of the drainage channel on the southeast portion of the property.

Photo 31 (4/20/16): Southwesterly view of the drainage channel on the southeast portion of the property.

Photo 32 (4/20/16): Southwesterly view of the drainage channel on the southeast portion of the property.

Photo 33 (4/20/16): View from a bridge over the Scioto River at the termination of the man-made drainage ditch.

Photo 34 (4/20/16): Northerly view along the Scioto River bordering the east side of the property.

Photo 35 (4/15/16): Southeasterly view across a depression on the southern portion of the property.

Photo 36 (4/15/16): Typical view of exposed ground surfaces in the depression on the southern portion of the property, and throughout much of the quarry.

Photo 37 (4/15/16): Southeasterly view across the quarry pond on the southeastern portion of the property (Pond #2)

Photo 38 (4/20/16): Northwesterly view across the quarry pond on the southeastern portion of the property (Pond #2)

Photo 39 (4/20/16): Northerly view across the quarry pond on the southeastern portion of the property (Pond #2)

Photo 40 (4/20/16): Northeasterly view along the southern edge of the quarry pond on the southeastern portion of the property (Pond #2)

Photo 41 (4/15/16): Typical view of vegetation and surface cover in the areas north of Pond #2.

Photo 42 (4/15/16): View of common reed (Phragmites australis) growing is shallow water waste areas north of Pond #2. These areas had a rock and gravel substrate with a very thin layer of silt or sand. These areas did not contain hydric soil conditions.

Photo 43 (4/15/16): Northwesterly view across shallow water areas on the west central portion of the property. These shallow water areas were considered the southwestern portion of Pond #1.

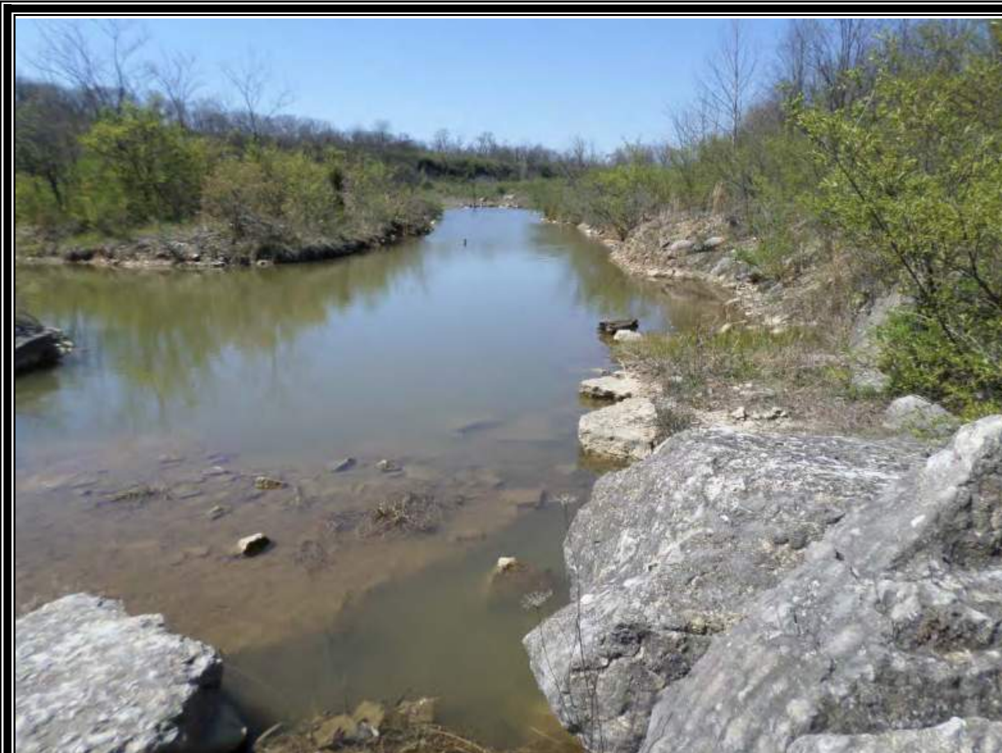


Photo 44 (4/15/16): Northerly view across shallow water areas of Pond #1.

Photo 45 (6/14/16): Northwesterly view across shallow water areas of Pond #1.

Photo 46 (6/14/16): Easterly view across shallow water areas of Pond #1.

Photo 47 (6/14/16): View of a channel cut southwest of the quarried portion of Pond #1.

Photo 48 (6/14/16): View of a channel cut southwest of the quarried portion of Pond #1.

Photo 49 (6/14/16): Northerly view across the deep water portion of Pond #1.

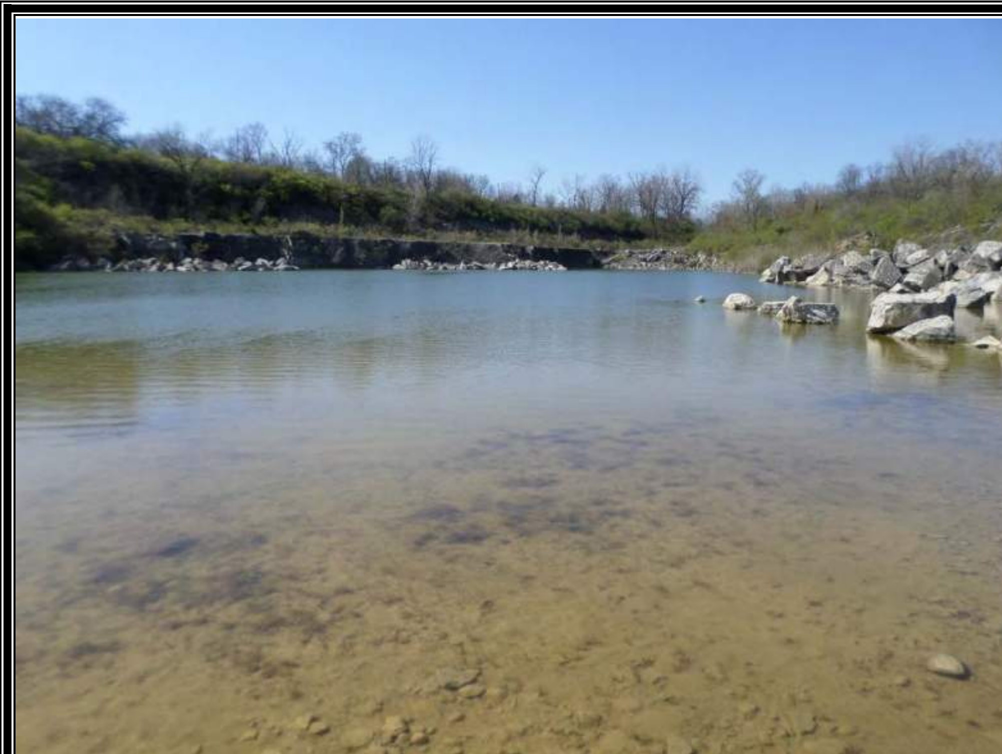


Photo 50 (4/15/16): Northwesterly view across the deep water portion of Pond #1.

Photo 51 (4/15/16): Typical view of the wooded areas comprising the eastern half of the property.

Photo 52 (4/15/16): Another view of the wooded areas comprising the eastern half of the property.

Photo 53 (4/15/16): Typical substrate observed in the wooded areas comprising the eastern half of the property.

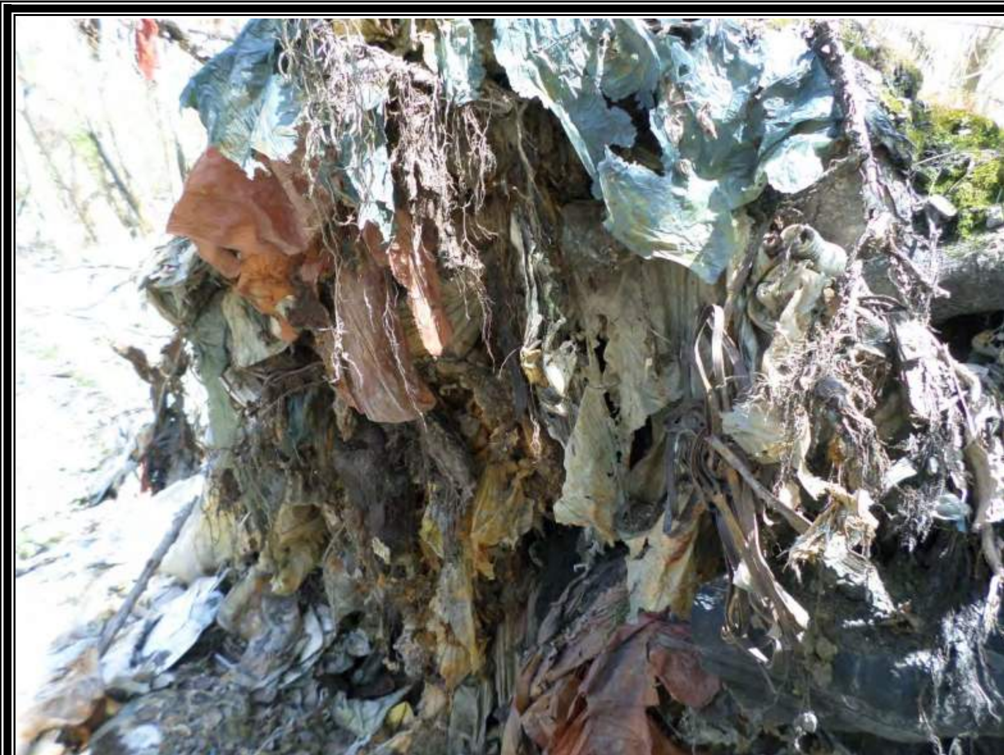


Photo 54 (4/15/16): Evidence of buried trash in the wooded areas comprising the eastern half of the property. Eastern portions of the property were previously used as a landfill.

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD):

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State:Ohio County/parish/borough: Franklin City: Columbus
Center coordinates of site (lat/long in degree decimal format): Lat. 40.000732° **N**, Long. -83.085820° **W**.
Universal Transverse Mercator:
Name of nearest waterbody: Roberts Millikin Ditch
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Scioto River
Name of watershed or Hydrologic Unit Code (HUC): 050600011205

☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date:
☐ Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "***navigable waters of the U.S.***" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [***Required***]

☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are no** "***waters of the U.S.***" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [***Required***]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☒ Non-RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: 3,366 linear feet: 6 width (ft) and/or 0.463 acres.
      Wetlands: acres.

   c. **Limits (boundaries) of jurisdiction** based on: **Established by OHWM.**
      Elevation of established OHWM (if known): 753 AMSL.

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional. Explain: **1) The drainage does not have more than a speculative or an insubstantial effect on the chemical, physical, and/or biological integrity of a TNW (in this case, the Scioto River) 2) The drainage lacks in volume 3) Continuous flow throughout the entire channel exists only during, and directly after, a heavy rain or snow melt. These flow events would be infrequent and of short duration 4) The channel lacks surface water flow (except for approximately 175 liner**

---

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

feet west of the waterfall and pool) during the majority of the year, even though flow coming into the site from the west is perennial 5) The proximity of the water source to the termination of the man-made channel is approximately 3,266 linear feet (total length of man-made channel minus 100 feet of channel between Dublin Road and the waterfall which is natural). This distance makes the effect on the TNW speculative or insubstantial 6) The channel does not support aquatic fish, amphibian, or vegetation 7) The man-made channel bed consists of a layer of limestone spoils and gravel over previously mined limestone bedrock 8) The drainage channel does not support wetlands and there are no wetlands adjacent to the drainage 9) The drainage channel was excavated/constructed in uplands and drains only uplands and does not carry a relatively permanent flow of water 10) The drainage does not support wildlife, does not transport sediment, does not support nutrient cycling, does not retain sediment, and does not trap pollutants or improve water quality of TNW.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. TNW
Identify TNW: **N/A**.

Summarize rationale supporting determination: .

2. Wetland adjacent to TNW
Summarize rationale supporting conclusion that wetland is "adjacent": N/A.

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:
Watershed size: 2.9 **square miles**
Drainage area: **Pick List**
Average annual rainfall: 39.31 inches
Average annual snowfall: 26.7 inches

(ii) Physical Characteristics:
(a) Relationship with TNW:
☒ Tributary flows directly into TNW.
☐ Tributary flows through **Pick List** tributaries before entering TNW.

Project waters are **1 (or less)** river miles from TNW.
Project waters are **1 (or less)** river miles from RPW.
Project waters are **1 (or less)** aerial (straight) miles from TNW.
Project waters are **1 (or less)** aerial (straight) miles from RPW.
Project waters cross or serve as state boundaries. Explain: .

Identify flow route to TNW[5]: man-made drainage channel discharges directly into TNW.
Tributary stream order, if known: .

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.
[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☐ Natural
☒ Artificial (man-made). Explain: .
☐ Manipulated (man-altered). Explain: .

Tributary properties with respect to top of bank (estimate):
Average width: 6 feet
Average depth: 0 feet
Average side slopes: **4:1 (or greater).**

Primary tributary substrate composition (check all that apply):

☐ Silts ☐ Sands ☐ Concrete
☒ Cobbles ☒ Gravel ☐ Muck
☐ Bedrock ☐ Vegetation. Type/% cover:
☐ Other. Explain: substrate materials consist of limestone quarry overburden materials.

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: some erosion due to short, swift flow.
Presence of run/riffle/pool complexes. Explain: drainage typically dry.
Tributary geometry: **Relatively straight**
Tributary gradient (approximate average slope): 2 %

(c) Flow:

Tributary provides for: **Ephemeral flow**
Estimate average number of flow events in review area/year: **6-10**
Describe flow regime: during and directly after rain event of 1" or more.
Other information on duration and volume: flow is of short duration with fast flow.

Surface flow is: **Confined.** Characteristics: man-made channel.

Subsurface flow: **Yes**. Explain findings: channel substrate consists of unconsolidated material. Channel constructed over previously mined limestone quarry containing fractured limestone bedrock. Surface water within the channel percolates into the unconsolidated material and fractured limestone.

☐ Dye (or other) test performed: .

Tributary has (check all that apply):

☒ Bed and banks
☐ OHWM[6] (check all indicators that apply):
- ☐ clear, natural line impressed on the bank
- ☐ changes in the character of soil
- ☐ shelving
- ☐ vegetation matted down, bent, or absent
- ☐ leaf litter disturbed or washed away
- ☐ sediment deposition
- ☐ water staining
- ☐ other (list):
- ☒ the presence of litter and debris
- ☐ destruction of terrestrial vegetation
- ☐ the presence of wrack line
- ☐ sediment sorting
- ☐ scour
- ☐ multiple observed or predicted flow events
- ☐ abrupt change in plant community

☐ Discontinuous OHWM.[7] Explain: .

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

☐ High Tide Line indicated by:
- ☐ oil or scum line along shore objects
- ☐ fine shell or debris deposits (foreshore)
- ☐ physical markings/characteristics
- ☐ tidal gauges
- ☐ other (list):

☐ Mean High Water Mark indicated by:
- ☐ survey to available datum;
- ☐ physical markings;
- ☐ vegetation lines/changes in vegetation types.

(iii) Chemical Characteristics:

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain: clear.
Identify specific pollutants, if known: .

[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

☐ Riparian corridor. Characteristics (type, average width): .
☐ Wetland fringe. Characteristics: .
☐ Habitat for:
  ☐ Federally Listed species. Explain findings: .
  ☐ Fish/spawn areas. Explain findings: .
  ☐ Other environmentally-sensitive species. Explain findings: .
  ☐ Aquatic/wildlife diversity. Explain findings: .

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:
Properties:
Wetland size: acres
Wetland type. Explain: .
Wetland quality. Explain: .
Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:
Flow is: **Pick List**. Explain: .

Surface flow is**: Pick List**
Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .
☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:
☐ Directly abutting
☐ Not directly abutting
  ☐ Discrete wetland hydrologic connection. Explain: .
  ☐ Ecological connection. Explain: .
  ☐ Separated by berm/barrier. Explain: .

(d) Proximity (Relationship) to TNW
Project wetlands are **Pick List** river miles from TNW.
Project waters are **Pick List** aerial (straight) miles from TNW.
Flow is from: **Pick List.**
Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: .
Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):

☐ Riparian buffer. Characteristics (type, average width): .
☐ Vegetation type/percent cover. Explain: .
☐ Habitat for:
  ☐ Federally Listed species. Explain findings: .
  ☐ Fish/spawn areas. Explain findings: .
  ☐ Other environmentally-sensitive species. Explain findings: .
  ☐ Aquatic/wildlife diversity. Explain findings: .

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **Pick List**
Approximately ( ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed: .

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D: Tributary does not have a significant nexus to to TNW. The drainage does not have more than a speculative or an insubstantial effect on the chemical, physical, and/or biological integrity of a TNW (in this case, the Scioto River); The drainage lacks in volume; Continuous flow throughout the entire channel exists only during, and directly after, a heavy rain or snow melt. These flow events would be infrequent and of short duration; The channel lacks surface water flow (except for approximately 175 liner feet west of the waterfall and pool) during the majority of the year, even though flow coming into the site from the west is perennial; The proximity of the water source to the termination of the man-made channel is approximately 3,266 linear feet (total length of man-made channel minus 100 feet of channel between Dublin Road and the waterfall which is natural). This distance makes the effect on the TNW speculative or insubstantial; The channel does not support aquatic fish, amphibian, or vegetation; The man-made channel bed consists of a layer of limestone spoils and gravel over previously mined limestone bedrock; The drainage channel does not support wetlands; there are no wetlands adjacent to the drainage; The drainage channel was excavated/constructed in uplands and drains only uplands and does not carry a relatively permanent flow of water; The drainage does not support wildlife, does not transport sediment, does not support nutrient cycling, does not retain sediment, and does not trap pollutants or improve water quality of TNW.

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   ☐ TNWs: linear feet width (ft), Or, acres.
   ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   ☐ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial: .
   ☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: .

   Provide estimates for jurisdictional waters in the review area (check all that apply):
   ☐ Tributary waters: linear feet width (ft).
   ☐ Other non-wetland waters: acres.
   Identify type(s) of waters: .

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
   ☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

   Provide estimates for jurisdictional waters within the review area (check all that apply):
   ☐ Tributary waters: linear feet width (ft).
   ☐ Other non-wetland waters: acres.
   Identify type(s) of waters: **.**

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**
   ☐ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
   ☐ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: **.**

   ☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

   Provide acreage estimates for jurisdictional wetlands in the review area: acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**
   ☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

   Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**
   ☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

   Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.[9]**
   As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
   ☐ Demonstrate that impoundment was created from "waters of the U.S.," or
   ☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
   ☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

---
[8]See Footnote # 3.
[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]

☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain: .
☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: **.**
☐ Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

☒ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
☐ Prior to the Jan 2001 Supreme Court decision in "***SWANCC***," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
☒ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: **.**
☐ Other: (explain, if not covered above): **.**

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
☒ Non-wetland waters (i.e., rivers, streams): **3,366** linear feet, **6** width (ft).
☒ Lakes/ponds: 16.91 acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
☐ Office concurs with data sheets/delineation report.
☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps: .
☐ Corps navigable waters' study: .
☐ U.S. Geological Survey Hydrologic Atlas: .
☐ USGS NHD data.
☐ USGS 8 and 12 digit HUC maps.
☒ U.S. Geological Survey map(s). Cite scale & quad name:Northwest and Southwest Columbus, Ohio.
☒ USDA Natural Resources Conservation Service Soil Survey. Citation: .
☒ National wetlands inventory map(s). Cite name: .
☐ State/Local wetland inventory map(s): .

[10] Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.*

- ☒ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☒ Photographs: ☒ Aerial (Name & Date): .
  or ☐ Other (Name & Date): .
- ☐ Previous determination(s). File no. and date of response letter: .
- ☐ Applicable/supporting case law: .
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): GCI Jurisdictional Determination Report.

B. ADDITIONAL COMMENTS TO SUPPORT JD: .

DEPARTMENT OF THE ARMY
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
502 EIGHTH STREET
HUNTINGTON, WEST VIRGINIA 25701-2070

REPLY TO
ATTENTION OF

October 6, 2016

Regulatory Division
North Branch
LRH-2016-593-SCR-Unnamed Tributary Scioto River

APPROVED JURISDICTIONAL DETERMINATION

Mr. Gilbert Black
Wagenbrenner Development
842 North 4th Street, Suite 200
Columbus, Ohio 43215

Dear Mr. Black:

I refer to the *Report of Jurisdictional Determination, Marble Cliff Quarry Property, Dublin Road, Columbus, Franklin County, Ohio* dated July 5, 2016, and submitted on your behalf by Geotechnical Consultants, Inc. (GCI). You have requested an approved jurisdictional determination (JD) for the non-jurisdictional features identified on the 150 acre study site located east of Dublin Road and north of Trabue Road in the west central portion of the City of Columbus, Franklin County, Ohio (40.0007° N, 83.085820° W). Your JD request has been assigned the following file number: LRH-2016-593-SCR-Unnamed Tributary Scioto River. Please reference this file number on all future correspondence related to this JD request.

The United States Army Corps of Engineers (Corps) authority to regulate waters of the United States is based on the definitions and limits of jurisdiction contained in 33 CFR 328 and 33 CFR 329. Section 404 of the Clean Water Act requires a Department of the Army (DA) permit be obtained prior to discharging dredged or fill material into waters of the United States, including wetlands. Section 10 of the Rivers and Harbors Act of 1899 requires a DA permit be obtained for any work in, on, over or under a navigable water. Our December 2, 2008 headquarters guidance entitled *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States* was followed in the final verification of Clean Water Act jurisdiction.

Based on a review of the information provided, a field investigation conducted on September 7, 2016 by a representative of this office, and other information available to us, there are two (2) open water quarry ponds (Pond 1-7.87 acres and Pond 2- 9.04 acres) and one (1) non-jurisdictional channel located within the project area. Pond 1 and Pond 2 are man-made features that have been constructed for limestone mining activities. Approximately 3,266 linear feet of a man-made drainage channel has been created in uplands to support the limestone mining activities. Based on this information, Pond 1, Pond 2, and the constructed drainage channel designed to meet the requirements of the Clean Water Act are not considered to be jurisdictional waters of the United States and are not be subject to Section 404.

This jurisdictional verification is valid for a period of five (5) years from the date of this letter unless new information warrants revision of the delineation prior to the expiration date. This letter contains an approved JD for the subject site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and Request for Appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the Great Lakes and Ohio River Division Office at the following address:

Appeals Review Officer
Great Lakes and Ohio River Division
550 Main Street RM 10524
Cincinnati, Ohio 45202-3222
Phone: (513) 684-7261 Fax: (513) 684-2460

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by December 5, 2016. **It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this letter.**

A copy of this letter will be provided to your consultant, Matthew R. Kaminski, with GCI, Inc. If you have any questions concerning the above, please contact Ms. Crystal Chambers of the North Branch at 304-399-5630, by mail at the above address, or by email at crystal.d.chambers@usace.army.mil.

Sincerely,

SPAGNA.TERESA.D.1229740519

Teresa D. Spagna
Chief, North Branch

Enclosure
cc:

Matthew R. Kaminski
Geotechnical consultants, Inc.
720 Greencrest Drive
Westerville, Ohio 43081

QUARRY TRAILS METRO PARK
TYPE III VARIANCE REQUEST
MILLIKIN DITCH SCPZ DELINEATION

Section 1.3.1 of the *Columbus Stormwater Drainage Manual* establishes the Stream Corridor Protection Zone (SCPZ) width as the greatest of the following:

1. The Federal Emergency Management Agency (FEMA) designated 100-year floodway (where applicable);

2. A calculated width based on the equation below, with calculated values capped at a minimum total width of 50 ft. and a maximum total width of 250 ft.

$$\text{SCPZ width (ft.)} = 147 \times (DA^{0.38})$$

Where DA = upstream drainage area in square miles (mi^2); or

3. 50 ft. from the top of each bank for fourth order streams or larger.

Millikin Ditch is not in a FEMA-mapped floodway, and is not a fourth order or larger stream (3rd order); therefore, SCPZ width was calculated in accordance with the equation presented in No. 2 above. Estimated upstream drainage area in the project area is 3.26 mi^2:

$$\text{Total SCPZ width} = 147 \times (3.26^{0.38}) = \mathbf{230\ ft.}$$

The above calculated total SCPZ width corresponds to an approximate width of 115 ft per side when centered on the stream channel.

APPENDIX F

OEPA RULE 13 AUTHORIZATION

Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

NOVEMBER 15, 2017

Mark A. Wagenbrenner
Marble Cliff Canyon, LLC
842 N. Fourth Street, Suite 200
Columbus, Ohio 43215

Re: Marble Cliff Quarry Landfill
Director's Authorization
Approval
Municipal Solid Waste Landfills
Franklin County
MSWL021367

Re: Marble Cliff Quarry Landfill
Non-Permit Related Exemption
Approval
Municipal Solid Waste Landfills
Franklin County
MSWL021367

Ohio EPA NOV 15 '17
Entered Directors Journal

Subject: Marble Cliff Quarry Landfill, Franklin County
Ohio Administrative Code (OAC) Rule 3745-27-13 Authorization

Dear Mr. Wagenbrenner:

On July 10, 2017, the Ohio Environmental Protection Agency (Ohio EPA), Division of Materials and Waste Management (DMWM), Central District Office (CDO) received a request, dated June 28, 2017, titled "OAC 3745-27-13(E) Request" (Request). The Request was submitted in accordance with OAC Rule 3745-27-13(E) by Marble Cliff Canyon, LLC (MCC), with acknowledgement from Trabue Dublin, LLC (Owner), for the closed Marble Cliff Quarry Landfill (Facility) located at 2650 Dublin Road Columbus, Ohio.

Ohio EPA, Division of Environmental Response and Revitalization (DERR), CDO staff initially reviewed the Request, and in coordination with DMWM, CDO staff, provided a notice of deficiencies dated August 29, 2017. In response to the August 29, 2017 letter, the Request was revised and re-submitted on September 18, 2017.

OAC Rule 3745-27-13 requires authorization from the Director of Ohio EPA (Director) before engaging in filling, grading, excavating, building, drilling, or mining on land where a solid waste facility was operated. The Facility operated as a municipal solid waste landfill until 1974. MCC requests to conduct clearing, soil grading, on-site waste relocation, soil and waste compaction, and capping.

The revised Request also proposed exemptions from the requirements of OAC Rules 3745-27-13(E)(1), (E)(11), and (H)(6).

Based upon a review of the Request, I have determined, pursuant to OAC Rule 3745-27-13, that the proposed activities, if conducted in accordance with the Request, as revised, and the following conditions, will not result in violation of applicable laws and regulations, will not create a nuisance, and are unlikely to adversely affect public safety or health or the environment. Therefore, MCC is hereby authorized to perform the activities outlined in this letter in accordance with the plans, specifications, and information submitted as part of the Request.

As part of this approval, MCC is subject to the following conditions:

CONDITIONS

General Conditions:

1. This approval grants authorization to perform activities at the Facility in accordance with the Request as submitted on July 10, 2017 and revised on September 18, 2017. All activities shall be conducted in strict accordance with the plans, specifications, and other information submitted as part of the Request. There may be no deviation from the approved plans without prior written authorization from Ohio EPA. Any future activities at the Facility may require additional Ohio EPA approval.

2. Not later than seventy-two (72) hours prior to the start of the activities associated with this authorization, MCC shall submit written notification, which specifies the anticipated date of commencement, to Ohio EPA, DMWM, CDO and Columbus Public Health.

3. Access shall be allowed at the Facility to the Director or a representative authorized by the Director at any time to make inspections, conduct tests, or examine records and reports pertaining to the authorized activities.

4. All on-site activities shall be accomplished in compliance with all applicable state and federal laws and regulations pertaining to environmental protection, including but not limited to the control of air pollution, leachate, surface water run-on and run-off, and protection of ground water.

Operational Conditions:

5. OAC Rule 3745-27-13(G)(3)(c)

   Any solid and/or hazardous waste to be removed from the Facility shall be containerized and securely stored until these materials are properly characterized and disposed of in accordance with Ohio Revised Code (ORC) Chapter 3734 and the regulations promulgated thereunder.

6. Ohio Revised Code (ORC) Chapter 6111

Any liquids, semi-solids, industrial wastes, and other wastes regulated by ORC Chapter 6111 that are removed during intrusive activities shall be containerized and securely stored until these materials are properly characterized and disposed of in accordance with ORC Chapter 6111 and the regulations promulgated thereunder.

7. OAC Rule 3745-27-13(H)(4)

Prior to any disposal of waste or contaminated soil from the Facility, MCC shall submit copies of sample analysis results, the treatment or disposal method selected, and a letter of acceptance from the treatment or disposal facility, to Ohio EPA, DMWM, CDO, pursuant to OAC Rule 3745-27-13(H)(4).

8. OAC Rule 3745-27-13(J)

All on-site activities shall be performed in a manner that:

a. Prevents migration of leachate, explosive gas, or toxic gas from the Facility;

b. Does not create a nuisance or adversely affect public safety or health or the environment;

c. Controls fugitive dust and other air emissions; and

d. Minimizes the potential for increased infiltration of surface water.

9. For the purposes of erosion control, MCC shall use best management practices and standards as specified in the National Resources Conservation manual titled "Rainwater and Land Development" prepared by the Ohio EPA Division of Surface Water.

10. OAC Rule 3745-27-13(H)(6)

No boring or excavation shall occur within the limits of the waste placement unless any excavated waste is replaced within previously existing horizontal limits of waste placement or is treated or disposed of at a licensed, permitted treatment or disposal facility, in accordance with ORC Chapter 3734 and the regulations promulgated thereunder.

11. OAC Rule 3745-27-13(H)(7)

If boring or excavation occurs outside the limits of waste placement at the Facility, MCC shall not use material consisting of solid waste or hazardous waste to backfill the bored or excavated areas.

12. OAC Rule 3745-27-13(H)(10)

Not later than sixty (60) days after completing the activities authorized through this approval, MCC shall submit to Ohio EPA, DMWM, CDO, a certification report in accordance with OAC Rule 3745-27-13(H)(10).

13. OAC Rule 3745-27-13(M)

This authorization shall terminate three (3) years after its effective date if MCC has not begun the activities authorized herein.

14. OAC Rule 3745-27-13(O)

The Director may revoke this authorization if MCC violates, or is likely to violate, any applicable law or if continued implementation of the approved plans may cause a threat to human health or safety or the environment.

Special Conditions:

15. Upon completion of filling, grading, excavating, building, drilling, or mining activities at the Facility, MCC shall restore the condition of the Facility cap in accordance with the appropriate provisions of ORC Chapter 3734 and the rules promulgated thereunder, as were applicable at the time the Facility owner or operator originally submitted certification of closure, or the rules the Facility owner or operator was required to close under if certification was never submitted.

16. MCC shall have a waste management plan approved by Ohio EPA prior to excavation of any wastes.

17. MCC shall install an additional vapor well in order to monitor for explosive gas migration at the location depicted on the updated soil gas well exhibit. This additional vapor well shall be monitored on a monthly basis once activities begin at the site.

END OF CONDITIONS

EXEMPTIONS

Pursuant to ORC Section 3734.02(G) and OAC Rule 3745-27-03(B), the Director may, by order, exempt any person generating, collecting, storing, treating, disposing of, or transporting solid wastes, or processing solid wastes that consist of scrap tires, in such quantities or under such circumstances that, in the determination of the Director, are unlikely to adversely affect the public health or safety or the environment, from any requirements to obtain a registration certificate or license or comply with other requirements of ORC Chapter 3734 or any rules adopted thereunder.

EXEMPTION FROM OAC RULE 3745-27-13(E)(1)

MCC has requested an exemption from OAC Rule 3745-27-13(E)(1), which requires that the request includes the location specified on a 7-1/2 minute USGS topographical map and on a topographic map with a maximum scale of one inch equals two hundred feet, legal description, type of facility, demonstration of current property ownership, and demonstration of current facility ownership.

Ohio EPA has reviewed the exemption request and has determined that, because a legal description of the property will be submitted at a later date, granting MCC an exemption from the requirement to submit a legal description within this Request is unlikely to adversely affect the public health or safety or the environment. Therefore, pursuant to ORC Section 3734.02(G) and OAC Rule 3745-27-03(B), MCC is hereby exempted from the requirement of OAC Rule 3745-27-13(E)(1) as it applies to submitting a legal description within the Request. This exemption shall remain in effect throughout the effective period of this authorization unless otherwise revoked.

EXEMPTION FROM OAC RULE 3745-27-13(E)(11)

MCC has requested an exemption from OAC Rule 3745-27-13(E)(11), which requires that, if waste will still remain on the property, that the Request includes a detailed description of a notation or update to any prior recorded notation to be placed on the deed to the property to notify in perpetuity any potential purchaser of the property that the land has been used as a hazardous waste facility or solid waste facility. The notation shall describe the impacted acreage, including the known location, depth, volume, and nature of waste disturbed at the site. MCC proposes to include information regarding the property under an environmental covenant established through the Voluntary Action Program after the activities proposed in the Request are completed.

Ohio EPA has reviewed the exemption request and has determined that, because the deed notation will be later provided under an environmental covenant for the property, granting MCC an exemption from providing a detailed description of a recorded deed notation within the Request is unlikely to adversely affect the public health or safety or the environment. Therefore, pursuant to ORC Section 3734.02(G) and OAC Rule 3745-27-03(B), MCC is hereby exempted from the requirement of OAC Rule 3745-27-13(E)(11) as it applies to providing a detailed description of a recorded deed notation within the Request. This exemption shall remain in effect throughout the effective period of this authorization unless otherwise revoked.

EXEMPTION FROM OAC RULE 3745-27-13(H)(6)

MCC has requested an exemption from OAC Rule 3745-27-13(H)(6), which requires that no excavation of waste shall occur unless the excavated waste is replaced within previously existing horizontal and vertical limits of waste placement or is treated or disposed of at a licensed, permitted treatment or disposal facility, in accordance with Chapter 3734 of the Revised Code and the regulations promulgated thereunder. MCC proposes to increase the vertical limits of waste placement in some lower-lying areas by relocating waste from higher areas to achieve an overall lowering of the vertical limits of waste prior to installation of a soil cover.

Ohio EPA has reviewed the request and has determined that, because the relocation of waste materials will occur within the previously existing horizontal limits of waste placement and a final cover system will be reestablished over the relocated waste materials in accordance with the conditions of this authorization, granting MCC an exemption to relocate waste materials above the previously existing limits of waste placement is unlikely to adversely affect public health or safety or the environment. Therefore, pursuant to ORC Section 3734.02(G) and OAC Rule 3745-27-03(B), MCC is hereby exempted from the requirement of OAC Rule 3745-27-13(H)(6) as it applies to the placement of waste materials above the previously existing vertical limits of waste placement during the performance of activities described in the Request, provided that MCC strictly complies with all conditions of this authorization. This exemption shall remain in effect throughout the effective period of this authorization unless otherwise revoked.

END OF EXEMPTIONS

Nothing in this letter shall be construed to authorize any waiver from the requirements of any applicable federal or state laws or regulations except as specified herein. This authorization shall not be interpreted to release MCC from responsibility under ORC Chapters 3704, 3714, 3734, or 6111; under the Federal Clean Water Act, the Resource Conservation and Recovery Act, the Toxic Substances Control Act, or the Comprehensive Environmental Response, Compensation, and Liability Act; or from other applicable requirements for remedying conditions resulting from any release of contaminants to the environment.

You are hereby notified that this action of the Director of Environmental Protection (Director) is final and may be appealed to the Environmental Review Appeals Commission pursuant to ORC Section 3745.04. The appeal must be in writing and set forth the action complained of and the grounds upon which the appeal is based. The appeal must be filed with the Commission within thirty (30) days after notice of the

Director's action. The appeal must be accompanied by a filing fee of $70.00, made payable to "Treasurer, State of Ohio." The Commission, in its discretion, may reduce the fee if by affidavit it is demonstrated that payment of the full amount of the fee would cause extreme hardship. Notice of the filing of the appeal shall be filed with the Director within three (3) days of filing with the Commission. Ohio EPA requests that a copy of the appeal be served upon the Ohio Attorney General's Office, Environmental Enforcement Section. An appeal may be filed with the Environmental Review Appeals Commission at the following address:

Environmental Review Appeals Commission
30 East Broad Street, 4th Floor
Columbus, Ohio 43215

If you have any questions regarding this authorization, please contact Allan Hurtt of Ohio EPA, CDO at (614) 728-3889.

Sincerely,

Craig W. Butler
Director

c: John Tallichet, Trabue Dublin, LLC

e: Kelli Dodd, Columbus Public Health
Deborah Strayton, DERR/CDO
Constance Livchak, DMWM/CDO
Miles Davidson, DMWM/CDO
Scott Hester, DMWM/CO
Troy Harter, Legal
Sue Kroeger, Legal

APPENDIX G

FLOOD IMPACT STUDY REPORT

FLOOD IMPACT STUDY
SUMMARY REPORT

MARBLE CLIFF QUARRY DEVELOPMENT

TRABUE ROAD
COLUMBUS, OHIO

MARCH 2018
REVISED FEBRUARY 2019

STATE OF OHIO
Doyle E.
Hartman
E-046761
REGISTERED
PROFESSIONAL ENGINEER

2/1/19

BY
HARTMAN ENGINEERING
150 SOUTH PARKWAY DRIVE
DELAWARE, OHIO 43015

Flood Impact Study

Marble Cliff Quarry Development

Trabue Road
Columbus, Ohio

March 2018
Revised February 2019

Introduction.

This report provides summary data of an analysis made to assess the impact the planned Marble Cliff Quarry development just north of Trabue Road and west of the Scioto River would have on the 100-year peak flow rates and flood elevations along the Scioto River downstream of the site. Although all proposed fill for the development in the Scioto River floodplain will be placed outside the floodway in an off-channel area of an old quarry, the City of Columbus requested a study be performed to evaluate the impact the resulting loss of existing floodplain storage would have on downstream flow conditions. This report briefly summarizes the analyses made and the results obtained based on design plans provided by the developer, Wagenbrenner Development, at the time of the study.

The study reach extended from Flood Insurance Study (FIS) report Section AZ, which is located about 2800 feet downstream of Griggs Dam, to about 3.2 miles downstream to FIS Section AR, which is located about 1.3 miles downstream of Fifth Avenue.

Please note that the elevations indicated in this report and shown on the FEMA FIRM maps and in the Flood Insurance Study (FIS) are referenced to the NAVD88 datum.

January 2019 Revisions to Study.

The January 2019 revisions to the study primarily reflect proposed changes to the opening under the main access road. In the March 2018 study the proposed culvert under this road was assumed to be a 20’ x 10’ box culvert. This culvert is now proposed to be replaced with a bridge with a substantially larger opening. A pedestrian bridge carrying water and sanitary sewer lines is also proposed just west of the main access road, and some grading changes proposed in this general area and the resulting reduction in available storage was also modeled in this revised study.

Methodology.

Since the focus of this study was to evaluate the impact the proposed floodplain fill would have on downstream 100-year peak flows and flood elevations, it was necessary to perform an unsteady flow analysis in order to evaluate how much of the overall 100-year flood volume is currently stored in the quarry area and how much would be stored after fill is placed as proposed. Steady flow HEC-RAS analyses are based only on peak flow rates input by the user and not the entire flood hydrograph and thus do not take into account reductions in peak flows from channel or off-channel storage.

Thus it was necessary to estimate a 100-year flood hydrograph for the Scioto River in the quarry area. For this study, this hydrograph was estimated using historic Scioto River hydrograph information obtained from the Dam Safety Section of the ODNR Division of Water Resources from a previous hydrologic and hydraulic study performed by the Corps of Engineers for a 1981 Phase I Dam Safety Inspection report for Griggs Dam. The information thus obtained is included in the Appendix. Data obtained from ODNR were input into the HEC-1 computer program to reproduce the computation of the hydrograph used in the Corps study. This resulting hydrograph information was then modified proportionally such that the hydrograph peak flow rate matched the peak 100-year flow rate used in the effective FEMA floodplain study. These HEC-1 input and output data are also included in the Appendix along with the Corps data obtained from ODNR.

For the hydraulic analyses, the effective FIS hydraulic model data for the study reach along the Scioto River were obtained from FEMA and used for this study. The FEMA data were modified slightly to better meet current modeling standards, as requested by the City, primarily in the modeling of the downstream bridges and the overbank distances assumed between cross-sections. Bridge data provided by Franklin County were used to update the Trabue Road bridge model data, and the drawings used for this are included in the Appendix. The Corps of Engineers HEC-RAS computer program was then used to route the resulting estimated 100-year flood hydrograph through the study reach using these revised hydraulic data.

Existing off-channel storage in the quarry area was included in an existing conditions HEC-RAS model and analyses were made to estimate the extent of existing storage used during the 100-year flood, given the duration of flooding and the existing restrictions to flow from the Scioto River into the quarry area. Two quarry areas were assumed, one smaller area just west of the river, and then a larger area further west and north of the first quarry area. Currently flow enters the first quarry area through an existing 84" culvert and by overtopping the existing embankment at this culvert, and then the flow enters the second larger quarry area by overtopping an embankment located just to the west of this 84" culvert.

The existing conditions HEC-RAS model was then modified to reflect proposed conditions, including modifying the embankment height to reflect the proposed associated main access road grading, replacing the existing 84" culvert with a much larger culvert representative of the opening under the proposed bridge for the road, and reducing the existing available storage in the quarry area based on the provided fill plan for the quarry development. For the proposed conditions, only one quarry area was assumed due to the proposed grading and filling. A proposed pedestrian bridge in the quarry area just west of the main access road which will support water and sanitary water lines was ignored in the HEC-RAS calculations due to the opening size under this structure and the associated minimal impact to the floodplain storage in the quarry area or to the flow through the quarry area. This plan information is included on the drawing provided in the Appendix.

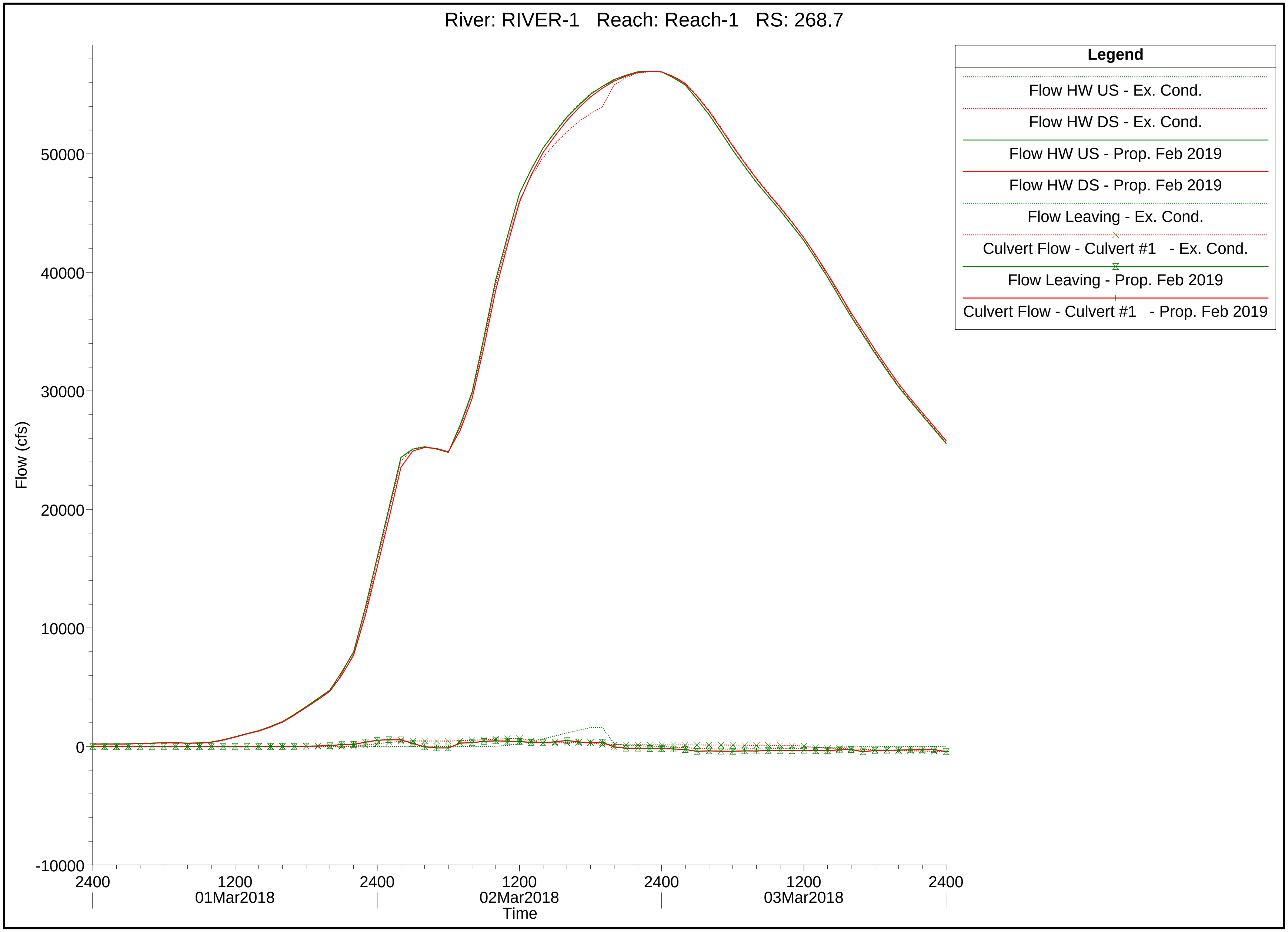
Results.

A comparison of the results of the existing and proposed conditions HEC-RAS models provides an evaluation of the impact of the proposed net loss of storage on upstream and downstream flood flows and peak flood elevations on the Scioto River as estimated by the HEC-RAS analyses. These results are shown in the summary table on the next page and on the HEC-RAS output graphs and data provided on following pages.

The maximum Scioto River 100-year water surface elevations shown in Column 4 for existing conditions and in Column 6 for proposed conditions in Table 1 on Page 3 are those computed by the HEC-RAS analyses rounded to the default allowable difference in the computer program for the internal computations of the flood elevations. As noted in Column 7 of Table 1, the changes in the Scioto River 100-year peak flood elevations from proposed to existing conditions as summarized in Columns 4 and 6 range from a maximum decrease of 0.02' upstream of the site to no change downstream of the site. Furthermore, from the graph on Page 4, it appears the available off-channel storage in the quarry area is essentially full prior to the passing of peak flows during the 100-year flood for both existing and proposed conditions .

Table 1 – Scioto River 100-Year Flood Data

Section No.	Location	Existing Conditions		Proposed Conditions		
		Peak 100-Year Peak Rate (cfs)	Max. 100-Year Water Surface Elevation (NAVD88)	Peak 100-Year Flow Rate (cfs)	Max. 100-Year Water Surface Elevation (NAVD88	Elev. Difference (ft) (6) – (4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
271	FIS Section AZ	56946	747.04	56955	747.02	-0.02
270.5	FIS Section AY	56941	745.70	56944	745.70	0.00
270.4		56937	745.64	56944	745.62	-0.02
270.3	Pipeline Crossing Bridge					
270.2		56937	745.44	56944	745.44	0.00
270.1		56937	745.60	56944	745.58	-0.02
269		56936	745.16	56943	745.14	-0.02
268.7	Lateral Structure					
268.5	FIS Section AX	57493	743.42	56940	743.40	-0.02
268.4		57111	744.06	56939	744.04	-0.02
268.3	Old Quarry Road Bridge					
268.2		57108	743.56	56939	743.56	0.00
268.1		57014	743.60	56939	743.60	0.00
267.5	FIS Section AW	56929	742.62	56939	742.62	0.00
267.4		56927	742.46	56939	742.46	0.00
267.3	Trabue Road Bridge					
267.2		56927	742.10	56935	742.10	0.00
267.1		56924	742.00	56935	742.00	0.00
266		56926	741.00	56934	741.00	0.00
265.5	FIS Section AV	56924	739.70	56934	739.70	0.00
265.4		56924	739.58	56934	739.58	0.00
265.3	Conrail Railroad Bridge					
265.2		56922	739.46	56932	739.46	0.00
265.1		56922	739.42	56932	739.42	0.00
264.5	FIS Section AU	56922	738.14	56930	738.14	0.00
264.4		56922	738.18	56930	738.18	0.00
264.3	Fifth Avenue Bridge					
264.2		56921	737.76	56930	737.76	0.00
264.1		56921	737.80	56930	737.80	0.00
263	FIS Section AT	56919	736.40	56929	736.40	0.00
262	FIS Section AS	56918	733.90	56927	733.90	0.00
261	FIS Section AR	56918	733.10	56927	733.10	0.00



1 in Horiz. = 0.5 1 in Vert. = 12000 ft

APPENDIX

BACKGROUND FEMA DATA

National Flood Hazard Layer FIRMette

FEMA

40°0'11.62"N

83°5'29.48"W

83°4'52.03"W

39°59'44.06"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth
- Regulatory Floodway *Zone AE, AO, AH, VE, AR*

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- (B) 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- (8) — Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

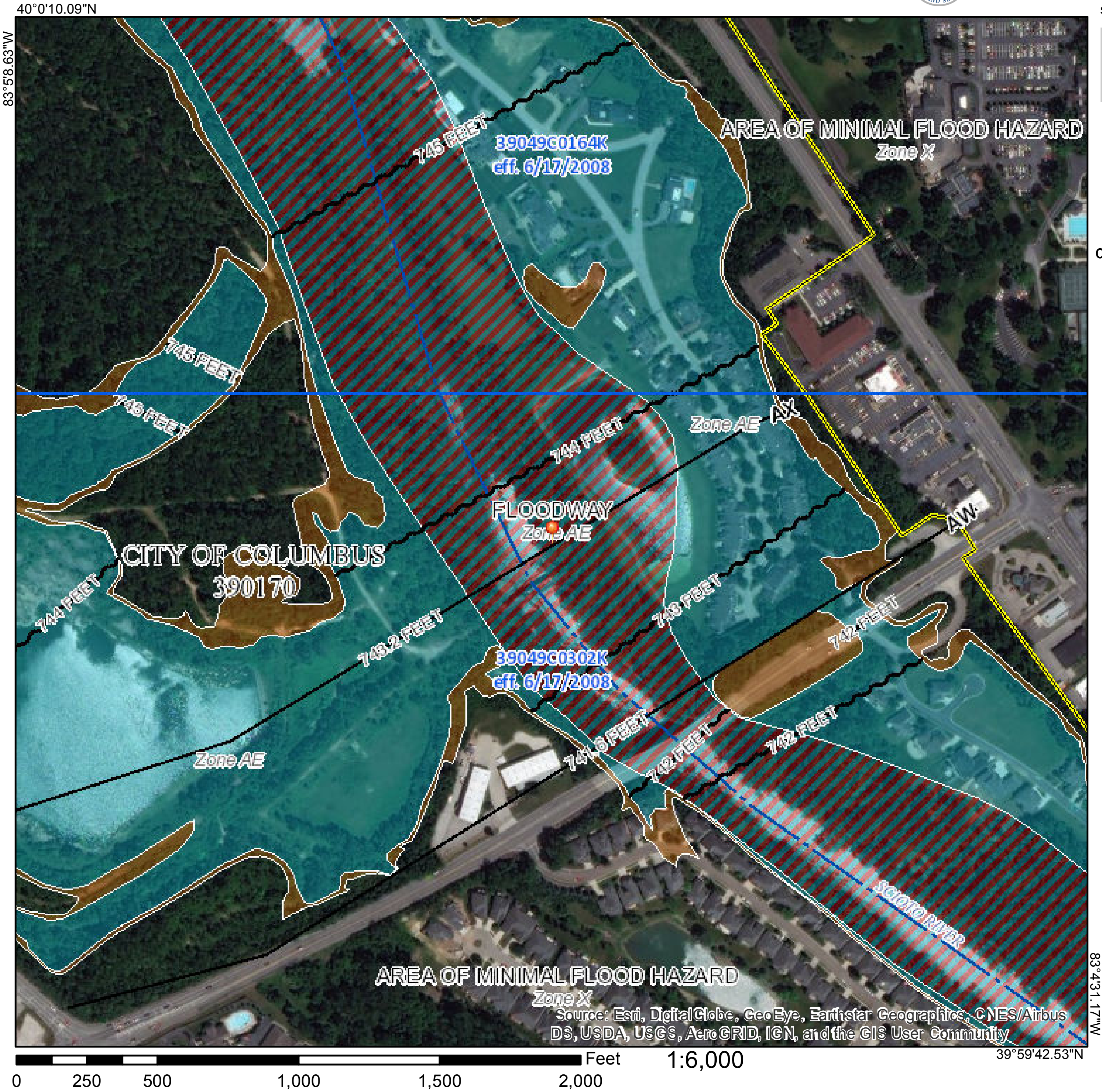
N

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/19/2018 at 4:59:01 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: base map imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

National Flood Hazard Layer FIRMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth
- Regulatory Floodway *Zone AE, AO, AH, VE, AR*

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 — Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/19/2018 at 5:01:21 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: base map imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Table 7. Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cfs)			
		10-percent-annual-chance	2-percent-annual-chance	1-percent-annual-chance	0.2-percent-annual-chance
Orders & Wallace Ditch					
At Country Club Road	1.56	295	572	723	1,230
Patzer Ditch					
Just US of confluence with Grant Run	3.88	820	1,580	2,050	3,560
At Interstate Route 71	2.15	454	876	1,136	1,973
At Haughn Road	1.60	338	652	848	1,468
Plum Run					
Section 310 at confluence with the Scioto River	10.4	1,900	3,440	4,280	6,900
Section 312, approximately 0.43 miles US of confluence with the Scioto River	7.0	1,340	2,430	3,060	4,900
Plum Run					
At State Route 665	4.3	1,040	1,900	2,380	3,900
Section 321, approximately 3.4 miles US of confluence with the Scioto River	2.0	670	1,240	1,590	2,600
Section 328, approximately 5.4 miles US of confluence with the Scioto River	0.6	177	327	420	687
Plum Run Tributary					
At confluence with Plum Run	1.8	560	1,030	1,320	2,160
Approximately 1.37 miles US of confluence with Plum Run	0.7	281	517	663	1,084
Powell Ditch					
At confluence with Blacklick Creek	3.8	*	*	2,600	*
Rhodes Ditch					
At confluence with Blacklick Creek	3.8	*	*	1,600	*
Rocky Fork Creek					
At confluence with Big Walnut Creek	30.3	3,550	6,400	8,000	13,100
At confluence of Sugar Run	10.4	1,220	2,210	2,760	4,520
Scioto Big Run					
At confluence with Scioto River	24.9	3,200	5,800	7,300	12,000
Approximately 4.35 miles US of confluence	16.2	2,380	3,910	4,750	7,320
Approximately 6.25 miles US of	13.3	1,025	1,875	2,300	6,000
Approximately 8.83 miles US of confluence	2.8	325	610	720	1,300
Scioto River					
Just DS of Big Walnut Creek	2,266.0	47,600	74,500	86,600	122,500
Just US of mouth of Big Walnut Creek	1,709.0	39,000	63,500	76,600	110,500
At gaging station at Columbus	1,629.0	37,000	60,400	72,900	108,500
Just US of confluence of Olentangy River	1,076.0	29,600	48,500	58,300	85,500
At gaging station below O'Shaughnessy Dam near Dublin	980.0	27,000	43,400	52,300	77,900

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	WIDTH REDUCED FROM PRIOR STUDY	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE (FEET)
Scioto River									
AA	128.391	509		13,929	5.4	711.8	711.8	712.5	0.7
AB	128.849	572		16,520	4.5	713.3	713.3	714.0	0.7
AC	128.993	515		14,846	5.1	713.5	713.5	714.1	0.6
AD	129.353	1,096		26,157	2.9	714.1	714.1	714.8	0.7
AE	129.795	515		13,690	5.5	714.4	714.4	715.0	0.6
AF	130.205	522		14,240	5.3	715.6	715.6	716.1	0.5
AG	130.448	569		13,919	5.4	716.1	716.1	716.7	0.6
AH	130.579	617		12,933	5.8	717.2	717.2	717.6	0.4
AI	130.767	645		12,067	6.2	717.9	717.9	718.3	0.4
AJ	131.009	598		14,710	5.1	719.4	719.4	719.7	0.3
AK	131.292	584		12,512	6.0	719.5	719.5	719.9	0.4
AL	131.601	660		15,182	5.0	720.4	720.4	720.7	0.3
AM	131.850	433		8,106	7.0	720.8	720.8	721.1	0.3
AN	132.226	299		6,723	8.5	723.2	723.2	723.4	0.2
AO	133.220	211		4,459	9.4	725.1	725.1	725.5	0.4
AP	133.568	270		10,931	5.2	727.9	727.9	728.2	0.3
AQ	133.329	314		6,922	8.2	730.5	730.5	730.8	0.3
AR	134.582	279		6,836	8.3	731.8	731.8	732.3	0.5
AS	134.986	285		5,574	10.2	732.9	732.9	733.3	0.4
AT	135.374	577		16,231	3.5	735.8	735.8	736.2	0.4
AU	135.918	231		5,637	10.1	736.4	736.4	736.8	0.4
AV	136.076	310		7,930	7.2	738.3	738.3	738.9	0.6
AW	136.769	336		6,471	8.8	741.6	741.6	742.3	0.7
AX	136.865	664		7,995	7.1	743.2	743.2	743.7	0.5
AY	137.346	380		8,921	6.4	745.3	745.3	746.1	0.8
AZ	137.829	514		11	5.4	747.7	747.7	748.1	0.4

[1]Miles above mouth

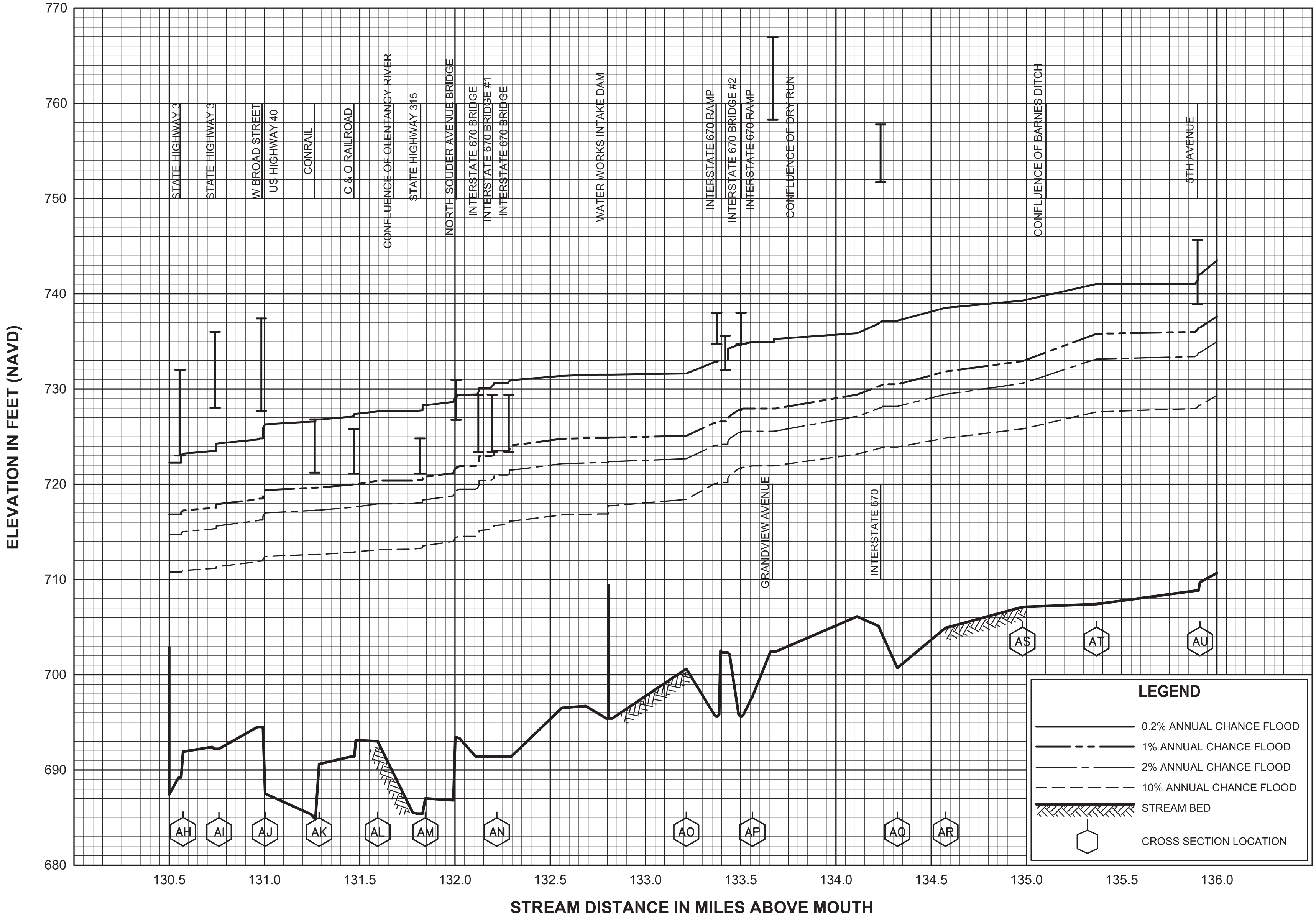
Table 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

FRANKLIN COUNTY, OHIO
AND INCORPORATED AREAS

FLOODWAY DATA

Scioto River



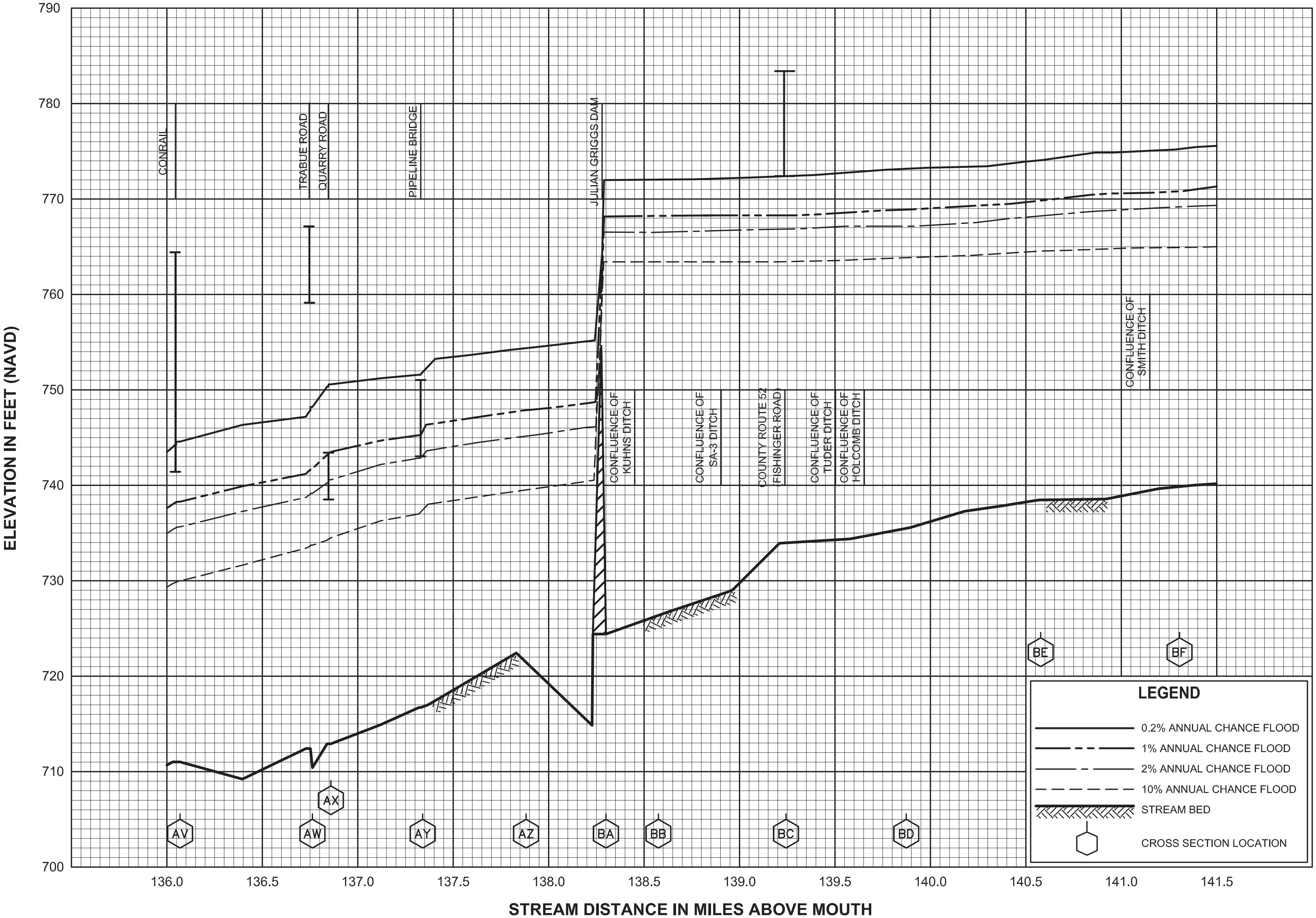
FLOOD PROFILES

SCIOTO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FRANKLIN COUNTY, OH

AND INCORPORATED AREAS



FLOOD PROFILES

SCIOTO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FRANKLIN COUNTY, OH

AND INCORPORATED AREAS

EXISTING BRIDGE DATA

ISSUE | PROJECT

TRABUE ROAD BRIDGES AND APPROACHES

1/76

STATE OF OHIO
DEPARTMENT OF HIGHWAYS

TRABUE ROAD BRIDGE OVER SCIOTO RIVER

FRA. 27-10.77

TRABUE ROAD BRIDGE OVER PENN CENTRAL R.R.

