North Shore Levee

Aberdeen & Hoquiam, Washington

Interior Drainage Analysis

For the 60% Design – CLOMR Application Submittal

July 2017

kpff Consulting Engineers

CITY OF HOQUIAM

ABERDEEN WASHINGTON

North Shore Levee

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For the 60% Design – CLOMR Submittal

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Prepared for:

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1. Introduction

1.1 – PROJECT DESCRIPTION AND OBJECTIVE

The objective of the North Shore Levee project is to design a levee for the Cities of Aberdeen and Hoquiam, which once constructed will result in a revision of the National Flood Insurance Program mapping, removing the project areas from the 100-year flood plain.

Levee improvements are proposed within the City of Aberdeen and the City of Hoquiam, along an alignment approximately 5.6 miles long through mostly developed residential and industrial areas, with a small portion in forested areas. Proposed levee improvements include raised roadways, concrete flood walls, sheet pile flood walls, earthen levees, and stop log closures that establish a barrier within the project area for flood relief. The levee structure varies in height from between 0 and 5 feet to establish a top of levee elevation of 15.2 feet. This elevation includes the base flood elevation of 13.2 feet and 2 feet of free board. See Figure 1 – Vicinity Map below for an illustration of the proposed levee alignment.

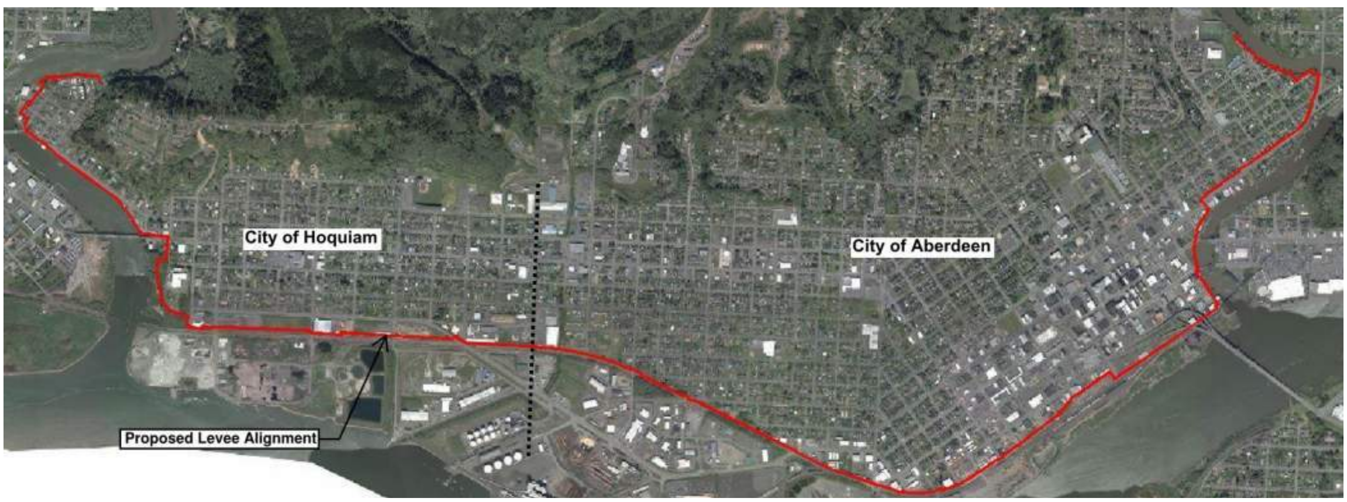


Figure 1 – Vicinity Map

1.2 – SCOPE OF STUDY

This study has been prepared by KPFF Consulting Engineers for the Cities of Aberdeen and Hoquiam to support the North Shore Levee Conditional Letter of Map Revision (LOMR) submittal. The purpose of the study is to:

- Delineate interior storm drainage basins relative to the proposed levee and storm outfall locations.
- Calculate stormwater runoff for the interior drainage basins.
- Identify the locations of existing and proposed storm drainage pumping stations and outfalls.
- Provide preliminary design criteria for interior pump stations.
- Identify general locations of storm drainage system conveyance improvements.

