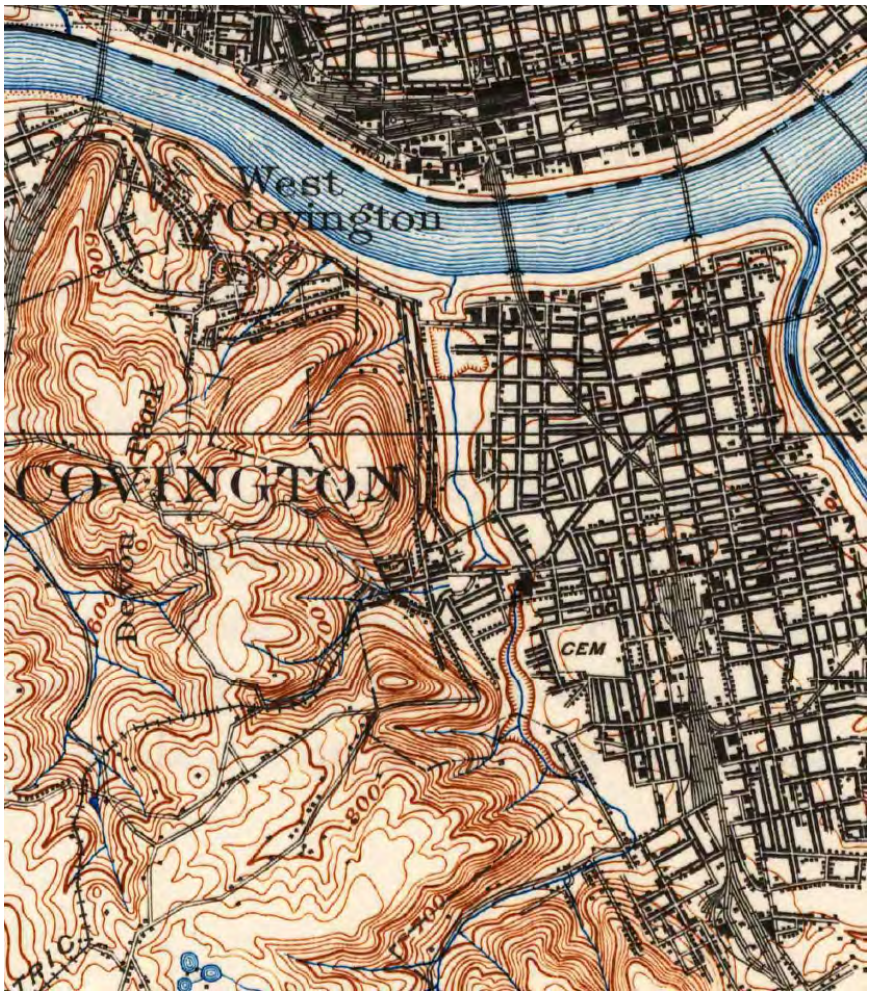
Willow Run Storm Water Separation Feasibility Study Report

I-71/I-75 (BRENT SPENCE BRIDGE PROJECT)

Kenton County, KY
MP 188.6 to MP 191.4
Item No. 6-17.00



PREPARED BY:

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Revised December, 2022

Table of Contents

Project Scope and Background

The Willow Run watershed is the largest watershed in Sanitation District 1's (SD1) system. It drains 1,871 acres, discharges into the Ohio River, and the combined sewer system accounts for 33% of SD1's total system flow. During times of wet weather, it overflows and discharges untreated sewerage into the river and into neighborhood parks, streams and creeks. The EPA, through a consent decree, has mandated that the overflows be reduced or eliminated in the watershed.

According to SD1, there are 7 low-flow diversions in the Willow Run combined sewer. During dry weather, these divert combined flow into a parallel sanitary interceptor sewer. Flows are then carried, via gravity, to the treatment plant. During wet weather, when the flow exceeds the capacity of the diversions, a portion of the flow overtops the diversions and overflows directly into the Ohio River. Generally it takes about a ½" rain in the Willow Run watershed to trigger an overflow event.

During normal Ohio River levels, the Willow Run combined sewer outfall drains into the river by gravity. During high Ohio River levels (exceeding a gage height of 38 feet) the following occurs:

1. The Ohio River water backs up into the combined system, flows over the diversions and gets into the interceptor sewer.
2. A gage height of 40 feet is considered "action stage" according to the USGS National Water Dashboard.
3. At a gage height of 43.5 feet, the flow backs out of the Willow Run combined sewer, via outlet relief drains, into Goebel Park.
4. At a gage height of 45.9', the pumps are turned on to pump the combined system over the levee and back into the river. A 12'X12' sluice gate is lowered at this point.
5. A gage height of 52 feet is considered "minor flood stage" according to the USGS National Water Dashboard.

The boundary of the Willow Run watershed is located along Kyles Lane at its interchange with I-71/I-75. Therefore, all storm runoff from the I-71/I-75 corridor, between the Kyles Lane interchange and the Ohio River currently drains into the Willow Run combined sewer system at various points. The proposed widening of the interstate corridor will increase storm runoff by increasing the impervious area in the watershed. The existing combined sewer system is already experiencing capacity problems according to the City of Covington, notably in the Peaselburg neighborhood. See Appendix A for maps of the Willow Run watershed and the Peaselburg neighborhood.

In a letter dated January 5, 2022 from the City of Covington's Mayor Joe Meyer to Kentucky Transportation Cabinet (KYTC) Secretary Jim Gray, the City requested that KYTC resolve the storm water runoff capacity issues. It should be noted that the City has reassumed storm water responsibility from SD1. They are responsible for storm water runoff until it reaches the combined sewer system, at which point it becomes the responsibility of SD1. In that letter, the City mentioned the following specific problem areas with the existing system:

- Excessive runoff from the interstate corridor to Highland Avenue (located in the Peaselburg neighborhood)
- Flooding in Lewisburg at the end of Laurel Street
- Street and basement flooding along Euclid Avenue (located in the Peaselburg neighborhood).

The City requested the following measures in their letter:

- Ensure the City is engaged and a part of storm water and water quality planning
- Separate the storm water from the Willow Run combined sewer system north of 16th Street
- Expand storm water removal capacity to eliminate backups on Euclid Avenue
- Improve maintenance of all storm water drains and detention areas along the interstate corridor to prevent clogging from debris.

To address the City's concerns, KYTC tasked Palmer Engineering with studying options for separating storm water runoff in the I-71/I-75 corridor within the Willow Run watershed. The project team also coordinated with the City and its consultants to evaluate the existing capacity of the Willow Run trunk line and to analyze potential improvements to its capacity in an effort to reduce system surcharging, especially in the Peaselburg neighborhood.

Goals

Palmer's goal was to develop a feasibility study for separating interstate corridor storm water flow within the Willow Run watershed from the combined sewer system. During scoping discussions with KYTC, the project team decided to study two proposed alternatives – one which specifically addressed the City's request to separate storm water flow from the combined sewer system from 16th Street to the Ohio River, and another which went beyond their request and provided a separate storm water system from Kyles Lane to the Ohio River.

Palmer was provided files from the original preliminary drainage layout done by others, completed in approximately 2010 during the environmental assessment. These files included PDFs of the drainage layout, CADD files for the corridor, and InRoads data files. At that time, the designers did not have a goal of separating all of the corridor's storm water flow from the combined system. Their goal was to evaluate options that could achieve a net-zero effect, or better, for the storm water runoff that reached the combined system. After reviewing all of the files, Palmer determined that it would be best to start from scratch with the proposed drainage layouts to achieve the goals of this study.

Proposed Alternatives

See Appendix B and C for plan views of each proposed alternative discussed below. The following should be noted about the layout of the proposed alternatives:

- "Concept W" Revisions - After the scoping study layout was originally completed for the proposed Alternatives 1 and 2, described below, the interchange layout was modified by the roadway design team. It was changed to a layout known as "Concept W." At that time,

Alternative 2 had already been selected as the preferred alternative for this study. Therefore, only Alternative 2 was redesigned to reflect the Concept W interchange layout. The Alternative 1 discussion below, and its associated exhibit, still refer to the old interchange layout. However, the Alternative 2 discussion below, and its associated exhibits, reflect the current Concept W interchange layout.

- Inlets were placed using the proposed DTMs and cross sections that were provided. They account for crest and sag locations, superelevation transitions, barrier wall and retaining wall locations, and bridge locations.
- Spread calculations were not performed for each inlet location. But, some general spread calculations were used to determine if pipe length would control inlet spacing or if spread would control
- Bridge deck drains were not laid out, but bridge deck runoff was accounted for in the storm sewer system at ground level below the bridges.
- Bridge pier locations are not known at this time. They could impact the location of the proposed storm sewer or relocated existing sewers during final design.
- Due to large pipe sizes, many inlets and manholes will require special designs during final design, since they will be outside of the pipe size limits of KYTC's standard drawings.

Alternative 1

The goal of Alternative 1 was to separate the corridor's storm water runoff from the combined system from 16th Street to the Ohio River. The proposed storm sewer trunk line begins at Lt. Sta. 526+00, crosses the interstate at a sag point near Sta. 530+50, and then continues northward generally under the proposed Jillians Way pavement. Branch connections at each side road attempt to separate as much storm water runoff from the side streets as possible within the footprint of the side road reconstruction.

There are a couple of areas where the depth of the proposed Alt 1 trunk line was critical. At 9th Street, the proposed storm sewer trunk line crosses the existing 96" combined sewer just upstream from where the existing sewer joins with the 120" Willow Run trunk line. SD1's GIS data was used to check the elevations of the existing line versus the proposed. The elevation of this crossing prevented the proposed Alt 1 system from intercepting a low area approximately 1 acre in size in the vicinity of the 12th Street and Bullock Street intersection. Intercepting the storm water runoff in this area would have pushed the proposed Alt 1 system too low and created a conflict at the crossing.

Goebel Park is also a low area where the existing combined system backs up and floods during high water events on the Ohio River. The proposed Alt 1 system was able to be raised by taking advantage of the higher Jillians Way grade, where it is being built up with a retaining wall.

The proposed Alt 1 trunk line and the relocated Willow Run system are proposed to tie back into the existing system just upstream from the existing pump station. Alt 1 does not propose a new pump station or new outfall to the Ohio River. Rather, it would utilize the existing system from the existing outfall/pump station to the river.

Alternative 2

The goal of Alternative 2 was to separate the corridor's storm water runoff from the combined system from Kyles Lane to the Ohio River. The proposed storm sewer trunk line begins at Sta. 448+00, continues along the interstate median until crossing to the left side at Sta. 490+00, and then remains on the left side until joining with the beginning of the proposed layout of Alternative 1.

There is an existing 42" pipe that crosses the interstate near Sta. 456+50. The existing pipe conveys offsite drainage which eventually ends up in a detention basin near Rt. Sta. 470+00. In the original Alternative 2 layout, prior to the Concept W revisions, this pipe was proposed to remain in service and the offsite drainage was not proposed to be intercepted. However, that was modified along with the Concept W revisions, and the current layout also intercepts this flow. This additional interception resulted in larger pipe diameters of the proposed storm sewer trunk line, but it helped toward achieving the goal of separating as much flow as possible from the existing combined system.

There are 5 existing detention basins along the corridor for Alt 2.

- Rt. Sta. 470+00 – The outlet for this basin drains away from the interstate. Alt 2 reduces the flow that reaches the basin by intercepting some storm runoff that currently reaches it.
- Lt. Sta. 477+00 – The outlet for this basin drains into the left roadside ditch for the interstate. There is an existing pipe crossing the interstate that currently conveys the left roadside ditch across the interstate just upstream from where the basin outlets into the left roadside ditch. Alt 2 captures the outlet flow from the basin, and captures the upstream roadside ditch flow described above. This eliminates the existing pipe crossing, and thus reduces the flow that reaches the problematic Highland Avenue area in the Peaselburg neighborhood.
- Lt. Sta. 490+00 – The outlet for this basin drains into the left roadside ditch for the interstate. Alt 2 captures the outlet flow from the basin.
- Lt. Sta. 518+00 – The outlet for this basin is a junction where existing sanitary and storm flow join, beginning a combined sewer line. Alt 2 proposes to separate the storm water flow, and create a new storm-only outlet structure for the basin. This will reduce the flow that enters the combined sewer system.
- Rt. Sta. 520+00 – This basin captures runoff from the right interstate roadside ditch and cut area, along with runoff from St. Elizabeth Covington Hospital. The outlet for this basin drains away from the interstate and toward the problematic Euclid Avenue area. Alt 2 proposes to capture the interstate roadside ditch before it reaches the basin, thereby reducing the flow that eventually reaches the Euclid Avenue area in the Peaselburg neighborhood.

The details of the detention basin outlet control structures are not known at this time, and proposed outlet flows were assumed for this study. Detailed design of the basins during final design could affect downstream pipe sizes. Each basin that is impacted by the roadway widening is being modified by the roadway design team to replace any lost volume. The proposed outflow from the basins along the left side of the interstate will not be as critical to control, since they will all flow into the proposed separate storm sewer. The proposed outflow from the basins on the right side

of the interstate will each be reduced by the proposed storm sewer system intercepting some of the runoff that currently reaches the existing basins.

From Station 525+00 downstream toward the river, Alt 2 mimics the general concept of Alt 1, except Alt 2 has been redesigned for the Concept W revisions. The proposed storm sewer trunk line crosses the interstate to the right side at a sag point near Sta. 530+50, and then continues northward generally under the proposed Jillians Way or ramp pavement along the right boundary of the interstate corridor. The proposed storm sewer trunk line then crosses back to the left side of the interstate just south of 4th Street, and continues along the left side before tying back into the existing Willow Run trunk line just upstream from the existing pump station. Alt 2 does not propose a new pump station or new outfall to the Ohio River. Rather, it would utilize the existing system from the existing outfall/pump station to the river.

Branch connections at each side road attempt to separate as much storm water runoff from the side streets as possible within the footprint of the side road reconstruction.

Alt 2 is similar to Alt 1 at 9th Street, where the depth of the proposed trunk line was critical as it crosses the existing 96" combined branch line. Also similar to Alt 1, this critical depth area at 9th Street prevented the proposed Alt 2 system from intercepting the low area in the vicinity of the 12th Street and Bullock Street intersection. In the low-lying Goebel Park area, the proposed Alt 2 trunk line is able to cross over the existing Willow Run trunk line by taking advantage of the Jillians Way and ramp grades. The proposed Alt 2 trunk line is proposed to tie back into the existing Willow Run trunk line just upstream from the existing pump station.

At the Project Team's Alternative Review Meeting on February 21, 2022, KYTC decided that Alternative 2 was the preferred option. Alt 2 would be advanced with a cost estimate, a summary of drainage areas separated from the Willow Run combined sewer, and the concept would be presented to the City of Covington and SD1. The project team presented Alt 2 to local officials including the City of Covington and SD1 on March 3, 2022. See Appendix E for documentation of all pertinent meetings.

Alternative 2 separates a total of 503 acres (27% of the total Willow Run watershed area) from the existing Willow Run combined sewer system. This area is comprised of 194 acres of impervious area and 309 acres of pervious area.

The preliminary cost of Alternate 2 is estimated to be $13.9 million. This includes the estimated cost for relocated portions of the existing Willow Run combined sewer. The preliminary estimate does not include a cost for potential modifications to the existing pump station, which is expected to be significant.

Relocated Willow Run Trunk Line Segments

Segments of the existing Willow Run trunk line are proposed to be relocated with the roadway construction. These are shown schematically in the proposed exhibits in Appendix C. Relocation Segment 1 is from Rt. Sta. 530+00 to Rt. Sta. 549+00. Segment 1 will relocate the existing Willow

Run trunk line outside the footprint of the interstate and ramps. This relocation will create room for the location of the proposed Alt 2 storm sewer trunk line.

Relocation Segment 2 is from Lt. Sta. 524+00 to Lt. Sta. 544+00, where an existing branch line, varying in size from 36" to 60" in diameter, to the Willow Run system is proposed to be relocated along Bullock Street.

From 9th Street to the Ohio River, the existing Willow Run trunk line is proposed to remain in service in its current location. This segment was discussed at length among the project team, and it was determined to be preferable not to relocate it due to right of way acquisition concerns. If the preferred option of leaving the trunk line in place is determined to not be feasible for constructability reasons, or if the selected design-build team prefers to relocate it for other reasons, then a possible alternative concept is shown in Appendix C. This relocation option includes relocating a portion of the existing trunk line from near the Goebel Park pool to near the existing pump station. Either option that is selected will require design of a concept to replace the existing flood outlet relief structure near Rt. Sta. 562+00 that is being impacted by the proposed roadway construction.

Capacity Improvements

By intercepting some runoff from the Willow Run watershed, the proposed Alt 2 storm sewer system will reduce flows to the existing combined sewer system in the Peaselburg neighborhood, providing some improvement to the existing system surcharging problems. However, even with that improvement, more capacity would still be needed to meet current 10-year and 25-year design criteria. The current criteria is to contain the 10-year hydraulic grade line within the pipe, and to provide 1 foot of freeboard before surcharging for the 25-year event. To provide additional flooding relief in the Peaselburg area, the project team worked with the City's consultants, VS Engineering and RL Record, to determine additional improvement options.

Palmer provided the proposed Alt 2 drawings and data files to VS Engineering to incorporate into their model of the existing Willow Run system. The existing model shows that a bottleneck occurs approximately 1100 feet upstream from the Relocation Segment 1 discussed above. Two existing 96" diameter pipes join near the hospital, and then the trunk line continues downstream with a single line of pipe varying in size from 96" to 108" until near 9th Street. Existing and proposed models were run for a 10-year, 24-hour event and a 25-year, 24-hour event.

In the existing condition, the model results show surcharging at several nodes along Euclid Avenue for the 10-year event. Several iterations of proposed options were analyzed, resulting in the recommendation of increasing the size of Relocation Segment 1 to 120" diameter. This increased capacity provided enough improvement to eliminate surcharging for the 10-year event, but not for the 25-year event.

Even with the additional capacity provided by increasing the size of Relocation Segment 1, the bottleneck at the junction of the two 96" lines near the hospital would remain and would continue to be problematic. However, extending the proposed capacity improvements upstream to the junction would require approximately 1100 feet of additional pipe be replaced, and it is outside

the footprint of this project. After meeting with the City and explaining the problems associated with work outside the footprint of the project, a partnership was discussed to incorporate this additional length of relocation into the design, but with the City bearing the cost of the segment that lies outside the footprint of the project. This is potential segment of capacity improvement is labeled as Relocation Segment 1A in the Appendix C exhibits.

VS analyzed replacing Segment 1A with a 120" pipe in their model. This option provided a significant improvement, lowering the hydraulic grade line several feet and eliminating the system surcharging for the 25-year event. The potential partnership and cost sharing with the City will need to be coordinated during final design to determine if Relocation Segment 1A will become a part of the project. See Appendix G for tables and exhibits showing the results of the modeling performed by VS Engineering.

Another possibility for the project to provide additional drainage benefits could be to increase the size of the proposed Alt 2 trunk line. This would provide additional capacity in the event that the City was able to separate more storm runoff from the combined system, and then tie into to the interstate's separated storm sewer system. At the time of this report, the City did not have potential separation projects planned. Further coordination with the City is recommended during final design to determine if this option should be pursued further.

Flood Protection / Pump Station

The existing pump station is planned to remain in service with the proposed Alternative 2. See Appendix D for record plans for the pump station. The Alt 2 storm sewer trunk line is proposed to connect to the existing Willow Run trunk line just upstream from the pump station. This concept was discussed with SD1 at the project team's Local Officials Meeting (See Appendix E), and SD1 requested data files for the proposed Alt 2 layout for the purpose of evaluating its impact in their system's hydrologic and hydraulic model. SD1 then provided the results of their modelers' evaluation of potential impacts. That evaluation concluded there is not a large impact other than slightly larger peak flows and volumes which correlates to longer run times for the pump station. SD1 stated that the ultimate decision on potential modifications to the pump station will be up to the U.S. Army Corps of Engineers (USACE) during the Section 408 permitting process.

The project team also met with the USACE and the City of Covington on March 17, 2022 to discuss the Section 408 permitting process. The Corps advised the project team about what items would be required for the Section 408 permit and the review time to expect. It was also recommended that the selected design-build team should continue to coordinate with the City of Covington and SD1 regarding the flood control system. The levee, floodwall, and pump station system are owned by the City of Covington, and they are operated and maintained by SD1.

In follow-up discussions with the USACE, the issue of Goebel Park was discussed as it relates to the overall flood protection system. In the original design of the flood protection system, the park was utilized as supplemental flood storage. As discussed earlier, flood water that backs up into the system is released into the park via outlet relief drains. See Appendix H for an exhibit of the original ponding area, extracted from the 1955 USACE Operation and Maintenance Manual, and also for current photos of the outlet relief drains. Appendix C also shows the current ponding area

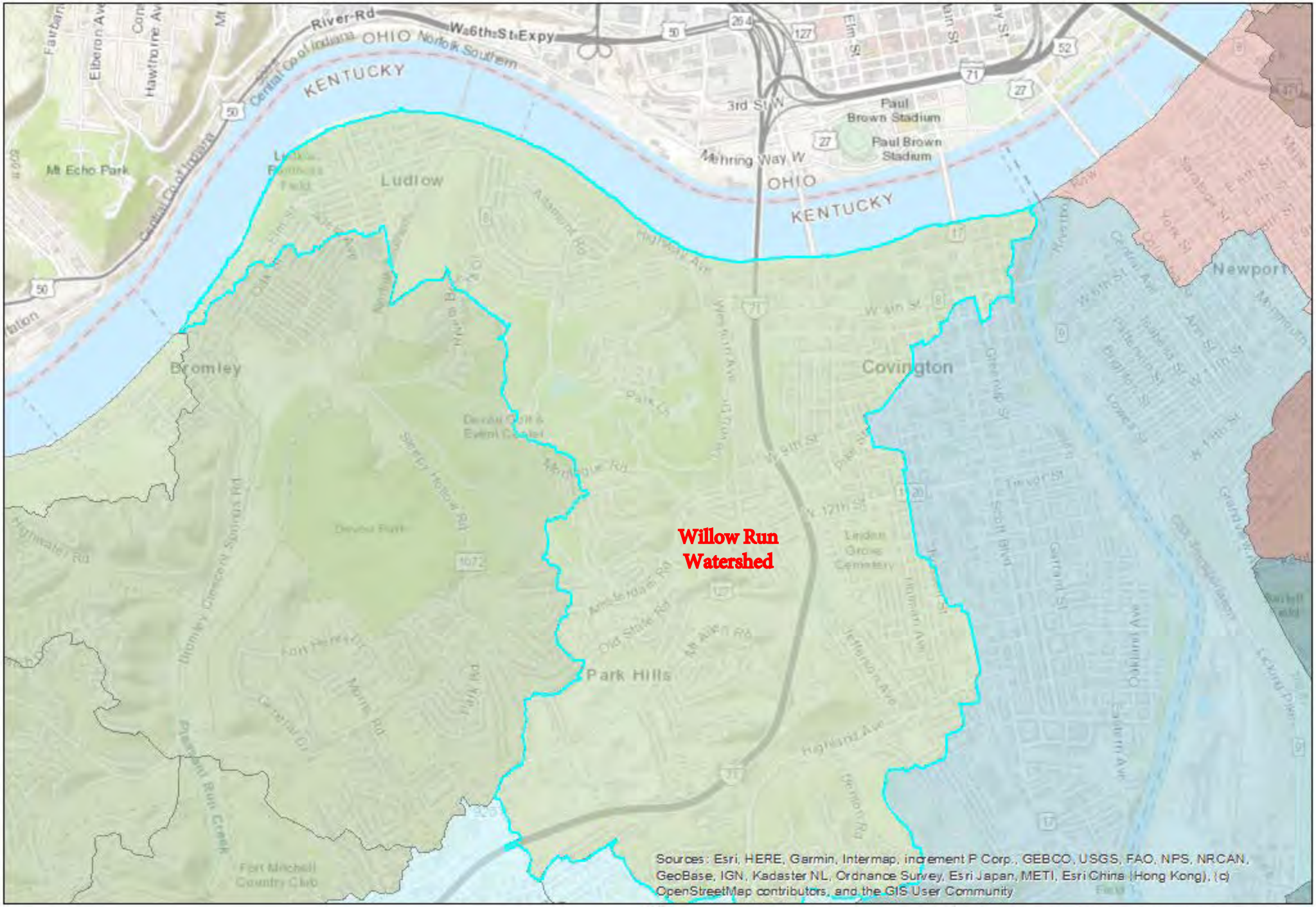
relative to the proposed roadway layout. It should be noted that it appears the ponding area was also impacted by the construction of the existing interstate, but it is unknown what, if any, modifications were made to the flood control system at that time.

The widening of the interstate corridor through the park area will impact a portion of the low area in Goebel Park that provides flood storage. It will also directly impact one of the outlet relief structures, which will require a replacement concept during final design as discussed previously. As part of the Concept W interchange layout revisions, the proposed profile grade of Jillians Way and nearby ramps were revised through the park to mitigate the loss of flood storage. But even with these revisions, there will still be a loss of flood storage in the park. The USACE indicated that any flood storage loss will need to be accounted for with the project. When asked about potential modifications to the pump station, they indicated that this would be acceptable if upgrades could be proven to offset the loss of flood storage volume.

The details of proposed pump station modifications are not known at this time, but it is anticipated that modifications to the existing pumps station would be more cost effective that constructing a new pump station for the Alt 2 separate storm sewer trunk line.

APPENDIX A

Willow Run Watershed and Peaselburg Neighborhood Exhibits



0 0.45 0.9 1.35 mi

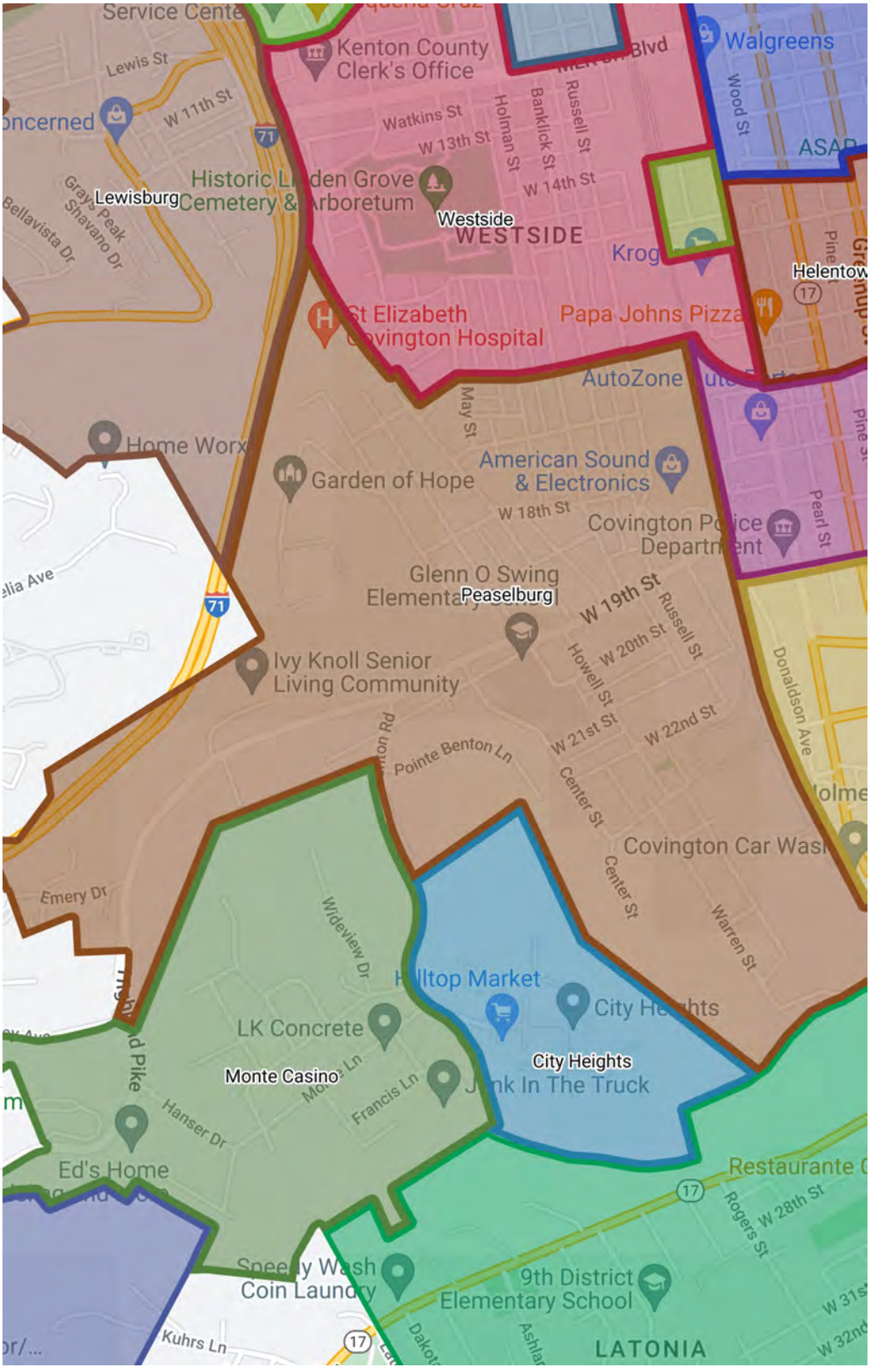
SD1 Infrastructure
Web Map Export

City of Covington, Kentucky Neighborhoods

Neighborhoods

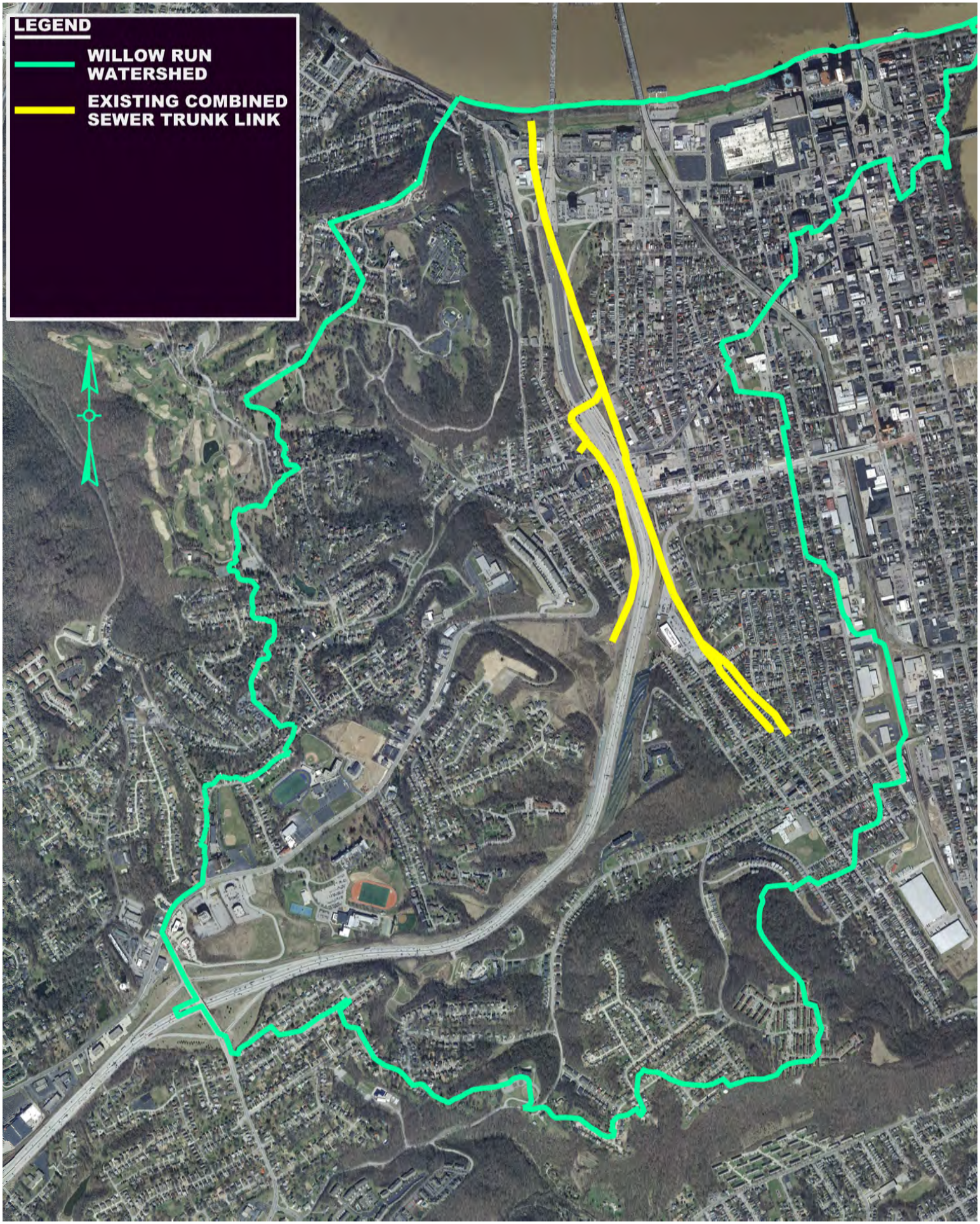
- Kenton Hills
- Monte Casino
- Kuhrs Lane
- West Latonia
- South Covington
- Licking Riverside
- Mainstrasse
- Old Town/Mutter Gottes
- Westside
- Historic West 15th Street
- Botany Hills
- Seminary Square
- Eastside
- City Heights
- Latonia/Rosedale
- Ritte's East Latonia
- Austinburg
- Central Business District
- Wallace Woods
- Levassor Park
- Peaselburg
- Lewisburg
- Latonia Milldale
- Helentown

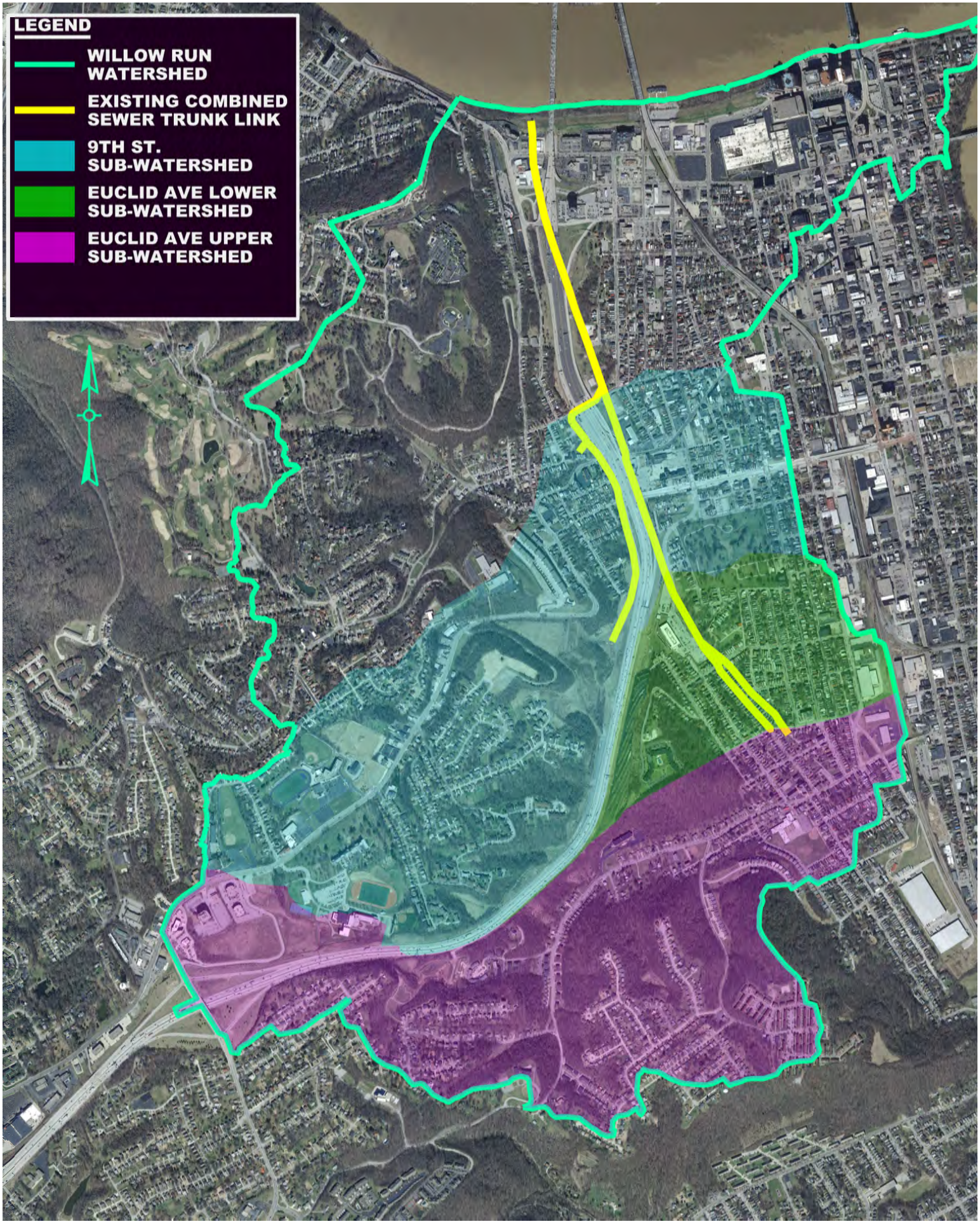
Untitled layer

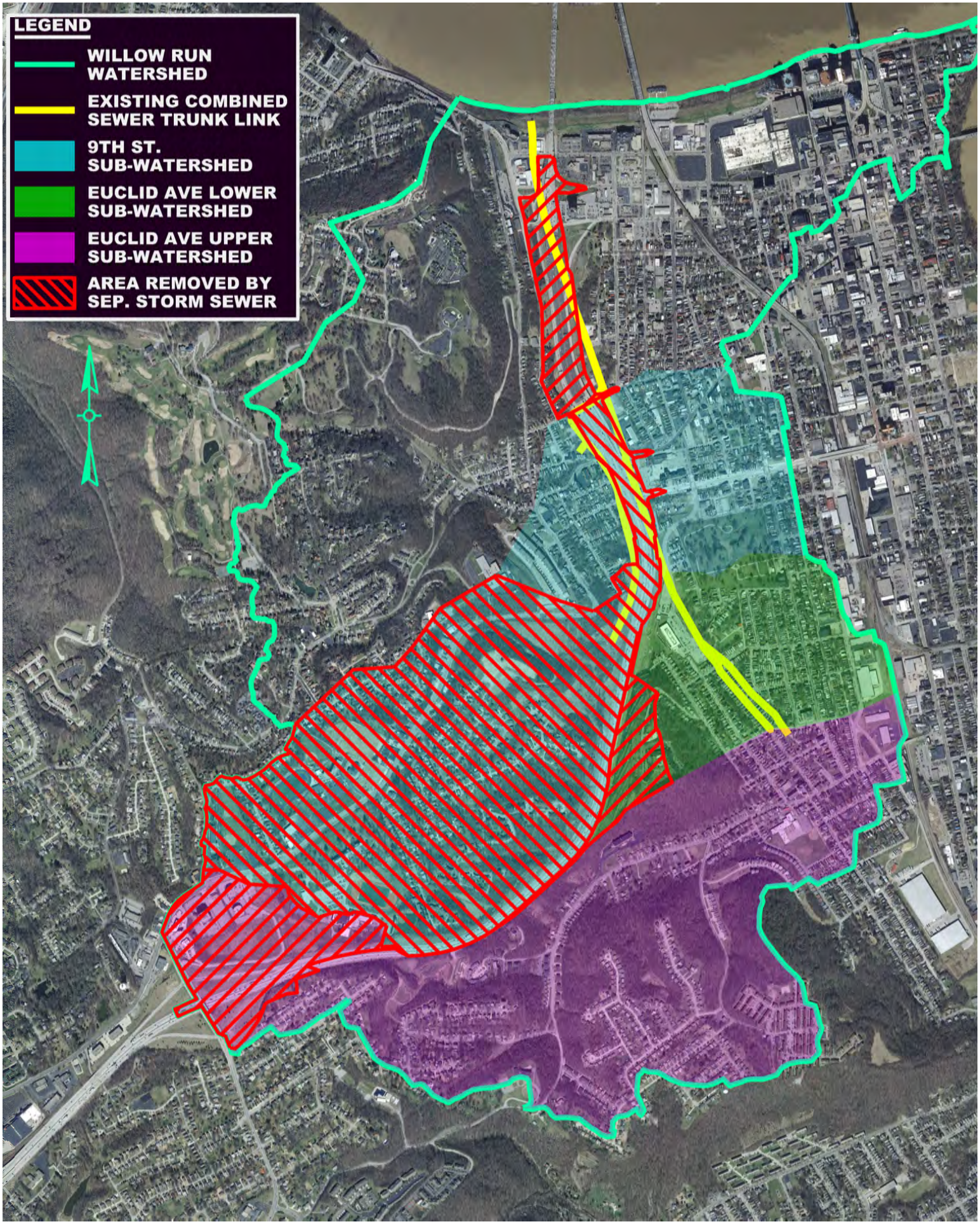


Neighborhoods of Covington with their respective Neighborhood Associations and websites (where available).