FRA. 27-10.87

AND APPROACHES

CITY OF COLUMBUS
CITY OF UPPER ARLINGTON
FRANKLIN COUNTY, OHIO

CONVENTIONAL SIGNS

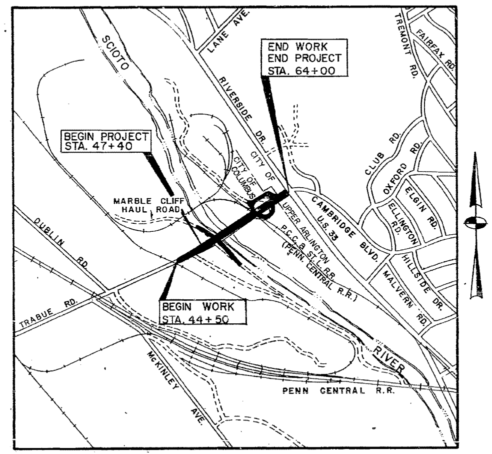
Proposed Guard Rail
Existing Guard Rail
Railroads
Manholes Reconstructed or Adjusted
Existing R/W
Proposed R/W
Proposed Temporary R/W
Center Line
Telephone Conduit
Corporation Line
Property Line
Existing Fence Line
Gas Line
Gas Valve
Existing Sewer
Proposed Sewer
Trees & Stumps
Power Pole
Light Pole
Telephone or Telegraph Pole
Water Line
Water Valves
Water Hydrant
Existing Manholes
Proposed Manholes
Existing Catch Basins
Proposed Catch Basins

DESIGN DESIGNATION

1971 ADT	=	18,308
1991 ADT	=	13,629
DHV	=	1363
Direction Distribution	=	53 %
% B & C Commercial	=	13 %
Design Speed	=	50 mph

LINE DATA

Trabue Road	
Begin Work	44+50.00
Begin Project	47+40.00
End Work	64+00.00
End Project	64+00.00
Haul Road	
Begin Work	9+96.98
End Work	18+50.00
Net Length	853.02 L.F.
Total Net Length of Work	2803.02 L.F. 0.531 Miles
Total Net Length of Project	1660.00 L.F. 0.314 Miles



SCALE: 1" = 800'

INDEX OF SHEETS

Delete Pages 30-33, 66-72 & 74

PLAN SCALE

PLAN AND PROFILE — 0 25' 50' 100'
PAVEMENT DETAILS — 0 10' 20' 40'
CROSS SECTIONS — 0 5' 10' 20'

STATE HIGHWAY DEPARTMENT			
STANDARD DRAWINGS		STANDARD DRAWINGS	
BP-1	6-1-65	HL-1	11-1-65
BP-3	1-1-71	HL-2	11-1-65
BP-4	1-1-71	HL-3	11-1-65
BP-5	1-1-71	HL-4	1-1-66
BP-7	1-1-66	BR-1-67	1-1-71
CB-2-2-A&B	6-1-65	SD-1-69 Sht.#3	6-12-69
GR-2B	1-1-71	GR-2A	1-1-71
GR-3	1-1-71		
GR-4	1-1-71		
HW-4	1-1-70	SUPPLEMENTAL SPECIFICATIONS	
MC-3	6-20-69		
MC-4	6-13-69		
MC-6	6-1-65	808	1-1-71
AS-1-67	6-12-69	836	1-1-71
MH-1	10-1-68	1001	1-1-69
MC-8	12-1-67	941	11-25-70
F-1	3-10-69		

BRUNING 44-560 10943

SUBSTANDARD DRAWING

This drawing does not meet minimum filming standards: [illegible] does not accept responsibility for the inferior results due to the condition of this drawing.

1971 SPECIFICATIONS

The Standard Specifications of the State of Ohio, Department of Highways including changes and supplemental specifications listed in the proposal shall govern this improvement.

I hereby approve these plans and declare that the making of this improvement will not require the closing of the highway to traffic and that provisions for the maintenance and safety of the traffic will be as set forth on the plans and estimate.

FOR FRANKLIN COUNTY

CHIEF DEPUTY ENGINEER ______ DATE

COUNTY AUDITOR ______ DATE

COUNTY ENGINEER ______ DATE

We, the Commissioners of Franklin County, hereby approve these plans and declare that the Right-Of-Way as shown on plans is available for the construction, maintenance and repair of the highway.

______ 5-17-71
______ 5-17-71
______ 5/17/71
COUNTY COMMISSIONERS DATE

FOR CITY OF COLUMBUS

SERVICE DIRECTOR ______ DATE

CITY ENGINEER ______ 5-20-71 DATE

FOR CITY OF UPPER ARLINGTON

CITY MANAGER ______ 5-17-71 DATE

CITY ENGINEER ______ 5-17-71 DATE

Check against Micro plans before destruction

FOR THE STATE OF OHIO

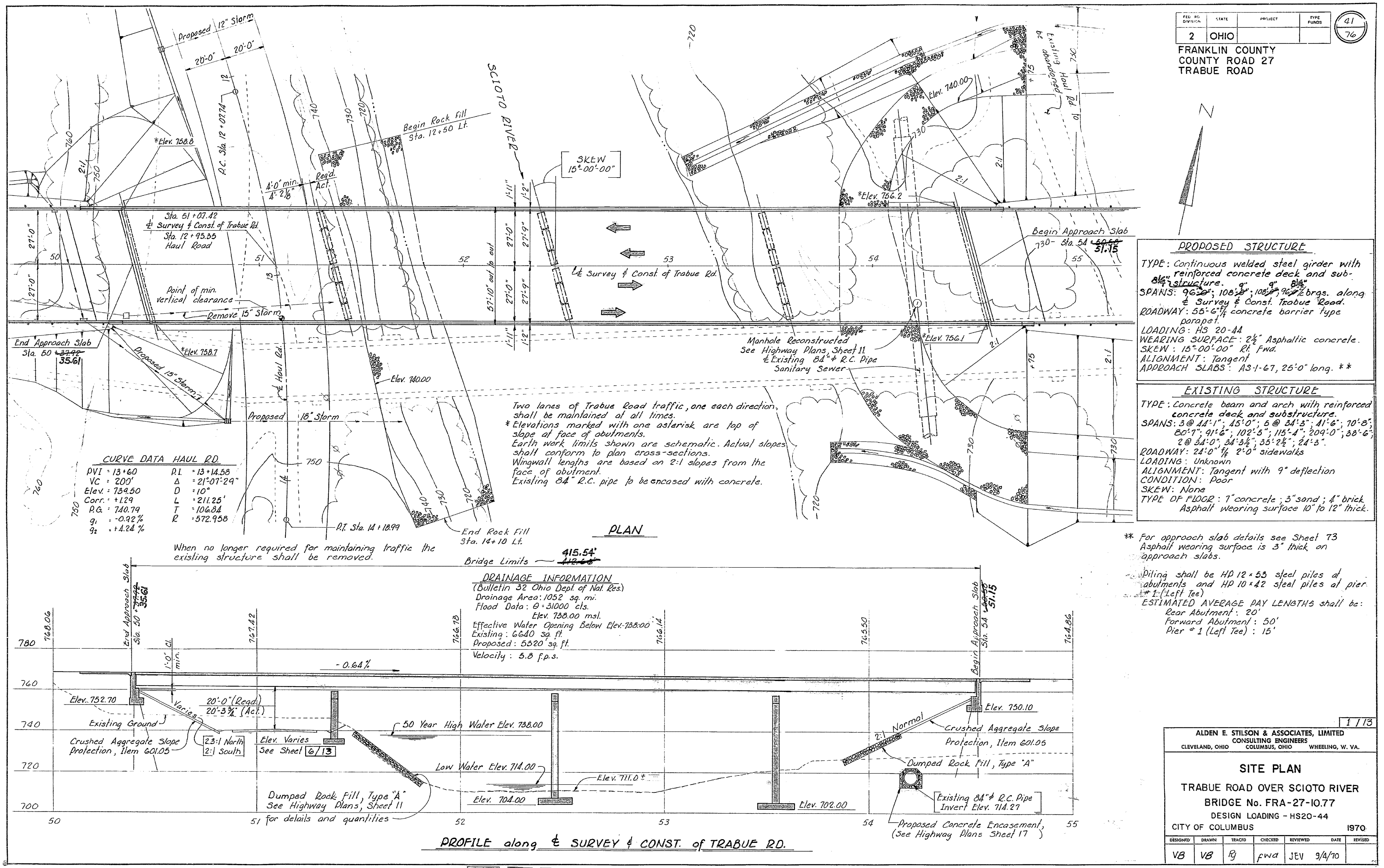
Approved *Bernard B. Hurst Jr.*
Date *May 14, 1971* Division Deputy Director
Approved ______
Date ______ Engineer of Bridges
Approved ______
Date ______ Engineer of Location & Design
Approved ______
Date ______ Deputy Director of Design & Construction
Approved ______
Date ______ Deputy Director of Right of Way
Approved ______
Date ______ Deputy Director of Planning & Programming
Approved ______
Date ______ First Assistant Director
Approved ______
Date ______ Director of Highways

PLANS PREPARED BY
ALDEN E. STILSON & ASSOCIATES, LIMITED
CONSULTING ENGINEERS
170 NORTH HIGH STREET
COLUMBUS, OHIO
FOR
FRANKLIN COUNTY, OHIO

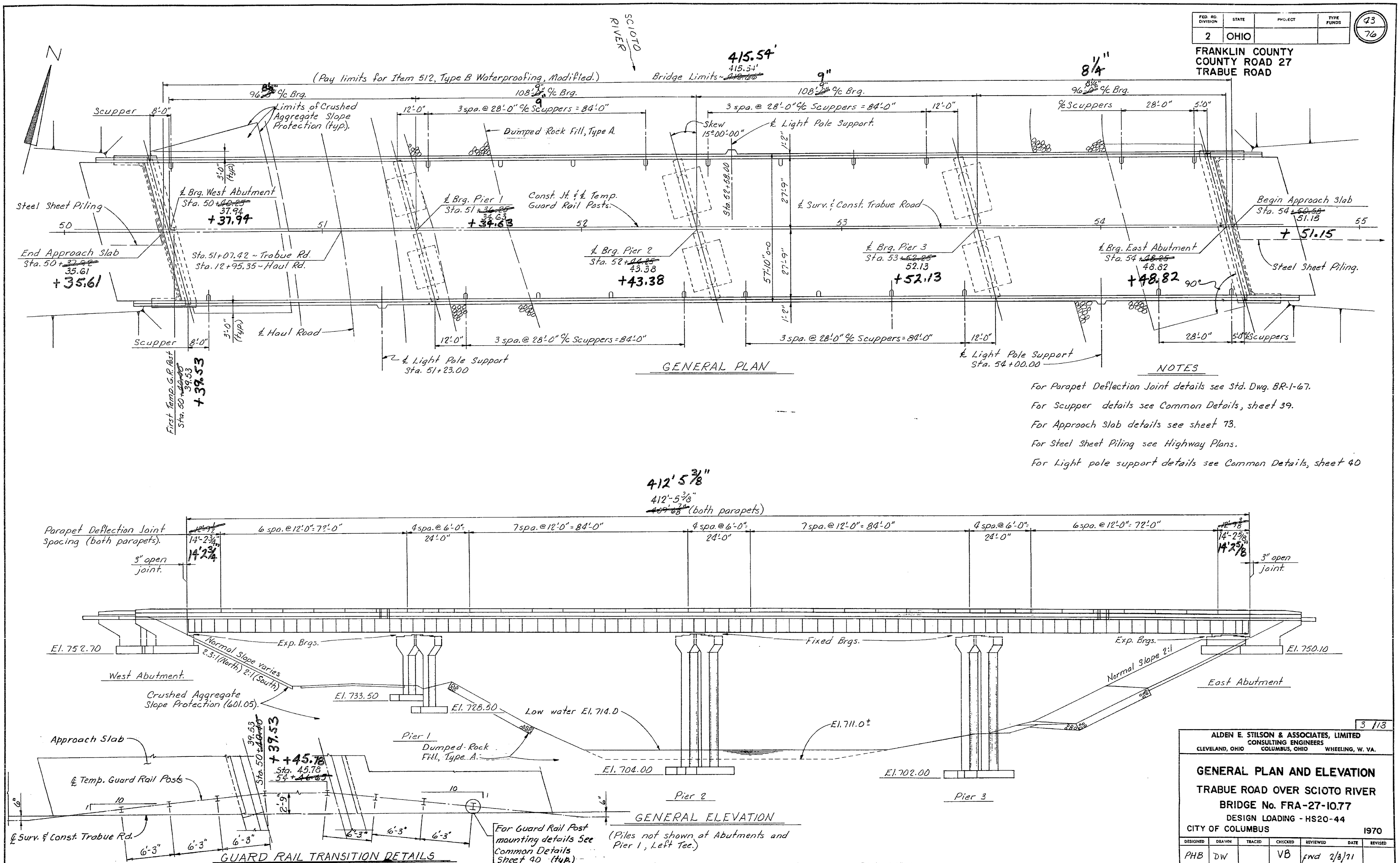
FILE Nº	FRANKLIN COUNTY - TRABUE ROAD BRIDGES DATE OF LETTING ______ 1971 CONTRACT Nº ______

4770 010 TITLE SHEET 1077 1971 0010 060

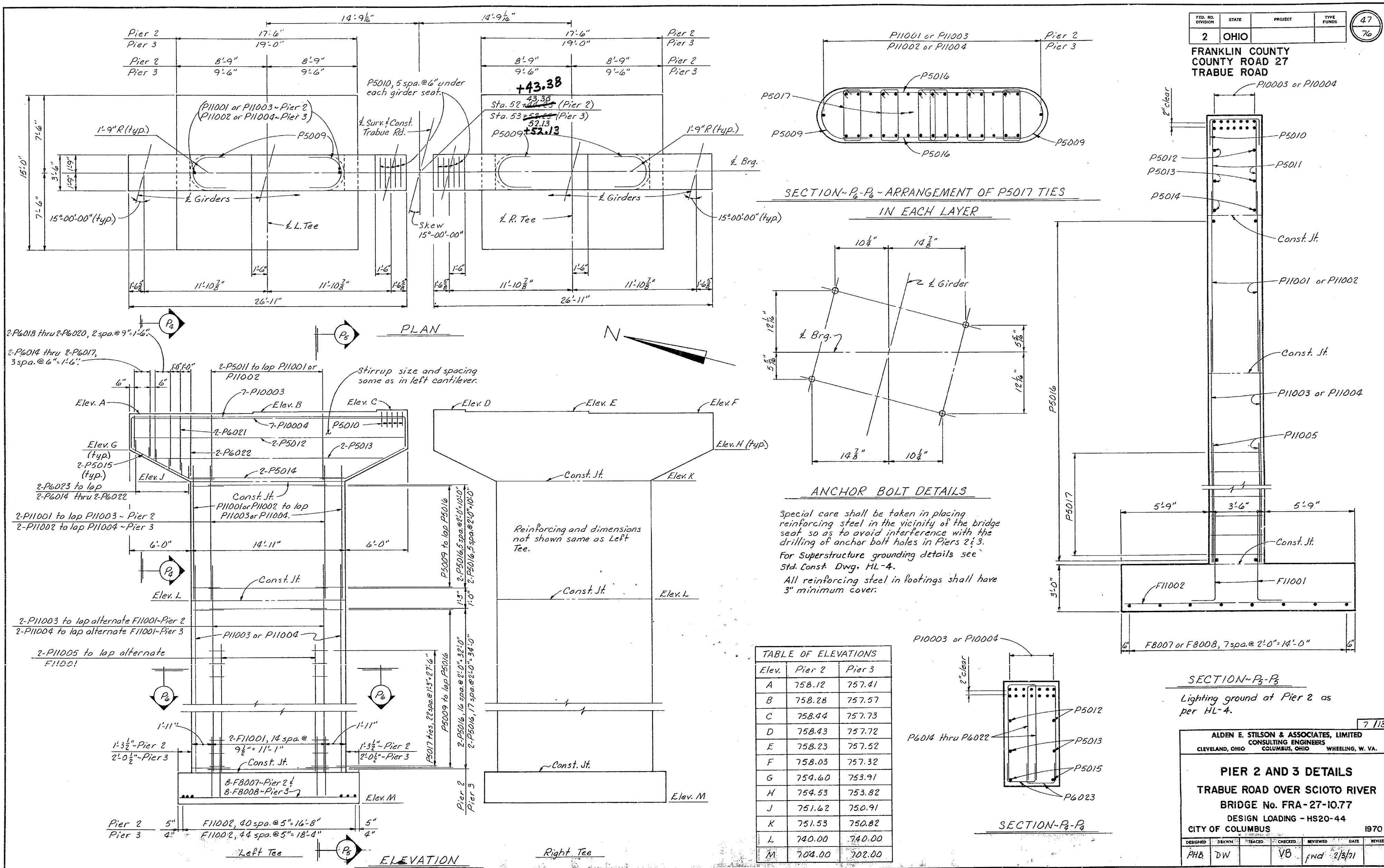
Trabue Rd.



4770 010 REVISED 1077 1971 0061 060



FED. RD. DIVISION 2 | STATE OHIO | PROJECT | TYPE FUNDS
93/76
FRANKLIN COUNTY
COUNTY ROAD 27
TRABUE ROAD
SCIOTO RIVER
(Pay limits for Item 512, Type B Waterproofing, Modified.)
Bridge Limits ~ 415.54'
Limits of Crushed Aggregate Slope Protection (typ).
Dumped Rock Fill, Type A.
Skew 15°00'00"
℄ Light Pole Support.
Scupper
Steel Sheet Piling
℄ Brg. West Abutment Sta. 50+37.94
℄ Brg. Pier 1 Sta. 51+34.63
Const. Jt. & ℄ Temp. Guard Rail Posts.
℄ Surv. & Const. Trabue Road
Begin Approach Slab Sta. 54+51.15
End Approach Slab Sta. 50+35.61
Sta. 51+07.42 ~ Trabue Rd. Sta. 12+95.35 ~ Haul Rd.
℄ Brg. Pier 2 Sta. 52+43.38
℄ Brg. Pier 3 Sta. 53+52.13
℄ Brg. East Abutment Sta. 54+48.82
Steel Sheet Piling.
℄ Haul Road
First Temp. G.R. Post Sta. 50+39.53
℄ Light Pole Support Sta. 51+23.00
℄ Light Pole Support Sta. 54+00.00
GENERAL PLAN
NOTES
For Parapet Deflection Joint details see Std. Dwg. BR-1-67.
For Scupper details see Common Details, sheet 39.
For Approach Slab details see sheet 73.
For Steel Sheet Piling see Highway Plans.
For Light pole support details see Common Details, sheet 40
412'-5 3/8" (both parapets)
Parapet Deflection Joint Spacing (both parapets).
3" open joint.
Exp. Brgs.
Fixed Brgs.
El. 752.70
El. 750.10
West Abutment.
East Abutment
Normal Slope varies 2.3:1 (North) 2:1 (South)
Normal Slope 2:1
Crushed Aggregate Slope Protection (601.05).
El. 733.50
El. 728.50
Low water El. 714.0
El. 711.0±
El. 704.00
El. 702.00
Pier 1
Pier 2
Pier 3
Dumped Rock Fill, Type A.
Approach Slab
℄ Temp. Guard Rail Posts
℄ Surv. & Const. Trabue Rd.
For Guard Rail Post mounting details See Common Details Sheet 40 (typ.)
GUARD RAIL TRANSITION DETAILS
GENERAL ELEVATION
(Piles not shown at Abutments and Pier 1, Left Tee.)
3/13
ALDEN E. STILSON & ASSOCIATES, LIMITED
CONSULTING ENGINEERS
CLEVELAND, OHIO COLUMBUS, OHIO WHEELING, W. VA.
GENERAL PLAN AND ELEVATION
TRABUE ROAD OVER SCIOTO RIVER
BRIDGE No. FRA-27-10.77
DESIGN LOADING - HS20-44
CITY OF COLUMBUS 1970
DESIGNED PHB | DRAWN DW | TRACED | CHECKED VB | REVIEWED FWD 2/3/71
4770 010 REVISED 1077 1971 0081 060
Revised 2-29-72



Special care shall be taken in placing reinforcing steel in the vicinity of the bridge seat so as to avoid interference with the drilling of anchor bolt holes in Piers 2 & 3.

For Superstructure grounding details see Std. Const. Dwg. HL-4.

All reinforcing steel in footings shall have 3" minimum cover.

TABLE OF ELEVATIONS

Elev.	Pier 2	Pier 3
A	758.12	757.41
B	758.28	757.57
C	758.44	757.73
D	758.43	757.72
E	758.23	757.52
F	758.03	757.32
G	754.60	753.91
H	754.53	753.82
J	751.62	750.91
K	751.53	750.82
L	740.00	740.00
M	704.00	702.00

FED. RD. DIVISION	STATE	PROJECT	TYPE FUNDS
2	OHIO		

47/76

FRANKLIN COUNTY
COUNTY ROAD 27
TRABUE ROAD

7/13

ALDEN E. STILSON & ASSOCIATES, LIMITED
CONSULTING ENGINEERS
CLEVELAND, OHIO — COLUMBUS, OHIO — WHEELING, W. VA.

PIER 2 AND 3 DETAILS

TRABUE ROAD OVER SCIOTO RIVER
BRIDGE No. FRA-27-10.77
DESIGN LOADING - HS20-44
CITY OF COLUMBUS 1970

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
PHB	DW		VB	FWD	2/3/71	

4770 010 REVISED 1077 1971 0121 060

REVISED 2-29-72

Revised 2-29-72

HYDROLOGY & HYDRAULIC DATA OBTAINED FROM ODNR
AND
ASSOCIATED HEC-1 INPUT AND OUTPUT

X

EVALUATION OF HYDRAULIC AND HYDROLOGIC (H&H) FEATURES

1. Design Data

A summary of the design of this structure is given in American Society of Civil Engineers Paper No. 1146, entitled "The Improved Water and Sewage Works of Columbus, Ohio," by John H. Gregory. On Page 218 it states "The overflow is 500 feet long, and was designed to discharge a maximum rainfall of 6 inches, on the drainage area of 1032 square miles above the dam, flowing off in 24 hours, or about 166,500 cubic feet per second. To discharge this quantity would require a depth of about 21.7 feet on the overflow." The analysis of this report indicate that the spillway discharging at the top of the dam (171,153 cfs) would pass 70 to 80 percent at the Probable Maximum Flood (PMF). 70 to 80 percent PMF rainfall amounts for a 72-hour duration storm would be 14.76 and 16.87 inches respectively.

After the 1913 flood, the engineering firm of Alvord & Burdick of Chicago, Illinois, prepared "A Report to the Mayor and City Council on Flood Protection for the City of Columbus, Ohio" dated September 15, 1913. In their analysis of the March, 1913, flood they developed a rating curve for Julian Griggs Dam (Page 88, Figure 31). This rating curve was based in part on experimental data and was used in this inspection report for the left abutment ogee section (see Page F-10).

2. Experience Data

Two major flood events have occurred on the Scioto River since construction of the dam. Between March 23 and March 27, 1913, approximately 9.34 inches of rain fell on the watershed above Griggs Dam resulting in a peak water surface 12.8 feet above the crest (elevation 766.2) and a maximum tailwater depth of 25 feet at an estimated flow of 80,000 cfs (See Photograph No.16, Appendix E). According to the above mentioned report, apparently some scouring of rock occurred at the downstream toe of the dam as a result of this flow

The flood of January 21-24, 1959, resulted in a maximum gage reading at Griggs Dam of 763.91 and a peak flow of 50,000 to 55,000 (See Photograph No. 13, Appendix E). Flashboards, installed July 28, 1945, raised the crest elevation 2.2 feet, therefore, the depth of flow over the flashboards was 8.36 feet. However, unconfirmed reports indicate some of the flashboards may have failed during this storm so the actual depth of flow may have been up to 2.2 feet greater in areas. The flashboards are made of wood and were estimated to be 2 inches thick. The flashboards are supported by vertical pipes in the crest of the spillway (see Photograph No. 3, Appendix E). Over 5 inches of rain fell on parts of the watershed during the storm. Runoff exceeded rainfall in many areas because of antecedent snowfall conditions. Apparently no damage occurred to the dam as a result of this flow.

3. Visual Observations

A small smount of flow was passing over the crest of the spillway during the inspection. A close examination couldnot be made of the spillway surface; however, the smooth flow pattern would indicate that no large areas of spalling or eroded concrete exist (See Photographs No. 1 and 2, Appendix E). Past reports have commented on the quality of the concrete surface of the overflow section.

Ponded water at the toe of the dam prevented a determination of the amount of scour which has occurred to stream bedrock in this area. Soundings should be taken at the downstream toe of the dam to determine how much scour has occurred.

4. Hydrology

Since the hazard rating is HIGH and the size classification is INTERMEDIATE, the Recommended Spillway Design Flood (SDF) is the Probable Maximum Flood (PMF). The PMF used in this analysis is generated by 21.09 inches of rain falling in a 72 hour period in accordance with Reference No. 2 (See Page F-10 of this Appendix).

Using reservoir pool records and streamflow records for the U.S.G.S. stream gage located 0.7 mile downstream from O'Shaughnessy Dam, a site-specific unit hydrograph was developed for the O'Shaughnessy Dam. Because of difficulties encountered in locating and obtaining streamflow records, only a single storm (February 26, 1929) was employed in determining the unit graph (See F-7). This unit hydrograph was used in combination with the appropriate runoff amounts to develop inflow hydrographs for the Probable Maximum Flood (PMF) and lesser floods.

To each storm routed through O'Shaughnessy reservoir, local inflow was added to the O'Shaughnessy outflow and the combined flow routing through Griggs Dam. Local inflow was calculated separately for both the east and west sides of the lake downstream from O'Shaughnessy dam by calculating a time of concentration and assuming triangular unit hydrographs (see F-8). The peak inflow rate for the PMF was 250,866 cfs.

Old publications have listed the drainage area of the Scioto River at Griggs Dam at 1032 and 1052 square miles. The latest U.S.G.S. Publication indicates the drainage area is 1044 square miles. 979 square miles of this area is located upstream of O'Shaughnessy Dam. The spillway capacity at the top of the dam is 171,153 cfs. This capacity assumes that the existing flashboards would not fail.

5. Overtopping Potential:

Flood routings indicated the combined discharge-storage capacity of the facility is inadequate to handle flows associated with the PMF. The PMF would cause overtopping of the left and right abutment sections to a maximum depth of 4.72 feet for 28 hours. If the flashboards failed, this depth would be slightly lower. The spillway could pass the inflows associated with a 70 percent PMF.

6. Significance of Overtopping

No serious problems are anticipated as a result of overtopping by storms greater than a 70 percent PMF. The structure itself is all concrete and should experience little deterioration due to flows of this duration and limestone bedrock would be exposed at a shallow depth should erosion occur at the abutments.

7. Spillway Adequacy

Even though the spillway cannot handle flows associated with the PMF, additional spillway capacity is not being recommended at this time.

X

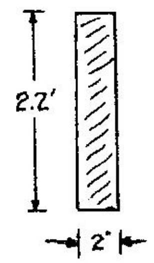
- ALL CALCULATIONS MADE USING WEIR FORMULA $Q = CLH^{3/2}$

- "C" VALUES FOR THE LEFT ABUTMENT (OGEE SHAPED CREST) WERE TAKEN FROM REF. NO. 7 (F-10)

- "C" VALUES FOR THE SPILLWAY (WITH FLASHBOARDS), RIGHT ABUTMENT, AND 47' OF THE L. ABUTMENT (FLAT CREST 6 ft. WIDE) WERE DERIVED USING REF. NO. 3

  NOTE: "C" for all calculations of flow over flashboards (1) was "3.90". {since H/b is a Large No., 3.90 is thought to yield conservative values of flow over this area.}

FLASHBOARD DIMENSIONS:



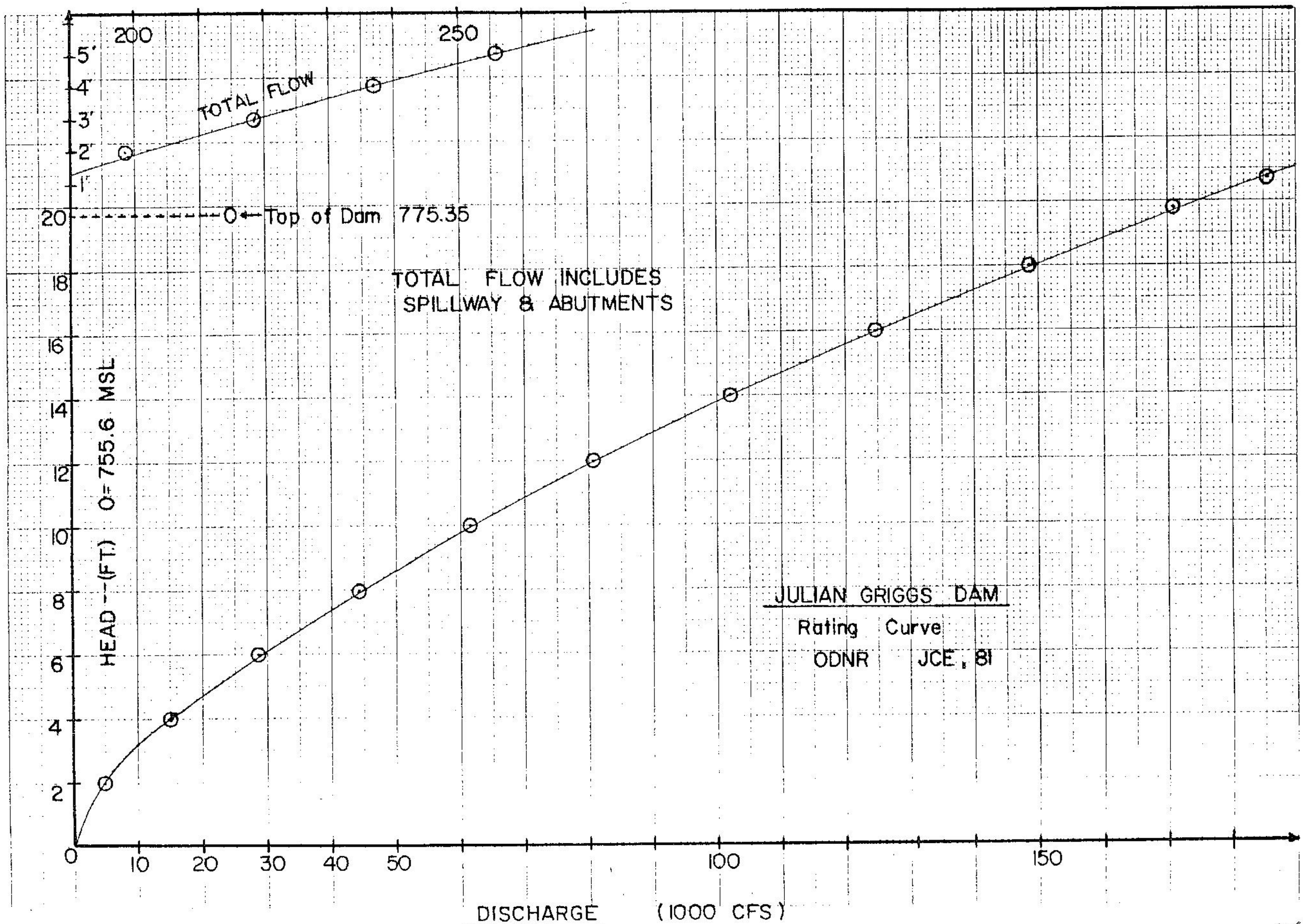
BREATH : 2"
HEIGHT : 2.2'

(1) SPILLWAY L=500'

(2) LEFT ABUTMENT L = 196'

(3) RIGHT ABUTMENT L = 220' + 47' of L. ABUT.

ELEV. MSL	(1) H	(1) C	(1) Q	(2) H	(2) C	(2) Q	(3) H	(3) H/L	(3) C	(3) Q	TOTAL Q
	ft.		cfs.	ft.		cfs.	ft.	L=6'		cfs.	cfs.
755.60	–	3.90	–								
757.60	2	↓	5515								5515
759.60	4		15,600								15,600
761.60	6		28,659								28,659
763.60	8		44,123								44,123
765.60	10		61,664								61,664
767.60	12		81,060								81,060
769.60	14		102,147								102,147
771.60	16		124,800								124,800
773.60	18		148,917								148,917
775.35	19.75		171,153	0			0				171,153
776.35	20.75		184,315	1	3.04	596	1	.167	2.78	742	185,653
777.35	21.75		194,799	2	3.14	1741	2	.33	2.81	2122	198,662
778.35	22.75		211,596	3	3.17	3228	3	.50	2.83	3926	218,750
779.35	23.75		225,699	4	3.20	5018	4	.67	2.88	6152	236,869
780.35	24.75	↓	240,103	5	3.23	7078	5	.83	2.97	8866	256,047


200
250
5'
4'
3'
2'
1'
TOTAL FLOW
20
0←Top of Dam 775.35
18
TOTAL FLOW INCLUDES
SPILLWAY & ABUTMENTS
16
14
12
10
8
6
4
2
HEAD --(FT.) 0= 755.6 MSL
JULIAN GRIGGS DAM
Rating Curve
ODNR JCE, 81
0
10
20
30
40
50
100
150
DISCHARGE (1000 CFS)

STATE of OHIO

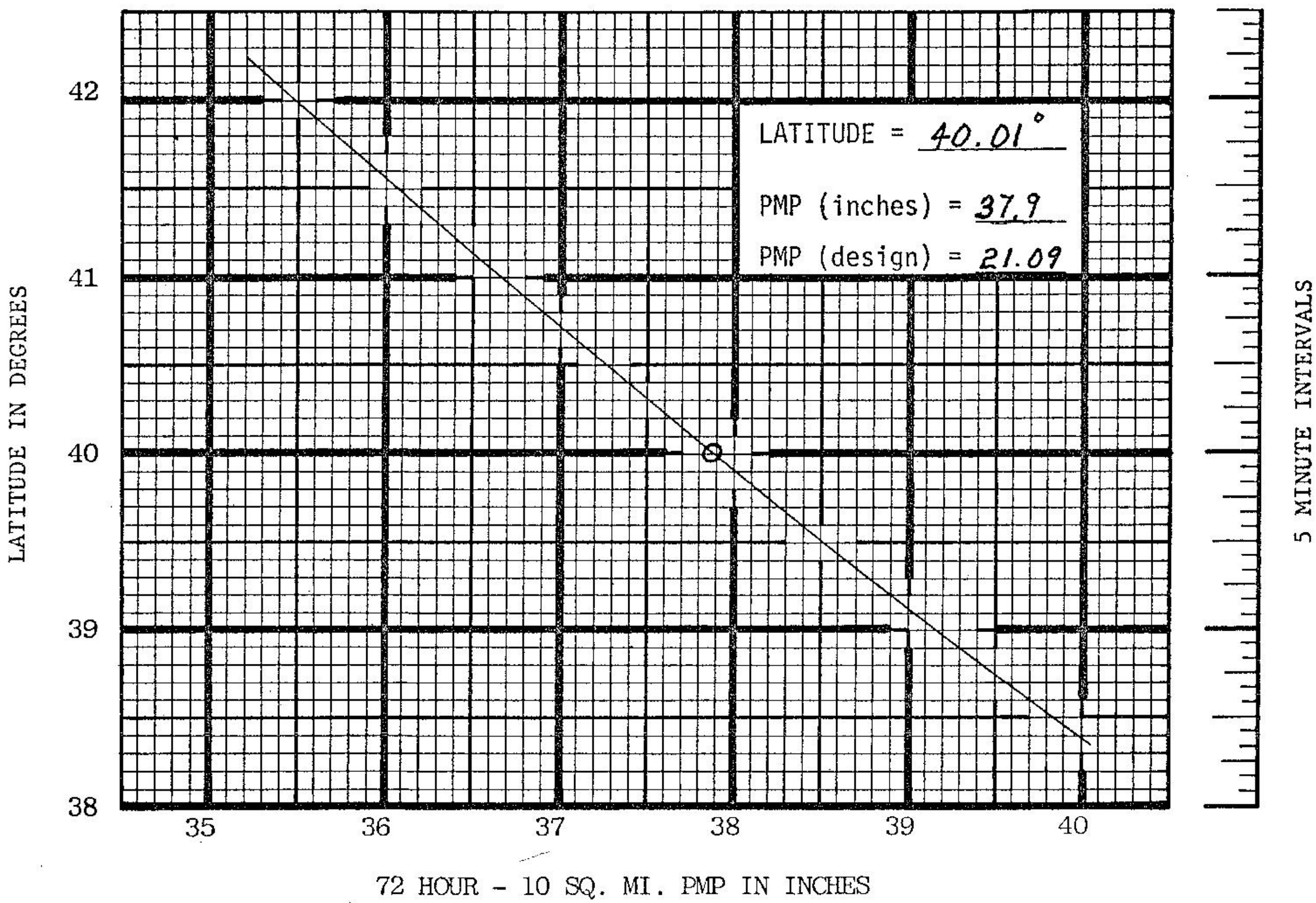
PMP vs LATITUDE

for

DAM SAFETY ANALYSIS

U.S. ARMY ENGR. DIST., PITTSBURGH

WHS DEC, 77



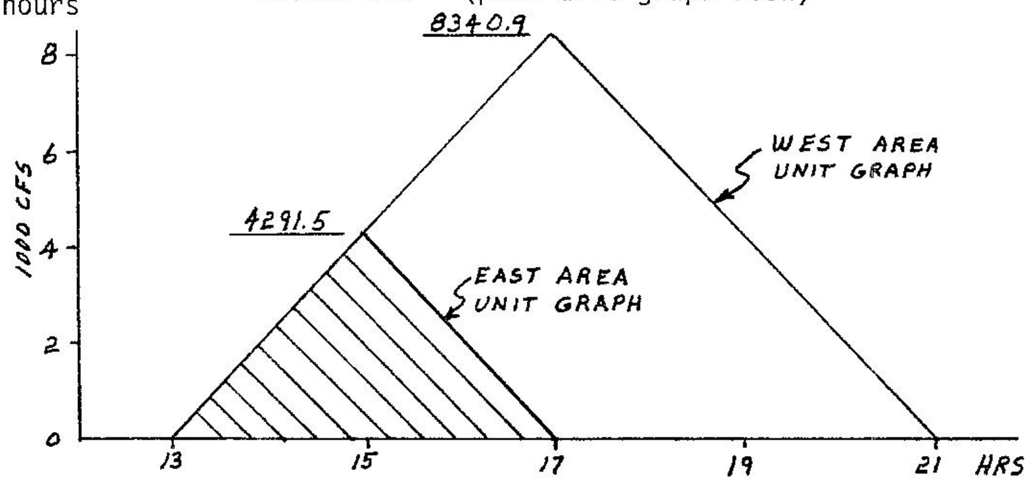
Development of Triangular Unit Hydrographs for
Local Area between O'Shaughnessy and Griggs

Total Drainage Area for Griggs	=	1044 sq. mi.
Total Drainage Area for O'Shaughnessy	=	979 sq. mi.
Local Drainage Area		65 sq. mi.

Local	65.0	
-East	13.3	(from planimetered data)
West	51.7	

Time of concentration for the West area was estimated to be 4 hours.

$$\frac{(1\ \text{inch})(51.7\ \text{mi}^2)}{4\ \text{hours}} = 8340.9\ \text{cfs}$$ (peak unit graph flow)



It was assumed that the inflow would occur beginning at hour 13 of the storm to be consistent with the rainfall and runoff pattern of the 24 hour precipitation used to develop the unit hydrograph for O'Shaughnessy Reservoir.

Time of concentration for East area was assumed to be 2 hours.

$$\frac{(1\ \text{inch})(13.3\ \text{miles})}{2\ \text{hours}} = 4291.5\ \text{cfs}$$

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  21 AUG 78
**********************************
A1                                JULIAN GRIGGS DAM
A2                FEDERAL INVENTORY NO. OH-740 / OHIO FILE NO. 0030-001
A3                  O,SHAUGHNESSY OUTFLOW COMBINED WITH LOCAL INFLOW
B        70       2       0       0       0       0       0       0       0       0
B1        5
J         1       7       0
J1      .25     .50     .60     .70     .80     .90     1.0
K         0       1                       2       0       1
K1          CALCULATION OF INFLOW HYDROGRAPH
M         1      -1     979            1044                                       1
P         0   37.77      35      43      49      56      61
T                                                       1.8    .029
U        70
U1        0      66      73      85     117     224     544    2293    5234   12216
U1    13364   13842   14499   14871   15428   16017   15715   14861   14368   13551
U1    12700   11800   10800    9864    8864    7961    7074    6389    5800    5272
U1     4684    4147    3809    3490    3218    2986    2770    2578    2422    2279
U1     2157    2041    1938    1848    1759    1672    1593    1513    1433    1360
U1     1284    1208    1131    1065     995     929     856     793     723     660
U1      597     544     484     435     385     338     250     200     130      40
X         0       0       1
K         1       2                       2       0       1
K1          FLOOD ROUTINGS          WITH FLASHBOARDS
Y                                 1       1
Y1        1                                          -847.9      -1
Y4    847.9   848.5     849     850     852     854     856     858     860   861.8
Y4      862     864     866  866.25     868     870
Y5        0    1104    2916    8569   25032   45420   68664   94504  131461  173785
Y5   178434  222287  284212  293081  362642  466698
$S    16285   16750   17250   18383   20400   22950   25800   29050   32523   36066
$S    36450   40500   44800   45400   49250   53803
$E    847.9   848.5     849     850     852     854     856     858     860   861.8
$E      862     864     866  866.25     868     870
$$    847.9
$D    861.8
K         0       3                       2       0       1
K1          DETERMINATION OF LOCAL INFLOW TO GRIGGS - EAST DA.
M         1      -1    13.3            1044                                       1
P         0   37.77      35      43      49      56      61
T                                                      1.94    .029
U         7
U1        0       0       0       0       0  4291.5       0
X         0       0       1
K         0       4                       2       0       1
K1          DETERMINATION OF LOCAL INFLOW TO GRIGGS - WEST DA.
M         1      -1    51.7            1044                                       1
P         0   37.77      35      43      49      56      61
T                                                      1.83    .029
U         9
U1        0       0       0       0       0  4170.5    8341  4170.5       0
X         0       0       1
K         3       5                       2       0       1
K1          COMBINE LOCAL INFLOWS AND O,SHAUGHNESSY OUTFLOW
K         1       6                       2       0       1
K1          ROUTE COMBINED FLOW THROUGH GRIGGS DAM
Y                                 1       1
Y1        1                                          -755.6      -1
Y4    755.6   757.6   759.6   761.6   763.6   765.6   767.6   769.6   771.6   773.6
Y4   775.35  776.35  777.35  778.35  779.35  780.35
Y5        0    5515   15600   28559   44123   61664   81060  102147  124800  148917
Y5   171153  185653  198662  218750  236869  256047
$A        0      95     225     380     560     755     960
$E      723     735     745     755     765     775     785
$$    755.6
$D   775.35
K        99
A
A
A
A
A
```

O'SHAUGNESSY

SUMMARY OF DAM SAFETY ANALYSIS

LAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	847.90	847.90	861.80
STORAGE	16285.	16285.	36066.
OUTFLOW	0.	0.	173785.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.25	853.68	0.0	22543.	42165.	0.0	72.00	0.0
0.50	859.01	0.0	30805.	113181.	0.0	70.00	0.0
0.60	860.42	0.0	33355.	141399.	0.0	70.00	0.0
0.70	861.59	0.0	35658.	168916.	0.0	70.00	0.0
0.80	862.77	0.97	38009.	195318.	14.00	70.00	0.0
0.90	864.00	2.20	40501.	222295.	24.00	70.00	0.0
1.00	864.89	3.09	42417.	249893.	28.00	70.00	0.0

F-15

GRIGGS

SUMMARY OF DAM SAFETY ANALYSIS

LAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	755.60	755.60	775.35
STORAGE	5156.	5156.	16412.
OUTFLOW	0.	0.	171153.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.25	763.39	0.0	8719.	42479.	0.0	74.00	0.0
0.50	770.63	0.0	13041.	113775.	0.0	72.00	0.0
0.60	773.02	0.0	14692.	141904.	0.0	72.00	0.0
0.70	775.22	0.0	16317.	169559.	0.0	72.00	0.0
0.80	777.17	1.82	17829.	196283.	16.00	72.00	0.0
0.90	778.62	3.27	19004.	223558.	24.00	72.00	0.0
1.00	780.07	4.72	20230.	250866.	28.00	72.00	0.0

REFERENCES

1. Six Hour Unit Hydrograph Determination for State of Ohio Dam Safety Inspection, U.S. Army Corps of Engineers, Pittsburgh District.

2. Supplemental Hydrologic and Hydraulic Information for State of Ohio Dam Safety Inspection, U.S. Army Corps of Engineers, Pittsburgh District.

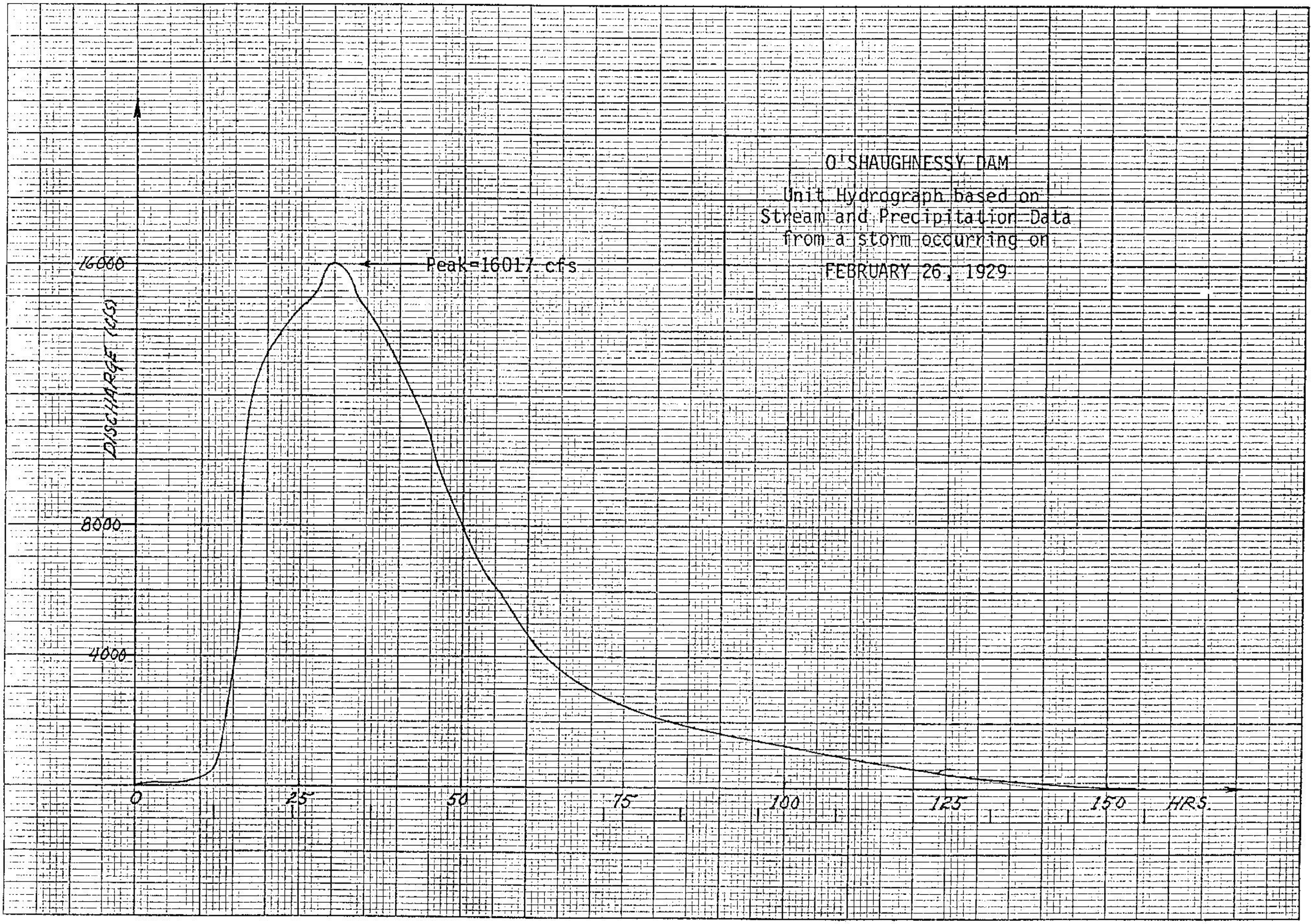
3. "Free Flow Coefficients for Flat Crested Weirs" from paper A-39, XIII Congress Proceedings of IAHR.

4. Recommended Guidelines for Safety Inspections of Dams, Department of the Army, Office of the Chief of Engineers, Washington, D.C.

5. "National Program of Inspection of Non-Federal Dams" Department of the Army, Office of the Chief of Engineers, Circular No. 1110-2-188, 30 December 1977.

6. "Techniques of Water Resource Investigations of the United States Geological Survey," Measurement of Peak Discharge at Dam by Indirect Methods, Pages 4 and 27.

7. "A Report to the Mayor and City Council on Flood Protection for the City of Columbus, Ohio" dated September 15, 1913, by Alvord & Burdick of Chicago, Illinois.


O'SHAUGHNESSY DAM
Unit Hydrograph based on
Stream and Precipitation Data
from a storm occurring on
FEBRUARY 26, 1929
Peak=16017 cfs
DISCHARGE (CFS)
16000
8000
4000
0
25
50
75
100
125
150
HRS.