The report has been prepared based on the levee improvements shown in the 60% review submittal package, dated July 2017 by KPFF Consulting Engineers.

2. Existing Conditions

2.1 – TOPOGRAPHY

The topography surrounding the project area consists of hills located to the north, the Hoquiam River to the west, Grays Harbor to the south, and the Wishkah River to the east. Areas of high ground (elevation 16’ NAVD88 or above) are located in the hills, north of the project area, as well as, the industrial area near Grays Harbor. Areas of low ground (10’ NAVD88 or below) are typically located along the waterbodies (the Hoquiam River, Grays Harbor, & the Wishkah River). The majority of the levee will be constructed in areas that vary in elevation from 10’ to 16’ NAVD88.

The topography near the Hoquiam River, Grays Harbor, and the Wishkah River is flat with slopes generally less than 5%. The topography to the north of the project site has a mixture of moderate slopes with grades between 5% and 30%, and steep slopes with grades between 30% and 65%. Approximately 78% of the total area located within the levee has low slopes, while 16% of the area is moderately sloped, and the other 6% is steep slopes.

The west terminus of the levee alignment starts at the left bank of the Hoquiam River near where 16th Street turns into Broadway Avenue in east Hoquiam. The levee follows the river downstream to the northern side of the Puget Sound and Pacific railroad tracks. The levee alignment then parallels the railroad tracks that extend west to east from the Hoquiam River to the Wishkah River. At the Wishkah River, the levee heads upstream and follows the right bank of the Wishkah River where it reaches the east terminus near Stewart Field. The topography within the levee defines multiple sub-basins within the project area. The specific delineation of the basins is provided in the above vicinity map and the Drainage Basin Exhibits located in Appendix A.

2.2 – DEVELOPMENT PATTERNS

The Cities include a mixture of residential, industrial, commercial, and forested areas. Housing is the major land use in the basins occupying well over half of the developed land. Basins are comprised of approximately 66% residential, 12% industrial, 16% commercial, and 6% forested areas. The basins have few undeveloped parcels and or opportunities for significant changes in developed land condition. Redevelopment of existing parcels is anticipated but storm drainage runoff from the interior basins is not expected to change significantly in the future.

Residential uses are mainly located in areas north of Market Street and vary in elevations between 10’ and 16’ NAVD88. The Port of Grays Harbor accounts for nearly all of the industrial areas within the project limits. The Port of Grays Harbor is located at the south side of the project area, along Port Industrial Road. The industrial areas generally vary between 10’ – 16’ NAVDD88 in elevation. The majority of the industrial area will be located outside the protection area of the levee. Commercial development is mainly located between 1st and Steele Streets in Aberdeen and along Simpson Ave in Hoquiam. The forested/vegetated areas located within the project limits are scattered throughout the Cities, but mainly consist of parks, drainages, and hill sides.

2.3 – SOIL CHARACTERISTICS

The project site is located on the north side of the Grays Harbor/Chehalis River. The geologic map “Geologic Map of the Humptulips Quadrangle and Adjacent Areas, Grays Harbor County, Washington,” indicates the soils at the site are Quaternary Deposits (Qd), which includes alluvium and glacial drift of alpine origin. The hills to the north of the western extent of the project area, along the Hoquiam River where the high ground tie-in is located, are mapped as the Montesano Formation (Tmss), which is described as a medium- to fine grained sandstone and conglomerate. The Montesano Formation also borders a thin strip of the Quaternary Deposits along the edge of the Hoquiam River where Riverside Avenue is located.

Additional soil characteristics were derived from the USDA Natural Resource Conservation Service Web Soil Survey. All soils mapped within the project basins correspond to hydrologic soil groups A/B or C. The site soils are mapped as approximately 75% Udorthents, 20% Elochoman silt loam, and 5% other. Others include Zenker silt loam, Skamo silt loam, and Rennie silty clay loam.

Per section *3.3.1.4 Groundwater* in the Geotechnical Analysis and Levee Certification Report, the groundwater level is at a depth of approximately 3 to 5 feet below the ground surface.