For information about this map or to report any errors, please contact City of Covington GIS Specialist: Jessica Moss (jmoss@covingtonky.gov) (859) 292-2165


LEGEND
WILLOW RUN WATERSHED
EXISTING COMBINED SEWER TRUNK LINK


LEGEND
WILLOW RUN WATERSHED
EXISTING COMBINED SEWER TRUNK LINK
9TH ST. SUB-WATERSHED
EUCLID AVE LOWER SUB-WATERSHED
EUCLID AVE UPPER SUB-WATERSHED


LEGEND
WILLOW RUN WATERSHED
EXISTING COMBINED SEWER TRUNK LINK
9TH ST. SUB-WATERSHED
EUCLID AVE LOWER SUB-WATERSHED
EUCLID AVE UPPER SUB-WATERSHED
AREA REMOVED BY SEP. STORM SEWER

APPENDIX B

Alternative 1 Plan

BRENT SPENCE BRIDGE
REPLACEMENT STUDY

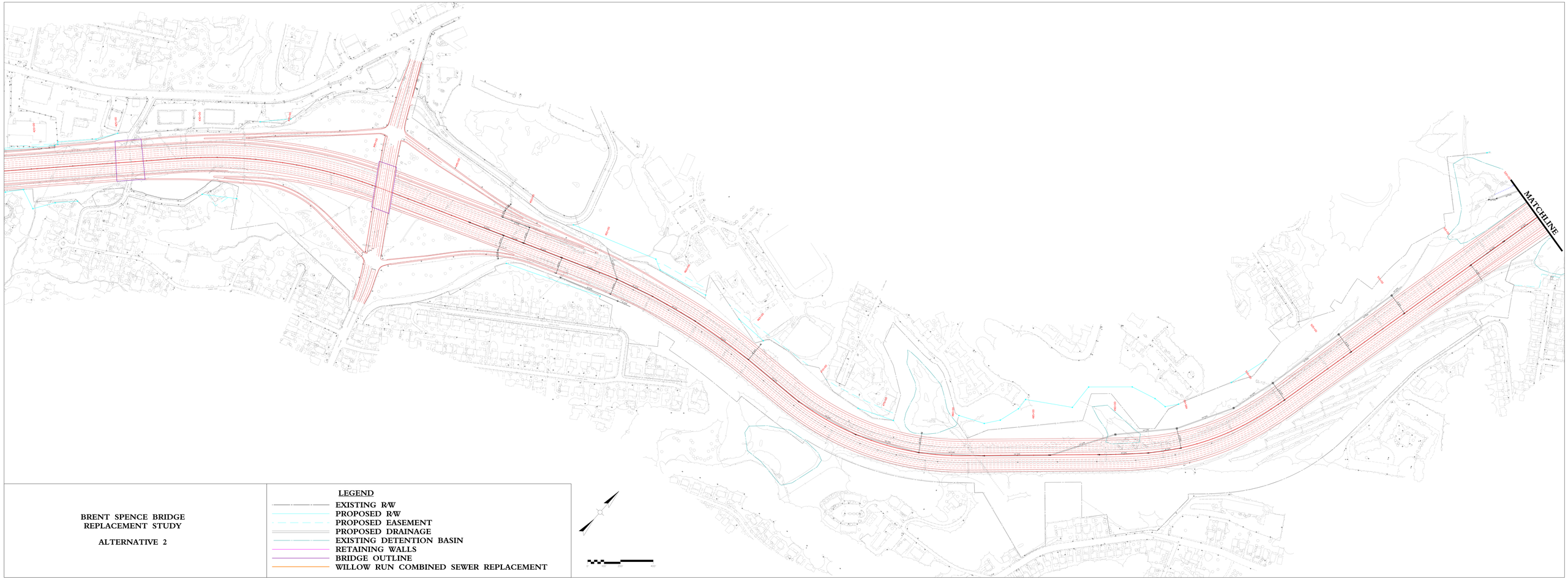
ALTERNATIVE I

LEGEND

- EXISTING R/W
- PROPOSED DRAINAGE
- EXISTING DETENTION BASIN
- RETAINING WALLS
- BRIDGE OUTLINE
- WILLOW RUN COMBINED SEWER REPLACEMENT
- WILLOW RUN LOW FLOW DIVERSION REPLACEMENT

APPENDIX C

Alternative 2 Plan, Cost, and Drainage Area Summary



BRENT SPENCE BRIDGE
REPLACEMENT STUDY

ALTERNATIVE 2

LEGEND

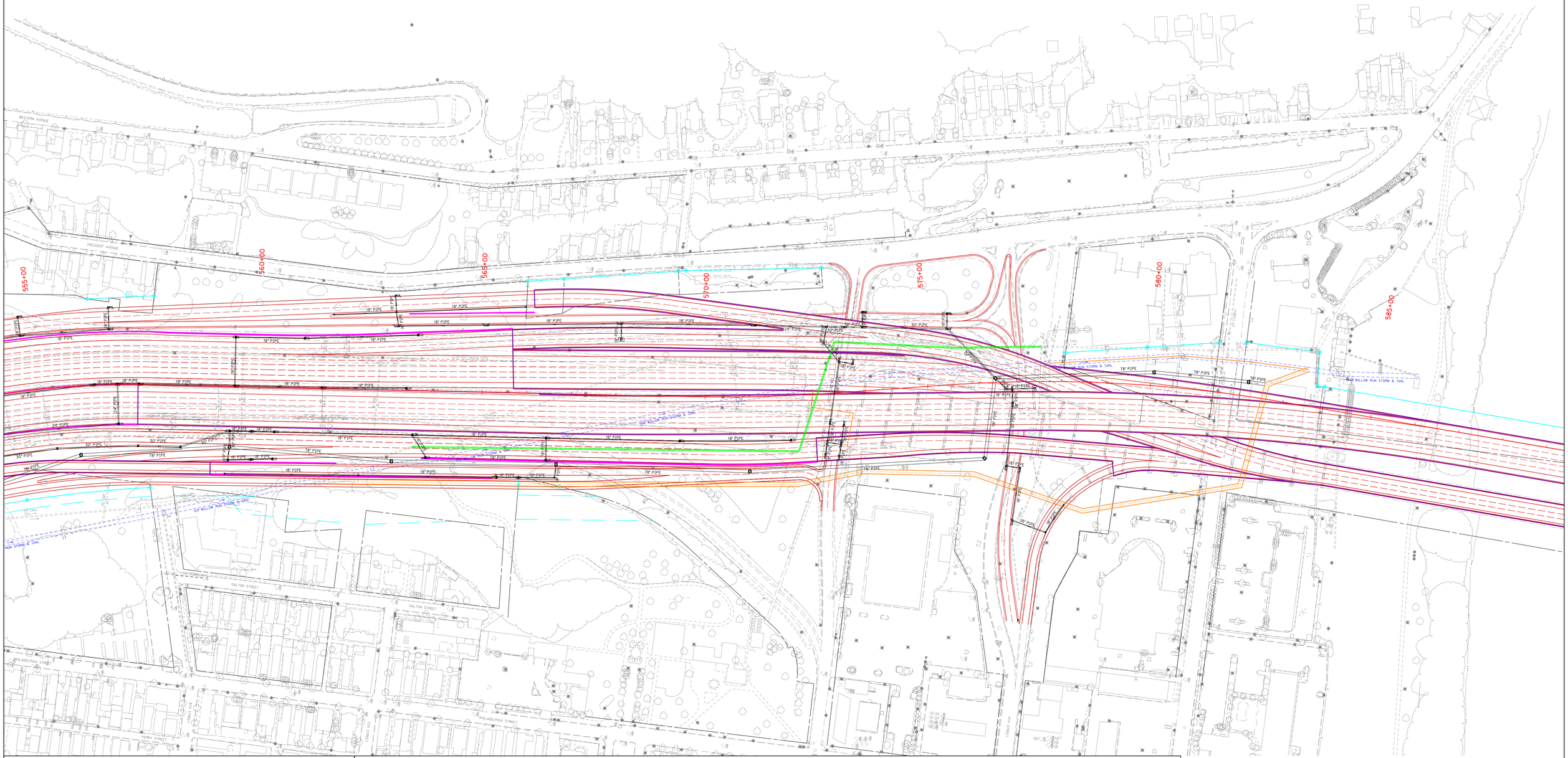
- EXISTING R/W
- PROPOSED R/W
- PROPOSED EASEMENT
- PROPOSED DRAINAGE
- EXISTING DETENTION BASIN
- RETAINING WALLS
- BRIDGE OUTLINE
- WILLOW RUN COMBINED SEWER REPLACEMENT

BRENT SPENCE BRIDGE REPLACEMENT STUDY

ALTERNATIVE 2

LEGEND

- EXISTING R/W
- PROPOSED R/W
- PROPOSED EASEMENT
- PROPOSED DRAINAGE
- EXISTING DETENTION BASIN
- RETAINING WALLS
- BRIDGE OUTLINE
- WILLOW RUN COMBINED SEWER REPLACEMENT
- GOEBEL PARK FLOOD RELIEF PONDING AREA



BRENT SPENCE BRIDGE REPLACEMENT STUDY

COMBINED SEWER RELOCATION OPTION

LEGEND

- EXISTING R/W
- PROPOSED R/W
- PROPOSED EASEMENT
- PROPOSED DRAINAGE
- EXISTING DETENTION BASIN
- RETAINING WALLS
- BRIDGE OUTLINE
- WILLOW RUN COMBINED SEWER REPLACEMENT
- WILLOW RUN LOW FLOW DIVERSION REPLACEMENT

0' 100' 200' 400'

PRELIMINARY COST ESTIMATE

CONSTRUCTION

Road Name:	**I-71/I-75**
From:	16th Street
To:	Ohio River

Willow Run Storm Water Separation - ALT 2
Concept W Revisions

ITEM NO.	ITEM	QUANTITIES	UNIT	UNIT PRICE	COST
	DRAINAGE				
522	18" STORM SEWER PIPE	14843	LF	$57	$846,051
524	24" STORM SEWER PIPE	1637	LF	$78	$127,686
526	30" STORM SEWER PIPE	3143	LF	$108	$339,444
528	36" STORM SEWER PIPE	120	LF	$120	$14,400
529	42" STORM SEWER PIPE	438	LF	$136	$59,568
530	48" STORM SEWER PIPE	298	LF	$140	$41,720
531	54" STORM SEWER PIPE	4778	LF	$180	$860,040
532	60" STORM SEWER PIPE	1246	LF	$220	$274,120
533	66" STORM SEWER PIPE	1554	LF	$260	$404,040
534	72" STORM SEWER PIPE	541	LF	$300	$162,300
535	78" STORM SEWER PIPE	3421	LF	$325	$1,111,825
1456	CURB BOX INLET TYPE A	67	EACH	$5,450	$365,150
1480	CURB BOX INLET TYPE B	2	EACH	$4,820	$9,640
1490	DROP BOX INLET TYPE 1	21	EACH	$4,400	$92,400
1493	DROP BOX INLET TYPE 2	2	EACH	$4,600	$9,200
1538	DROP BOX INLET TYPE 7	6	EACH	$5,900	$35,400
1559	DROP BOXINLET TYPE 13G	26	EACH	$4,450	$115,700
1568	DROP BOXINLET TYPE 13S	5	EACH	$5,050	$25,250
1614	CMBBI TY 14	75	EACH	$3,650	$273,750
1767	MANHOLE TY C	25	EACH	$6,600	$165,000
RELOCATED WILLOW RUN SEWER					
528	36" STORM SEWER PIPE	606	LF	$120	$72,720
531	54" STORM SEWER PIPE	900	LF	$180	$162,000
532	60" STORM SEWER PIPE	287	LF	$220	$63,140
	120" STORM SEWER PIPE	1980	LF	$2,200	$4,356,000
1767	MANHOLE TY C	16	EACH	$9,000	$144,000
	DETENTION BASIN RECONSTR	3	EACH	$100,000	$300,000
---	PUMP STATION	1	LS		$0
				SUBTOTAL	**$10,430,544**
2568	Mobillization (5%)	1	5.0%		**$521,527**
2569	Demobillization (1.5%)	1	1.5%		**$156,458**
				PROJECT SUBTOTAL	**$11,108,529**
			25%	**Contingency**	**$2,777,132**
				CONSTRUCTION TOTAL	**$13,885,662**

Drainage Reports

Drainage Data File: BSB Willow Run - ALT 2

ID (cfs)	AttachTo	Total Area (Ac)	% impervious	% pervious	Area impervious (Ac)	Area pervious (Ac)
A1	IN42	0.49	100%	0%	0.49	0.00
A2	IN40	0.79	100%	0%	0.79	0.00
A3	IN41	0.28	100%	0%	0.28	0.00
A4	IN39	0.35	100%	0%	0.35	0.00
A5	IN30	3.62	25%	75%	0.91	2.72
A6	IN46	1.90	45%	55%	0.86	1.05
A7	IN38	0.89	100%	0%	0.89	0.00
A8	IN23	1.77	100%	0%	1.77	0.00
A9	IN31	0.53	100%	0%	0.53	0.00
A10	IN20	0.47	100%	0%	0.47	0.00
A11	IN151	0.46	0%	100%	0.00	0.46
A12	IN36	0.24	100%	0%	0.24	0.00
A13	IN21	0.16	100%	0%	0.16	0.00
A14	IN37	0.25	100%	0%	0.25	0.00
A15	IN22	0.25	100%	0%	0.25	0.00
A16	IN163	0.32	100%	0%	0.32	0.00
A17	IN34	0.05	100%	0%	0.05	0.00
A18	IN35	0.12	100%	0%	0.12	0.00
A19	IN49	0.18	100%	0%	0.18	0.00
A20	IN50	0.25	100%	0%	0.25	0.00
A21	IN97	0.07	100%	0%	0.07	0.00
A22	P164	0.50	100%	0%	0.50	0.00
A23	IN32	0.48	100%	0%	0.48	0.00
A24	IN26	0.12	100%	0%	0.12	0.00
A25	IN29	0.23	100%	0%	0.23	0.00
A26	IN28	0.56	100%	0%	0.56	0.00
A27	IN24	0.16	100%	0%	0.16	0.00
A28	IN33	0.44	100%	0%	0.44	0.00
A29	IN103	0.32	100%	0%	0.32	0.00
A30	IN104	0.14	100%	0%	0.14	0.00
A31	IN84	0.12	100%	0%	0.12	0.00
A32	P164	0.17	100%	0%	0.17	0.00
A33	IN107	0.06	100%	0%	0.06	0.00
A34	P164	2.25	100%	0%	2.25	0.00
A35	IN106	0.15	100%	0%	0.15	0.00
A36	IN106	1.14	100%	0%	1.14	0.00
A37	IN93	0.10	100%	0%	0.10	0.00
A38	IN94	0.05	100%	0%	0.05	0.00
A39	IN51	0.16	100%	0%	0.16	0.00

ID (cfs)	AttachTo	Total Area (Ac)	% impervious	% pervious	Area impervious (Ac)	Area pervious (Ac)
A40	IN48	0.08	100%	0%	0.08	0.00
A41	IN52	0.28	100%	0%	0.28	0.00
A42	IN54	0.20	100%	0%	0.20	0.00
A43	IN53	0.20	100%	0%	0.20	0.00
A44	IN58	0.23	100%	0%	0.23	0.00
A45	IN59	0.07	100%	0%	0.07	0.00
A46	IN98	0.32	100%	0%	0.32	0.00
A47	IN105	0.19	100%	0%	0.19	0.00
A48	IN91	0.12	100%	0%	0.12	0.00
A49	IN60	0.15	100%	0%	0.15	0.00
A50	IN92	0.23	100%	0%	0.23	0.00
A51	IN87	0.15	100%	0%	0.15	0.00
A52	IN61	0.03	100%	0%	0.03	0.00
A53	IN56	0.08	100%	0%	0.08	0.00
A54	IN15	0.40	100%	0%	0.40	0.00
A55	IN55	0.30	100%	0%	0.30	0.00
A56	IN14	0.83	100%	0%	0.83	0.00
A57	IN13	0.45	100%	0%	0.45	0.00
A58	IN218	1.53	100%	0%	1.53	0.00
A59	IN218	0.17	100%	0%	0.17	0.00
A60	IN5	0.63	100%	0%	0.63	0.00
A61	IN9	0.81	100%	0%	0.81	0.00
A62	IN8	0.30	100%	0%	0.30	0.00
A63	IN1	0.45	100%	0%	0.45	0.00
A64	IN3	0.41	100%	0%	0.41	0.00
A65	IN43	0.17	100%	0%	0.17	0.00
A66	IN68	0.18	100%	0%	0.18	0.00
A67	IN45	0.47	100%	0%	0.47	0.00
A68	IN47	0.35	100%	0%	0.35	0.00
A69	IN4	0.22	100%	0%	0.22	0.00
A70	IN154	1.27	100%	0%	1.27	0.00
A71	IN158	0.48	100%	0%	0.48	0.00
A72	IN129	0.75	100%	0%	0.75	0.00
A73	IN130	0.54	100%	0%	0.54	0.00
A74	IN7	0.16	100%	0%	0.16	0.00
A75	IN16	0.27	100%	0%	0.27	0.00
A76	IN17	0.21	100%	0%	0.21	0.00
A77	IN2	0.61	100%	0%	0.61	0.00
A78	IN67	0.06	100%	0%	0.06	0.00
A79	IN71	0.63	100%	0%	0.63	0.00
A80	IN62	0.66	100%	0%	0.66	0.00
A81	IN148	0.10	100%	0%	0.10	0.00
A82	IN149	0.09	100%	0%	0.09	0.00
A83	IN63	0.65	100%	0%	0.65	0.00

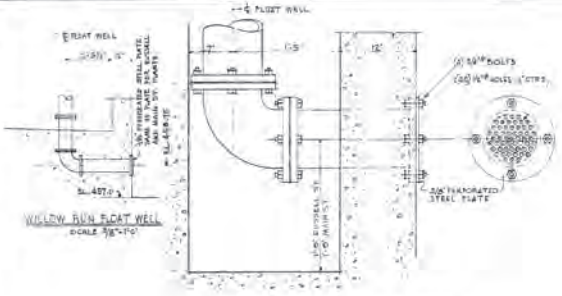
ID (cfs)	AttachTo	Total Area (Ac)	% impervious	% pervious	Area impervious (Ac)	Area pervious (Ac)
A84	IN64	0.65	100%	0%	0.65	0.00
A85	IN90	0.18	100%	0%	0.18	0.00
A86	IN143	0.13	100%	0%	0.13	0.00
A87	IN89	0.05	100%	0%	0.05	0.00
A88	IN109	0.03	100%	0%	0.03	0.00
A89	IN88	0.06	100%	0%	0.06	0.00
A90	IN145	0.03	100%	0%	0.03	0.00
A91	IN111	0.07	100%	0%	0.07	0.00
A92	IN128	0.69	100%	0%	0.69	0.00
A93	IN12	1.05	40%	60%	0.42	0.63
A94	IN167	2.63	20%	80%	0.53	2.10
A95	IN10	0.12	100%	0%	0.12	0.00
A96	IN11	0.14	100%	0%	0.14	0.00
A97	IN18	0.18	100%	0%	0.18	0.00
A98	IN19	0.20	100%	0%	0.20	0.00
A99	IN57	0.08	100%	0%	0.08	0.00
A100	IN69	0.11	100%	0%	0.11	0.00
A101	IN71	0.06	100%	0%	0.06	0.00
A102	IN73	0.12	100%	0%	0.12	0.00
A103	IN70	0.20	100%	0%	0.20	0.00
A104	IN75	0.30	100%	0%	0.30	0.00
A105	IN62	0.19	100%	0%	0.19	0.00
A106	IN66	0.25	100%	0%	0.25	0.00
A107	IN63	0.21	100%	0%	0.21	0.00
A108	IN72	0.20	100%	0%	0.20	0.00
A109	IN64	0.35	100%	0%	0.35	0.00
A110	IN65	0.07	100%	0%	0.07	0.00
A111	IN74	0.15	100%	0%	0.15	0.00
A112	IN100	0.63	100%	0%	0.63	0.00
A113	IN79	0.24	100%	0%	0.24	0.00
A114	IN80	0.24	100%	0%	0.24	0.00
A115	IN77	0.32	100%	0%	0.32	0.00
A116	IN76	0.19	100%	0%	0.19	0.00
A117	IN81	0.09	100%	0%	0.09	0.00
A118	IN133	0.09	100%	0%	0.09	0.00
A119	IN135	0.42	100%	0%	0.42	0.00
A120	IN168	1.69	100%	0%	1.69	0.00
A121	IN169	2.11	90%	10%	1.90	0.21
A122	IN135	0.02	100%	0%	0.02	0.00
A123	IN110	0.04	100%	0%	0.04	0.00
A124	IN146	0.03	100%	0%	0.03	0.00
A125	IN147	0.04	20%	80%	0.01	0.03
A126	IN216	0.03	100%	0%	0.03	0.00
A127	IN111	0.04	100%	0%	0.04	0.00

ID (cfs)	AttachTo	Total Area (Ac)	% impervious	% pervious	Area impervious (Ac)	Area pervious (Ac)
A128	IN217	0.04	100%	0%	0.04	0.00
A129	IN113	0.04	100%	0%	0.04	0.00
A130	IN215	0.12	100%	0%	0.12	0.00
A131	IN114	0.11	100%	0%	0.11	0.00
A132	IN214	0.13	100%	0%	0.13	0.00
A133	IN115	0.12	100%	0%	0.12	0.00
A134	IN112	0.14	100%	0%	0.14	0.00
A135	IN127	0.12	100%	0%	0.12	0.00
A136	IN213	0.50	100%	0%	0.50	0.00
A137	IN116	0.39	100%	0%	0.39	0.00
A138	IN211	0.16	100%	0%	0.16	0.00
A139	IN118	0.21	100%	0%	0.21	0.00
A140	IN117	0.16	100%	0%	0.16	0.00
A141	P181	44.73	50%	50%	22.37	22.37
A142	IN102	3.73	15%	85%	0.56	3.17
A143	IN192	1.05	100%	0%	1.05	0.00
A144	IN108	0.35	100%	0%	0.35	0.00
A145	IN152	0.82	100%	0%	0.82	0.00
A146	IN155	0.57	100%	0%	0.57	0.00
A147	IN210	0.25	55%	45%	0.14	0.11
A148	IN119	0.48	85%	15%	0.41	0.07
A149	IN120	1.04	55%	45%	0.57	0.47
A150	IN121	0.44	15%	85%	0.07	0.37
A151	IN122	0.13	10%	90%	0.01	0.12
A152	IN129	0.05	100%	0%	0.05	0.00
A153	IN153	0.93	100%	0%	0.93	0.00
A154	IN130	0.04	100%	0%	0.04	0.00
A155	IN125	0.45	100%	0%	0.45	0.00
A156	IN124	0.08	100%	0%	0.08	0.00
A157	IN136	0.02	100%	0%	0.02	0.00
A158	IN137	0.29	30%	70%	0.09	0.20
A159	IN138	0.29	50%	50%	0.15	0.15
A160	IN140	0.24	100%	0%	0.24	0.00
A161	IN141	0.05	100%	0%	0.05	0.00
A162	IN198	7.54	60%	40%	4.52	3.02
A163	IN189	0.40	45%	55%	0.18	0.22
A164	IN190	2.43	35%	65%	0.84	1.59
A165	IN195	0.82	100%	0%	0.82	0.00
A166	IN186	1.83	100%	0%	1.83	0.00
A167	IN196	0.51	100%	0%	0.51	0.00
A168	IN187	0.23	100%	0%	0.23	0.00
A169	IN194	0.31	100%	0%	0.31	0.00
A170	IN191	3.72	35%	65%	1.30	2.42
A171	IN188	0.58	100%	0%	0.58	0.00

ID (cfs)	AttachTo	Total Area (Ac)	% impervious	% pervious	Area impervious (Ac)	Area pervious (Ac)
A172	IN182	0.72	100%	0%	0.72	0.00
A173	IN157	0.82	100%	0%	0.82	0.00
A175	IN174	0.58	100%	0%	0.58	0.00
A176	IN192	4.19	45%	55%	1.89	2.30
A177	IN181	0.73	100%	0%	0.73	0.00
A178	IN6	221.00	22%	78%	48.62	172.38
A179	IN180	0.86	100%	0%	0.86	0.00
A182	IN177	0.87	100%	0%	0.87	0.00
A185	IN198	35.69	35%	65%	12.49	23.20
A186	IN176	0.87	100%	0%	0.87	0.00
A188	IN174	0.39	100%	0%	0.39	0.00
A191	IN173	0.27	100%	0%	0.27	0.00
A192	IN173	0.35	100%	0%	0.35	0.00
A193	IN25	0.72	100%	0%	0.72	0.00
A194	IN44	0.47	100%	0%	0.47	0.00
A195	IN170	1.48	100%	0%	1.48	0.00
A196	IN202	33.92	30%	70%	10.18	23.74
A197	IN203	0.94	30%	70%	0.28	0.66
A198	IN204	2.63	100%	0%	2.63	0.00
A199	IN205	29.19	30%	70%	8.76	20.43
A200	IN171	0.69	100%	0%	0.69	0.00
A201	IN171	0.50	100%	0%	0.50	0.00
A202	IN172	0.47	100%	0%	0.47	0.00
A203	IN172	0.47	100%	0%	0.47	0.00
A204	IN200	0.58	100%	0%	0.58	0.00
A205	IN200	0.58	100%	0%	0.58	0.00
A206	IN206	3.57	30%	70%	1.07	2.50
A207	IN207	3.83	20%	80%	0.77	3.06
A208	P232	21.65	25%	75%	5.41	16.24
A209	IN175	4.86	40%	60%	1.94	2.92
A211	IN126	0.52	30%	70%	0.16	0.36
A212	IN124	0.17	100%	0%	0.17	0.00
		503.0			193.7	309.3

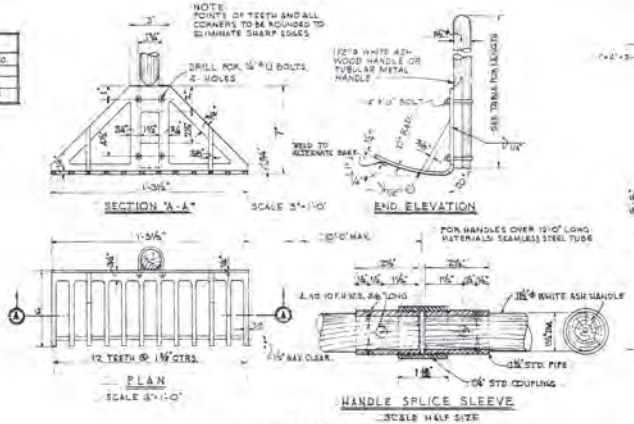
APPENDIX D

Pump Station Record Plans

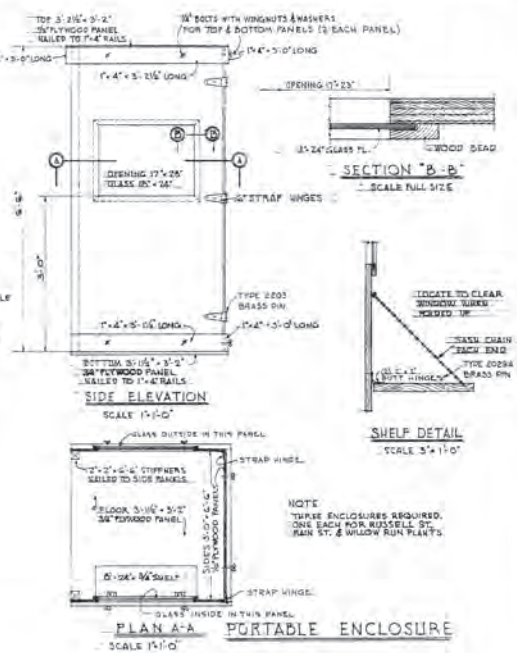


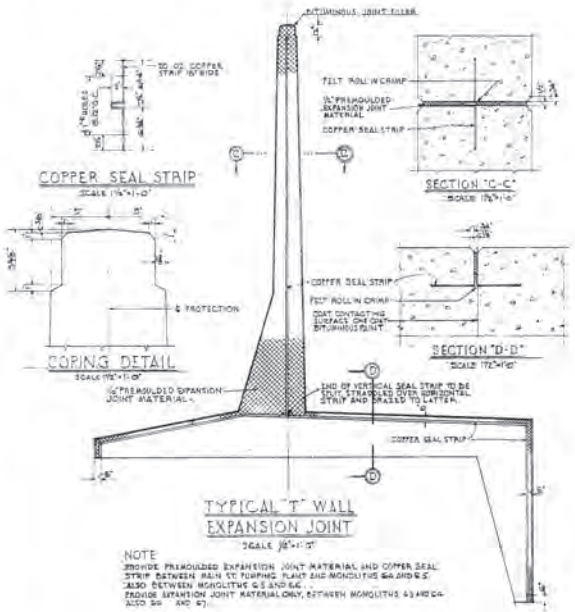
FLOAT WELL BAFFLE DETAIL
SCALE 1/2"=1'-0"

RAKE SCHEDULE		
PLANT	HANDLE LENGTH	NO.
RUSSELL ST.	21'-0"	1
MAIN ST.	19'-6"	1
WILLOW RUN	23'-0"	1

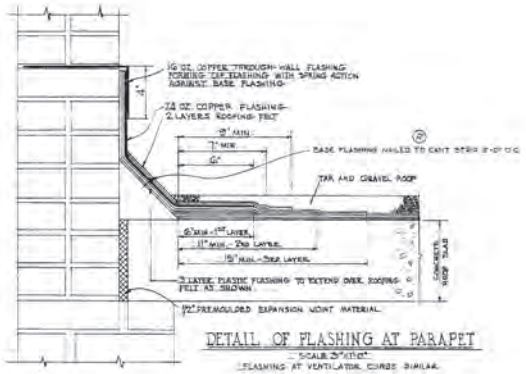


HAND RAKE DETAIL





NOTE
PROVIDE PREMOLDED EXPANSION JOINT MATERIAL AND COPPER SEAL STRIP BETWEEN MAIN ST. PUMPING PLANT AND MONOLITHS 64 AND 65. ALSO BETWEEN MONOLITHS 65 AND 66.
PROVIDE EXPANSION JOINT MATERIAL ONLY, BETWEEN MONOLITHS 63 AND 64 ALSO 66 AND 67.



(P) Note added "Field"

GRAPHIC SCALES

REVISION	DATE	DESCRIPTION	BY
1	10/20/50	Rake handle material note revised	WAN

A. M. KINNEY, INC
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

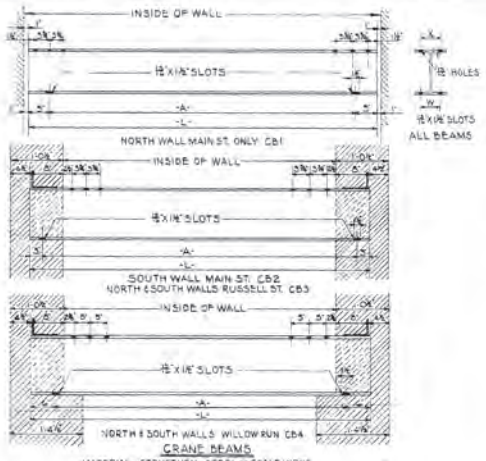
OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
MISCELLANEOUS DETAILS

DRAWN: B.A.K.
TRACED: E.O.B.
CHECKED: R.C.
SUBMITTED: A.M. KINNEY, INC.
APPROVED: DATE: SEPT. 1949
U.S. CORPS OF ENGINEERS, LOUISVILLE DISTRICT
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT
SCALE: AS NOTED | SHEET 12 OF 48 SHEETS
DRAWING NUMBER 471-122/12

AS BUILT

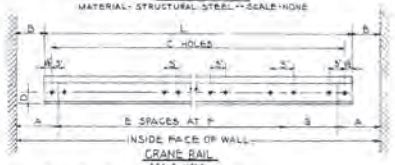
CORPS OF ENGINEERS

U.S. ARMY



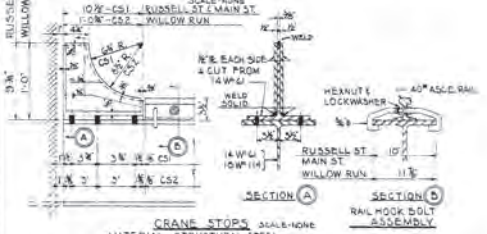
CRANE BEAMS

MATERIAL- STRUCTURAL STEEL -- SCALE-NONE



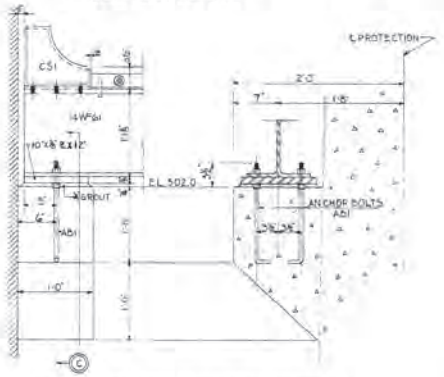
CRANE RAIL

SCALE-NONE



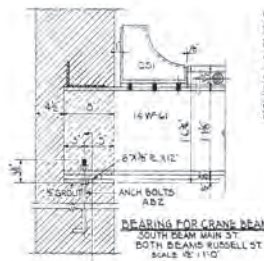
CRANE STOPS SCALE-NONE

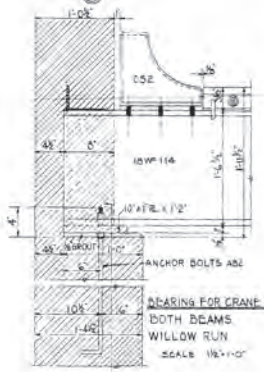
MATERIAL-- STRUCTURAL STEEL

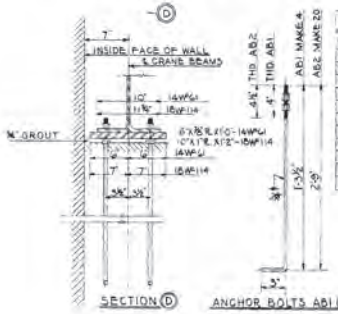


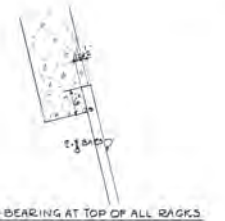
BEARING FOR CRANE BEAM-NORTH BEAM, MAIN ST.

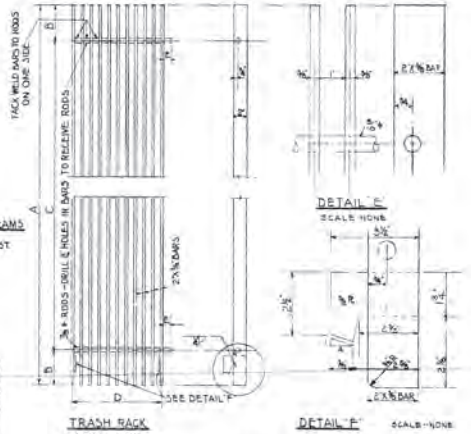
SCALE 1½"=1'-0"





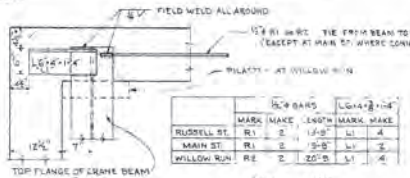






TRASH RACK

SCALE-NONE



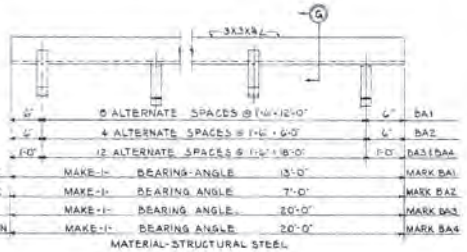
	¾"ø BARS			L.G.14+2-1'-6"	
	MARK	MAKE	LENGTH	MARK	MAKE
RUSSELL ST.	R1	2	19'-9"	L1	4
MAIN ST.	R1	2	19'-8"	L1	3
WILLOW RUN	R2	2	20'-8"	L1	6

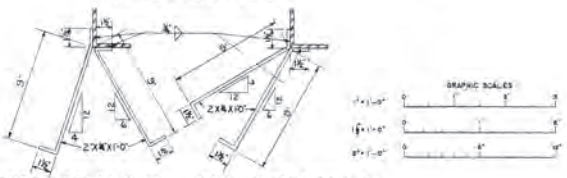
RACK LIST

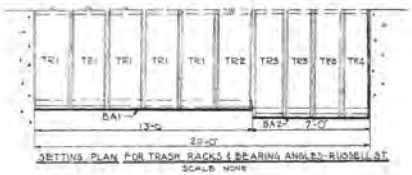
TRASH RACK DETAILS -- MATERIAL -- STRUCTURAL STEEL

TRASH RACK GRATING

PUMP PLANT	MAKE	MARK	A	B	C	D	E	SIZE OF BAR	WT. EA.
RUSSELL ST.	5	TR1	8'-10⅝"	5⅞"	4 SPCS @ 2'-0"	18 SPCS @ 1⅞"-0"	½"	2"X⅜"	442
RUSSELL ST.	1	TR2	8'-10⅝"	5⅞"	4 SPCS @ 2'-0"	17 SPCS @ 1⅞"-11⅛"	1"	2"X⅜"	418
RUSSELL ST.	5	TR3	9'-10⅝"	5¼"	4 SPCS @ 2'-3"	14 SPCS @ 1⅞"-11⅛"	1½"	2"X⅜"	388
RUSSELL ST.	1	TR4	9'-10⅝"	5¼"	4 SPCS @ 2'-3"	15 SPCS @ 1⅞"-11⅛"	1½"	2"X⅜"	413
MAIN ST.	6	TR5	10'-8⅝"	4½"	4 SPCS @ 2'-6"	16 SPCS @ 1⅞"-11⅛"	1½"	2"X⅜"	474
MAIN ST.	3	TR6	10'-8⅝"	4½"	4 SPCS @ 2'-6"	17 SPCS @ 1⅞"-11⅛"	1"	2"X⅜"	502
MAIN ST.	1	TR7	10'-8⅝"	4½"	4 SPCS @ 2'-6"	17 SPCS @ 1⅞"-11⅛"	1"	2"X⅜"	502
WILLOW RUN	16	TR8	11'-11⅛"	3⅝"	5 SPCS @ 2'-5"	8 SPCS @ 1⅞"-11⅛"	½"	2"X⅜"	447
WILLOW RUN	2	TR9	12'-11⅛"	3⅝"	5 SPCS @ 2'-5"	9 SPCS @ 1⅞"-11⅛"	½"	2"X⅜"	496
WILLOW RUN	1	TR10	13'-11⅛"	3⅝"	5 SPCS @ 2'-5"	9 SPCS @ 1⅞"-11⅛"	½"	2"X⅜"	496





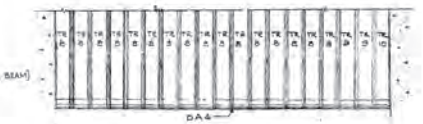


SETTING PLAN FOR TRASH RACKS & BEARING ANGLES-RUSSELL ST.

SCALE NONE

SETTING PLAN FOR TRASH RACKS & BEARING ANGLE-MAIN STREET

SCALE NONE



SETTING PLAN FOR TRASH RACKS & BEARING ANGLE-WILLOW RUN

SCALE-NONE

CRANE BEAMS

PLANT	SIZE OF BEAM	DIMENSIONS A	L	W	X	MARK	MAKE
MAIN STREET NORTH BEAM	14WF61	21'-6"	22'-2"	7"	7"	CB1	1
MAIN STREET SOUTH BEAM	14WF61	23'-2"	23'-8"	7"	7"	CB2	1
RUSSELL STREET	14WF61	22'-8"	23'-2"	7"	7"	CB3	2
WILLOW RUN	18WF114	30'-0"	30'-0"	7"	7"	CB4	2

CRANE RAILS

PLANT	WEIGHT A.S.C.E. RAIL	DIMENSIONS A	B	C	E	F	G	L	MARK	MAKE	RAIL HOOKS SIZE	RAIL HOOKS MAKE
MAIN STREET	40#	1'-2⅝	11⅜	1¾	1⅜	3	2'-0"	1'-10⅞	20-4½	CR1	2	¾ø	44
RUSSELL STREET	40#	1'-2⅝	11⅜	1¾	1⅜	3	2'-0"	1'-4⅞	15'-6½	CR2	2	¾ø	44
WILLOW RUN	40#	1'-4⅜	11⅛	1¾	1⅜	3	2'-0"	1'-10⅞	27'-4½	CR3	2	¾ø	60

CRANE STOPS

PLANT	SIZE OF L	HEIGHT OF L	LENTH OF L	REINFORCING RATES	MARK	MAKE
MAIN STREET	CUT FROM 14 WF 61	9⅜	10⅛"	2#S 0'-8½"X 0'-9⅜"	CS1	4
RUSSELL STREET	CUT FROM 14WF61	9⅜	10⅛"	2#S 0'-8½"X 0'-9⅜"	CS1	4
WILLOW RUN	CUT FROM 14WF61	11⅜	1'-0⅛"	2#S 10⅜"X 1'-0"	CS2	4

REVISION	DATE	DESCRIPTION	BY
1	4/26/50	Plate sizes revised Section D	W.R.K.