```
1*****************************************                                                            ***************************************
 *                                       *                                                            *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                            *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998                *                                                            *    HYDROLOGIC ENGINEERING CENTER    *
 *          VERSION 4.1                  *                                                            *          609 SECOND STREET          *
 *                                       *                                                            *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   21MAR18  TIME  09:59:27   *                                                            *           (916) 756-1104            *
 *                                       *                                                            *                                     *
 *****************************************                                                            ***************************************



                                                        X     X  XXXXXXX   XXXXX          X
                                                        X     X  X        X     X        XX
                                                        X     X  X        X               X
                                                        XXXXXXX  XXXX     X       XXXXX   X
                                                        X     X  X        X               X
                                                        X     X  X        X     X         X
                                                        X     X  XXXXXXX   XXXXX         XXX



                  THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

                  THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
                  THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
                  NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
                  DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
                  KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                       HEC-1 INPUT                                                         PAGE  1

                 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                   1           ID         SCIOTO RIVER BELOW GRIGGS DAM
                   2           ID         PMF- BASED ON CORPS OF ENGINEERS 1980 PHASE I STUDY
                   3           ID         O'SHAUGHNESSY OUTFLOW COMBINED WITH LOCAL INFLOW
                   4           ID         HARTMAN ENGINEERING, MARCH 2018
                   5           IT     120       0       0     100
                   6           IO       0
                               *
                   7           JR    FLOW     1.0 0.22810

                   8           KK  INFLOW CALCULATION OF RUNOFF TO O'SHAUGHNESSY DAM
                   9           KO       5
                  10           BA     979
                               *   Rainfall Data from Phase I Report
                  11           PM   37.77       0       0      NO      35      43      49      56      61
```

```
                 *
   12            LU     1.8   0.029
                 *
   13            IN     120
   14            UI       0      66      73      85     117     224     544    2293    5234   12216
   15            UI   13364   13842   14499   14871   15428   16017   15715   14861   14368   13551
   16            UI   12700   11800   10800    9864    8864    7961    7074    6389    5800    5272
   17            UI    4684    4147    3809    3490    3218    2986    2770    2578    2422    2279
   18            UI    2157    2041    1938    1848    1759    1672    1593    1513    1433    1360
   19            UI    1284    1208    1131    1065     995     929     856     793     723     660
   20            UI     597     544     484     435     385     338     250     200     130      40
                 *

   21            KK  OSHAUG ROUTE FLOWS THROUGH O'SHAUGNESSY RES ASSUMING FLASHBOARDS IN PLACE
   22            KO       5
   23            RS       1    ELEV   847.9
   24            SQ       0    1104    2916    8568   25032   45420   68664   94504  131461  173785
   25            SQ  178434  222287  284212  293081  362642  466698
   26            SE   847.9   848.5     849     850     852     854     856     858     860   861.8
   27            SE     862     864     866  866.25     868     870
   28            SV   16285   16750   17250   18383   20400   22950   25800   29050   32523   36066
   29            SV   36450   40500   44800   45400   49250   53803
   30            SE   847.9   848.5     849     850     852     854     856     858     860   861.8
   31            SE     862     864     866  866.25     868     870
   32            SS   847.9
   33            ST   861.8
                 *
                 *  Compute local inflow to Griggs Reservoir from the East

   34            KK    EAST
   35            KO       5
   36            BA    13.3
                 *   Rainfall Data from Phase I Report
   37            PM   37.77       0       0      NO      35      43      49      56      61
                 *
   38            LU    1.94   0.029
                 *
   39            IN     120
   40            UI       0       0       0       0       0  4291.5       0
                 *
                 *  Compute local inflow to Griggs Reservoir from the West
1                                          HEC-1 INPUT                                          PAGE  2

         LINE    ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


   41            KK    WEST
   42            KO       5
   43            BA    51.7
                 *   Rainfall Data from Phase I Report
   44            PM   37.77       0       0      NO      35      43      49      56      61
                 *
```

```
         45           LU    1.83   0.029
                      *
         46           IN     120
         47           UI       0       0       0       0       0  4170.5    8341  4170.5       0
                      *
                      *  Combine all three hydrographs for inflow to Griggs Dam

         48           KK    COMB
         49           KO       5
         50           HC       3
                      *

         51           KK   GRIGG  ROUTE COMBINED FLOWS THROUGH GRIGGS RESERVOIR
         52           RS       1    ELEV   755.6
         53           SQ       0    5515   15600   28659   44123   61664   81060  102147  124800  148917
         54           SQ  171153  185653  198662  218750  236869  256047
         55           SE   755.6   757.6   759.6   761.6   763.6   765.6   767.6   769.6   771.6   773.6
         56           SE  775.35  776.35  777.35  778.35  779.35  780.35
         57           SA       0      95     225     380     560     755     960
         58           SE     723     735     745     755     765     775     785
         59           SS   755.6
         60           ST  775.35
                      *
         61           ZZ
1*****************************************                                                    *****************************************
 *                                       *                                                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998                *                                                    *    HYDROLOGIC ENGINEERING CENTER      *
 *          VERSION 4.1                  *                                                    *          609 SECOND STREET            *
 *                                       *                                                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   21MAR18  TIME  09:59:27   *                                                    *           (916) 756-1104              *
 *                                       *                                                    *                                       *
 *****************************************                                                    *****************************************




                                SCIOTO RIVER BELOW GRIGGS DAM
                                PMF- BASED ON CORPS OF ENGINEERS 1980 PHASE I STUDY
                                O'SHAUGHNESSY OUTFLOW COMBINED WITH LOCAL INFLOW
                                HARTMAN ENGINEERING, MARCH 2018

    6 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           0  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN         120  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1    0  STARTING DATE
                        ITIME        0000  STARTING TIME
```

```
                    NQ         100  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE      9    0  ENDING DATE
                NDTIME        0600  ENDING TIME
                ICENT           19  CENTURY MARK

             COMPUTATION INTERVAL    2.00 HOURS
                  TOTAL TIME BASE  198.00 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT

    JP          MULTI-PLAN OPTION
                      NPLAN           1  NUMBER OF PLANS

    JR          MULTI-RATIO OPTION
                    RATIOS OF RUNOFF
                   1.00       .23


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
   8 KK    *   INFLOW   *      CALCULATION OF RUNOFF TO O'SHAUGHNESSY DAM
           *            *
           **************

   9 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
  21 KK    *   OSHAUG   *      ROUTE FLOWS THROUGH O'SHAUGNESSY RES ASSUMING FLASHBOARDS IN PLACE
           *            *
           **************

  22 KO          OUTPUT CONTROL VARIABLES
```

```
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

         **************
         *            *
  34 KK  *      EAST  *
         *            *
         **************

  35 KO          OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

         **************
         *            *
  41 KK  *      WEST  *
         *            *
         **************

  42 KO          OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

         **************
         *            *
  48 KK  *      COMB  *
         *            *
         **************

  49 KO          OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 51 KK    *   GRIGG    *      ROUTE COMBINED FLOWS THROUGH GRIGGS RESERVOIR
          *            *
          **************

             HYDROGRAPH ROUTING DATA

 52 RS         STORAGE ROUTING
                     NSTPS           1  NUMBER OF SUBREACHES
                      ITYP        ELEV  TYPE OF INITIAL CONDITION
                    RSVRIC      755.60  INITIAL CONDITION
                         X         .00 WORKING R AND D COEFFICIENT

 57 SA              AREA          .0      95.0     225.0     380.0     560.0     755.0     960.0

 58 SE         ELEVATION      723.00    735.00    745.00    755.00    765.00    775.00    785.00

 53 SQ         DISCHARGE          0.     5515.    15600.    28659.    44123.    61664.    81060.   102147.   124800.   148917.
                             171153.   185653.   198662.   218750.   236869.   256047.

 55 SE         ELEVATION      755.60    757.60    759.60    761.60    763.60    765.60    767.60    769.60    771.60    773.60
                              775.35    776.35    777.35    778.35    779.35    780.35

 59 SS         SPILLWAY
                      CREL      755.60  SPILLWAY CREST ELEVATION
                     SPWID         .00  SPILLWAY WIDTH
                      COQW         .00  WEIR COEFFICIENT
                      EXPW        1.50  EXPONENT OF HEAD

 60 ST         TOP OF DAM
                     TOPEL      775.35  ELEVATION AT TOP OF DAM
                    DAMWID         .00  DAM WIDTH
                      COQD         .00  WEIR COEFFICIENT
                      EXPD         .00  EXPONENT OF HEAD
                                                                        ***

                                                        COMPUTED STORAGE-ELEVATION DATA

          STORAGE         .00    380.00   1934.01   4925.35   9596.36  16147.13  24701.64
        ELEVATION      723.00    735.00    745.00    755.00    765.00    775.00    785.00

                                                    COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

                                                          (INCLUDING FLOW OVER DAM)
```

STORAGE	.00	380.00	1934.01	4925.35	5156.28	5969.32	6851.02	7804.16	8831.53	9596.36
OUTFLOW	.00	.00	.00	.00	.00	5515.00	15600.00	28659.00	44123.00	56401.91
ELEVATION	723.00	735.00	745.00	755.00	755.60	757.60	759.60	761.60	763.60	765.00

STORAGE	9935.61	11114.19	12367.99	13699.32	15110.51	16147.13	16412.54	17184.02	17975.10	18786.03
OUTFLOW	61664.00	81060.00	102147.00	124800.00	148917.00	166706.10	171153.00	185653.00	198662.00	218750.00
ELEVATION	765.60	767.60	769.60	771.60	773.60	775.00	775.35	776.35	777.35	778.35

STORAGE	19617.06	20468.42	24701.64
OUTFLOW	236869.00	256047.00	345225.20
ELEVATION	779.35	780.35	785.00

****

HYDROGRAPH AT STATION GRIGG
PLAN 1, RATIO = 1.00

****

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	5156.3	755.6	*	3		2000	35	245485.	19997.0	779.8	*	6		1600	69	27857.	7743.5	761.5
1		0200	2	0.	5156.3	755.6	*	3		2200	36	249453.	20173.4	780.0	*	6		1800	70	26392.	7633.5	761.3
1		0400	3	0.	5156.3	755.6	*	4		0000	37	250318.	20212.0	780.1	*	6		2000	71	24855.	7519.0	761.0
1		0600	4	0.	5156.3	755.6	*	4		0200	38	247710.	20095.8	779.9	*	6		2200	72	23375.	7409.7	760.8
1		0800	5	0.	5156.3	755.6	*	4		0400	39	240190.	19763.0	779.5	*	7		0000	73	21971.	7306.9	760.6
1		1000	6	0.	5156.3	755.6	*	4		0600	40	228646.	19237.4	778.9	*	7		0200	74	20639.	7210.2	760.4
1		1200	7	0.	5156.3	755.6	*	4		0800	41	215230.	18642.5	778.2	*	7		0400	75	19348.	7117.1	760.2
1		1400	8	0.	5156.3	755.6	*	4		1000	42	203647.	18174.5	777.6	*	7		0600	76	18071.	7025.8	760.0
1		1600	9	0.	5156.3	755.6	*	4		1200	43	195326.	17770.3	777.1	*	7		0800	77	16828.	6937.6	759.8
1		1800	10	0.	5156.3	755.6	*	4		1400	44	181732.	16973.5	776.1	*	7		1000	78	15606.	6851.5	759.6
1		2000	11	2.	5156.6	755.6	*	4		1600	45	167094.	16170.2	775.0	*	7		1200	79	14546.	6755.5	759.4
1		2200	12	7.	5157.3	755.6	*	4		1800	46	153775.	15389.6	774.0	*	7		1400	80	13378.	6650.7	759.2
2		0000	13	13.	5158.1	755.6	*	4		2000	47	140526.	14610.3	772.9	*	7		1600	81	12269.	6552.1	758.9
2		0200	14	20.	5159.1	755.6	*	4		2200	48	128490.	13910.0	771.9	*	7		1800	82	11171.	6455.2	758.7
2		0400	15	409.	5214.2	755.7	*	5		0000	49	118701.	13333.1	771.1	*	7		2000	83	10132.	6364.3	758.5
2		0600	16	1180.	5324.7	756.0	*	5		0200	50	108510.	12734.0	770.2	*	7		2200	84	9118.	6276.3	758.3
2		0800	17	1427.	5360.2	756.1	*	5		0400	51	98903.	12170.1	769.3	*	8		0000	85	8259.	6202.3	758.1
2		1000	18	1111.	5314.7	756.0	*	5		0600	52	90669.	11676.1	768.5	*	8		0200	86	7475.	6135.2	758.0
2		1200	19	1908.	5430.0	756.3	*	5		0800	53	83061.	11229.9	767.8	*	8		0400	87	6554.	6056.9	757.8
2		1400	20	4304.	5784.9	757.2	*	5		1000	54	76449.	10827.3	767.1	*	8		0600	88	5547.	5972.0	757.6
2		1600	21	7395.	6128.4	758.0	*	5		1200	55	70064.	10436.9	766.5	*	8		0800	89	4809.	5861.5	757.3
2		1800	22	12073.	6534.7	758.9	*	5		1400	56	64449.	10100.3	765.9	*	8		1000	90	3874.	5720.4	757.0
2		2000	23	18938.	7087.8	760.1	*	5		1600	57	59571.	9799.9	765.4	*	8		1200	91	2977.	5586.8	756.7
2		2200	24	26303.	7626.8	761.2	*	5		1800	58	55153.	9516.8	764.9	*	8		1400	92	2250.	5479.9	756.4
3		0000	25	42050.	8689.4	763.3	*	5		2000	59	50952.	9252.2	764.4	*	8		1600	93	1695.	5399.0	756.2
3		0200	26	82081.	11173.2	767.7	*	5		2200	60	47395.	9031.6	764.0	*	8		1800	94	1304.	5342.5	756.1
3		0400	27	116712.	13215.0	770.9	*	6		0000	61	44280.	8841.1	763.6	*	8		2000	95	1053.	5306.4	756.0
3		0600	28	113991.	13054.3	770.6	*	6		0200	62	41834.	8674.7	763.3	*	8		2200	96	887.	5282.5	755.9
3		0800	29	108697.	12744.8	770.2	*	6		0400	63	39203.	8496.5	763.0	*	9		0000	97	760.	5264.3	755.9
3		1000	30	139772.	14565.9	772.8	*	6		0600	64	36810.	8336.2	762.7	*	9		0200	98	656.	5249.5	755.8
3		1200	31	187861.	17316.9	776.5	*	6		0800	65	34689.	8195.8	762.4	*	9		0400	99	564.	5236.4	755.8

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
3		1400	32	216161.	18680.4	778.2	*	6		1000	66	32757.	8069.1	762.1	*	9		0600	100	479.	5224.3	755.8
3		1600	33	228197.	19216.8	778.9	*	6		1200	67	30975.	7953.2	761.9	*							
3		1800	34	238354.	19682.3	779.4	*	6		1400	68	29303.	7845.5	761.7	*							

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PEAK OUTFLOW IS 250318. AT TIME 72.00 HOURS

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	198.00-HR
+	(CFS)	(HR)					
			(CFS)				
+	250318.	72.00		248790.	229582.	145736.	60048.
			(INCHES)	2.216	8.178	15.575	17.647
			(AC-FT)	123367.	455369.	867188.	982608.

	PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	198.00-HR
+	(AC-FT)	(HR)				
	20212.	72.00	20144.	19285.	14712.	9333.

	PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	198.00-HR
+	(FEET)	(HR)				
	780.05	72.00	779.97	778.94	772.63	763.41

CUMULATIVE AREA = 1044.00 SQ MI

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HYDROGRAPH AT STATION GRIGG
PLAN 1, RATIO = .23

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	5156.3	755.6	*	3		2000	35	55234.	9522.0	764.9	*	6		1600	69	6556.	6057.1	757.8
1		0200	2	0.	5156.3	755.6	*	3		2200	36	56443.	9599.0	765.0	*	6		1800	70	6194.	6026.5	757.7
1		0400	3	0.	5156.3	755.6	*	4		0000	37	57001.	9634.7	765.1	*	6		2000	71	5846.	5997.2	757.7
1		0600	4	0.	5156.3	755.6	*	4		0200	38	56891.	9627.6	765.1	*	6		2200	72	5513.	5969.0	757.6
1		0800	5	0.	5156.3	755.6	*	4		0400	39	55609.	9545.8	764.9	*	7		0000	73	5281.	5933.4	757.5
1		1000	6	0.	5156.3	755.6	*	4		0600	40	53014.	9381.5	764.6	*	7		0200	74	4992.	5889.3	757.4
1		1200	7	0.	5156.3	755.6	*	4		0800	41	49976.	9191.3	764.3	*	7		0400	75	4694.	5844.0	757.3
1		1400	8	0.	5156.3	755.6	*	4		1000	42	47299.	9025.7	764.0	*	7		0600	76	4400.	5799.5	757.2
1		1600	9	0.	5156.3	755.6	*	4		1200	43	44965.	8882.7	763.7	*	7		0800	77	4111.	5756.0	757.1
1		1800	10	0.	5156.3	755.6	*	4		1400	44	42430.	8715.3	763.4	*	7		1000	78	3830.	5713.7	757.0
1		2000	11	1.	5156.4	755.6	*	4		1600	45	39299.	8502.9	763.0	*	7		1200	79	3552.	5672.2	756.9
1		2200	12	2.	5156.5	755.6	*	4		1800	46	35977.	8280.9	762.5	*	7		1400	80	3280.	5631.7	756.8
2		0000	13	3.	5156.7	755.6	*	4		2000	47	32893.	8078.0	762.1	*	7		1600	81	3026.	5594.0	756.7

2	0200	14	5.	5156.9	755.6 *	4	2200	48	30062.	7894.2	761.8 *	7	1800	82	2798.	5560.4	756.6
2	0400	15	94.	5169.5	755.6 *	5	0000	49	27696.	7731.4	761.5 *	7	2000	83	2581.	5528.4	756.5
2	0600	16	270.	5194.5	755.7 *	5	0200	50	25348.	7555.6	761.1 *	7	2200	84	2361.	5496.2	756.5
2	0800	17	326.	5202.5	755.7 *	5	0400	51	23140.	7392.4	760.8 *	8	0000	85	2141.	5463.9	756.4
2	1000	18	253.	5192.1	755.7 *	5	0600	52	21017.	7237.5	760.4 *	8	0200	86	1920.	5431.7	756.3
2	1200	19	416.	5215.2	755.8 *	5	0800	53	19107.	7099.9	760.1 *	8	0400	87	1694.	5398.9	756.2
2	1400	20	903.	5284.8	755.9 *	5	1000	54	17458.	6982.2	759.9 *	8	0600	88	1461.	5365.2	756.1
2	1600	21	1412.	5358.1	756.1 *	5	1200	55	16027.	6881.1	759.7 *	8	0800	89	1235.	5332.5	756.0
2	1800	22	2204.	5473.2	756.4 *	5	1400	56	14850.	6783.1	759.5 *	8	1000	90	1033.	5303.5	756.0
2	2000	23	3515.	5666.6	756.9 *	5	1600	57	13742.	6683.3	759.2 *	8	1200	91	850.	5277.2	755.9
2	2200	24	4913.	5877.3	757.4 *	5	1800	58	12744.	6594.2	759.0 *	8	1400	92	680.	5252.9	755.8
3	0000	25	8322.	6207.7	758.2 *	5	2000	59	11771.	6508.0	758.8 *	8	1600	93	535.	5232.3	755.8
3	0200	26	16673.	6926.6	759.8 *	5	2200	60	10939.	6434.8	758.7 *	8	1800	94	421.	5216.0	755.8
3	0400	27	25071.	7535.0	761.1 *	6	0000	61	10210.	6371.1	758.5 *	8	2000	95	334.	5203.7	755.7
3	0600	28	25324.	7553.8	761.1 *	6	0200	62	9566.	6315.1	758.4 *	8	2200	96	268.	5194.3	755.7
3	0800	29	24734.	7510.0	761.0 *	6	0400	63	8983.	6264.7	758.3 *	9	0000	97	219.	5187.2	755.7
3	1000	30	30317.	7910.7	761.8 *	6	0600	64	8508.	6223.7	758.2 *	9	0200	98	180.	5181.8	755.7
3	1200	31	40077.	8555.4	763.1 *	6	0800	65	8119.	6190.3	758.1 *	9	0400	99	149.	5177.4	755.7
3	1400	32	47306.	9026.2	764.0 *	6	1000	66	7724.	6156.4	758.0 *	9	0600	100	123.	5173.7	755.6
3	1600	33	50854.	9246.1	764.4 *	6	1200	67	7323.	6122.2	758.0 *						
3	1800	34	53339.	9402.0	764.7 *	6	1400	68	6932.	6089.0	757.9 *						
					*						*						

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PEAK OUTFLOW IS 57001. AT TIME 72.00 HOURS

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	198.00-HR
+	(CFS)	(HR)					
			(CFS)				
+	57001.	72.00		56639.	52124.	33164.	13705.
			(INCHES)	.504	1.857	3.544	4.028
			(AC-FT)	28086.	103387.	197338.	224269.

	PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	198.00-HR
+	(AC-FT)	(HR)				
	9635.	72.00	9612.	9327.	8048.	6433.

	PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	198.00-HR
+	(FEET)	(HR)				
	765.07	72.00	765.03	764.51	762.00	758.48

CUMULATIVE AREA = 1044.00 SQ MI

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

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                                                                     RATIOS APPLIED TO FLOWS
 OPERATION       STATION     AREA    PLAN           RATIO 1  RATIO 2
                                                       1.00      .23

 HYDROGRAPH AT
+                 INFLOW    979.00     1   FLOW      250359.   57107.
                                           TIME        70.00    70.00

 ROUTED TO
+                 OSHAUG    979.00     1   FLOW      249600.   56650.
                                           TIME        70.00    70.00

                                      ** PEAK STAGES IN FEET **
                                       1   STAGE      864.88   854.97
                                           TIME        70.00    70.00

 HYDROGRAPH AT
+                   EAST     13.30     1   FLOW       24101.    5497.
                                           TIME        50.00    50.00

 HYDROGRAPH AT
+                   WEST     51.70     1   FLOW       70773.   16143.
                                           TIME        52.00    52.00

  3 COMBINED AT
+                   COMB   1044.00     1   FLOW      250199.   57091.
                                           TIME        70.00    72.00

 ROUTED TO
+                  GRIGG   1044.00     1   FLOW      250318.   57001.
                                           TIME        72.00    72.00

                                      ** PEAK STAGES IN FEET **
                                       1   STAGE      780.05   765.07
                                           TIME        72.00    72.00
1                                  SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION   OSHAUG
                              (PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED  DURING BREACH FORMATION)


      PLAN  1 ...............                 INITIAL VALUE     SPILLWAY CREST     TOP OF DAM
                                ELEVATION         847.90              847.90            861.80
                                STORAGE           16285.              16285.            36066.
                                OUTFLOW               0.                  0.           173785.


                       RATIO      MAXIMUM      MAXIMUM    MAXIMUM    MAXIMUM    DURATION     TIME OF      TIME OF
                         OF      RESERVOIR      DEPTH     STORAGE    OUTFLOW    OVER TOP   MAX OUTFLOW    FAILURE
                        PMF       W.S.ELEV    OVER DAM     AC-FT       CFS       HOURS        HOURS        HOURS

                       1.00        864.88        3.08     42397.    249600.      28.00        70.00          .00
```

.23	854.97	.00	24327.	56650.	.00	70.00	.00

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION GRIGG
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	755.60	755.60	775.35
STORAGE	5156.	5156.	16413.
OUTFLOW	0.	0.	171153.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	780.05	4.70	20212.	250318.	28.00	72.00	.00
.23	765.07	.00	9635.	57001.	.00	72.00	.00

*** NORMAL END OF HEC-1 ***

HEC-RAS INPUT AND OUTPUT DATA

DUPLICATE EFFECTIVE CONDITIONS MODEL
(STEADY FLOW MODEL)

HEC-RAS HEC-RAS 5.0.3 September 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX   XXXX        XXXX     XX    XXXX
X     X  X       X    X       X   X   X  X  X
X     X  X       X            X   X  X    X X
XXXXXXX  XXXX    X      XXX   XXXX   XXXXXX  XXXX
X     X  X       X            X X    X    X      X
X     X  X       X    X       X  X   X    X      X
X     X  XXXXXX   XXXX        X   X  X    X  XXXXX
```

PROJECT DATA
Project Title: Scioto River near Trabue Road
Project File : SciotoRiver.prj
Run Date and Time: 3/21/2018 10:35:24 AM

Project in English units

Project Description:
Effective model data obtained from FEMA by Hartman Engineering. For the existing or corrected effective model, the bridge data was updated from HEC-2 style formatting to HEC-RAS formatting, effective flow boundaries were corrected, top of bank designations were modified to maintain better consistency between sections, and overbank distances were modified to better match actual field conditions.

Duplicate effective data based on NGVD29 datum, and corrected effective or existing conditions and proposed conditions data based on NAVD88 datum.

Information below was what was included in the effective FEMA data:

Columbus, OH Scioto River HEC-RAS Model for FEMA Map Study of Local Protection Project

Model Date: July 2001

Model Produced for the Huntington District, Corps of Engineers by

Fuller, Mossbarger,
Scott and May Engineers
1409 North Forbes Road
Lexington, Kentucky
40511-2050
Phone: (859) 422-3000

Project Engineers: Erman Caudill, Angela Fister
QA/QC Engineers: Joe Herman, Brian Belcher
Project Managers: Jim Latchaw, John Montgomery

Model is a HEC-RAS conversion and update of a previously existing HEC-2 model.
Updated data pertains solely to modeling convention and limited bridge construction plans around the Interstate 670 construction project provided by the Ohio Department of Transportation (ODOT). Model also includes the effects of a new overflow channel that was constructed as part of that project. In addition, the newly constructed West Columbus Local Protection Project was included in the model. Although the model has

been updated it does not necessarily reflect as built conditions. Geometry was taken from the HEC-2 model and best available planimetric mapping for the new construction.

Flow data was taken from the HEC-2 model provided by the Corps.

For further information refer to accompanying narrative report.

PLAN DATA

Plan Title: Duplicate Effective - Steady Flow
Plan File : C:\Users\Hartman\Documents\All Jobs\Wagenbrenner - Scioto River\HEC-RAS\SciotoRiver.p11

Geometry Title: Duplicate Effective Cond. Steady Flow
Geometry File : C:\Users\Hartman\Documents\All Jobs\Wagenbrenner - Scioto River\HEC-RAS\SciotoRiver.g09

Flow Title : FIS Flows
Flow File : C:\Users\Hartman\Documents\All Jobs\Wagenbrenner - Scioto River\HEC-RAS\SciotoRiver.f01

Plan Summary Information:

Number of:	Cross Sections =	26	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	5	Lateral Structures =	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: FIS Flows
Flow File : C:\Users\Hartman\Documents\All Jobs\Wagenbrenner - Scioto River\HEC-RAS\SciotoRiver.f01

Flow Data (cfs)

River	Reach	RS	100-Yr
RIVER-1	Reach-1	271	57000

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	100-Yr		Known WS = 732.4

GEOMETRY DATA

Geometry Title: Duplicate Effective Cond. Steady Flow
Geometry File : C:\Users\Hartman\Documents\All Jobs\Wagenbrenner - Scioto River\HEC-RAS

\SciotoRiver.g09

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 271

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	789	121	765	150	765	181	764	276	735
316	735	320	734.9	471	730	492	730	516	729
520	727	521	726.5	525	726.5	530	723	760	723
775	723	790	730	880	780				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.053	516	.042	790	.053

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
516	790	2386.56	2386.56	2386.56	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.5

INPUT
Description:
Station Elevation Data num= 67

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	758	80	754	80	784	157	784	157	752
263	750	263	769	402	769	402	747	534	745
534	765	556	765	556	744	666	751.4	666	743.6
669	743.6	669	738.6	706	735.4	720	731	742	724.1
742.1	724.1	746.9	721.4	747	721.4	756	721.3	791	719.2
819.9	721	820	721	824.9	720.9	825	720.9	866	719.3
898.9	719.8	899	719.8	903.9	717.3	904	717.3	936	720
981.9	719	982	719	986.9	719	987	719	1000	720.2
1014	721.4	1056	735.1	1056	744.6	1058.5	744.6	1058.5	752.4
1087	741	1121	742	1147	742.5	1194	743	1225	754
1247	754	1257	751	1412	759	1520	753	1649	760
1830	758.1	1840	758	1916	760	1968	761	2011	761
2041	761	2088	787	2212	797	2320	793	2340	782
2500	782	2760	782						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	742.1	.042	1014	.058

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
742.1	1014	52.8	52.8	52.8	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.4

INPUT
Description: Unnamed Pipe Line Crossing Bridge - Upstream Section
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	759	127	753	127	784	138	784	138	752
238	749	238	769	379	769	379	747	491	743
491	761	614	761	614	743	670	751.4	670	743.6
673	743.6	673	738.6	710	735.4	720	732.3	746	724.1
752	721.4	760	721.3	795	719.2	824	721	829	720.9

870	719.3	903	719.8	908	717.3	940	720	986	719
991	719	1015	721.1	1018	721.4	1060	735.1	1060	744.6
1062.5	744.6	1062.5	752.4	1100	749	1163	750	1249	751
1496	753	1623	756	1680	756	1686	756	1899	759
2022	760	2044	760	2101	789	2228	796	2353	793
2376	782	2380	784	2600	784	2800	784		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	752	.042	1018	.054

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
752	1018	8.7	8.7	8.7	.1	.3

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 270.3

INPUT
Description: Structure #28 Unnamed Pipeline Crossing Bridge
Distance from Upstream XS = .6
Deck/Roadway Width = 7
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 12

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
491	743	743	614	743	743	670	751	743
1060	752	744	1100	749	727	1249	751	751
1496	753	753	1623	756	756	1680	756	756
1899	759	759	2044	760	760	2101	789	789

Upstream Bridge Cross Section Data
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	759	127	753	127	784	138	784	138	752
238	749	238	769	379	769	379	747	491	743
491	761	614	761	614	743	670	751.4	670	743.6
673	743.6	673	738.6	710	735.4	720	732.3	746	724.1
752	721.4	760	721.3	795	719.2	824	721	829	720.9
870	719.3	903	719.8	908	717.3	940	720	986	719
991	719	1015	721.1	1018	721.4	1060	735.1	1060	744.6
1062.5	744.6	1062.5	752.4	1100	749	1163	750	1249	751
1496	753	1623	756	1680	756	1686	756	1899	759
2022	760	2044	760	2101	789	2228	796	2353	793
2376	782	2380	784	2600	784	2800	784		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	752	.042	1018	.054

Bank Sta: Left	Right	Coeff Contr.	Expan.
752	1018	.1	.3

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
491	743	743	614	743	743	757	751	743
1147	752	744	1187	749	727	1336	751	751
1496	753	753	1623	756	756	1680	756	756

Downstream Bridge Cross Section Data
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	769	46	751	262	742	550	743	562	743
645	753	658	753	757	751.4	757	743.6	760	743.6
760	738.6	797	735.4	800	734.5	833	724.1	839	721.4
847	721.3	882	719.2	911	721	916	720.9	957	719.3
990	719.8	995	717.3	1027	720	1073	719	1078	719
1100	721	1105	721.4	1147	735.1	1147	744.6	1149.5	744.6

1149.5	752.4	1166	751	1227	752	1360	755.5	1377	756
1582	762	1605	762	1680	762	1900	762	1990	762
2100	762	2230	762	2318	788	2478	788	2485	780
2870	780	2882	790	2949	792	2971	790		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	839	.042	1105	.054

Bank Sta: Left	Right	Coeff Contr.	Expan.
839	1105	.1	.3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 4

Pier Data
Pier Station Upstream= 748.5 Downstream= 835.5
Upstream num= 2

Width	Elev	Width	Elev
5	721.4	5	745

Downstream num= 2

Width	Elev	Width	Elev
5	721.4	5	745

Pier Data
Pier Station Upstream= 826.5 Downstream= 913.5
Upstream num= 2

Width	Elev	Width	Elev
5	720.9	5	745

Downstream num= 2

Width	Elev	Width	Elev
5	720.9	5	745

Pier Data
Pier Station Upstream= 905.5 Downstream= 992.5
Upstream num= 2

Width	Elev	Width	Elev
5	717.3	5	745

Downstream num= 2

Width	Elev	Width	Elev
5	717.3	5	745

Pier Data
Pier Station Upstream= 988.5 Downstream= 1075.5
Upstream num= 2

Width	Elev	Width	Elev
5	719	5	745

Downstream num= 2

Width	Elev	Width	Elev
5	719	5	745

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth

inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.2

INPUT
Description: Unnamed Pipe Line Crossing Bridge -Downstream Section
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	769	46	751	262	742	550	743	562	743
645	753	658	753	757	751.4	757	743.6	760	743.6
760	738.6	797	735.4	800	734.5	833	724.1	839	721.4
847	721.3	882	719.2	911	721	916	720.9	957	719.3
990	719.8	995	717.3	1027	720	1073	719	1078	719
1100	721	1105	721.4	1147	735.1	1147	744.6	1149.5	744.6
1149.5	752.4	1166	751	1227	752	1360	755.5	1377	756
1582	762	1605	762	1680	762	1900	762	1990	762
2100	762	2230	762	2318	788	2478	788	2485	780
2870	780	2882	790	2949	792	2971	790		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	839	.042	1105	.054

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
839	1105	42.24	42.24	42.24	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.1

INPUT
Description:
Station Elevation Data num= 62

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	772	48	749	274	741	463	742	463	758
553	758	553	743	591	742	623	756	635	756
640	755.8	729	751.4	729	743.6	732	743.6	732	738.6
769	735.4	800	725.7	804.9	724.1	805	724.1	810	721.4
810.1	721.4	819	721.3	854	719.2	882.9	721	883	721
887.9	720.9	888	720.9	929	719.3	961.9	719.8	962	719.8
966.9	717.3	967	717.3	999	720	1044.9	719	1045	719
1049.9	719	1050	719	1077	721.4	1110	732.2	1119	735.1
1119	744.6	1121.5	744.6	1121.5	752.4	1132	726	1190	727
1249	752	1300	753.9	1382	757	1587	761	1609	761
1680	760	1925	760	2010	761.9	2015	762	2290	762
2335	787	2480	788	2490	780	2900	780	2918	791
2975	794	2994	791						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.054	810.1	.042	1077	.048

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
810.1	1077	1054.79	1054.79	1054.79	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 269

INPUT
Description:
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	781	148	777	186	770	214	770	227	771
240	765.5	295	742	446	742	460	742	580	742
600	744	617	744	660	742	840	742	841	742
860	726	866	721	877	715.5	1016	715.5	1027	721
1030	722.4	1040	727	1289	730	1351	761	1400	761
1528	761	1611	764	1641	767	1702	766	1856	764
1960	760	2360	760	2400	760	2680	760	2690	762
2770	761	2780	760	3000	760	3200	760	3263	802
3412	806								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.047	866	.042	1027	.051

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
866	1027	1379.48	1379.48	1379.48	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 268.5

INPUT
Description: Effective section shortened on right overbank so end of section would be close to assumed lateral structure.
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	768	83	771	83	795	264	795	264	770
356	764	400	745	600	745	800	745	1055	745
1059	743.8	1059	739	1060	739.1	1061	739.1	1081.5	739.1
1082	734.9	1124	717	1159	713.5	1174	713.8	1193	715.8
1212.9	716.6	1213	716.6	1223.9	719.1	1224	719.1	1259	719.2
1309	725.4	1334	727.8	1340	731.7	1351	738.8	1359	739.6
1359	744.4	1394	741	1442	741	1545	744	1569	744
1580	744	1581	750.6						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.051	1124	.042	1259	.051

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1124	1259	58.09	58.09	58.09	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1550	1581		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 268.4

INPUT
Description: Haul Road Bridge (Marble Cliff Quarries) - Upstream Section.
Effective section shortened on right overbank so end of section would be close to assumed lateral structure.
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	768	63	771	196	769	300	766	379	763
435	736	597	735	697	735	723	735	845	736
929	737	1011	738	1088	743.8	1089	739.1	1091	739.1
1111.5	739.1	1112	734.9	1135	725.1	1154	717	1189	713.5
1204	713.8	1223	715.8	1243	716.6	1254	719.1	1289	719.2
1339	725.4	1364	727.8	1380	738.2	1381	738.8	1389	739.6
1389	744.4	1430	740	1459	742	1530	743	1590	742
1591	750.6								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

0	.052	1154	.042	1289	.057

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1154	1289	15.5	15.5	15.5	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1450	1591		T

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 268.3

INPUT
Description: Structure #27 Haul Road Bridge (Marble Cliff Quarries)
Distance from Upstream XS = 1
Deck/Roadway Width = 13
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
1088	743.8	743.8	1088	744	744	1089	744	739.1
1389	744	739.1	1389	742	742			

Upstream Bridge Cross Section Data
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	768	63	771	196	769	300	766	379	763
435	736	597	735	697	735	723	735	845	736
929	737	1011	738	1088	743.8	1089	739.1	1091	739.1
1111.5	739.1	1112	734.9	1135	725.1	1154	717	1189	713.5
1204	713.8	1223	715.8	1243	716.6	1254	719.1	1289	719.2
1339	725.4	1364	727.8	1380	738.2	1381	738.8	1389	739.6
1389	744.4	1430	740	1459	742	1530	743	1590	742
1591	750.6								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.052	1154	.042	1289	.057

Bank Sta: Left	Right	Coeff Contr.	Expan.
1154	1289	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1450	1591		T

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
1008	743.8	743.8	1008	744	744	1008	744	739.1
1309	744	739.1	1309	742	742	1520	742	742
2000	742	742	2300	742	742	2320	753	753
3015	753	753	3076	801	801			

Downstream Bridge Cross Section Data
Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	768	190	768	304	766	410	760	455	739.9
466	735	620	735	677	736	706	736	721	734
755	737	848	737	1009	743.8	1009	739	1011	739.1
1031.5	739.1	1032	734.9	1074	717	1109	713.5	1124	713.8
1135	715	1143	715.8	1163	716.6	1174	719.1	1209	719.2
1259	725.4	1284	727.8	1301	738.8	1309	739.6	1309	744.4
1320	744	1325	744	1357	744	1371	744	1414	744
1440	744	1500	744	1501	750.6				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.052	1074	.042	1209	.043

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
          1074    1209             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1375    1501               T

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=  1248.5    Downstream=  1168.5
Upstream     num=       2
    Width   Elev    Width   Elev
      11   716.6      11   739.1
Downstream     num=       2
    Width   Elev    Width   Elev
      11   716.6      11   739.1

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 268.2

INPUT
Description: Haul Road Bridge (Marble Cliff Quarries) - Downstream Section.
             Effective section shortened on right overbank so end of section
             would be close to assumed lateral structure.
Station Elevation Data    num=      38
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     768     190     768     304     766     410     760     455   739.9
     466     735     620     735     677     736     706     736     721     734
     755     737     848     737    1009   743.8    1009     739    1011   739.1
  1031.5   739.1    1032   734.9    1074     717    1109   713.5    1124   713.8
    1135     715    1143   715.8    1163   716.6    1174   719.1    1209   719.2
    1259   725.4    1284   727.8    1301   738.8    1309   739.6    1309   744.4
    1320     744    1325     744    1357     744    1371     744    1414     744
    1440     744    1500     744    1501   750.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .052    1074    .042    1209    .043

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1074    1209            31.68   31.68   31.68             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1375    1501               T
```

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 268.1

INPUT
Description: Effective section shortened on right overbank so end of section would be close to assumed lateral structure.
Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	768	105	770	105	789	206	789	206	767
305	765	407	761	474	735	617	735	640	736.6
659	738	690	738	710	734	851	737	974	736
1005	743.8	1005	739	1007	739.1	1027.5	739.1	1028	734.9
1070	717	1105	713.5	1120	713.8	1130	714.9	1139	715.8
1158.9	716.6	1159	716.6	1169.9	719.1	1170	719.1	1205	719.2
1255	725.4	1280	727.8	1297	738.8	1305	739.6	1305	744.4
1320	744	1324	744	1367	744	1379	744	1400	744.6
1415	744	1500	744	1501	750.6				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.054	1070	.045	1205	.057

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1070	1205	403.75	403.75	403.75	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1300	1501		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 267.5

INPUT
Description:
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
5	766.9	63.5	767.9	193	766.9	299.8	761.9	332.3	748.1
579	748	585	747.4	814	747.5	849.4	747.1	862.6	740.5
900	729.2	940.6	724.8	999.4	719.2	1014.2	714.8	1022.7	713.5
1032.1	713.1	1054.2	711	1068.5	711.1	1084	711	1105.5	711
1112.1	712.6	1122.2	714.7	1142	722.6	1160.3	739	1161.9	741.5
1197.1	741.6	1202.7	742.9	1308.4	743	1308.7	741.8	1343.9	742
1373.4	741.3	1414.5	767.9	1443.4	770.2	1463.6	785	1581.1	784.9
1581.1	770.2	1613.5	771	1666.4	771	1707.3	772.1	1720.9	790
1750.3	790	1754.3	772.1	1789.3	772.9	1826.6	763.9	2895.6	764
2931	789.6								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
5	.062	999.4	.045	1122.2	.058

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
999.4	1122.2	58.08	58.08	58.08	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 267.4

INPUT
Description: Trabue Road - Upstream Section
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767	106	768	107	784	147	784	147	768

169	766	185	763	200	763	213	766	254	766
282	748	400	748	560	748	814	748	816	758.9
817	758	817	757.5	875	730	909.999	722.2	914	721.5
956	715.4	990	714.2	1018.9	714	1023	714	1050	713
1077	714.7	1100	731	1120	740.7	1128	741.5	1132	741.6
1180	741.8	1225	759.6	1226	761	1227	761.3	1267	745
1278	744.4	1295	744	1304	741	1336	741	1354	739
1419	770	1635	770	1642	770	1879	775	1950	764
2200	764	2400	764	2590	764	2685	765	2845	765
2920	801	2943	802	2988	802	3107	803	3173	804
3187	804	3237	803						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	817	.045	1225	.058

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
817	1225	58.5	58.5	58.5	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	812.29	767.15	F

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 267.3

INPUT
Description: Structure #26 Trabue Road Bridge
Distance from Upstream XS = 1
Deck/Roadway Width = 56
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 24

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	767	767	147	768	768	254	766	748
400	763	748	560	764	748	814	766	748
815	766.7	766.7	816	766	758.9	817	766	758
1226	769	761	1227	769	761.3	1228	769.2	769.2
1230	770	730	1354	770	730	1419	770	770
1635	770	770	1879	775	775	1950	777	764
2200	785	764	2400	792	764	2590	797	764
2685	798	765	2845	802	765	2920	802	0

Upstream Bridge Cross Section Data
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767	106	768	107	784	147	784	147	768
169	766	185	763	200	763	213	766	254	766
282	748	400	748	560	748	814	748	816	758.9
817	758	817	757.5	875	730	909.999	722.2	914	721.5
956	715.4	990	714.2	1018.9	714	1023	714	1050	713
1077	714.7	1100	731	1120	740.7	1128	741.5	1132	741.6
1180	741.8	1225	759.6	1226	761	1227	761.3	1267	745
1278	744.4	1295	744	1304	741	1336	741	1354	739
1419	770	1635	770	1642	770	1879	775	1950	764
2200	764	2400	764	2590	764	2685	765	2845	765
2920	801	2943	802	2988	802	3107	803	3173	804
3187	804	3237	803						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	817	.045	1225	.058

Bank Sta: Left	Right	Coeff Contr.	Expan.
817	1225	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	812.29	767.15	F

Downstream Deck/Roadway Coordinates
num= 21

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
308	761	761	400	763	730	560	764	748
863	766	748	864	766.7	766.7	865	766	758.9
866	766	758	1275	769	761	1275	769	761.3
1275	769.2	769.2	1280	770	0	1403	770	0
1468	770	740	1684	770	740	1928	775	740
1999	777	740	2249	785	740	2449	792	740
2639	797	740	2734	798	740	2894	801	0

Downstream Bridge Cross Section Data
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	766	129	763	262.999	761	308	761	330.001	756
500	756	608	756	690	756	692	756	864	758.9
866	758.9	866	757.5	924	730	959	722.2	963	721.5
1005	715.4	1039	714.2	1040	714.2	1068	714	1072	714
1099	713	1126	714.7	1149	731	1169	740.7	1177	741.5
1181	741.6	1200	741.7	1229	741.8	1275	759.6	1275	761.3
1277	761.3	1300	741	1320	740	1355	752	1411	752
1435	768	1533	769	1621	768	1653	769	1677.999	758
2000	758	2400	758	2600	758	2765	758	2767	756
2827	801	2932	801	3024	803	3056	804	3079	804
3095	800	3125	802						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.068	866	.045	1169	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
866	1169	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	856.09	767.15	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 3

Pier Data
Pier Station Upstream= 912 Downstream= 961
Upstream num= 2

Width	Elev	Width	Elev
3.8	721.5	3.8	760

Downstream num= 2

Width	Elev	Width	Elev
3.8	721.5	3.8	760

Pier Data
Pier Station Upstream= 1021 Downstream= 1070
Upstream num= 2

Width	Elev	Width	Elev
3.8	714	3.8	760

Downstream num= 2

Width	Elev	Width	Elev
3.8	714	3.8	760

Pier Data
Pier Station Upstream= 1130 Downstream= 1179
Upstream num= 2

Width	Elev	Width	Elev
3.8	741.5	3.8	761

Downstream num= 2

Width	Elev	Width	Elev

3.8	741.5	3.8	761

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
    Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
    Energy Only

Additional Bridge Parameters
    Add Friction component to Momentum
    Do not add Weight component to Momentum
    Class B flow critical depth computations use critical depth
        inside the bridge at the upstream end
    Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 267.2

INPUT
Description: Trabue Road - Downstream Section
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	766	129	763	262.999	761	308	761	330.001	756
500	756	608	756	690	756	692	756	864	758.9
866	758.9	866	757.5	924	730	959	722.2	963	721.5
1005	715.4	1039	714.2	1040	714.2	1068	714	1072	714
1099	713	1126	714.7	1149	731	1169	740.7	1177	741.5
1181	741.6	1200	741.7	1229	741.8	1275	759.6	1275	761.3
1277	761.3	1300	741	1320	740	1355	752	1411	752
1435	768	1533	769	1621	768	1653	769	1677.999	758
2000	758	2400	758	2600	758	2765	758	2767	756
2827	801	2932	801	3024	803	3056	804	3079	804
3095	800	3125	802						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.068	866	.045	1169	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
866	1169	63.36	63.36	63.36	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	856.09	767.15	F

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 267.1

INPUT
Description:
Station Elevation Data num= 73

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767	122	766	286	760	327	758	446	745
493	741	514	740	537	740	573	734	610	734
780	730	783	766.7	783	758.9	785	758.9	785	757.5
843	730	877.9	722.2	878	722.2	881.9	721.5	882	721.5
924	715.4	958	714.2	986.9	714	987	714	990.9	714
991	714	1018	713	1030	713.8	1045	714.7	1068	731
1088	740.7	1095.9	741.5	1096	741.5	1099.9	741.6	1100	741.6
1148	741.8	1194	759.6	1194	761.3	1196	761.3	1196	769.2
1200	751.4	1202	750	1239	750	1281	745	1308	745
1329	743	1357	752	1411	752	1442	769	1501	769
1501	779	1556	779	1557	769	1578	768	1598	768

1629	768	1640	756	1800	756	2000	756	2200	756
2360	756	2419	757	2437	757	2460	759	2618	757
2803	756	2861	802	2987	806	3016	799	3036	804
3057	804	3070	799	3098	802				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.068	843	.045	1068	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
843	1068	1759.28	1759.28	1759.28	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	784.41	767.36	F

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 266

INPUT
Description:
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	770.8	134.9	764.9	236.7	762.1	372.1	762	380.1	776.9
733	777	746	756.8	819.8	751.9	885.2	750.9	926.3	751
992.4	748.9	1007.3	744	1113.3	743.8	1195.6	725.8	1328.1	721
1374.9	721.5	1400.3	723.2	1440.6	718.7	1459.1	714.5	1505.2	714.3
1521.4	713.5	1558.1	711.1	1578.5	709.8	1593.7	710.9	1601.4	713.9
1616	722.6	1651.1	744.7	1656.2	741.2	1672.7	743	1713.9	742.9
1726.2	742.1	2120.3	742.1	2520.4	742.1	2546.6	774.1	2639.5	776
2659.2	781.9	2676	783.1	2740.8	783	2831	780	2870.6	764.3
2920.4	760.1	2979.2	760.1	2982.8	799.8	3029.9	799.7	3029.9	760.1
3091.1	759.9	3125.7	761	3132.2	760	3514.6	760	3536.2	772
3612.8	771.9	3640.2	783.9	3667.7	786.9	3782.5	782.2	3803.4	786.2
3895.8	788.9	3978.1	789						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	1400.3	.048	1616	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1400.3	1616	1721.77	1721.77	1721.77	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.5

INPUT
Description:
Station Elevation Data num= 87

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	801	68	799	180	776	204	776	241	770
262	770	321	768	321	775	372	775	372	768
472	764	514	764	566	763	566	758	623	758
693	756	693	765	740	765	740	755	765	756
802	756	880	756	958	754	977	752	1023	749
1050	749	1054	749	1103	765	1103	742.6	1103	740.8
1114	740.8	1114	723.8	1132	718.4	1159	714	1187	711.6
1234.9	712.6	1235	712.6	1241.9	712.6	1242	712.6	1251	712.7
1251.1	712.7	1258.9	712.7	1259	712.7	1280	712.7	1303	712.6
1343	712.3	1380.8	712.5	1380.9	712.5	1381	714.5	1391.9	716
1392	716	1413	717.8	1430	721.4	1451	725.8	1502	725.8
1521	734.5	1521	740.8	1528	740.8	1528	742.6	1528	765
1536	736	1571	737	1584	737	1609	737	1686	751
1811	765	1861	768	1883	768	2029	767	2137	767
2156	767	2213	757	2246	746	2432	747	2465	747
2495	746	2800	746	3000	746	3320	746	3320	749

3720	749	3776	786	3965	786	4166	786	4177	783
4189	785	4212	785						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.088	1132	.055	1413	.088

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1132	1413	110.88	110.88	110.88	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1875	4212		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.4

INPUT
Description: Penn Central Railroad Bridge Crossing #3 - Upstream Section
Station Elevation Data num= 78

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	800	150	778	219	770	239	770	291	768
291	775	348	775	348	767	414	763	458	763
557	761	631	758	631	765	687	765	687	757
743	756	756	756	800	755	823	755	920	753.2
928	753	974	750	1018	748	1046	747	1104.1	742.6
1104.2	740.8	1115	740.8	1115	723.8	1133	718.4	1160	714
1188	711.6	1230	712.5	1236	712.6	1236	717.4	1243	717.4
1252	717.4	1260	717.4	1260	712.7	1304	712.6	1344	712.3
1382	712.5	1382	714	1393	716	1414	717.8	1452	725.8
1503	725.8	1522	734.5	1522	740.8	1529	740.8	1529	742.6
1544	736	1614	761	1676	766	1703	766	1760	765
1887	758	2056	762	2072	762	2101	762	2152	755
2169	745	2355	746	2395	746	2400	746	2600	746
2800	746	3000	746	3275	746	3280	749	3480	749
3600	749	3720	749	3782	787	3959	787	4154	786
4164	783	4174	785	4199	785				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	1104.2	.055	1522	.086

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1104.2	1522	38.5	38.5	38.5	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1675	4199		T

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 265.3

INPUT
Description: Structure #25 Penn Central Railroad Bridge, Crossing #3
Distance from Upstream XS = 1
Deck/Roadway Width = 36
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
687	757	757	743	756	756	756	756	756
800	755	755	1046	755	747	1104.1	765	742.6
1104.2	765	742	1529	765	742	1544	765	736
1614	765	761	1676	766	766			

Upstream Bridge Cross Section Data
Station Elevation Data num= 78

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	800	150	778	219	770	239	770	291	768
291	775	348	775	348	767	414	763	458	763
557	761	631	758	631	765	687	765	687	757
743	756	756	756	800	755	823	755	920	753.2
928	753	974	750	1018	748	1046	747	1104.1	742.6
1104.2	740.8	1115	740.8	1115	723.8	1133	718.4	1160	714
1188	711.6	1230	712.5	1236	712.6	1236	717.4	1243	717.4
1252	717.4	1260	717.4	1260	712.7	1304	712.6	1344	712.3
1382	712.5	1382	714	1393	716	1414	717.8	1452	725.8
1503	725.8	1522	734.5	1522	740.8	1529	740.8	1529	742.6
1544	736	1614	761	1676	766	1703	766	1760	765
1887	758	2056	762	2072	762	2101	762	2152	755
2169	745	2355	746	2395	746	2400	746	2600	746
2800	746	3000	746	3275	746	3280	749	3480	749
3600	749	3720	749	3782	787	3959	787	4154	786
4164	783	4174	785	4199	785				

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	1104.2	.055	1522	.086

Bank Sta: Left   Right   Coeff Contr.   Expan.
1104.2   1522   .1   .3

Ineffective Flow   num=   1

Sta L	Sta R	Elev	Permanent
1675	4199		T

Downstream Deck/Roadway Coordinates
num=   9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
687	757	757	743	756	756	756	756	756
800	755	755	923	755	730	981	765	730
981.1	765	742.6	981.2	765	742	1406	765	742

Downstream Bridge Cross Section Data
Station Elevation Data   num=   66

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	783	118	779	205	770	231	770	271	764
271	775	500	775	500	760	541	759	560	759
603	757	621	757	657	759	698	758	733	756
790	759	815	762	832	762	873	761	921	743
967	741	981	742.6	981	740.8	992	740.8	992	723.8
1010	718.4	1037	714	1065	711.6	1113	712.6	1113	717.4
1120	717.4	1129	717.4	1137	717.4	1137	712.7	1181	712.6
1221	712.3	1259	712.5	1259	714	1270	716	1291	717.8
1329	725.8	1380	725.8	1399	734.5	1399	740.8	1406	740.8
1406	742.6	1406	765	1408	764	1487	761	1520	746
1800	746	2000	746	2200	746	2400	746	2600	746
2800	746	3000	746	3200	746	3400	746	3600	746
3800	746	3975	746	4014	789	4025	783	4037	785
4065	785								

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.09	992	.055	1399	.09

Bank Sta: Left   Right   Coeff Contr.   Expan.
992   1399   .1   .3

Ineffective Flow   num=   1

Sta L	Sta R	Elev	Permanent
1425	4065		T

Upstream Embankment side slope   =   0 horiz. to 1.0 vertical
Downstream Embankment side slope   =   0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =   .95
Elevation at which weir flow begins   =
Energy head used in spillway design   =
Spillway height used in design   =
Weir crest shape   = Broad Crested

Number of Piers = 2

Pier Data
Pier Station Upstream= 1247.5 Downstream= 1124.5
Upstream num= 2

Width	Elev	Width	Elev
9	717.4	9	742

Downstream num= 2

Width	Elev	Width	Elev
9	717.4	9	742

Pier Data
Pier Station Upstream= 1387.5 Downstream= 1264.5
Upstream num= 2

Width	Elev	Width	Elev
11	714	11	742

Downstream num= 2

Width	Elev	Width	Elev
11	714	11	742

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.2

INPUT
Description: Penn Central Railroad Bridge Crossing #3 -Downstream Section
Station Elevation Data num= 66

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	783	118	779	205	770	231	770	271	764
271	775	500	775	500	760	541	759	560	759
603	757	621	757	657	759	698	758	733	756
790	759	815	762	832	762	873	761	921	743
967	741	981	742.6	981	740.8	992	740.8	992	723.8
1010	718.4	1037	714	1065	711.6	1113	712.6	1113	717.4
1120	717.4	1129	717.4	1137	717.4	1137	712.7	1181	712.6
1221	712.3	1259	712.5	1259	714	1270	716	1291	717.8
1329	725.8	1380	725.8	1399	734.5	1399	740.8	1406	740.8
1406	742.6	1406	765	1408	764	1487	761	1520	746
1800	746	2000	746	2200	746	2400	746	2600	746
2800	746	3000	746	3200	746	3400	746	3600	746
3800	746	3975	746	4014	789	4025	783	4037	785
4065	785								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.09	992	.055	1399	.09

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
992	1399	52.8	52.8	52.8	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1425	4065		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.1

INPUT
Description:
Station Elevation Data num= 66

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	783	133	779	200	770	226	770	272	765
272	775	476	775	477	760	530	759	546	759
587	757	606	757	760	760	778	760	922	743
968	741	979	765	979	742.6	979	740.8	990	740.8
991	723.8	1008	718.4	1035	714	1063	711.6	1111	712.6
1111.1	712.6	1117.9	712.6	1118	712.6	1126.9	712.7	1127	712.7
1134.9	712.7	1135	712.7	1179	712.6	1219	712.3	1257	712.5
1257.1	712.5	1257.2	714.5	1267.9	716	1268	716	1289	717.8
1327	725.8	1378	725.8	1397	734.5	1397	740.8	1404	740.8
1404	742.6	1404	765	1411	762	1497	761	1535	746
1800	746	2000	746	2200	746	2400	746	2600	746
2800	746	3000	746	3200	746	3400	746	3600	746
3800	746	3975	746	4004	789	4017	783	4033	785
4059	785								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	991	.055	1289	.084