3. Existing Interior Drainage

3.1 – EXISTING STORM DRAINAGE CONVEYANCE SYSTEM

The Cities of Aberdeen and Hoquiam both have stormwater drainage systems that include catch basins, pipes, and drainage ditches that convey stormwater runoff to natural waterways or pump stations, that collect and discharge water to the Hoquiam River, Wishkah River, Chehalis River or Grays Harbor. Much of the existing pipe system in the lowlands of Aberdeen and Hoquiam was initially constructed as a combined sanitary and storm system. In the 1950s, the Cities began to construct a separate system to convey sanitary wastewater to treatment plants. The older pipe system has been dedicated for stormwater use. Because of the age of the storm system pipes, their condition is degrading and it is assumed that there is significant intrusion of groundwater into the drainage system. This reduces the capacity of the drainage system to convey water, especially in winter months when the ground is saturated and groundwater levels rise closer to the surface.

Stormwater runoff flows downhill, following natural topography, and if it enters catch basins is conveyed through a network of underground pipes that form a manmade drainage basin. The drainage system is designed for gravity flow to outfalls. Most of the drainage basins discharge to pump stations that pump stormwater when high tides rise above the elevation of the outfalls and prevent gravity flow. Because of the flat topography of the Cities lowlands, there is little hydraulic gradient to drain water in the pipe system. Many, but not all, of the pumps have variable drives that turn on when the level of water in wet wells reaches a threshold. The pumps increase drainage capacity of the system, creating a greater hydraulic gradient that draws water through the pipes. Most of the pumps are decades old and are undersized relative to the capacity needed to drain large rain events. Calculations show that all 16 of the existing pump stations lack the capacity to convey the runoff volume from the 100-year storm.

3.2 – DRAINAGE BASIN DELINEATION

The storm drainage basins for the interior drainage analysis were delineated based on the following documents:

- City of Aberdeen Storm System Base Map. File provided by the City of Aberdeen in CAD format in March 2015 (last revised 9/28/2006).
- City of Hoquiam Storm System Base Map. File provided by Maul Foster Alongi.
- City of Aberdeen Storm Pump As-built Sketches.
- City of Hoquiam Storm Pump As-built Sketches.
- Timberworks Master Plan provided by Maul Foster Alongi.
- Aerial Survey prepared by David C. Smith & Associates from photography dated 4/8/2016.
- Supplemental on-ground survey prepared by KPFF Consulting Engineers (performed in 2015 & 2016).

- USGS 7.5-Minute Series Topographic Map for the Aberdeen Quadrangle (2014).
- North Shore Levee Plan Set (60% Draft) prepared by KPFF Consulting Engineers.

The Timberworks Master Plan was the primary document used to delineate basins, and the other documents were supplementary. The system base map shows inlets, manholes, storm laterals, trunk lines, pump stations, and outfalls. From the base map, color coding was used to delineate basins, identify trunk lines, and locate corresponding pump stations. Table 1 shows the existing basins.

Table 1 – Basin Areas

Basin*	Total Basin Area	Residential Area	Industrial Area	Forest Area	Existing Pump
	(Acres)	**(Acres)**	**(Acres)**	**(Acres)**	**(Yes/No)**
Broadway Ave.	1.59	1.59	0	0	No
16th St.	21.35	18.41	0	2.94	No
19th St.	15.00	11.19	0	3.81	Yes
20th St.	12.48	8.98	1.15	2.35	Yes
28th St.	341.91	229.08	75.22	37.61	Yes
Fry Creek	183.27	78.81	100.80	3.66	Yes
Duffy St.	178.52	108.90	0	69.62	Yes
Division St.	247.02	187.73	54.34	4.94	Yes
Cherry St.	214.17	87.81	0	126.36	Yes
Lincoln St.	154.05	127.86	26.19	0	Yes
Washington St.	29.11	16.01	13.10	0	Yes
Jefferson St.	131.00	91.70	39.30	0	Yes
K St.	59.91	11.98	47.93	0	Yes
H St.	68.07	10.21	57.86	0	Yes
River St.	0.29	0	0.29	0	No
State St.	4.17	0	4.17	0	No
Zelasko Park	17.79	0	17.79	0	No
Wishkah St.	4.04	0	4.04	0	No
E St.	101.44	81.15	20.29	0	Yes
D St.	25.97	21.04	4.93	0	No
B St.	9.58	7.66	1.92	0	No
Arthur St.	77.68	77.68	0	0	Yes
Stanton St.	5.57	5.57	0	0	No
Chicago St.	1.85	1.85	0	0	No