A.M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN A.E.B.
TRACED K.W.
CHECKED E.S.

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS-OHIO RIVER SECTION

MISCELLANEOUS METAL DETAILS

SUBMITTED: A.M. KINNEY, INC. — APPROVED: [signature] — DATE: SEPT. 1948

APPROVAL RECOMMENDED: [signature] CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

U.S. CORPS OF ENGINEERS, ACTING DISTRICT ENGINEER, LOUISVILLE DISTRICT

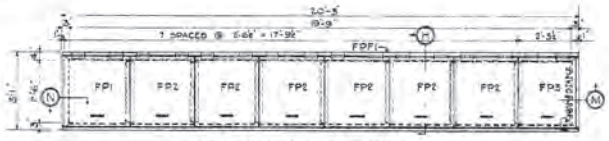
SCALE: AS NOTED | SHEET 15 OF 46 SHEETS

DRAWING NUMBER 471-12.2/13

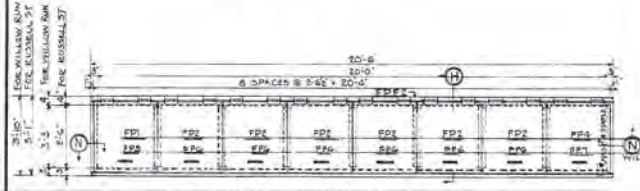
AS BUILT

CORPS OF ENGINEERS

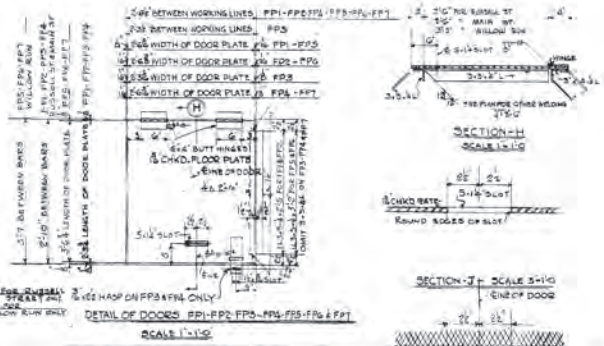
U.S. ARMY

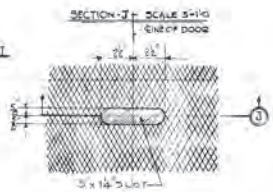


FLOOR PLATES FOR MAIN STREET
SCALE 1"=1'-0"

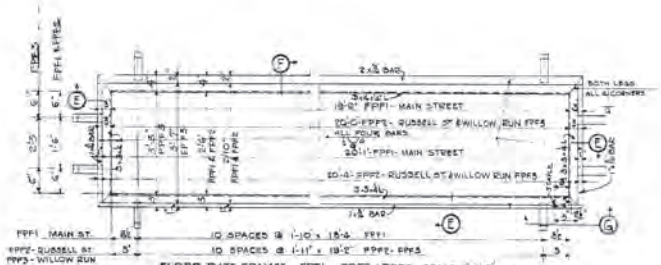


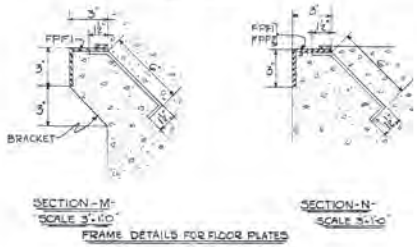
FLOOR PLATES FOR RUSSELL STREET & WILLOW RUN
SCALE 1"=1'-0"



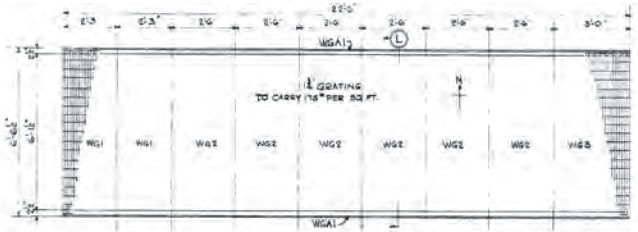


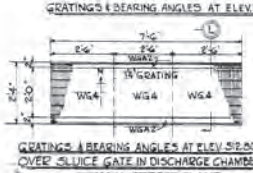
FLOOR PLATES & ANGLE FRAMES						
PLANT	FLOOR PLATES			ANGLE FRAMES		
	MARK	MAKE	MATERIAL	MARK	MAKE	MATERIAL
MAIN STREET	FP1	1	½" CONCRETE	FPF1	1	3-3-9 L 4-3-14 L
	FP2	G	DO.	—	—	—
	FP3	1	DO.	—	—	—
RUSSELL STREET	FP1	1	DO.	FPF2	1	3-3-9 L 4-3-14 L
	FP2	G	DO.	—	—	—
	FP4	1	DO.	—	—	—
WILLOW RUN	FP5	1	DO.	FPF3	1	3-3-9 L 4-3-14 L
	FP6	G	DO.	—	—	—
	FP7	1	DO.	—	—	—





WALKWAY GRATINGS AND WALKWAY GRATING BEARING ANGLES									
GRATINGS			WALKWAY GRATING BEARING ANGLES						
PLANT	MARK	MAKE	MARK	MAKE	DIMENSIONS				
					A	B	C	D	L
MAIN STREET	WG1	2	WGA1	2	7½"	13"	22½"	1'-8"	22'-8"
	WG2	G							
	WG3	1							
	WG4	3	WGA2	2	8"	3"	2"	1'-6"	7'-6"





REVISION	DATE	DESCRIPTION	BY

A.M. KINNEY, INC
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN E.E.S.
TRACED E.E.S.
CHECKED E.E.

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION

MISCELLANEOUS METAL DETAILS

SUBMITTED: A.M. KINNEY, INC.
APPROVED: [illegible] DATE: SEPT 1949
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT
[illegible] CORPS OF ENGINEERS, OHIO RIVER DISTRICT ENGINEER, LOUISVILLE DISTRICT

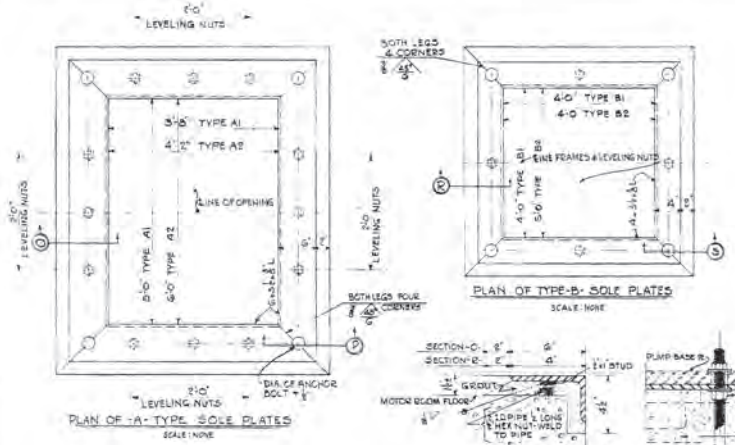
SCALE AS NOTED SHEET 14 OF 48 SHEETS
DRAWING NUMBER
471-122/14

AS BUILT

073

CORPS OF ENGINEERS

U.S. ARMY



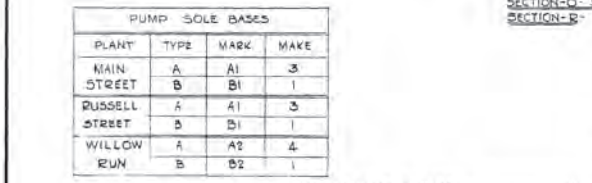
PLAN OF -A- TYPE SOLE PLATES

SCALE: NONE

PLAN OF TYPE-B- SOLE PLATES

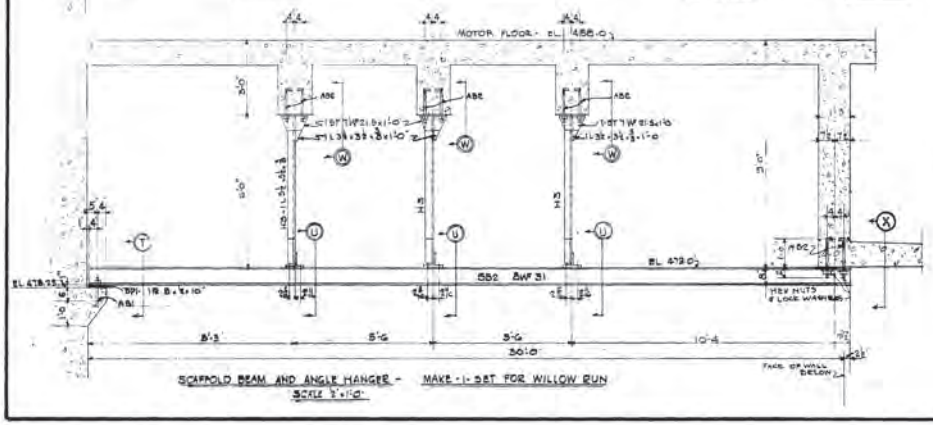
SCALE: NONE

PUMP SOLE BASES			
PLANT	TYPE	MARK	MAKE
MAIN STREET	A	A1	3
	B	B1	1
RUSSELL STREET	A	A1	3
	B	B1	1
WILLOW RUN	A	A2	4
	B	B2	1



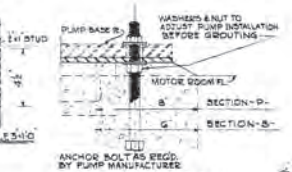
SCAFFOLD BEAMS AND L HANGERS { MAKE-1-SET FOR RUSSELL ST / MAKE-1-SET FOR MAIN ST

SCALE 1/2"=1'-0"



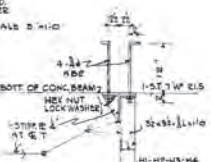
SCAFFOLD BEAM AND ANGLE HANGER - MAKE-1-SET FOR WILLOW RUN

SCALE 1/2"=1'-0"



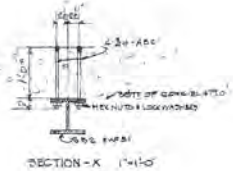
SECTION-P- SCALE 3"=1'-0"

SECTION-S-

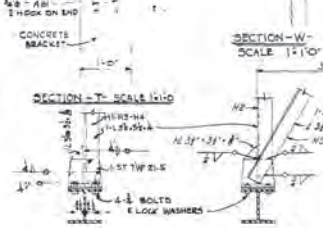


SECTION-W-

SCALE 1"=1'-0"



SECTION-X 1"=1'-0"

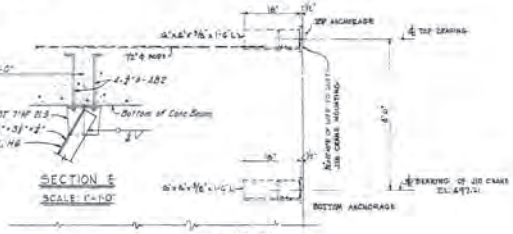


SECTION-U

SCALE 1"=1'-0"

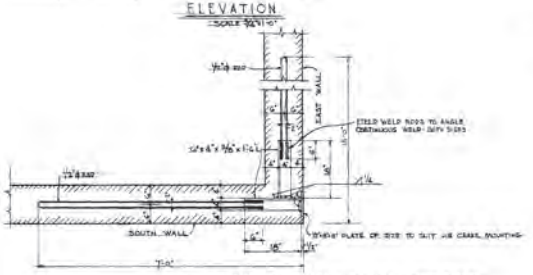
SECTION-D

SCALE 1"=1'-0"



SECTION E

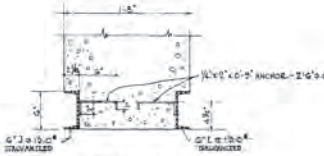
SCALE 1"=1'-0"



PLAN - TOP ANCHORAGE SCALE 3/8"=1'-0"

BOTTOM ANCHORAGE SAME AS ABOVE EXCEPT RODS IN SOUTH WALL ARE OMITTED.

ANCHORAGE FOR 1/2 TON JIB CRANE - WILLOW RUN PLANT



CHANNEL GUIDES

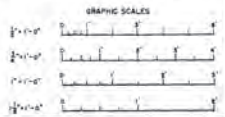
FOR BULKHEADS IN DISCHARGE CHAMBER - MAIN ST. PLANT

SEE SHEETS NO. 21 AND 22 FOR LOCATION.

ARE NUMERICAL REQUIRED.

SCALE: 1/2"=1'-0"

GRAPHIC SCALES



REVISION	DATE	DESCRIPTION	W.A.M.
1	14 Feb 50	Sections D-D and E-E added.	

A.M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION

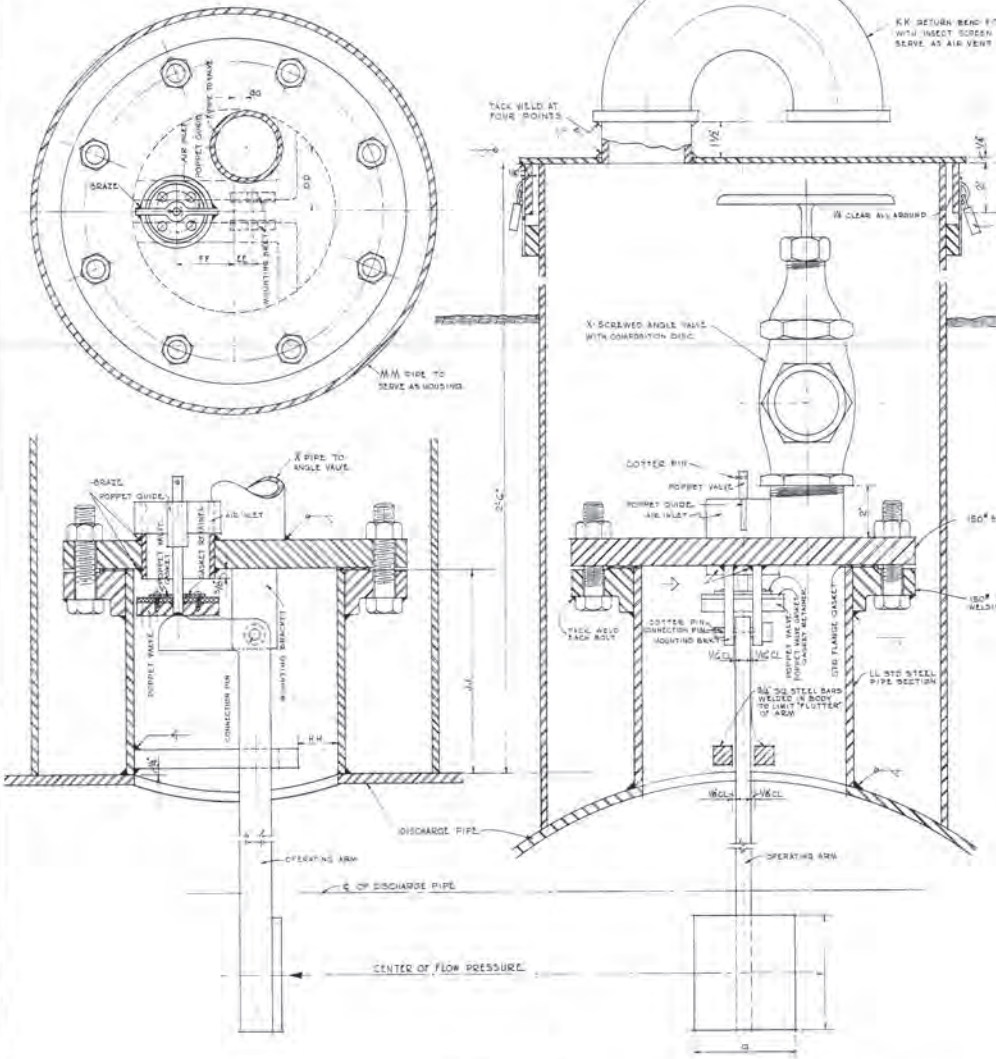
MISCELLANEOUS METAL DETAILS

DRAWN: R.E.B.
TRACED: R.E.B.
CHECKED: R.C.
SUBMITTED: A.M. KINNEY, INC.
APPROVED: Col. [illegible] Corps of Engineers, Acting District Engineer, Louisville District
DATE: SEPT 1948
APPROVAL RECOMMENDED: Chief, Engineering Division, Corps of Engineers, Louisville District
SCALE: AS NOTED
SHEET 15 OF 46 SHEETS
DRAWING NUMBER
471-12.2/15

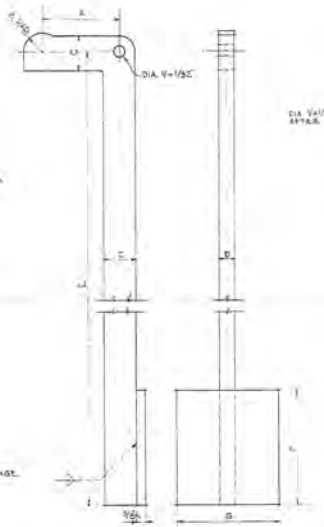
AS BUILT

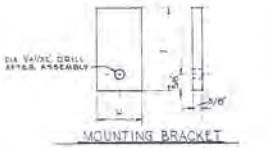
CORPS OF ENGINEERS

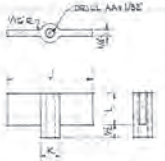
U.S. ARMY

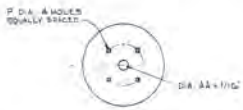


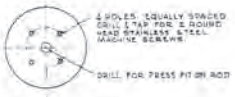
SIPHON BREAKER

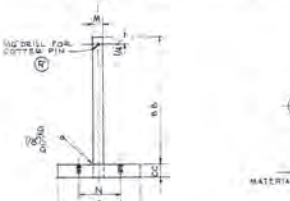


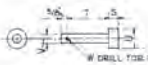






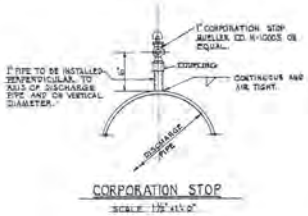






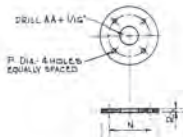
NOTES:
1. ALL FILLET WELDS 1/8" UNLESS OTHERWISE NOTED.
2. ALL WELDS SEALING BREAKER ASSEMBLY MUST BE CONTINUOUS AND AIR TIGHT.
3. QUANTITIES SHOWN ARE FOR ONE ASSEMBLY.

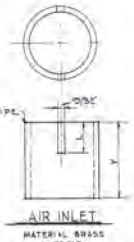
(R) COTTER KEY REPLACED WITH WASHER WELDED ON STEM (WILLOW RUN RP ONLY)



CORPORATION STOP

SCALE: 1½" = 1'-0"





DIMENSION SCHEDULE

LETTERING DESIGNATION	BREAKER ASSEMBLY FOR DISCHARGE PIPE SIZE 12"	14"	30"	36"
A	1 3/4"	1 3/4"	5"	5"
B	15 1/2"	9 1/16"	7 1/4"	7 1/16"
C	7/16"	3/4"	1 1/4"	1 1/2"
D	5/16"	3/16"	5/16"	9/16"
E	13 1/2"	15 1/2"	27 1/2"	34"
F	5"	3"	4 1/2"	12"
G	23 1/2"	27 1/2"	4"	41 1/2"
H	1"	1"	1 3/16"	1 3/16"
I	2 5/16"	2 9/16"	3 1/4"	3 5/16"
J	2 1/16"	2 1/16"	3 3/16"	3 3/16"
K	1/2"	1/2"	3/16"	3/16"
L	1/2"	1/2"	1 1/4"	1 1/4"
M	1/16"	1/16"	3/16"	3/16"
N	7/16"	7/16"	1 5/16"	1 7/16"
O	2 1/4"	2 1/4"	3 1/16"	3 3/16"
P	9 1/32"	5 1/32"	5 11/32"	1/16"
Q	1 1/16"	1 1/16"	2 1/4"	2 1/2"
R	1 7/32"	1 1/16"	1 1/16"	1 1/8"
S	1/8"	1/8"	3/16"	3/16"
T	1 7/16"	1 7/16"	1 5/16"	1 5/16"
U	1/2"	1/2"	3/16"	3/16"
V	1/16"	1/16"	3/16"	1/2"
W	3/32"	3/32"	1/16"	5/32"
X	1 1/2"	1 1/2"	2 1/2"	5"
Y	2 1/16"	2 1/16"	3 11/16"	3 11/16"
Z	*5	*5	*8	*10
AA	3/16"	3/16"	3/16"	3/16"
BB	3 1/2"	3 1/2"	5"	5 1/2"
CC	1/4"	1/2"	1 1/2"	1 1/2"
DD	3 1/2"	1 3/16"	2 1/16"	2"
EE	1/16"	1/16"	3/16"	1/16"
FF	1 1/2"	1 1/2"	2 1/4"	2 7/16"
GG	1"	1"	1 1/2"	1"
HH	1 1/16"	1 1/4"	1 7/16"	1 1/2"
JJ	7 1/2"	5 1/16"	6"	7"
KK	1 1/2"	1 1/2"	5"	5"
LL	12"	14"	30"	10"
MM	13 5/8"	15 3/8"	32 1/2"	38 1/2"

REVISION	DATE	DESCRIPTION	BY

A.M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN E.A.K. B.D.
TRACED E.A.K.
CHECKED B.D.
SUBMITTED: A.M. KINNEY, INC.

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION

SIPHON BREAKER

APPROVED: LT. COL. CORPS OF ENGINEERS, ACTING DISTRICT ENGINEER, LOUISVILLE DISTRICT
DATE: SEPT. 1948

APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

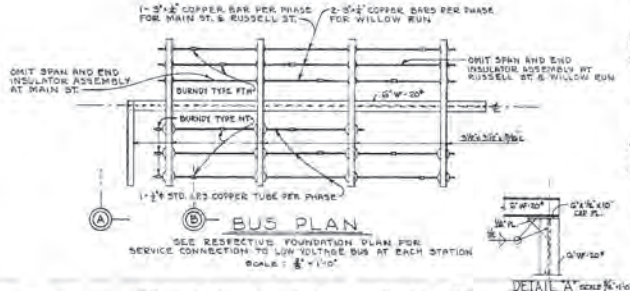
SCALE: AS NOTED | SHEET 18 OF 46 SHEETS

DRAWING NUMBER
471 - 12.2/18

AS BUILT

CORPS OF ENGINEERS

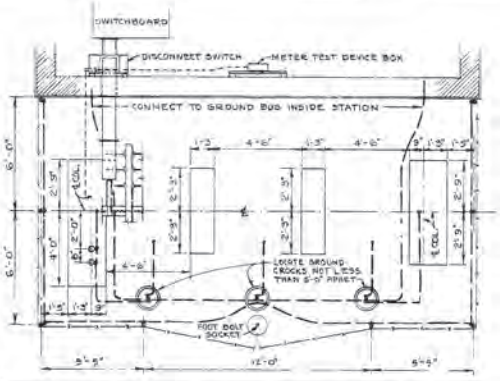
U.S. ARMY



BUS PLAN

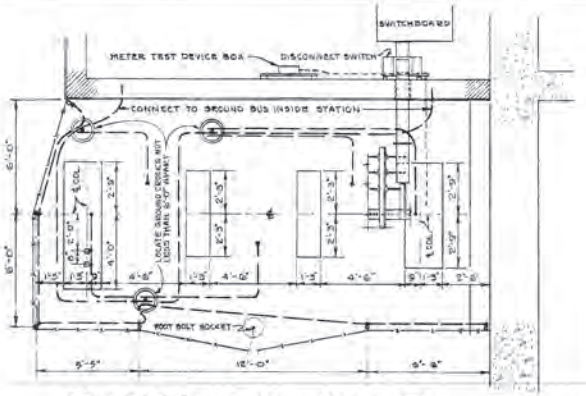
SEE RESPECTIVE FOUNDATION PLAN FOR SERVICE CONNECTION TO LOW VOLTAGE BUS AT EACH STATION

SCALE: ⅜"=1'-0"



FOUNDATION PLAN - RUSSELL ST.

SCALE: ⅜"=1'-0"

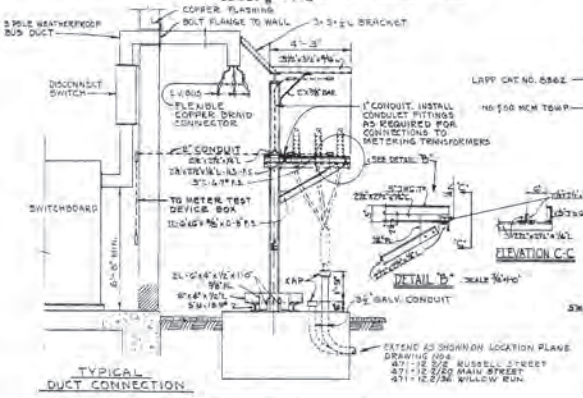


FOUNDATION PLAN - MAIN ST.

SCALE: ⅜"=1'-0"

ELEVATION - H.V. SIDE

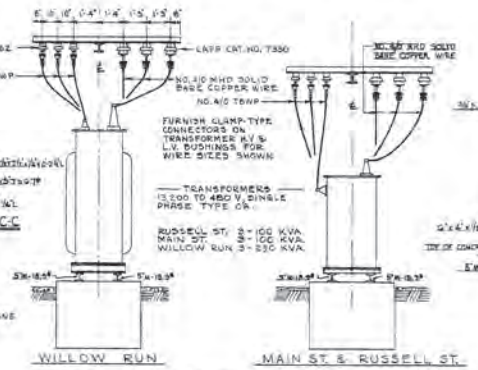
SCALE: ⅜"=1'-0"



TYPICAL DUCT CONNECTION

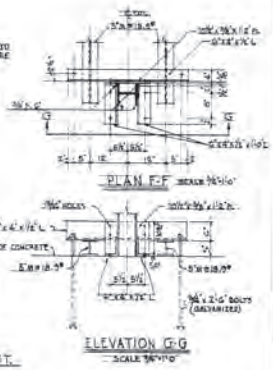
SECTION A-A

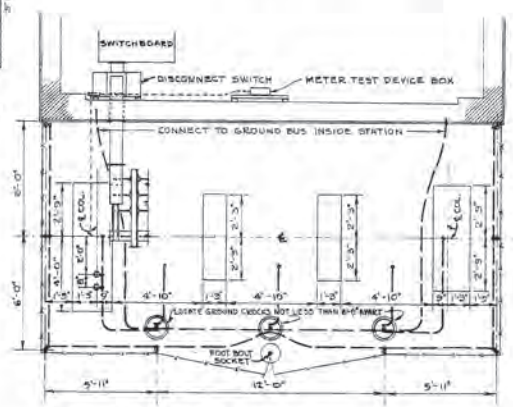
SCALE: ⅜"=1'-0"



SECTION B-B

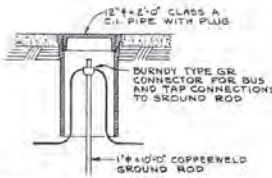
SCALE: ⅜"=1'-0"





FOUNDATION PLAN - WILLOW RUN

SCALE: ⅜"=1'-0"



GROUND CROCK DETAIL

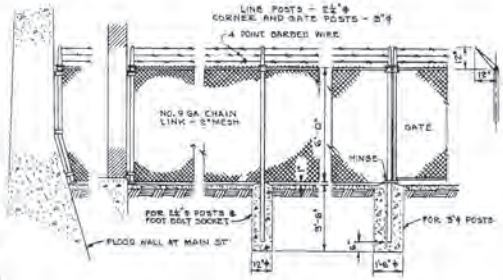
SCALE: 1"=1'-0"

GROUNDING NOTES

ALL GROUNDING CONDUCTORS, SOFT DRAWN STRANDED COPPER, MAIN BUS, NO. 4/0; TAPS TO TRANSFORMER CASES AND STRUCTURAL STEEL, NO. 2/0; FENCE GROUND, NO. 2.

GROUND CONNECTIONS INDICATED THUS ⊕ TO BE MADE WITH BURNDY, OR EQUAL, APPROVED CONNECTORS.

BOND GATE FRAMES TO ADJACENT POSTS WITH BURNDY TYPE BB FLEXIBLE COPPER BRAID AND TYPE GG CONNECTORS.



FENCE DETAIL

SCALE: ⅜"=1'-0"

GENERAL NOTES

PROVIDE 3-INCH THICK CRUSHED LIMESTONE BLANKET OVER AREA WITHIN AND EXTENDING 3'-0" BEYOND FENCE ON ALL OPEN SIDES.

STRUCTURAL CONNECTIONS SHALL BE WELDED OR RIVETED IN ACCORDANCE WITH STANDARDS OF A.I.S.C.

CONNECTORS AND INSULATORS SHALL BE SIMILAR AND EQUAL TO TYPE AND MANUFACTURE NOTED HEREON.

SCREWS, BOLTS, NUTS, LOCKWASHERS, ETC. USED TO ATTACH ITEMS OF ELECTRICAL EQUIPMENT SHALL BE "EVERDUR" OR EQUAL.

GRAPHIC SCALES

REVISION	DATE	DESCRIPTION	BY
1	4 APR 50	Note added Section A-A	WEK

A.M. KINNEY, INC.
CONSULTING ENGINEERS - ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN L.P.K. E.A.K.
TRACED E.A.K.
CHECKED L.P.K. R.D.
SUBMITTED: A.M. KINNEY, INC.

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
TRANSFORMER SUB-STATIONS

APPROVED: DATE SEPT. 1948
LT. COL., CORPS OF ENGINEERS, ACTING DISTRICT ENGINEER, LOUISVILLE DISTRICT

APPROVING RECOMMENDED
CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

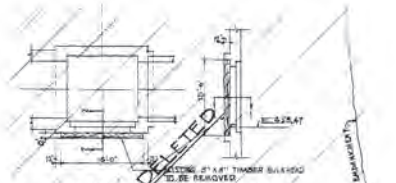
SCALE: AS NOTED SHEET 8 OF 46 SHEETS

DRAWING NUMBER
471-12.2/19

AS BUILT

CORPS OF ENGINEERS

U.S. ARMY



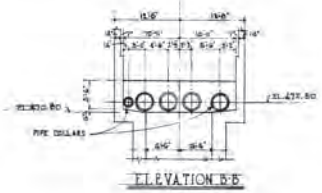
PLAN 1-1 SECTION 2-2

EXISTING CONDITIONS AT MANHOLE NO. 3

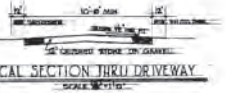
SCALE 1"=10'-0"

SITE PLAN

SCALE 1"=100'

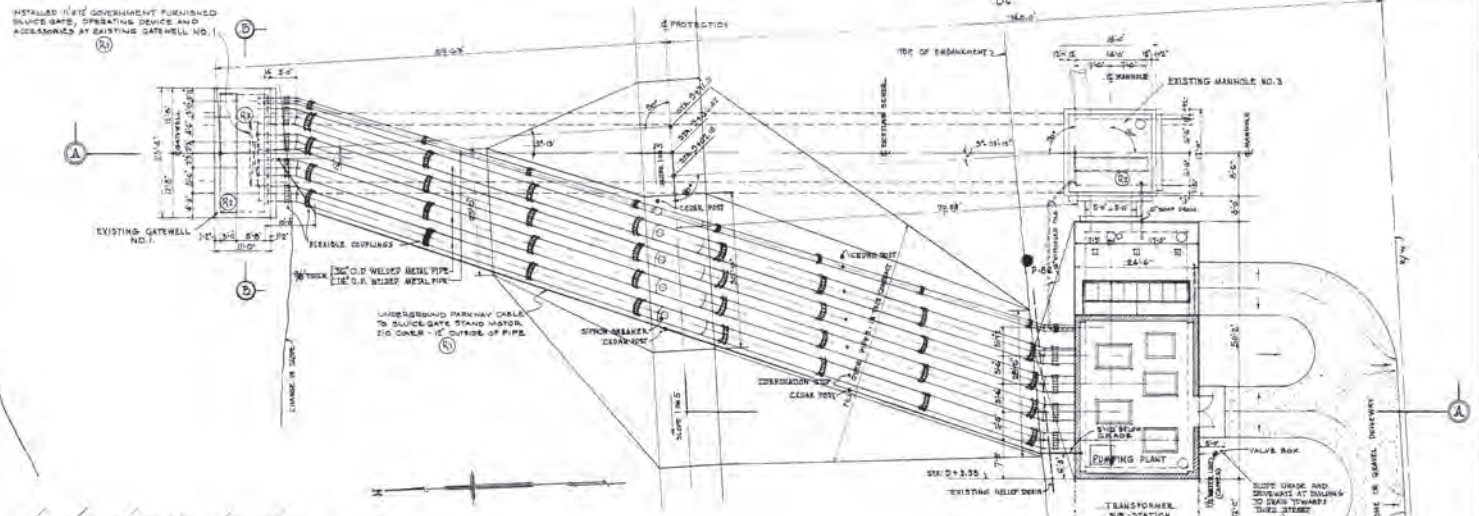


ELEVATION B-B



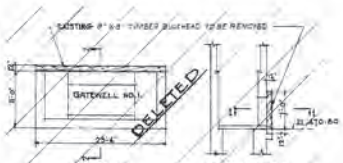
TYPICAL SECTION THRU DRIVEWAY

SCALE 1"=10'



LOCATION PLAN

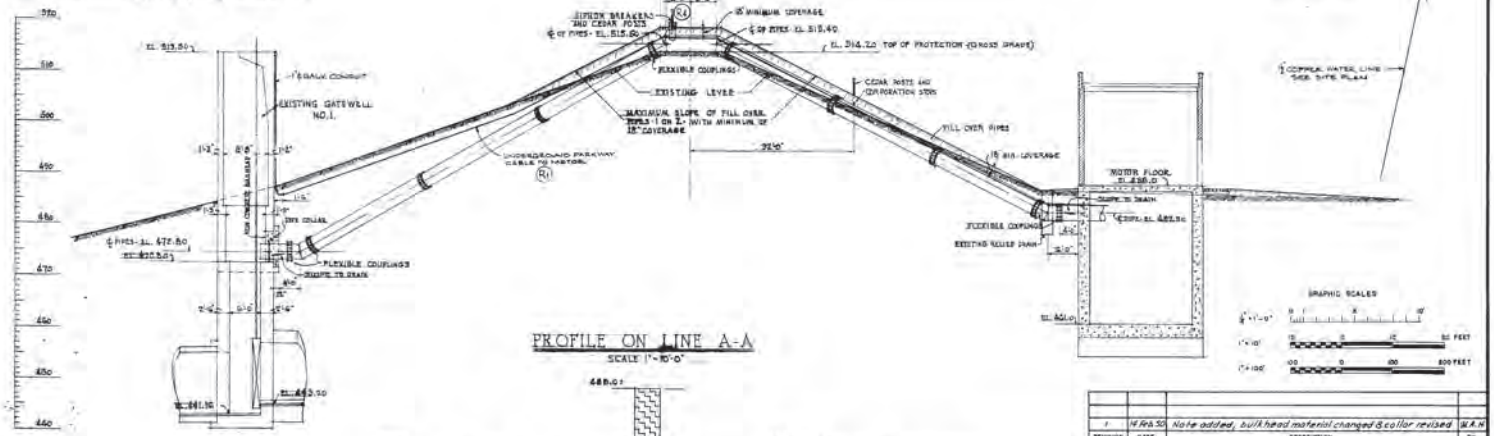
SCALE 1"=10'-0"



PLAN 1-1 SECTION 2-2

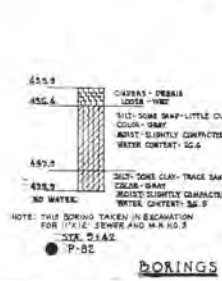
EXISTING CONDITIONS AT OPENING FOR DISCHARGE PIPES - GATEWELL NO. 1

SCALE 1"=10'-0"



PROFILE ON LINE A-A

SCALE 1"=10'-0"



BORINGS

NOTES:

1. R/W = RIGHT OF WAY
2. C/E = CONSTRUCTION EASEMENT
3. FOR DETAIL OF SIPHON BREAKERS ON DISCHARGE PIPES SEE SHEET 16.
4. FOR DETAILS OF TRANSFORMER SUB-STATION SEE SHEET 19.
5. SEE SHEET 16 FOR CORROSION STOPS.
6. CEDAR POSTS SHALL BE 12" DIAMETER BY 6'10" LONG, 2'6" IN GROUND ADJACENT TO AND IN LINE WITH CORROSION STOPS AND SIPHON BREAKERS.
7. RESTORE RELIEF DRAIN AT TOE OF EMBANKMENT WHERE DISTURBED BY INSTALLATION OF DISCHARGE PIPING.

(24) REPLACING THE COTTER KEYS ON THE STEM OF POPPET VALVES AND WELDING WASHER ON END OF STEM

(23) SLUICE GATE INSTALLED C.O. NO. 1

(22) HINGES REPLACED C.O. NO. 3

(21) PARKWAY CABLE ADDED C.O. NO. 1

GRAPHIC SCALES

1"=10' 0 10 20 30 FEET

1"=100' 0 100 200 FEET

REVISION	DATE	DESCRIPTION	BY
1	14 Feb 50	Note added, bulkhead material changed & collar revised	W.R.H.