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
991	1289	632.31	632.31	632.31	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1425	4059		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264.5

INPUT
Description:
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
5.2	761.9	22.8	761.9	66.2	767.8	83.8	767.7	133.5	758.9
260	750.9	371.8	751	382	762.9	452.6	762.7	465.4	749.7
562.1	740.8	591.6	740.9	620	740.2	628.7	737.5	658.6	725.8
693.3	712.1	709.2	711.1	731.2	710.3	757	710.6	783.4	710.6
814.3	710.5	832.8	711.1	846.2	712	856.4	713.6	870.9	718.6
901.3	720.5	956.9	747	958.7	747.4	1024.7	751.1	1178	752
1437.2	753	1469.9	745.8	2281.7	746	2378	783.9	2683.9	784

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
5.2	.089	658.6	.055	901.3	.085

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
658.6	901.3	47.52	47.52	47.52	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264.4

INPUT
Description: West 5th Avenue Bridge - Upstream Section
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	763	18	763	88	768	99	768	162	759

343	751	343	763	525	763	525	750	590	742.1
599	741	661	741	672	737	713	720	733	711.3
752	711.3	755	709.8	770	709.4	772	709.4	792	709.6
830.5	711	833.5	710	872	709.8	895	711.2	910.5	717
913.5	717	947	720.1	972	731.9	975	733.3	991	740.8
992	744.2	993	747.4	1068	746	1273	753	1498	755
1535	746	1800	746	2000	746	2280	746	2355	784
2692	785	2712	785	2808	787	2909	788	3172	788
3429	788	3551	790	3560	788	3572	789	3602	789

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	672	.055	972	.086

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
672	972	43	43	43	.1	.3

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 264.3

INPUT
Description: Structure #24 West 5th Avenue Bridge
Distance from Upstream XS = 1
Deck/Roadway Width = 40.5
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 14

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
525	750	750	599	741	741	672	741	737
713	745	738	947	750	744	992	747.4	744.4
993	747.4	747.4	1068	746	746	1273	753	753
1498	755	755	1535	746	746	2000	746	746
2280	746	746	2355	784	784			

Upstream Bridge Cross Section Data
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	763	18	763	88	768	99	768	162	759
343	751	343	763	525	763	525	750	590	742.1
599	741	661	741	672	737	713	720	733	711.3
752	711.3	755	709.8	770	709.4	772	709.4	792	709.6
830.5	711	833.5	710	872	709.8	895	711.2	910.5	717
913.5	717	947	720.1	972	731.9	975	733.3	991	740.8
992	744.2	993	747.4	1068	746	1273	753	1498	755
1535	746	1800	746	2000	746	2280	746	2355	784
2692	785	2712	785	2808	787	2909	788	3172	788
3429	788	3551	790	3560	788	3572	789	3602	789

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	672	.055	972	.086

Bank Sta: Left	Right	Coeff Contr.	Expan.
672	972	.1	.3

Downstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
525	750	750	599	741	741	756	741	737
797	745	738	1031	750	744	1077	747.4	744.5

Downstream Bridge Cross Section Data
Station Elevation Data num= 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	765	21	765	87	768	103	768	155	760
221	755	221	790	309	790	309	753	414	763
425	763	440	761	529	749	583	747	720	738.2
723	738	745	741	746	737.6	805	720	817	711.3

```
      836   711.3     839   709.8     840   709.8     856   709.4     876   709.6
    914.5     711   917.5     710     956   709.8     979   711.2   994.5     717
    997.5     717    1020   719.1    1031   720.1    1056   731.9    1075   740.8
     1075   744.2    1077   747.4    1108     743    1206     749    1300   750.7
     1314     751    1634     755    1640   753.5    1670     746    1800     746
     1900     746    2065     746    2223     763    2261     780    2533     783
     2727     784    2750     784    2979     787    3168     788    3397     789
     3570     790    3580     788    3592     789    3620     789

Manning's n Values        num=       3
      Sta   n Val     Sta   n Val     Sta   n Val
        0    .092     746    .055    1031    .087

Bank Sta: Left   Right    Coeff Contr.   Expan.
           746    1031             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  3

Pier Data
Pier Station     Upstream=   753.5    Downstream=   837.5
Upstream     num=       2
    Width   Elev    Width   Elev
        3   709.8       3   739.4
Downstream     num=       2
    Width   Elev    Width   Elev
        3   709.8       3   739.4

Pier Data
Pier Station     Upstream=     832    Downstream=     916
Upstream     num=       2
    Width   Elev    Width   Elev
        3     710       3   741.4
Downstream     num=       2
    Width   Elev    Width   Elev
        3     710       3   741.4

Pier Data
Pier Station     Upstream=     912    Downstream=     996
Upstream     num=       2
    Width   Elev    Width   Elev
        3     717       3     744
Downstream     num=       2
    Width   Elev    Width   Elev
        3     717       3     744

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION
```

RIVER: RIVER-1
REACH: Reach-1 RS: 264.2

INPUT
Description: West 5th Avenue Bridge - Downstream Section
Station Elevation Data num= 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	765	21	765	87	768	103	768	155	760
221	755	221	790	309	790	309	753	414	763
425	763	440	761	529	749	583	747	720	738.2
723	738	745	741	746	737.6	805	720	817	711.3
836	711.3	839	709.8	840	709.8	856	709.4	876	709.6
914.5	711	917.5	710	956	709.8	979	711.2	994.5	717
997.5	717	1020	719.1	1031	720.1	1056	731.9	1075	740.8
1075	744.2	1077	747.4	1108	743	1206	749	1300	750.7
1314	751	1634	755	1640	753.5	1670	746	1800	746
1900	746	2065	746	2223	763	2261	780	2533	783
2727	784	2750	784	2979	787	3168	788	3397	789
3570	790	3580	788	3592	789	3620	789		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	746	.055	1031	.087

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
746	1031	47.52	47.52	47.52	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264.1

INPUT
Description:
Station Elevation Data num= 76

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767	25	767	83	768	98	768	144	760
214	758	214	790	315	790	315	754	400	752.2
457	751	514	749	669	741	736	741	737	737.6
786	720	808	711.3	826.9	711.3	827	711.3	829.9	709.8
830	709.8	847	709.4	855	709.5	867	709.6	905.5	711
905.6	711	908.4	710	908.5	710	947	709.8	970	711.2
985.4	717	985.5	717	988.4	717	988.5	717	1020	719.9
1022	720.1	1047	731.9	1066	740.8	1066	744.2	1068	747.4
1072	725	1149	756	1253	752	1314	751	1432	755
1560	755.9	1572	756	1702	754	1731	748	1770	746
1885	746	1920	748	1985	751	2115	751	2137	754
2205	765	2236	781	2539	781	2740	783	2760	783
2895	786	2895	795	2931	795	2931	786	3079	787
3080	787	3200	787	3201	807	3240	807	3311	807
3311	789	3461	789	3569	790	3581	788	3598	789
3627	789								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	786	.055	1022	.09

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
786	1022	2733.27	2733.27	2733.27	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 263

INPUT
Description:
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	776	61	755	105	761	125	761	171	745
440	735	689	735	750	737	810	734	828	737
1044	736	1120	713.9	1123	713	1133	708	1656	708
1666	713	1670	716.7	1702	746	1715	747	1871	746
1880	746	1960	746	2000	746	2200	746	2400	746
2515	746	2545	746	2565	765	2618	763	2638	763
2815	762	3000	762	3200	762	3400	762	3600	762
3800	762	3980	762	4052	772	4163	778		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	1123	.047	1666	.082

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1123	1666	2048.64	2048.64	2048.64	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 262

INPUT
Description:
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	773.9	31.2	758.8	49.7	760	63.8	760	97	758.6
175.6	739.9	237	738	261.2	736.9	890.3	736	904.2	736.9
951.2	736.9	965.7	736.8	1223.9	736.8	1520	736	1550.2	736
1579.7	717.1	1599.9	713.2	1609	710	1628	709.6	1656.3	708.6
1691.7	707.7	1720	708	1749.7	709.1	1757.7	709.3	1762.3	710.4
1804.4	727	1805	727.1	1805	732.2	1983.1	739.8	2117	751.9
2201.3	752.9	2215.8	751	2224.8	752.9	2253	752.8	2286	751.8
2431.2	754	2597.8	766.7						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	1579.7	.035	1762.3	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1579.7	1762.3	2133.12	2133.12	2133.12	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	950	736.6	F

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 261

INPUT
Description:
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	759	26	758	109	745	143	754	159	756
174	756	222	736	222	749	253	749	253	736
307	736	307	758	475	758	475	736	480	736
481	736	600	736	755	736	810	736	865	736
1000	736	1020	736	1200	736	1400	736	1600	736
1800	736	2000	736	2150	736	2195	736	2216	745
2246	745	2279	742	2293	744	2324	744	2362	736
2451	729	2480	713.1	2482	712	2495	705.5	2693	705.5
2706	712	2710	713.5	2749	728	2790	729	2905	740
3119	750	3200	750	3240	750	3400	750	3600	750
3800	750	3950	750	4038	766	4370	766		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.048	2482	.035	2706	.058

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
2482	2706	1335.84	1335.84	1335.84	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	2350	736.6	F

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3
Reach-1	271	.053	.042	.053
Reach-1	270.5	.05	.042	.058
Reach-1	270.4	.06	.042	.054
Reach-1	270.3	Bridge		
Reach-1	270.2	.06	.042	.054
Reach-1	270.1	.054	.042	.048
Reach-1	269	.047	.042	.051
Reach-1	268.5	.051	.042	.051
Reach-1	268.4	.052	.042	.057
Reach-1	268.3	Bridge		
Reach-1	268.2	.052	.042	.043
Reach-1	268.1	.054	.045	.057
Reach-1	267.5	.062	.045	.058
Reach-1	267.4	.065	.045	.058
Reach-1	267.3	Bridge		
Reach-1	267.2	.068	.045	.06
Reach-1	267.1	.068	.045	.06
Reach-1	266	.08	.048	.07
Reach-1	265.5	.088	.055	.088
Reach-1	265.4	.086	.055	.086
Reach-1	265.3	Bridge		
Reach-1	265.2	.09	.055	.09
Reach-1	265.1	.092	.055	.084
Reach-1	264.5	.089	.055	.085
Reach-1	264.4	.092	.055	.086
Reach-1	264.3	Bridge		
Reach-1	264.2	.092	.055	.087
Reach-1	264.1	.092	.055	.09
Reach-1	263	.092	.047	.082
Reach-1	262	.05	.035	.06
Reach-1	261	.048	.035	.058

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	271	2386.56	2386.56	2386.56
Reach-1	270.5	52.8	52.8	52.8
Reach-1	270.4	8.7	8.7	8.7
Reach-1	270.3	Bridge		
Reach-1	270.2	42.24	42.24	42.24
Reach-1	270.1	1054.79	1054.79	1054.79
Reach-1	269	1379.48	1379.48	1379.48
Reach-1	268.5	58.09	58.09	58.09
Reach-1	268.4	15.5	15.5	15.5
Reach-1	268.3	Bridge		
Reach-1	268.2	31.68	31.68	31.68
Reach-1	268.1	403.75	403.75	403.75
Reach-1	267.5	58.08	58.08	58.08
Reach-1	267.4	58.5	58.5	58.5
Reach-1	267.3	Bridge		

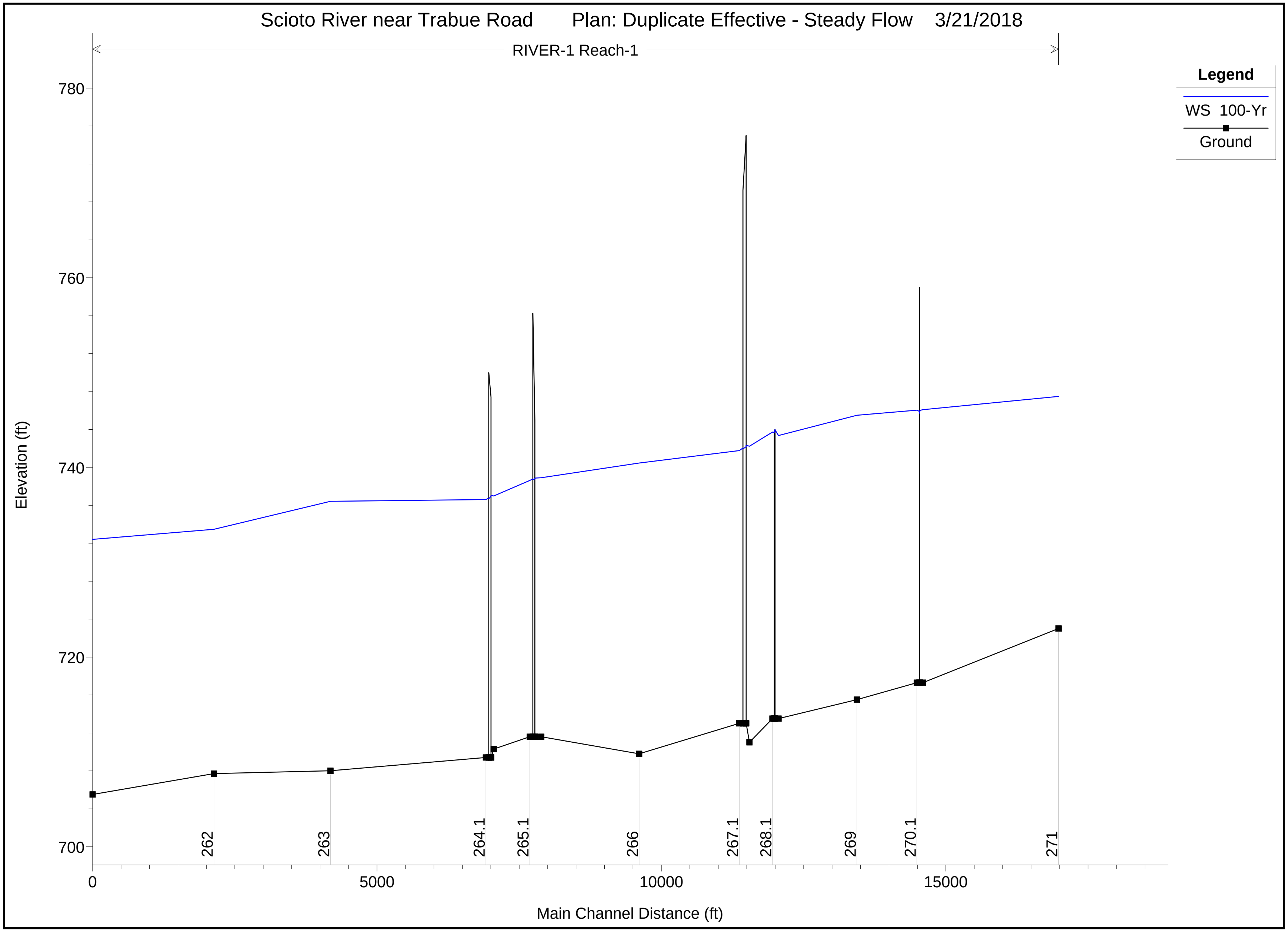
Reach-1	267.2	63.36	63.36	63.36
Reach-1	267.1	1759.28	1759.28	1759.28
Reach-1	266	1721.77	1721.77	1721.77
Reach-1	265.5	110.88	110.88	110.88
Reach-1	265.4	38.5	38.5	38.5
Reach-1	265.3	Bridge		
Reach-1	265.2	52.8	52.8	52.8
Reach-1	265.1	632.31	632.31	632.31
Reach-1	264.5	47.52	47.52	47.52
Reach-1	264.4	43	43	43
Reach-1	264.3	Bridge		
Reach-1	264.2	47.52	47.52	47.52
Reach-1	264.1	2733.27	2733.27	2733.27
Reach-1	263	2048.64	2048.64	2048.64
Reach-1	262	2133.12	2133.12	2133.12
Reach-1	261	1335.84	1335.84	1335.84

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	271	.1	.3
Reach-1	270.5	.1	.3
Reach-1	270.4	.1	.3
Reach-1	270.3	Bridge	
Reach-1	270.2	.1	.3
Reach-1	270.1	.1	.3
Reach-1	269	.1	.3
Reach-1	268.5	.1	.3
Reach-1	268.4	.1	.3
Reach-1	268.3	Bridge	
Reach-1	268.2	.1	.3
Reach-1	268.1	.1	.3
Reach-1	267.5	.1	.3
Reach-1	267.4	.1	.3
Reach-1	267.3	Bridge	
Reach-1	267.2	.1	.3
Reach-1	267.1	.1	.3
Reach-1	266	.1	.3
Reach-1	265.5	.1	.3
Reach-1	265.4	.1	.3
Reach-1	265.3	Bridge	
Reach-1	265.2	.1	.3
Reach-1	265.1	.1	.3
Reach-1	264.5	.1	.3
Reach-1	264.4	.1	.3
Reach-1	264.3	Bridge	
Reach-1	264.2	.1	.3
Reach-1	264.1	.1	.3
Reach-1	263	.1	.3
Reach-1	262	.1	.3
Reach-1	261	.1	.3

HEC-RAS Plan: Dup. Eff. Steady River: RIVER-1 Reach: Reach-1 Profile: 100-Yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	271	100-Yr	57000.00	723.00	747.48		748.02	0.0005	6.45	10758.6	586.4	0.23
Reach-1	270.5	100-Yr	57000.00	717.30	746.08		746.80	0.0005	7.12	9347.1	623.1	0.25
Reach-1	270.4	100-Yr	57000.00	717.30	746.00	730.92	746.76	0.0006	7.32	8943.2	496.6	0.25
Reach-1	270.3		Bridge									
Reach-1	270.2	100-Yr	57000.00	717.30	745.90		746.62	0.0005	7.18	9979.7	810.3	0.25
Reach-1	270.1	100-Yr	57000.00	717.30	746.03		746.54	0.0004	6.30	11802.6	881.6	0.22
Reach-1	269	100-Yr	57000.00	715.50	745.49		746.07	0.0005	7.24	11691.6	1033.2	0.23
Reach-1	268.5	100-Yr	57000.00	713.50	743.36		744.96	0.0013	11.39	6386.5	453.3	0.39
Reach-1	268.4	100-Yr	57000.00	713.50	743.93	732.51	744.64	0.0007	8.55	11427.3	1167.3	0.29
Reach-1	268.3		Bridge									
Reach-1	268.2	100-Yr	57000.00	713.50	743.69		744.55	0.0008	8.94	9923.3	859.9	0.30
Reach-1	268.1	100-Yr	57000.00	713.50	743.72		744.50	0.0009	8.74	10381.8	853.2	0.29
Reach-1	267.5	100-Yr	57000.00	711.00	742.23		743.97	0.0014	11.81	6461.6	406.9	0.38
Reach-1	267.4	100-Yr	57000.00	713.00	742.32	730.42	743.79	0.0020	9.72	5946.1	393.3	0.41
Reach-1	267.3		Bridge									
Reach-1	267.2	100-Yr	57000.00	713.00	742.03	730.41	743.57	0.0016	9.95	5787.7	358.1	0.38
Reach-1	267.1	100-Yr	57000.00	713.00	741.76	730.40	743.45	0.0015	10.47	5662.1	617.9	0.38
Reach-1	266	100-Yr	57000.00	709.80	740.46		741.20	0.0009	7.77	9864.5	515.8	0.27
Reach-1	265.5	100-Yr	57000.00	711.60	738.90		739.64	0.0010	7.20	9172.5	491.3	0.25
Reach-1	265.4	100-Yr	57000.00	711.60	738.86	724.50	739.50	0.0010	6.42	8900.6	421.5	0.24
Reach-1	265.3		Bridge									
Reach-1	265.2	100-Yr	57000.00	711.60	738.77		739.41	0.0010	6.45	8842.0	407.0	0.24
Reach-1	265.1	100-Yr	57000.00	711.60	738.62		739.35	0.0010	7.10	8881.7	406.9	0.25
Reach-1	264.5	100-Yr	57000.00	710.30	736.98		738.43	0.0020	9.77	6153.6	305.8	0.36
Reach-1	264.4	100-Yr	57000.00	709.40	737.06	724.58	738.27	0.0019	8.84	6473.2	311.2	0.34
Reach-1	264.3		Bridge									
Reach-1	264.2	100-Yr	57000.00	709.40	736.75		738.07	0.0021	9.28	6340.0	317.5	0.35
Reach-1	264.1	100-Yr	57000.00	709.40	736.61		737.98	0.0018	9.53	6607.3	348.2	0.34
Reach-1	263	100-Yr	57000.00	708.00	736.41		736.62	0.0002	3.64	17121.2	1129.9	0.12
Reach-1	262	100-Yr	57000.00	707.70	733.47	723.87	735.72	0.0012	12.34	5226.0	280.6	0.44
Reach-1	261	100-Yr	57000.00	705.50	732.40	718.59	733.64	0.0006	9.15	7136.7	417.8	0.31



1 in Horiz. = 2500 ft 1 in Vert. = 15 ft

HEC-RAS INPUT AND OUTPUT DATA

EXISTING CONDITIONS MODEL

HEC-RAS HEC-RAS 5.0.6 November 2018
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX   XXXX        XXXX     XX    XXXX
X     X  X       X    X       X   X   X  X  X
X     X  X       X            X   X  X    X X
XXXXXXX  XXXX    X      XXX   XXXX   XXXXXX  XXXX
X     X  X       X            X  X   X    X      X
X     X  X       X    X       X   X  X    X      X
X     X  XXXXXX   XXXX        X    X X    X XXXXX
```

PROJECT DATA
Project Title: Scioto River near Trabue Road
Project File : SciotoRiver.prj
Run Date and Time: 2/1/2019 9:33:05 AM

Project in English units

Project Description:
Effective model data obtained from FEMA by Hartman Engineering. For the existing or corrected effective model, the bridge data was updated from HEC-2 style formatting to HEC-RAS formatting, effective flow boundaries were corrected, top of bank designations were modified to maintain better consistency between sections, and overbank distances were modified to better match actual field conditions.

Duplicate effective data based on NGVD29
datum, and corrected effective or existing conditions and proposed conditions data based on NAVD88 datum.

Information below was what was included in the
effective FEMA data:

Columbus, OH Scioto River HEC-RAS Model for FEMA Map
Study of Local Protection Project

Model Date: July 2001

Model Produced
for the Huntington District, Corps of Engineers by

Fuller, Mossbarger,
Scott and May Engineers
1409 North Forbes Road
Lexington, Kentucky
40511-2050
Phone: (859) 422-3000

Project Engineers: Erman Caudill, Angela
Fister
QA/QC Engineers: Joe Herman, Brian Belcher
Project Managers: Jim
Latchaw, John Montgomery

Model is a HEC-RAS conversion and update of a
previously existing HEC-2 model.
Updated data pertains solely to modeling
convention and limited bridge construction plans around the Interstate 670 construction project provided by the Ohio Department of Transportation (ODOT).
Model also includes the effects of a new overflow channel that was constructed

as part of that project. In addition, the newly constructed West Columbus Local Protection Project was included in the model. Although the model has been updated it does not necessarily reflect as built conditions. Geometry was taken from the HEC-2 model and best available planimetric mapping for the new construction.

Flow data was taken from the HEC-2 model provided by the Corps.

For further information refer to accompanying narrative report.

PLAN DATA

Plan Title: Existing Conditions
Plan File : C:\Users\Hartman\Documents\All Jobs\1058 - Wagenbrenner, Scioto River Quarry\HEC-RAS\SciotoRiver.p06

Geometry Title: Existing Conditions
Geometry File : C:\Users\Hartman\Documents\All Jobs\1058 - Wagenbrenner, Scioto River Quarry\HEC-RAS\SciotoRiver.g06

Flow Title :
Flow File :

Plan Summary Information:

Number of:	Cross Sections =	26	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	5	Lateral Structures =	1

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

GEOMETRY DATA

Geometry Title: Existing Conditions
Geometry File : C:\Users\Hartman\Documents\All Jobs\1058 - Wagenbrenner, Scioto River Quarry\HEC-RAS\SciotoRiver.g06

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 271

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	788.4	121	764.4	150	764.4	181	763.4	276	734.4
316	734.4	320	734.3	471	729.4	492	729.4	516	728.4
520	726.4	521	725.9	525	725.9	530	722.4	760	722.4
775	722.4	790	729.4	880	779.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.053	516	.042	790	.053

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
516	790	2420	2386.56	2370	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.5

INPUT
Description:
Station Elevation Data num= 67

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	757.4	80	753.4	80	783.4	157	783.4	157	751.4
263	749.4	263	768.4	402	768.4	402	746.4	534	744.4
534	764.4	556	764.4	556	743.4	666	750.8	666	743
669	743	669	738	706	734.8	720	730.4	742	723.5
742.1	723.5	746.9	720.8	747	720.8	756	720.7	791	718.6
819.9	720.4	820	720.4	824.9	720.3	825	720.3	866	718.7
898.9	719.2	899	719.2	903.9	716.7	904	716.7	936	719.4
981.9	718.4	982	718.4	986.9	718.4	987	718.4	1000	719.6
1014	720.8	1056	734.5	1056	744	1058.5	744	1058.5	751.8
1087	740.4	1121	741.4	1147	741.9	1194	742.4	1225	753.4
1247	753.4	1257	750.4	1412	758.4	1520	752.4	1649	759.4
1830	757.5	1840	757.4	1916	759.4	1968	760.4	2011	760.4
2041	760.4	2088	786.4	2212	796.4	2320	792.4	2340	781.4
2500	781.4	2760	781.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	746.9	.042	1014	.058

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
746.9	1014	80	50	20	.3	.5

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.4

INPUT
Description: Unnamed Pipe Line Crossing Bridge - Upstream Section
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	758.4	127	752.4	127	783.4	138	783.4	138	751.4
238	748.4	238	768.4	379	768.4	379	746.4	491	742.4
491	760.4	614	760.4	614	742.4	670	750.8	670	743
673	743	673	738	710	734.8	720	731.7	746	723.5
752	720.8	760	720.7	795	718.6	824	720.4	829	720.3
870	718.7	903	719.2	908	716.7	940	719.4	986	718.4
991	718.4	1015	720.5	1018	720.8	1060	734.5	1060	744
1062.5	744	1062.5	751.8	1100	748.4	1163	749.4	1249	750.4
1496	752.4	1623	755.4	1680	755.4	1686	755.4	1899	758.4
2022	759.4	2044	759.4	2101	788.4	2228	795.4	2353	792.4
2376	781.4	2380	783.4	2600	783.4	2800	783.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	752	.042	1018	.054

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
752	1018	15	15	15	.3	.5

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 270.3

INPUT
Description: Structure #28 Unnamed Pipeline Crossing Bridge
Distance from Upstream XS = 4
Deck/Roadway Width = 7
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 12

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
491	742.4	742.4	614	742.4	742.4	670	750.4	742.4
1060	751.4	743.4	1100	748.4	726.4	1249	750.4	750.4
1496	752.4	752.4	1623	755.4	755.4	1680	755.4	755.4
1899	758.4	758.4	2044	759.4	759.4	2101	788.4	788.4

Upstream Bridge Cross Section Data
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	758.4	127	752.4	127	783.4	138	783.4	138	751.4
238	748.4	238	768.4	379	768.4	379	746.4	491	742.4
491	760.4	614	760.4	614	742.4	670	750.8	670	743
673	743	673	738	710	734.8	720	731.7	746	723.5
752	720.8	760	720.7	795	718.6	824	720.4	829	720.3
870	718.7	903	719.2	908	716.7	940	719.4	986	718.4
991	718.4	1015	720.5	1018	720.8	1060	734.5	1060	744
1062.5	744	1062.5	751.8	1100	748.4	1163	749.4	1249	750.4
1496	752.4	1623	755.4	1680	755.4	1686	755.4	1899	758.4
2022	759.4	2044	759.4	2101	788.4	2228	795.4	2353	792.4
2376	781.4	2380	783.4	2600	783.4	2800	783.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	752	.042	1018	.054

Bank Sta: Left	Right	Coeff Contr.	Expan.
752	1018	.3	.5

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
491	742.4	742.4	614	742.4	742.4	757	750.4	742.4
1147	751.4	743.4	1187	748.4	726.4	1336	750.4	750.4
1496	752.4	752.4	1623	755.4	755.4	1680	755.4	755.4

Downstream Bridge Cross Section Data
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	768.4	46	750.4	262	741.4	550	742.4	562	742.4
645	752.4	658	752.4	757	750.8	757	743	760	743
760	738	797	734.8	800	733.9	833	723.5	839	720.8
847	720.7	882	718.6	911	720.4	916	720.3	957	718.7
990	719.2	995	716.7	1027	719.4	1073	718.4	1078	718.4
1100	720.4	1105	720.8	1147	734.5	1147	744	1149.5	744
1149.5	751.8	1166	750.4	1227	751.4	1360	754.9	1377	755.4
1582	761.4	1605	761.4	1680	761.4	1900	761.4	1990	761.4
2100	761.4	2230	761.4	2318	787.4	2478	787.4	2485	779.4
2870	779.4	2882	789.4	2949	791.4	2971	789.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	839	.042	1105	.054

Bank Sta: Left	Right	Coeff Contr.	Expan.
839	1105	.3	.5

Upstream Embankment side slope = 0 horiz. to 1.0 vertical

```
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  4

Pier Data
Pier Station     Upstream=   748.5    Downstream=   835.5
Upstream     num=       2
    Width   Elev    Width   Elev
       5   720.8       5   744.4
Downstream     num=       2
    Width   Elev    Width   Elev
       5   720.8       5   744.4

Pier Data
Pier Station     Upstream=   826.5    Downstream=   913.5
Upstream     num=       2
    Width   Elev    Width   Elev
       5   720.3       5   744.4
Downstream     num=       2
    Width   Elev    Width   Elev
       5   720.3       5   744.4

Pier Data
Pier Station     Upstream=   905.5    Downstream=   992.5
Upstream     num=       2
    Width   Elev    Width   Elev
       5   716.7       5   744.4
Downstream     num=       2
    Width   Elev    Width   Elev
       5   716.7       5   744.4

Pier Data
Pier Station     Upstream=   988.5    Downstream=  1075.5
Upstream     num=       2
    Width   Elev    Width   Elev
       5   718.4       5   744.4
Downstream     num=       2
    Width   Elev    Width   Elev
       5   718.4       5   744.4

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 270.2

INPUT
Description: Unnamed Pipe Line Crossing Bridge -Downstream Section
```

Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	768.4	46	750.4	262	741.4	550	742.4	562	742.4
645	752.4	658	752.4	757	750.8	757	743	760	743
760	738	797	734.8	800	733.9	833	723.5	839	720.8
847	720.7	882	718.6	911	720.4	916	720.3	957	718.7
990	719.2	995	716.7	1027	719.4	1073	718.4	1078	718.4
1100	720.4	1105	720.8	1147	734.5	1147	744	1149.5	744
1149.5	751.8	1166	750.4	1227	751.4	1360	754.9	1377	755.4
1582	761.4	1605	761.4	1680	761.4	1900	761.4	1990	761.4
2100	761.4	2230	761.4	2318	787.4	2478	787.4	2485	779.4
2870	779.4	2882	789.4	2949	791.4	2971	789.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	839	.042	1105	.054

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
839	1105	40	40	40	.3	.5

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.1

INPUT
Description:
Station Elevation Data num= 62

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	771.4	48	748.4	274	740.4	463	741.4	463	757.4
553	757.4	553	742.4	591	741.4	623	755.4	635	755.4
640	755.2	729	750.8	729	743	732	743	732	738
769	734.8	800	725.1	804.9	723.5	805	723.5	810	720.8
810.1	720.8	819	720.7	854	718.6	882.9	720.4	883	720.4
887.9	720.3	888	720.3	929	718.7	961.9	719.2	962	719.2
966.9	716.7	967	716.7	999	719.4	1044.9	718.4	1045	718.4
1049.9	718.4	1050	718.4	1077	720.8	1110	731.6	1119	734.5
1119	744	1121.5	744	1121.5	751.8	1132	725.4	1190	726.4
1249	751.4	1300	753.3	1382	756.4	1587	760.4	1609	760.4
1680	759.4	1925	759.4	2010	761.3	2015	761.4	2290	761.4
2335	786.4	2480	787.4	2490	779.4	2900	779.4	2918	790.4
2975	793.4	2994	790.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.054	810.1	.042	1077	.048

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
810.1	1077	1050	1054.79	1050	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 269

INPUT
Description:
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	780.4	148	776.4	186	769.4	214	769.4	227	770.4
240	764.9	295	741.4	446	741.4	460	741.4	580	741.4
600	743.4	617	743.4	660	741.4	840	741.4	841	741.4
860	725.4	866	720.4	877	714.9	1016	714.9	1027	720.4
1030	721.8	1040	726.4	1289	729.4	1351	760.4	1400	760.4
1528	760.4	1611	763.4	1641	766.4	1702	765.4	1856	763.4
1960	759.4	2360	759.4	2400	759.4	2680	759.4	2690	761.4
2770	760.4	2780	759.4	3000	759.4	3200	759.4	3263	801.4

3412 805.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.047	860	.042	1040	.051

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
860	1040	1350	1379.48	1380	.1	.3

LATERAL STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 268.7

INPUT
Description:
Lateral structure position = Right overbank
Distance from Upstream XS =
Deck/Roadway Width = 60
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	745	42	744	100	742	120	741.5	260	741
295	740	335	739	342	737	348	737	367	745

Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	7	

FHWA Chart # 1 - Concrete Pipe Culvert
FHWA Scale # 1 - Square edge entrance with headwall
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	150	.013	.013	0	.5	1

Upstream Elevation = 723
Centerline Station = 300
Downstream Elevation = 723
Centerline Station = 300

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 268.5

INPUT
Description: Effective section shortened on right overbank so end of section would be close to assumed lateral structure.
Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767.4	83	770.4	83	794.4	264	794.4	264	769.4
356	763.4	400	744.4	600	744.4	800	744.4	1055	744.4
1059	743.2	1059	738.4	1060	738.5	1061	738.5	1081.5	738.5
1082	734.3	1102	725	1124	716.4	1159	712.9	1174	713.2
1193	715.2	1212.9	716	1213	716	1223.9	718.5	1224	718.5
1259	718.6	1309	724.8	1334	727.2	1340	731.1	1351	738.2
1359	739	1359	743.8	1394	740.4	1442	740.4	1545	743.4
1569	743.4	1580	743.4	1581	750				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.051	1102	.042	1334	.051

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1102    1334               55      55      55              .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1550    1581               T

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 268.4

INPUT
Description: Haul Road Bridge (Marble Cliff Quarries) - Upstream Section.
             Effective section shortened on right overbank so end of section
             would be close to assumed lateral structure.
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   767.4      63   770.4     196   768.4     300   765.4     379   762.4
     435   735.4     597   734.4     697   734.4     723   734.4     845   735.4
     929   736.4    1011   737.4    1088   743.2    1089   738.5    1091   738.5
  1111.5   738.5    1112   734.3    1135   724.5    1154   716.4    1189   712.9
    1204   713.2    1223   715.2    1243     716    1254   718.5    1289   718.6
    1339   724.8    1364   727.2    1380   737.6    1381   738.2    1389     739
    1389   743.8    1430   739.4    1459   741.4    1530   742.4    1590   741.4
    1591     750

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .052    1135    .042    1364    .057

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1135    1364               21      21      21              .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1450    1591               T

BRIDGE


RIVER: RIVER-1
REACH: Reach-1            RS: 268.3

INPUT
Description: Structure #27 Haul Road Bridge (Marble Cliff Quarries)
Distance from Upstream XS =       4
Deck/Roadway Width        =      13
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    1088   743.2   743.2    1088   743.4   743.4    1089   743.4   738.5
    1389   743.4   738.5    1389   741.4   741.4

Upstream Bridge Cross Section Data
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   767.4      63   770.4     196   768.4     300   765.4     379   762.4
     435   735.4     597   734.4     697   734.4     723   734.4     845   735.4
     929   736.4    1011   737.4    1088   743.2    1089   738.5    1091   738.5
  1111.5   738.5    1112   734.3    1135   724.5    1154   716.4    1189   712.9
    1204   713.2    1223   715.2    1243     716    1254   718.5    1289   718.6
    1339   724.8    1364   727.2    1380   737.6    1381   738.2    1389     739
    1389   743.8    1430   739.4    1459   741.4    1530   742.4    1590   741.4
    1591     750

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .052    1135    .042    1364    .057
```

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right	Contr.	Expan.
1135	1364	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1450	1591		T

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
1008	743.2	743.2	1008	743.4	743.4	1008	743.4	738.5
1309	743.4	738.5	1309	741.4	741.4	1520	741.4	741.4
2000	741.4	741.4	2300	741.4	741.4	2320	752.4	752.4
3015	752.4	752.4	3076	800.4	800.4			

Downstream Bridge Cross Section Data
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767.4	190	767.4	304	765.4	410	759.4	455	739.3
466	734.4	620	734.4	677	735.4	706	735.4	721	733.4
755	736.4	848	736.4	1009	743.2	1009	738.4	1011	738.5
1031.5	738.5	1032	734.3	1055	724	1074	716.4	1109	712.9
1124	713.2	1135	714.4	1143	715.2	1163	716	1174	718.5
1209	718.6	1259	724.8	1284	727.2	1301	738.2	1309	739
1309	743.8	1320	743.4	1325	743.4	1357	743.4	1371	743.4
1414	743.4	1440	743.4	1500	743.4	1501	750		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.052	1055	.042	1284	.043

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right	Contr.	Expan.
1055	1284	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1375	1501		T

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 1

Pier Data
Pier Station Upstream= 1248.5 Downstream= 1168.5
Upstream num= 2

Width	Elev	Width	Elev
11	716	11	738.5

Downstream num= 2

Width	Elev	Width	Elev
11	716	11	738.5

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth

```
            inside the bridge at the upstream end
        Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 268.2

INPUT
Description: Haul Road Bridge (Marble Cliff Quarries) - Downstream Section.
             Effective section shortened on right overbank so end of section
             would be close to assumed lateral structure.
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   767.4     190   767.4     304   765.4     410   759.4     455   739.3
     466   734.4     620   734.4     677   735.4     706   735.4     721   733.4
     755   736.4     848   736.4    1009   743.2    1009   738.4    1011   738.5
  1031.5   738.5    1032   734.3    1055     724    1074   716.4    1109   712.9
    1124   713.2    1135   714.4    1143   715.2    1163     716    1174   718.5
    1209   718.6    1259   724.8    1284   727.2    1301   738.2    1309     739
    1309   743.8    1320   743.4    1325   743.4    1357   743.4    1371   743.4
    1414   743.4    1440   743.4    1500   743.4    1501     750

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .052    1055    .042    1284    .043

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1055    1284               28      28      28              .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1375    1501               T

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 268.1

INPUT
Description: Effective section shortened on right overbank so end of section
             would be close to assumed lateral structure.
Station Elevation Data    num=      41
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   767.4     105   769.4     105   788.4     206   788.4     206   766.4
     305   764.4     407   760.4     474   734.4     617   734.4     640     736
     659   737.4     690   737.4     710   733.4     851   736.4     974   735.4
    1005   743.2    1005   738.4    1007   738.5  1027.5   738.5    1028   734.3
    1048     726    1070   716.4    1105   712.9    1120   713.2    1130   714.3
    1139   715.2  1158.9     716    1159     716  1169.9   718.5    1170   718.5
    1205   718.6    1255   724.8    1280   727.2    1297   738.2    1305     739
    1305   743.8    1320   743.4    1324   743.4    1367   743.4    1500   743.4
    1501     750

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .054    1048    .045    1280    .057

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1048    1280           403.75  403.75  403.75              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1300    1501               T

CROSS SECTION


RIVER: RIVER-1
```

REACH: Reach-1 RS: 267.5

INPUT
Description:
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
5	766.3	63.5	767.3	193	766.3	299.8	761.3	332.3	747.5
579	747.4	585	746.8	814	746.9	849.4	746.5	862.6	739.9
900	728.6	940.6	724.2	999.4	718.6	1014.2	714.2	1022.7	712.9
1032.1	712.5	1054.2	710.4	1068.5	710.5	1084	710.4	1105.5	710.4
1112.1	712	1122.2	714.1	1142	722	1160.3	738.4	1161.9	740.9
1197.1	741	1202.7	742.3	1308.4	742.4	1308.7	741.2	1343.9	741.4
1373.4	740.7	1414.5	767.3	1443.4	769.6	1463.6	784.4	1581.1	784.3
1581.1	769.6	1613.5	770.4	1666.4	770.4	1707.3	771.5	1720.9	789.4
1750.3	789.4	1754.3	771.5	1789.3	772.3	1826.6	763.3	2895.6	763.4
2931	789								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
5	.062	999.4	.045	1142	.058

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
999.4	1142	70	58.08	50	.3	.5

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 267.4

INPUT
Description: Trabue Road - Upstream Section
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	766.4	106	767.4	107	783.4	147	783.4	147	767.4
169	765.4	185	762.4	200	762.4	213	765.4	254	765.4
282	747.4	400	747.4	560	747.4	814	747.4	816	758.3
817	757.4	817	756.9	875	729.4	909.999	721.6	914	720.9
956	714.8	990	713.6	1018.9	713.4	1023	713.4	1050	712.4
1077	714.1	1100	730.4	1120	740.1	1128	740.9	1132	741
1180	741.2	1225	759	1226	760.4	1227	760.7	1267	744.4
1278	743.8	1295	743.4	1304	740.4	1336	740.4	1354	738.4
1419	769.4	1635	769.4	1642	769.4	1879	774.4	1950	763.4
2200	763.4	2400	763.4	2590	763.4	2685	764.4	2845	764.4
2920	800.4	2943	801.4	2988	801.4	3107	802.4	3173	803.4
3187	803.4	3237	802.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	875	.045	1100	.058

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
875	1100	64	64	64	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	812.29	766.55	F

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 267.3

INPUT
Description: Structure #26 Trabue Road Bridge
Distance from Upstream XS = 4
Deck/Roadway Width = 56
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates

num= 23

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	766.4	766.4	147	767.4	767.4	254	765.4	747.4
400	762.4	747.4	560	763.4	747.4	814	765.4	747.4
816	765.4	758.3	817	765.4	757.4	1226	768.4	760.4
1227	768.4	760.7	1228	768.6	760.7	1230	768.6	729.4
1354	769.4	729.4	1419	769.4	769.4	1635	769.4	769.4
1879	774.4	774.4	1950	776.4	763.4	2200	784.4	763.4
2400	791.4	763.4	2590	796.4	763.4	2685	797.4	764.4
2845	801.4	764.4	2920	801.4	-.6			

Upstream Bridge Cross Section Data

Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	766.4	106	767.4	107	783.4	147	783.4	147	767.4
169	765.4	185	762.4	200	762.4	213	765.4	254	765.4
282	747.4	400	747.4	560	747.4	814	747.4	816	758.3
817	757.4	817	756.9	875	729.4	909.999	721.6	914	720.9
956	714.8	990	713.6	1018.9	713.4	1023	713.4	1050	712.4
1077	714.1	1100	730.4	1120	740.1	1128	740.9	1132	741
1180	741.2	1225	759	1226	760.4	1227	760.7	1267	744.4
1278	743.8	1295	743.4	1304	740.4	1336	740.4	1354	738.4
1419	769.4	1635	769.4	1642	769.4	1879	774.4	1950	763.4
2200	763.4	2400	763.4	2590	763.4	2685	764.4	2845	764.4
2920	800.4	2943	801.4	2988	801.4	3107	802.4	3173	803.4
3187	803.4	3237	802.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	875	.045	1100	.058

Bank Sta: Left	Right	Coeff Contr.	Expan.
875	1100	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	812.29	766.55	F

Downstream Deck/Roadway Coordinates

num= 20

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
308	760.4	760.4	400	762.4	729.4	560	763.4	747.4
863	765.4	747.4	865	765.4	758.3	866	765.4	757.4
1275	768.4	760.4	1275	768.4	760.7	1275	768.6	760.7
1280	768.5	720	1403	769.4	720	1468	769.4	739.4
1684	769.4	739.4	1928	774.4	739.4	1999	776.4	739.4
2249	784.4	739.4	2449	791.4	739.4	2639	796.4	739.4
2734	797.4	739.4	2894	800.4	-.6			

Downstream Bridge Cross Section Data

Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	765.4	129	762.4	262.999	760.4	308	760.4	330.001	755.4
500	755.4	608	755.4	690	755.4	692	755.4	864	758.3
866	758.3	866	756.9	924	729.4	959	721.6	963	720.9
1005	714.8	1039	713.6	1040	713.6	1068	713.4	1072	713.4
1099	712.4	1126	714.1	1149	730.4	1169	740.1	1177	740.9
1181	741	1200	741.1	1229	741.2	1275	759	1275	760.7
1277	760.7	1300	740.4	1320	739.4	1355	751.4	1411	751.4
1435	767.4	1533	768.4	1621	767.4	1653	768.4	1677.999	757.4
2000	757.4	2400	757.4	2600	757.4	2765	757.4	2767	755.4
2827	800.4	2932	800.4	3024	802.4	3056	803.4	3079	803.4
3095	799.4	3125	801.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.068	924	.045	1149	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
924	1149	.3	.5

```
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  856.09  766.55       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  3

Pier Data
Pier Station     Upstream=     912    Downstream=     961
Upstream     num=       2
    Width   Elev    Width   Elev
     3.8   720.9     3.8   759.4
Downstream     num=       2
    Width   Elev    Width   Elev
     3.8   720.9     3.8   759.4

Pier Data
Pier Station     Upstream=    1021    Downstream=    1070
Upstream     num=       2
    Width   Elev    Width   Elev
     3.8   713.4     3.8   759.4
Downstream     num=       2
    Width   Elev    Width   Elev
     3.8   713.4     3.8   759.4

Pier Data
Pier Station     Upstream=    1130    Downstream=    1179
Upstream     num=       2
    Width   Elev    Width   Elev
     3.8   740.9     3.8   760.4
Downstream     num=       2
    Width   Elev    Width   Elev
     3.8   740.9     3.8   760.4

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum               Cd   =    1.33
       Yarnell                KVal =      .9
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 267.2

INPUT
Description: Trabue Road - Downstream Section
Station Elevation Data    num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

0	765.4	129	762.4	262.999	760.4	308	760.4	330.001	755.4
500	755.4	608	755.4	690	755.4	692	755.4	864	758.3
866	758.3	866	756.9	924	729.4	959	721.6	963	720.9
1005	714.8	1039	713.6	1040	713.6	1068	713.4	1072	713.4
1099	712.4	1126	714.1	1149	730.4	1169	740.1	1177	740.9
1181	741	1200	741.1	1229	741.2	1275	759	1275	760.7
1277	760.7	1300	740.4	1320	739.4	1355	751.4	1411	751.4
1435	767.4	1533	768.4	1621	767.4	1653	768.4	1677.999	757.4
2000	757.4	2400	757.4	2600	757.4	2765	757.4	2767	755.4
2827	800.4	2932	800.4	3024	802.4	3056	803.4	3079	803.4
3095	799.4	3125	801.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.068	924	.045	1149	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
924	1149	66	66	66	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	856.09	766.55	F

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 267.1

INPUT
Description:
Station Elevation Data num= 73

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	766.4	122	765.4	286	759.4	327	757.4	446	744.4
493	740.4	514	739.4	537	739.4	573	733.4	610	733.4
780	729.4	783	766.1	783	758.3	785	758.3	785	756.9
843	729.4	877.9	721.6	878	721.6	881.9	720.9	882	720.9
924	714.8	958	713.6	986.9	713.4	987	713.4	990.9	713.4
991	713.4	1018	712.4	1030	713.2	1045	714.1	1068	730.4
1088	740.1	1095.9	740.9	1096	740.9	1099.9	741	1100	741
1148	741.2	1194	759	1194	760.7	1196	760.7	1196	768.6
1200	750.8	1202	749.4	1239	749.4	1281	744.4	1308	744.4
1329	742.4	1357	751.4	1411	751.4	1442	768.4	1501	768.4
1501	778.4	1556	778.4	1557	768.4	1578	767.4	1598	767.4
1629	767.4	1640	755.4	1800	755.4	2000	755.4	2200	755.4
2360	755.4	2419	756.4	2437	756.4	2460	758.4	2618	756.4
2803	755.4	2861	801.4	2987	805.4	3016	798.4	3036	803.4
3057	803.4	3070	798.4	3098	801.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.068	843	.045	1068	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
843	1068	1600	1758	1780	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	784.41	766.76	F

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 266

INPUT
Description:
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	770.2	134.9	764.3	236.7	761.5	372.1	761.4	380.1	776.3

733	776.4	746	756.2	819.8	751.3	885.2	750.3	926.3	750.4
992.4	748.3	1007.3	743.4	1113.3	743.2	1195.6	725.2	1328.1	720.4
1374.9	720.9	1400.3	722.6	1440.6	718.1	1459.1	713.9	1505.2	713.7
1521.4	712.9	1558.1	710.5	1578.5	709.2	1593.7	710.3	1601.4	713.3
1616	722	1651.1	744.1	1656.2	740.6	1672.7	742.4	1713.9	742.3
1726.2	741.5	2120.3	741.5	2520.4	741.5	2546.6	773.5	2639.5	775.4
2659.2	781.3	2676	782.5	2740.8	782.4	2831	779.4	2870.6	763.7
2920.4	759.5	2979.2	759.5	2982.8	799.2	3029.9	799.1	3029.9	759.5
3091.1	759.3	3125.7	760.4	3132.2	759.4	3514.6	759.4	3536.2	771.4
3612.8	771.3	3640.2	783.3	3667.7	786.3	3782.5	781.6	3803.4	785.6
3895.8	788.3	3978.1	788.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	1400.3	.048	1616	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1400.3	1616	1800	1721.77	1550	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.5

INPUT
Description:
Station Elevation Data num= 85

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	800.4	68	798.4	180	775.4	204	775.4	241	769.4
262	769.4	321	767.4	321	774.4	372	774.4	372	767.4
472	763.4	514	763.4	566	762.4	566	757.4	623	757.4
693	755.4	693	764.4	740	764.4	740	754.4	765	755.4
802	755.4	880	755.4	958	753.4	977	751.4	1023	748.4
1050	748.4	1054	748.4	1103	742	1103	740.2	1114	740.2
1114	723.2	1132	717.8	1159	713.4	1187	711	1234.9	712
1235	712	1241.9	712	1242	712	1251	712.1	1251.1	712.1
1258.9	712.1	1259	712.1	1280	712.1	1303	712	1343	711.7
1380.8	711.9	1380.9	711.9	1381	713.9	1391.9	715.4	1392	715.4
1413	717.2	1430	720.8	1451	725.2	1502	725.2	1521	733.9
1521	740.2	1528	740.2	1528	742	1536	735.4	1571	736.4
1584	736.4	1609	736.4	1686	750.4	1811	764.4	1861	767.4
1883	767.4	2029	766.4	2137	766.4	2156	766.4	2213	756.4
2246	745.4	2432	746.4	2465	746.4	2495	745.4	2800	745.4
3000	745.4	3320	745.4	3320	748.4	3720	748.4	3776	785.4
3965	785.4	4166	785.4	4177	782.4	4189	784.4	4212	784.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.088	1132	.055	1413	.088

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1132	1413	180	107	20	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1875	4212		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.4

INPUT
Description: Penn Central Railroad Bridge Crossing #3 - Upstream Section
Station Elevation Data num= 78

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	799.4	150	777.4	219	769.4	239	769.4	291	767.4
291	774.4	348	774.4	348	766.4	414	762.4	458	762.4

557	760.4	631	757.4	631	764.4	687	764.4	687	756.4
743	755.4	756	755.4	800	754.4	823	754.4	920	752.6
928	752.4	974	749.4	1018	747.4	1046	746.4	1104.1	742
1104.2	740.2	1115	740.2	1115	723.2	1133	717.8	1160	713.4
1188	711	1230	711.9	1236	712	1236	716.8	1243	716.8
1252	716.8	1260	716.8	1260	712.1	1304	712	1344	711.7
1382	711.9	1382	713.4	1393	715.4	1414	717.2	1452	725.2
1503	725.2	1522	733.9	1522	740.2	1529	740.2	1529	742
1544	735.4	1614	760.4	1676	765.4	1703	765.4	1760	764.4
1887	757.4	2056	761.4	2072	761.4	2101	761.4	2152	754.4
2169	744.4	2355	745.4	2395	745.4	2400	745.4	2600	745.4
2800	745.4	3000	745.4	3275	745.4	3280	748.4	3480	748.4
3600	748.4	3720	748.4	3782	786.4	3959	786.4	4154	785.4
4164	782.4	4174	784.4	4199	784.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	1133	.055	1414	.086

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1133	1414	44	44	44	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1675	4199		T

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 265.3

INPUT
Description: Structure #25 Penn Central Railroad Bridge, Crossing #3
Distance from Upstream XS = 4
Deck/Roadway Width = 36
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
687	756.4	756.4	743	755.4	755.4	756	755.4	755.4
800	754.4	754.4	1046	754.4	746.4	1104.1	764.4	742
1104.2	764.4	741.4	1529	764.4	741.4	1544	764.4	735.4
1614	764.4	760.4	1676	765.4	765.4			

Upstream Bridge Cross Section Data
Station Elevation Data num= 78

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	799.4	150	777.4	219	769.4	239	769.4	291	767.4
291	774.4	348	774.4	348	766.4	414	762.4	458	762.4
557	760.4	631	757.4	631	764.4	687	764.4	687	756.4
743	755.4	756	755.4	800	754.4	823	754.4	920	752.6
928	752.4	974	749.4	1018	747.4	1046	746.4	1104.1	742
1104.2	740.2	1115	740.2	1115	723.2	1133	717.8	1160	713.4
1188	711	1230	711.9	1236	712	1236	716.8	1243	716.8
1252	716.8	1260	716.8	1260	712.1	1304	712	1344	711.7
1382	711.9	1382	713.4	1393	715.4	1414	717.2	1452	725.2
1503	725.2	1522	733.9	1522	740.2	1529	740.2	1529	742
1544	735.4	1614	760.4	1676	765.4	1703	765.4	1760	764.4
1887	757.4	2056	761.4	2072	761.4	2101	761.4	2152	754.4
2169	744.4	2355	745.4	2395	745.4	2400	745.4	2600	745.4
2800	745.4	3000	745.4	3275	745.4	3280	748.4	3480	748.4
3600	748.4	3720	748.4	3782	786.4	3959	786.4	4154	785.4
4164	782.4	4174	784.4	4199	784.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.086	1133	.055	1414	.086

Bank Sta: Left Right Coeff Contr. Expan.

	1133	1414		.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1675	4199		T

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
687	756.4	756.4	743	755.4	755.4	756	755.4	755.4
800	754.4	754.4	923	754.4	729.4	981	764.4	729.4
981.1	764.4	742	981.2	764.4	741.4	1406	764.4	741.4

Downstream Bridge Cross Section Data
Station Elevation Data num= 66

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	782.4	118	778.4	205	769.4	231	769.4	271	763.4
271	774.4	500	774.4	500	759.4	541	758.4	560	758.4
603	756.4	621	756.4	657	758.4	698	757.4	733	755.4
790	758.4	815	761.4	832	761.4	873	760.4	921	742.4
967	740.4	981	742	981	740.2	992	740.2	992	723.2
1010	717.8	1037	713.4	1065	711	1113	712	1113	716.8
1120	716.8	1129	716.8	1137	716.8	1137	712.1	1181	712
1221	711.7	1259	711.9	1259	713.4	1270	715.4	1291	717.2
1329	725.2	1380	725.2	1399	733.9	1399	740.2	1406	740.2
1406	742	1406	764.4	1408	763.4	1487	760.4	1520	745.4
1800	745.4	2000	745.4	2200	745.4	2400	745.4	2600	745.4
2800	745.4	3000	745.4	3200	745.4	3400	745.4	3600	745.4
3800	745.4	3975	745.4	4014	788.4	4025	782.4	4037	784.4
4065	784.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.09	1010	.055	1291	.09

Bank Sta: Left	Right	Coeff Contr.	Expan.
1010	1291	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1425	4065		T

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 2

Pier Data
Pier Station Upstream= 1247.5 Downstream= 1124.5
Upstream num= 2

Width	Elev	Width	Elev
9	716.8	9	741.4

Downstream num= 2

Width	Elev	Width	Elev
9	716.8	9	741.4

Pier Data
Pier Station Upstream= 1387.5 Downstream= 1264.5
Upstream num= 2

Width	Elev	Width	Elev
11	713.4	11	741.4

Downstream num= 2

Width	Elev	Width	Elev
11	713.4	11	741.4

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.2

INPUT
Description: Penn Central Railroad Bridge Crossing #3 -Downstream Section
Station Elevation Data num= 66

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	782.4	118	778.4	205	769.4	231	769.4	271	763.4
271	774.4	500	774.4	500	759.4	541	758.4	560	758.4
603	756.4	621	756.4	657	758.4	698	757.4	733	755.4
790	758.4	815	761.4	832	761.4	873	760.4	921	742.4
967	740.4	981	742	981	740.2	992	740.2	992	723.2
1010	717.8	1037	713.4	1065	711	1113	712	1113	716.8
1120	716.8	1129	716.8	1137	716.8	1137	712.1	1181	712
1221	711.7	1259	711.9	1259	713.4	1270	715.4	1291	717.2
1329	725.2	1380	725.2	1399	733.9	1399	740.2	1406	740.2
1406	742	1406	764.4	1408	763.4	1487	760.4	1520	745.4
1800	745.4	2000	745.4	2200	745.4	2400	745.4	2600	745.4
2800	745.4	3000	745.4	3200	745.4	3400	745.4	3600	745.4
3800	745.4	3975	745.4	4014	788.4	4025	782.4	4037	784.4
4065	784.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.09	1010	.055	1291	.09

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1010	1291	45	48	90	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1425	4065		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.1

INPUT
Description:
Station Elevation Data num= 65

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	782.4	133	778.4	200	769.4	226	769.4	272	764.4
272	774.4	476	774.4	477	759.4	530	758.4	546	758.4
587	756.4	606	756.4	760	759.4	778	759.4	922	742.4
968	740.4	979	742	979	740.2	990	740.2	991	723.2
1008	717.8	1035	713.4	1063	711	1111	712	1111.1	712
1117.9	712	1118	712	1126.9	712.1	1127	712.1	1134.9	712.1
1135	712.1	1179	712	1219	711.7	1257	711.9	1257.1	711.9
1257.2	713.9	1267.9	715.4	1268	715.4	1289	717.2	1327	725.2
1378	725.2	1397	733.9	1397	740.2	1404	740.2	1404	742

1404	764.4	1411	761.4	1497	760.4	1535	745.4	1800	745.4
2000	745.4	2200	745.4	2400	745.4	2600	745.4	2800	745.4
3000	745.4	3200	745.4	3400	745.4	3600	745.4	3800	745.4
3975	745.4	4004	788.4	4017	782.4	4033	784.4	4059	784.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	1008	.055	1289	.084

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1008	1289	500	632.31	610	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1425	4059		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264.5

INPUT
Description:
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
5.2	761.3	22.8	761.3	66.2	767.2	83.8	767.1	133.5	758.3
260	750.3	371.8	750.4	382	762.3	452.6	762.1	465.4	749.1
562.1	740.2	591.6	740.3	620	739.6	628.7	736.9	658.6	725.2
672	719.9	693.3	711.5	709.2	710.5	731.2	709.7	757	710
783.4	710	814.3	709.9	832.8	710.5	846.2	711.4	856.4	713
870.9	718	901.3	719.9	956.9	746.4	958.7	746.8	1024.7	750.5
1178	751.4	1437.2	752.4	1469.9	745.2	2281.7	745.4	2378	783.3
2683.9	783.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
5.2	.089	672	.055	901.3	.085

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
672	901.3	44	44	44	.3	.5

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264.4

INPUT
Description: West 5th Avenue Bridge - Upstream Section
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	762.4	18	762.4	88	767.4	99	767.4	162	758.4
343	750.4	343	762.4	525	762.4	525	749.4	590	741.5
599	740.4	661	740.4	672	736.4	713	719.4	733	710.7
752	710.7	755	709.2	770	708.8	772	708.8	792	709
830.5	710.4	833.5	709.4	872	709.2	895	710.6	910.5	716.4
913.5	716.4	947	719.5	972	731.3	975	732.7	991	740.2
992	743.6	993	746.8	1068	745.4	1273	752.4	1498	754.4
1535	745.4	1800	745.4	2000	745.4	2280	745.4	2355	783.4
2692	784.4	2712	784.4	2808	786.4	2909	787.4	3172	787.4
3429	787.4	3551	789.4	3560	787.4	3572	788.4	3602	788.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	713	.055	947	.086

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
713	947	48	48	48	.3	.5

BRIDGE