*A majority of the delineated basins have one individual outfall, but in a few cases, a basin has multiple outfalls. See Interior Drainage Basin Exhibits in Appendix A

Basin Delineation Notes:

- The supplemental on-ground survey was performed along some of the proposed levee alignment.
- A majority of the basin delineations were driven by the existing stormwater conveyance system.

- The storm system base map includes pipe flow directions which help delineate interior drainage basins.
- Both Cities storm systems contain multiple connections between different storm basins (i.e. two (2) outlet pipes out of a single structure to different downstream outfalls). For this analysis, only the primary outfall was used for basin delineation.
- The basin information shown accounts for minor surface runoff changes associated with the proposed levee project.
- All interior basins correspond to existing piped storm outfalls.

Interior storm drainage basin maps, along with the proposed levee location are included in Appendix A.

STORM DRAINAGE CALCULATIONS

Storm drainage calculations for the interior basins were performed using Western Washington Continuous Simulation Hydrology Model version 2012 software (WWHM2012). The 1% annual chance rainfall event was evaluated with all tide gates and outfalls submerged. As the worst case scenario, these flows were used to determine the necessary pump station capacity reported below.

The following calculations were performed as part of this study:

- Interior drainage basins were modeled using identified soil type, slopes, land cover, and historic rainfall records.
- Storm drainage runoff tributary to each basin was calculated for the 2-year, 25-year, and 100-year storm recurrence intervals.

Model assumptions and calculation constraints include:

- No storage facilities are planned as part of this project and runoff calculations do not account for routing of runoff through storage facilities or conveyance pipes. Storage facilities may become part of future design.
- Calculated runoff to basin outfalls is based on total runoff generated in the sub-basins using a one-hour time step for the 24-hour storm.
- The study assumes that interior storm events will coincide with the 100-year exterior flooding event eliminating the ability for gravity flows.

Table 2 shows the storm drainage modeling results.

Table 2 – Results of Storm Drainage Modeling

Basin/Outfall	CALCULATED STORM RUNOFF TO BASIN OUTFALL					
	Q2-YR		Q25-YR		Q100-YR	
	CFS	GPM	CFS	GPM	CFS	GPM
Broadway Ave.	0.5	231	0.9	394	1.0	466
15th St.	6.1	2,720	10.5	4,697	12.4	5,581
19th St.	3.7	1,681	6.6	2,947	7.8	3,519
20th St.	3.5	1,587	6.0	2,672	7.0	3,150
28th St.	107.0	48,005	175.0	78,558	205.8	92,369
Fry Creek	67.4	30,231	107.0	48,038	124.6	55,940
Duffy St.	30.8	13,815	51.4	23,056	60.4	27,104
Division St.	86.9	39,015	142.7	64,049	168.0	75,388
Cherry St.	33.7	15,131	65.6	29,451	80.9	36,347
Lincoln St.	51.1	22,931	86.0	38,619	101.4	45,533
Washington St.	10.9	4,885	17.5	7,840	20.4	9,159
Jefferson St.	48.8	21,902	78.8	35,361	92.2	41,393
K St.	26.8	12,013	40.7	18,250	46.9	21,052
H St.	31.3	14,059	47.4	21,269	54.6	24,499
River St.	0.1	61	0.2	92	0.2	105
State St.	2.0	891	3.0	1,329	3.4	1,524
Zelasko Park	8.7	3,889	12.9	5,810	14.8	6,664
Wishkah St.	1.9	862	2.9	1,285	3.2	1,473
E St.	38.0	17,047	61.7	27,707	72.0	32,302
D St.	9.2	4,133	15.2	6,828	17.9	8,052
B St.	3.4	1,520	5.6	2,506	6.6	2,954
Arthur St.	25.7	11,538	43.8	19,657	51.8	23,260
Stanton St.	1.8	811	3.1	1,384	3.7	1,638
Chicago St.	0.6	270	1.0	460	1.2	545