A. M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

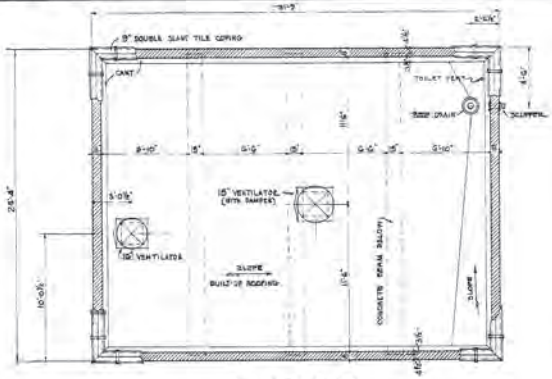
OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
LOCATION PLAN AND PLOTTING

DRAWN: B.E.R. C.C.
TRACED: C.C.
CHECKED: C.C.
SUBMITTED: A.M. KINNEY, INC.
APPROVED: DATE: SEPT 1946
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT
U.S. CORPS OF ENGINEERS, FIFTH DISTRICT ENGINEER, LOUISVILLE DISTRICT
SCALES AS NOTED SHEET 34 OF 46 SHEETS
DRAWING NUMBER 471-12.2/36

AS BUILT

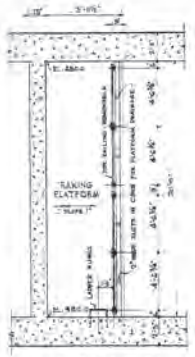
CORPS OF ENGINEERS

U.S. ARMY



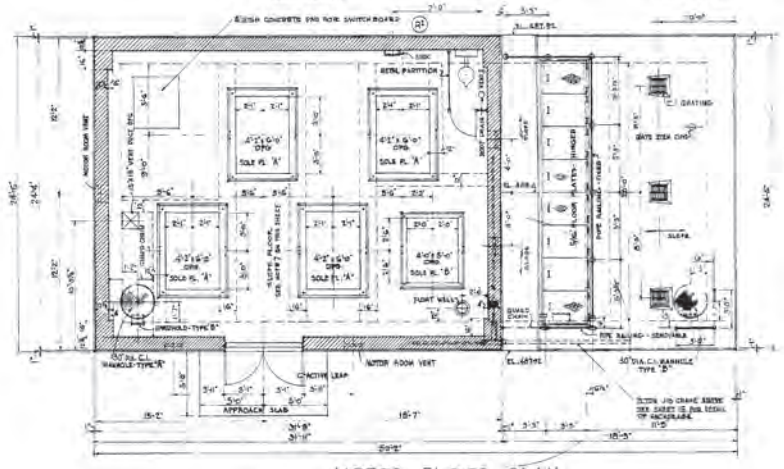
ROOF PLAN

SCALE 3/16"=1'-0"



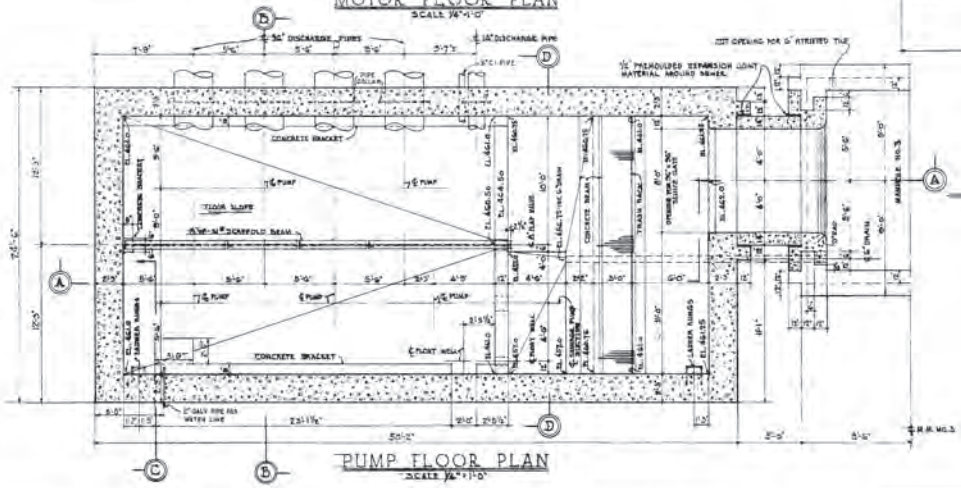
RAKING PLATFORM PLAN

SCALE 1/8"=1'-0"



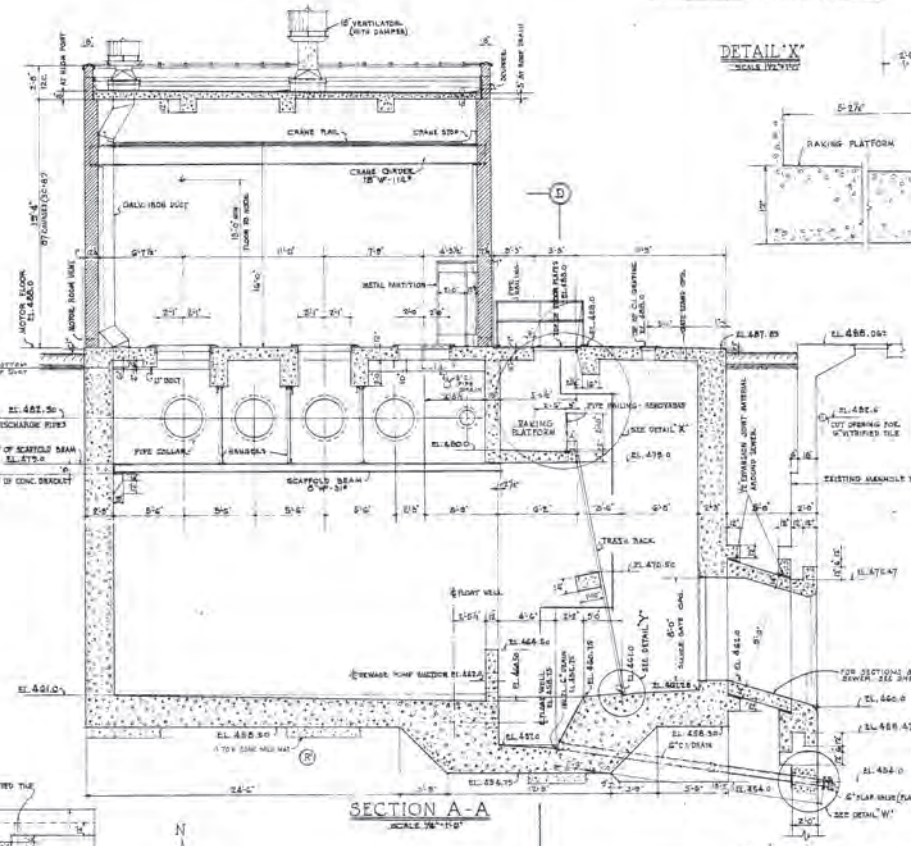
MOTOR FLOOR PLAN

SCALE 1/4"=1'-0"



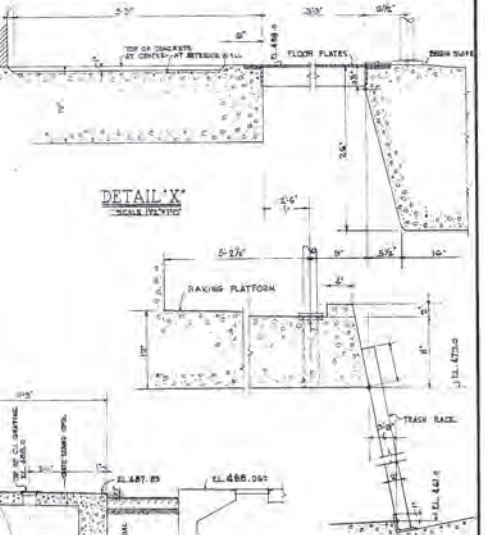
PUMP FLOOR PLAN

SCALE 1/4"=1'-0"



SECTION A-A

SCALE 1/4"=1'-0"

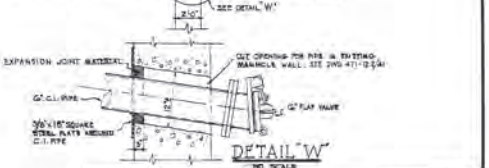


DETAIL 'X'

SCALE 1/2"=1'-0"

DETAIL 'Y'

SCALE 1/2"=1'-0"



DETAIL 'W'

NO SCALE

NOTES:

1. FOR LOCATION PLAN AND PROFILE - SEE SHEET 34.
2. FOR SOUTH ELEVATION AND SECTIONS B-B, C-C, AND D-D - SEE SHEET 38. FOR NORTH, EAST AND WEST ELEVATIONS - SEE SHEET 39.
4. FOR WALL SECTIONS, ENTRANCE DOORS, MOTOR ROOM VENTS, HANDHOLDS, LADDER RUNGS, PIPE COLLARS, J" BOLTS, PIPE RAILING, ROOF VENTILATOR CURBS, ROOF DRAIN AND SCUPPER, MANHOLE AND CHAIN GUARDS, - SEE SHEET 11.
5. FOR DETAILS OF TRASH RACK AND CRANE BEAMS - SEE SHEET 13. FOR DETAILS OF FLOOR PLATES AND ANGLE FRAMES - SEE SHEET 14. FOR DETAILS OF SOLE PLATES AND SCAFFOLD BEAMS - SEE SHEET 15.
6. FOR DETAILS OF FLOAT WELL BAFFLE, PORTABLE ENCLOSURE, AND HAND RAILS - SEE SHEET 12.
7. ELEVATION 488.0 IS ELEVATION OF MOTOR FLOOR AT WALLS AND AROUND PUMP BASE PLATES AND SWITCHBOARD PAD. SLOPE SURFACE FROM ELEV. 488.0 TO DRAIN TO ELEV. 480.5 FT. AT SILL OF DOUBLE DOOR.
8. SEE SHEET 15 FOR DETAIL OF JIB CRANE ANCHORS.

(R) SINK ADDED, ADD. NO. 1.
(R) MUD MAT ADDED "FIELD"

GRAPHIC SCALES

REVISION	DATE	DESCRIPTION	BY
	14 Feb 38	Type A-8-8 W.H.3 revised & relocated, collar change, handrail and note added, dimensions changed.	W.H.K.

A.M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

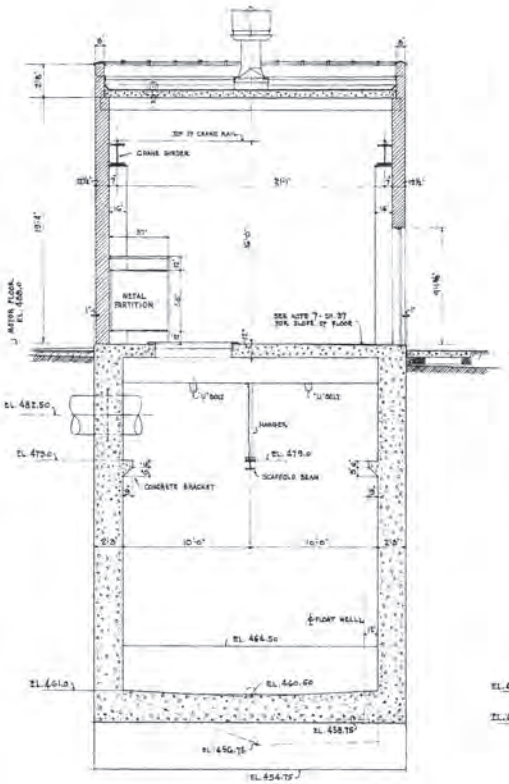
OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
MASONRY DETAILS
PLANS AND SECTION

DRAWN: H.D., E.A.R.
TRACED: E.A.R.
CHECKED: H.D.
SUBMITTED: A.M. KINNEY, INC.
APPROVED: DATE: SEPT. 1940
LT. COL., CORPS OF ENGINEERS, ACTING DISTRICT ENGINEER, LOUISVILLE DISTRICT
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT
SCALE: AS NOTED SHEET 37 OF 46 SHEETS
DRAWING NUMBER 471-12.2/37

AS BUILT

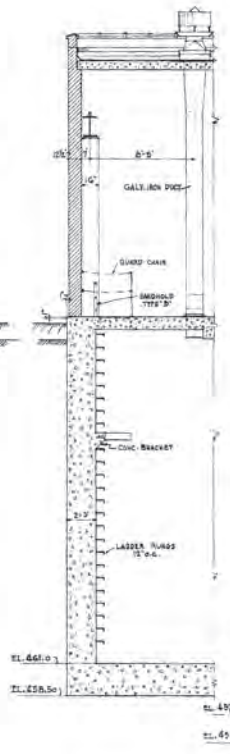
CORPS OF ENGINEERS

U.S.ARMY



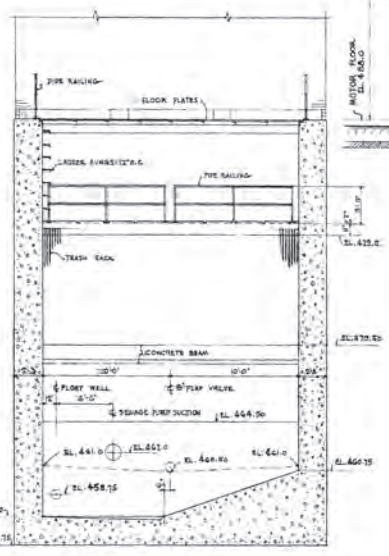
SECTION B-B

SCALE 1/4"=1'-0"



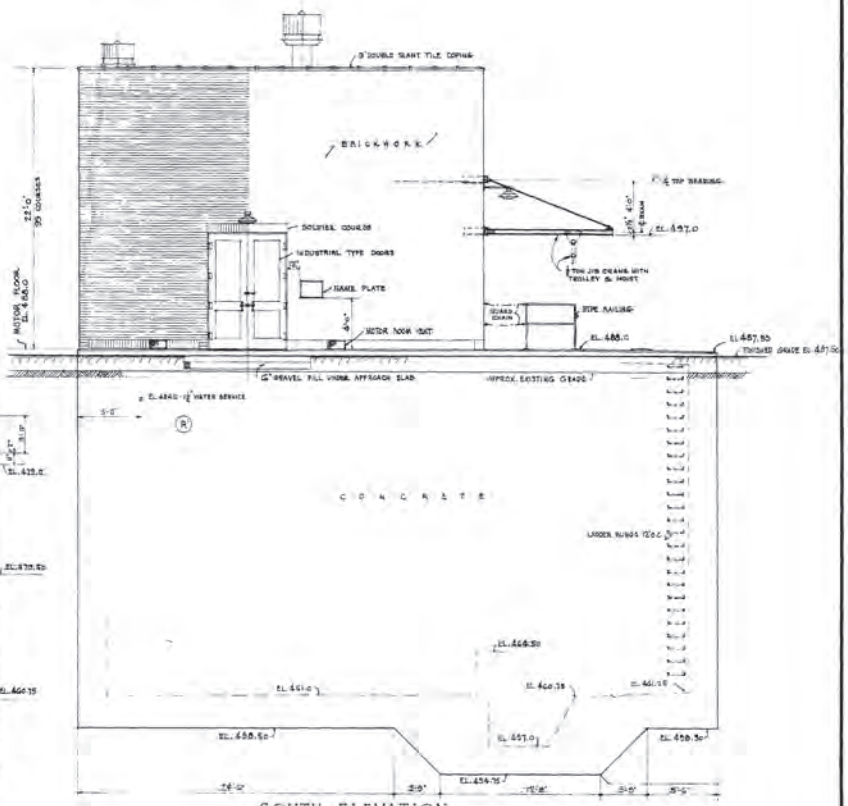
SECTION C-C

SCALE 1/4"=1'-0"



SECTION D-D

SCALE 1/4"=1'-0"



SOUTH ELEVATION

SCALE 1/4"=1'-0"

(R) WATER SERVICE ADDED.

REVISION	DATE	DESCRIPTION	BY
1	18 Feb 50	Duct revised, Landing and crane added	WAH

A. M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN: E.A.R. R.E.
TRACED: E.A.R.
CHECKED: E.C.
SUBMITTED: A.M. KINNEY, INC.
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
MASONRY DETAILS
SECTIONS AND ELEVATION

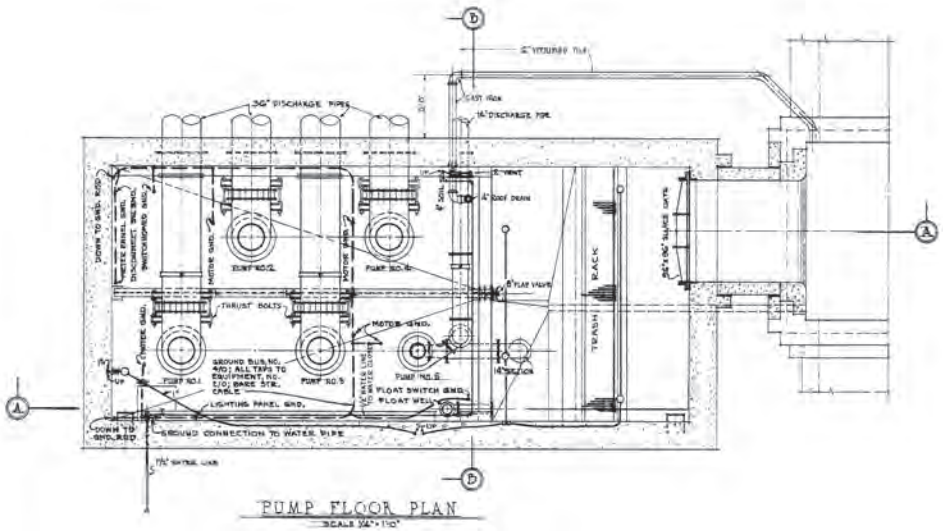
APPROVED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT
DATE: SEPT 1948
SCALE: 1/4"=1'-0" | SHEET 38 OF 48 SHEETS
DRAWING NUMBER: 471-122/38

AS BUILT

116

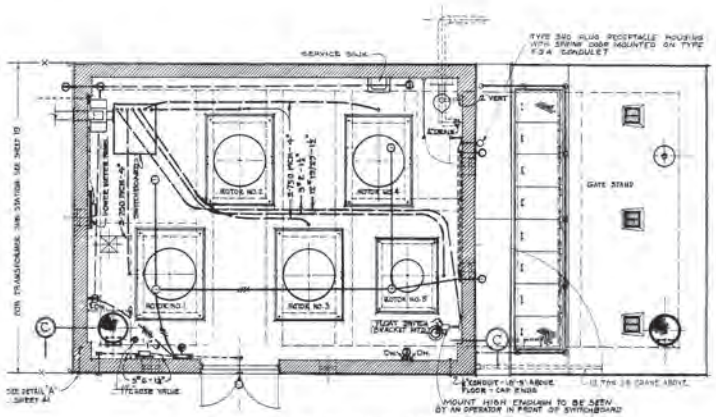
CORPS OF ENGINEERS

U. S. ARMY



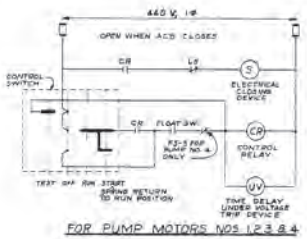
PUMP FLOOR PLAN

SCALE 1/4"=1'0"



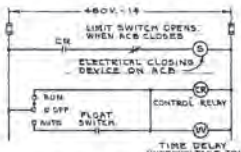
MOTOR FLOOR PLAN

SCALE 1/2"=1'0"



FOR PUMP MOTORS NOS 1 2 3 & 4

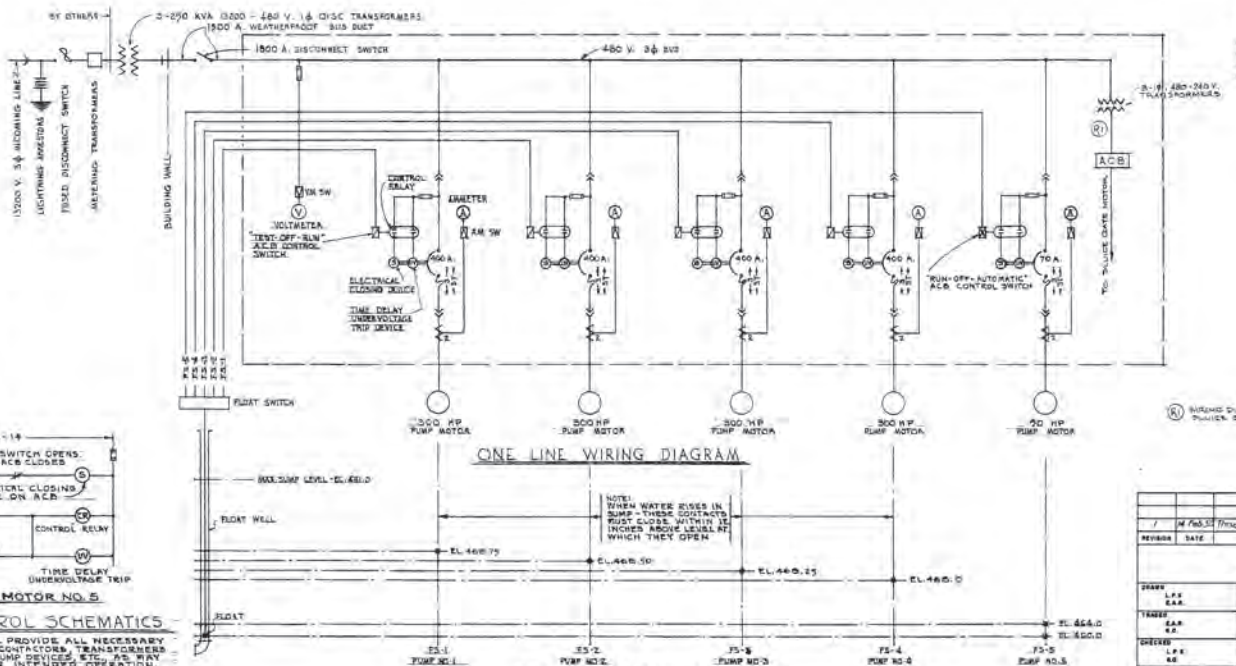
CONTROL SWITCH



FOR PUMP MOTOR NO. 5

PUMP CONTROL SCHEMATICS

CONTRACTOR SHALL PROVIDE ALL NECESSARY AUXILIARY RELAYS, CONTACTORS, TRANSFORMERS RECTIFIERS, ANTI-PUMP DEVICES, ETC. AS MAY BE REQUIRED FOR INTENDED OPERATION.



ONE LINE WIRING DIAGRAM

PUMP CONTROL DIAGRAM

X LEVEL AT WHICH FLOAT SWITCH CONTACTS CLOSE WITH RISING WATER SURFACE IN SUMP
O LEVEL AT WHICH FLOAT SWITCH CONTACTS OPEN WITH FALLING WATER SURFACE IN SUMP

LEGEND

- INCANDESCENT LIGHT OUTLET.
- RECEPTACLE OUTLET.
- SPECIAL OUTLET, 3 WIRE, POLARIZED.
- CONDUIT CONCEALED IN CEILING OR WALL.
- CONDUIT UNDER FLOOR.
- EXPOSED CONDUIT.
- INDICATES NUMBER OF NO.12 CONDUCTORS (3 SHOWN) IN LIGHTING CIRCUIT CONDUITS. CONDUITS NOT MARKED CONTAIN TWO CONDUCTORS.

(R) WIRING DIAGRAM REVISED ADDING WIRING FOR POWER GATE MOTOR, C.O. NO. 1

GRAPHIC SCALE

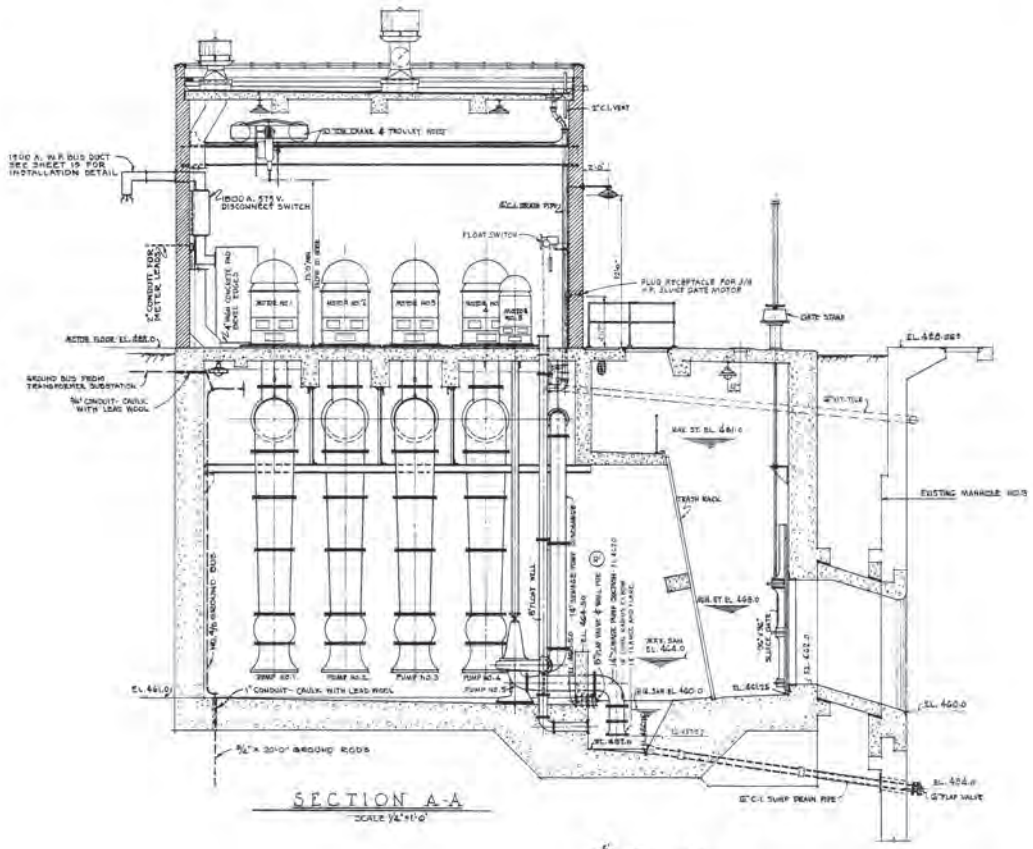
REVISION	DATE	DESCRIPTION	BY
1	14 Feb 50	Thrust bolts added, wiring & wiring diagram revised.	H.A.R.

A. N. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
MECHANICAL EQUIPMENT
PLANS

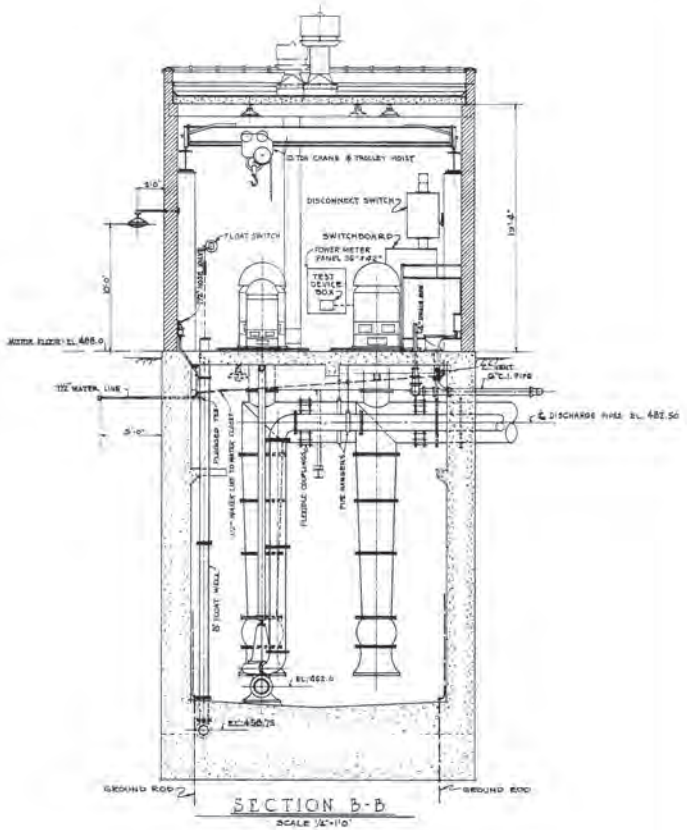
DRAWN: L.P.K. E.A.R.
TRACED: E.A.R. H.R.
CHECKED: L.P.K.
SUBMITTED: A.N. KINNEY, INC.
APPROVED: SEPT. 1949
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT
SCALE: AS NOTED | SHEET 40 OF 46 SHEETS
DRAWING NUMBER 471-122/40

AS BUILT



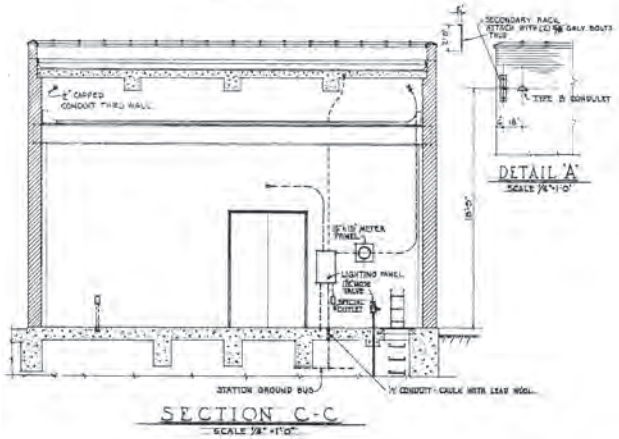
SECTION A-A

SCALE 1/4"=1'-0"



SECTION B-B

SCALE 1/4"=1'-0"

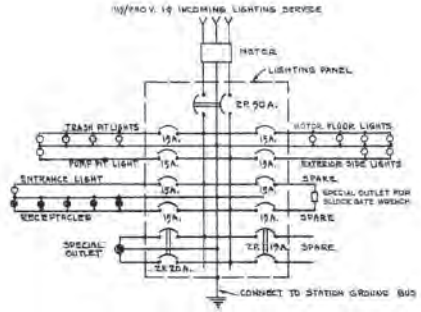


DETAIL 'A'

SCALE 1/4"=1'-0"

SECTION C-C

SCALE 1/4"=1'-0"



LIGHTING PANEL WIRING DIAGRAM

NOTES

1. ALL LIGHTING CIRCUIT WIRING NO.12 S/S UNLESS OTHERWISE INDICATED.
2. MINIMUM SIZE CONDUIT - 3/4 INCH.
3. FURNISH 500 WATT LAMPS FOR MOTOR FLOOR FIXTURES, 200 WATT LAMPS FOR ALL OTHERS.

(K) FLAP GATE FURNISHED BY GOV'T. (C.O. NO. 8)

GRAPHIC SCALE

1"=10'-0" 0 5' 10' 20'

REVISION	DATE	DESCRIPTION	BY
1	16 Feb 50	Float switch relocated Platform and plug receptacle added duct revised	WAK

A. M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN: E.A.B., L.P.K.
TRACED: E.A.B.
CHECKED: L.P.K., E.G.
SUBMITTED: A.M. KINNEY, INC.

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
MECHANICAL EQUIPMENT
SECTIONS

APPROVED: DATE: SEPT. 1949
CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

APPROVED, RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

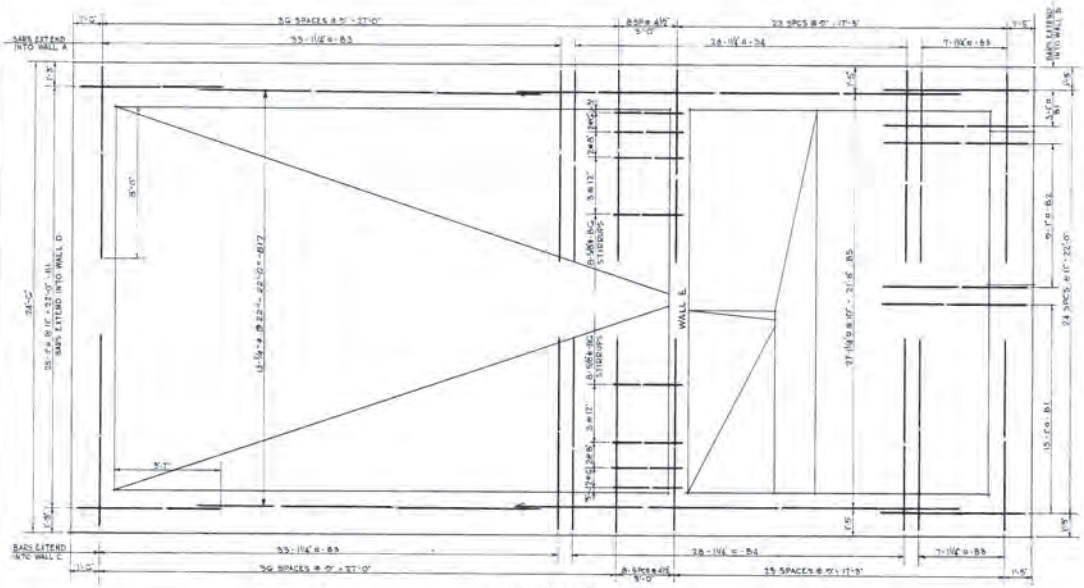
SCALE: AS NOTED SHEET 41 OF 46 SHEETS

DRAWING NUMBER
471-122/41

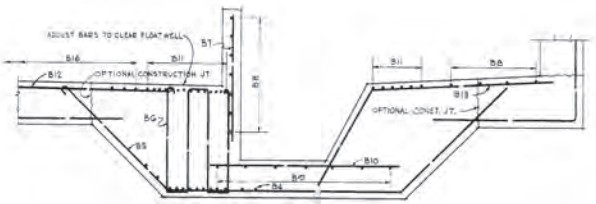
AS BUILT

CORPS OF ENGINEERS

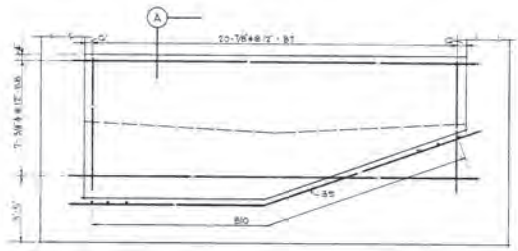
U. S. ARMY



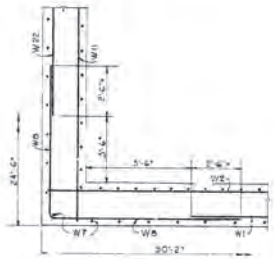
BASE SLAB
BOTTOM REINFORCING
SCALE: 3/8"=1'-0"



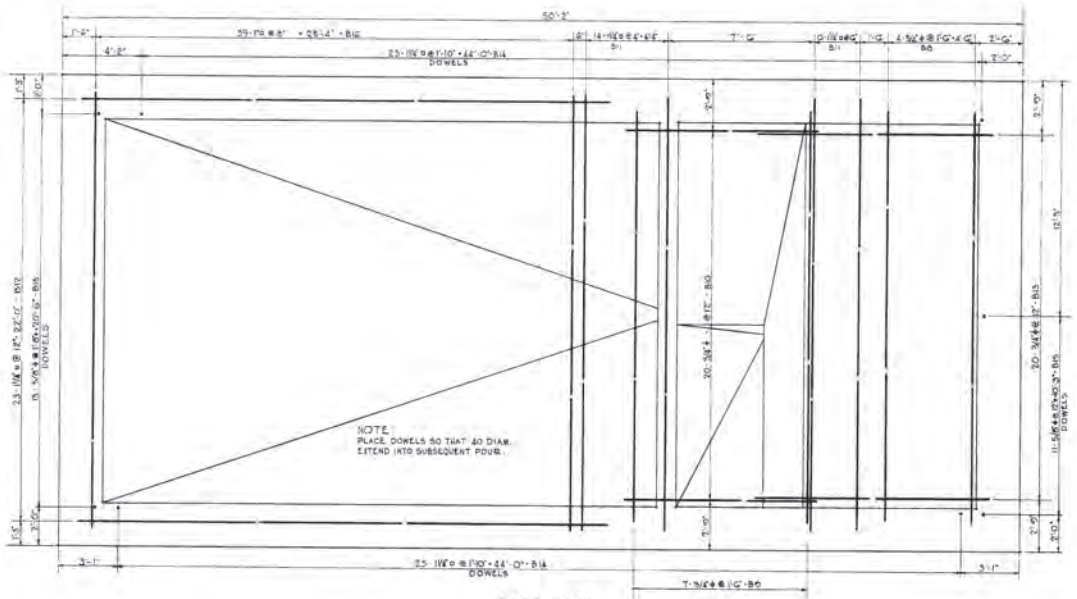
SECTION A
SCALE: 3/8"=1'-0"



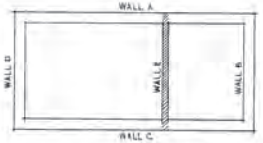
ELEVATION WALL E
LOOKING WEST
SCALE: 3/8"=1'-0"



PLAN SECTION OF TYPICAL CORNER
SCALE: 3/8"=1'-0"



BASE SLAB
TOP REINFORCING
SCALE: 3/8"=1'-0"



KEY PLAN OF WALLS

GRAPHIC SCALE
3/8"=1'-0"

REVISION	DATE	DESCRIPTION	BY
1	4 Feb 50	Reinforcing added	W.A.H.

A. M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO.

DRAWN: R.D.M.C.
TRACED: E.A.R.
CHECKED: J.H. H.S.R.