```
RIVER: RIVER-1
REACH: Reach-1            RS: 264.3

INPUT
Description: Structure #24 West 5th Avenue Bridge
Distance from Upstream XS =       4
Deck/Roadway Width        =    40.5
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      14
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
     525   749.4   749.4     599   740.4   740.4     672   740.4   736.4
     713   744.4   737.4     947   749.4   743.4     992   746.8   743.8
     993   746.8   746.8    1068   745.4   745.4    1273   752.4   752.4
    1498   754.4   754.4    1535   745.4   745.4    2000   745.4   745.4
    2280   745.4   745.4    2355   783.4   783.4

Upstream Bridge Cross Section Data
Station Elevation Data    num=      50
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   762.4      18   762.4      88   767.4      99   767.4     162   758.4
     343   750.4     343   762.4     525   762.4     525   749.4     590   741.5
     599   740.4     661   740.4     672   736.4     713   719.4     733   710.7
     752   710.7     755   709.2     770   708.8     772   708.8     792     709
   830.5   710.4   833.5   709.4     872   709.2     895   710.6   910.5   716.4
   913.5   716.4     947   719.5     972   731.3     975   732.7     991   740.2
     992   743.6     993   746.8    1068   745.4    1273   752.4    1498   754.4
    1535   745.4    1800   745.4    2000   745.4    2280   745.4    2355   783.4
    2692   784.4    2712   784.4    2808   786.4    2909   787.4    3172   787.4
    3429   787.4    3551   789.4    3560   787.4    3572   788.4    3602   788.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .092     713    .055     947    .086

Bank Sta: Left   Right    Coeff Contr.   Expan.
           713     947             .3       .5

Downstream  Deck/Roadway Coordinates
    num=       6
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
     525   749.4   749.4     599   740.4   740.4     756   740.4   736.4
     797   744.4   737.4    1031   749.4   743.4    1077   746.8   743.9

Downstream Bridge Cross Section Data
Station Elevation Data    num=      58
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   764.4      21   764.4      87   767.4     103   767.4     155   759.4
     221   754.4     221   789.4     309   789.4     309   752.4     414   762.4
     425   762.4     440   760.4     529   748.4     583   746.4     720   737.6
     723   737.4     746     737     805   719.4     817   710.7     836   710.7
     839   709.2     840   709.2     856   708.8     876     709   914.5   710.4
   917.5   709.4     956   709.2     979   710.6   994.5   716.4   997.5   716.4
    1020   718.5    1031   719.5    1056   731.3    1075   740.2    1075   743.6
    1077   746.8    1108   745.4    1206   748.4    1300   750.1    1314   750.4
    1634   754.4    1640   752.9    1670   745.4    1800   745.4    1900   745.4
    2065   745.4    2223   762.4    2261   779.4    2533   782.4    2727   783.4
    2750   783.4    2979   786.4    3168   787.4    3397   788.4    3570   789.4
    3580   787.4    3592   788.4    3620   788.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .092     805    .055    1031    .087

Bank Sta: Left   Right    Coeff Contr.   Expan.
           805    1031             .3       .5
```

```
Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  3

Pier Data
Pier Station     Upstream=   753.5    Downstream=   837.5
Upstream     num=       2
    Width   Elev    Width   Elev
       3   709.2       3   738.8
Downstream     num=       2
    Width   Elev    Width   Elev
       3   709.2       3   738.8

Pier Data
Pier Station     Upstream=     832    Downstream=     916
Upstream     num=       2
    Width   Elev    Width   Elev
       3   709.4       3   740.8
Downstream     num=       2
    Width   Elev    Width   Elev
       3   709.4       3   740.8

Pier Data
Pier Station     Upstream=     912    Downstream=     996
Upstream     num=       2
    Width   Elev    Width   Elev
       3   716.4       3   743.4
Downstream     num=       2
    Width   Elev    Width   Elev
       3   716.4       3   743.4

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 264.2

INPUT
Description: West 5th Avenue Bridge - Downstream Section
Station Elevation Data    num=      58
```

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	764.4	21	764.4	87	767.4	103	767.4	155	759.4
221	754.4	221	789.4	309	789.4	309	752.4	414	762.4
425	762.4	440	760.4	529	748.4	583	746.4	720	737.6
723	737.4	746	737	805	719.4	817	710.7	836	710.7
839	709.2	840	709.2	856	708.8	876	709	914.5	710.4

917.5	709.4	956	709.2	979	710.6	994.5	716.4	997.5	716.4
1020	718.5	1031	719.5	1056	731.3	1075	740.2	1075	743.6
1077	746.8	1108	745.4	1206	748.4	1300	750.1	1314	750.4
1634	754.4	1640	752.9	1670	745.4	1800	745.4	1900	745.4
2065	745.4	2223	762.4	2261	779.4	2533	782.4	2727	783.4
2750	783.4	2979	786.4	3168	787.4	3397	788.4	3570	789.4
3580	787.4	3592	788.4	3620	788.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	805	.055	1031	.087

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
805	1031	42.5	42.5	42.5	.3	.5

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264.1

INPUT
Description:
Station Elevation Data num= 76

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	766.4	25	766.4	83	767.4	98	767.4	144	759.4
214	757.4	214	789.4	315	789.4	315	753.4	400	751.6
457	750.4	514	748.4	669	740.4	736	740.4	737	737
786	719.4	808	710.7	826.9	710.7	827	710.7	829.9	709.2
830	709.2	847	708.8	855	708.9	867	709	905.5	710.4
905.6	710.4	908.4	709.4	908.5	709.4	947	709.2	970	710.6
985.4	716.4	985.5	716.4	988.4	716.4	988.5	716.4	1020	719.3
1022	719.5	1047	731.3	1066	740.2	1066	743.6	1068	746.8
1072	724.4	1149	755.4	1253	751.4	1314	750.4	1432	754.4
1560	755.3	1572	755.4	1702	753.4	1731	747.4	1770	745.4
1885	745.4	1920	747.4	1985	750.4	2115	750.4	2137	753.4
2205	764.4	2236	780.4	2539	780.4	2740	782.4	2760	782.4
2895	785.4	2895	794.4	2931	794.4	2931	785.4	3079	786.4
3080	786.4	3200	786.4	3201	806.4	3240	806.4	3311	806.4
3311	788.4	3461	788.4	3569	789.4	3581	787.4	3598	788.4
3627	788.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	786	.055	1022	.09

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
786	1022	2750	2733.27	2700	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 263

INPUT
Description:
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	775.4	61	754.4	105	760.4	125	760.4	171	744.4
440	734.4	689	734.4	750	736.4	810	733.4	828	736.4
1044	735.4	1120	713.3	1123	712.4	1133	707.4	1656	707.4
1666	712.4	1670	716.1	1702	745.4	1715	746.4	1871	745.4
1880	745.4	1960	745.4	2000	745.4	2200	745.4	2400	745.4
2515	745.4	2545	745.4	2565	764.4	2618	762.4	2638	762.4
2815	761.4	3000	761.4	3200	761.4	3400	761.4	3600	761.4
3800	761.4	3980	761.4	4052	771.4	4163	777.4		

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .092    1123    .047    1666    .082

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1123    1666              2100 2048.64    2000              .1       .3

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 262

INPUT
Description:
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   773.3    31.2   758.2    49.7   759.4    63.8   759.4      97     758
   175.6   739.3     237   737.4   261.2   736.3   890.3   735.4   904.2   736.3
   951.2   736.3   965.7   736.2  1223.9   736.2    1520   735.4  1550.2   735.4
  1579.7   716.5  1599.9   712.6    1609   709.4    1628     709  1656.3     708
  1691.7   707.1    1720   707.4  1749.7   708.5  1757.7   708.7  1762.3   709.8
  1804.4   726.4    1805   726.5    1805   731.6  1983.1   739.2    2117   751.3
  2201.3   752.3  2215.8   750.4  2224.8   752.3    2253   752.2    2286   751.2
  2431.2   753.4  2597.8   766.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .05  1599.9    .035  1762.3     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1599.9  1762.3              1400 2133.12    2200              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0     950     736       F

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 261

INPUT
Description:
Station Elevation Data    num=      54
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   758.4      26   757.4     109   744.4     143   753.4     159   755.4
     174   755.4     222   735.4     222   748.4     253   748.4     253   735.4
     307   735.4     307   757.4     475   757.4     475   735.4     480   735.4
     481   735.4     600   735.4     755   735.4     810   735.4     865   735.4
    1000   735.4    1020   735.4    1200   735.4    1400   735.4    1600   735.4
    1800   735.4    2000   735.4    2150   735.4    2195   735.4    2216   744.4
    2246   744.4    2279   741.4    2293   743.4    2324   743.4    2362   735.4
    2451   728.4    2480   712.5    2482   711.4    2495   704.9    2693   704.9
    2706   711.4    2710   712.9    2749   727.4    2790   728.4    2905   739.4
    3119   749.4    3200   749.4    3240   749.4    3400   749.4    3600   749.4
    3800   749.4    3950   749.4    4038   765.4    4370   765.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .048    2482    .035    2706    .058

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          2482    2706           1335.84 1335.84 1335.84              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0    2350     736       F


STORAGE AREA: Quarry 1
```

Volume Method : Rating Curve

Elevation	Volume
720	0
725	2
730	14
735	36
740	69
745	111

STORAGE AREA: Quarry 2
Volume Method : Rating Curve

Elevation	Volume
722	0
725	69
730	163
735	293
740	453
745	635

CONNECTION: Overflow Weir

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3
Reach-1	271	.053	.042	.053
Reach-1	270.5	.05	.042	.058
Reach-1	270.4	.06	.042	.054
Reach-1	270.3	Bridge		
Reach-1	270.2	.06	.042	.054
Reach-1	270.1	.054	.042	.048
Reach-1	269	.047	.042	.051
Reach-1	268.7	Lat Struct		
Reach-1	268.5	.051	.042	.051
Reach-1	268.4	.052	.042	.057
Reach-1	268.3	Bridge		
Reach-1	268.2	.052	.042	.043
Reach-1	268.1	.054	.045	.057
Reach-1	267.5	.062	.045	.058
Reach-1	267.4	.065	.045	.058
Reach-1	267.3	Bridge		
Reach-1	267.2	.068	.045	.06
Reach-1	267.1	.068	.045	.06
Reach-1	266	.08	.048	.07
Reach-1	265.5	.088	.055	.088
Reach-1	265.4	.086	.055	.086
Reach-1	265.3	Bridge		
Reach-1	265.2	.09	.055	.09
Reach-1	265.1	.092	.055	.084
Reach-1	264.5	.089	.055	.085
Reach-1	264.4	.092	.055	.086
Reach-1	264.3	Bridge		
Reach-1	264.2	.092	.055	.087
Reach-1	264.1	.092	.055	.09
Reach-1	263	.092	.047	.082
Reach-1	262	.05	.035	.06
Reach-1	261	.048	.035	.058

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	271	2420	2386.56	2370
Reach-1	270.5	80	50	20
Reach-1	270.4	15	15	15
Reach-1	270.3	Bridge		
Reach-1	270.2	40	40	40
Reach-1	270.1	1050	1054.79	1050
Reach-1	269	1350	1379.48	1380
Reach-1	268.7	Lat Struct		
Reach-1	268.5	55	55	55
Reach-1	268.4	21	21	21
Reach-1	268.3	Bridge		
Reach-1	268.2	28	28	28
Reach-1	268.1	403.75	403.75	403.75
Reach-1	267.5	70	58.08	50
Reach-1	267.4	64	64	64
Reach-1	267.3	Bridge		
Reach-1	267.2	66	66	66
Reach-1	267.1	1600	1758	1780
Reach-1	266	1800	1721.77	1550
Reach-1	265.5	180	107	20
Reach-1	265.4	44	44	44
Reach-1	265.3	Bridge		
Reach-1	265.2	45	48	90
Reach-1	265.1	500	632.31	610
Reach-1	264.5	44	44	44
Reach-1	264.4	48	48	48
Reach-1	264.3	Bridge		
Reach-1	264.2	42.5	42.5	42.5
Reach-1	264.1	2750	2733.27	2700
Reach-1	263	2100	2048.64	2000
Reach-1	262	1400	2133.12	2200
Reach-1	261	1335.84	1335.84	1335.84

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

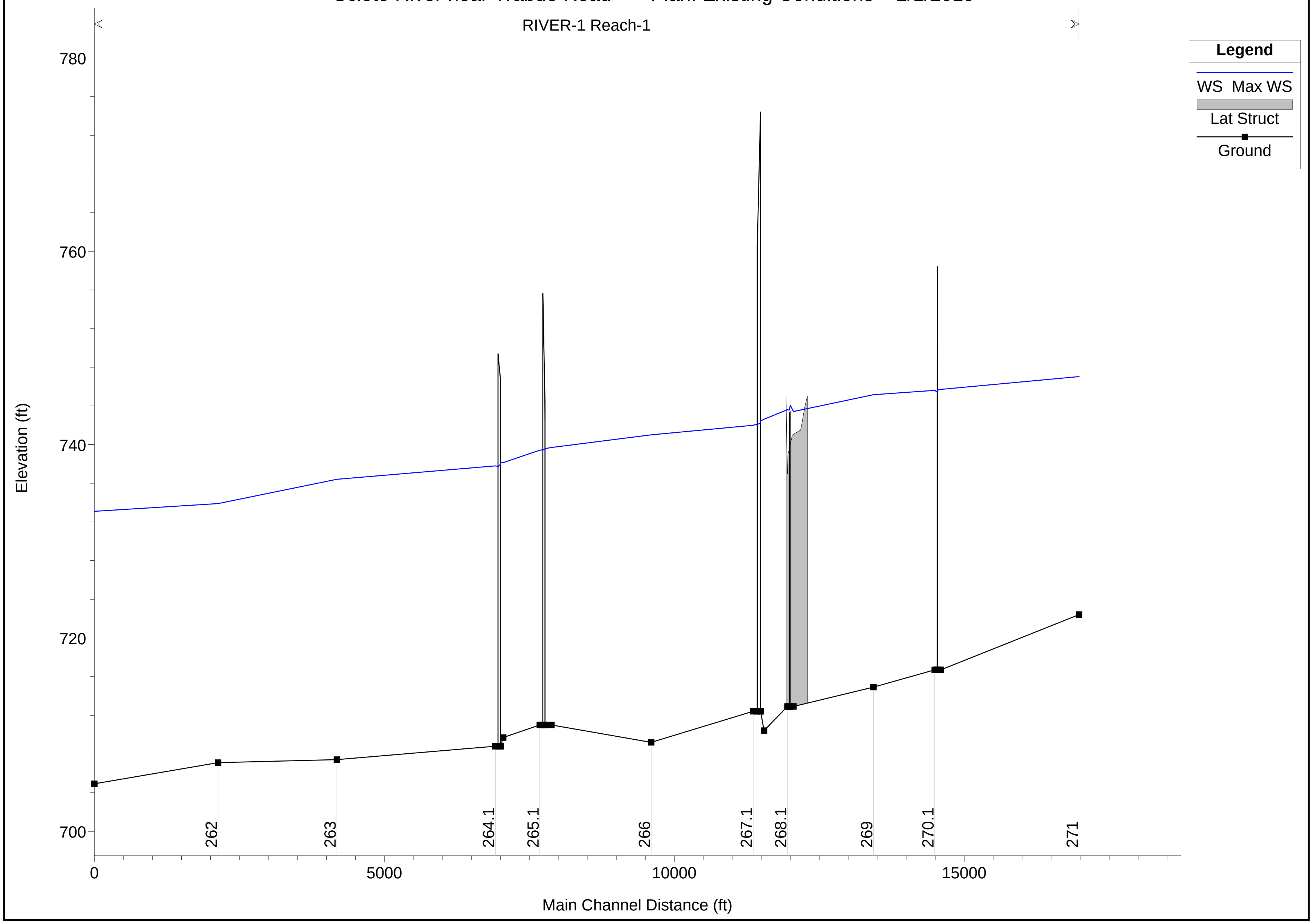
Reach	River Sta.	Contr.	Expan.
Reach-1	271	.1	.3
Reach-1	270.5	.3	.5
Reach-1	270.4	.3	.5
Reach-1	270.3	Bridge	
Reach-1	270.2	.3	.5
Reach-1	270.1	.1	.3
Reach-1	269	.1	.3
Reach-1	268.7	Lat Struct	
Reach-1	268.5	.3	.5
Reach-1	268.4	.3	.5
Reach-1	268.3	Bridge	
Reach-1	268.2	.3	.5
Reach-1	268.1	.1	.3
Reach-1	267.5	.3	.5
Reach-1	267.4	.3	.5
Reach-1	267.3	Bridge	
Reach-1	267.2	.3	.5
Reach-1	267.1	.1	.3
Reach-1	266	.1	.3
Reach-1	265.5	.3	.5

Reach-1	265.4		.3	.5
Reach-1	265.3	Bridge		
Reach-1	265.2		.3	.5
Reach-1	265.1		.1	.3
Reach-1	264.5		.3	.5
Reach-1	264.4		.3	.5
Reach-1	264.3	Bridge		
Reach-1	264.2		.3	.5
Reach-1	264.1		.1	.3
Reach-1	263		.1	.3
Reach-1	262		.1	.3
Reach-1	261		.1	.3

HEC-RAS Plan: Ex. Cond. River: RIVER-1 Reach: Reach-1 Profile: Max WS

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	271	Max WS	56946	722.40	747.036		747.56	0.0005	6.40	10847.5	587.1	0.23
Reach-1	270.5	Max WS	56941	716.70	745.706		746.41	0.0005	7.07	9489.8	642.6	0.24
Reach-1	270.4	Max WS	56937	716.70	745.638	730.32	746.38	0.0005	7.23	9061.1	504.7	0.25
Reach-1	270.3		Bridge									
Reach-1	270.2	Max WS	56937	716.70	745.444		746.14	0.0005	7.12	10094.2	814.8	0.24
Reach-1	270.1	Max WS	56937	716.70	745.602		746.10	0.0004	6.23	11956.3	887.4	0.21
Reach-1	269	Max WS	56936	714.90	745.154		745.69	0.0004	6.85	11963.4	1034.3	0.22
Reach-1	268.7		Lat Struct									
Reach-1	268.5	Max WS	57493	712.90	743.422		744.78	0.0010	9.54	6713.3	517.8	0.34
Reach-1	268.4	Max WS	57111	712.90	744.053	731.05	744.62	0.0005	6.98	12173.7	1173.3	0.24
Reach-1	268.3		Bridge									
Reach-1	268.2	Max WS	57108	712.90	743.552		744.31	0.0007	7.77	10340.0	1047.7	0.27
Reach-1	268.1	Max WS	57014	712.90	743.606		744.27	0.0007	7.37	10789.3	1042.5	0.26
Reach-1	267.5	Max WS	56929	710.40	742.617		744.09	0.0012	10.64	6894.7	519.2	0.34
Reach-1	267.4	Max WS	56927	712.40	742.454	729.79	743.93	0.0012	9.83	6236.0	400.4	0.34
Reach-1	267.3		Bridge									
Reach-1	267.2	Max WS	56927	712.40	742.105		743.64	0.0013	10.02	6030.7	364.0	0.35
Reach-1	267.1	Max WS	56924	712.40	741.994		743.55	0.0013	10.08	5937.6	640.4	0.36
Reach-1	266	Max WS	56926	709.20	741.001		741.66	0.0007	7.36	10460.5	527.1	0.25
Reach-1	265.5	Max WS	56924	711.00	739.697		740.35	0.0008	6.77	9873.1	503.3	0.23
Reach-1	265.4	Max WS	56924	711.00	739.586	723.97	740.26	0.0009	6.89	9462.8	428.2	0.24
Reach-1	265.3		Bridge									
Reach-1	265.2	Max WS	56922	711.00	739.452		740.14	0.0009	6.96	9364.2	407.0	0.24
Reach-1	265.1	Max WS	56922	711.00	739.424		740.10	0.0008	6.86	9453.3	407.0	0.23
Reach-1	264.5	Max WS	56922	709.70	738.136		739.42	0.0016	9.25	6698.7	314.8	0.32
Reach-1	264.4	Max WS	56922	708.80	738.176	723.89	739.35	0.0014	8.82	7015.2	319.6	0.30
Reach-1	264.3		Bridge									
Reach-1	264.2	Max WS	56921	708.80	737.753		739.02	0.0015	9.21	6868.8	352.2	0.32
Reach-1	264.1	Max WS	56921	708.80	737.797		738.95	0.0014	8.81	7240.3	359.8	0.30
Reach-1	263	Max WS	56919	707.40	736.405		736.60	0.0001	3.57	17841.1	1306.1	0.12
Reach-1	262	Max WS	56918	707.10	733.892		736.06	0.0011	12.34	5526.2	306.1	0.43
Reach-1	261	Max WS	56918	704.90	733.091	717.98	734.19	0.0005	8.64	7695.4	447.7	0.29

Scioto River near Trabue Road Plan: Existing Conditions 2/1/2019



1 in Horiz. = 2500 ft 1 in Vert. = 15 ft

HEC-RAS INPUT AND OUTPUT DATA

PROPOSED CONDITIONS MODEL

HEC-RAS HEC-RAS 5.0.6 November 2018
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX   XXXX        XXXX     XX     XXXX
X     X  X       X    X       X   X   X  X   X
X     X  X       X            X   X  X    X  X
XXXXXXX  XXXX    X      XXX   XXXX   XXXXXX   XXXX
X     X  X       X            X X    X    X       X
X     X  X       X    X       X  X   X    X       X
X     X  XXXXXX   XXXX        X   X  X    X  XXXXX
```

PROJECT DATA
Project Title: Scioto River near Trabue Road
Project File : SciotoRiver.prj
Run Date and Time: 2/1/2019 10:30:00 AM

Project in English units

Project Description:
Effective model data obtained from FEMA by Hartman Engineering. For the existing or corrected effective model, the bridge data was updated from HEC-2 style formatting to HEC-RAS formatting, effective flow boundaries were corrected, top of bank designations were modified to maintain better consistency between sections, and overbank distances were modified to better match actual field conditions.

Duplicate effective data based on NGVD29 datum, and corrected effective or existing conditions and proposed conditions data based on NAVD88 datum.

Information below was what was included in the effective FEMA data:

Columbus, OH Scioto River HEC-RAS Model for FEMA Map Study of Local Protection Project

Model Date: July 2001

Model Produced for the Huntington District, Corps of Engineers by

Fuller, Mossbarger,
Scott and May Engineers
1409 North Forbes Road
Lexington, Kentucky
40511-2050
Phone: (859) 422-3000

Project Engineers: Erman Caudill, Angela Fister
QA/QC Engineers: Joe Herman, Brian Belcher
Project Managers: Jim Latchaw, John Montgomery

Model is a HEC-RAS conversion and update of a previously existing HEC-2 model.
Updated data pertains solely to modeling convention and limited bridge construction plans around the Interstate 670 construction project provided by the Ohio Department of Transportation (ODOT).
Model also includes the effects of a new overflow channel that was constructed

as part of that project. In addition, the newly constructed West Columbus Local Protection Project was included in the model. Although the model has been updated it does not necessarily reflect as built conditions. Geometry was taken from the HEC-2 model and best available planimetric mapping for the new construction.

Flow data was taken from the HEC-2 model provided by the Corps.

For further information refer to accompanying narrative report.

PLAN DATA

Plan Title: Proposed Conditions - Revised Feb 2019
Plan File : C:\Users\Hartman\Documents\All Jobs\1058 - Wagenbrenner, Scioto River Quarry\HEC-RAS\SciotoRiver.p03

Geometry Title: Proposed Conditions - Revised Feb 2019
Geometry File : C:\Users\Hartman\Documents\All Jobs\1058 - Wagenbrenner, Scioto River Quarry\HEC-RAS\SciotoRiver.g03

Flow Title :
Flow File :

Plan Summary Information:

Number of:	Cross Sections =	26	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	5	Lateral Structures =	1

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

GEOMETRY DATA

Geometry Title: Proposed Conditions - Revised Feb 2019
Geometry File : C:\Users\Hartman\Documents\All Jobs\1058 - Wagenbrenner, Scioto River Quarry\HEC-RAS\SciotoRiver.g03

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 271

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	788.4	121	764.4	150	764.4	181	763.4	276	734.4
316	734.4	320	734.3	471	729.4	492	729.4	516	728.4
520	726.4	521	725.9	525	725.9	530	722.4	760	722.4
775	722.4	790	729.4	880	779.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.053	516	.042	790	.053

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
516	790	2420	2386.56	2370	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.5

INPUT
Description:
Station Elevation Data num= 67

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	757.4	80	753.4	80	783.4	157	783.4	157	751.4
263	749.4	263	768.4	402	768.4	402	746.4	534	744.4
534	764.4	556	764.4	556	743.4	666	750.8	666	743
669	743	669	738	706	734.8	720	730.4	742	723.5
742.1	723.5	746.9	720.8	747	720.8	756	720.7	791	718.6
819.9	720.4	820	720.4	824.9	720.3	825	720.3	866	718.7
898.9	719.2	899	719.2	903.9	716.7	904	716.7	936	719.4
981.9	718.4	982	718.4	986.9	718.4	987	718.4	1000	719.6
1014	720.8	1056	734.5	1056	744	1058.5	744	1058.5	751.8
1087	740.4	1121	741.4	1147	741.9	1194	742.4	1225	753.4
1247	753.4	1257	750.4	1412	758.4	1520	752.4	1649	759.4
1830	757.5	1840	757.4	1916	759.4	1968	760.4	2011	760.4
2041	760.4	2088	786.4	2212	796.4	2320	792.4	2340	781.4
2500	781.4	2760	781.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	746.9	.042	1014	.058

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
746.9	1014	80	50	20	.3	.5

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.4

INPUT
Description: Unnamed Pipe Line Crossing Bridge - Upstream Section
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	758.4	127	752.4	127	783.4	138	783.4	138	751.4
238	748.4	238	768.4	379	768.4	379	746.4	491	742.4
491	760.4	614	760.4	614	742.4	670	750.8	670	743
673	743	673	738	710	734.8	720	731.7	746	723.5
752	720.8	760	720.7	795	718.6	824	720.4	829	720.3
870	718.7	903	719.2	908	716.7	940	719.4	986	718.4
991	718.4	1015	720.5	1018	720.8	1060	734.5	1060	744
1062.5	744	1062.5	751.8	1100	748.4	1163	749.4	1249	750.4
1496	752.4	1623	755.4	1680	755.4	1686	755.4	1899	758.4
2022	759.4	2044	759.4	2101	788.4	2228	795.4	2353	792.4
2376	781.4	2380	783.4	2600	783.4	2800	783.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	752	.042	1018	.054

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
752	1018	15	15	15	.3	.5

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 270.3

INPUT
Description: Structure #28 Unnamed Pipeline Crossing Bridge
Distance from Upstream XS = 4
Deck/Roadway Width = 7
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 12

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
491	742.4	742.4	614	742.4	742.4	670	750.4	742.4
1060	751.4	743.4	1100	748.4	726.4	1249	750.4	750.4
1496	752.4	752.4	1623	755.4	755.4	1680	755.4	755.4
1899	758.4	758.4	2044	759.4	759.4	2101	788.4	788.4

Upstream Bridge Cross Section Data
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	758.4	127	752.4	127	783.4	138	783.4	138	751.4
238	748.4	238	768.4	379	768.4	379	746.4	491	742.4
491	760.4	614	760.4	614	742.4	670	750.8	670	743
673	743	673	738	710	734.8	720	731.7	746	723.5
752	720.8	760	720.7	795	718.6	824	720.4	829	720.3
870	718.7	903	719.2	908	716.7	940	719.4	986	718.4
991	718.4	1015	720.5	1018	720.8	1060	734.5	1060	744
1062.5	744	1062.5	751.8	1100	748.4	1163	749.4	1249	750.4
1496	752.4	1623	755.4	1680	755.4	1686	755.4	1899	758.4
2022	759.4	2044	759.4	2101	788.4	2228	795.4	2353	792.4
2376	781.4	2380	783.4	2600	783.4	2800	783.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	752	.042	1018	.054

Bank Sta: Left	Right	Coeff Contr.	Expan.
752	1018	.3	.5

Downstream Deck/Roadway Coordinates
num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
491	742.4	742.4	614	742.4	742.4	757	750.4	742.4
1147	751.4	743.4	1187	748.4	726.4	1336	750.4	750.4
1496	752.4	752.4	1623	755.4	755.4	1680	755.4	755.4

Downstream Bridge Cross Section Data
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	768.4	46	750.4	262	741.4	550	742.4	562	742.4
645	752.4	658	752.4	757	750.8	757	743	760	743
760	738	797	734.8	800	733.9	833	723.5	839	720.8
847	720.7	882	718.6	911	720.4	916	720.3	957	718.7
990	719.2	995	716.7	1027	719.4	1073	718.4	1078	718.4
1100	720.4	1105	720.8	1147	734.5	1147	744	1149.5	744
1149.5	751.8	1166	750.4	1227	751.4	1360	754.9	1377	755.4
1582	761.4	1605	761.4	1680	761.4	1900	761.4	1990	761.4
2100	761.4	2230	761.4	2318	787.4	2478	787.4	2485	779.4
2870	779.4	2882	789.4	2949	791.4	2971	789.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	839	.042	1105	.054

Bank Sta: Left	Right	Coeff Contr.	Expan.
839	1105	.3	.5

Upstream Embankment side slope = 0 horiz. to 1.0 vertical

```
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  4

Pier Data
Pier Station     Upstream=   748.5    Downstream=   835.5
Upstream     num=       2
    Width   Elev    Width   Elev
       5   720.8       5   744.4
Downstream     num=       2
    Width   Elev    Width   Elev
       5   720.8       5   744.4

Pier Data
Pier Station     Upstream=   826.5    Downstream=   913.5
Upstream     num=       2
    Width   Elev    Width   Elev
       5   720.3       5   744.4
Downstream     num=       2
    Width   Elev    Width   Elev
       5   720.3       5   744.4

Pier Data
Pier Station     Upstream=   905.5    Downstream=   992.5
Upstream     num=       2
    Width   Elev    Width   Elev
       5   716.7       5   744.4
Downstream     num=       2
    Width   Elev    Width   Elev
       5   716.7       5   744.4

Pier Data
Pier Station     Upstream=   988.5    Downstream=  1075.5
Upstream     num=       2
    Width   Elev    Width   Elev
       5   718.4       5   744.4
Downstream     num=       2
    Width   Elev    Width   Elev
       5   718.4       5   744.4

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 270.2

INPUT
Description: Unnamed Pipe Line Crossing Bridge -Downstream Section
```

Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	768.4	46	750.4	262	741.4	550	742.4	562	742.4
645	752.4	658	752.4	757	750.8	757	743	760	743
760	738	797	734.8	800	733.9	833	723.5	839	720.8
847	720.7	882	718.6	911	720.4	916	720.3	957	718.7
990	719.2	995	716.7	1027	719.4	1073	718.4	1078	718.4
1100	720.4	1105	720.8	1147	734.5	1147	744	1149.5	744
1149.5	751.8	1166	750.4	1227	751.4	1360	754.9	1377	755.4
1582	761.4	1605	761.4	1680	761.4	1900	761.4	1990	761.4
2100	761.4	2230	761.4	2318	787.4	2478	787.4	2485	779.4
2870	779.4	2882	789.4	2949	791.4	2971	789.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	839	.042	1105	.054

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
839	1105	40	40	40	.3	.5

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270.1

INPUT
Description:
Station Elevation Data num= 62

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	771.4	48	748.4	274	740.4	463	741.4	463	757.4
553	757.4	553	742.4	591	741.4	623	755.4	635	755.4
640	755.2	729	750.8	729	743	732	743	732	738
769	734.8	800	725.1	804.9	723.5	805	723.5	810	720.8
810.1	720.8	819	720.7	854	718.6	882.9	720.4	883	720.4
887.9	720.3	888	720.3	929	718.7	961.9	719.2	962	719.2
966.9	716.7	967	716.7	999	719.4	1044.9	718.4	1045	718.4
1049.9	718.4	1050	718.4	1077	720.8	1110	731.6	1119	734.5
1119	744	1121.5	744	1121.5	751.8	1132	725.4	1190	726.4
1249	751.4	1300	753.3	1382	756.4	1587	760.4	1609	760.4
1680	759.4	1925	759.4	2010	761.3	2015	761.4	2290	761.4
2335	786.4	2480	787.4	2490	779.4	2900	779.4	2918	790.4
2975	793.4	2994	790.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.054	810.1	.042	1077	.048

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
810.1	1077	1050	1054.79	1050	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 269

INPUT
Description:
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	780.4	148	776.4	186	769.4	214	769.4	227	770.4
240	764.9	295	741.4	446	741.4	460	741.4	580	741.4
600	743.4	617	743.4	660	741.4	840	741.4	841	741.4
860	725.4	866	720.4	877	714.9	1016	714.9	1027	720.4
1030	721.8	1040	726.4	1289	729.4	1351	760.4	1400	760.4
1528	760.4	1611	763.4	1641	766.4	1702	765.4	1856	763.4
1960	759.4	2360	759.4	2400	759.4	2680	759.4	2690	761.4
2770	760.4	2780	759.4	3000	759.4	3200	759.4	3263	801.4

3412 805.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.047	860	.042	1040	.051

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
860	1040	1350	1379.48	1380	.1	.3

LATERAL STRUCTURE

RIVER: RIVER-1
REACH: Reach-1 RS: 268.7

INPUT
Description:
Lateral structure position = Right overbank
Distance from Upstream XS =
Deck/Roadway Width = 60
Weir Coefficient = 2.5
Weir Flow Reference = Water Surface
Weir Embankment Coordinates num = 2

Sta	Elev	Sta	Elev
0	752	100	752

Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
Culvert #1	Box	24	56

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
	100	.03	.03	0	.1	1

Upstream Elevation = 721
Centerline Station = 60
Downstream Elevation = 721
Centerline Station = 60

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 268.5

INPUT
Description:
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767.4	83	770.4	83	794.4	264	794.4	264	769.4
356	763.4	400	744.4	600	744.4	800	744.4	1055	744.4
1059	743.2	1059	738.4	1060	738.5	1061	738.5	1081.5	738.5
1082	734.3	1102	725	1124	716.4	1159	712.9	1174	713.2
1193	715.2	1212.9	716	1213	716	1223.9	718.5	1224	718.5
1259	718.6	1309	724.8	1334	727.2	1340	731.1	1351	738.2
1359	739	1359	743.8	1370	743.4	1560	743.4	1583	754

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.051	1102	.042	1334	.051

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1102	1334	55	55	55	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1475	1583		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 268.4

INPUT
Description: Haul Road Bridge (Marble Cliff Quarries) - Upstream Section
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767.4	63	770.4	196	768.4	300	765.4	379	762.4
435	735.4	597	734.4	697	734.4	723	734.4	845	735.4
929	736.4	1011	737.4	1088	743.2	1089	738.5	1091	738.5
1111.5	738.5	1112	734.3	1135	724.5	1154	716.4	1189	712.9
1204	713.2	1223	715.2	1243	716	1254	718.5	1289	718.6
1339	724.8	1364	727.2	1380	737.6	1381	738.2	1389	739
1389	743.8	1400	743.4	1568	743.4	1595	756		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.052	1135	.042	1364	.057

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1135	1364	21	21	21	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1490	1595		T

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 268.3

INPUT
Description: Structure #27 Haul Road Bridge (Marble Cliff Quarries)
Distance from Upstream XS = 4
Deck/Roadway Width = 13
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 5

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
1088	743.2	743.2	1088	743.4	743.4	1089	743.4	738.5
1389	743.4	738.5	1389	741.4	741.4			

Upstream Bridge Cross Section Data
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767.4	63	770.4	196	768.4	300	765.4	379	762.4
435	735.4	597	734.4	697	734.4	723	734.4	845	735.4
929	736.4	1011	737.4	1088	743.2	1089	738.5	1091	738.5
1111.5	738.5	1112	734.3	1135	724.5	1154	716.4	1189	712.9
1204	713.2	1223	715.2	1243	716	1254	718.5	1289	718.6
1339	724.8	1364	727.2	1380	737.6	1381	738.2	1389	739
1389	743.8	1400	743.4	1568	743.4	1595	756		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.052	1135	.042	1364	.057

Bank Sta: Left	Right	Coeff Contr.	Expan.
1135	1364	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1490	1595		T

Downstream Deck/Roadway Coordinates
num= 11

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
1008	743.2	743.2	1008	743.4	743.4	1008	743.4	738.5
1309	743.4	738.5	1309	741.4	741.4	1520	741.4	741.4
2000	741.4	741.4	2300	741.4	741.4	2320	752.4	752.4
3015	752.4	752.4	3076	800.4	800.4			

Downstream Bridge Cross Section Data
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	767.4	190	767.4	304	765.4	410	759.4	455	739.3
466	734.4	620	734.4	677	735.4	706	735.4	721	733.4
755	736.4	848	736.4	1009	743.2	1009	738.4	1011	738.5
1031.5	738.5	1032	734.3	1055	724	1074	716.4	1109	712.9
1124	713.2	1135	714.4	1143	715.2	1163	716	1174	718.5
1209	718.6	1259	724.8	1284	727.2	1301	738.2	1309	739
1309	743.8	1320	743.4	1482	743.4	1508	756		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.052	1055	.042	1284	.043

Bank Sta: Left	Right	Coeff Contr.	Expan.
1055	1284	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1395	1508		T

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 1

Pier Data
Pier Station Upstream= 1248.5 Downstream= 1168.5
Upstream num= 2

Width	Elev	Width	Elev
11	716	11	738.5

Downstream num= 2

Width	Elev	Width	Elev
11	716	11	738.5

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 268.2

```
INPUT
Description: Haul Road Bridge (Marble Cliff Quarries) - Downstream Section
Station Elevation Data    num=      34
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   767.4     190   767.4     304   765.4     410   759.4     455   739.3
     466   734.4     620   734.4     677   735.4     706   735.4     721   733.4
     755   736.4     848   736.4    1009   743.2    1009   738.4    1011   738.5
  1031.5   738.5    1032   734.3    1055     724    1074   716.4    1109   712.9
    1124   713.2    1135   714.4    1143   715.2    1163     716    1174   718.5
    1209   718.6    1259   724.8    1284   727.2    1301   738.2    1309     739
    1309   743.8    1320   743.4    1482   743.4    1508     756

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .052    1055    .042    1284    .043

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1055    1284               28      28      28              .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1395    1508               T

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 268.1

INPUT
Description:
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   767.4     105   769.4     105   788.4     206   788.4     206   766.4
     305   764.4     407   760.4     474   734.4     617   734.4     640     736
     659   737.4     690   737.4     710   733.4     851   736.4     974   735.4
    1005   743.2    1005   738.4    1007   738.5  1027.5   738.5    1028   734.3
    1048     726    1070   716.4    1105   712.9    1120   713.2    1130   714.3
    1139   715.2  1158.9     716    1159     716  1169.9   718.5    1170   718.5
    1205   718.6    1255   724.8    1280   727.2    1297   738.2    1305     739
    1305   743.8    1320   743.4    1500   743.4    1501     750

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .054    1048    .045    1280    .057

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1048    1280           403.75  403.75  403.75              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1360    1501               T

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 267.5

INPUT
Description:
Station Elevation Data    num=      46
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       5   766.3    63.5   767.3     193   766.3   299.8   761.3   332.3   747.5
     579   747.4     585   746.8     814   746.9   849.4   746.5   862.6   739.9
     900   728.6   940.6   724.2   999.4   718.6  1014.2   714.2  1022.7   712.9
  1032.1   712.5  1054.2   710.4  1068.5   710.5    1084   710.4  1105.5   710.4
  1112.1     712  1122.2   714.1    1142     722  1160.3   738.4  1161.9   740.9
  1197.1     741  1202.7   742.3  1308.4   742.4  1308.7   741.2  1343.9   741.4
  1373.4   740.7  1414.5   767.3  1443.4   769.6  1463.6   784.4  1581.1   784.3
```

```
  1581.1   769.6  1613.5   770.4  1666.4   770.4  1707.3   771.5  1720.9   789.4
  1750.3   789.4  1754.3   771.5  1789.3   772.3  1826.6   763.3  2895.6   763.4
    2931     789

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       5    .062   999.4    .045    1142    .058

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         999.4    1142               70   58.08      50             .3       .5

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 267.4

INPUT
Description: Trabue Road - Upstream Section
Station Elevation Data    num=      57
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   766.4     106   767.4     107   783.4     147   783.4     147   767.4
     169   765.4     185   762.4     200   762.4     213   765.4     254   765.4
     282   747.4     400   747.4     560   747.4     814   747.4     816   758.3
     817   757.4     817   756.9     875   729.4 909.999   721.6     914   720.9
     956   714.8     990   713.6  1018.9   713.4    1023   713.4    1050   712.4
    1077   714.1    1100   730.4    1120   740.1    1128   740.9    1132     741
    1180   741.2    1225     759    1226   760.4    1227   760.7    1267   744.4
    1278   743.8    1295   743.4    1304   740.4    1336   740.4    1354   738.4
    1419   769.4    1635   769.4    1642   769.4    1879   774.4    1950   763.4
    2200   763.4    2400   763.4    2590   763.4    2685   764.4    2845   764.4
    2920   800.4    2943   801.4    2988   801.4    3107   802.4    3173   803.4
    3187   803.4    3237   802.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .065     875    .045    1100    .058

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           875    1100               64      64      64             .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  812.29  766.55       F

BRIDGE


RIVER: RIVER-1
REACH: Reach-1            RS: 267.3

INPUT
Description: Structure #26 Trabue Road Bridge
Distance from Upstream XS =       4
Deck/Roadway Width        =      56
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      23
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0   766.4   766.4     147   767.4   767.4     254   765.4   747.4
     400   762.4   747.4     560   763.4   747.4     814   765.4   747.4
     816   765.4   758.3     817   765.4   757.4    1226   768.4   760.4
    1227   768.4   760.7    1228   768.6   760.7    1230   768.6   729.4
    1354   769.4   729.4    1419   769.4   769.4    1635   769.4   769.4
    1879   774.4   774.4    1950   776.4   763.4    2200   784.4   763.4
    2400   791.4   763.4    2590   796.4   763.4    2685   797.4   764.4
    2845   801.4   764.4    2920   801.4     -.6

Upstream Bridge Cross Section Data
Station Elevation Data    num=      57
```

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	766.4	106	767.4	107	783.4	147	783.4	147	767.4
169	765.4	185	762.4	200	762.4	213	765.4	254	765.4
282	747.4	400	747.4	560	747.4	814	747.4	816	758.3
817	757.4	817	756.9	875	729.4	909.999	721.6	914	720.9
956	714.8	990	713.6	1018.9	713.4	1023	713.4	1050	712.4
1077	714.1	1100	730.4	1120	740.1	1128	740.9	1132	741
1180	741.2	1225	759	1226	760.4	1227	760.7	1267	744.4
1278	743.8	1295	743.4	1304	740.4	1336	740.4	1354	738.4
1419	769.4	1635	769.4	1642	769.4	1879	774.4	1950	763.4
2200	763.4	2400	763.4	2590	763.4	2685	764.4	2845	764.4
2920	800.4	2943	801.4	2988	801.4	3107	802.4	3173	803.4
3187	803.4	3237	802.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.065	875	.045	1100	.058

Bank Sta: Left	Right	Coeff Contr.	Expan.
875	1100	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	812.29	766.55	F

Downstream Deck/Roadway Coordinates
num= 20

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
308	760.4	760.4	400	762.4	729.4	560	763.4	747.4
863	765.4	747.4	865	765.4	758.3	866	765.4	757.4
1275	768.4	760.4	1275	768.4	760.7	1275	768.6	760.7
1280	768.5	720	1403	769.4	720	1468	769.4	739.4
1684	769.4	739.4	1928	774.4	739.4	1999	776.4	739.4
2249	784.4	739.4	2449	791.4	739.4	2639	796.4	739.4
2734	797.4	739.4	2894	800.4	-.6			

Downstream Bridge Cross Section Data
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	765.4	129	762.4	262.999	760.4	308	760.4	330.001	755.4
500	755.4	608	755.4	690	755.4	692	755.4	864	758.3
866	758.3	866	756.9	924	729.4	959	721.6	963	720.9
1005	714.8	1039	713.6	1040	713.6	1068	713.4	1072	713.4
1099	712.4	1126	714.1	1149	730.4	1169	740.1	1177	740.9
1181	741	1200	741.1	1229	741.2	1275	759	1275	760.7
1277	760.7	1300	740.4	1320	739.4	1355	751.4	1411	751.4
1435	767.4	1533	768.4	1621	767.4	1653	768.4	1677.999	757.4
2000	757.4	2400	757.4	2600	757.4	2765	757.4	2767	755.4
2827	800.4	2932	800.4	3024	802.4	3056	803.4	3079	803.4
3095	799.4	3125	801.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.068	924	.045	1149	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
924	1149	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	856.09	766.55	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 3

Pier Data
Pier Station Upstream= 912 Downstream= 961
Upstream num= 2

Width	Elev	Width	Elev
3.8	720.9	3.8	759.4

Downstream num= 2

Width	Elev	Width	Elev
3.8	720.9	3.8	759.4

Pier Data
Pier Station Upstream= 1021 Downstream= 1070
Upstream num= 2

Width	Elev	Width	Elev
3.8	713.4	3.8	759.4

Downstream num= 2

Width	Elev	Width	Elev
3.8	713.4	3.8	759.4

Pier Data
Pier Station Upstream= 1130 Downstream= 1179
Upstream num= 2

Width	Elev	Width	Elev
3.8	740.9	3.8	760.4

Downstream num= 2

Width	Elev	Width	Elev
3.8	740.9	3.8	760.4

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Momentum Cd = 1.33
Yarnell KVal = .9
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 267.2

INPUT
Description: Trabue Road - Downstream Section
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	765.4	129	762.4	262.999	760.4	308	760.4	330.001	755.4
500	755.4	608	755.4	690	755.4	692	755.4	864	758.3
866	758.3	866	756.9	924	729.4	959	721.6	963	720.9
1005	714.8	1039	713.6	1040	713.6	1068	713.4	1072	713.4
1099	712.4	1126	714.1	1149	730.4	1169	740.1	1177	740.9
1181	741	1200	741.1	1229	741.2	1275	759	1275	760.7
1277	760.7	1300	740.4	1320	739.4	1355	751.4	1411	751.4
1435	767.4	1533	768.4	1621	767.4	1653	768.4	1677.999	757.4
2000	757.4	2400	757.4	2600	757.4	2765	757.4	2767	755.4
2827	800.4	2932	800.4	3024	802.4	3056	803.4	3079	803.4
3095	799.4	3125	801.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.068	924	.045	1149	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
924	1149	66	66	66	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	856.09	766.55	F

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 267.1

INPUT
Description:
Station Elevation Data num= 73

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	766.4	122	765.4	286	759.4	327	757.4	446	744.4
493	740.4	514	739.4	537	739.4	573	733.4	610	733.4
780	729.4	783	766.1	783	758.3	785	758.3	785	756.9
843	729.4	877.9	721.6	878	721.6	881.9	720.9	882	720.9
924	714.8	958	713.6	986.9	713.4	987	713.4	990.9	713.4
991	713.4	1018	712.4	1030	713.2	1045	714.1	1068	730.4
1088	740.1	1095.9	740.9	1096	740.9	1099.9	741	1100	741
1148	741.2	1194	759	1194	760.7	1196	760.7	1196	768.6
1200	750.8	1202	749.4	1239	749.4	1281	744.4	1308	744.4
1329	742.4	1357	751.4	1411	751.4	1442	768.4	1501	768.4
1501	778.4	1556	778.4	1557	768.4	1578	767.4	1598	767.4
1629	767.4	1640	755.4	1800	755.4	2000	755.4	2200	755.4
2360	755.4	2419	756.4	2437	756.4	2460	758.4	2618	756.4
2803	755.4	2861	801.4	2987	805.4	3016	798.4	3036	803.4
3057	803.4	3070	798.4	3098	801.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.068	843	.045	1068	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
843	1068	1600	1758	1780	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	784.41	766.76	F

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 266

INPUT
Description:
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	770.2	134.9	764.3	236.7	761.5	372.1	761.4	380.1	776.3
733	776.4	746	756.2	819.8	751.3	885.2	750.3	926.3	750.4
992.4	748.3	1007.3	743.4	1113.3	743.2	1195.6	725.2	1328.1	720.4
1374.9	720.9	1400.3	722.6	1440.6	718.1	1459.1	713.9	1505.2	713.7
1521.4	712.9	1558.1	710.5	1578.5	709.2	1593.7	710.3	1601.4	713.3
1616	722	1651.1	744.1	1656.2	740.6	1672.7	742.4	1713.9	742.3
1726.2	741.5	2120.3	741.5	2520.4	741.5	2546.6	773.5	2639.5	775.4
2659.2	781.3	2676	782.5	2740.8	782.4	2831	779.4	2870.6	763.7
2920.4	759.5	2979.2	759.5	2982.8	799.2	3029.9	799.1	3029.9	759.5
3091.1	759.3	3125.7	760.4	3132.2	759.4	3514.6	759.4	3536.2	771.4
3612.8	771.3	3640.2	783.3	3667.7	786.3	3782.5	781.6	3803.4	785.6
3895.8	788.3	3978.1	788.4						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	1400.3	.048	1616	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1400.3	1616	1800	1721.77	1550	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.5

INPUT
Description:
Station Elevation Data num= 85

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	800.4	68	798.4	180	775.4	204	775.4	241	769.4
262	769.4	321	767.4	321	774.4	372	774.4	372	767.4
472	763.4	514	763.4	566	762.4	566	757.4	623	757.4
693	755.4	693	764.4	740	764.4	740	754.4	765	755.4
802	755.4	880	755.4	958	753.4	977	751.4	1023	748.4
1050	748.4	1054	748.4	1103	742	1103	740.2	1114	740.2
1114	723.2	1132	717.8	1159	713.4	1187	711	1234.9	712
1235	712	1241.9	712	1242	712	1251	712.1	1251.1	712.1
1258.9	712.1	1259	712.1	1280	712.1	1303	712	1343	711.7
1380.8	711.9	1380.9	711.9	1381	713.9	1391.9	715.4	1392	715.4
1413	717.2	1430	720.8	1451	725.2	1502	725.2	1521	733.9
1521	740.2	1528	740.2	1528	742	1536	735.4	1571	736.4
1584	736.4	1609	736.4	1686	750.4	1811	764.4	1861	767.4
1883	767.4	2029	766.4	2137	766.4	2156	766.4	2213	756.4
2246	745.4	2432	746.4	2465	746.4	2495	745.4	2800	745.4
3000	745.4	3320	745.4	3320	748.4	3720	748.4	3776	785.4
3965	785.4	4166	785.4	4177	782.4	4189	784.4	4212	784.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.088	1132	.055	1413	.088

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1132	1413	180	107	20	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1875	4212		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.4

INPUT
Description: Penn Central Railroad Bridge Crossing #3 - Upstream Section
Station Elevation Data num= 78

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	799.4	150	777.4	219	769.4	239	769.4	291	767.4
291	774.4	348	774.4	348	766.4	414	762.4	458	762.4
557	760.4	631	757.4	631	764.4	687	764.4	687	756.4
743	755.4	756	755.4	800	754.4	823	754.4	920	752.6
928	752.4	974	749.4	1018	747.4	1046	746.4	1104.1	742
1104.2	740.2	1115	740.2	1115	723.2	1133	717.8	1160	713.4
1188	711	1230	711.9	1236	712	1236	716.8	1243	716.8
1252	716.8	1260	716.8	1260	712.1	1304	712	1344	711.7
1382	711.9	1382	713.4	1393	715.4	1414	717.2	1452	725.2
1503	725.2	1522	733.9	1522	740.2	1529	740.2	1529	742
1544	735.4	1614	760.4	1676	765.4	1703	765.4	1760	764.4
1887	757.4	2056	761.4	2072	761.4	2101	761.4	2152	754.4
2169	744.4	2355	745.4	2395	745.4	2400	745.4	2600	745.4
2800	745.4	3000	745.4	3275	745.4	3280	748.4	3480	748.4
3600	748.4	3720	748.4	3782	786.4	3959	786.4	4154	785.4

```
    4164   782.4    4174   784.4    4199   784.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .086    1133    .055    1414    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1133    1414               44      44      44              .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1675    4199              T

BRIDGE


RIVER: RIVER-1
REACH: Reach-1            RS: 265.3

INPUT
Description: Structure #25 Penn Central Railroad Bridge, Crossing #3
Distance from Upstream XS =       4
Deck/Roadway Width        =      36
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      11
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
     687   756.4   756.4     743   755.4   755.4     756   755.4   755.4
     800   754.4   754.4    1046   754.4   746.4  1104.1   764.4     742
  1104.2   764.4   741.4    1529   764.4   741.4    1544   764.4   735.4
    1614   764.4   760.4    1676   765.4   765.4

Upstream Bridge Cross Section Data
Station Elevation Data    num=      78
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   799.4     150   777.4     219   769.4     239   769.4     291   767.4
     291   774.4     348   774.4     348   766.4     414   762.4     458   762.4
     557   760.4     631   757.4     631   764.4     687   764.4     687   756.4
     743   755.4     756   755.4     800   754.4     823   754.4     920   752.6
     928   752.4     974   749.4    1018   747.4    1046   746.4  1104.1     742
  1104.2   740.2    1115   740.2    1115   723.2    1133   717.8    1160   713.4
    1188     711    1230   711.9    1236     712    1236   716.8    1243   716.8
    1252   716.8    1260   716.8    1260   712.1    1304     712    1344   711.7
    1382   711.9    1382   713.4    1393   715.4    1414   717.2    1452   725.2
    1503   725.2    1522   733.9    1522   740.2    1529   740.2    1529     742
    1544   735.4    1614   760.4    1676   765.4    1703   765.4    1760   764.4
    1887   757.4    2056   761.4    2072   761.4    2101   761.4    2152   754.4
    2169   744.4    2355   745.4    2395   745.4    2400   745.4    2600   745.4
    2800   745.4    3000   745.4    3275   745.4    3280   748.4    3480   748.4
    3600   748.4    3720   748.4    3782   786.4    3959   786.4    4154   785.4
    4164   782.4    4174   784.4    4199   784.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .086    1133    .055    1414    .086

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1133    1414             .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    1675    4199              T

Downstream  Deck/Roadway Coordinates
    num=       9
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
     687   756.4   756.4     743   755.4   755.4     756   755.4   755.4
     800   754.4   754.4     923   754.4   729.4     981   764.4   729.4
   981.1   764.4     742   981.2   764.4   741.4    1406   764.4   741.4

Downstream Bridge Cross Section Data
```

Station Elevation Data num= 66

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	782.4	118	778.4	205	769.4	231	769.4	271	763.4
271	774.4	500	774.4	500	759.4	541	758.4	560	758.4
603	756.4	621	756.4	657	758.4	698	757.4	733	755.4
790	758.4	815	761.4	832	761.4	873	760.4	921	742.4
967	740.4	981	742	981	740.2	992	740.2	992	723.2
1010	717.8	1037	713.4	1065	711	1113	712	1113	716.8
1120	716.8	1129	716.8	1137	716.8	1137	712.1	1181	712
1221	711.7	1259	711.9	1259	713.4	1270	715.4	1291	717.2
1329	725.2	1380	725.2	1399	733.9	1399	740.2	1406	740.2
1406	742	1406	764.4	1408	763.4	1487	760.4	1520	745.4
1800	745.4	2000	745.4	2200	745.4	2400	745.4	2600	745.4
2800	745.4	3000	745.4	3200	745.4	3400	745.4	3600	745.4
3800	745.4	3975	745.4	4014	788.4	4025	782.4	4037	784.4
4065	784.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.09	1010	.055	1291	.09

Bank Sta: Left	Right	Coeff Contr.	Expan.
1010	1291	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1425	4065		T

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 2

Pier Data
Pier Station Upstream= 1247.5 Downstream= 1124.5
Upstream num= 2

Width	Elev	Width	Elev
9	716.8	9	741.4

Downstream num= 2

Width	Elev	Width	Elev
9	716.8	9	741.4

Pier Data
Pier Station Upstream= 1387.5 Downstream= 1264.5
Upstream num= 2

Width	Elev	Width	Elev
11	713.4	11	741.4

Downstream num= 2

Width	Elev	Width	Elev
11	713.4	11	741.4

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end

Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.2

INPUT
Description: Penn Central Railroad Bridge Crossing #3 -Downstream Section
Station Elevation Data num= 66

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	782.4	118	778.4	205	769.4	231	769.4	271	763.4
271	774.4	500	774.4	500	759.4	541	758.4	560	758.4
603	756.4	621	756.4	657	758.4	698	757.4	733	755.4
790	758.4	815	761.4	832	761.4	873	760.4	921	742.4
967	740.4	981	742	981	740.2	992	740.2	992	723.2
1010	717.8	1037	713.4	1065	711	1113	712	1113	716.8
1120	716.8	1129	716.8	1137	716.8	1137	712.1	1181	712
1221	711.7	1259	711.9	1259	713.4	1270	715.4	1291	717.2
1329	725.2	1380	725.2	1399	733.9	1399	740.2	1406	740.2
1406	742	1406	764.4	1408	763.4	1487	760.4	1520	745.4
1800	745.4	2000	745.4	2200	745.4	2400	745.4	2600	745.4
2800	745.4	3000	745.4	3200	745.4	3400	745.4	3600	745.4
3800	745.4	3975	745.4	4014	788.4	4025	782.4	4037	784.4
4065	784.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.09	1010	.055	1291	.09

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1010	1291	45	48	90	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
1425	4065		T

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 265.1

INPUT
Description:
Station Elevation Data num= 65

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	782.4	133	778.4	200	769.4	226	769.4	272	764.4
272	774.4	476	774.4	477	759.4	530	758.4	546	758.4
587	756.4	606	756.4	760	759.4	778	759.4	922	742.4
968	740.4	979	742	979	740.2	990	740.2	991	723.2
1008	717.8	1035	713.4	1063	711	1111	712	1111.1	712
1117.9	712	1118	712	1126.9	712.1	1127	712.1	1134.9	712.1
1135	712.1	1179	712	1219	711.7	1257	711.9	1257.1	711.9
1257.2	713.9	1267.9	715.4	1268	715.4	1289	717.2	1327	725.2
1378	725.2	1397	733.9	1397	740.2	1404	740.2	1404	742
1404	764.4	1411	761.4	1497	760.4	1535	745.4	1800	745.4
2000	745.4	2200	745.4	2400	745.4	2600	745.4	2800	745.4
3000	745.4	3200	745.4	3400	745.4	3600	745.4	3800	745.4
3975	745.4	4004	788.4	4017	782.4	4033	784.4	4059	784.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	1008	.055	1289	.084

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1008	1289	500	632.31	610	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent

```
    1425    4059               T

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1           RS: 264.5

INPUT
Description:
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     5.2   761.3    22.8   761.3    66.2   767.2    83.8   767.1   133.5   758.3
     260   750.3   371.8   750.4     382   762.3   452.6   762.1   465.4   749.1
   562.1   740.2   591.6   740.3     620   739.6   628.7   736.9   658.6   725.2
     672   719.9   693.3   711.5   709.2   710.5   731.2   709.7     757     710
   783.4     710   814.3   709.9   832.8   710.5   846.2   711.4   856.4     713
   870.9     718   901.3   719.9   956.9   746.4   958.7   746.8  1024.7   750.5
    1178   751.4  1437.2   752.4  1469.9   745.2  2281.7   745.4    2378   783.3
  2683.9   783.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
     5.2    .089     672    .055   901.3    .085

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            672   901.3               44      44      44              .3       .5

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1           RS: 264.4

INPUT
Description: West 5th Avenue Bridge - Upstream Section
Station Elevation Data    num=      50
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   762.4      18   762.4      88   767.4      99   767.4     162   758.4
     343   750.4     343   762.4     525   762.4     525   749.4     590   741.5
     599   740.4     661   740.4     672   736.4     713   719.4     733   710.7
     752   710.7     755   709.2     770   708.8     772   708.8     792     709
   830.5   710.4   833.5   709.4     872   709.2     895   710.6   910.5   716.4
   913.5   716.4     947   719.5     972   731.3     975   732.7     991   740.2
     992   743.6     993   746.8    1068   745.4    1273   752.4    1498   754.4
    1535   745.4    1800   745.4    2000   745.4    2280   745.4    2355   783.4
    2692   784.4    2712   784.4    2808   786.4    2909   787.4    3172   787.4
    3429   787.4    3551   789.4    3560   787.4    3572   788.4    3602   788.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .092     713    .055     947    .086

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            713     947               48      48      48              .3       .5

BRIDGE


RIVER: RIVER-1
REACH: Reach-1           RS: 264.3

INPUT
Description: Structure #24 West 5th Avenue Bridge
Distance from Upstream XS =       4
Deck/Roadway Width        =    40.5
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      14
```

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
525	749.4	749.4	599	740.4	740.4	672	740.4	736.4
713	744.4	737.4	947	749.4	743.4	992	746.8	743.8
993	746.8	746.8	1068	745.4	745.4	1273	752.4	752.4
1498	754.4	754.4	1535	745.4	745.4	2000	745.4	745.4
2280	745.4	745.4	2355	783.4	783.4			

Upstream Bridge Cross Section Data
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	762.4	18	762.4	88	767.4	99	767.4	162	758.4
343	750.4	343	762.4	525	762.4	525	749.4	590	741.5
599	740.4	661	740.4	672	736.4	713	719.4	733	710.7
752	710.7	755	709.2	770	708.8	772	708.8	792	709
830.5	710.4	833.5	709.4	872	709.2	895	710.6	910.5	716.4
913.5	716.4	947	719.5	972	731.3	975	732.7	991	740.2
992	743.6	993	746.8	1068	745.4	1273	752.4	1498	754.4
1535	745.4	1800	745.4	2000	745.4	2280	745.4	2355	783.4
2692	784.4	2712	784.4	2808	786.4	2909	787.4	3172	787.4
3429	787.4	3551	789.4	3560	787.4	3572	788.4	3602	788.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	713	.055	947	.086

Bank Sta: Left	Right	Coeff Contr.	Expan.
713	947	.3	.5

Downstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
525	749.4	749.4	599	740.4	740.4	756	740.4	736.4
797	744.4	737.4	1031	749.4	743.4	1077	746.8	743.9

Downstream Bridge Cross Section Data
Station Elevation Data num= 58

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	764.4	21	764.4	87	767.4	103	767.4	155	759.4
221	754.4	221	789.4	309	789.4	309	752.4	414	762.4
425	762.4	440	760.4	529	748.4	583	746.4	720	737.6
723	737.4	746	737	805	719.4	817	710.7	836	710.7
839	709.2	840	709.2	856	708.8	876	709	914.5	710.4
917.5	709.4	956	709.2	979	710.6	994.5	716.4	997.5	716.4
1020	718.5	1031	719.5	1056	731.3	1075	740.2	1075	743.6
1077	746.8	1108	745.4	1206	748.4	1300	750.1	1314	750.4
1634	754.4	1640	752.9	1670	745.4	1800	745.4	1900	745.4
2065	745.4	2223	762.4	2261	779.4	2533	782.4	2727	783.4
2750	783.4	2979	786.4	3168	787.4	3397	788.4	3570	789.4
3580	787.4	3592	788.4	3620	788.4				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	805	.055	1031	.087

Bank Sta: Left	Right	Coeff Contr.	Expan.
805	1031	.3	.5

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 3

Pier Data
Pier Station Upstream= 753.5 Downstream= 837.5

```
Upstream     num=       2
    Width   Elev    Width   Elev
       3   709.2       3   738.8
Downstream     num=       2
    Width   Elev    Width   Elev
       3   709.2       3   738.8

Pier Data
Pier Station     Upstream=     832    Downstream=     916
Upstream     num=       2
    Width   Elev    Width   Elev
       3   709.4       3   740.8
Downstream     num=       2
    Width   Elev    Width   Elev
       3   709.4       3   740.8

Pier Data
Pier Station     Upstream=     912    Downstream=     996
Upstream     num=       2
    Width   Elev    Width   Elev
       3   716.4       3   743.4
Downstream     num=       2
    Width   Elev    Width   Elev
       3   716.4       3   743.4

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 264.2

INPUT
Description: West 5th Avenue Bridge - Downstream Section
Station Elevation Data    num=      58
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   764.4      21   764.4      87   767.4     103   767.4     155   759.4
     221   754.4     221   789.4     309   789.4     309   752.4     414   762.4
     425   762.4     440   760.4     529   748.4     583   746.4     720   737.6
     723   737.4     746     737     805   719.4     817   710.7     836   710.7
     839   709.2     840   709.2     856   708.8     876     709   914.5   710.4
   917.5   709.4     956   709.2     979   710.6   994.5   716.4   997.5   716.4
    1020   718.5    1031   719.5    1056   731.3    1075   740.2    1075   743.6
    1077   746.8    1108   745.4    1206   748.4    1300   750.1    1314   750.4
    1634   754.4    1640   752.9    1670   745.4    1800   745.4    1900   745.4
    2065   745.4    2223   762.4    2261   779.4    2533   782.4    2727   783.4
    2750   783.4    2979   786.4    3168   787.4    3397   788.4    3570   789.4
    3580   787.4    3592   788.4    3620   788.4

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .092     805    .055    1031    .087