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
REINFORCEMENT DETAILS - BASE SLAB

SUBMITTED: A. M. KINNEY, INC.
APPROVED: DATE: SEPT. 1948
LEGAL, CORPS OF ENGINEERS, ACTING DISTRICT ENGINEER, LOUISVILLE DISTRICT
APPROVAL RECOMMENDED:
CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

SCALE: AS NOTED | SHEET 42 OF 46 SHEETS

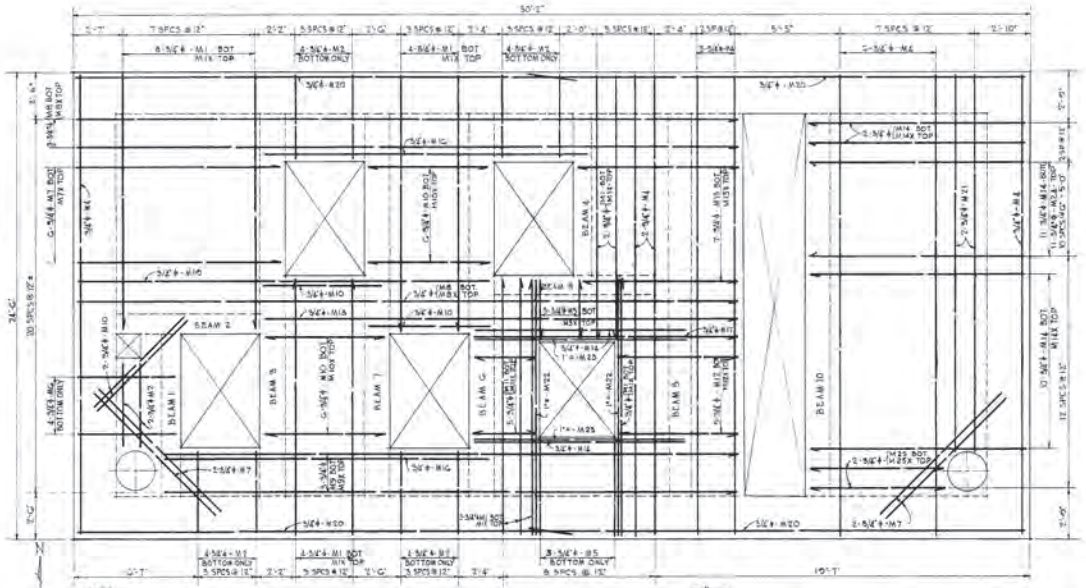
DRAWING NUMBER
471-12.2/42

AS BUILT

120

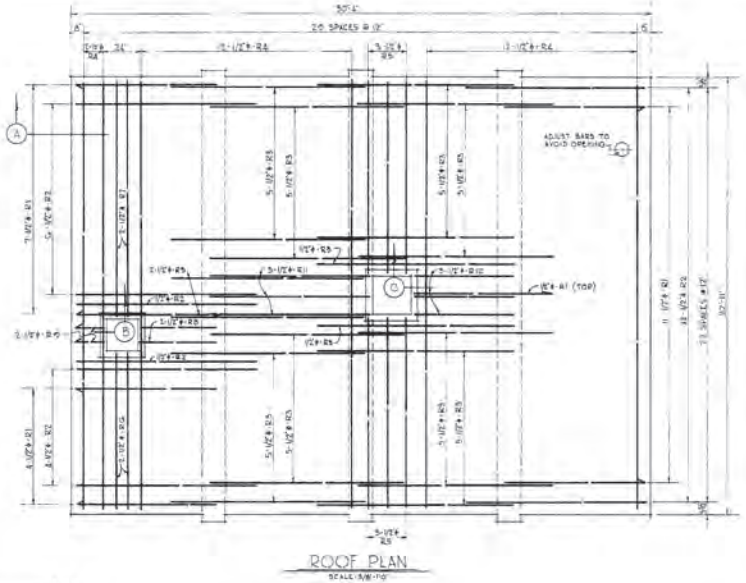
CORPS OF ENGINEERS

U.S. ARMY

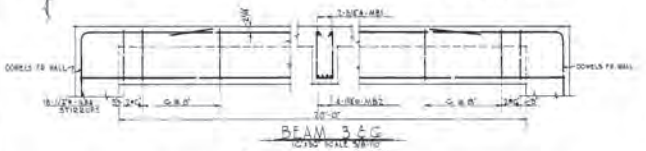


NOTE:
SAME REINFORCEMENT TOP & BOTTOM
EXCEPT AS NOTED.
PLACEMENT: HIGH BARS RUN EAST & WEST
LOW BARS RUN NORTH & SOUTH

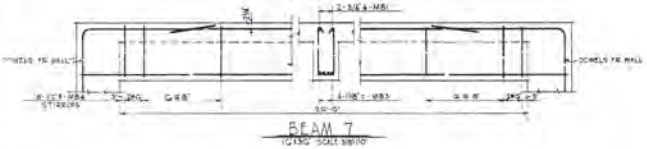
MOTOR FLOOR SLAB
SCALE 3/8"=1'-0"



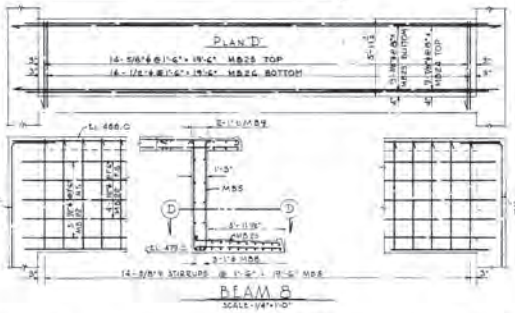
ROOF PLAN
SCALE 3/8"=1'-0"



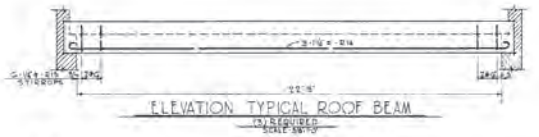
BEAM 3 & 6
12"x30" SCALE 3/8"=1'-0"



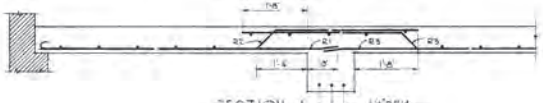
BEAM 7
12"x30" SCALE 3/8"=1'-0"



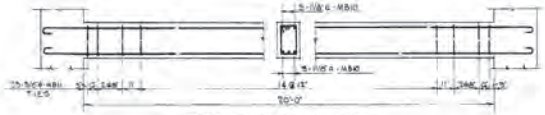
BEAM 8
SCALE 1/4"=1'-0"



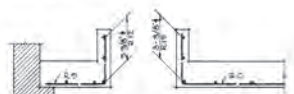
ELEVATION TYPICAL ROOF BEAM
(12 REQUIRED)
SCALE 3/8"=1'-0"



SECTION A
SCALE 3/4"=1'-0"

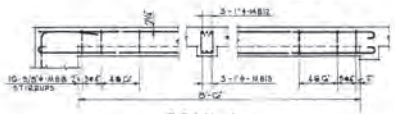


TRASH RACK SUPPORT
14"x22" SCALE 3/8"=1'-0"

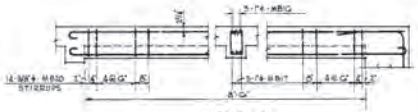


SECTION B
SCALE 3/4"=1'-0"

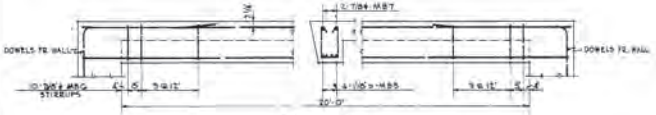
SECTION C
SCALE 3/4"=1'-0"



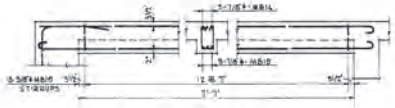
BEAM 1
12"x30" SCALE 3/8"=1'-0"



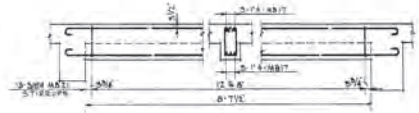
BEAM 4
12"x30" SCALE 3/8"=1'-0"



BEAM 10
12"x30" SCALE 3/8"=1'-0"



BEAM 2
12"x30" SCALE 3/8"=1'-0"



BEAM 5
12"x22" SCALE 3/8"=1'-0"

REVISION	DATE	DESCRIPTION	BY

A. M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN: R.B.N.G.
TRACED: K.A.R.
CHECKED: J.W. H.E.R.
SUBMITTED: A. M. KINNEY, INC.
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
REINFORCEMENT DETAILS
MOTOR FLOOR AND ROOF SLAB

APPROVED: DATE: SEPT. 1948
U.S. CORPS OF ENGINEERS, OHIO RIVER DIVISION ENGINEER, LOUISVILLE DISTRICT

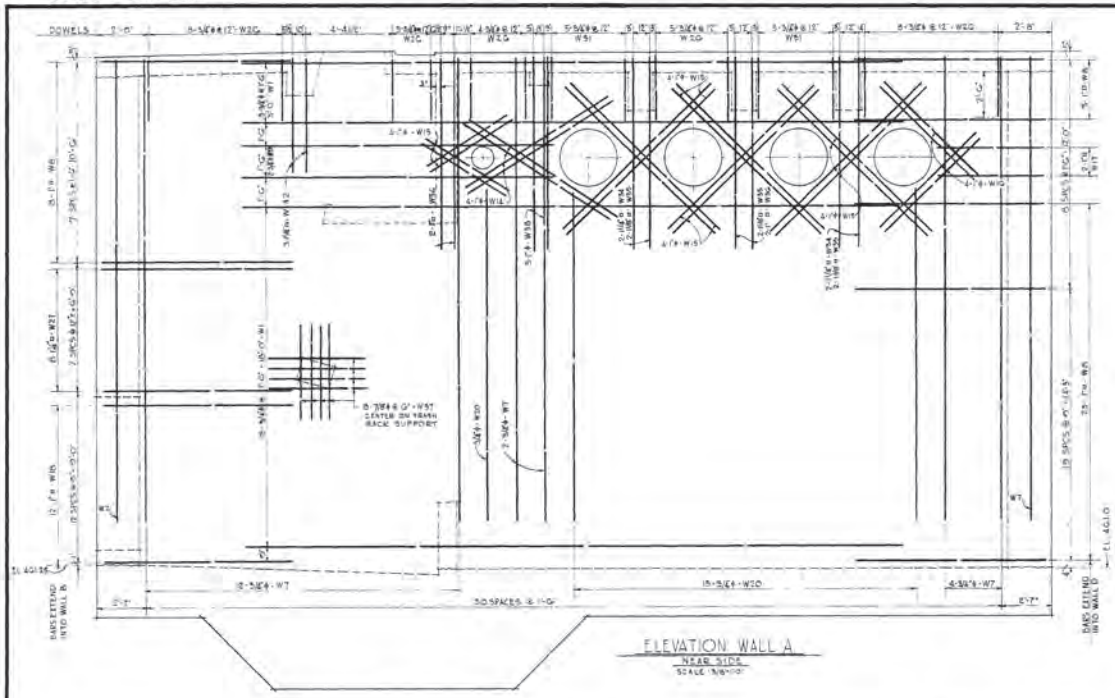
SCALE: AS NOTED | SHEET 43 OF 46 SHEETS
DRAWING NUMBER
471-122/43

AS BUILT

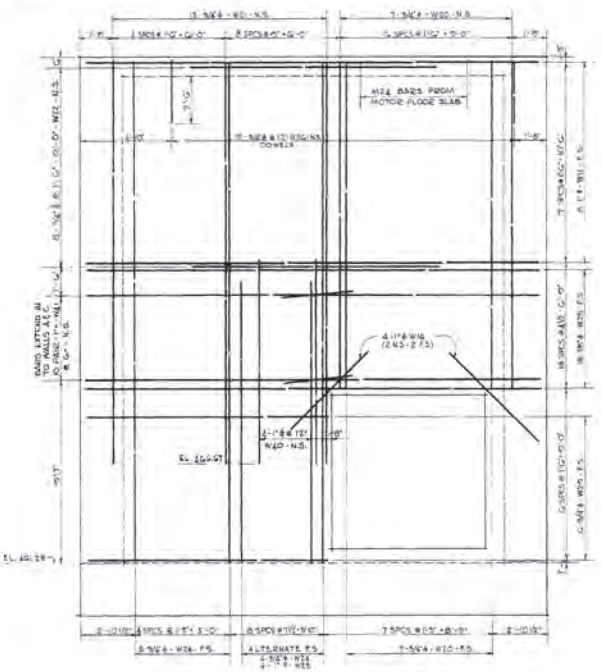
121

CORPS OF ENGINEERS

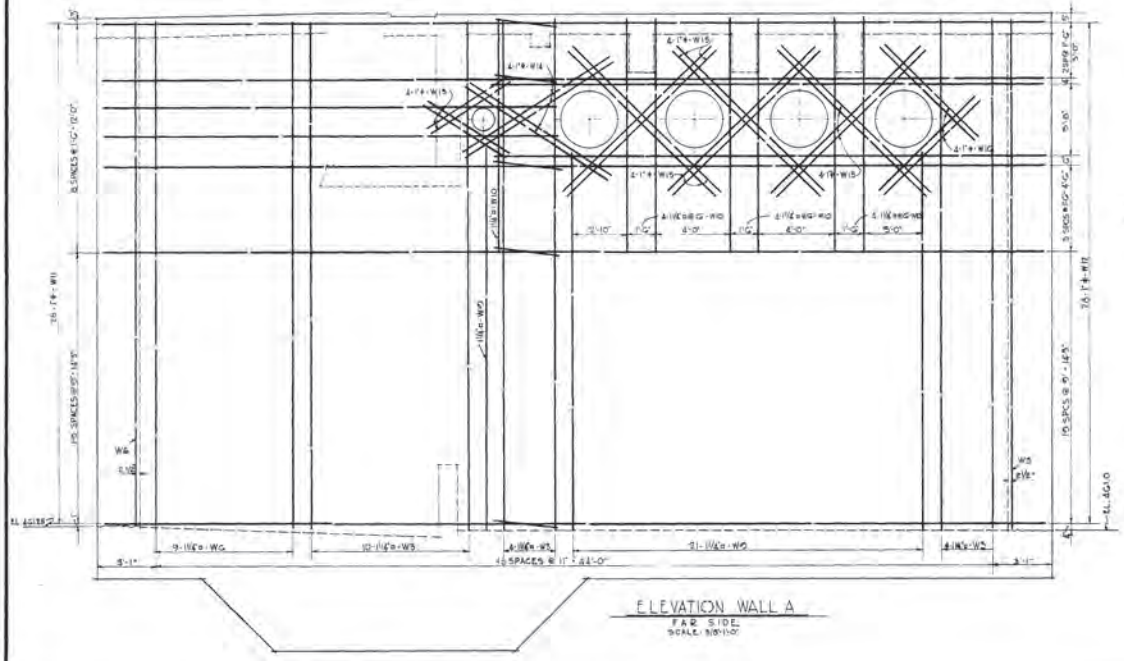
U.S. ARMY



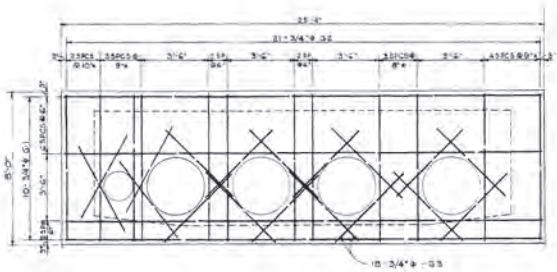
ELEVATION WALL A
NEAR SIDE
SCALE 3/8"=1'-0"



ELEVATION - WALL B
SCALE 3/8"=1'-0"



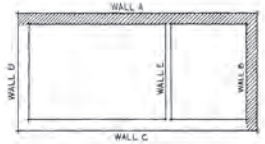
ELEVATION WALL A
FAR SIDE
SCALE 3/8"=1'-0"



ELEVATION BULKHEAD
FOR EXISTING GATEWELL NO. 1
SCALE - 3/8"=1'-0"

SECTION

GENERAL NOTES FOR WALLS
VERTICAL WALL STEEL SHALL BE 2½" CLEAR FROM WALL FACE.
HORIZONTAL WALL STEEL SHALL BE ON INNER SIDE OF VERTICAL STEEL.



KEY PLAN OF WALLS

REVISION	DATE	DESCRIPTION	BY
1	4 Feb 50	Reinforcing Size and Spacing changed. ELEV. WALL A	W.A.H.

A. M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN: R.B.M.G.
TRACED: E.A.K.
CHECKED: J.R. K.E.B.
SUBMITTED: A.M. KINNEY, INC.

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
REINFORCEMENT DETAILS - WALLS

APPROVED: [signature] DATE: SEPT. 1948
COL. CORPS OF ENGINEERS, OHIO DISTRICT ENGINEER, LOUISVILLE DISTRICT

APPROVAL RECOMMENDED: [signature]
CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

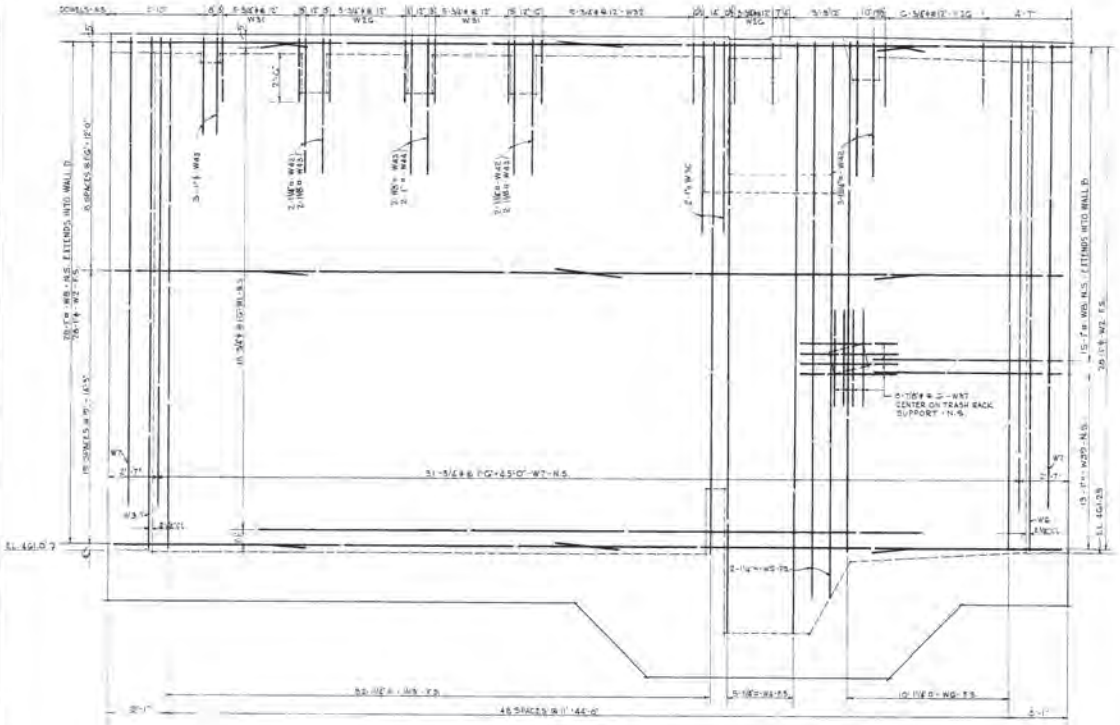
SCALE: AS NOTED SHEET 44 OF 46 SHEETS

DRAWING NUMBER
471-12.2/44

AS BUILT

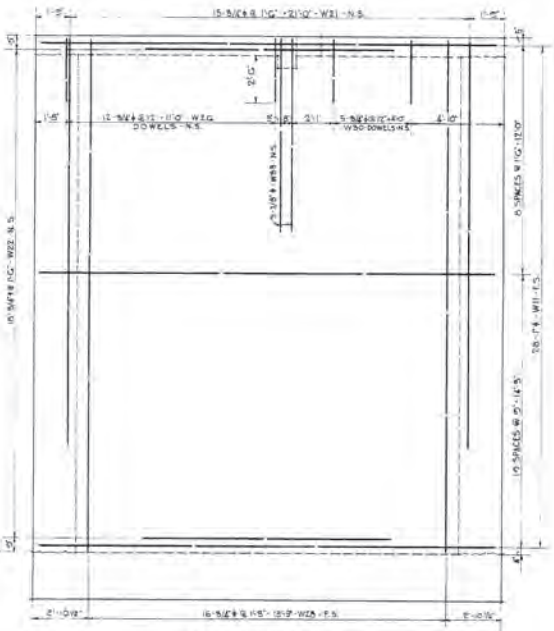
CORPS OF ENGINEERS

U.S. ARMY



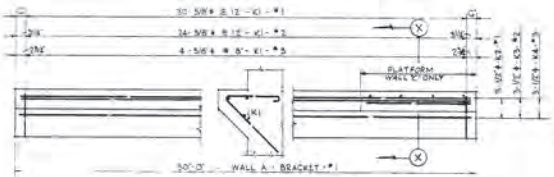
ELEVATION WALL C

SCALE - 3/8"=1'0"



ELEVATION WALL D

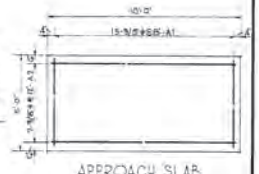
SCALE - 3/8"=1'0"



ELEVATION - WALL BRACKETS

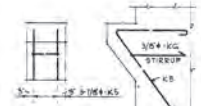
SCALE - 3/4"=1'0"

NOTE: FOR SECTION X-X SEE SHEET 8.



APPROACH SLAB

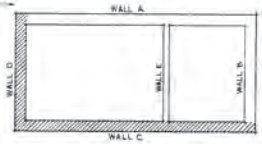
SCALE - 3/8"=1'0"



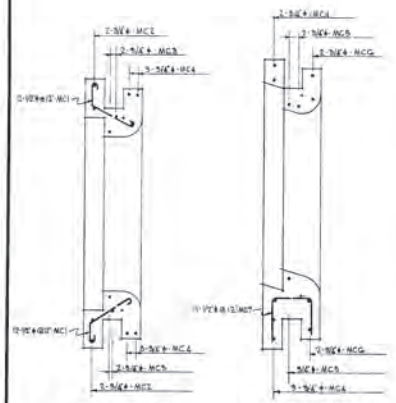
ELEVATION SECTION

WALL D BRACKET

SCALE - 3/4"=1'0"



KEY PLAN OF WALLS

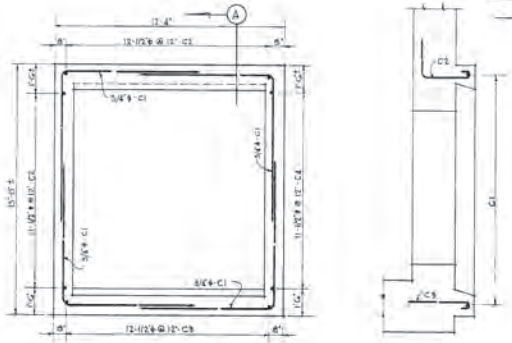


SECTIONAL PLAN SECTIONAL ELEVATION

MANHOLE NO. 3 - SEWER COLLAR

SCALE - 3/8"=1'0"

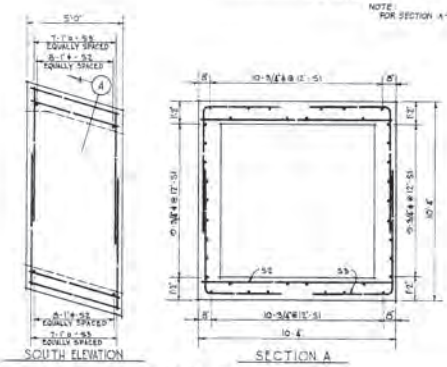
NOTE: BEND OR CUT EXISTING STEEL AS REQUIRED



ELEVATION SECTION A

PLANT SEWER COLLAR

SCALE - 3/8"=1'0"



SOUTH ELEVATION SECTION A

96" SEWER

SCALE - 3/8"=1'0"

REVISION	DATE	DESCRIPTION	BY
1	14 Feb 50	Section X-X shown, note added	WAH

A. M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN: H.B.M.C.
TRACED: E.A.P.
CHECKED: J.W. H.E.B.

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
REINFORCEMENT DETAILS - WALLS

SUBMITTED: A.M. KINNEY, INC.

APPROVED: DATE: SEPT. 1949
LT.COL., CORPS OF ENGINEERS, ACTING DISTRICT ENGINEER, LOUISVILLE DISTRICT

APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

SCALE: AS NOTED | SHEET 45 OF 46 SHEETS

DRAWING NUMBER
471-12.2/45

AS BUILT

123

CORPS OF ENGINEERS

U.S. ARMY

BAR	NO REQ'D	SIZE	LENGTH	BENDING DIAGRAM	WEIGHT EACH	TOTAL WEIGHT
				BASE SLAB		
B1	21	1" ▭	12'-9"	10'-2"	40.35	2474.4
B2	9	1" ▭	11'-7"	2'-11"	39.37	354.3
B3	80	1-1/4" ▭	17'-2"	7'-2"	51.22	7259.6
B4	56	1-1/4" ▭	21'-0"	10'-0"	11.57	6247.0
B5	27	1-1/4" ▭	28'-11"	10'-0"	153.63	4148.0
B6	16	3/8"ϕ	25'-5"	5'-3"	20.51	424.2
B7	20	7/8"ϕ	6'-8"	6'-8"	15.65	272.6
B8	11	3/4"ϕ	21'-4"	STRAIGHT	32.04	352.4
B9	7	3/4"ϕ	22'-0"	10'-3"	33.06	231.3
B10	20	3/4"ϕ	10'-0"	STRAIGHT	15.02	300.4
B11	20	1-1/4" ▭	22'-6"	"	110.38	2590.8
B12	23	1-1/4" ▭	27'-8"	"	141.01	3581.2
B13	20	3/4"ϕ	13'-6"	5'-6"	23.18	405.6
B14	50	1-1/2" ▭	7'-7"	5'-3"	20.27	2015.5
B15	24	5/8"ϕ	4'-10"	4'-3"	5.06	121.0
B16	39	1" ▭	22'-0"	STRAIGHT	74.80	2917.2
B17	13	3/4"ϕ	18'-0"	"	27.04	351.5
				MOTOR FLOOR SLAB		
M1	22	3/4"ϕ	13'-4"	STRAIGHT	20.02	440.4
M2	20	3/4"ϕ	2'-4"	"	9.50	190.0
M3	3	3/4"ϕ	3'-1"	"	6.65	19.9
M4	29	3/4"ϕ	24'-1"	"	36.17	940.4
M5	5	3/4"ϕ	4'-10"	"	7.25	36.3
M6	4	3/4"ϕ	5'-3"	"	7.89	31.6
M7	14	3/4"ϕ	10'-9"	"	16.15	226.1
M8	4	3/4"ϕ	34'-3"	"	51.15	204.6
M9	3	3/4"ϕ	30'-6"	"	45.51	136.4
M10	20	3/4"ϕ	6'-8"	"	10.01	200.2
M11	5	3/4"ϕ	5'-3"	"	7.88	39.4
M12	5	3/4"ϕ	9'-4"	"	14.01	70.1
M13	7	3/4"ϕ	8'-6"	"	12.77	89.4
M14	27	3/4"ϕ	11'-4"	"	17.01	459.5
M15	4	3/4"ϕ	17'-1"	STRAIGHT	25.65	102.6
M17	2	3/4"ϕ	14'-8"	14'-8"	22.03	44.1
M18	2	3/4"ϕ	25'-8"	25'-8"	38.56	77.1
M19	2	3/4"ϕ	21'-8"	STRAIGHT	32.51	65.0
M20	8	3/4"ϕ	26'-1"	"	39.17	313.4
M21	4	3/4"ϕ	19'-6"	"	29.29	117.2
M22	4	1" ▭	13'-4"	"	45.32	181.3
M23	4	1" ▭	11'-4"	"	38.52	154.1
M24	11	3/4"ϕ	18'-0"	6'-0" 11'-6"	27.04	297.4
M25	2	3/4"ϕ	7'-1"	STRAIGHT	10.64	21.3
SEE LAST		COLUMN SCH.		CONTINUATION		

BAR	NO REQ'D	SIZE	LENGTH	BENDING DIAGRAM	WEIGHT EACH	TOTAL WEIGHT
				MOTOR FLOOR BEAMS		
MB1	6	3/4"ϕ	15'-0"	STRAIGHT	22.53	135.2
MB2	8	1-1/4" ▭	24'-0"	"	127.51	1020.1
MB3	8	1-1/2" ▭	24'-0"	"	183.27	1826.2
MB4	56	1/2"ϕ	7'-8"	2'-8½"	5.12	276.5
MB5	14	5/8"ϕ	19'-4"	15'-3" 16"	20.16	282.2
MB6	10	3/8"ϕ	5'-8"	1'-10½" 1'-11"	2.13	21.3
MB7	2	7/8"ϕ	24'-0"	STRAIGHT	45.09	90.1
MB8	3	1" ▭	24'-0"	"	84.08	192.2
MB9	2	1" ▭	24'-0"	"	81.90	163.2
MB10	6	1-1/8" ▭	26'-7"	2'-4"-1"	114.38	686.3
MB11	29	3/8"ϕ	5'-10"	5" 1'-7" 10"	2.15	30.4
MB12	3	1" ▭	12'-5"	11'-8"	53.18	99.5
MB13	3	1" ▭	13'-6"	11'-4"	36.08	108.2
MB14	3	7/8"ϕ	11'-7"	10'-9"	23.67	71.0
MB15	3	7/8"ϕ	12'-5"	10'-9"	23.35	76.2
MB16	3	1" ▭	12'-4"	11'-3"	32.92	98.8
MB17	5	1" ▭	13'-5"	11'-3"	35.88	332.5
MB18	16	3/8"ϕ	4'-0"	2'-2½" 9"	1.50	24.0
MB19	13	3/8"ϕ	4'-2"	1'-3½" 9"	1.57	20.4
MB20	14	3/8"ϕ	6'-4"	5'-4½" 9"	1.63	22.8
MB21	13	3/8"ϕ	4'-5"	1'-5" 9"	1.66	21.6
MB22	9	1/2"ϕ	23'-0"	STRAIGHT	15.36	138.2
MB23	9	7/8"ϕ	22'-0"	"	44.87	404.7
MB24	9	7/8"ϕ	23'-8"	24'-0"	32.47	292.2
MB25	14	5/8"ϕ	7'-4"	6'-8"	7.65	107.1
MB26	14	1/2"ϕ	6'-11"	STRAIGHT	4.62	64.7
				EDGE		
E1	23	1/2"ϕ	8'-0"	7'-0"	5.34	122.8
E2	74	1/2"ϕ	9'-8"	5½" 3'-11½" 4" 3'-6"	6.51	156.2
E3	44	1/2"ϕ	10'-5"	5½" 4'-3½" 4" 3'-8"	6.96	306.2
E4	24	1/2"ϕ	22'-8"	STRAIGHT	15.14	363.4
E5	8	1/2"ϕ	11'-3"	1'-3" 10'-2"	7.63	45.8
E6	2	1/2"ϕ	9'-6"	1'-3" 8'-3"	6.35	12.7
E7	2	1/2"ϕ	15'-9"	1'-3" 12'-6"	9.15	18.4
E8	2	1/2"ϕ	5'-2"	1'-3" 3'-11"	3.45	6.9
E9	2	1/2"ϕ	3'-2"	1'-3" 1'-5"	2.12	4.2
E10	3	1/2"ϕ	8'-5"	1'-3" 5'-2"	4.26	12.8
E11	3	1/2"ϕ	9'-8"	1'-3" 8'-5"	6.46	19.4
E12	3	3/8"ϕ	8'-6"	6" 3'-0" 3'-0"	3.20	9.6
E13	3	3/8"ϕ	9'-10"	6" 2'-4" 7'-4"	3.70	11.1
E14	9	1-1/4" ▭	26'-2"	23'-8"-2"	130.04	1254.4
E15	18	1/2"ϕ	6'-2"	1'-2" 1'-0"	4.70	12.6

BAR	NO REQ'D	SIZE	LENGTH	BENDING DIAGRAM	WEIGHT EACH	TOTAL WEIGHT
				WALLS		
W1	34	3/4"ϕ	34'-8"	STRAIGHT	52.07	1770.4
W2	56	1"ϕ	26'-6"	"	70.76	3962.6
W3	32	1-1/2" ▭	26'-9"	"	142.12	4548.0
W4	5	1-1/2" ▭	30'-8"	"	162.95	814.8
W5	2	1-1/2" ▭	28'-10"	"	159.17	306.3
W6	21	1-1/4" ▭	26'-3"	"	140.37	2947.8
W7	53	3/4"ϕ	24'-3"	"	36.42	1930.2
W8	77	1" ▭	18'-0"	8'-0" 10'-0"	61.20	4712.4
W9	22	1-1/4" ▭	19'-9"	STRAIGHT	104.53	2300.5
W10	13	1-1/4" ▭	12'-2"	"	64.05	840.5
W11	64	1"ϕ	24'-0"	"	64.08	4101.1
W12	28	1"ϕ	29'-0"	"	77.43	2168.0
W13	6	1"ϕ	5'-0"	"	3.35	106.8
W14	8	1"ϕ	9'-0"	"	24.03	192.2
W15	24	1"ϕ	11'-0"	"	29.37	704.9
W16	12	1"ϕ	7'-0"	"	18.09	324.9
W17	2	1" ▭	13'-9"	8'-0" 5'-3"	46.78	93.5
W18	12	1" ▭	13'-10"	2'-3" 10'-0"	47.02	564.2
W19	2	3/4"ϕ	10'-6"	STRAIGHT	5.28	10.6
W20	28	3/4"ϕ	17'-3"	"	28.31	792.5
W21	27	3/4"ϕ	21'-2"	"	31.80	858.6
W22	26	3/4"ϕ	13'-0"	"	19.88	507.8
W23	4	1" ▭	14'-9"	"	50.16	200.6
W24	9	3/4"ϕ	29'-4"	"	39.58	353.0
W25	18	7/8"ϕ	24'-0"	"	69.06	868.1
W26	73	3/4"ϕ	5'-9"	2'-6" 3'-3"	8.64	630.7
W27	8	1-1/8" ▭	18'-0"	8'-0" 10'-0"	93.63	749.0
W28	16	3/4"ϕ	26'-3"	STRAIGHT	40.16	642.6
W29	6	3/4"ϕ	12'-9"	"	19.15	114.9
W30	3	3/4"ϕ	8'-5"	5'-3" 3'-2"	12.65	63.3
W31	20	3/4"ϕ	7'-8"	6'-3" 1'-3"	11.27	225.4
W32	3	3/4"ϕ	8'-0"	4'-9" 3'-3"	12.02	108.2
W33	3	7/8"ϕ	12'-11"	11'-11" 10'-0"	26.41	79.2
W34	4	1-1/4" ▭	17'-3"	7'-3" 10'-0"	91.65	366.6
W35	5	1-1/8" ▭	17'-0"	7'-0" 10'-0"	73.15	365.8
W36	6	1" ▭	17'-0"	7'-0" 10'-0"	57.80	346.8
W37	16	7/8"ϕ	5'-0"	STRAIGHT	10.22	163.5
W38	3	1"ϕ	13'-4"	5'-4" 10'-0"	35.53	106.6
W39	13	1"ϕ	22'-8"	12'-8" 10'-0"	73.08	1002.0
W40	4	1"ϕ	10'-9"	STRAIGHT	28.04	112.2
W41	20	1"ϕ	21'-1"	7'-5" 13'-7"	71.67	1433.4
W42	10	1¼"ϕ	14'-6"	7'-5" 7'-1"	77.06	770.6

BAR	NO REQ'D	SIZE	LENGTH	BENDING DIAGRAM	WEIGHT EACH	TOTAL WEIGHT
W43	6	1"ϕ	14'-0"	7'-0" 7'-0"	48.14	564.4
W44	2	1"ϕ	14'-0"	7'-0" 7'-0"	47.80	95.2
W45	3	1"ϕ	8'-4"	5'-0" 3'-4"	32.24	96.7
				WALL BRACKETS		
K1	58	5/8"ϕ	6'-10"	2'-7" 2'-7" 3'-0" 3'-0"	7.12	413.0
K2	3	1/2"ϕ	29'-8"	STRAIGHT	59.62	178.5
K3	3	1/2"ϕ	28'-2"	"	15.45	46.4
K4	3	1/2"ϕ	2'-2"	"	1.45	4.4
K5	3	7/8"ϕ	7'-8"	2'-7" 3'-0" 2'-7" 3'-0"	15.68	47.0
K6	1	3/8"ϕ	5'-8"	3'-0" 2'-7"	2.04	2.0
K8	4	3/8"ϕ	4'-8"		4.61	17.4
K10	2	1/2"ϕ	5'-8"	STRAIGHT	1.97	3.5
				APPROACH SLAB		
A1	15	3/8"ϕ	4'-8"	STRAIGHT	1.76	26.4
A2	7	3/8"ϕ	5'-8"	"	3.64	25.5
				PLANT SEWER COLLAR		
C1	4	3/4"ϕ	16'-0"	6'-9" 7'-3"	21.03	84.1
C2	23	1/2"ϕ	3'-3"	2'-9" 2'-0"	3.51	80.7
C3	12	1/2"ϕ	3'-6"	3'-0"	2.34	28.1
C4	11	1/2"ϕ	5'-3"	2'-3" 1'-6"	3.51	38.6
				MANHOLE #3 - SEWER COLLAR		
MC1	24	1/2"ϕ	4'-7"	1'-2" 2'-9" 1'-6"	3.08	73.4
MC2	4	3/4"ϕ	14'-8"	STRAIGHT	22.03	88.1
MC3	4	3/4"ϕ	11'-6"	"	17.53	70.1
MC4	11	3/4"ϕ	18'-8"	"	28.03	225.8
MC5	3	3/4"ϕ	10'-8"	"	16.08	48.1
MC6	4	3/4"ϕ	12'-8"	"	19.03	76.1
MC7	11	1/2"ϕ	5'-2"	1'-10" 2'-4" 2'-0"	5.45	97.0
				96" SEWER		
S1	38	3/4"ϕ	4'-10"	STRAIGHT	7.25	275.5
S2	19	1"ϕ	9'-11"	"	26.49	423.8
S3	28	1"ϕ	10'-11"	4'-4" 6'-7"	37.13	1050.9
				TRANSFORMER FOOTINGS		
T1	6	3/4"ϕ	5'-0"	STRAIGHT	7.54	45.1
T2	8	3/4"ϕ	4'-0"	"	6.01	48.1
T3	6	3/4"ϕ	8'-3"	"	9.35	56.3

BAR	NO REQ'D	SIZE	LENGTH	BENDING DIAGRAM	WEIGHT EACH	TOTAL WEIGHT
				MOTOR FLOOR SLAB CONT.		
M1X	22	3/4"ϕ	16'-0"	6'-4"	21.05	462.7
M3X	3	3/4"ϕ	4'-6"	3'-2"	6.76	20.3
M7X	6	3/4"ϕ	14'-8"	10'-9"	17.19	103.1
M8X	4	3/4"ϕ	38'-5"	34'-3"	55.30	221.2
M9X	3	3/4"ϕ	34'-8"	30'-6"	48.81	146.4
M10X	12	3/4"ϕ	7'-10"	6'-8"	11.76	141.1
M11X	5	3/4"ϕ	4'-8"	3'-4"	7.01	35.1
M12X	5	3/4"ϕ	7'-8"	6'-4"	11.51	57.6
M13X	7	3/4"ϕ	9'-10"	8'-6"	14.76	103.3
M14X	12	3/4"ϕ	12'-0"	11'-4"	18.02	216.2
M23X	2	3/4"ϕ	8'-3"	7'-1"	12.64	25.3
				BULKHEAD GATEWALL NO. 1		
G1	10	3/4"ϕ	24'-11"	STRAIGHT	37.49	374.9
G2	21	3/4"ϕ	11'-7"	"	17.35	364.2
G3	18	3/4"ϕ	6'-0"	"	9.01	162.2

TOTAL WEIGHT OF REINFORCEMENT
98876.3#

REVISION	DATE	DESCRIPTION	BY
1	4/6/38	Additions and changes .	WKH

A. M. KINNEY, INC.
CONSULTING ENGINEERS ASSOCIATED ARCHITECTS
CINCINNATI, OHIO

DRAWN: K.B.H.C.
TRACED: R.B.M.C.
CHECKED: J.R. K.E.A.
SUBMITTED: A.M. KINNEY, INC.

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS - OHIO RIVER SECTION
WILLOW RUN PLANT
REINFORCEMENT SCHEDULE

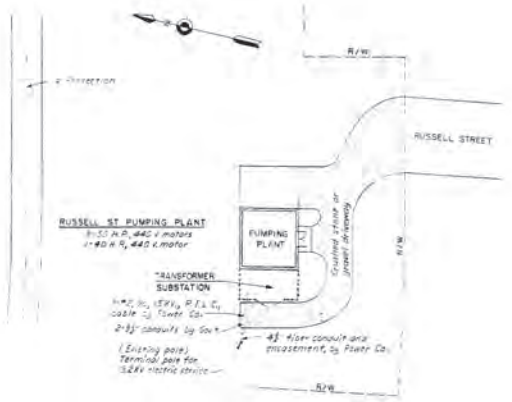
APPROVED: [signature] DATE: SEPT. 1938
CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

APPROVED RECOMMENDED: [signature]
CHIEF, ENGINEERING DIVISION, CORPS OF ENGINEERS, LOUISVILLE DISTRICT

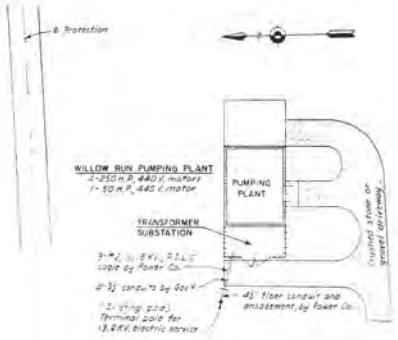
SCALE: AS NOTED | SHEET 46 OF 46 SHEETS
DRAWING NUMBER 471-12.2/46

AS BUILT

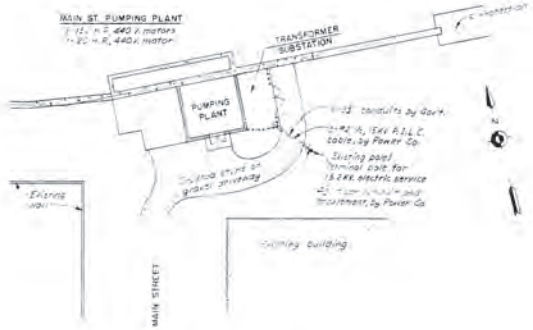
124



RUSSELL STREET PUMPING PLANT



WILLOW RUN PUMPING PLANT



MAIN STREET PUMPING PLANT

(2493)

Pumping Plant Transformer Stations to be provided by the Government. Metering equipment to be furnished and installed by the Union Light, Heat and Power Company. The metering transformers shall be installed on the transformer structures. The metering panels and meters shall be installed in the pumping plants.

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
LOUISVILLE, KENTUCKY

DESIGNED BY D.S.
DRAWN BY C.S.
TRACED BY J.S.J.
CHECKED BY D.S.
SUBMITTED
CHIEF, ENGINEERING DIVISION
APPROVED

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.