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
```

805	1031	42.5	42.5	42.5		.3	.5	

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264.1

INPUT
Description:
Station Elevation Data num= 76

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	766.4	25	766.4	83	767.4	98	767.4	144	759.4
214	757.4	214	789.4	315	789.4	315	753.4	400	751.6
457	750.4	514	748.4	669	740.4	736	740.4	737	737
786	719.4	808	710.7	826.9	710.7	827	710.7	829.9	709.2
830	709.2	847	708.8	855	708.9	867	709	905.5	710.4
905.6	710.4	908.4	709.4	908.5	709.4	947	709.2	970	710.6
985.4	716.4	985.5	716.4	988.4	716.4	988.5	716.4	1020	719.3
1022	719.5	1047	731.3	1066	740.2	1066	743.6	1068	746.8
1072	724.4	1149	755.4	1253	751.4	1314	750.4	1432	754.4
1560	755.3	1572	755.4	1702	753.4	1731	747.4	1770	745.4
1885	745.4	1920	747.4	1985	750.4	2115	750.4	2137	753.4
2205	764.4	2236	780.4	2539	780.4	2740	782.4	2760	782.4
2895	785.4	2895	794.4	2931	794.4	2931	785.4	3079	786.4
3080	786.4	3200	786.4	3201	806.4	3240	806.4	3311	806.4
3311	788.4	3461	788.4	3569	789.4	3581	787.4	3598	788.4
3627	788.4								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	786	.055	1022	.09

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
786	1022	2750	2733.27	2700	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 263

INPUT
Description:
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	775.4	61	754.4	105	760.4	125	760.4	171	744.4
440	734.4	689	734.4	750	736.4	810	733.4	828	736.4
1044	735.4	1120	713.3	1123	712.4	1133	707.4	1656	707.4
1666	712.4	1670	716.1	1702	745.4	1715	746.4	1871	745.4
1880	745.4	1960	745.4	2000	745.4	2200	745.4	2400	745.4
2515	745.4	2545	745.4	2565	764.4	2618	762.4	2638	762.4
2815	761.4	3000	761.4	3200	761.4	3400	761.4	3600	761.4
3800	761.4	3980	761.4	4052	771.4	4163	777.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.092	1123	.047	1666	.082

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1123	1666	2100	2048.64	2000	.1	.3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 262

INPUT

Description:
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	773.3	31.2	758.2	49.7	759.4	63.8	759.4	97	758
175.6	739.3	237	737.4	261.2	736.3	890.3	735.4	904.2	736.3
951.2	736.3	965.7	736.2	1223.9	736.2	1520	735.4	1550.2	735.4
1579.7	716.5	1599.9	712.6	1609	709.4	1628	709	1656.3	708
1691.7	707.1	1720	707.4	1749.7	708.5	1757.7	708.7	1762.3	709.8
1804.4	726.4	1805	726.5	1805	731.6	1983.1	739.2	2117	751.3
2201.3	752.3	2215.8	750.4	2224.8	752.3	2253	752.2	2286	751.2
2431.2	753.4	2597.8	766.1						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	1599.9	.035	1762.3	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1599.9	1762.3	1400	2133.12	2200	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	950	736	F

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 261

INPUT
Description:
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	758.4	26	757.4	109	744.4	143	753.4	159	755.4
174	755.4	222	735.4	222	748.4	253	748.4	253	735.4
307	735.4	307	757.4	475	757.4	475	735.4	480	735.4
481	735.4	600	735.4	755	735.4	810	735.4	865	735.4
1000	735.4	1020	735.4	1200	735.4	1400	735.4	1600	735.4
1800	735.4	2000	735.4	2150	735.4	2195	735.4	2216	744.4
2246	744.4	2279	741.4	2293	743.4	2324	743.4	2362	735.4
2451	728.4	2480	712.5	2482	711.4	2495	704.9	2693	704.9
2706	711.4	2710	712.9	2749	727.4	2790	728.4	2905	739.4
3119	749.4	3200	749.4	3240	749.4	3400	749.4	3600	749.4
3800	749.4	3950	749.4	4038	765.4	4370	765.4		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.048	2482	.035	2706	.058

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
2482	2706	1335.84	1335.84	1335.84	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	2350	736	F

STORAGE AREA: Quarry 1
Volume Method : Rating Curve

Elevation	Volume
721	0
723	9
724	19
725	30
726	42
727	56
728	71
729	91
730	117
731	145

732	174
733	204
734	235
735	268
736	301
737	335
738	371
739	407
740	444
741	481
742	520
743	558
744	598
745	638

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3
Reach-1	271	.053	.042	.053
Reach-1	270.5	.05	.042	.058
Reach-1	270.4	.06	.042	.054
Reach-1	270.3	Bridge		
Reach-1	270.2	.06	.042	.054
Reach-1	270.1	.054	.042	.048
Reach-1	269	.047	.042	.051
Reach-1	268.7	Lat Struct		
Reach-1	268.5	.051	.042	.051
Reach-1	268.4	.052	.042	.057
Reach-1	268.3	Bridge		
Reach-1	268.2	.052	.042	.043
Reach-1	268.1	.054	.045	.057
Reach-1	267.5	.062	.045	.058
Reach-1	267.4	.065	.045	.058
Reach-1	267.3	Bridge		
Reach-1	267.2	.068	.045	.06
Reach-1	267.1	.068	.045	.06
Reach-1	266	.08	.048	.07
Reach-1	265.5	.088	.055	.088
Reach-1	265.4	.086	.055	.086
Reach-1	265.3	Bridge		
Reach-1	265.2	.09	.055	.09
Reach-1	265.1	.092	.055	.084
Reach-1	264.5	.089	.055	.085
Reach-1	264.4	.092	.055	.086
Reach-1	264.3	Bridge		
Reach-1	264.2	.092	.055	.087
Reach-1	264.1	.092	.055	.09
Reach-1	263	.092	.047	.082
Reach-1	262	.05	.035	.06
Reach-1	261	.048	.035	.058

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	271	2420	2386.56	2370
Reach-1	270.5	80	50	20
Reach-1	270.4	15	15	15
Reach-1	270.3	Bridge		

Reach-1	270.2	40	40	40
Reach-1	270.1	1050	1054.79	1050
Reach-1	269	1350	1379.48	1380
Reach-1	268.7	Lat Struct		
Reach-1	268.5	55	55	55
Reach-1	268.4	21	21	21
Reach-1	268.3	Bridge		
Reach-1	268.2	28	28	28
Reach-1	268.1	403.75	403.75	403.75
Reach-1	267.5	70	58.08	50
Reach-1	267.4	64	64	64
Reach-1	267.3	Bridge		
Reach-1	267.2	66	66	66
Reach-1	267.1	1600	1758	1780
Reach-1	266	1800	1721.77	1550
Reach-1	265.5	180	107	20
Reach-1	265.4	44	44	44
Reach-1	265.3	Bridge		
Reach-1	265.2	45	48	90
Reach-1	265.1	500	632.31	610
Reach-1	264.5	44	44	44
Reach-1	264.4	48	48	48
Reach-1	264.3	Bridge		
Reach-1	264.2	42.5	42.5	42.5
Reach-1	264.1	2750	2733.27	2700
Reach-1	263	2100	2048.64	2000
Reach-1	262	1400	2133.12	2200
Reach-1	261	1335.84	1335.84	1335.84

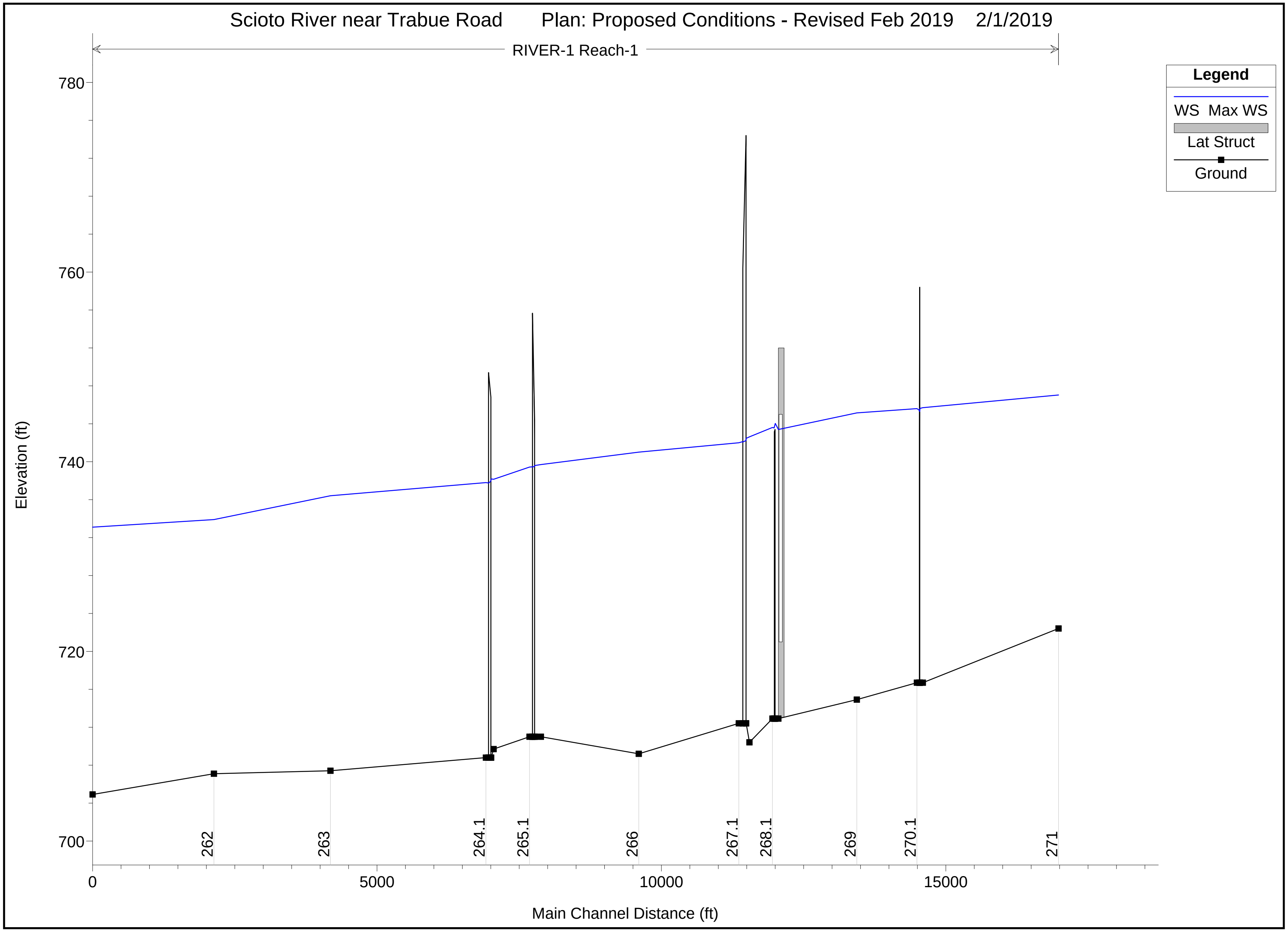
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	271	.1	.3
Reach-1	270.5	.3	.5
Reach-1	270.4	.3	.5
Reach-1	270.3	Bridge	
Reach-1	270.2	.3	.5
Reach-1	270.1	.1	.3
Reach-1	269	.1	.3
Reach-1	268.7	Lat Struct	
Reach-1	268.5	.3	.5
Reach-1	268.4	.3	.5
Reach-1	268.3	Bridge	
Reach-1	268.2	.3	.5
Reach-1	268.1	.1	.3
Reach-1	267.5	.3	.5
Reach-1	267.4	.3	.5
Reach-1	267.3	Bridge	
Reach-1	267.2	.3	.5
Reach-1	267.1	.1	.3
Reach-1	266	.1	.3
Reach-1	265.5	.3	.5
Reach-1	265.4	.3	.5
Reach-1	265.3	Bridge	
Reach-1	265.2	.3	.5
Reach-1	265.1	.1	.3
Reach-1	264.5	.3	.5
Reach-1	264.4	.3	.5
Reach-1	264.3	Bridge	
Reach-1	264.2	.3	.5
Reach-1	264.1	.1	.3
Reach-1	263	.1	.3
Reach-1	262	.1	.3

Reach-1	261	.1	.3

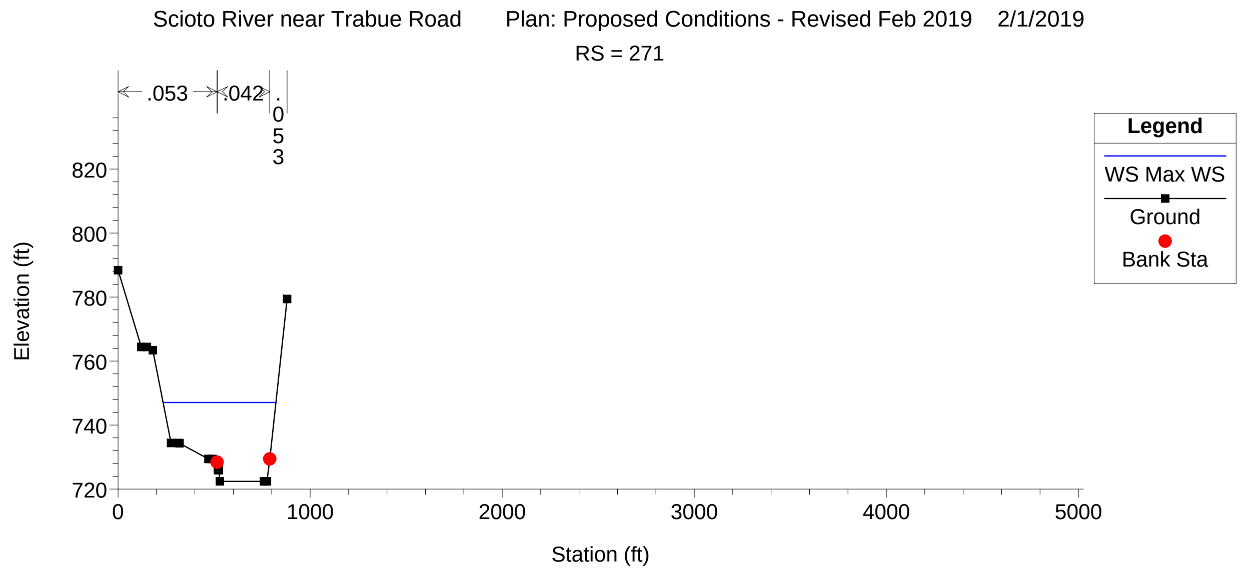
HEC-RAS Plan: Prop. Feb 2019   River: RIVER-1   Reach: Reach-1   Profile: Max WS

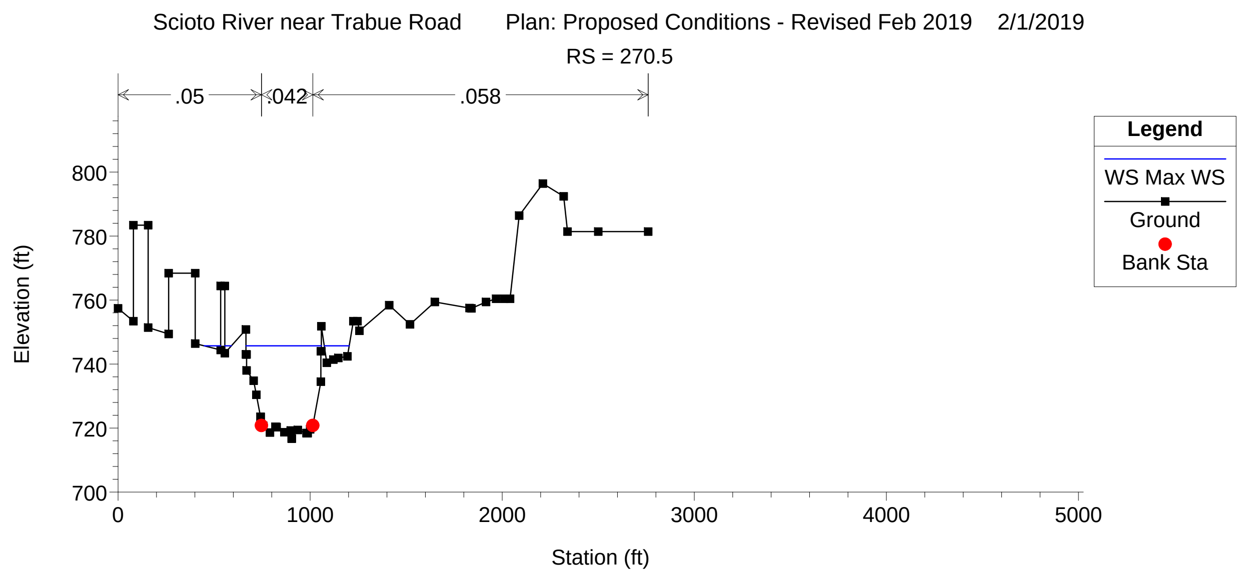
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	271	Max WS	56955	722.40	747.026		747.55	0.0005	6.40	10841.5	587.1	0.23
Reach-1	270.5	Max WS	56944	716.70	745.693		746.39	0.0005	7.08	9481.5	641.4	0.24
Reach-1	270.4	Max WS	56944	716.70	745.625	730.32	746.37	0.0005	7.24	9054.6	504.3	0.25
Reach-1	270.3		Bridge									
Reach-1	270.2	Max WS	56944	716.70	745.431		746.13	0.0005	7.12	10083.8	814.4	0.25
Reach-1	270.1	Max WS	56944	716.70	745.589		746.09	0.0004	6.23	11945.4	887.0	0.21
Reach-1	269	Max WS	56943	714.90	745.140		745.68	0.0004	6.86	11949.3	1034.2	0.22
Reach-1	268.7		Lat Struct									
Reach-1	268.5	Max WS	56940	712.90	743.393		744.76	0.0010	9.55	6355.9	300.6	0.34
Reach-1	268.4	Max WS	56939	712.90	744.038	731.03	744.62	0.0005	7.01	12041.3	1152.3	0.25
Reach-1	268.3		Bridge									
Reach-1	268.2	Max WS	56939	712.90	743.561		744.31	0.0007	7.74	10351.7	1030.3	0.27
Reach-1	268.1	Max WS	56939	712.90	743.610		744.27	0.0007	7.36	10827.0	1042.7	0.26
Reach-1	267.5	Max WS	56939	710.40	742.619		744.09	0.0012	10.64	6895.9	519.2	0.34
Reach-1	267.4	Max WS	56939	712.40	742.457	729.78	743.93	0.0012	9.83	6236.9	400.4	0.34
Reach-1	267.3		Bridge									
Reach-1	267.2	Max WS	56935	712.40	742.108		743.64	0.0013	10.02	6031.6	364.0	0.35
Reach-1	267.1	Max WS	56935	712.40	741.997		743.56	0.0013	10.08	5938.5	640.4	0.36
Reach-1	266	Max WS	56934	709.20	741.004		741.67	0.0007	7.36	10461.9	527.1	0.25
Reach-1	265.5	Max WS	56934	711.00	739.700		740.35	0.0008	6.77	9874.4	503.4	0.23
Reach-1	265.4	Max WS	56934	711.00	739.589	723.97	740.26	0.0009	6.89	9463.9	428.2	0.24
Reach-1	265.3		Bridge									
Reach-1	265.2	Max WS	56932	711.00	739.454		740.15	0.0009	6.96	9365.3	407.0	0.24
Reach-1	265.1	Max WS	56932	711.00	739.426		740.10	0.0008	6.86	9454.3	407.0	0.23
Reach-1	264.5	Max WS	56930	709.70	738.138		739.42	0.0016	9.25	6699.5	314.9	0.32
Reach-1	264.4	Max WS	56930	708.80	738.178	723.89	739.35	0.0014	8.82	7016.0	319.6	0.30
Reach-1	264.3		Bridge									
Reach-1	264.2	Max WS	56930	708.80	737.755		739.03	0.0015	9.21	6869.6	352.2	0.32
Reach-1	264.1	Max WS	56930	708.80	737.800		738.96	0.0014	8.81	7241.2	359.8	0.30
Reach-1	263	Max WS	56929	707.40	736.407		736.60	0.0001	3.57	17844.4	1306.2	0.12
Reach-1	262	Max WS	56927	707.10	733.894		736.06	0.0011	12.34	5526.9	306.2	0.43
Reach-1	261	Max WS	56927	704.90	733.094	717.99	734.19	0.0005	8.64	7696.5	447.7	0.29

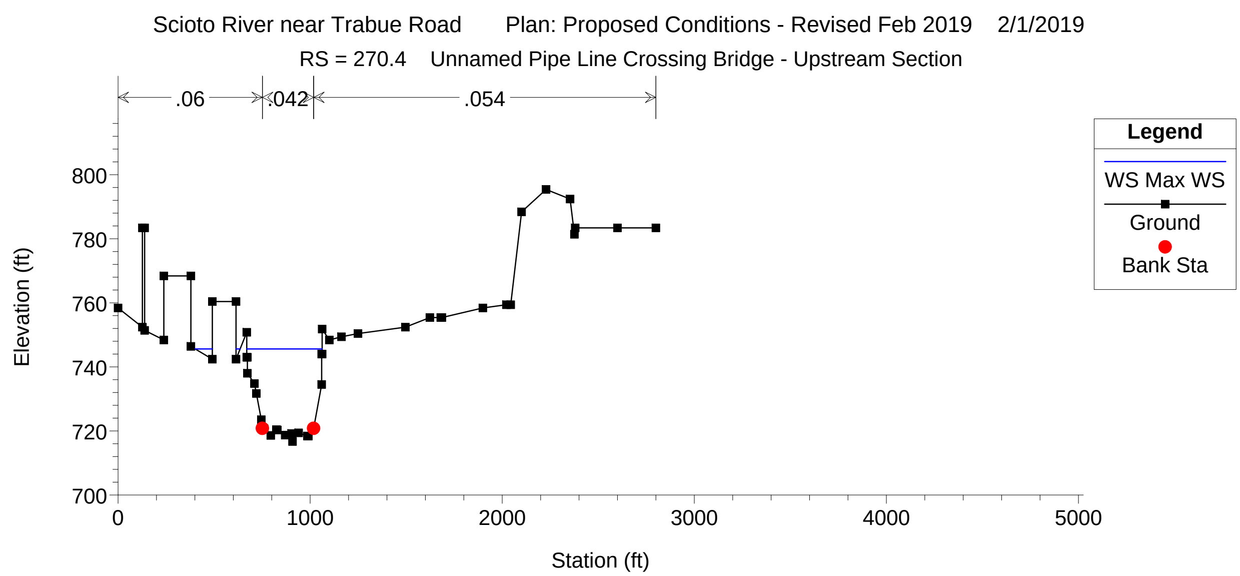


1 in Horiz. = 2500 ft 1 in Vert. = 15 ft

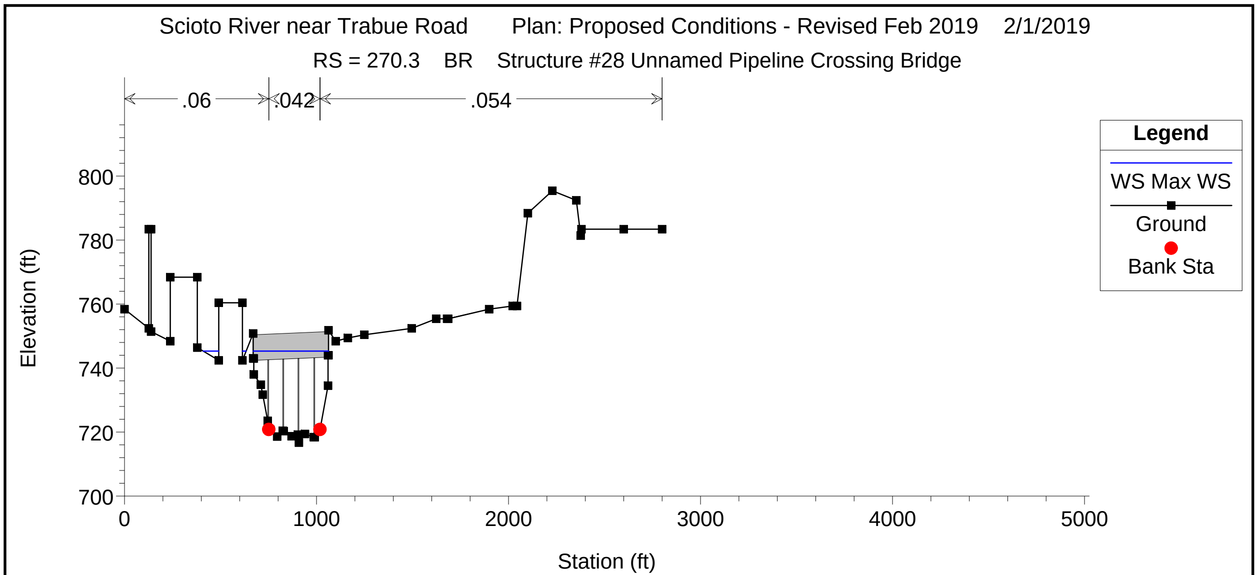
CROSS-SECTION PLOTS

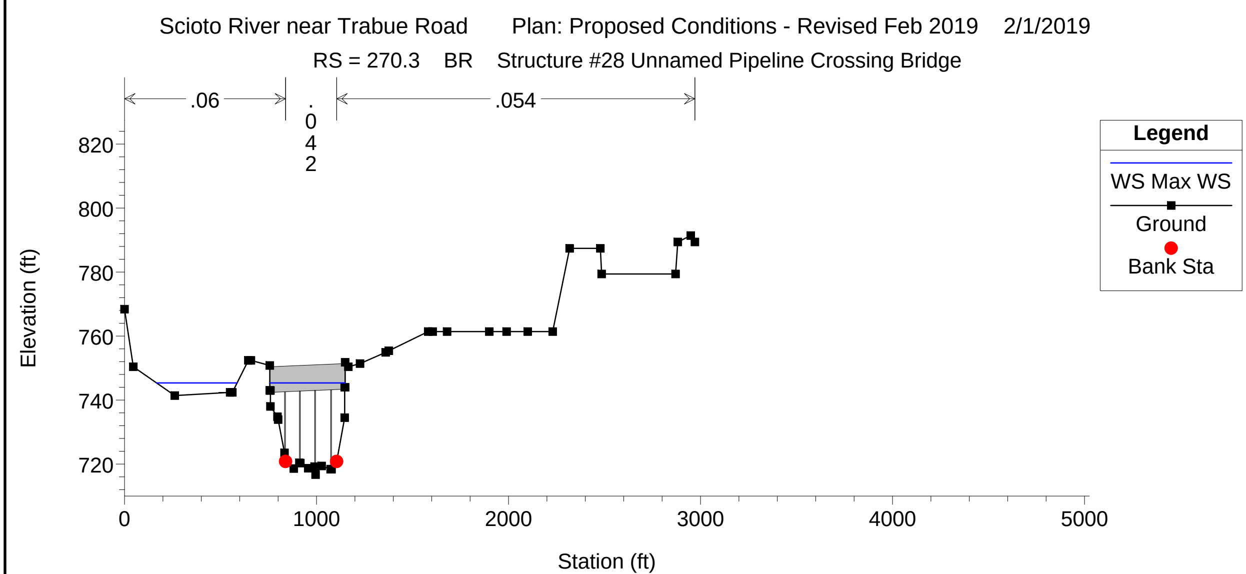


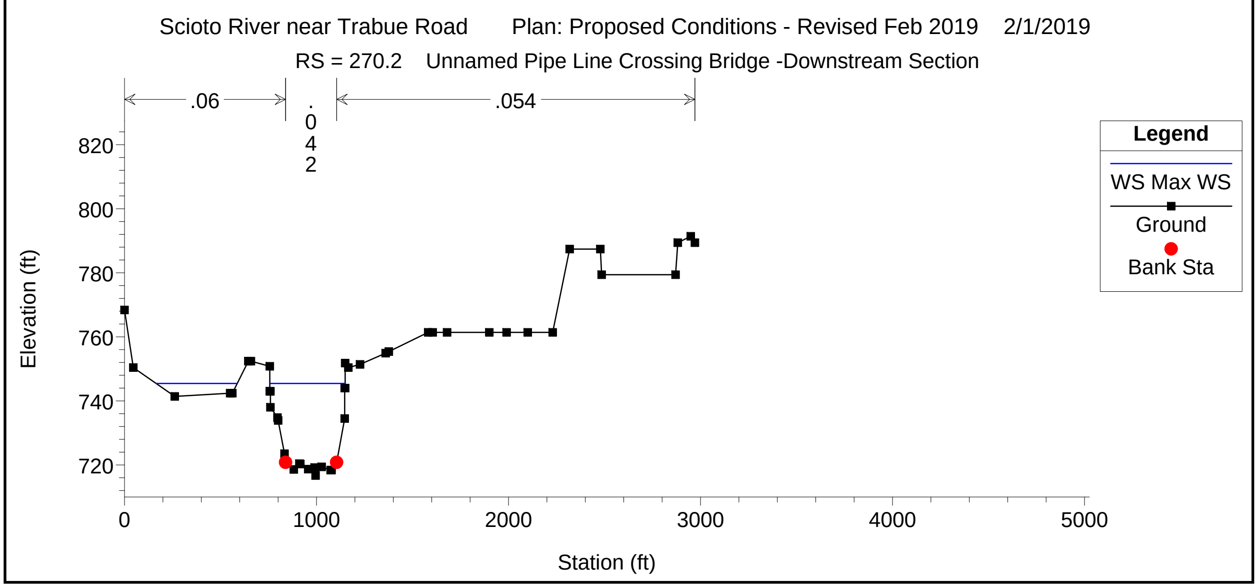




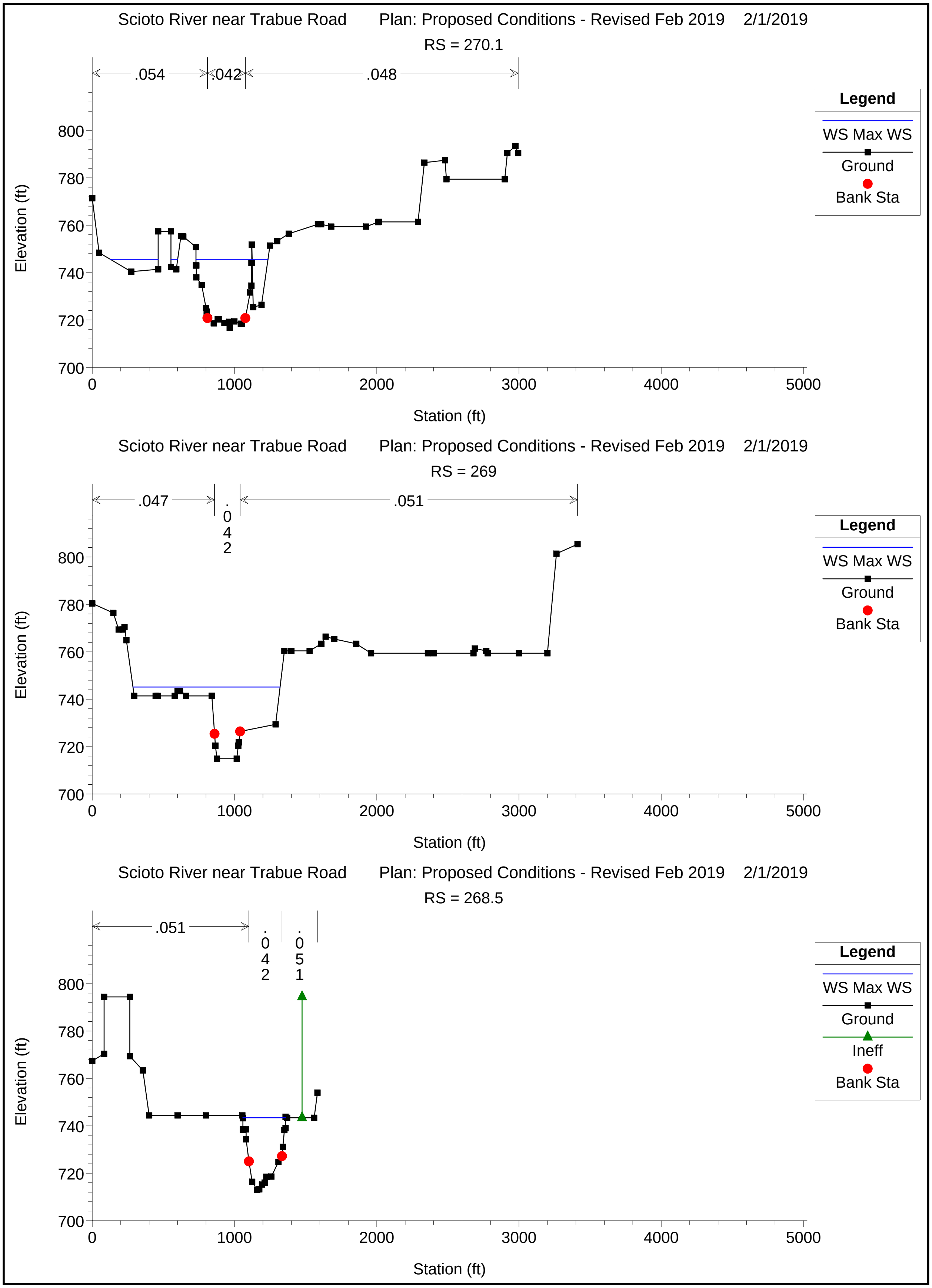
1 in Horiz. = 1000 ft 1 in Vert. = 60 ft







1 in Horiz. = 1000 ft 1 in Vert. = 60 ft



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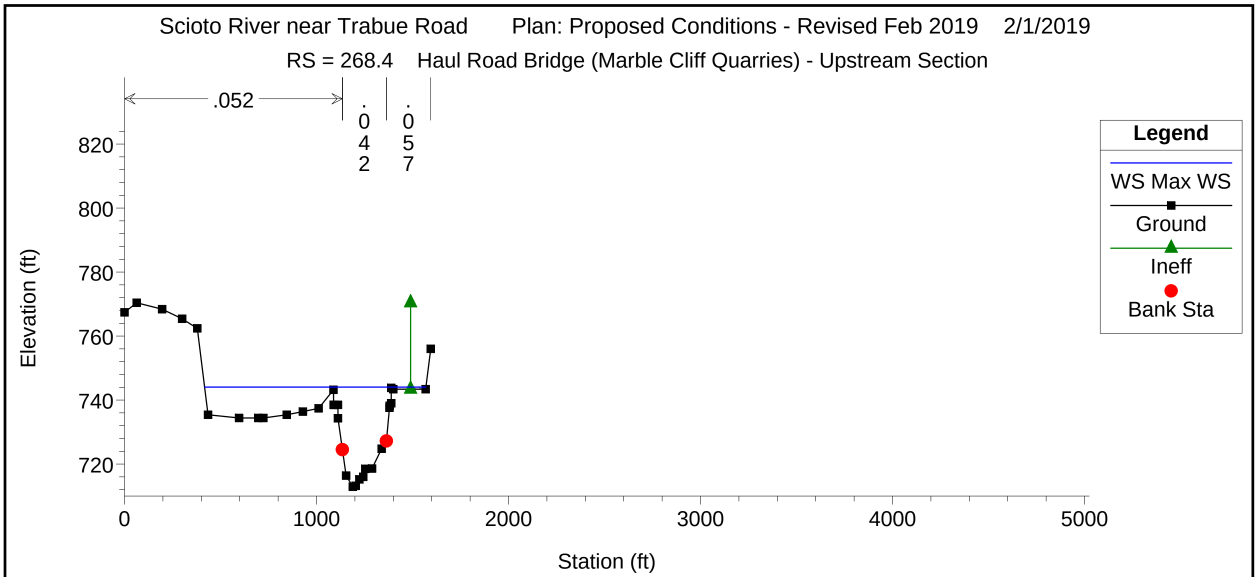
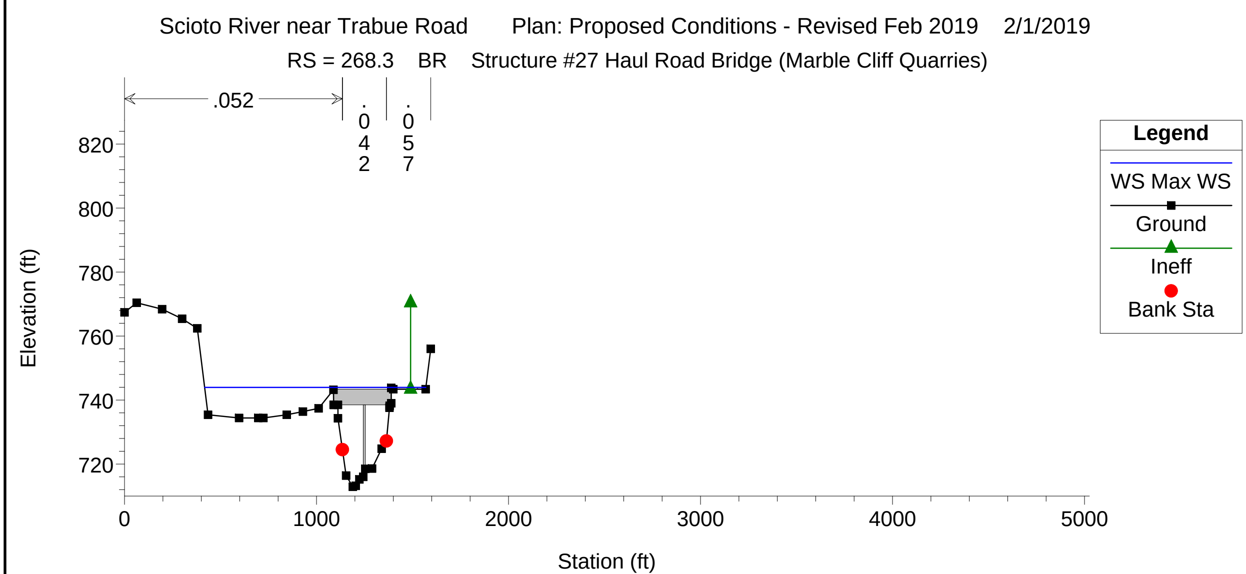
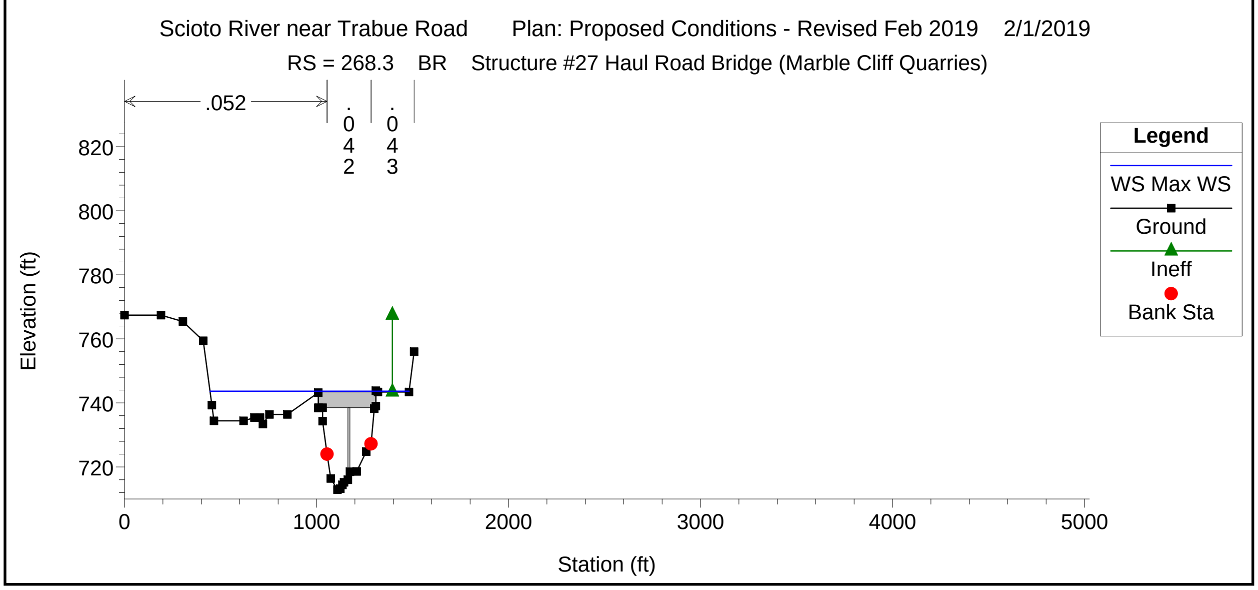
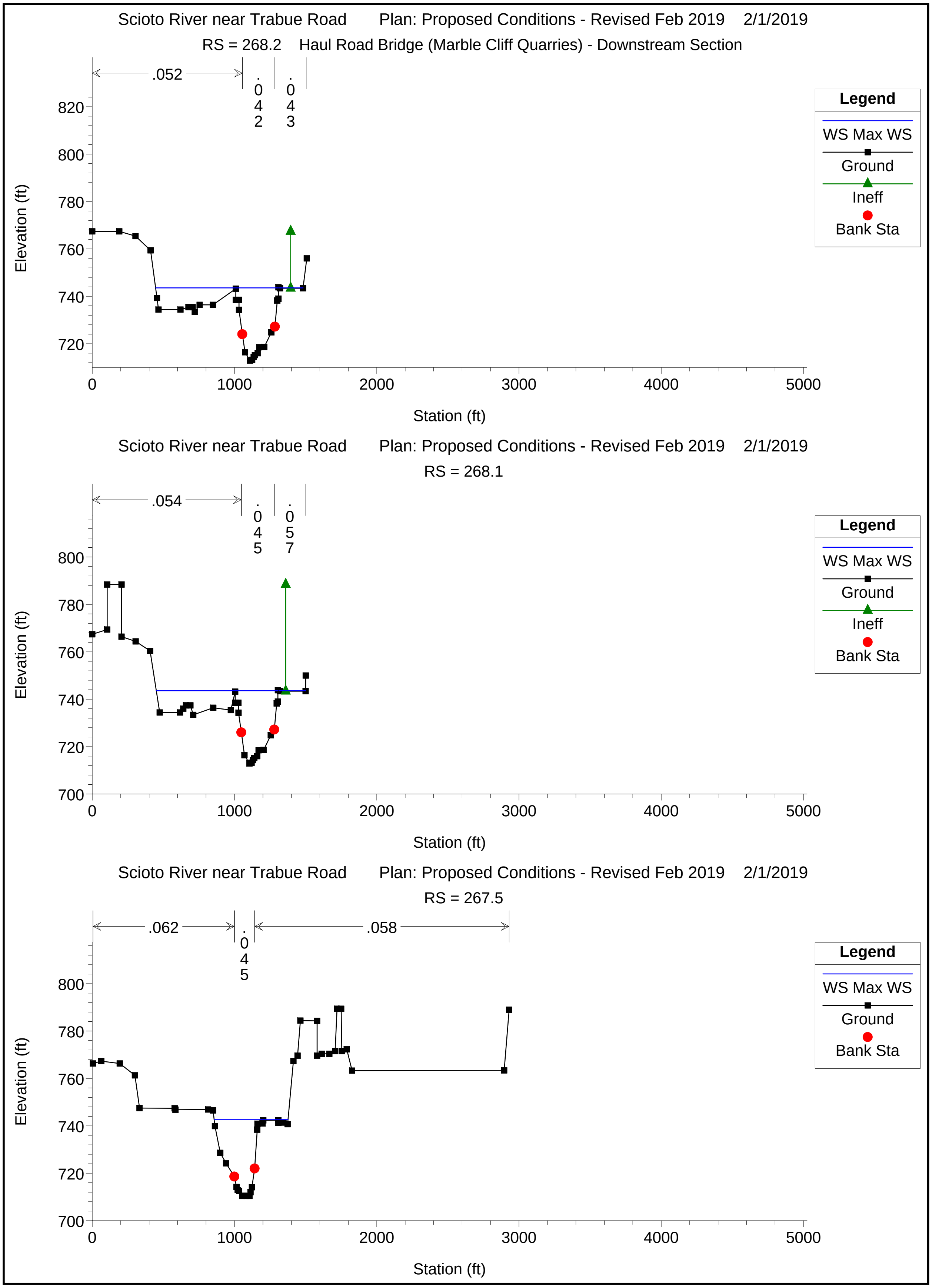






1 in Horiz. = 1000 ft 1 in Vert. = 60 ft



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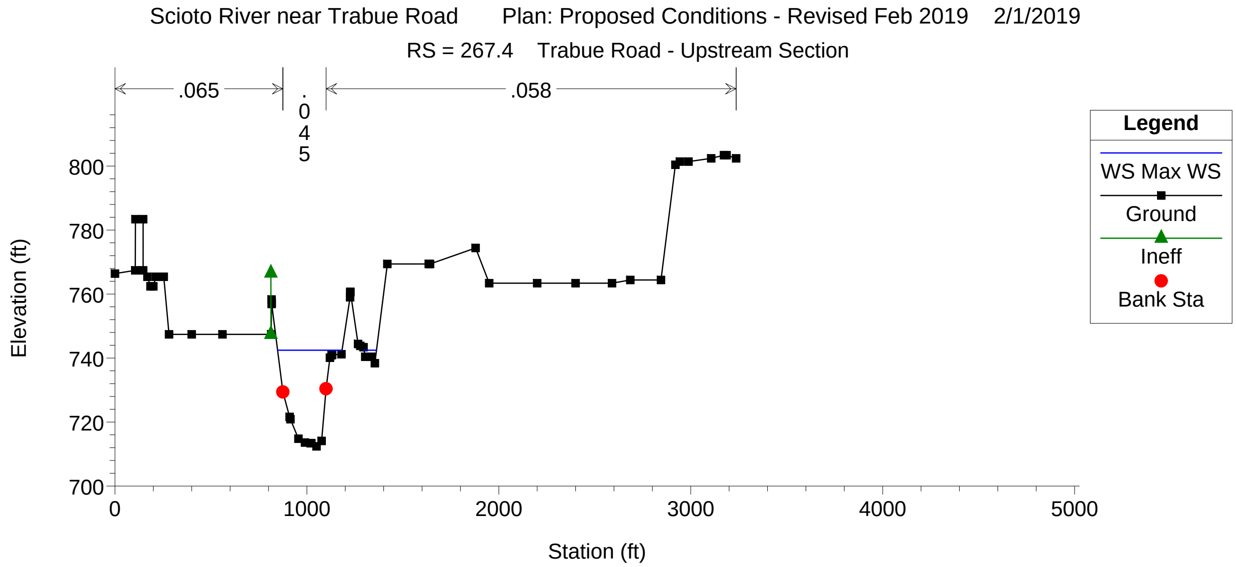

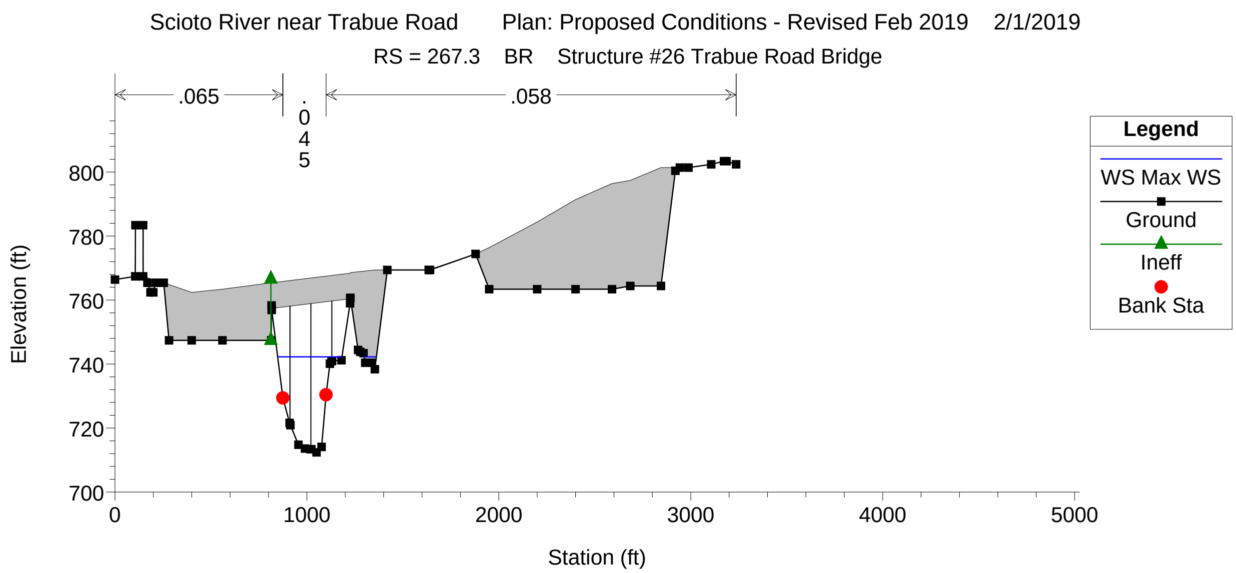

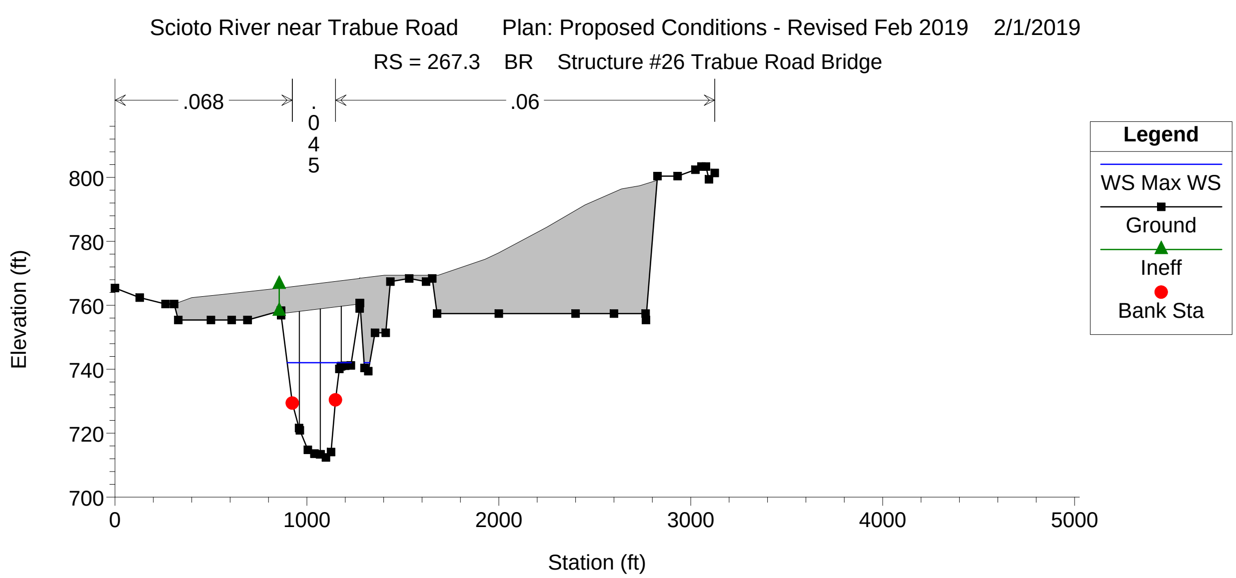

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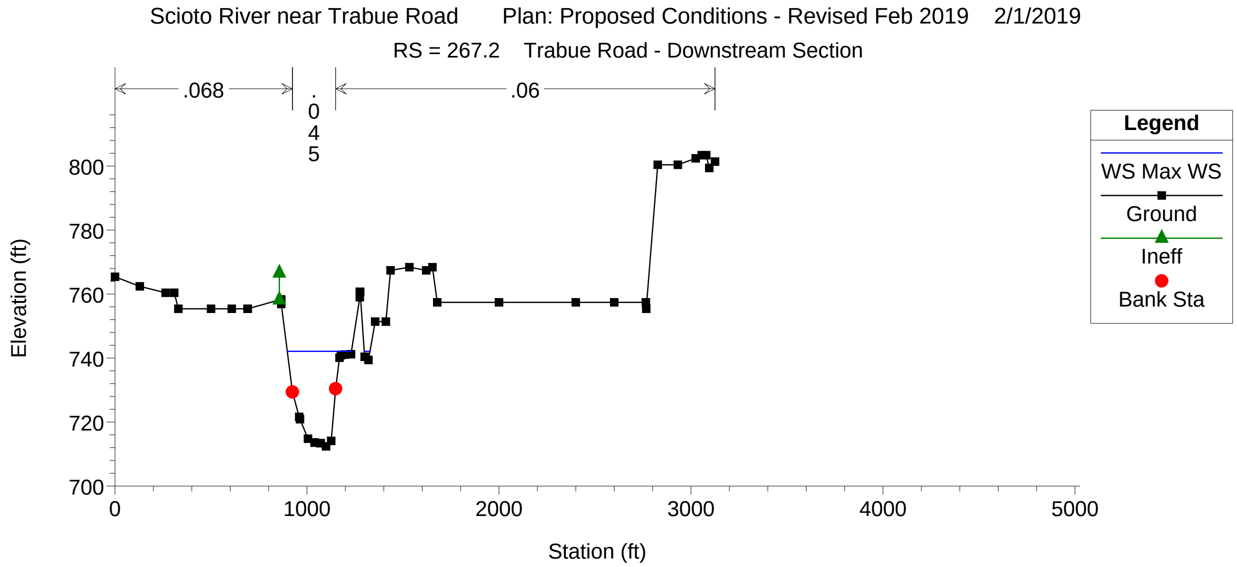
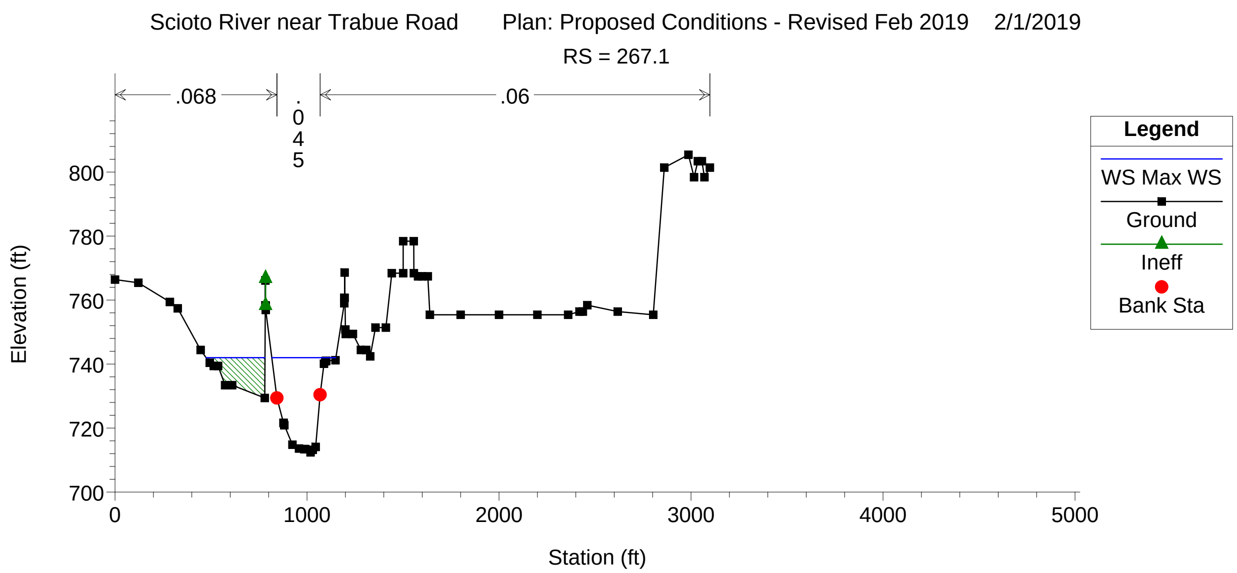
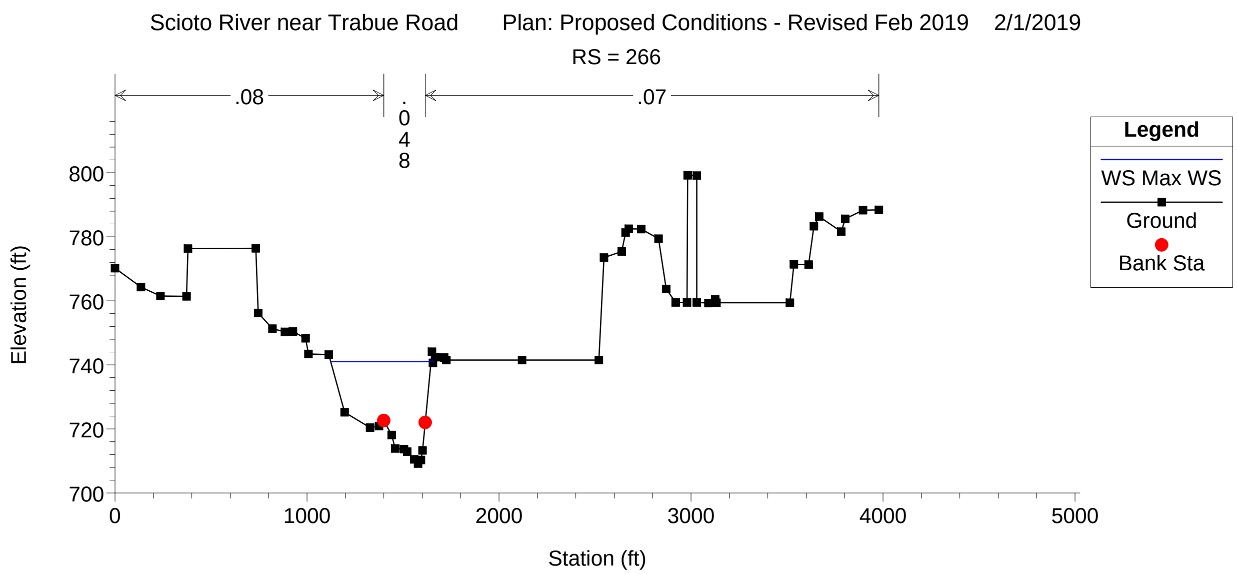
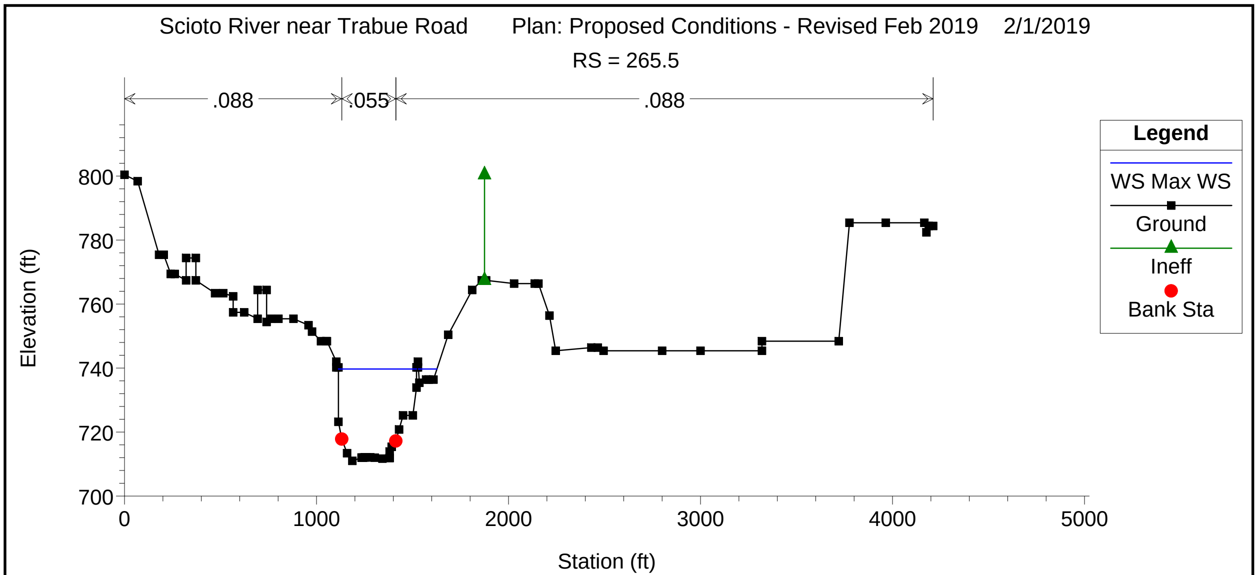
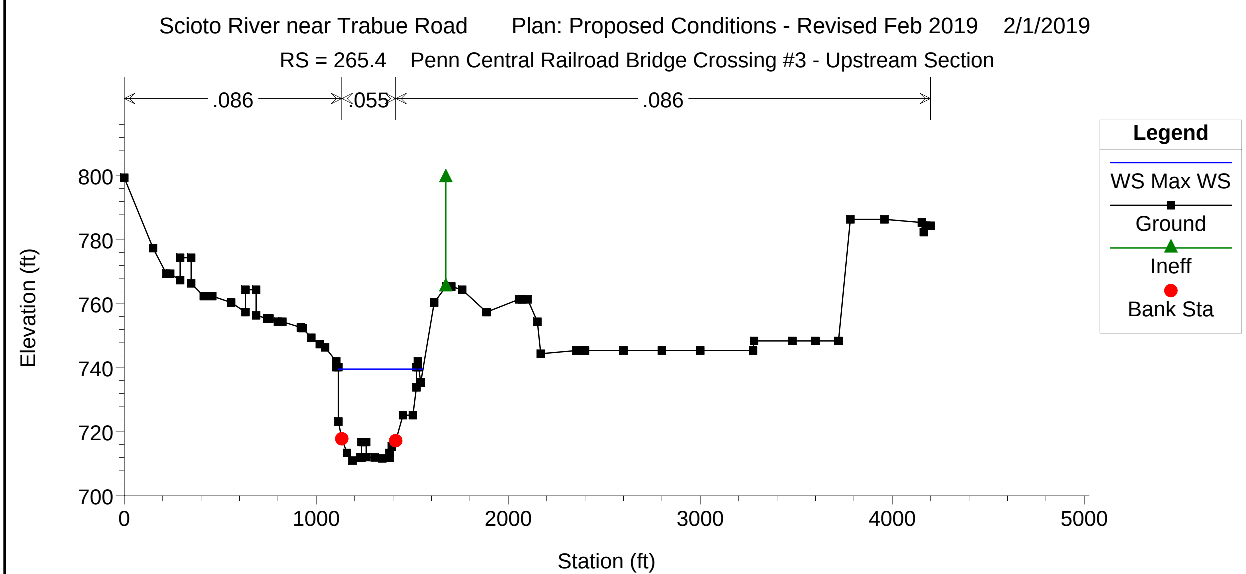


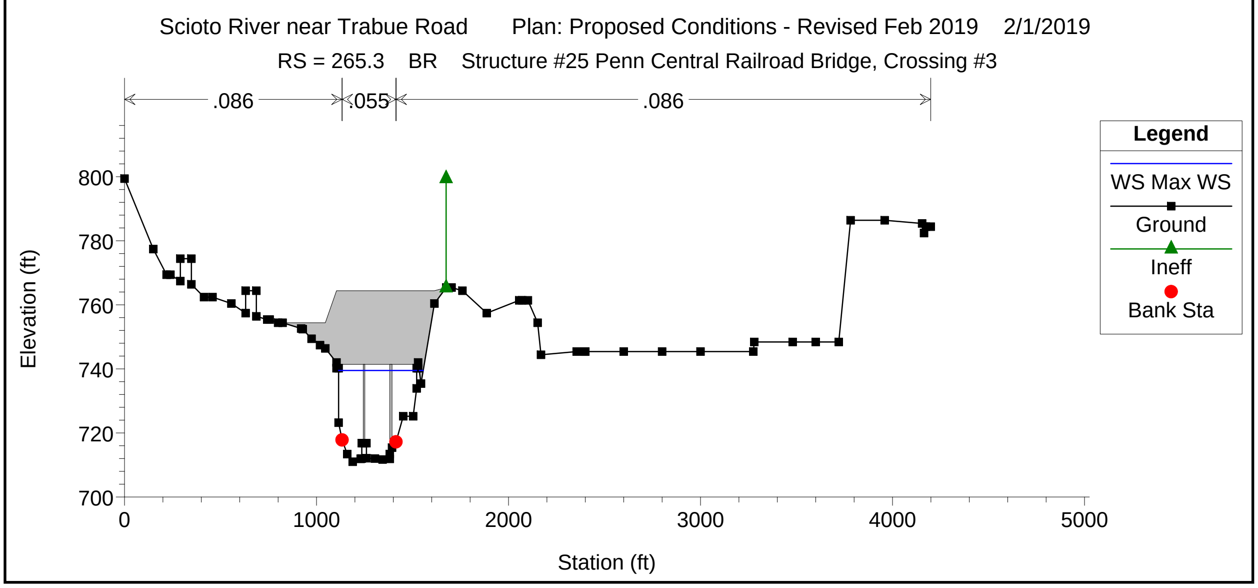




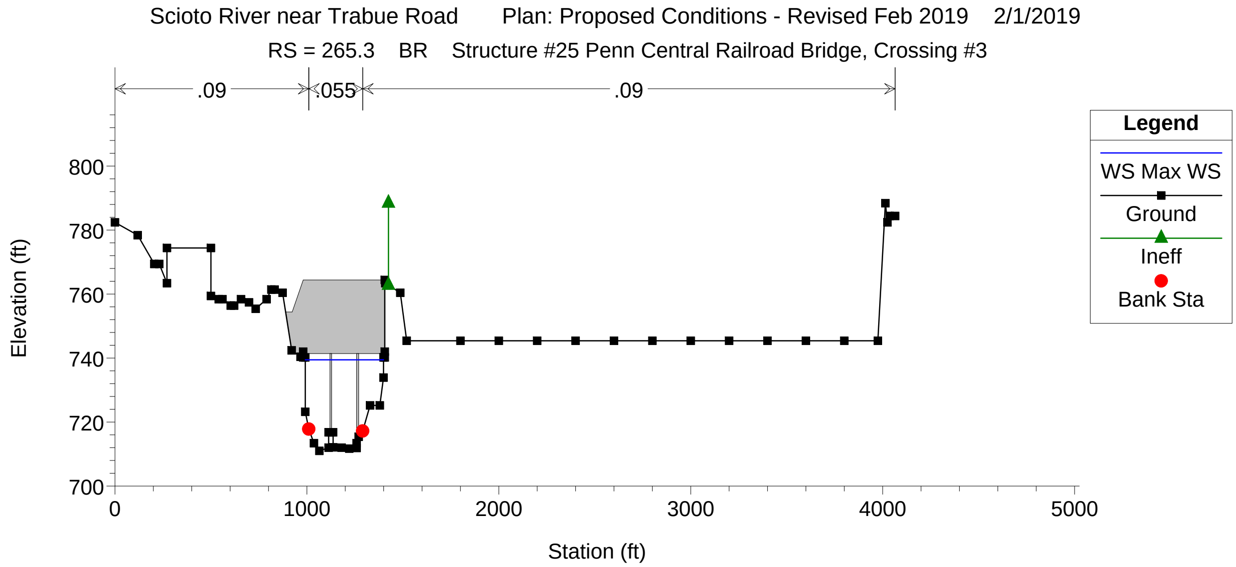
1 in Horiz. = 1000 ft 1 in Vert. = 60 ft

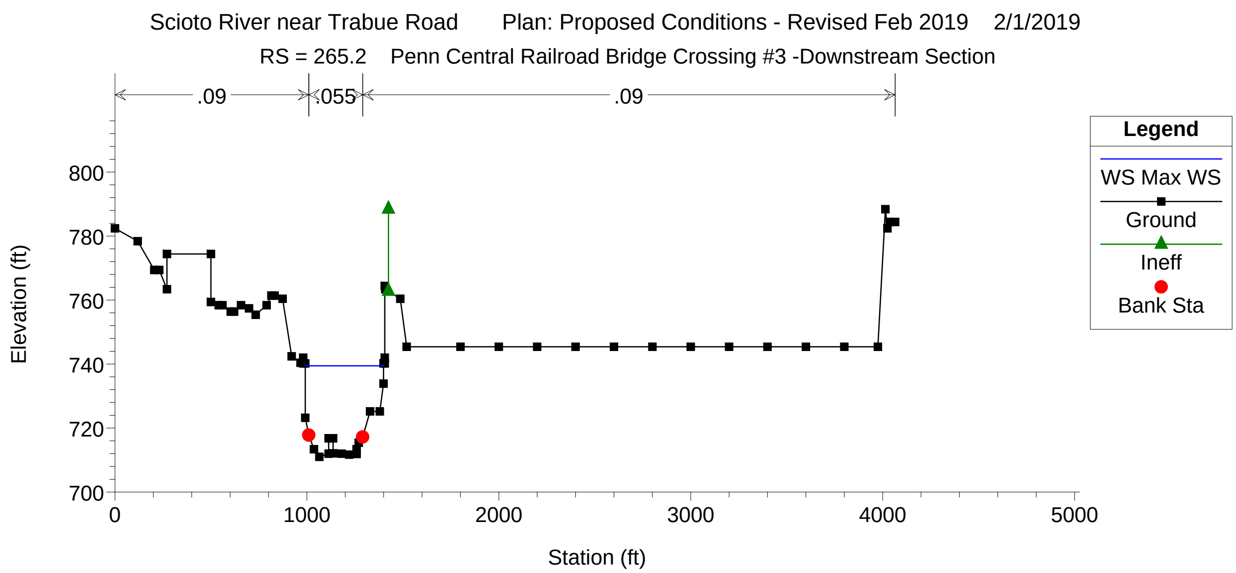


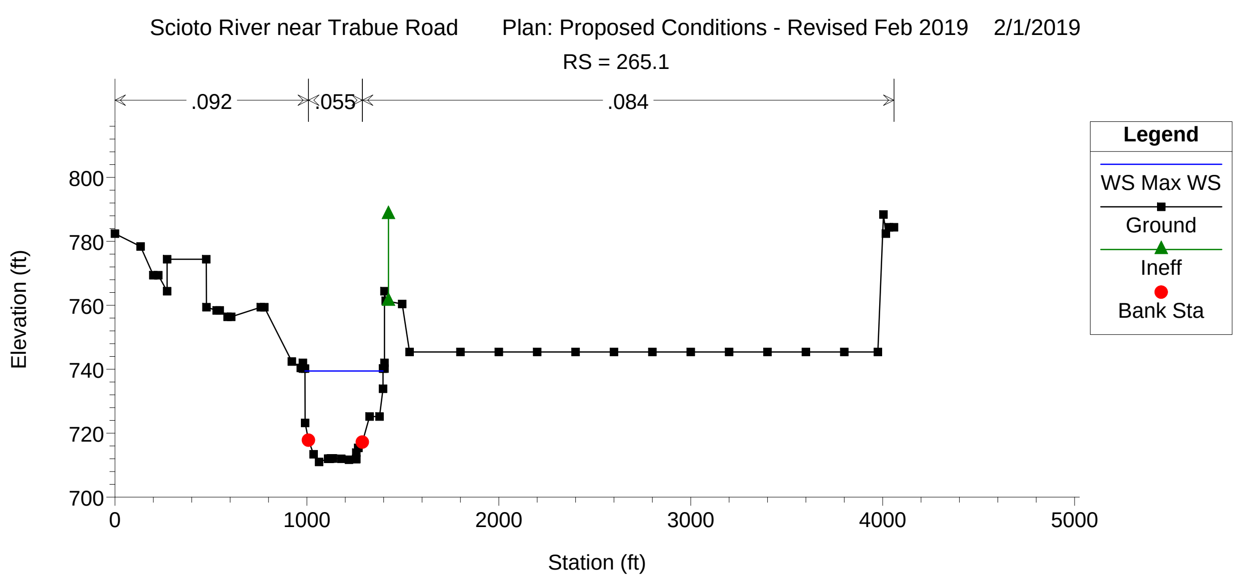




1 in Horiz. = 1000 ft 1 in Vert. = 60 ft







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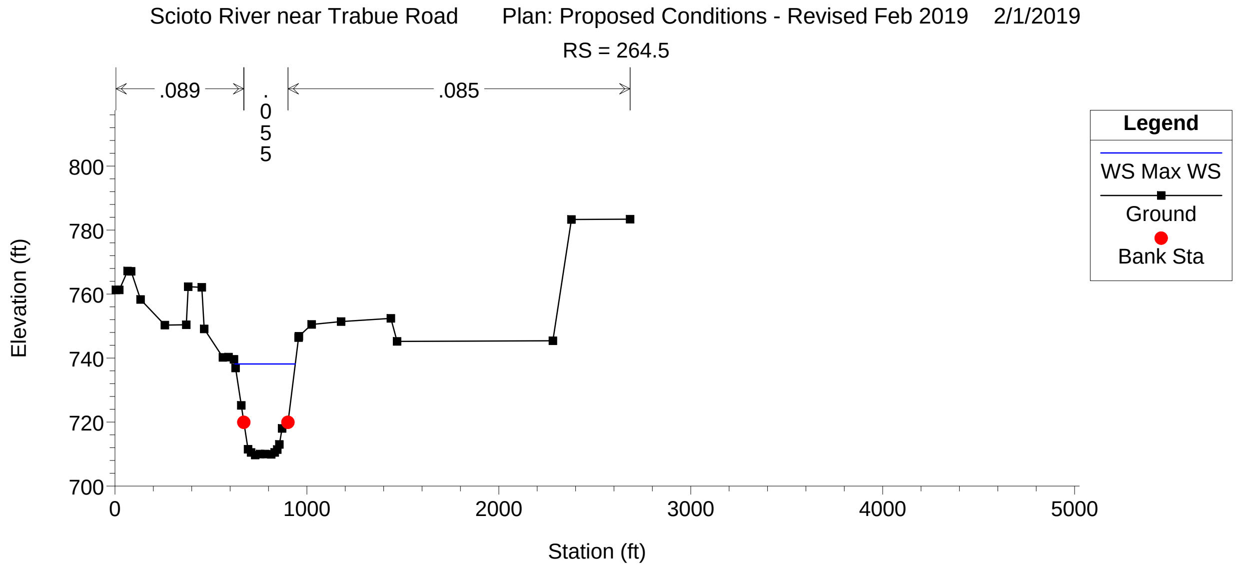
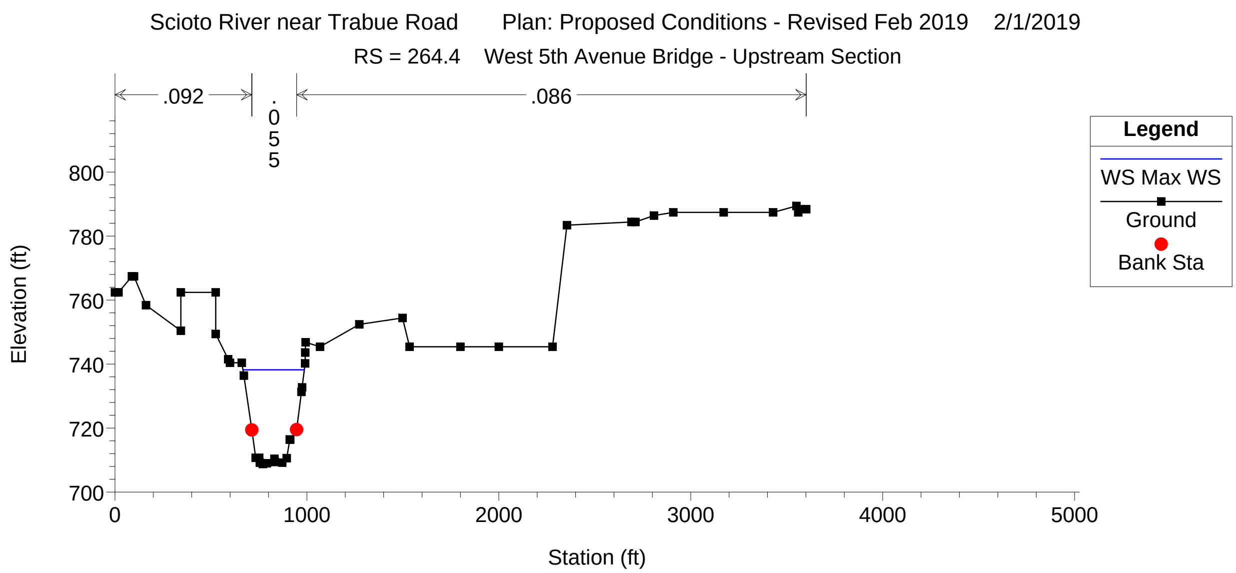
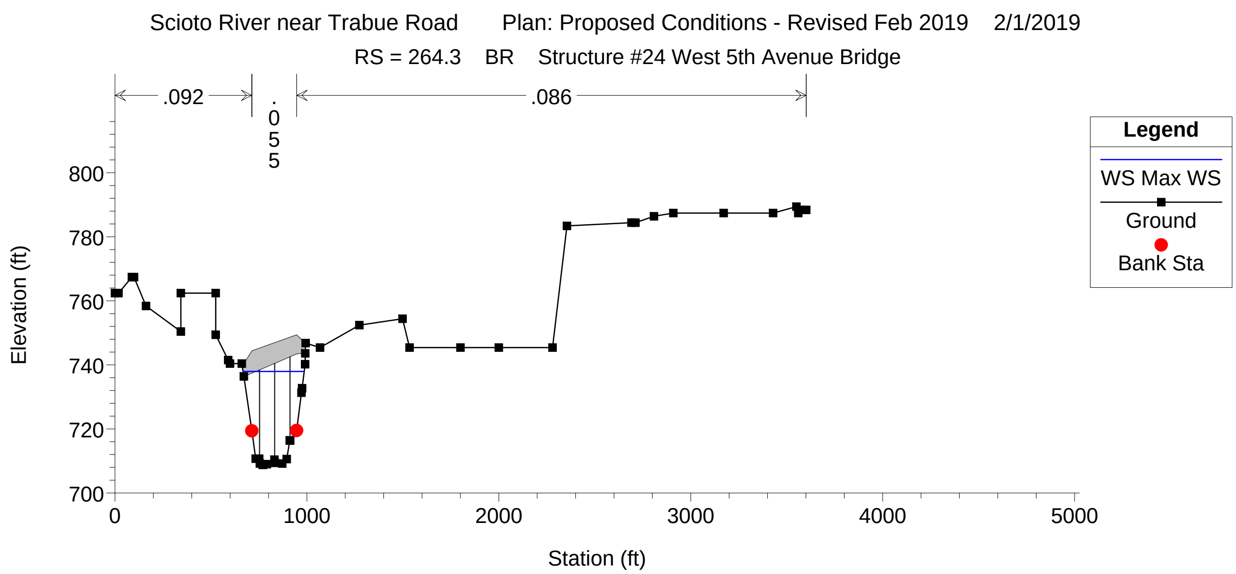
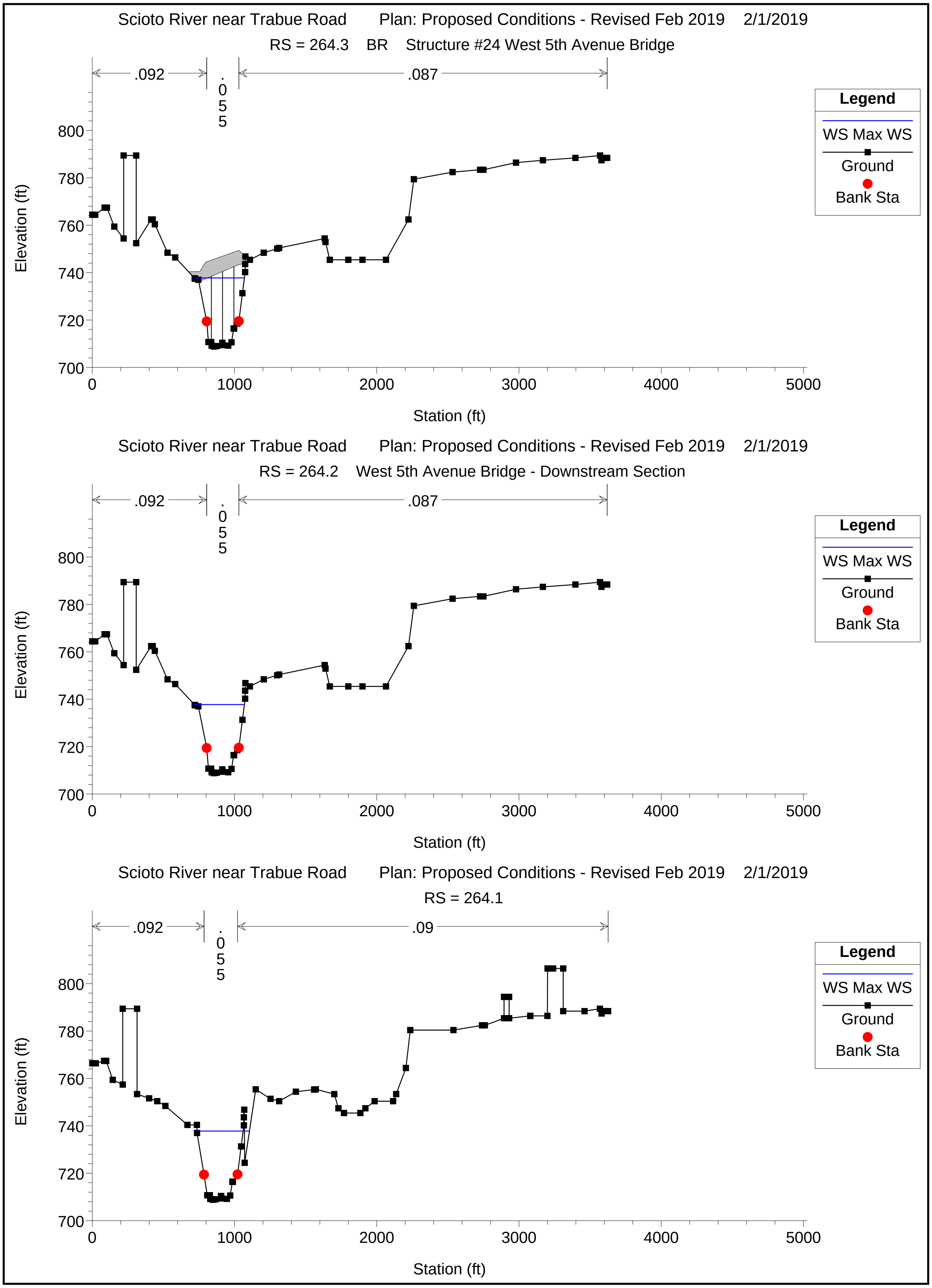


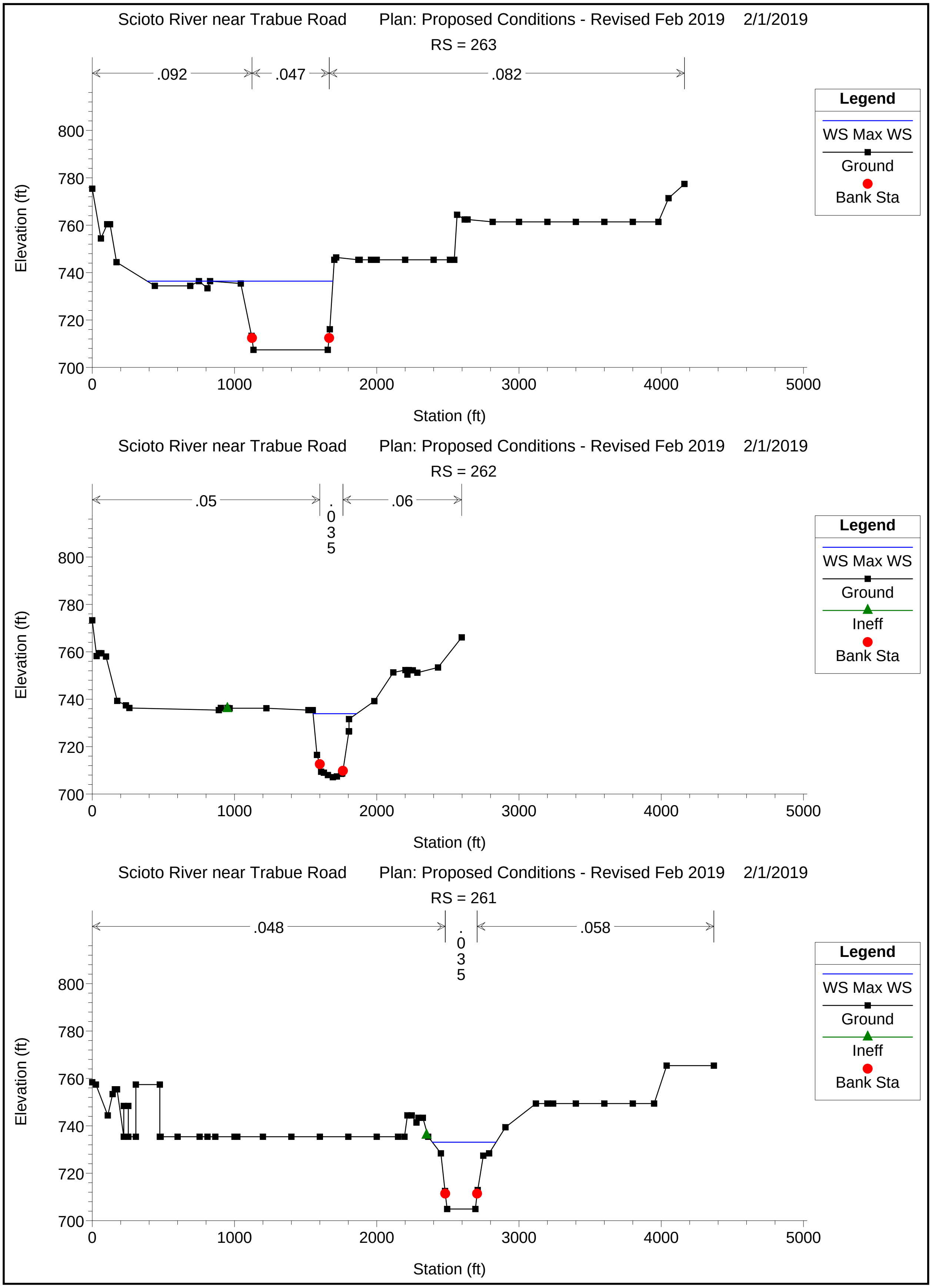




1 in Horiz. = 1000 ft 1 in Vert. = 60 ft



1 in Horiz. = 1000 ft 1 in Vert. = 60 ft



1 in Horiz. = 1000 ft   1 in Vert. = 60 ft

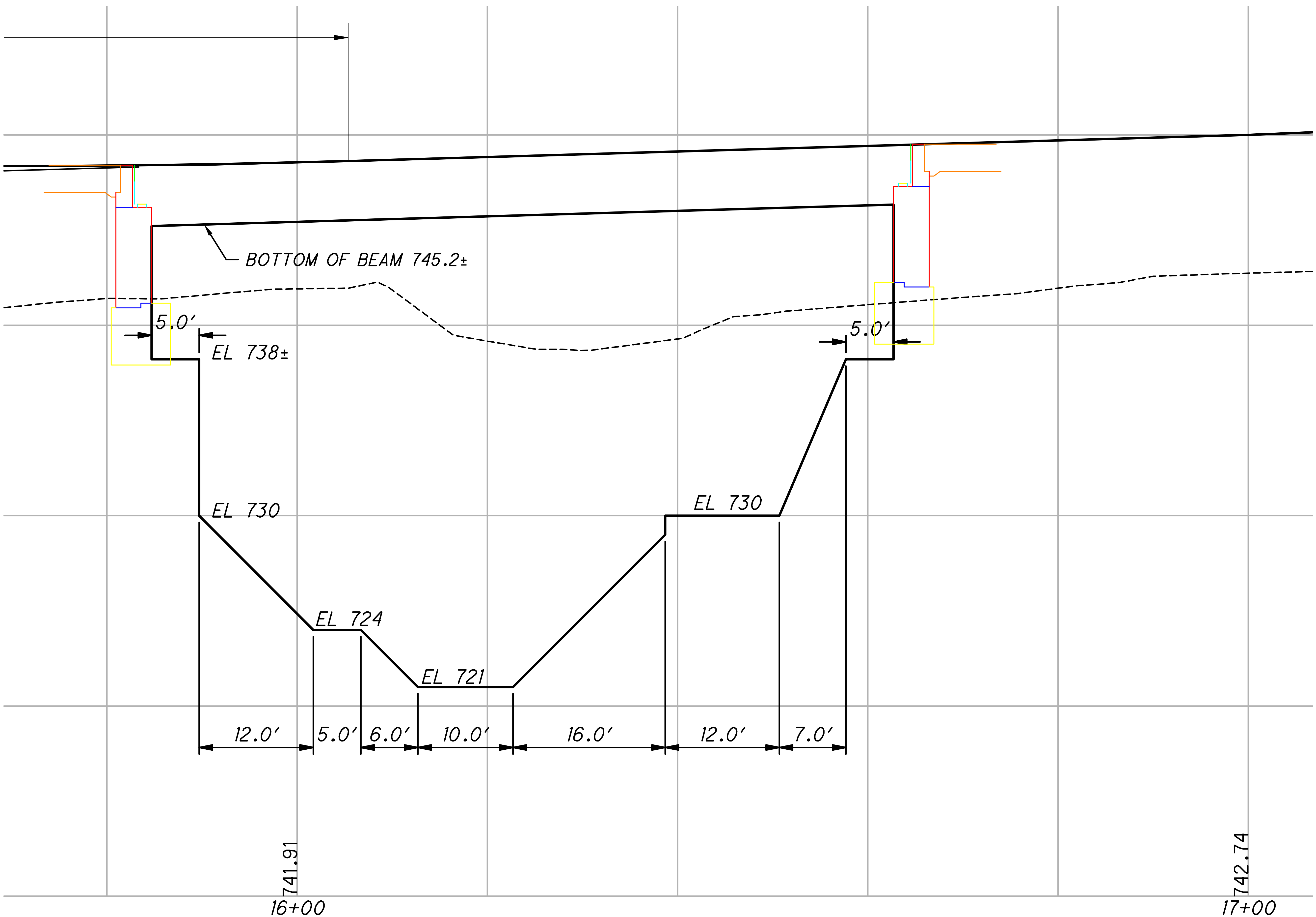
DRAWINGS

MARBLE CLIFF QUARRY DEVELOPMENT SITE MAPPING

SCALE: 1" = 120'

PROPOSED GRADING AROUND PEDESTRIAN AND MAIN ACCESS ROAD BRIDGES

SCALE: 1" = 20'



MAIN ACCESS ROAD BRIDGE OPENING

APPENDIX H

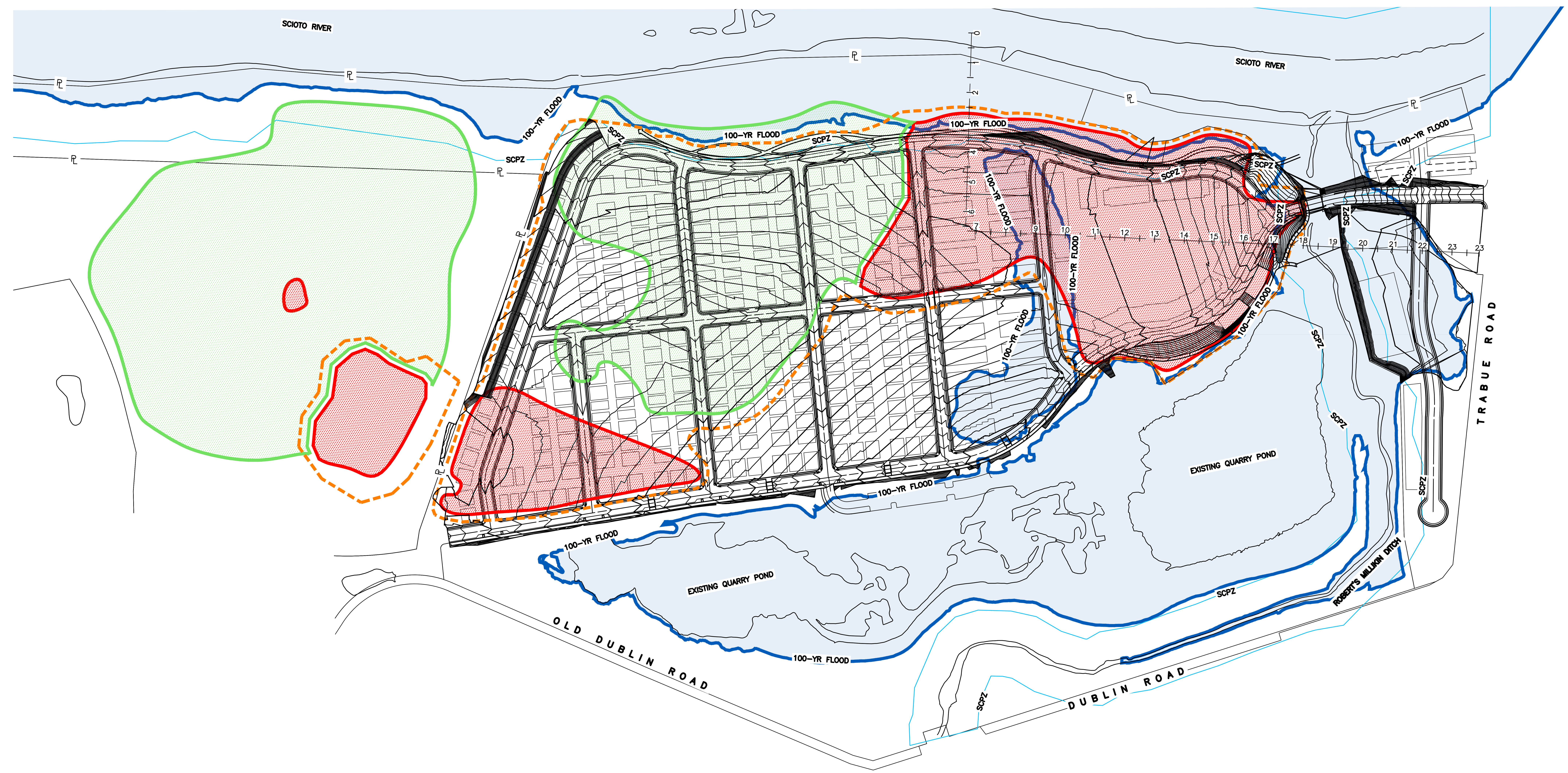
PREFERRED SITE RENDERING

QUARRY TRAILS
PROPOSED PLAN

01.10.19

APPENDIX I

FLOODPLAIN FILL ALTERNATIVES



LEGEND

- SOLID WASTE W/ MIN 4' OF COVER
- SOLID WASTE W/ 2' OR LESS OF COVER
- 100 YEAR FLOODPLAIN AREA
- RULE 13 AREA
- 100-YR FLOOD — 100 YEAR FLOOD ELEVATION
- SCPZ — STREAM CORRIDOR PROTECTION ZONE

0 100 200 400

REVISIONS	DATE	BY	CHK.

E. P. FERRIS AND ASSOCIATES INC
Consulting Civil Engineers and Surveyors

CONTACT:
880 KING AVENUE
COLUMBUS, OHIO 43212
(614) 299-2999
(614) 299-2992 (Fax)
www.EPFERRIS.com

CITY OF COLUMBUS, OHIO

MARBLE CLIFF QUARRY DEVELOPMENT

FOR

MARBLE CLIFF CANYON, LLC

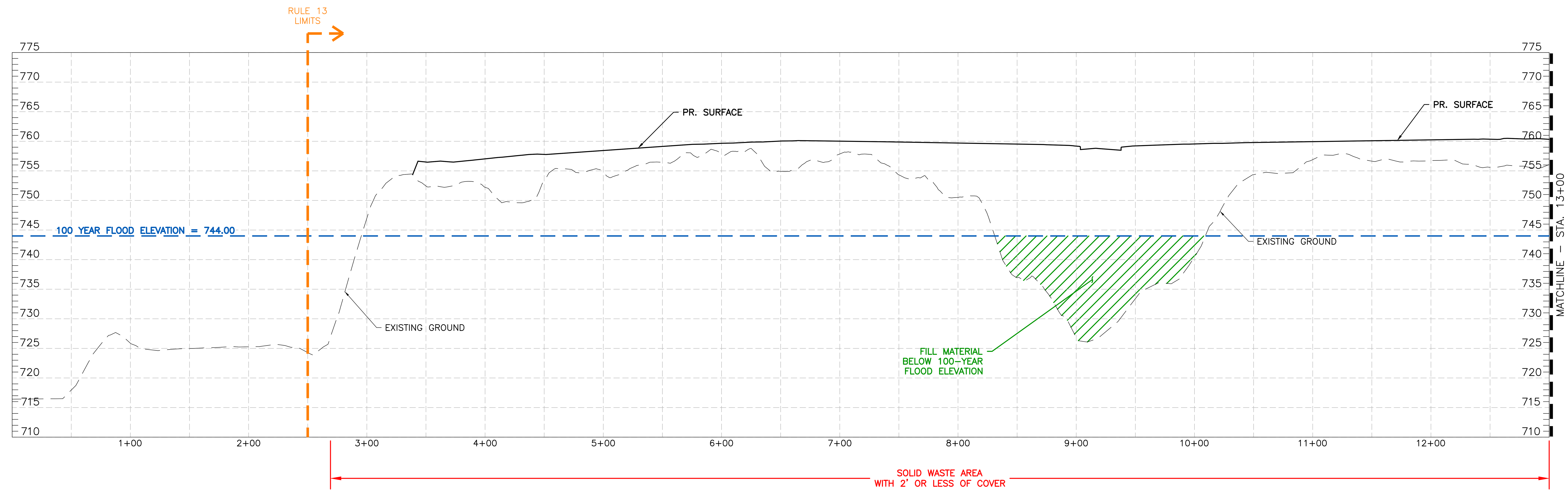
JOB NO.	1005.013
DESIGNED BY:	___
DRAWN BY:	JLC
CHECKED BY:	JLU
APPROVED BY:	___
DATE:	1/14/19

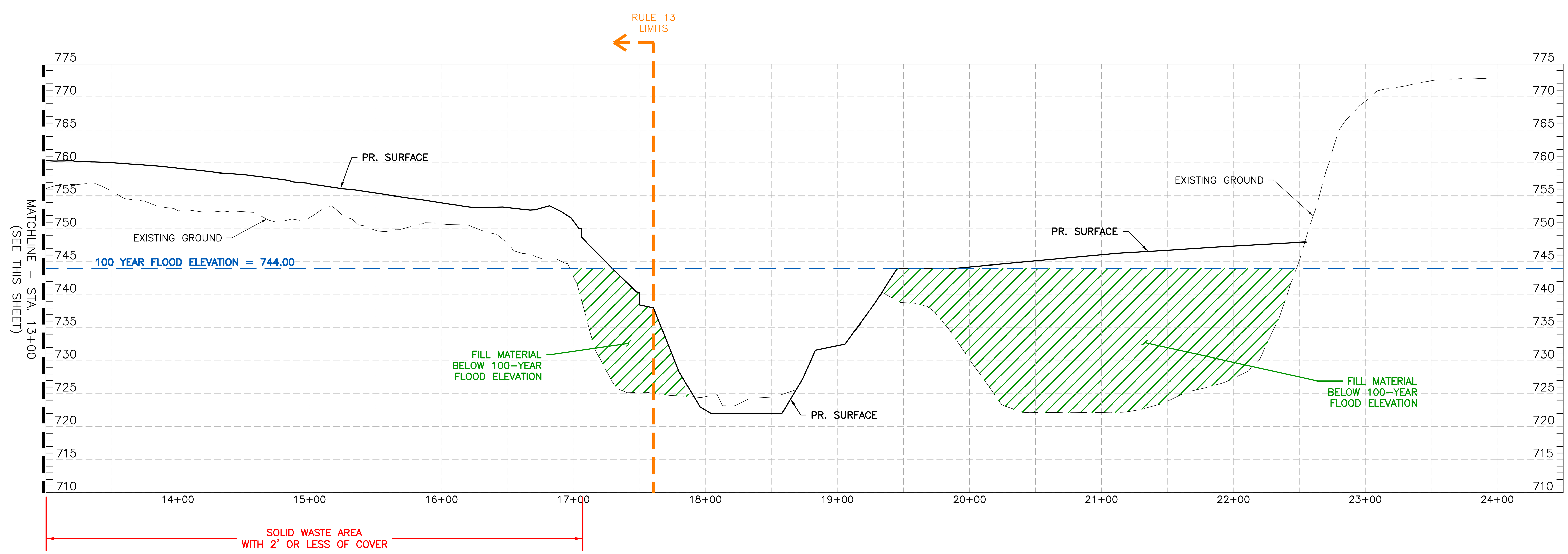
EXHIBIT A
PREFERRED GRADING PLAN

SCALE:	
1" = 200'	
SHEET NO.	OF
1	2

M:\1005013_TrabueRoad\DWG\Exhibits\Variance Exhibits\Type II Variance\Floodplain Fill Plan and Profile.dwg ~FLOODPLAIN FILL PLAN LAST EDITED BY:jcunningham ON 1/24/19

E.P. FERRIS & ASSOCIATES INC





REVISIONS	DATE	BY	CHK.

E. P. FERRIS AND ASSOCIATES INC
Consulting Civil Engineers and Surveyors

CONTACT:
880 KING AVENUE
COLUMBUS, OHIO 43212
(614) 299-2999
(614) 299-2992 (Fax)
www.EPFERRIS.com

CITY OF COLUMBUS, OHIO
MARBLE CLIFF QUARRY DEVELOPMENT
FOR
MARBLE CLIFF CANYON, LLC

JOB NO.	1005.013
DESIGNED BY:	___
DRAWN BY:	JLC
CHECKED BY:	JLU
APPROVED BY:	___
DATE:	1/10/19

EXHIBIT B
PREFERRED GRADING PROFILE

SCALE:
HORIZ: 1" = 50'
VERT: 1" = 10'

SHEET NO.	OF
2	2

M:\1005013_TrabueRoad\DWG\Exhibits\Variance Exhibits\Type II Variance\Floodplain Fill Plan and Profile.dwg ~FLOODPLAIN FILL Profile LAST EDITED BY:jcunningham ON 1/14/19

E.P. FERRIS & ASSOCIATES INC

APPENDIX J

MARBLE CLIFF QUARRY DEVELOPMENT SCPZ ENCROACHMENT ALTERNATIVES

REVISIONS	DATE	BY	CHK.

E. P. FERRIS AND ASSOCIATES INC