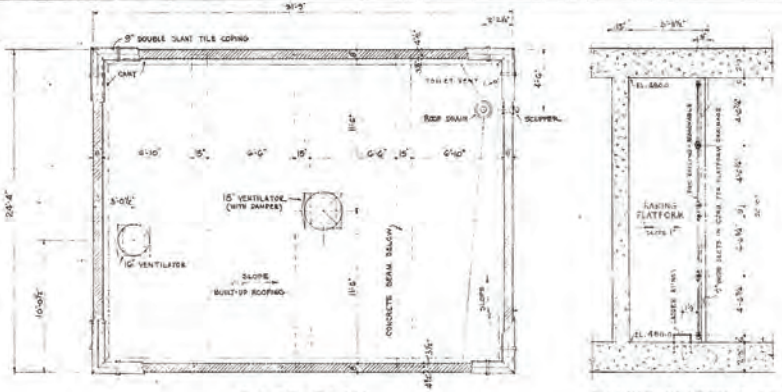
EXTENSION OF POWER FACILITIES

APPROVED
LT. COL., CORPS OF ENGINEERS, ACT. DISTRICT ENGINEER
DATE SEPT. 1950

CHIEF ENGINEERING ASSISTANT
APPROVED
DATE

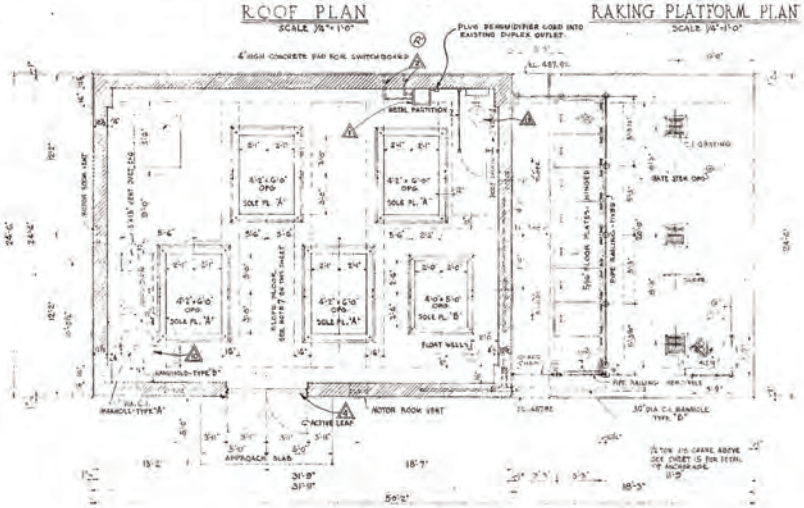
SCALE: NONE

DRAWING NUMBER
471-12.5/1

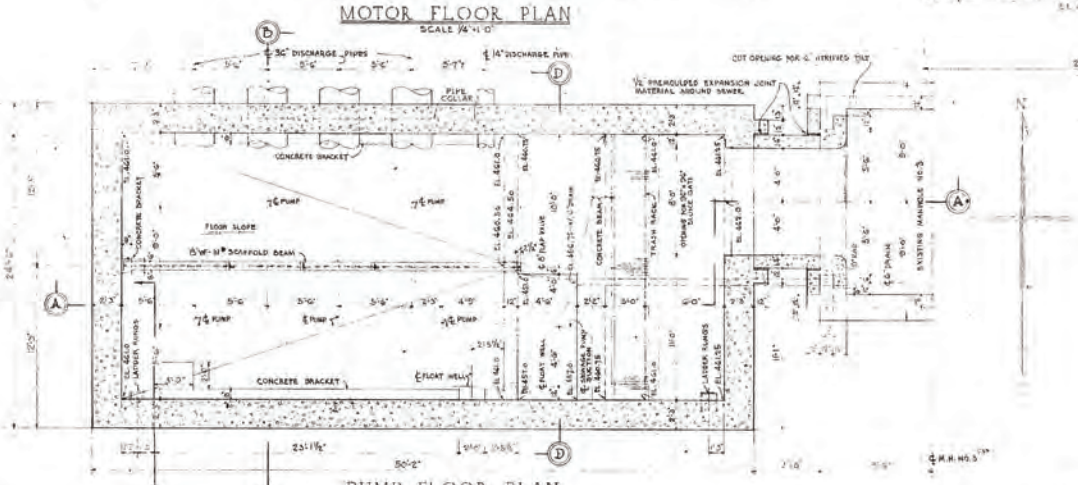


ROOF PLAN
SCALE 1/4"=1'-0"

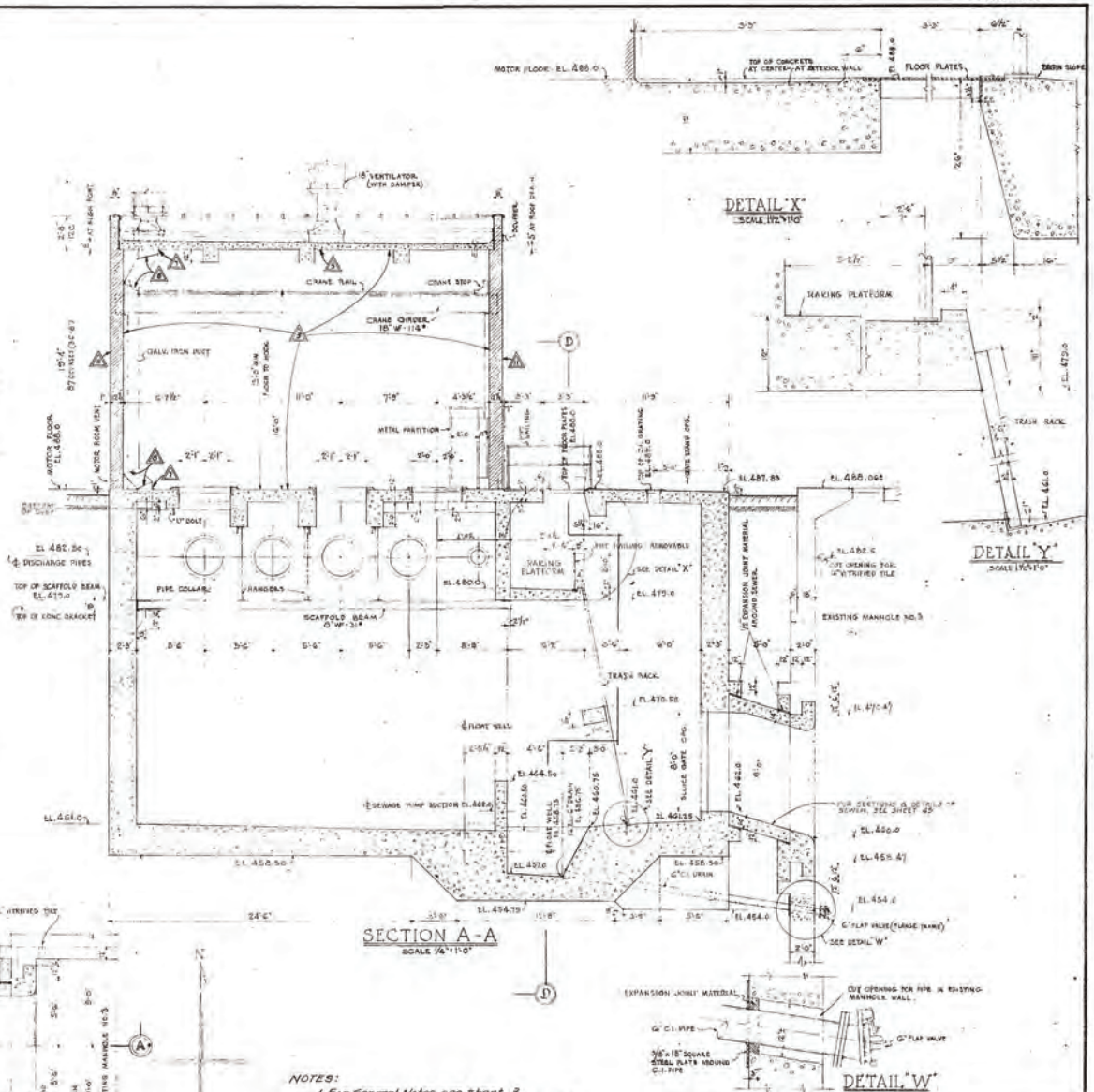
RAKING PLATFORM PLAN
SCALE 1/4"=1'-0"



MOTOR FLOOR PLAN
SCALE 1/4"=1'-0"



PUMP FLOOR PLAN
SCALE 1/4"=1'-0"



NOTES:
1. For General Notes see Sheet 3.
2. For Ventilator Cover plate see sheet 2.

(R) Relocation "Field"

GRAPHIC SCALES

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
LOUISVILLE, KENTUCKY

DESIGNED BY:
DRAWN BY: G. G.
TRACED BY: E. L. B
CHECKED BY: D. S.
SUBMITTED:
CHIEF ENGINEERING DIVISION
APPROVED:
CHIEF ENGINEERING ASSISTANT
APPROVED:
DATE:

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
WILLOW RUN PUMPING PLANT

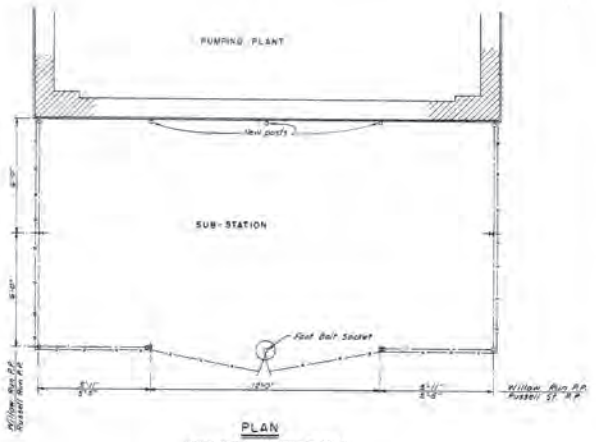
DEHUMIDIFICATION DETAILS

APPROVED:
LT. COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
DATE: AUGUST 1952
SCALE: AS SHOWN
DRAWING NUMBER
471-12.8/6

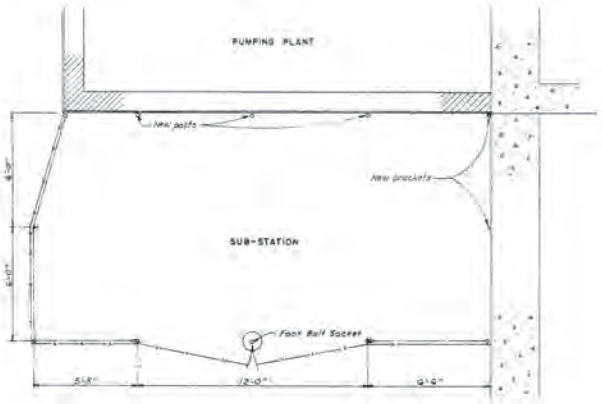
AS BUILT

CORPS OF ENGINEERS

U.S. ARMY

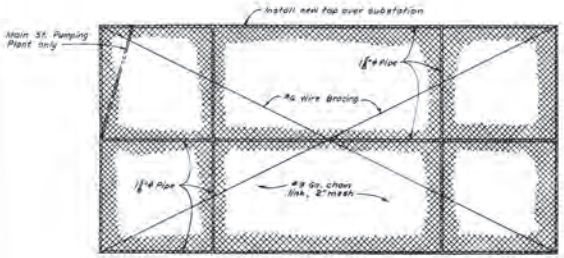


PLAN
(WILLOW RUN PUMPING PLANT)
(RUSSELL ST. PUMPING PLANT)

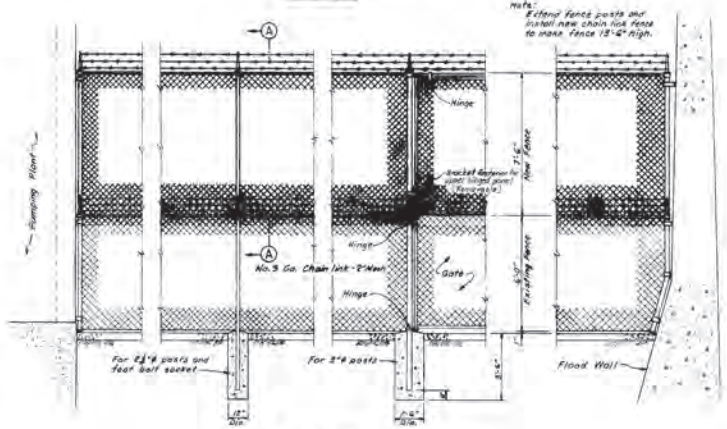


PLAN
(MAIN ST. PUMPING PLANT)

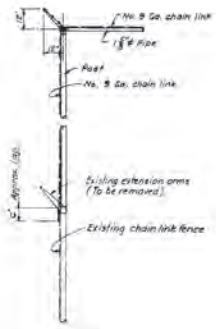
LOCATION PLAN
SCALE: 1"=1200'



TOP PLAN



FENCE DETAILS



SECTION A-A

Notes:
1. Line and gate post extensions to match existing construction.
2. New posts adjacent to buildings shall match existing line posts in section and shall be set in concrete similar to original construction.

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
LOUISVILLE, KENTUCKY

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY.
PUMPING PLANTS

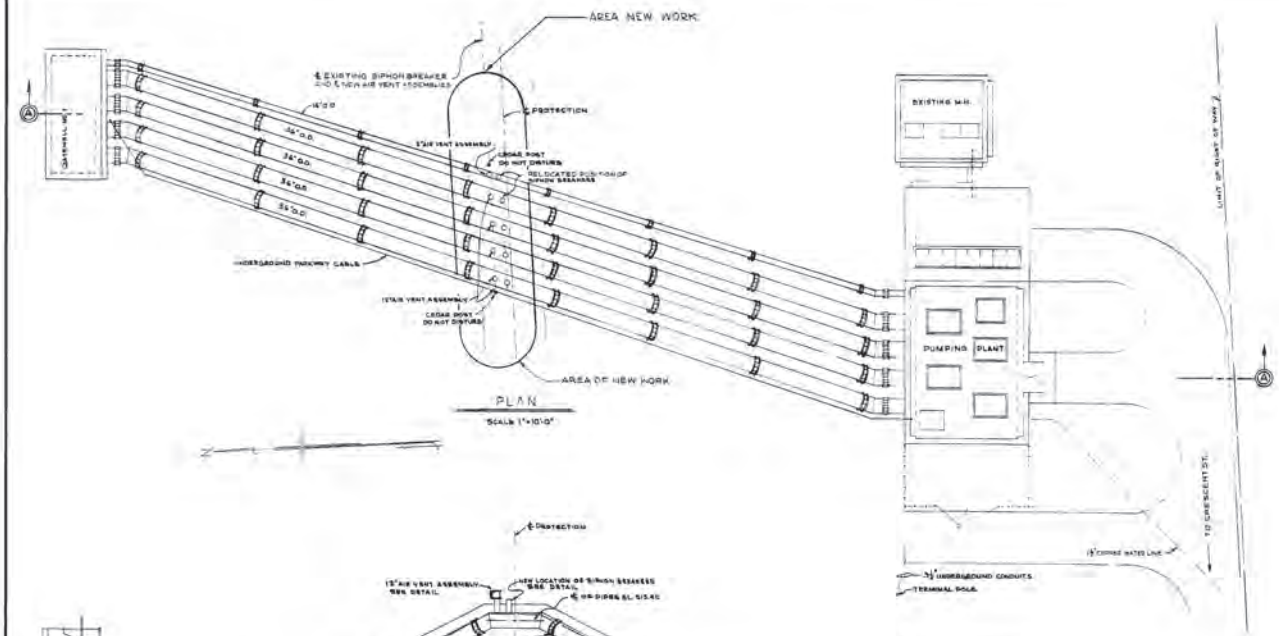
ALTERATIONS TO SUBSTATION FENCES

DESIGNED BY: ——
DRAWN BY: C.B.G.
TRACED BY: J.D.J.
CHECKED BY: J.D.A.
SUBMITTED: ASST. CHIEF, ENGINEERING DIV.
APPROVED: CHIEF, ENGINEERING DIVISION
APPROVED: DATE:
APPROVED: COL., CORPS OF ENGINEERS, DISTRICT ENGINEER — 31 DEC 1954
DATE:
SCALE: 1"=1'-0"
DRAWING NUMBER
471-12-13/1

AS BUILT

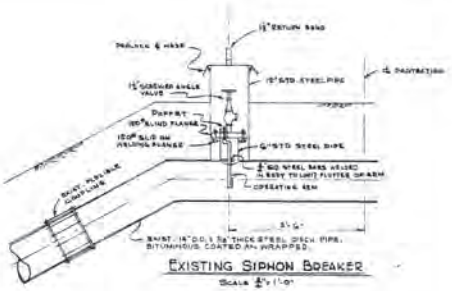
CORPS OF ENGINEERS

U.S. ARMY



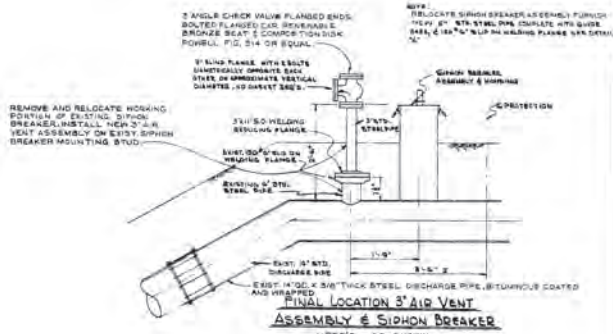
PLAN

SCALE 1"=10'-0"



EXISTING SIPHON BREAKER

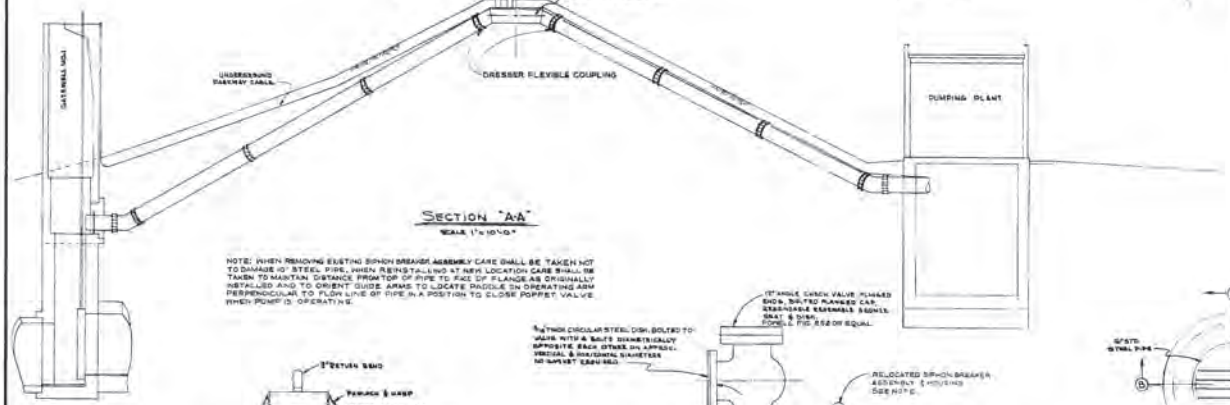
SCALE 1/2"=1'-0"



FINAL LOCATION 3" AIR VENT ASSEMBLY & SIPHON BREAKER

1-REQ'D AS SHOWN

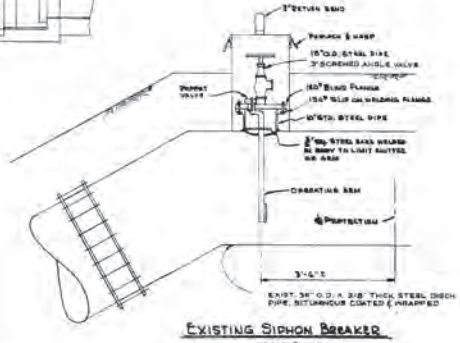
SCALE: 1/2"=1'-0"



SECTION "A-A"

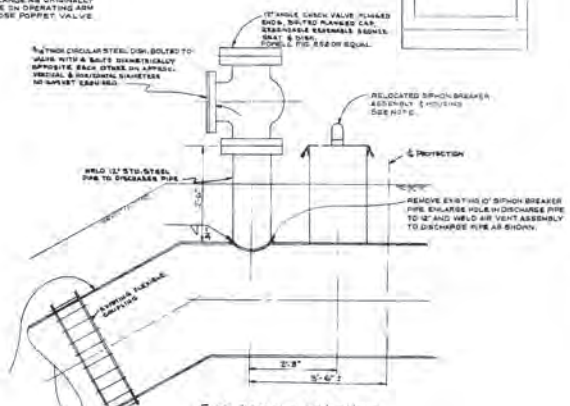
SCALE 1"=10'-0"

NOTE: WHEN REMOVING EXISTING SIPHON BREAKER ASSEMBLY CARE SHALL BE TAKEN NOT TO DAMAGE 10" STEEL PIPE. WHEN REINSTALLING AT NEW LOCATION CARE SHALL BE TAKEN TO MAINTAIN DISTANCE FROM TOP OF PIPE TO FACE OF FLANGE AS ORIGINALLY INSTALLED AND TO ORIENT GUIDE ARMS TO LOCATE PADDLE IN OPERATING ARM PERPENDICULAR TO FLOW LINE OF PIPE IN A POSITION TO CLOSE POPPET VALVE WHEN PUMP IS OPERATING.



EXISTING SIPHON BREAKER

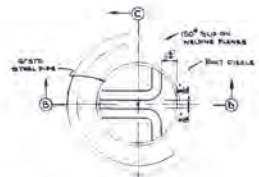
SCALE 3/4"=1'-0"



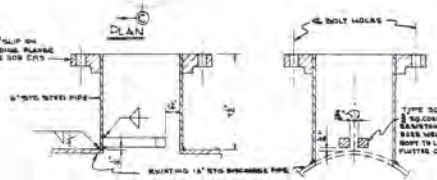
FINAL LOCATION 12" AIR VENT ASSEMBLY & SIPHON BREAKER

4-REQ'D AS SHOWN

SCALE: 3/4"=1'-0"



PLAN



SECTION "B-B"

DETAIL "A"

SCALE: 3"=1'-0"

SECTION "C-C"

NOTE C:
LOCATE GUIDE BARS AND ORIENT PADDLE SHOE IN BARS & MINIMIZE THAT PADDLE WHEN INSTALLED WILL BE PERPENDICULAR TO FLOW LINE OF PIPE AND WILL CLOSE POPPET VALVE WHEN PUMP IS OPERATING.

NOTE:
SEE GENERAL NOTE 1 SHEET 471-12.16/1

GRAPHIC SCALES

3/4"=1'-0" 0 1" 2"

3"=1'-0" 0 6" 12"

1"=10'-0" 0 5 10 FEET

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
LOUISVILLE, KENTUCKY

OHIO RIVER BASIN
FLOOD PROTECTION COVINGTON, KY
AIR VENTS AND VACUUM PRIMERS
WILLOW RUN PUMPING PLANT
INSTALLATION OF AIR VENTS

DESIGNED BY:
DRAWN BY: J.P.M. - W.S.C.
TRACED BY: J.P.M.
CHECKED BY:
SUBMITTED:
ASST. CHIEF, ENGINEERING DIV.
APPROVED:
CHIEF, ENGINEERING DIVISION
APPROVED:
COL. CORPS OF ENGINEERS, DISTRICT ENGINEER
DATE: 6 SEPT 1956
APPROVED:
DATE:
SCALE: AS SHOWN
DRAWING NUMBER
471-12.16/7

AS BUILT

APPENDIX E

Meeting Minutes

MEETING DOCUMENTATION

Project: I-71/I-75 (Brent Spence Br.) Willow Run Storm Water Separation Study

Location: Virtual – Teams Meeting

Meeting Date: February 21, 2022

Subject: Alternative Review Meeting

ATTENDEES

Gary Valentine	KYTC – CO	gvalentine@ky.gov
Stacee Hans	KYTC – D6	Stacee.hans@ky.gov
Tim Robinson	KYTC – CO	tims.robinson@ky.gov
David Lanham	Palmer Engineering	dlanham@palmernet.com
Janet Woods	Palmer Engineering	JWoods@palmernet.com

EXHIBITS

- Microstation DGN files

MEETING SUMMARY

David Lanham gave an overview of the study area. He reviewed the existing drainage system from the Kyles Lane interchange to the Ohio River, including detention basins, where storm water leaves the interstate drainage system, the location and operation of the Willow Run combined sewer trunk line, its major branches, and its low-flow diversion system.

David then reviewed the proposed alternatives. Alt 1 constructs a separate storm sewer system from approximately 16th Street northward toward the river. Alt 2 builds upon Alt 1, and it constructs a separate storm sewer system from the Kyles Lane interchange northward toward the river. The roadway drainage inlets were all placed based on the proposed DTMs and proposed cross sections, using actual low points, super transitions, etc. Judgements were made on spread, but in many areas, the maximum length of pipe controlled the spacing of inlets. Exact locations of bridge deck drains were not determined, but runoff from bridge decks was accounted for in the flow calculations.

There is a low area, approximately 1 acre in size near the intersection of Bullock and 12th Street that is not be intercepted by the proposed separate storm sewer system. Doing so would have caused the proposed storm sewer to be too low and would create a conflict with the Willow Run combined sewer downstream, where it was necessary to cross the existing Willow Run combined sewer with the proposed storm sewer trunk line

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The trunk line in Alt 1 is located primarily under Jillians Way, which also helps navigate the low area of Goebel Park since that section of Jillians Way will be built up with retaining wall. The exact layout of where it cross back to the west side of the interstate, near the floodwall, will have to be fine-tuned during later design phases based on bridge pier locations.

Segments of the existing combined sewer and its low-flow diversion will need to be reconstructed to avoid conflicts with the proposed roadway and bridge layout. Side streets will need to be reconnected to these relocated systems

The designed outflows from the existing basins are unknown. After discussing with Tim prior to this meeting, it was decided to roughly assume that the detention basins may attenuate 25% of the peak flow as compared to no basin at all. This may still be overly conservative, considering the size of the pipes in the outflow structures at the basins. But, that approach was used to size the pipes downstream of the basins at Lt Sta 478+00 and Lt Sta 490+00. For the basin at Lt Sta 518+00, that approach was determined to be too conservative. The size of that watershed (221 acres plus the upstream interchange watershed flowing to it) yielded flows that were far too high for the existing 36" pipe in the outflow system. Therefore, at that location an outflow was assumed, and it was based on the capacity of the existing 36" pipe at its existing slope. This assumption may be revisited, since Alt 2 sends more of the upstream watershed toward this basin.

Both Alts tie into the existing pump station and assume that it will need to be modified. The thinking at this point, although it is not known for certain, is that modifying the pump station versus constructing a separate one just for the proposed separate storm sewer system may make it easier to work through the Section 408 permitting process. This will be discussed in more detail with SD1 during a subsequent meeting.

Gary said that Palmer should focus the efforts going forward on Alt 2, as the preferred alternative to present to the City of Covington and SD1.

Next Steps:

- Palmer will prepare a cost estimate for Alt 2.
    - Note: this needs to also account for the relocated existing sewers.
- Palmer will quantify the area that Alt 2 removes from the Willow Run combined sewer system, to help with presenting the information to the City and SD1; and Palmer will quantify the interstate area that currently drains into the exiting combined sewer system.
- Stacee will set up a meeting with the City and SD1.

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MEETING DOCUMENTATION

Project: I-71/I-75 (Brent Spence Br.) Willow Run Storm Water Separation Study

Location: Hybrid – KYTC District 6, 1st Floor Conference Room; and Virtual Option – Teams

Meeting Date: March 3, 2022

Subject: Local Officials Review Meeting

ATTENDEES

Joe Meyer	City of Covington - Mayor	jumeyer@covingtonky.gov
Stacee Hans	KYTC - D6	Stacee.Hans@ky.gov
Tim Robinson	KYTC - C.O. Drainage	tims.robinson@ky.gov
Gary Valentine	KYTC - C.O. – Exec. Advisor	gvalentine@ky.gov
David Lanham	Palmer Engineering	dlanham@palmernet.com
Diana Martin	RL Record	dmartin@rlrecord.com
Rick Record	RL Record	rrecord@rlrecord.com
Phil Sebastian	SD1	psebastian@sd1.org
Lydia Watkins	SD1	lwatkins@sd1.org
Juan Carrizo	VS Engineering	jcarrizo@vsengineering.com
Josh Epperson	VS Engineering	jepperson@vsengineering.com

EXHIBITS

- Microstation DGN files

MEETING SUMMARY

After introductions, Gary reviewed the City's concerns with the 2012 drainage layout. The goal at that time was a net-zero flow change in the existing Willow Run combined sewer system. The Cabinet's goal with our updated layout was to address the City's concerns by developing a new drainage layout. Palmer Engineering was contracted to study the area and develop the revised drainage layout.

David Lanham reviewed the City's specific requests detailed in their Jan. 5, 2022 letter to the Cabinet, and then highlighted those areas in Google Earth for reference. One of the main points was the City's request to separate storm water from the combined sewer system from 16th Street north to the Ohio River along the I-75 corridor. The Cabinet developed a proposed drainage layout that not only achieved that goal, but went beyond by extending the separation concept upstream to the Willow Run watershed boundary at Kyles Lane.

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David gave an overview of the study area. He reviewed the existing drainage system from the Kyles Lane interchange to the Ohio River, including detention basins, where storm water leaves the interstate drainage system and flows eventually into the combined system; the location and operation of the Willow Run combined sewer trunk line, its major branches, and its low-flow diversion system.

David then reviewed the proposed drainage alternative, which would construct a separate storm sewer system from the Kyles Lane interchange northward toward the river. The roadway drainage inlets were all placed based on the proposed DTMs and proposed cross sections, using actual low points, super transitions, etc. Exact locations of bridge deck drains were not determined, but runoff from bridge decks was accounted for in the flow calculations.

There is a low area, approximately 1 acre in size near the intersection of Bullock and 12th Street that is not being intercepted by the proposed separate storm sewer system. Doing so would have caused the proposed storm sewer to be too low and would create a conflict with the Willow Run combined sewer downstream, where it was necessary to cross the existing Willow Run combined sewer with the proposed storm sewer trunk line

The trunk line is located mostly along the west side of the interstate from Kyles Lane to just south of 12th Street, where it crosses to the east side. It then is located under Jillians Way, which also helps navigate the low area of Goebel Park since that section of Jillians Way will be built up with a retaining wall. The exact layout of where it cross back to the west side of the interstate, near the floodwall, will have to be fine-tuned during later design phases based on bridge pier locations.

Segments of the existing combined sewer and its low-flow diversion will need to be reconstructed to avoid conflicts with the proposed roadway and bridge layout. Side streets will need to be reconnected to these relocated systems. Gary stated that the Cabinet would be willing to partner with SD1 for relocation and sizing of the relocated segments.

The existing basins are proposed to be modified when impacted by the project, to replace any lost storage. The designed outflows from the existing basins are not known, and some assumptions were made to assume an outflow for the purpose of sizing the proposed pipes. But, for the basins where the outflow leaves the interstate area, the proposed flows are reduced because of area being removed from their watershed. And for the basins where the outflow is contained in the proposed separate storm sewer, the outflow from the basin will only affect the proposed pipe sizes.

The total acreage removed from the combined sewer system, which would now be drainage via the proposed separate storm sewer system is estimated to be 467 acres (170 acres of impervious area and 297 acres of pervious area).

The proposed storm sewer system ties into the existing pump station and assumes that it may need to be modified. However, we are not changing the total watershed that drains to the pump station. We only be redirecting the separated storm sewer runoff to reach the pump station, rather than it reaching the pump station via the combined sewer system. Subsequent to the

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meeting, the project team decided to set up a meeting with the USACE and SD1 to discuss potential modifications to the pump station, and to discuss the Section 408 permitting process.

Josh asked if SD1 has a hydraulic model for the existing system. Lydia and Phil said it is a part of the Bromley model, and also that SD1 has record plans for the pump station.

SD1 currently is planning to install real-time controls in the basins along the interstate to regulate flows differently for low-flow and high-flow events. Our proposed drainage could be a benefit to SD1 by negating the need for that in basins that would be separated from the combined sewer system, and by reducing flows to those that would still drain toward the combined sewer system.

It is not expected that the construction will directly impact the pump station, besides the potential modifications mentioned above.

Mayor Meyer asked if this plan would help with the flooding along Highland and Euclid. The team discussed how the proposed plan would reduce the storm water runoff that reaches those problem areas.

Josh asked if DGN files could be shared, which the Cabinet agreed to. Josh and David will coordinate about that.

Subsequent to the meeting, Rick asked for the PDF plots of the proposed layout.

Next Steps:

- Palmer will provide PDFs to Rick and DGNs to Josh.
- Palmer will contact SD1 to obtain the record plans, and any other pertinent info, for the existing pump station.
- Palmer will contact the USACE and work to set up a meeting with them, SD1, and the project's permitting team.

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MEETING DOCUMENTATION

Project: I-71/I-75 (Brent Spence Br.) Willow Run Storm Water Separation Study

Location: Virtual – Teams

Meeting Date: March 17, 2022

Subject: Section 408 Coordination Meeting

ATTENDEES

Richard Anthony	City of Covington	Oliver.Anthony@covingtonky.gov
Andrew Brooks	USACE (Levee Safety POC)	Andrew.T.Brooks@usace.army.mil
Stacee Hans	KYTC - D6	Stacee.Hans@ky.gov
David Lanham	Palmer Engineering	dlanham@palmernet.com
Gary Valentine	KYTC - C.O. – Exec. Advisor	gvalentine@ky.gov
David Waldner	Palmer Engineering	dwaldner@palmernet.com

EXHIBITS

- N/A

MEETING SUMMARY

After introductions, David gave a brief overview of the project and its history. The goal of this meeting is to discuss the requirements for obtaining a Section 408 permit, since KYTC's project team is unfamiliar with the process.

The current layout for the project does not directly impact the floodwall, as it will be spanned by bridges similar to the existing condition. Impacts to the associated pump station are possible, however. The proposed separated storm sewer trunk line will tie in at the pump station. The exact details of that tie-in have not been developed at this time. Flow rates at the pump station could be affected by the separated storm water, by changing the timing of runoff reaching the pump station. However, the total watershed boundary for the pump station is not changing.

The levee, floodwall, and pump station system are owned by the City of Covington. They are operated and maintained by SD1.

The Section 408 application package will consist of the permit application, plans (showing easements), specifications, and an H&H report. The H&H report should focus on the flows as they reach the pump station and the criteria used to determine that. The application form should include a summary of the project. The form will require Richard's signature for the City of

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Covington as the sponsor, a signature by KYTC as the applicant, and then a signature by the Corps when approved.

During their review, the Corps will be interested in seeing that there are no impacts that cause additional ponding on the landside of the system. Their ROW section will also review access, staging areas, etc. in the vicinity of the floodwall as part of the application package. It is preferable to maintain a 15-foot buffer from the levee and floodwall during construction.

The review process should be expected to take at least 120 days. There is an initial 30-day introductory review period. After the completion of the review period, the technical review begins and takes 90 days. However, any questions, requests for clarification/information, or general back-and-forth correspondence pauses the clock for the technical review period. So, that could cause the review period to take longer than 90 days.

Richard requested a copy of the preliminary drainage layout, which David provided by email after the meeting.

Also after the meeting, Andrew provided a copy of the 408 application form and the document that goes into detail about the levee alteration process. David will include those documents with this meeting summary for KYTC.

Next Steps:

- The information from this meeting will be used to develop the design-build RFP
- During final design, the H&H team should coordinate with the City of Covington and SD1 regarding design flow rates, their effect on the H&H model for the levee system, and potential modifications to the pump station.

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MEETING DOCUMENTATION

Project: I-71/I-75 (Brent Spence Br.) Willow Run Storm Water Separation Study

Location: Hybrid – KYTC District 6, 1st Floor Conference Room; and Virtual Option – Teams

Meeting Date: July 12, 2022

Subject: Bridge Grant Application Coordination

ATTENDEES

Stacee Hans	KYTC - D6	Stacee.Hans@ky.gov
Tim Robinson	KYTC - C.O. Drainage	tims.robinson@ky.gov
Gary Valentine	KYTC - C.O. – Exec. Advisor	gvalentine@ky.gov
Joe Meyer	City of Covington - Mayor	jumeyer@covingtonky.gov
Phil Sebastian	SD1	psebastian@sd1.org
Lydia Watkins	SD1	lwatkins@sd1.org
David Lanham	Palmer Engineering	dlanham@palmernet.com
Juan Carrizo	VS Engineering	jcarrizo@vsengineering.com

EXHIBITS

- Microstation DGN files

MEETING SUMMARY

After introductions, Gary reviewed the purpose of this meeting. KYTC submitted an application for a federal grant under the Mega Grant program in May. That application is requesting $1.66 billion, but the total estimated cost of the project is $2.9 billion. In effort to fill in some of the funding gap for the project, KYTC is also going to submit an application for a grant under the Bridge Investment program. The application deadline for that is August 9, 2022.

To support the Bridge Investment program grant application, KYTC would like to better describe the benefits that would be gained by the proposed separate storm sewer system in the Willow Run Storm Water Separation Study. The purpose of this meeting is to discuss both quantitative and qualitative benefits that will be recognized by the City of Covington and SD1 with this commitment to reduce storm water flow into the existing combined sewer system.

The group discussed benefits of the stormwater separation study, including:

- Reduced flooding from capacity-related backups in the existing system, especially in the Euclid Avenue area.

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- Mayor Meyer said there will be public health benefits from reducing the flooding in the Euclid Avenue area that is caused by backups from the existing system. A previous event led to a hepatitis outbreak and eventually to a multi-million dollar lawsuit. A child, who played in floodwater containing sewage, contracted hepatitis. It spread to his mother who was a server at the Fort Mitchell Country Club, and she eventually spread it to hundreds of customers. The club was then sued.
- Reduction in flooding from backups could also result in reduced maintenance and emergency services costs.
- See Exhibit A for maps showing locations of historical basement and surface flooding, provided by VS Engineering. These are areas that would benefit from the storm water separation by reducing backups and the flooding caused by those backups.

- Reduction in the combined sewer overflows, since less stormwater will be in the combined system.
  - Based on SD1's preliminary analysis, they predict that there will be a reduction of 24 million gallons of overflow per year. SD1 also provided an estimated cost of treatment at $843/MG.
- Reduction in stormwater that is routed toward the wastewater treatment plant.
- Upgrades to the existing flood pump station, since upgrades will be required by the USACE as part of the Section 8 permit.
  - Upgraded pumps would be more efficient, and would lead to less stormwater reaching the treatment plant.
- Advance SD1's progress toward meeting the requirements of their consent decree. The reductions in overflows caused by this stormwater separation will advance SD1's efforts to meet their 2029 consent decree deadline.
  - Any SD1 projects relating to the consent decree that are not completed by the 2029 deadline would lead to fines per day and per project.
- Replacement of portions of the existing Willow Run trunk line; replacement of aging infrastructure.

SD1 has future plans for a new pump station next to the Willow Run pump station, and they would like to discuss the possibility of partnering with KYTC as a part of the Brent Spence Bridge project. Subsequent to today's meeting, the project team scheduled a coordination meeting with SD1 for July 25 to discuss this topic.

Goebel Park serves as a ponding area for the flood control system during flooding events, and it is listed as a ponding area in the O&M manual. The ponding area allows the pumps time to catch up during flood events and also allows more time for backup in the event of a pump failure. Section 8 impacts will need to consider any loss of storage volume in the park when it comes time to apply for that permit from the USACE. It may be possible to improve the level of service of the pump station to account for that loss of storage, since improvements to the pump

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station will already be required. However, the details of that are unknown at this time. SD1 cautioned that it is not feasible to expect pump station improvements to completely eliminate ponding in the park.

KYTC asked SD1 about the current construction activities in the park. SD1 said the purpose of that construction is for backflow prevention, which will prevent river floodwater from entering the system upstream from that point.

At the conclusion of the meeting, VS Engineering asked about the possibility of increasing the size of the relocated Willow Run trunk line. They analyzed the system in the vicinity of Euclid Avenue for the existing condition and also for the proposed condition with the separate interstate storm sewer system. While the proposed stormwater separation decreases flows in the existing Willow Run combined sewer system, their analysis suggest that more capacity is still needed in the existing trunk line. Their conclusion was that increasing the size of the relocated trunk line to a 132" diameter would help the system meet current capacity design standards. This could lead to complications in the vicinity of 9th Street, where approximately 1200 feet of the existing trunk line was proposed to remain in service, and is 120" in diameter. This is also a complicated area, including a 96" branch tying in at 9th Street, the beginning of the low-flow diversion system, potential impacts to the Goebel Park pool, etc. Palmer will coordinate with VS Engineering in a separate meeting to further discuss this issue.

Next Steps:

- Coordinate with SD1 regarding their future pump station plans
- Coordinate with VS Engineering regarding their Willow Run capacity analysis.

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MEETING DOCUMENTATION

Project: I-71/I-75 (Brent Spence Br.) Willow Run Storm Water Separation Study

Location: Teams

Meeting Date: July 15, 2022

Subject: Euclid Avenue Drainage Report

ATTENDEES

David Lanham	Palmer Engineering	dlanham@palmernet.com
Juan Carrizo	VS Engineering	jcarrizo@vsengineering.com

EXHIBITS

- Draft Euclid Avenue Drainage Report
- Microstation DGN files

MEETING SUMMARY

Juan presented an overview of the Euclid Avenue Drainage Report. In summary, the proposed stormwater separation results in a decrease of flow in the Willow Run combined sewer trunk line. However, even with that decrease, more capacity is needed in the Willow Run trunk line to meet current 10- and 25-year design criteria. The current criteria is to contain the 10-year hydraulic grade line within the pipe, and the 25-year hydraulic grade line within a 1-foot freeboard.

VS analyzed potential modifications to the system that would lead to acceptable capacity, and they found that the trunk line would need to be increased to an 11-foot (132") diameter.

The current proposed separated storm sewer design includes a relocated portion of the Willow Run trunk line in the vicinity of 12th Street and Pike Street. However, there is a section of Willow Run that is approximately 1200 feet long in the vicinity of 9th Street and Goebel Park that is proposed to remain in place, and not be reconstructed or relocated. This section of pipe is 120" in diameter. If we increase the size of the trunk line near 12th Street to 132", then the section around 9th Street and Goebel Park would also have to be increased.

The difficulties of reconstructing the section around 9th Street and Goebel Park include:

- The 96" branch line at 9th Street
- The low-flow diversion system begins just north of 9th Street, in the park
- Part of the existing trunk line is located under the Goebel Park pool
- Additional impacts to Goebel Park that weren't included in the environmental document.

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There is currently a 42” pipe that conveys flow across the interstation just north of the Kyles Lane interchange. In the current proposed storm sewer layout, that flow is not intersepted. David asked if intercepting that flow would provide enough benefit to prevent the need to upsize the Willow Run trunk line downstream in the Euclid Avenue area. However, VS’s model didn’t account for that flow in the Euclid Avenue system. They assumed it stayed on the west side of the interstate.

The existing Willow Run trunk line varies in size between 108” and 96” between the hospital and just south of 9th Street. At that point, the existing trunk line increases to 120”, and that is near the point where the proposed relocated section ties back into the existing trunk line in the current layout. David asked if we could increase the size of the trunk line to 120” to the point where the existing line is 120” just south of 9th Street, allowing us to leave the existing 120” trunk line across 9th and in the park area. Juan will consider this idea.

In response, Juan asked if KYTC could reconstruct the existing trunk line in the vicinity of the hospital, to increase the size and capacity of it. This would be outside the limits of the project, KYTC likely would not consider that.

Next Steps:

- We may have another meeting with the Mayor and with KYTC included after VS considers the idea of a 120” pipe, and avoiding reconstruction of the existing trunk line in the vicinity of 9th Street to the Goebel Park pool.

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MEETING DOCUMENTATION

Project: I-71/I-75 (Brent Spence Br.) Willow Run Storm Water Separation Study

Location: Virtual

Meeting Date: October 3, 2022

Subject: Willow Run Trunk Line Relocation Coordination

ATTENDEES

Stacee Hans	KYTC - D6	Stacee.Hans@ky.gov
Gary Valentine	KYTC - C.O. – Exec. Advisor	gvalentine@ky.gov
Ken Sperry	HMB	ksperry@hmbpe.com
Joey Mosley	HMB	jmosley@hmbpe.com
Phil Sebastian	SD1	psebastian@sd1.org
Lydia Watkins	SD1	lwatkins@sd1.org
David Lanham	Palmer Engineering	dlanham@palmernet.com

EXHIBITS

- Microstation DGN files
- Covington Flood Protection Operation & Maintenance Manual

MEETING SUMMARY

The purpose of this meeting was to coordinate with SD1 about the proposed relocated segments of the Willow Run combined sewer trunk line. The following topics were discussed:

- Relocated Willow Run segment from near 14th Street to near 9th Street
    - The group discussed proposed easement needs for the relocated segments.
        - The critical horizontal clearance point occurs near the curve in James Simpson Jr. Way. The plans currently show a distance of approximately 25 feet from the centerline of the proposed relocated trunk line to the existing right of way line. Based on the depth of the pipe, SD1 said that this would be acceptable, but near the minimum width that they would like to have.
        - In the vicinity of the Kenton County government center and the Kerry Toyota dealership, a desirable proposed easement width would be 15 feet from the edge of the proposed pipe.

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- Goebel Park Pond Area – the existing ponding area provided in Goebel Park is an integral part of the flood protection system. The pumping capacity is based on this ponding area. The proposed interstate reconstruction will reduce this ponding area significantly, and potential regrading in the park could have more impacts. Can these ponding area impacts be addressed by increased capacity of the pump station?
    - SD1 said this will ultimately be a USACE decision.
    - Pump capacity will not be the only issue. SD1 also advised that the USACE will likely say that there is no backup power provided at the pump station, and the ponding area provides a contingency in the event that the pump station loses power. Therefore they expect the two main issues to resolve with the USACE will be capacity of the pump station and backup power.
    - SD1 didn't expect the loss of ponding area to affect the elevation at which gate closures currently occur.
- Relocated Willow Run segment from Goebel Park to near the existing pump station
    - The team has looked at some new layout options, considering constructability. The goal is to provide a layout that the contractor could relocate early during construction and avoid conflicts with existing and proposed bridges.
    - The team asked SD1 if a new outlet to the river for the relocated combined system is possible. Could the relocated line stay on the east side of the bridge, construct a new pipe station, and outlet to the river. The old pump station would also remain in service, with reduced flow going to it. The consensus was that this option would likely lead to issues with the EPA and would be detrimental to SD1 meeting requirements under their consent decree. This option will not be pursued further.
    - SD1 did not have any major concerns about the new alignment for the relocated trunk line that would stay on the east side of the interstate until near 4th Street, before tying back into the existing line near the existing pump station. The PIs in the line are acceptable, as they are less than SD1's maximum deflection requirement of 90 degrees. SD1 offered to evaluate the capacity of the line with the new alignment, by entering it into their model. Palmer will provide the new data to them when it is complete.
    - The existing pipe sizes shown in SD1's GIS files were discussed. The specific area in question was just upstream from the junction of the 9th Street 96" branch line with the Willow Run trunk line. The team is proposing to tie in the proposed relocation at the point where the existing line becomes 120". So, if the sizes shown for the existing trunk line are incorrect, if could affect the limits of the relocation.
        - Palmer discussed this with Qk4 subsequent to this meeting. The discrepancy was clarified and both firms now show the same limit of 120" pipe.
        - SD1 offered to field verify the pipe size just upstream from the 9th street junction. The team agreed that this would be valuable to our design effort.

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MEETING DOCUMENTATION

Project: I-71/I-75 (Brent Spence Br.) Willow Run Storm Water Separation Study

Location: First Financial Bank, 601 Madison Ave, Covington, KY

Meeting Date: November 17, 2022

Subject: Peeselburg Neighborhood Drainage Discussion

ATTENDEES

Joe Meyer	City of Covington - Mayor	jumeyer@covingtonky.gov
Rick Record	RL Record	rrecord@rlrecord.com
Gary Valentine	KYTC - C.O. – Exec. Advisor	gvalentine@ky.gov
Juan Carrizo	VS Engineering	jcarrizo@vsengineering.com
Josh Epperson	VS Engineering	jepperson@vsengineering.com
David Lanham	Palmer Engineering	dlanham@palmernet.com

EXHIBITS

- VS's Euclid Ave Drainage Report
- Microstation DGN files

MEETING SUMMARY

The purpose of this meeting was to discuss how the proposed stormwater separation study will improve the current drainage/flooding problems in the Peeselburg neighborhood, and what additional opportunities there may be for further separation. The following topics were discussed:

- The current layout for the proposed interchange and separate storm sewer system includes replacing the existing Willow Run trunk line with a 120" diameter trunk line from Prague Street to just south of 9th Street. In this area, the existing trunk line varies from 96" to 108" in diameter. VS Engineering modeled the existing and proposed systems, including the proposed separate storm sewer system and the increased diameter of the relocated portion of the Willow Run trunk line. In the existing condition, the Peeselburg neighborhood has several nodes that surcharge from the design storm (10-year). The model shows that the proposed improvements result in zero nodes surcharging for the same design storm.
- The group discussed the project team's coordination with the USACE and SD1. According to SD1's modeling of our proposed layout, there would be a small increase in the peak flow reaching the pump station. SD1 was not opposed to that small increase, but the USACE will require that the increase be mitigated for approval of the Section 408

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permit. Flood storage loss in Goebel Park will also need to be mitigated. Coordination with USACE has indicated that modifications to the pump station would be acceptable, and that is the current mitigation plan.

- Are there opportunities to intercept more flow with the proposed separate storm sewer system? The size of the proposed storm sewer trunk line could be increased to provide additional capacity, even if it were for future separation that the City may anticipate.
    - There may be opportunities along the west side of the interstate for the City to separate more stormwater.
- The City would like to see the last flooding event analyzed with the proposed improvements. Could we prove to the residents that the flooding would not have occurred with the proposed improvements? The City will provide information from historical floods to VS for analysis in the model.
- A partnership with the City may be possible to provide more capacity in the Willow Run trunk line from the hospital to Prague Street, outside the limits of our project. There is currently a junction in the trunk line near the hospital, where two 96" lines join into a single 108" line. Providing additional capacity from that point to Prague Street could provide relief of this bottleneck in the system and reduce the potential of surcharging in the upstream system in the Peeselburg neighborhood.

Next Steps:

- Palmer will provide VS Engineering with updated design files that include invert elevation data for the proposed separate storm sewer system along the interstate.
- VS will investigate record floods and how the proposed system would respond to those. The City will assist with the record flood information.

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Next Steps:

- Palmer will provide SD1 with updated plans upon completion for capacity analysis in their model.
- SD1 will field verify the Willow Run trunk line pipe size upstream from the 9th Street junction.

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APPENDIX F

SD1 Willow Run Flood Station Evaluation

Brent Spence/Willow Run FS Evaluation

Hazen & Sawyer

Seth Bradley
Marissa Golgosky
Ethan Hypes
Bo Copeland

June 10, 2022

For SD1 –Lydia Watkins

DRAFT

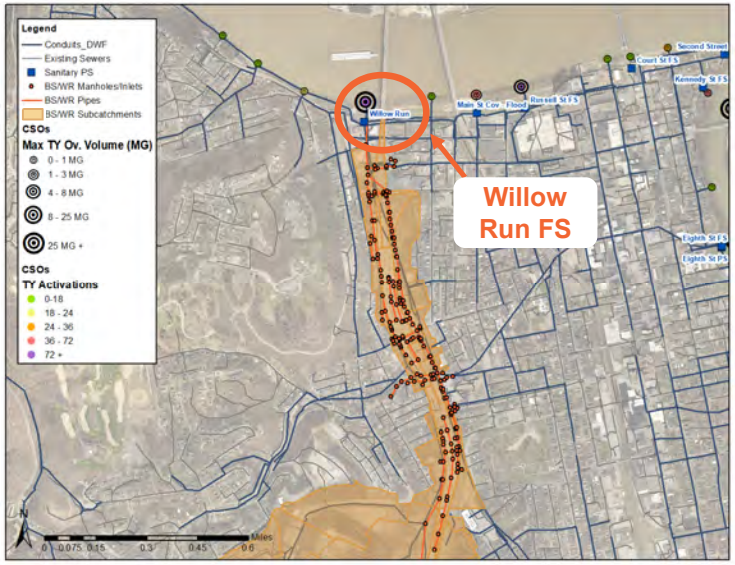
Outline

- Background and Purpose
- Model Representation
  - Storm Sewers and Manholes
  - Storm Separation Area
  - Willow Run FS
- Modeling Assumptions
- Model Results
  - Willow Run FS Influent Hydrograph
  - Willow Run FS Capacity
  - Willow Run FS Operation
  - Model HGL Profiles
- Discussion and Conclusions

Background and Purpose

Problem Description:

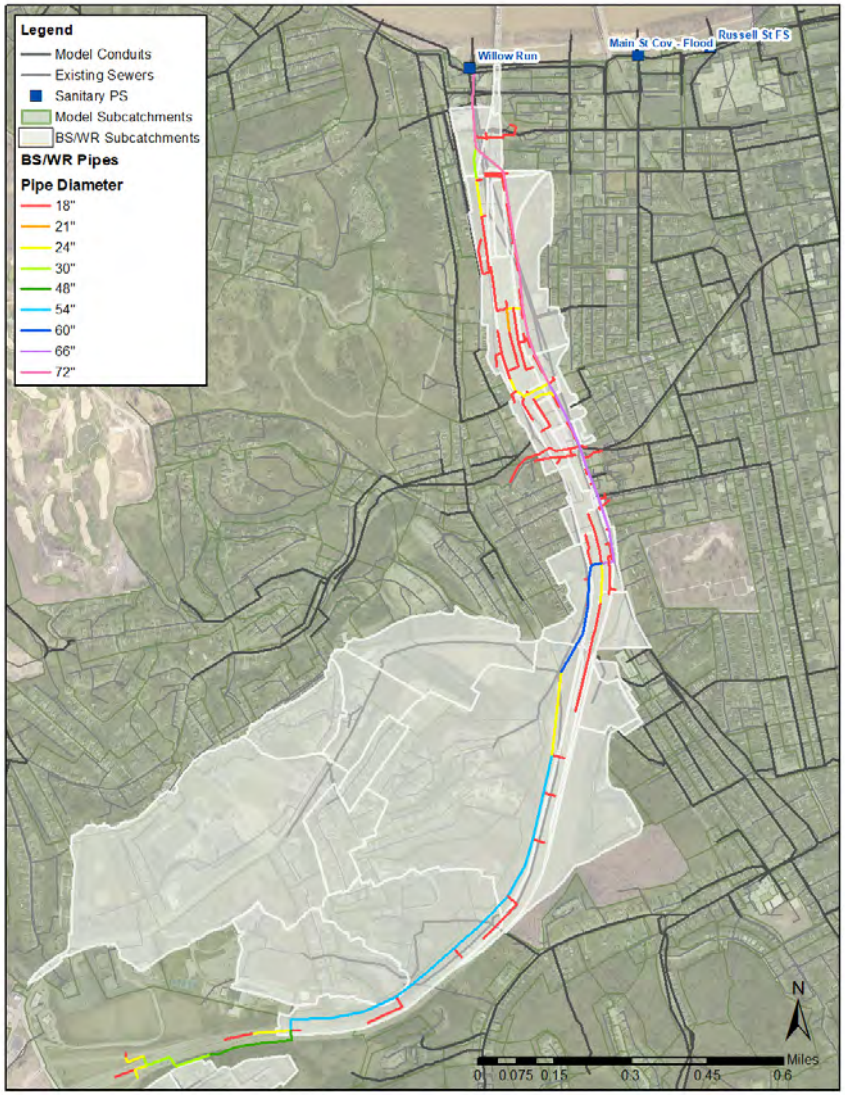
- The intent of this analysis is to examine the impact of proposed storm water separation associated with the Brent Spence Bridge project on the operation of the Willow Run Flood Station and relative HGL impacts upstream.
- The Brent Spence Bridge project will separate approximately 467 acres from the combined system and convey flow directly to the CSO outfall upstream of the Flood Station.
- Focus Area
  - **Willow Run Basin, CSO Outfall and Willow Run Flood Station**
- Perform all simulations for this analysis with the latest 2029 improvements model (modified to represent Willow Run FS operation) and using the Typical Year, 2-Year 1-Hour, 10-Year 1-Hour, and 25-Year 1-Hour rainfall with appropriate areal reduction factor.
- Note the Typical Year runs only include the period with river levels greater than 45.9 feet (04/02/70 - 04/09/70).



Model Representation

Storm Separation Sewers and Manholes

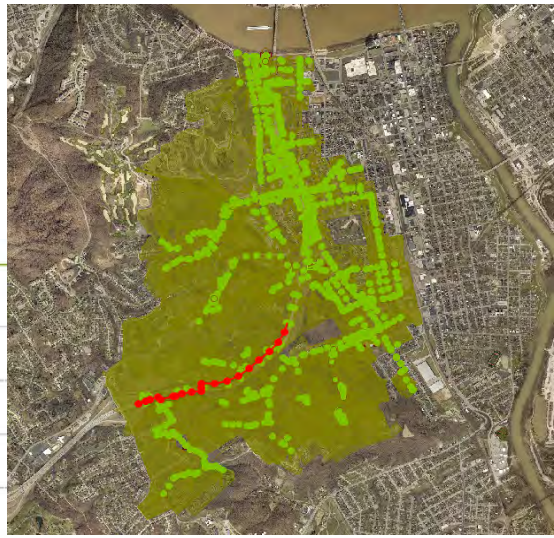
Model Network



Note - Added Storm Sewer Network based on data provided by SD1 and Palmer Engineering.

Storm Separation Sewers and Manholes

Sewer Profile 1/3



Link	-	-	WRIN194.1	-	WRIN192.1	-	-	WRIN183.1	WRIN184.1	-	-	WRIN175.1	WRIN178.1	WRIN197.1	WRIN198.1	WRIN199.1	WRIN201.1	WRIN202.1	WRIN203.1	WRIN204.1	
length (ft)	218.0	128.0	248.0	115.8	373.2	-	195.7	286.4	292.4	97.8	114.7	389.2	363.7	363.7	373.4	394.0	392.6	369.9	361.6	277.0	
width (in)	18.0	24.0	30.0	30.0	30.0	-	48.0	48.0	48.0	48.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	
us inv (ft AD)	851.540	-	833.160	-	815.970	-	796.370	790.730	786.810	-	-	783.070	772.760	758.560	739.540	721.580	701.930	676.390	659.430	639.430	
ds inv (ft AD)	839.580	-	821.710	-	796.920	-	790.810	786.900	784.870	-	-	772.840	758.640	739.620	721.660	702.010	676.470	659.510	639.510	626.790	
grad (%)	5.486	4.859	4.617	4.991	5.104	-	2.841	1.337	0.663	-	0.497	2.628	3.883	5.208	4.788	4.967	6.485	4.564	5.509	4.563	
Node	-	-	-	-	WRIN192	WRIN193	-	WRIN183	WRIN184	-	-	WRIN175	WRIN178	WRIN197	WRIN198	WRIN199	WRIN201	WRIN202	WRIN203	WRIN204	-
ground (ft AD)	-	-	-	-	819.760	800.630	-	794.440	790.610	788.580	-	788.400	776.550	762.350	743.330	725.370	705.720	680.180	663.220	643.220	-

Storm Separation Sewers and Manholes

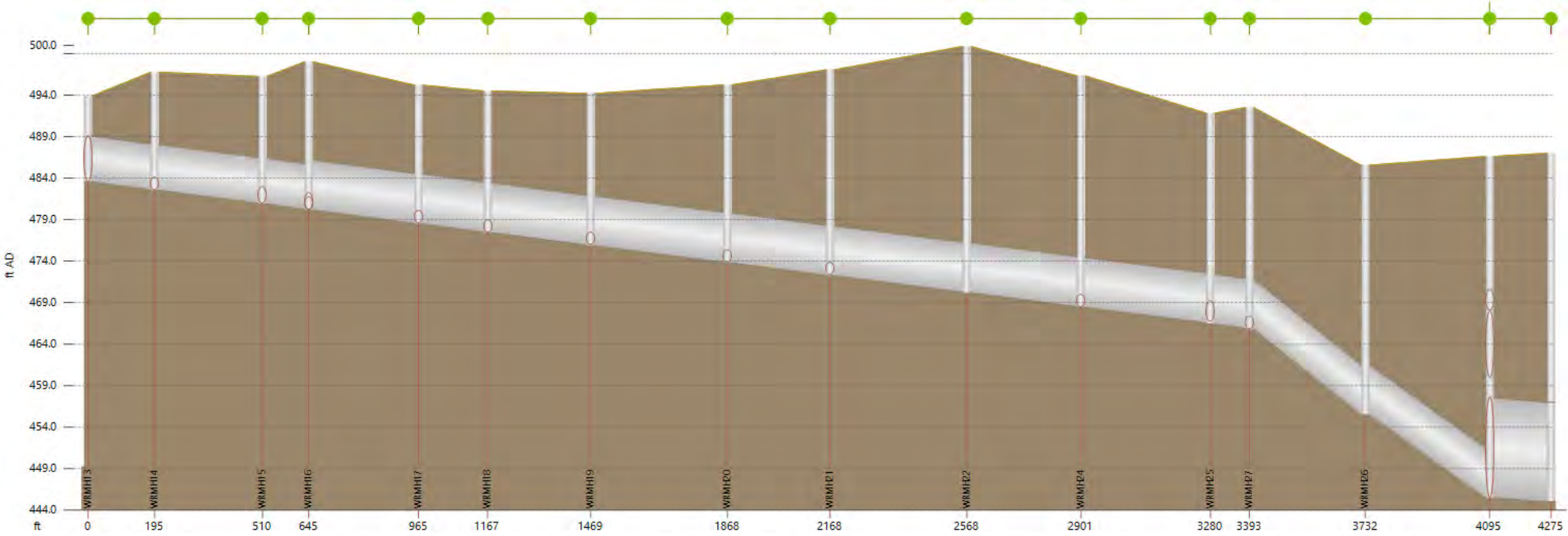
Sewer Profile 2/3

Link	WRIN205.1	WRIN206.1	WRIN207.2	WRIN6.1	WRMH30.1	WRMH2.1	-	-	-	-	WRMH5.1	WRMH6.1	-	WRMH8.1	-	-	-	-
length (ft)	492.0	394.2	869.2	450.9	292.6	276.2	150.7	106.1	-	-	346.7	247.0	81.0	172.0	134.5	141.0	133.2	82.7
width (in)	54.0	54.0	24.0	60.0	60.0	60.0	60.0	60.0	-	-	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
us inv (ft AD)	626.710	601.760	580.810	498.190	495.850	494.320	492.880	-	-	-	490.730	488.930	-	487.170	486.250	485.520	484.760	-
ds inv (ft AD)	601.840	580.890	498.190	495.940	494.400	492.960	492.140	-	-	-	489.010	487.720	-	486.330	485.600	484.840	484.110	-
grad (%)	5.055	5.295	9.506	0.499	0.496	0.492	0.491	0.481	-	-	0.496	0.490	-	0.488	0.483	0.482	0.488	-

Node	WRIN205	WRIN206	WRIN207	WRIN6	WRMH30	WRMH2	WRMH3	-	-	-	WRMH5	WRMH6	-	-	-	-	-	-
ground (ft AD)	630.500	605.550	584.600	509.340	524.450	508.880	507.450	-	-	-	517.360	504.810	497.000	-	-	-	-	-

Storm Separation Sewers and Manholes

Sewer Profile 3/3

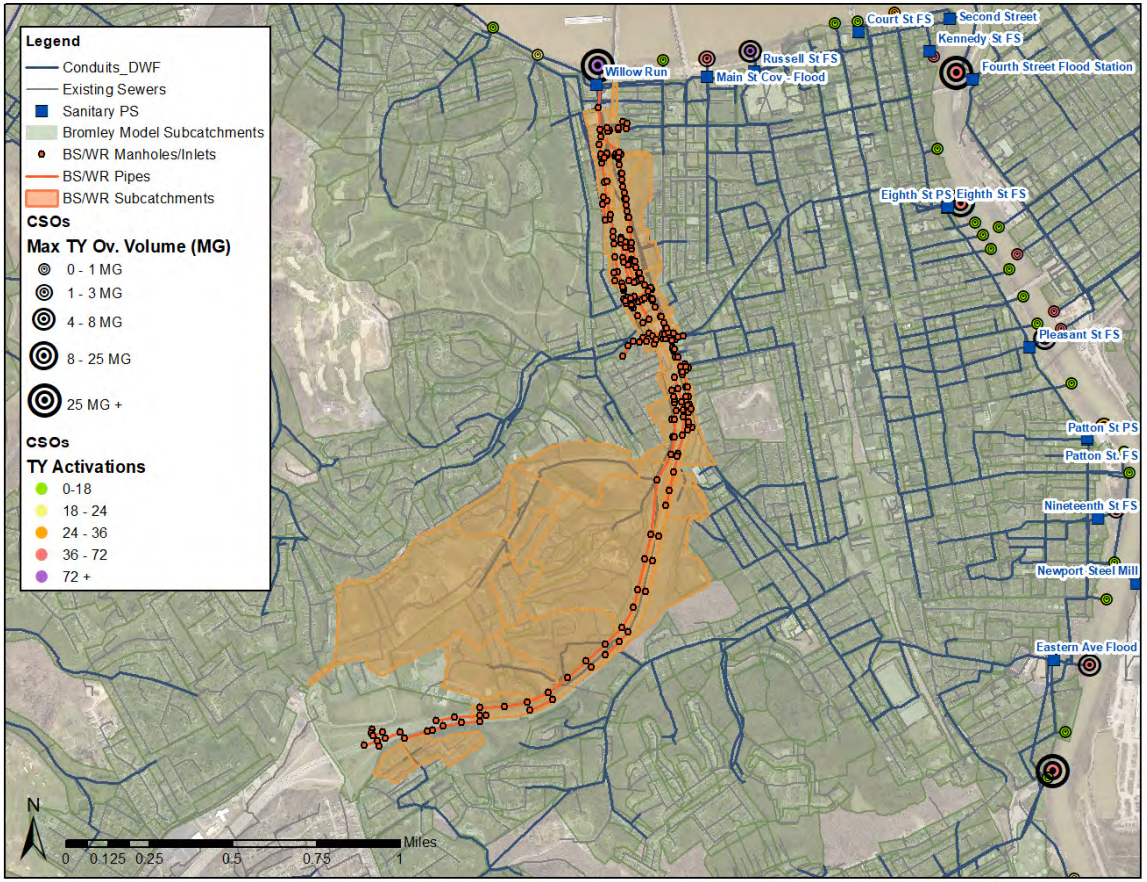


Link		WRMH13.1	WRMH14.1	-	WRMH16.1	WRMH17.1	WRMH18.1	WRMH19.1	WRMH20.1	WRMH21.1	WRMH22.1	WRMH24.1	-	WRMH27.1	WRMH26.1	1480096.1
length (ft)		194.6	315.0	135.0	320.8	201.5	301.9	399.6	299.5	400.0	333.6	378.5	113.2	338.6	363.0	180.4
width (in)		66.0	66.0	66.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	144.0
us inv (ft AD)		483.560	482.520	480.890	480.150	478.490	477.420	475.850	473.790	472.240	470.180	468.440	-	465.810	455.500	445.509
ds inv (ft AD)		482.600	480.970	480.230	478.570	477.500	475.930	473.870	472.320	470.260	468.520	466.550	-	455.500	445.500	445.000
grad (%)		0.493	0.492	0.489	0.492	0.491	0.494	0.496	0.491	0.495	0.498	0.499	0.504	3.045	2.755	0.282

Node	-	WRMH14	WRMH15	WRMH16	WRMH17	WRMH18	WRMH19	WRMH20	WRMH21	WRMH22	WRMH24	WRMH25	WRMH27	WRMH26	1480096	-
ground (ft AD)	-	496.760	496.250	498.010	495.210	494.500	494.200	495.230	497.050	499.870	496.320	491.820	492.510	485.560	486.614	-

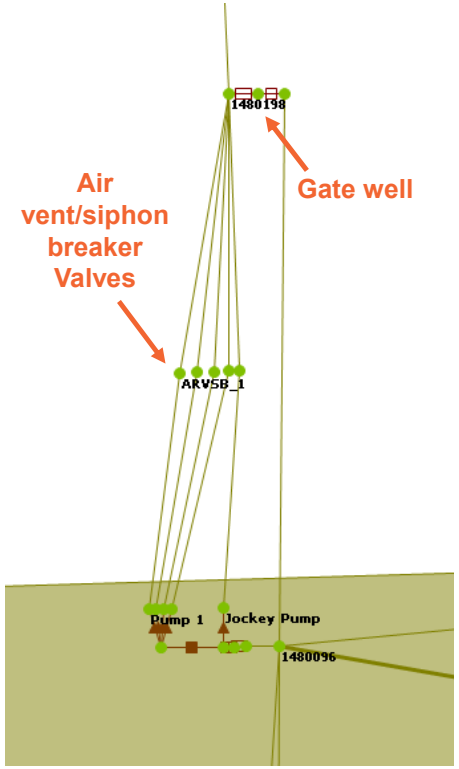
Storm Separation Area

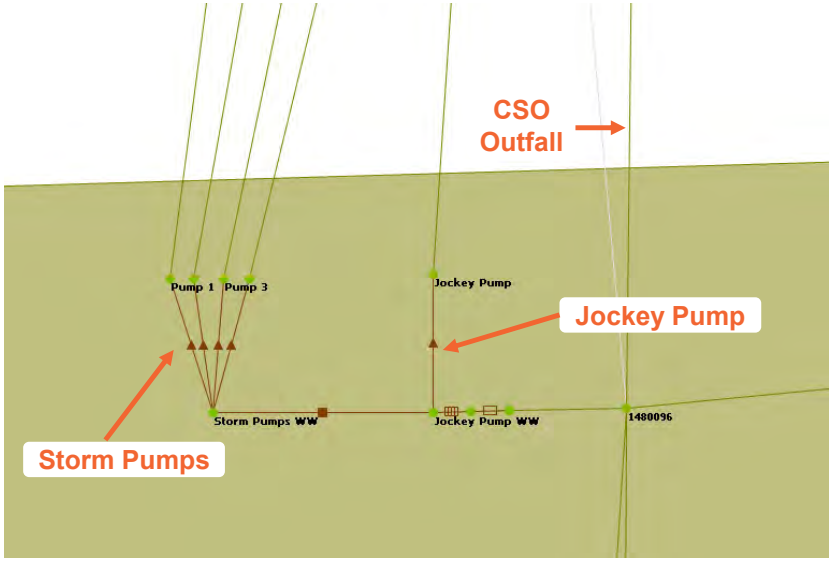
- Prior task identified 467 acres to offload from the combined system and connect to the proposed network. (Shown in orange in figure)



Willow Run FS

- Model representation taken from prior modeling efforts in 2011.
- SD1 has not made any improvements to the FS since 2011.
- Gatewell leakage modeled up to 6.75 mgd during high river conditions (river stage > 45.9 feet). It is understood that SD1 has potentially mitigated much of this leakage source but remains in the model for this evaluation.
- Model capacity assumes full siphoning in the force mains, effectively reducing the static head on the jockey and storm pumps.





Modeling Assumptions

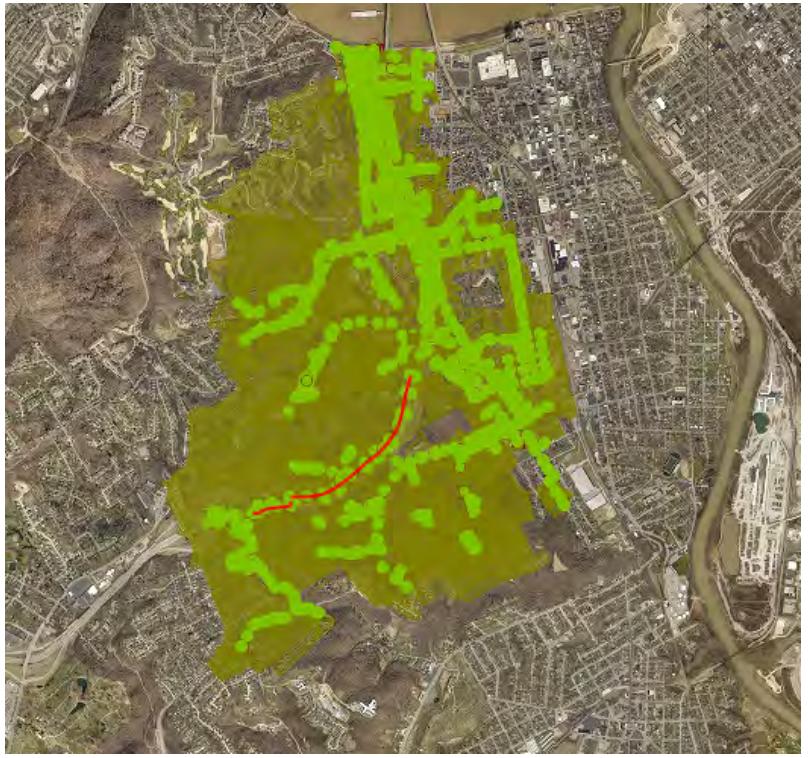
Modeling Assumptions

- Model clipped to 1480008 & 1470030 on the ORI to represent interceptor gate closure to isolate flows to flood station. This represents conditions when river stage > 45.9'. As stated previously, typical year results only include 04/02/70 – 04/09/70 when river stage exceeds this elevation.
- Imported proposed manholes and inlets as nodes from files provided by Palmer and loaded both based on best judgment.
- Removed orphan nodes/sewers and connected IN207 to IN6 using an open channel conduit.
- Adjusted the inverts for conduits 176.1 and 177.1 such that the pipe is below grade.
- KYTC Basin 1, KYTC Basin 2, and KYTC Basin 3 remain in the separation model with no outlet controls. Flow from these basins is routed to the proposed storm sewer network. Other basins are included with controls as planned in the 2029 UWSP improvements.
- FS representation taken from 2011 and includes gatewell leakage up to 6.75 mgd during high river conditions (river stage > 45.9'). In addition, full siphoning is assumed in the force mains.
- Model does not assume sediment in model outfall from 1480112 to the river; however, previous analysis in 2011 noted the likely presence of grit and debris in this sewer section. That analysis concluded this could be a significant factor in gatewell leakage.

Pipes Crowns Above Grade

- Based on data provided by Palmer, the following pipes have crowns above the top of the connecting structure. It doesn't impact results herein but should be addressed during design.

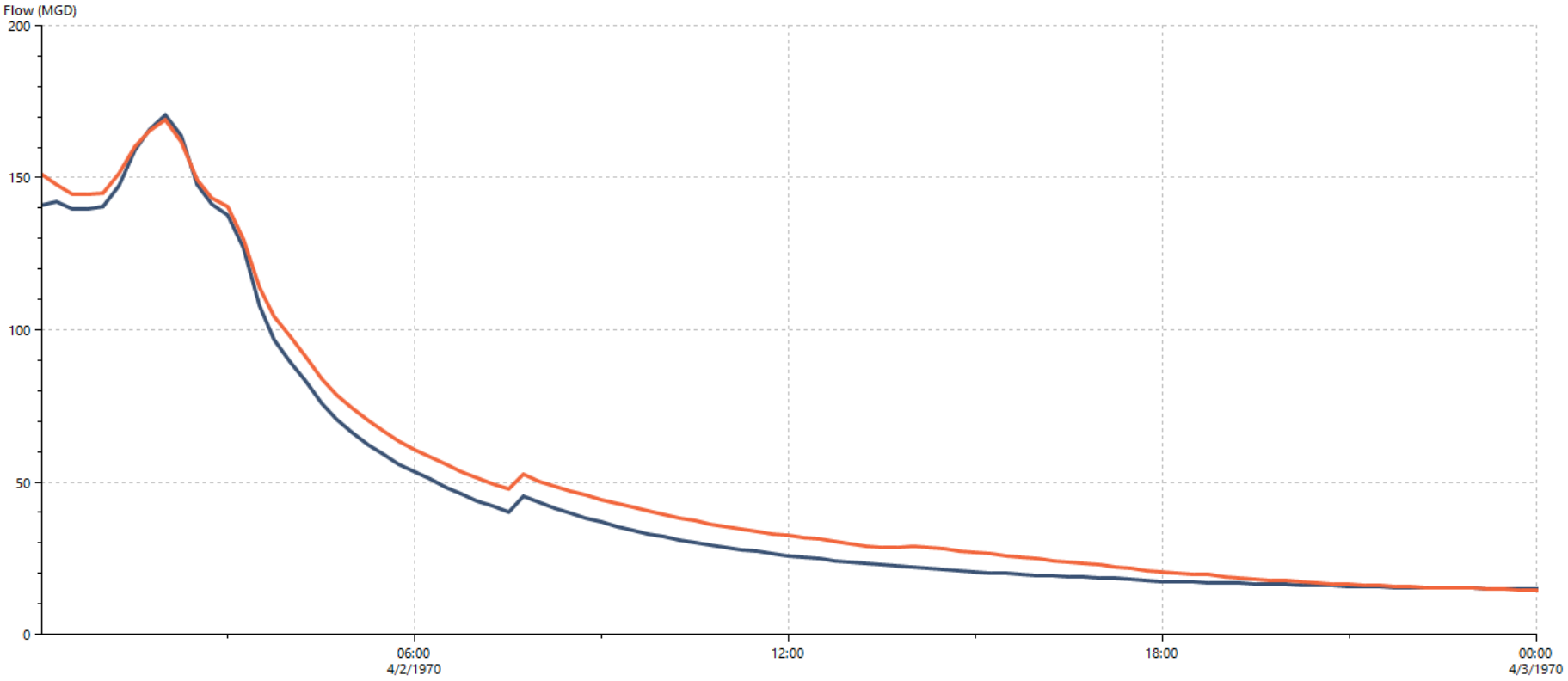
  - WRIN175.1
  - WRIN178.1
  - WRIN183.1
  - WRIN184.1
  - WRIN185.1
  - WRIN193.1
  - WRIN197.1
  - WRIN198.1
  - WRIN199.1
  - WRIN201.1
  - WRIN202.1
  - WRIN203.1
  - WRIN204.1
  - WRIN205.1
  - WRIN206.1
  - WRIN207.2
  - WRMH1.1



Model Results

Willow Run FS Influent Hydrograph

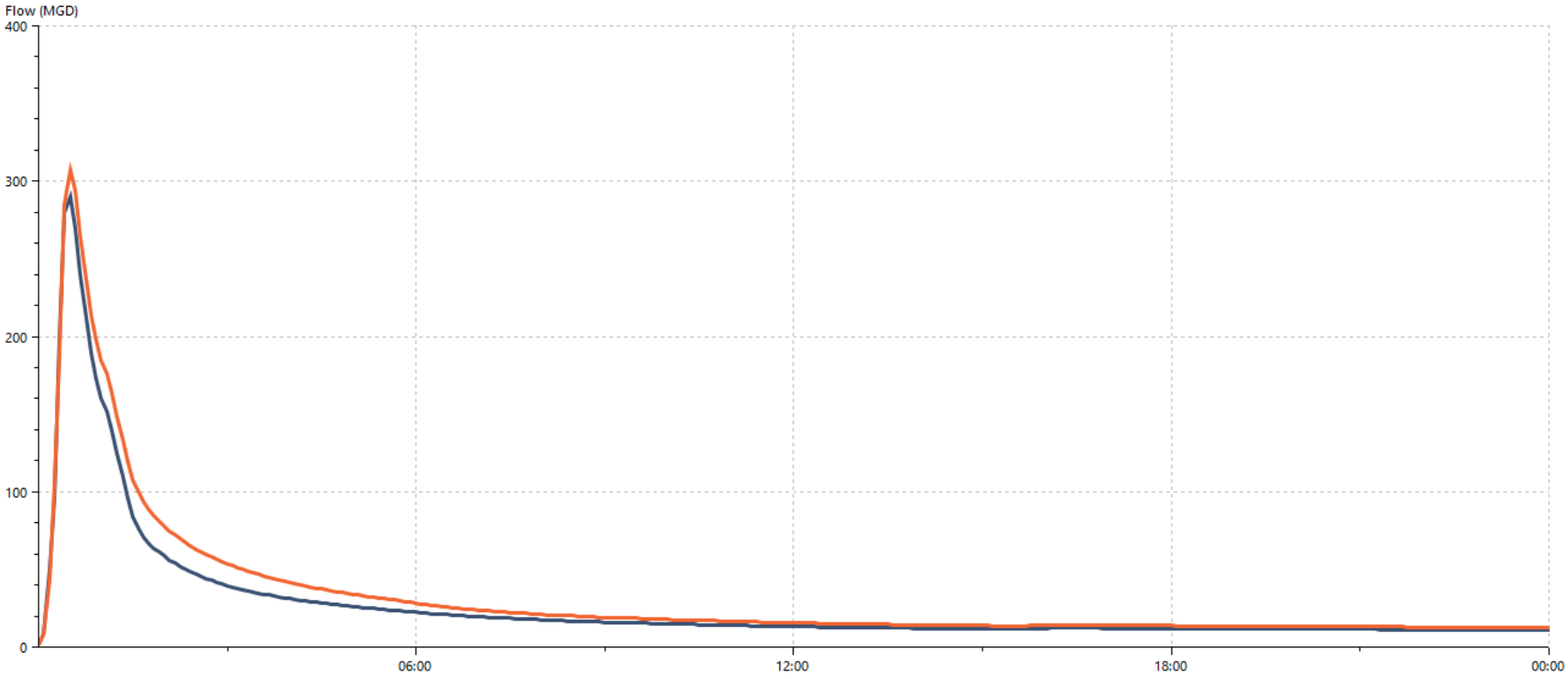
Max Typical Year Conditions – April 2 - April 9