Consulting Civil Engineers and Surveyors

CONTACT:
880 KING AVENUE
COLUMBUS, OHIO 43212
(614) 299-2999
(614) 299-2992 (Fax)
www.EPFERRIS.com

CITY OF COLUMBUS, OHIO

MARBLE CLIFF QUARRY DEVELOPMENT

FOR

MARBLE CLIFF CANYON, LLC

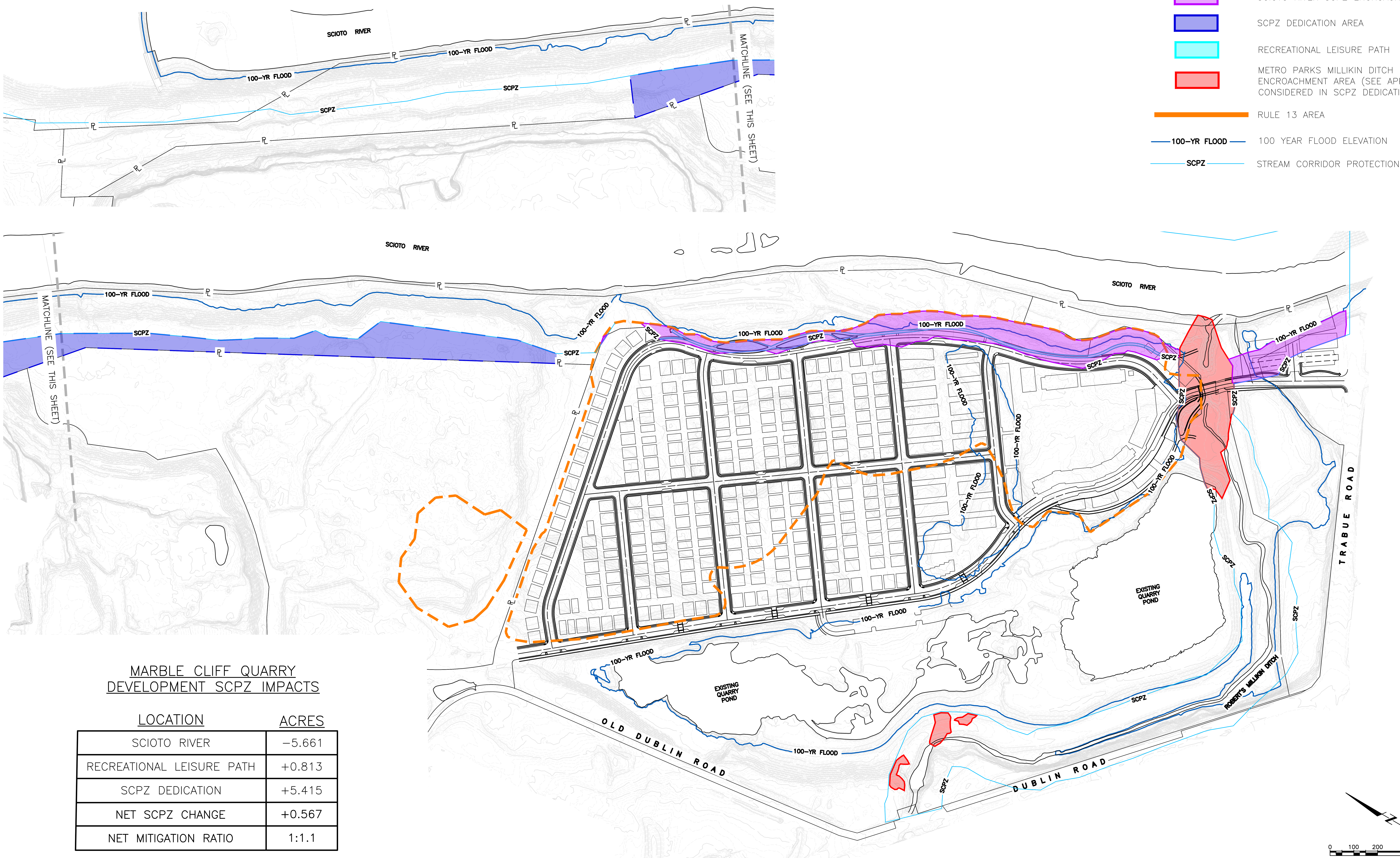
JOB NO.	1005.013
DESIGNED BY:	____
DRAWN BY:	JLC
CHECKED BY:	JLU
APPROVED BY:	____
DATE:	1/8/19

EXHIBIT A
NO IMPACT DEVELOPMENT PLAN

SCALE: 1" = 200'
SHEET NO. 1 OF 3

M:\1005013_TrabueRoad\DWG\Exhibits\Variance Exhibits\Type III Variance\Exhibit A - No SCPZ Impact.dwg -No Impact LAST EDITED BY:jcunningham ON 1/14/19

E.P. FERRIS & ASSOCIATES INC



LEGEND

- SCIOTO RIVER SCPZ ENCROACHMENT
- SCPZ DEDICATION AREA
- RECREATIONAL LEISURE PATH
- METRO PARKS MILLIKIN DITCH ENCROACHMENT AREA (SEE APPENDIX K, NOT CONSIDERED IN SCPZ DEDICATION)
- RULE 13 AREA
- 100-YR FLOOD — 100 YEAR FLOOD ELEVATION
- SCPZ — STREAM CORRIDOR PROTECTION ZONE

MARBLE CLIFF QUARRY DEVELOPMENT SCPZ IMPACTS

LOCATION	ACRES
SCIOTO RIVER	−5.661
RECREATIONAL LEISURE PATH	+0.813
SCPZ DEDICATION	+5.415
NET SCPZ CHANGE	+0.567
NET MITIGATION RATIO	1:1.1

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REVISIONS	DATE	BY	CHK.

E. P. FERRIS AND ASSOCIATES INC
Consulting Civil Engineers and Surveyors

CONTACT:
880 KING AVENUE
COLUMBUS, OHIO 43212
(614) 299-2999
(614) 299-2992 (Fax)
www.EPFERRIS.com

CITY OF COLUMBUS, OHIO

MARBLE CLIFF QUARRY DEVELOPMENT

FOR

MARBLE CLIFF CANYON, LLC

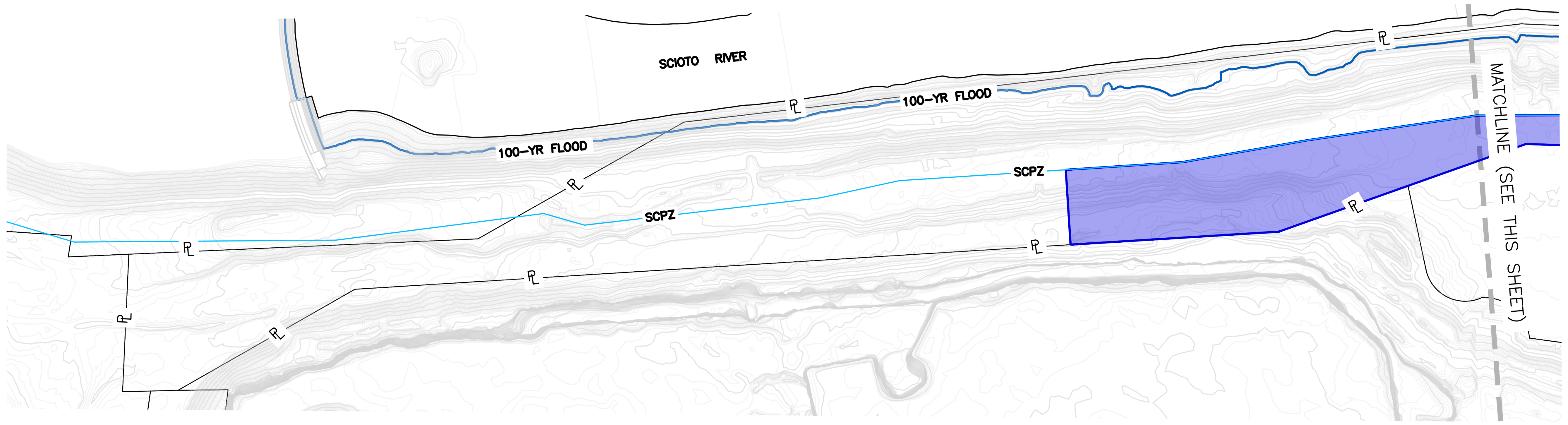
JOB NO.	1005.013
DESIGNED BY:	___
DRAWN BY:	JLC
CHECKED BY:	JLU
APPROVED BY:	___
DATE:	1/14/19

EXHIBIT B
MINIMAL SCPZ IMPACT PLAN

SCALE: 1" = 200'

SHEET NO. 2 OF 3

E.P. FERRIS & ASSOCIATES INC



LEGEND

- MILLIKIN DITCH SCPZ ENCROACHMENT
- SCIOTO RIVER SCPZ ENCROACHMENT
- SCPZ DEDICATION AREA
- RECREATIONAL LEISURE PATH
- METRO PARKS MILLIKIN DITCH ENCROACHMENT AREA (SEE APPENDIX K, NOT CONSIDERED IN SCPZ DEDICATION)
- RULE 13 AREA
- 100-YR FLOOD — 100 YEAR FLOOD ELEVATION
- SCPZ — STREAM CORRIDOR PROTECTION ZONE

MARBLE CLIFF QUARRY DEVELOPMENT SCPZ IMPACTS

LOCATION	ACRES
SCIOTO RIVER	−5.661
ROBERT'S MILLIKIN DITCH	−1.469
RECREATIONAL LEISURE PATH	+0.813
SCPZ DEDICATION	+7.030
NET SCPZ CHANGE	+0.713
NET MITIGATION RATIO	1:1.1

REVISIONS	DATE	BY	CHK.

E. P. FERRIS AND ASSOCIATES INC
Consulting Civil Engineers and Surveyors

CONTACT:
880 KING AVENUE
COLUMBUS, OHIO 43212
(614) 299-2999
(614) 299-2992 (Fax)
www.EPFERRIS.com

CITY OF COLUMBUS, OHIO
MARBLE CLIFF QUARRY DEVELOPMENT
FOR
MARBLE CLIFF CANYON, LLC

JOB NO. 1005.013
DESIGNED BY: ____
DRAWN BY: JLC
CHECKED BY: JLU
APPROVED BY: ____
DATE: 1/17/19

EXHIBIT C
PREFERRED DEVELOPMENT PLAN

SCALE: 1" = 200'
SHEET NO. 3 OF 3

M:\1005013_TrabueRoad\DWG\Exhibits\Variance Exhibits\Type III Variance\Exhibit C - Preferred Option.dwg --PREFERRED PLAN LAST EDITED By:jcunningham ON 1/17/19

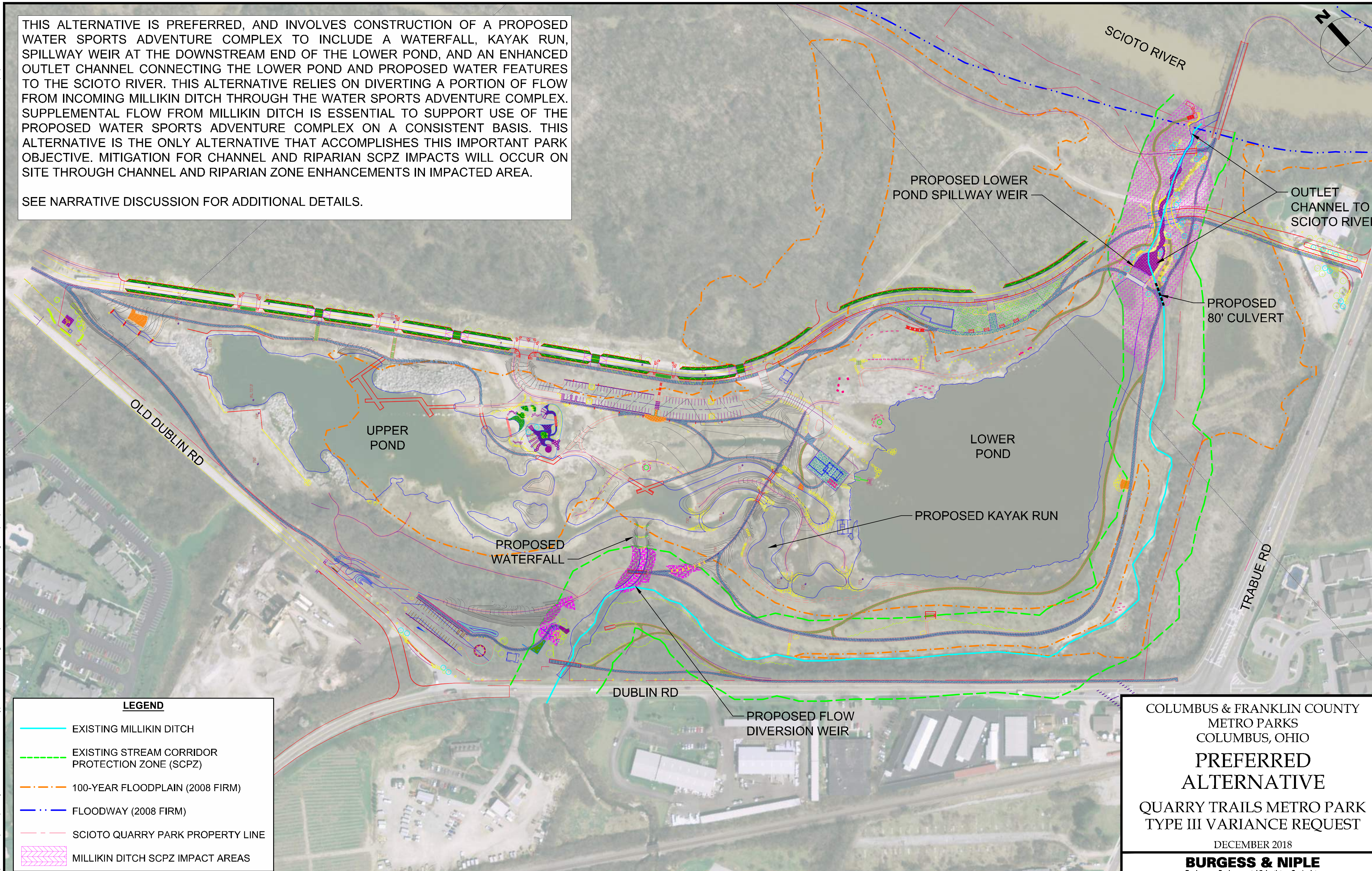
E.P. FERRIS & ASSOCIATES INC

APPENDIX K

COLUMBUS & FRANKLIN CO. METRO PARK SCPZ ENCROACHMENT ALTERNATIVES

THIS ALTERNATIVE IS PREFERRED, AND INVOLVES CONSTRUCTION OF A PROPOSED WATER SPORTS ADVENTURE COMPLEX TO INCLUDE A WATERFALL, KAYAK RUN, SPILLWAY WEIR AT THE DOWNSTREAM END OF THE LOWER POND, AND AN ENHANCED OUTLET CHANNEL CONNECTING THE LOWER POND AND PROPOSED WATER FEATURES TO THE SCIOTO RIVER. THIS ALTERNATIVE RELIES ON DIVERTING A PORTION OF FLOW FROM INCOMING MILLIKIN DITCH THROUGH THE WATER SPORTS ADVENTURE COMPLEX. SUPPLEMENTAL FLOW FROM MILLIKIN DITCH IS ESSENTIAL TO SUPPORT USE OF THE PROPOSED WATER SPORTS ADVENTURE COMPLEX ON A CONSISTENT BASIS. THIS ALTERNATIVE IS THE ONLY ALTERNATIVE THAT ACCOMPLISHES THIS IMPORTANT PARK OBJECTIVE. MITIGATION FOR CHANNEL AND RIPARIAN SCPZ IMPACTS WILL OCCUR ON SITE THROUGH CHANNEL AND RIPARIAN ZONE ENHANCEMENTS IN IMPACTED AREA.

SEE NARRATIVE DISCUSSION FOR ADDITIONAL DETAILS.



LEGEND

- EXISTING MILLIKIN DITCH
- EXISTING STREAM CORRIDOR PROTECTION ZONE (SCPZ)
- 100-YEAR FLOODPLAIN (2008 FIRM)
- FLOODWAY (2008 FIRM)
- SCIOTO QUARRY PARK PROPERTY LINE
- MILLIKIN DITCH SCPZ IMPACT AREAS

COLUMBUS & FRANKLIN COUNTY METRO PARKS
COLUMBUS, OHIO

PREFERRED ALTERNATIVE

QUARRY TRAILS METRO PARK
TYPE III VARIANCE REQUEST

DECEMBER 2018

BURGESS & NIPLE
Engineers ■ Environmental Scientists ■ Geologists

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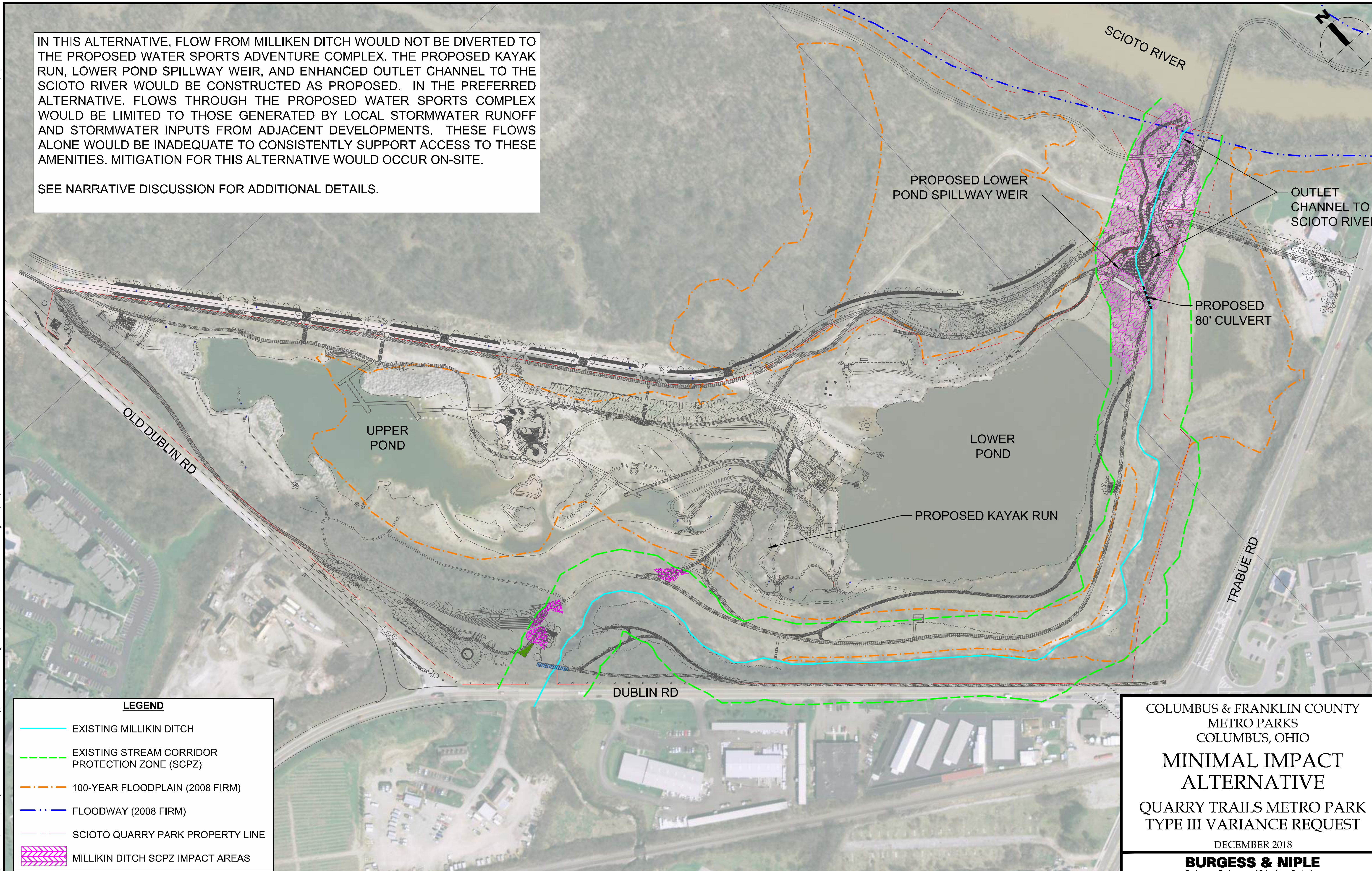

IN THIS ALTERNATIVE, FLOW FROM MILLIKEN DITCH WOULD NOT BE DIVERTED TO THE PROPOSED WATER SPORTS ADVENTURE COMPLEX. THE PROPOSED KAYAK RUN, LOWER POND SPILLWAY WEIR, AND ENHANCED OUTLET CHANNEL TO THE SCIOTO RIVER WOULD BE CONSTRUCTED AS PROPOSED. IN THE PREFERRED ALTERNATIVE. FLOWS THROUGH THE PROPOSED WATER SPORTS COMPLEX WOULD BE LIMITED TO THOSE GENERATED BY LOCAL STORMWATER RUNOFF AND STORMWATER INPUTS FROM ADJACENT DEVELOPMENTS. THESE FLOWS ALONE WOULD BE INADEQUATE TO CONSISTENTLY SUPPORT ACCESS TO THESE AMENITIES. MITIGATION FOR THIS ALTERNATIVE WOULD OCCUR ON-SITE.

SEE NARRATIVE DISCUSSION FOR ADDITIONAL DETAILS.

COLUMBUS & FRANKLIN COUNTY
METRO PARKS
COLUMBUS, OHIO

MINIMAL IMPACT ALTERNATIVE

QUARRY TRAILS METRO PARK
TYPE III VARIANCE REQUEST

DECEMBER 2018

BURGESS & NIPLE
Engineers ■ Environmental Scientists ■ Geologists

PLOTTED: 1/9/2019 10:36:19 AM

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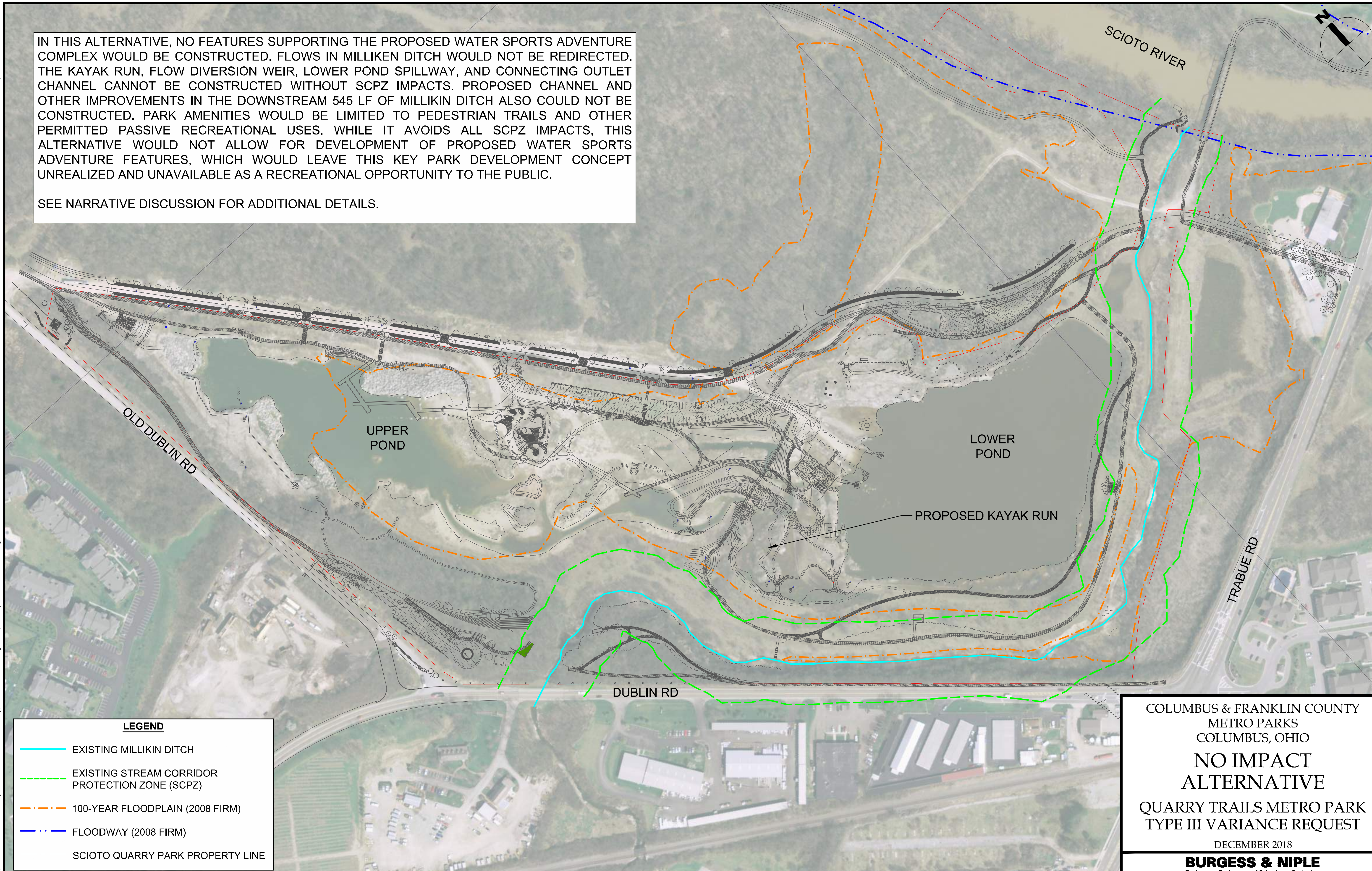
IN THIS ALTERNATIVE, NO FEATURES SUPPORTING THE PROPOSED WATER SPORTS ADVENTURE COMPLEX WOULD BE CONSTRUCTED. FLOWS IN MILLIKEN DITCH WOULD NOT BE REDIRECTED. THE KAYAK RUN, FLOW DIVERSION WEIR, LOWER POND SPILLWAY, AND CONNECTING OUTLET CHANNEL CANNOT BE CONSTRUCTED WITHOUT SCPZ IMPACTS. PROPOSED CHANNEL AND OTHER IMPROVEMENTS IN THE DOWNSTREAM 545 LF OF MILLIKIN DITCH ALSO COULD NOT BE CONSTRUCTED. PARK AMENITIES WOULD BE LIMITED TO PEDESTRIAN TRAILS AND OTHER PERMITTED PASSIVE RECREATIONAL USES. WHILE IT AVOIDS ALL SCPZ IMPACTS, THIS ALTERNATIVE WOULD NOT ALLOW FOR DEVELOPMENT OF PROPOSED WATER SPORTS ADVENTURE FEATURES, WHICH WOULD LEAVE THIS KEY PARK DEVELOPMENT CONCEPT UNREALIZED AND UNAVAILABLE AS A RECREATIONAL OPPORTUNITY TO THE PUBLIC.

SEE NARRATIVE DISCUSSION FOR ADDITIONAL DETAILS.



LEGEND

- EXISTING MILLIKIN DITCH
- EXISTING STREAM CORRIDOR PROTECTION ZONE (SCPZ)
- 100-YEAR FLOODPLAIN (2008 FIRM)
- FLOODWAY (2008 FIRM)
- SCIOTO QUARRY PARK PROPERTY LINE

COLUMBUS & FRANKLIN COUNTY METRO PARKS
COLUMBUS, OHIO

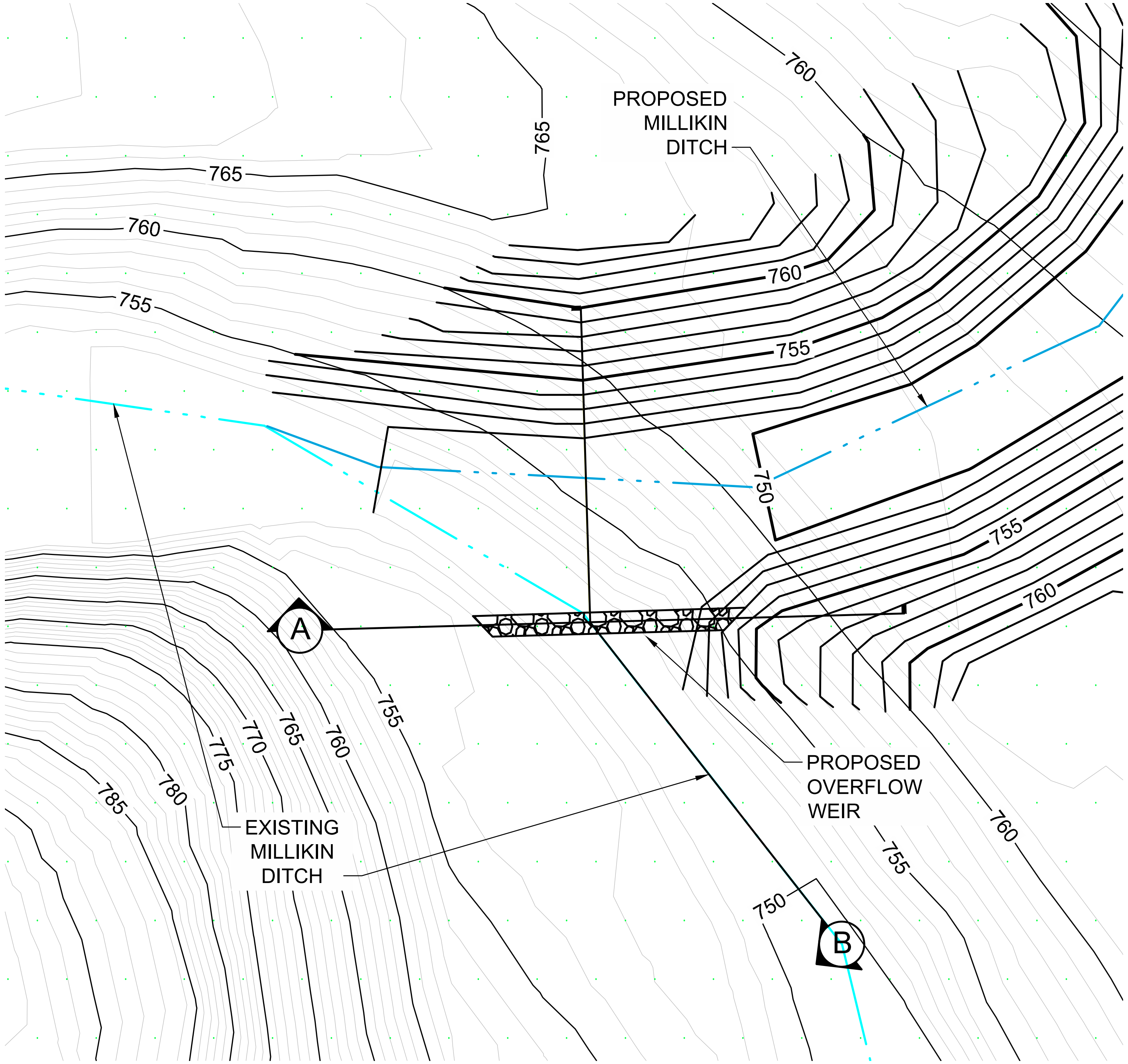
NO IMPACT ALTERNATIVE

QUARRY TRAILS METRO PARK
TYPE III VARIANCE REQUEST

DECEMBER 2018

BURGESS & NIPLE
Engineers ■ Environmental Scientists ■ Geologists

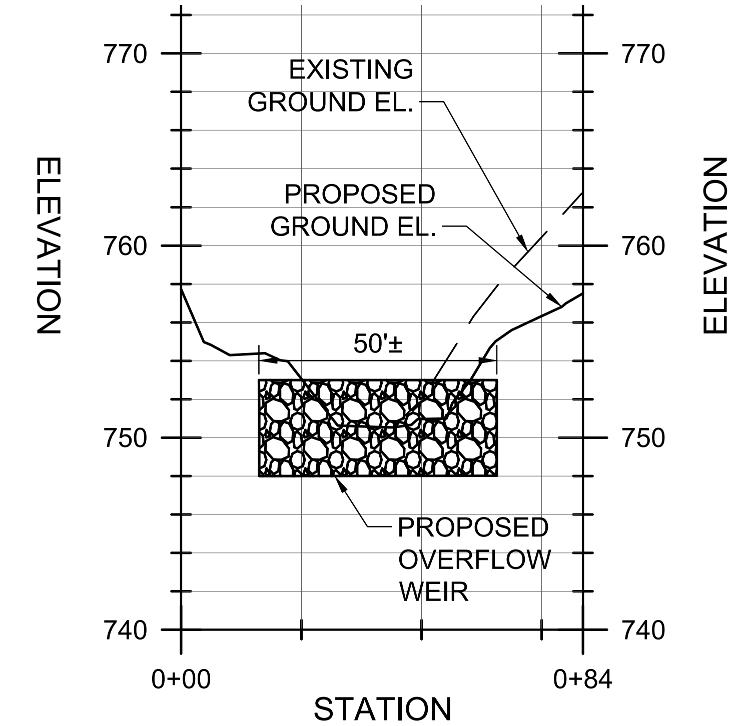
PLOTTED: 12/6/2018 1:08:08 PM



PROPOSED FLOW DIVERSION WEIR PLAN VIEW

SCALE: 1" = 50'

0 50' 100'



A FLOW DIVERSION WEIR SECTION

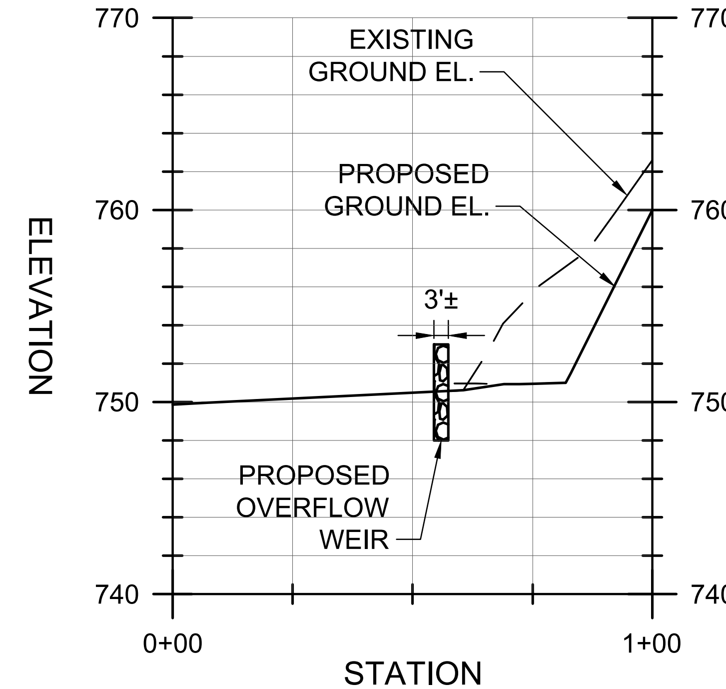
SCALE:

0 20' 40' 80'

HORIZONTAL SCALE

0 10' 20'

VERTICAL SCALE



B FLOW DIVERSION WEIR SECTION

SCALE:

0 20' 40' 80'

HORIZONTAL SCALE

0 10' 20'

VERTICAL SCALE

NOTE: EXISTING MILLIKIN DITCH IS TO REMAIN. A PORTION OF STORMWATER FLOWS FROM LARGE STORMS SHALL BE DIVERTED FROM THE PROPOSED MILLIKIN DITCH CHANNEL TO THE EXISTING MILLIKIN DITCH VIA THE PROPOSED FLOW DIVERSION WEIR.

COLUMBUS & FRANKLIN COUNTY METRO PARKS
COLUMBUS, OHIO

MILLIKIN DITCH FLOW DIVERSION WEIR

QUARRY TRAILS METRO PARK
TYPE III VARIANCE REQUEST

DECEMBER 2018

BURGESS & NIPLE
Engineers ■ Environmental Scientists ■ Geologists

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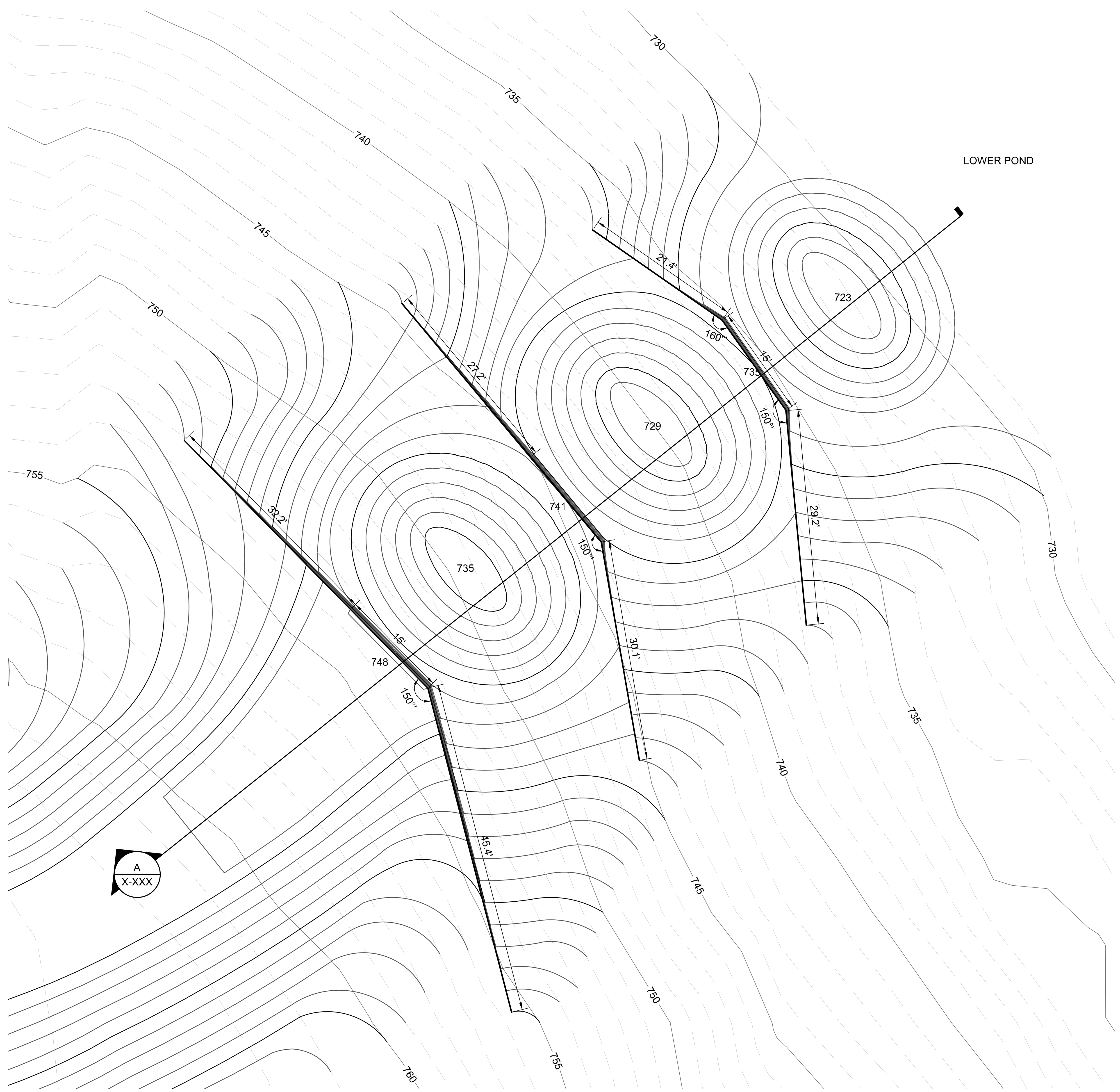
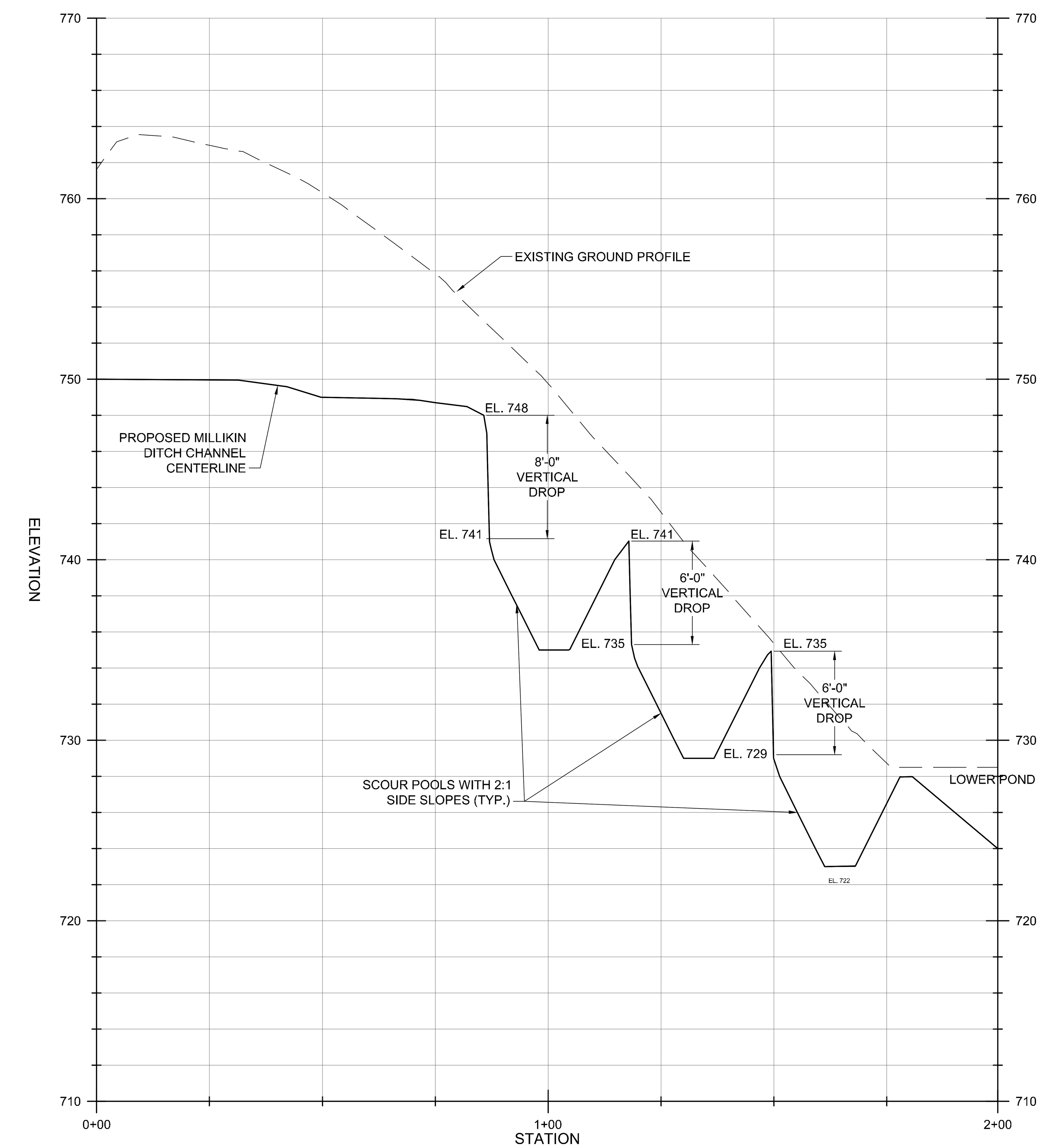


WATERFALL PLAN VIEW

SCALE: 1" = 20'



WATERFALL PROFILE

A X-XXX

SCALE:

0 2' 4' HORIZONTAL SCALE

0 2' 4' VERTICAL SCALE

BURGESS & NIPLE
5085 REED ROAD
COLUMBUS, OHIO 43220

COLUMBUS & FRANKLIN COUNTY METRO PARKS
QUARRY TRAILS METRO PARK

NO.	DESCRIPTION	DATE
	REVISIONS	

JOB NO:	PR56762
DATE:	XXX
DESIGNED BY:	XXX
DRAWN BY:	XXX
CHECKED BY:	XXX
APPROVED BY:	XXX
SCALE:	AS NOTED

Sheet Title Line 1

SHEET: XX OF 99

APPENDIX L

PROPOSED STREAM MITIGATION EXHIBITS

Ohio EPA — Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 54

Stream & Location: QUARRY TRAILS PARK - PROPOSED MILLIKIN DITCH IMPROVEMENTS **RM:** ___.__ **Date:** 11/30/18

Scorers Full Name & Affiliation: KATHERINE FONTAINE B&N

River Code: ___-___-___ **STORET #:** ______ **Lat./ Long.:** (NAD 83 - decimal °) 39.9981 / 83.0819 Office verified location ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]	✓	✓	☐☐ HARDPAN [4]		
☒☐ BOULDER [9]	✓	✓	☐☐ DETRITUS [3]		
☐☐ COBBLE [8]		✓	☐☐ MUCK [2]		
☐☐ GRAVEL [7]		✓	☐☐ SILT [2]		
☐☐ SAND [6]	✓	✓	☐☐ ARTIFICIAL [0]		
☐☒ BEDROCK [5]		✓	(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☒ 4 or more [2] ☐ 3 or less [0]

Comments

ORIGIN (Check ONE (Or 2 & average)): ☒ LIMESTONE [1] ☐ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☒ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☒ NORMAL [0] ☐ NONE [1]

Substrate 17 Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

____ UNDERCUT BANKS [1]
____ OVERHANGING VEGETATION [1]
____ SHALLOWS (IN SLOW WATER) [1]
____ ROOTMATS [1]
✓ POOLS > 70cm [2]
____ ROOTWADS [1]
✓ BOULDERS [1]
____ OXBOWS, BACKWATERS [1]
____ AQUATIC MACROPHYTES [1]
____ LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONE (Or 2 & average)): ☐ EXTENSIVE >75% [11] ☐ MODERATE 25-75% [7] ☒ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover 3 Maximum 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☒ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☒ LOW [2]	☒ FAIR [3]	☒ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel 11 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	
☒☒ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☐ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☒☒ NARROW 5-10m [2]	☒☒ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian 6 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☒ > 1m [6]	☒ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☒ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☒ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential
Primary Contact ✓
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 10 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☒ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☒ BEST AREAS 5-10cm [1]	☒ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☒ LOW [1]
☐ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run 5 Maximum 8

6] GRADIENT
GRADIENT (65 ft/mi) DRAINAGE AREA (3.26 mi²)

☒ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: 20 %GLIDE: __ %RUN: __ %RIFFLE: 80

Gradient 2 Maximum 10

A] SAMPLED REACH
Check ALL that apply

Comment RE: Reach consistency/ Is reach typical of steam?, *Recreation/* Observed - Inferred, *Other/* Sampling observations, Concerns, Access directions, etc.

METHOD
- ☐ BOAT
- ☐ WADE
- ☐ L. LINE
- ☐ OTHER

STAGE
1st -sample pass- 2nd
- ☐ HIGH ☐
- ☐ UP ☐
- ☐ NORMAL ☐
- ☐ LOW ☐
- ☐ DRY ☐

DISTANCE
- ☐ 0.5 Km
- ☐ 0.2 Km
- ☐ 0.15 Km
- ☐ 0.12 Km
- ☐ OTHER

_______ meters

CLARITY
1st --sample pass-- 2nd
- ☐ < 20 cm ☐
- ☐ 20-<40 cm ☐
- ☐ 40-70 cm ☐
- ☐ > 70 cm/ CTB ☐
- ☐ SECCHI DEPTH ☐

1st pass _______ cm
2nd pass _______ cm

CANOPY
- ☐ > 85%- OPEN
- ☐ 55%-<85%
- ☐ 30%-<55%
- ☐ 10%-<30%
- ☐ <10%- CLOSED

B] AESTHETICS
- ☐ NUISANCE ALGAE
- ☐ INVASIVE MACROPHYTES
- ☐ EXCESS TURBIDITY
- ☐ DISCOLORATION
- ☐ FOAM / SCUM
- ☐ OIL SHEEN
- ☐ TRASH / LITTER
- ☐ NUISANCE ODOR
- ☐ SLUDGE DEPOSITS
- ☐ CSOs/SSOs/OUTFALLS

C] RECREATION AREA DEPTH
POOL: ☐ >100ft² ☐ >3ft

D] MAINTENANCE

Circle some & *COMMENT*

PUBLIC / PRIVATE / BOTH / NA
ACTIVE / HISTORIC / BOTH / NA
YOUNG-SUCCESSION-OLD
SPRAY / SNAG / REMOVED
MODIFIED / DIPPED OUT / NA
LEVEED / ONE SIDED
RELOCATED / CUTOFFS
MOVING-BEDLOAD-STABLE
ARMOURED / SLUMPS
ISLANDS / SCOURED
IMPOUNDED / DESICCATED
FLOOD CONTROL / DRAINAGE

E] ISSUES

WWTP / CSO / NPDES / INDUSTRY
HARDENED / URBAN / DIRT&GRIME
CONTAMINATED / LANDFILL
BMPs-CONSTRUCTION-SEDIMENT
LOGGING / IRRIGATION / COOLING
BANK / EROSION / SURFACE
FALSE BANK / MANURE / LAGOON
WASH H_20 / TILE / H_20 TABLE
ACID / MINE / QUARRY / FLOW
NATURAL / WETLAND / STAGNANT
PARK / GOLF / LAWN / HOME
ATMOSPHERE / DATA PAUCITY

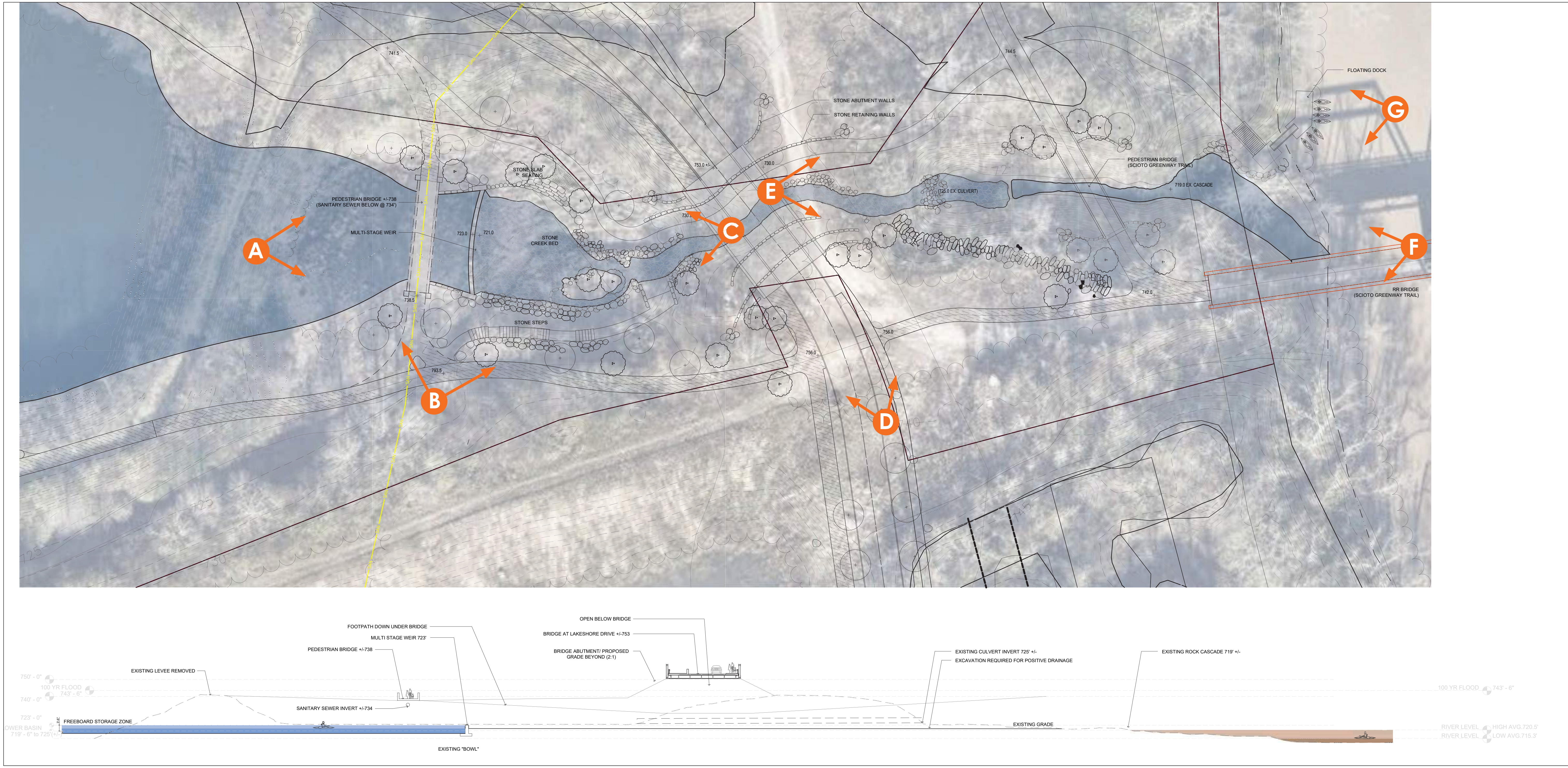
F] MEASUREMENTS

$\bar{x}$ width
$\bar{x}$ depth
max. depth
$\bar{x}$ bankfull width
bankfull $\bar{x}$ depth
W/D ratio
bankfull max. depth
floodprone x^2 width
entrench. ratio
Legacy Tree:

Stream Drawing:

BASED ON CONCEPT PLANS & RENDERINGS BY MKSK

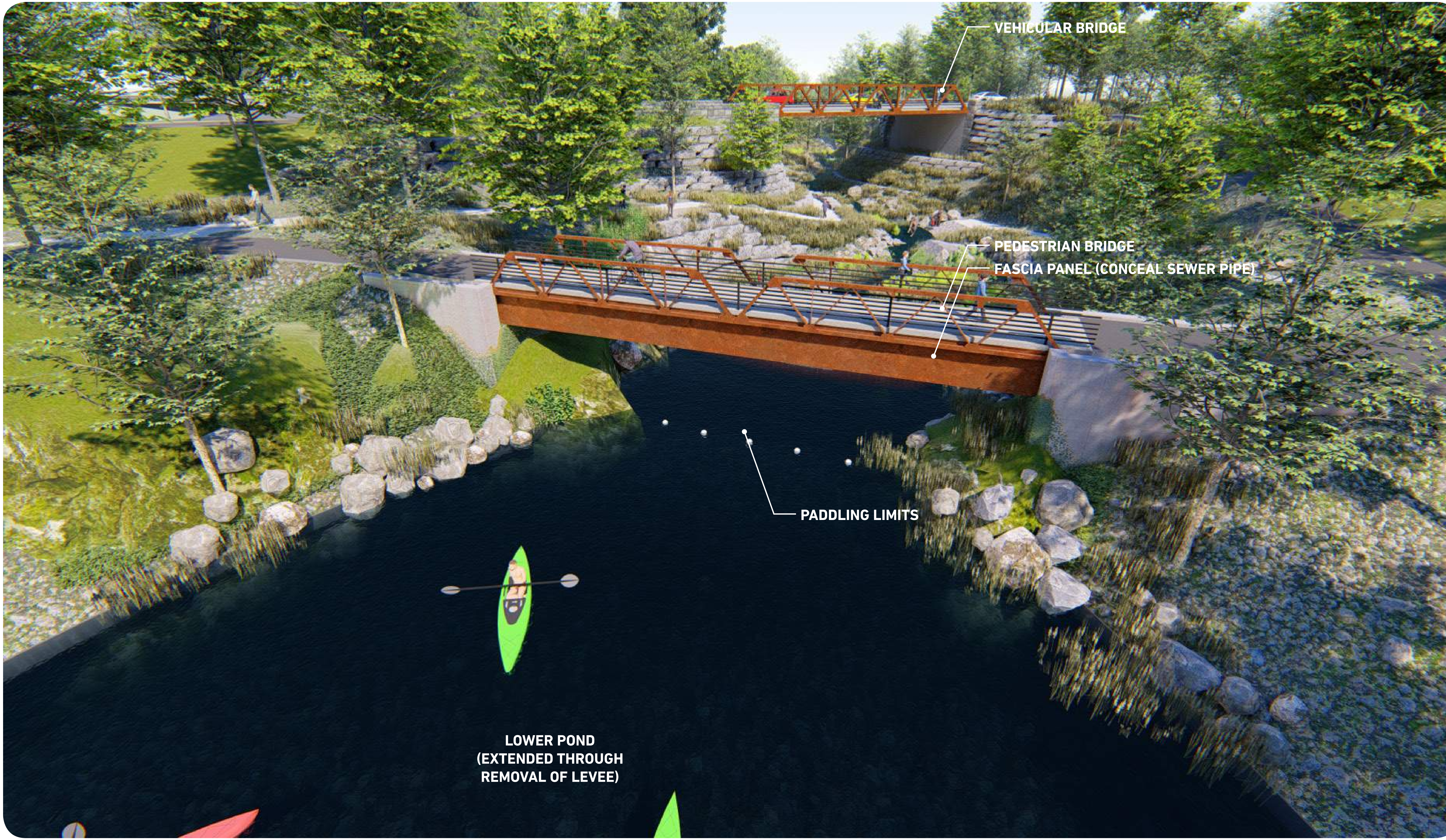
VIEW GUIDE



A LOWER BASIN TO SCIOTO RIVER CONNECTION STUDY
Scale: 1" = 20'-0"

0' 10' 20' 40'

VIEW A: LOWER POND BIRDSEYE LOOKING EAST



VIEW B: BIRDSEYE DOWN ON WEIR/SPILLWAY

VIEW C: LOOKING WEST TOWARDS WEIR

VIEW D: LOOKING NORTH APPROACHING ROADWAY BRIDGE

VIEW E: LOOKING EAST TOWARDS SCIOTO TRAIL PED BRIDGE

VIEW F: LOOKING WEST AT ROBERTS MILLIKIN DITCH OUTFALL TO SCIOTO

VIEW G: ROBERTS MILLIKIN DITCH OUTFALL TO SCIOTO