	Flow	
	Min	Max
Pre Separation	14.785	170.652
Post Separation	14.454	168.979

Willow Run FS Influent Hydrograph

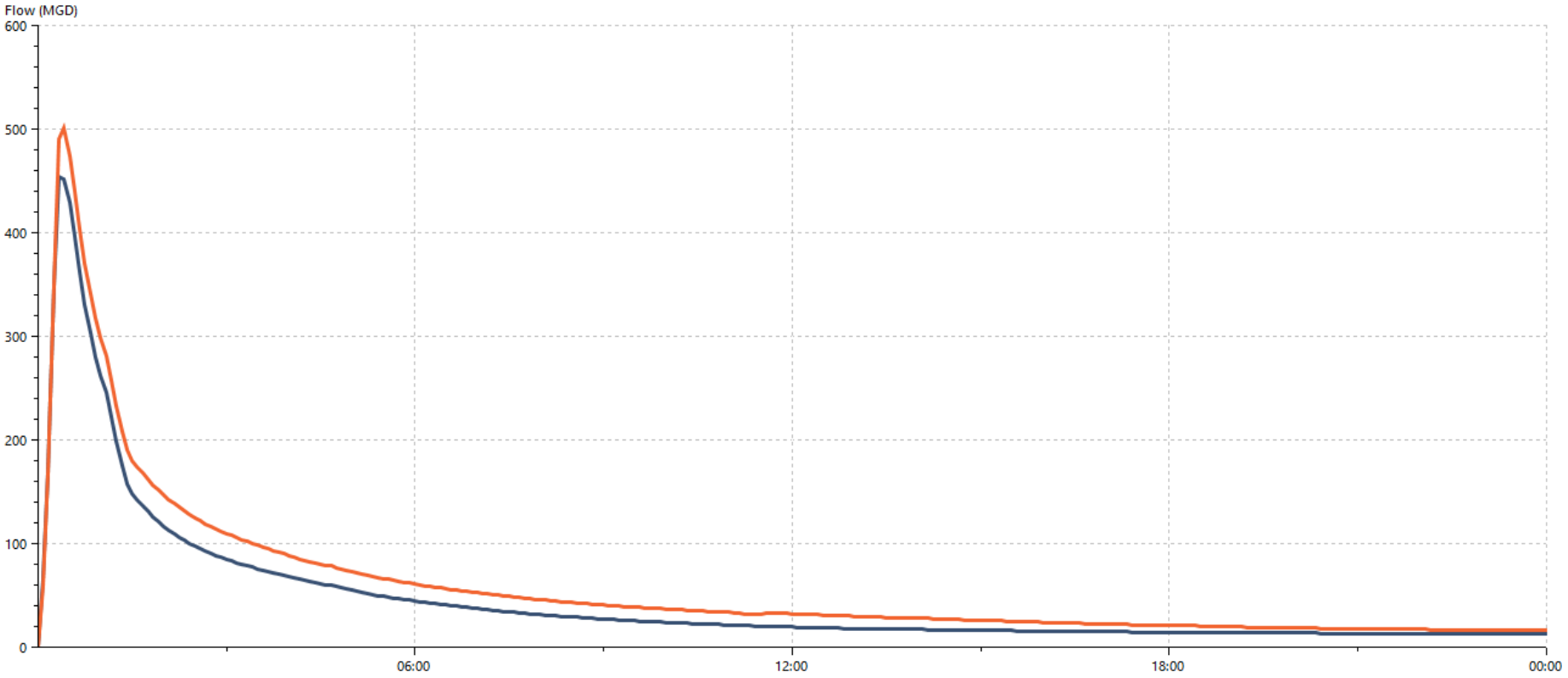
2-Year 1-Hour



	Flow	
	Min	Max
Pre Separation	8.375	289.982
Post Separation	8.261	307.592

Willow Run FS Influent Hydrograph

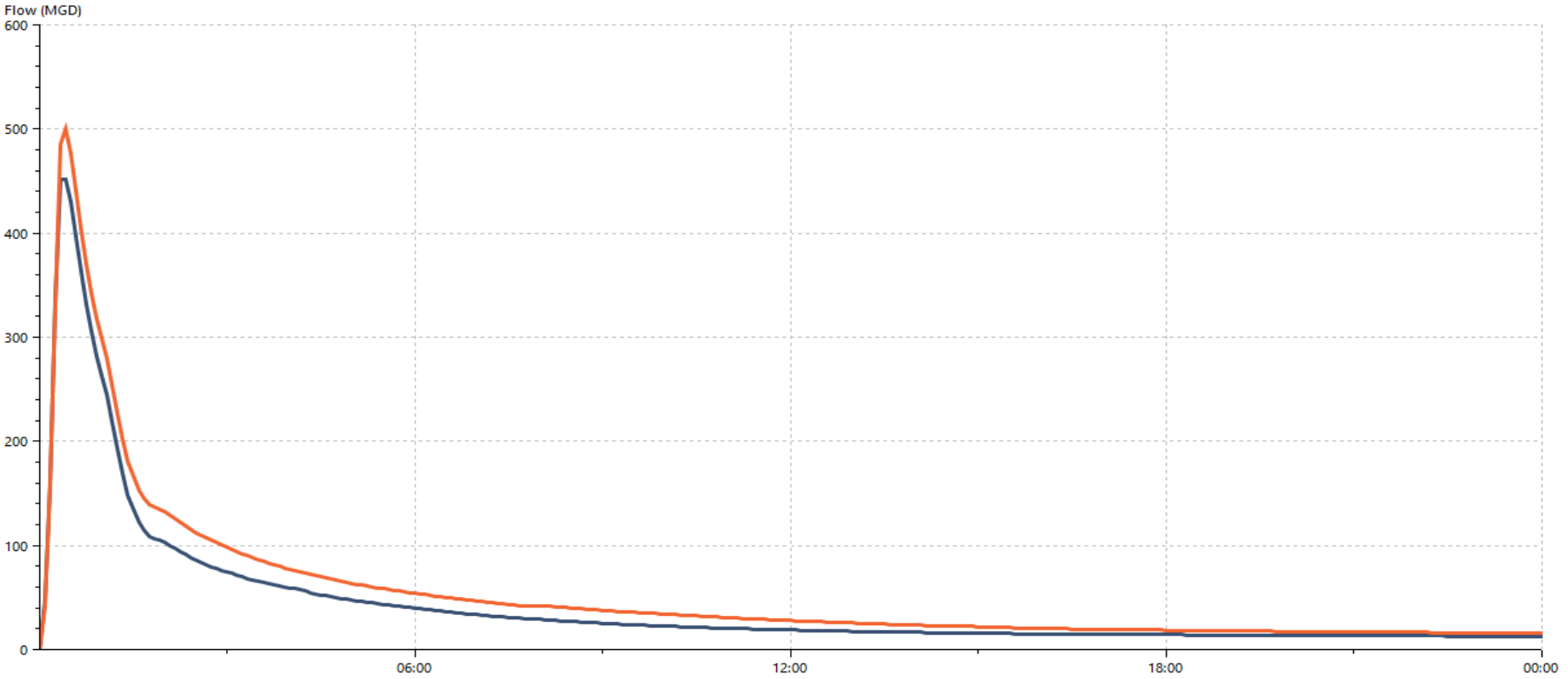
10-Year 1-Hour



	Flow	
	Min	Max
Pre Separation	12.766	454.186
Post Separation	16.197	500.695

Willow Run FS Influent Hydrograph

25-Year 1-Hour



	Flow	
	Min	Max
Pre Separation	12.735	452.231
Post Separation	15.783	500.785

Willow Run FS Capacity

Pump	Before Separation Capacity (MGD)	After Separation Capacity (MGD)
Jockey	8.8	8.8
Storm #1	48.1	48.3
Storm #2	48.2	48.4
Storm #3	48.1	50.5
Storm #4	50.2	48.4

Note:

1) Capacities listed are individual pump capacities
2) Jockey pump does not operate when any of the storm pumps are running
3) Storm pump capacities shown, assume sequential operation (e.g. storm #1 is operating during the storm #2 capacity shown, storm #1 and #2 are operating during storm #3 capacity shown, storm #1, #2, and #3 are operating during storm #4 capacity shown)

Willow Run FS Operation

Typical Year Runtime Comparison

Pump	Before Separation Runtime (mins)	After Separation Runtime (mins)
Jockey	8715	8400
Storm #1	1200	1560
Storm #2	315	390
Storm #3	240	315
Storm #4	0	15

Willow Run FS Operation

2-Year 1-Hour Runtime Comparison

Pump	Before Separation Runtime (mins)	After Separation Runtime (mins)
Jockey	9550	9375
Storm #1	585	765
Storm #2	135	160
Storm #3	75	105
Storm #4	0	0

Willow Run FS Operation

10-Year 1-Hour Runtime Comparison

Pump	Before Separation Runtime (mins)	After Separation Runtime (mins)
Jockey	8750	8680
Storm #1	1160	1500
Storm #2	250	305
Storm #3	190	220
Storm #4	0	115

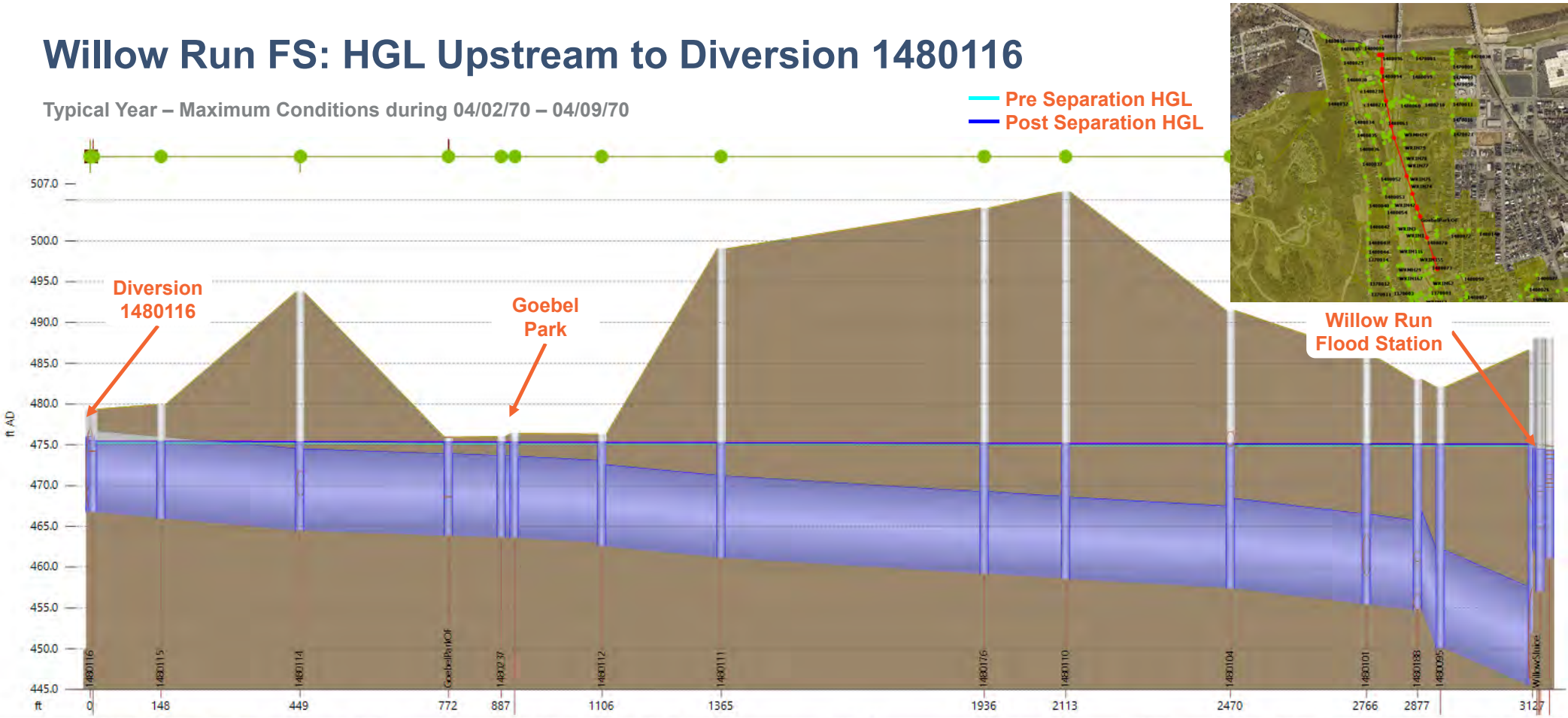
Willow Run FS Operation

25-Year 1-Hour Runtime Comparison

Pump	Before Separation Runtime (mins)	After Separation Runtime (mins)
Jockey	9125	8795
Storm #1	1040	1375
Storm #2	225	260
Storm #3	175	190
Storm #4	0	95

Willow Run FS: HGL Upstream to Diversion 1480116

Typical Year – Maximum Conditions during 04/02/70 – 04/09/70

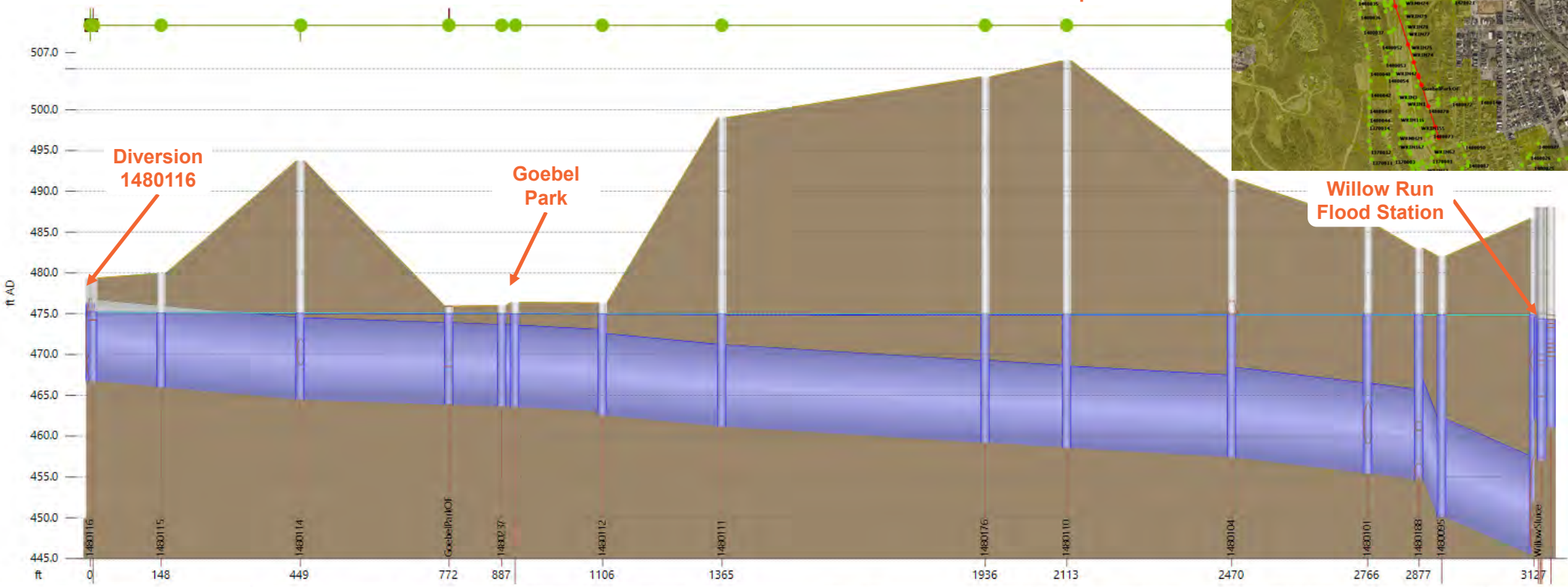


Link	1480116A.1	1480115.1	1480114.1	-	-	1480113.1	1480112.1	1480111.1	1480176.1	1480110.1	1480104.1	-	-	1480095.1
length (ft)	147.6	301.8	322.7	114.7	-	190.3	259.2	570.9	177.2	357.6	295.3	111.5	-	200.1
width (in)	120.0	120.0	120.0	120.0	-	120.0	120.0	120.0	120.0	120.0	132.0	132.0	-	144.0
us inv (ft AD)	466.745	465.981	464.478	463.880	-	463.560	462.530	461.152	459.236	458.540	457.388	455.449	-	450.049
ds inv (ft AD)	466.079	464.521	463.880	463.660	-	463.041	461.230	459.236	458.638	457.470	455.518	454.708	-	445.571
grad (%)	0.451	0.484	0.185	0.192	-	0.272	0.501	0.336	0.337	0.299	0.633	0.665	-	2.238

Node	-	1480115	1480114	GoebelParkOF	-	-	1480112	1480111	1480176	1480110	1480104	1480101	-	1480095	-
ground (ft AD)	-	479.921	493.701	475.920	-	-	476.312	499.016	504.003	506.004	491.470	486.155	-	482.054	-

Willow Run FS: HGL Upstream to Diversion 1480116

2-Year, 1-Hour – Maximum Conditions

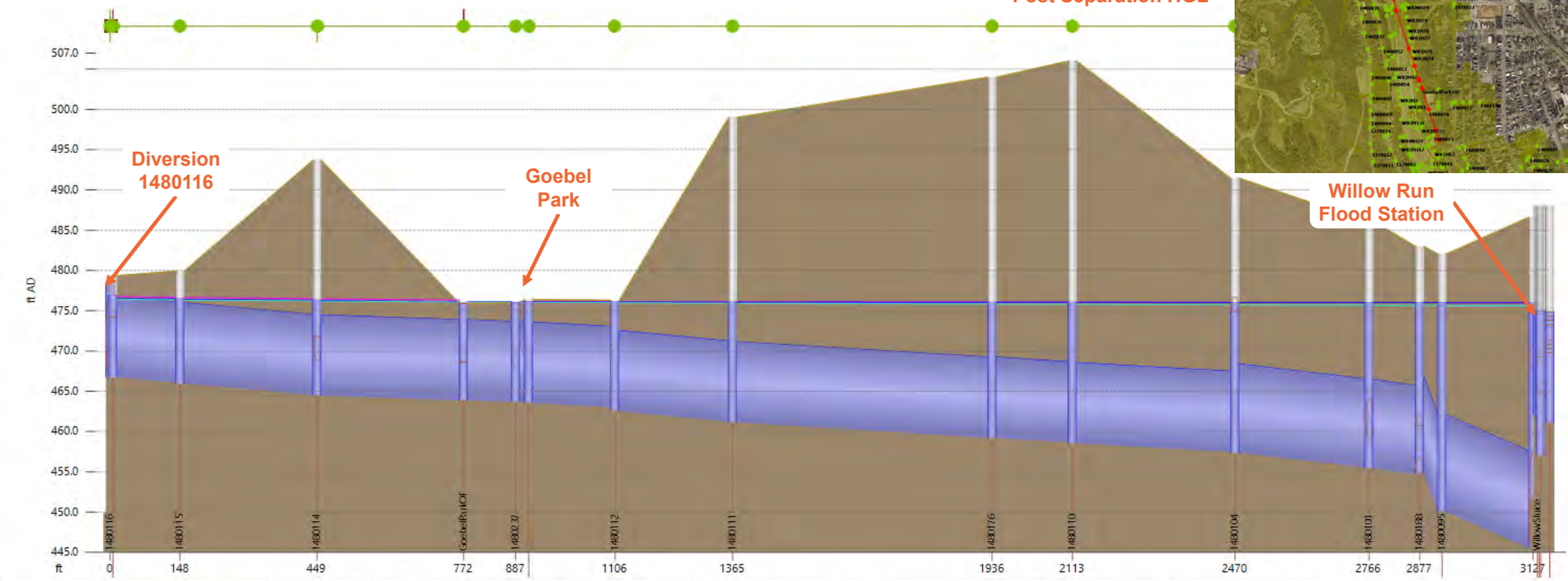


Link	1480116A.1	1480115.1	1480114.1	-	-	1480113.1	1480112.1	1480111.1	1480176.1	1480110.1	1480104.1	-	-	1480095.1
length (ft)	147.6	301.8	322.7	114.7	-	190.3	259.2	570.9	177.2	357.6	295.3	111.5	-	200.1
width (in)	120.0	120.0	120.0	120.0	-	120.0	120.0	120.0	120.0	120.0	132.0	132.0	-	144.0
us inv (ft AD)	466.745	465.981	464.478	463.880	-	463.560	462.530	461.152	459.236	458.540	457.388	455.449	-	450.049
ds inv (ft AD)	466.079	464.521	463.880	463.660	-	463.041	461.230	459.236	458.638	457.470	455.518	454.708	-	445.571
grad (%)	0.451	0.484	0.185	0.192	-	0.272	0.501	0.336	0.337	0.299	0.633	0.665	-	2.238

Node	-	1480115	1480114	GoebelParkOF	-	-	1480112	1480111	1480176	1480110	1480104	1480101	-	1480095	-
ground (ft AD)	-	479.921	493.701	475.920	-	-	476.312	499.016	504.003	506.004	491.470	486.155	-	482.054	-

Willow Run FS: HGL Upstream to Diversion 1480116

10-Year, 1-Hour – Maximum Conditions



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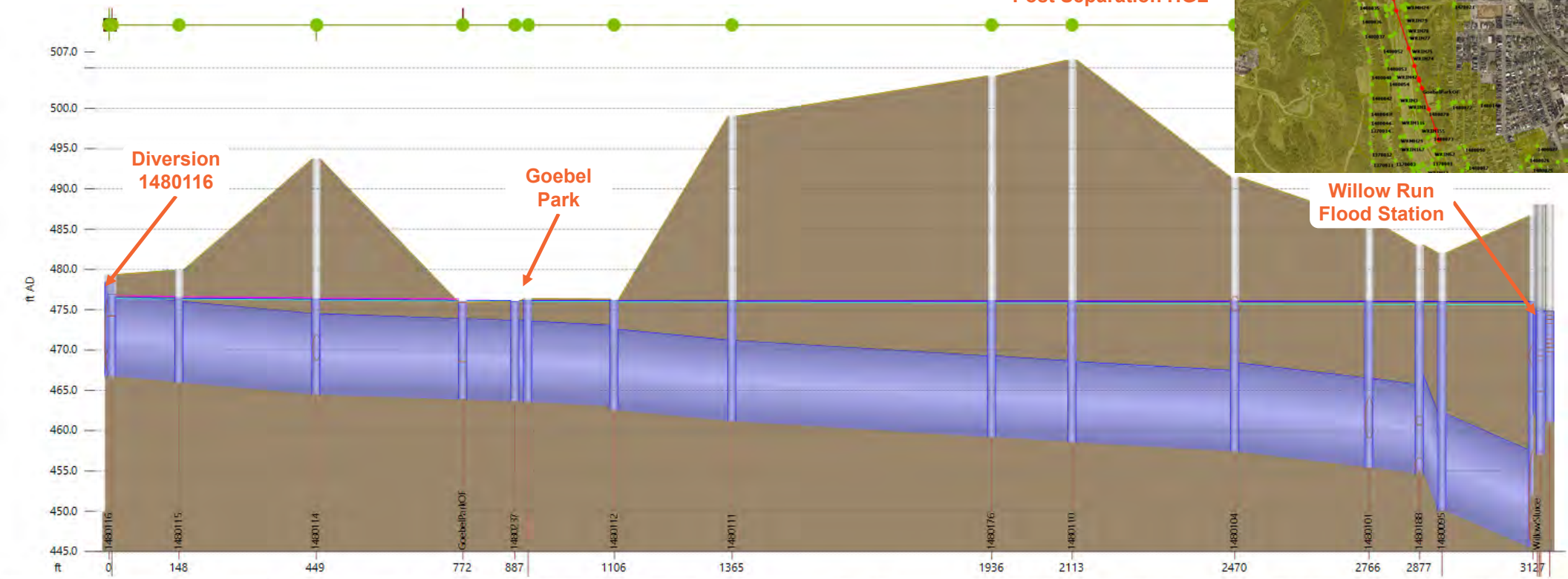
length (ft)	147.6	301.8	322.7	114.7	-	190.3	259.2	570.9	177.2	357.6	295.3	111.5	-	200.1
width (in)	120.0	120.0	120.0	120.0	-	120.0	120.0	120.0	120.0	120.0	132.0	132.0	-	144.0
us inv (ft AD)	466.745	465.981	464.478	463.880	-	463.560	462.530	461.152	459.236	458.540	457.388	455.449	-	450.049
ds inv (ft AD)	466.079	464.521	463.880	463.660	-	463.041	461.230	459.236	458.638	457.470	455.518	454.708	-	445.571
grad (%)	0.451	0.484	0.185	0.192	-	0.272	0.501	0.336	0.337	0.299	0.633	0.665	-	2.238
Node	-	1480115	1480114	GoebelParkOF	-	-	1480112	1480111	1480176	1480110	1480104	1480101	-	1480095	-
ground (ft AD)	-	479.921	493.701	475.920	-	-	476.312	499.016	504.003	506.004	491.470	486.155	-	482.054	-

Willow Run FS: HGL Upstream to Diversion 1480116

25-Year, 1-Hour – Maximum Conditions



Link	1480116A.1	1480115.1	1480114.1	-	-	1480113.1	1480112.1	1480111.1	1480176.1	1480110.1	1480104.1	-	-	1480095.1
length (ft)	147.6	301.8	322.7	114.7	-	190.3	259.2	570.9	177.2	357.6	295.3	111.5	-	200.1
width (in)	120.0	120.0	120.0	120.0	-	120.0	120.0	120.0	120.0	120.0	132.0	132.0	-	144.0
us inv (ft AD)	466.745	465.981	464.478	463.880	-	463.560	462.530	461.152	459.236	458.540	457.388	455.449	-	450.049
ds inv (ft AD)	466.079	464.521	463.880	463.660	-	463.041	461.230	459.236	458.638	457.470	455.518	454.708	-	445.571
grad (%)	0.451	0.484	0.185	0.192	-	0.272	0.501	0.336	0.337	0.299	0.633	0.665	-	2.238

Node	-	1480115	1480114	GoebelParkOF	-	-	1480112	1480111	1480176	1480110	1480104	1480101	-	1480095	-
ground (ft AD)	-	479.921	493.701	475.920	-	-	476.312	499.016	504.003	506.004	491.470	486.155	-	482.054	-

Discussion and Conclusions

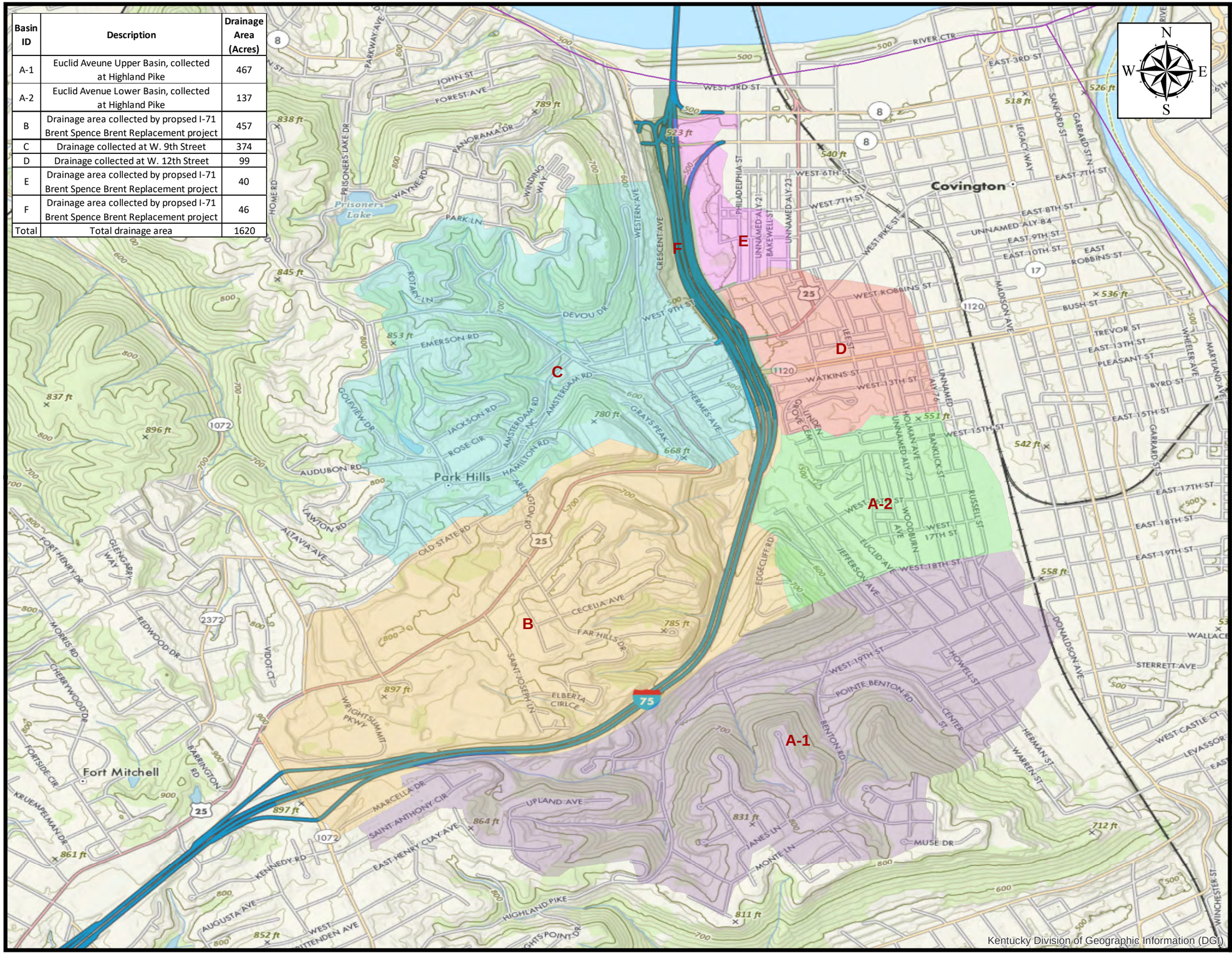
Discussion and Conclusions

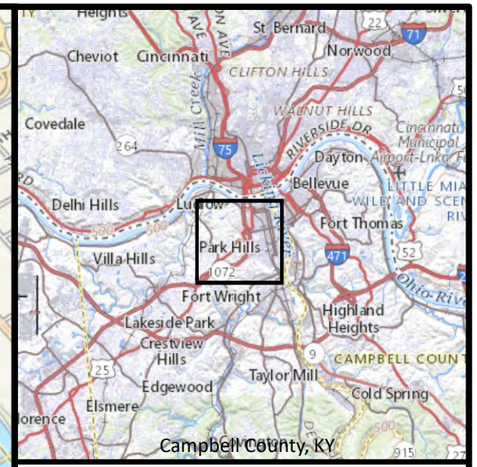
- HGL differences upstream of the FS to the Willow Run diversion are minimal and driven by differences in FS operation pre and post separation.
- FS capacities are minimally impacted, with differences driven by variations in wet well level during pre and post separation.
- No new overflows are created in the combined system from pre to post separation in the typical year, 2-year, 10-year or 25-year storms.
- Peak flows and volumes to the FS are higher post separation due to differences in flow routing and the absence of controls on the KYTC basins. This increase in peak flow/volume leads to slightly higher run times for the FS storm pumps and slightly lower run times for the jockey pump compared to the pre separation model.
- While no overflows are predicted in the proposed separated storm sewer network for the typical year, 2-year, or 10-year rainfall, a capacity assessment of this network was not performed and is beyond the scope of this evaluation.

APPENDIX G

VS Engineering Analysis Exhibits

Basin ID	Description	Drainage Area (Acres)
A-1	Euclid Aveune Upper Basin, collected at Highland Pike	467
A-2	Euclid Avenue Lower Basin, collected at Highland Pike	137
B	Drainage area collected by propsed I-71 Brent Spence Brent Replacement project	457
C	Drainage collected at W. 9th Street	374
D	Drainage collected at W. 12th Street	99
E	Drainage area collected by propsed I-71 Brent Spence Brent Replacement project	40
F	Drainage area collected by propsed I-71 Brent Spence Brent Replacement project	46
Total	Total drainage area	1620





Legend

Name

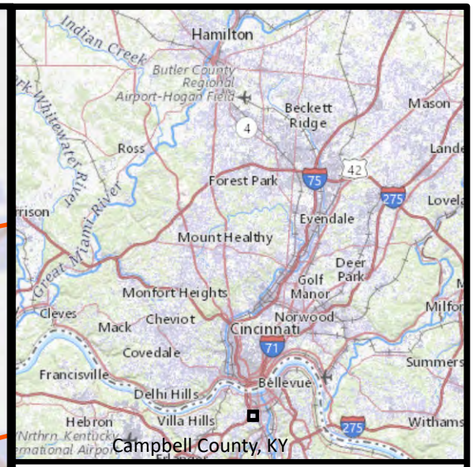
- A-1
- A-2
- B
- C
- D
- E
- F

0 500 1,000 2,000 Feet

Drainage Basin Map

VS ENGINEERING

FIGURE 2



Legend

- Manholes_Gravity
- Gravity_Line(Euclid_Ave)
- Sanitary Structure
- Storm Structure
- Sanitary Sewer
- Storm Sewer

260 130 0 260 Feet

Euclid Avenue Storm Collection System

June 2022

VS ENGINEERING

FIGURE 3

Table 4. 10-Yr 24-Hr Peak Flow Comparison, Existing Conditions and Proposed Pipe Upgrade to Euclid Avenue Trunkline

		Existing Conditions		Proposed Conditions		Difference: Proposed - Existing	
Description	**Node ID**	**Peak Flow (cfs)**	**Max Water Elev.**	**Peak Flow (cfs)**	**Max Water Elev.**	**Peak Flow (cfs)**	**Max Water Elev.**
Storm pipe along Highland Pike	1340086	825	509.13	580	502.72	-245	-6.41
Storm inlet along Euclid Ave., street flooding occurs approximately at elev. 507.18	**1340049**	318	**507.51**	228	501.75	-90	-5.76
Storm inlet along Euclid Ave., street flooding occurs approximately at elev. 506.94	**1340048**	283	**506.58**	226	500.98	-57	-5.60
Storm inlet along Euclid Ave., street flooding occurs approximately at elev. 505.96	**1340046**	271	**505.72**	225	500.18	-46	-5.54
Storm inlet along Euclid Ave., street flooding occurs approximately at elev. 504.47	**1340045**	264	**504.66**	224	499.13	-39	-5.53
Storm inlet along Euclid Ave., street flooding occurs approximately at elev. 503.29	**1340001**	260	**503.85**	222	497.95	-37	-5.90
Storm inlet along Euclid Ave., street flooding occurs approximately at elev. 502.85	**1360070**	253	**503.62**	220	496.52	-33	-7.10
Storm inlet along Euclid Ave., street flooding occurs approximately at elev. 502.18	**1360069**	238	**503.57**	220	497.09	-18	-6.48
Storm inlet along Euclid Ave., street flooding occurs approximately at elev. 502.22	**1360068**	227	**503.51**	221	496.69	-6	-6.82
Storm inlet along Euclid Ave., street flooding occurs approximately at elev. 502.40	**1360059**	223	**503.49**	221	496.31	-2	-7.18
No flooding occurs at this storm inlet	1360058	215	503.10	223	495.88	8	-7.22
No flooding occurs at this storm inlet	1360182	229	502.80	225	495.52	-4	-7.28
No flooding occurs at this storm inlet	1360023	215	502.53	226	495.18	11	-7.35
No flooding occurs at this storm inlet	1360022	215	502.30	149	495.05	-66	-7.25
No flooding occurs at this storm inlet	1360021	234	501.98	229	494.85	-4	-7.13
Junction Box at St. Elizabeth Hospital	C1360123	494	501.82	703	494.62	209	-7.20
Trunkline downstream of Junction Box	1360016	468	500.82	695	493.84	227	-6.98
Low area along Euclid Avenue's back alley, street flooding occurs approximately at elev. 503.0	**1340005**	468	**503.59**	335	501.22	-133	-2.37
Low area along Euclid Avenue's back alley, street flooding occurs approximately at elev. 503.0	Bowl	404	502.10	0	503.00	-404	0.90
Low area along back alley, street flooding occurs approximately at elev. 504.15	1340080	386	503.28	311	500.44	-75	-2.84
Low area along back alley, street flooding occurs approximately at elev. 503.34	1360108	301	503.22	303	499.64	2	-3.58
No flooding occurs at this storm inlet	1360112	430	503.22	514	498.97	84	-4.25
No flooding occurs at this storm inlet	C1360110	400	502.56	508	496.90	109	-5.66

Note: Bold text indicates flooding at hydrologic node

Table 5. 25-Yr 24-Hr Peak Flow Comparison, Existing Conditions and Proposed Pipe Upgrade to Euclid Avenue Trunkline

		Existing Conditions		Proposed Conditions		Difference: Proposed - Existing	
Description	**Node ID**	**Peak Flow (cfs)**	**Max Water Elev.**	**Peak Flow (cfs)**	**Max Water Elev.**	**Peak Flow (cfs)**	**Max Water Elev.**
Storm pipe along Highland Pike	1340086	1095	511.60	797	508.58	-298	-3.02
Storm inlet along Euclid Ave., street flooding occurs at elev. 507.18	**1340049**	407	**508.16**	341	**507.28**	-66	-0.88
Storm inlet along Euclid Ave., street flooding occurs at elev. 506.94	**1340048**	330	**507.08**	324	506.40	-6	-0.68
Storm inlet along Euclid Ave., street flooding occurs at elev. 505.96	**1340046**	317	**506.26**	315	505.54	-2	-0.72
Storm inlet along Euclid Ave., street flooding occurs at elev. 504.47	**1340045**	303	**504.97**	308	**504.53**	5	-0.44
Storm inlet along Euclid Ave., street flooding occurs at elev. 503.29	**1340001**	281	**504.56**	300	**503.57**	19	-0.99
Storm inlet along Euclid Ave., street flooding occurs at elev. 502.85	**1360070**	272	**504.51**	286	**503.12**	14	-1.39
Storm inlet along Euclid Ave., street flooding occurs at elev. 502.18	**1360069**	251	**504.52**	275	**502.72**	24	-1.80
Storm inlet along Euclid Ave., street flooding occurs at elev. 502.22	**1360068**	229	**504.50**	247	**502.41**	18	-2.09
Storm inlet along Euclid Ave., street flooding occurs at elev. 502.40	**1360059**	224	**504.50**	245	502.31	21	-2.19
No flooding occurs at this storm inlet	1360058	392	505.42	246	501.82	-146	-3.60
No flooding occurs at this storm inlet	1360182	242	505.73	248	501.43	6	-4.30
No flooding occurs at this storm inlet	1360023	227	503.58	249	501.08	22	-2.50
No flooding occurs at this storm inlet	1360022	227	503.38	163	500.95	-64	-2.43
No flooding occurs at this storm inlet	1360021	250	503.16	262	500.74	12	-2.42
Junction Box at St. Elizabeth Hospital	C1360123	496	503.07	739	500.53	243	-2.54
Trunkline downstream of Junction Box	1360016	468	503.07	721	499.93	253	-3.14
Low area along Euclid Avenue's back alley, street flooding occurs at elev. 503.0	**1340005**	577	**503.94**	440	**504.40**	-137	0.46
Low area along Euclid Avenue's back alley, street flooding occurs at elev. 503.0	**Bowl**	703	**503.44**	136	**503.80**	-567	0.36
Low area along back alley, street flooding occurs approximately at elev. 504.15	1340080	519	504.02	373	**504.41**	-146	0.39
Low area along back alley, street flooding occurs at elev. 503.34	**1360108**	298	**504.03**	354	**504.33**	56	0.30
No flooding occurs at this storm inlet	1360112	438	504.02	598	503.90	160	-0.12
No flooding occurs at this storm inlet	C1360110	402	503.55	577	502.25	175	-1.30

Note: Bold text indicates flooding at hydrologic node

APPENDIX H

Goebel Park Flood Relief Exhibits and Photos

OPERATION & MAINTENANCE MANUAL

FLOOD PROTECTION

COVINGTON, KENTUCKY

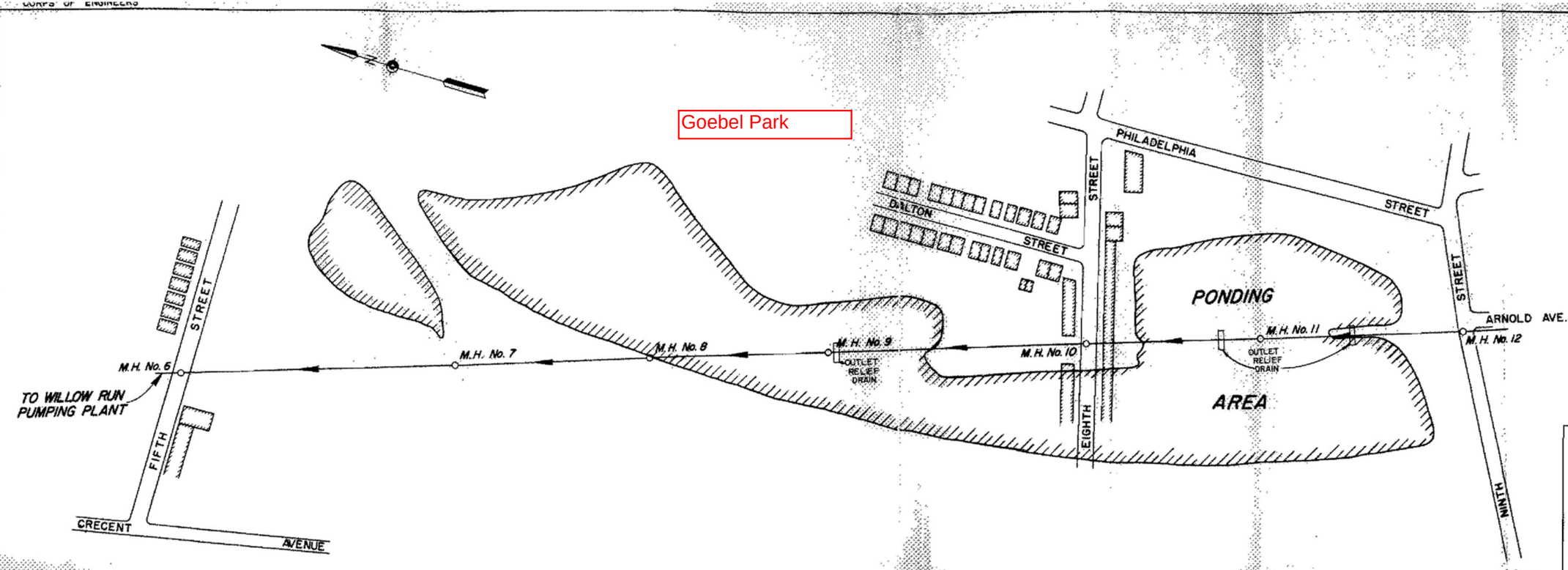
LOUISVILLE DISTRICT

CORPS OF ENGINEERS

1955

CORPS OF ENGINEERS

U.S. ARMY



NOTES:
Pump Starting River Elev. 476.8
Maximum Ponding Elev. 481.0

OHIO RIVER BASIN
FLOOD PROTECTION – COVINGTON, KY

WILLOW RUN PONDING AREAS

SCALE IN FEET
100 0 100 200

LOUISVILLE, KY. 1956
OPERATION AND MAINTENANCE MANUAL
PLATE A

'R' 1965

Goebel Park Flood Outlet Relief Structures