Future Studies:

It should be noted that an additional study that addresses the interior drainage is anticipated to begin in the near future to support the Letter of Map Revision (LOMR) and development of construction documents. This study will provide a more in-depth analysis of the complexities of the storm drainage system, and the impact on the interior flooding through the protection areas. It is anticipated that this study will provide a greater level of detail and eliminate some of the conservative assumptions used in this study. The study will also evaluate alternatives to reduce the magnitude and duration of predicted flows and potential ponding in the protection area. At this time, the results of that study are expected to supersede this study before the LOMR is submitted for the North Shore Levee project.

4. Proposed Storm Conveyance System

4.1 – GENERAL UPGRADES

During low and medium flow conditions the existing storm conveyance system will remain largely unaltered gravity flow with the proposed levee improvements.

General improvements of the storm system may consist of:

- Install new inlets near the proposed levee alignment where low points are generated to remove the potential for interior ponding.
- Install tide check valves on storm pipes that must pass under the levee and at all outfalls.
- Raise, lower, or relocate existing storm inlet rims to match proposed grades.
- All proposed outfalls will be above the OHWM and may receive pretreatment prior to entering the waterbody. The locations where this will occur will be determined by the Cities at a later time.

The levee is proposed to separate existing storm basins. At the separation point, inline check valves will be installed to hydraulically separate the storm basin on the inside of the levee from the storm basin on the outside. This will allow the basin on the inside of the levee to continue to drain via gravity, but will keep tide water out of the interior basin during a high tide event.

PUMP STATIONS

Storm pump system improvements consist of:

- Install new or replace existing storm pumps at strategic locations inside of levee protection.
- Upgrade outfalls at all upgraded pump stations.
- Abandon pump stations deemed no longer necessary to the Cities overall basin consolidation approach.

Drainage Basin Exhibit in Appendix A indicates locations of all existing and proposed pump stations. Trunk lines located within the basins may need to be upgraded to convey the 100- year storm. Analysis of the existing conveyance system will occur at future design, as well as selecting strategic points to reroute stormwater runoff. All stormwater will continue to be conveyed via gravity to the existing outfalls during low and medium flows. The current proposal includes interceptor pipes which will convey high flows to regional pump stations to evacuate the interior water out of the protection area.

Identified upgrades may include:

- A pump will be added to the Broadway Avenue basin to convey all stormwater to the 15th Street basin. The 15th Street basin is currently a gravity system and will require installation of a new pump to operate during high flood events.
- 19th Street, 20th Street, 28th Street, Duffy Street, and Division Street basins all have existing pumps and will require pump upgrades and force main upgrades. The conveyance systems for these basins will function as they do today.
- Stormwater interceptor pipe line(s) to convey high flows to regional pump stations with the City of Aberdeen. Per the Aberdeen Alternatives in Section 4.2.

Table 3 shows the proposed pump capacity required for the 100-year storm for the basins mentioned above. Basins not identified in this section are addressed in Section 4.2 – Aberdeen Alternatives. Regardless of the alternative chosen, the specific upgrades mentioned above will still apply.

Table 3 – Storm Pump Stations

Outfall	Basin Runoff	Proposed Storm Pump Station
	Q100-YR	**Preliminary Proposed Capacity**
	GPM	**GPM**
Broadway Ave.	466	500
15th St.	5,581	6,000
19th St.	3,519	4,000
20th St.	3,150	3,500
28th St.	92,369	93,000
Fry Creek	55,940	60,000
Duffy St.	27,104	28,000
Division St.	75,388	76,000

STORM PUMP CALCULATION ASSUMPTIONS

The following assumptions are made in this study in regard to the storm pump stations:

- Due to the extent of development in the project sub-basins and lack of undeveloped parcels, it is reasonable to assume the calculated basin characteristics will remain the same for the levee design life.
- The study assumes that interior storm events will coincide with the 100-year exterior flooding event.
- All interior basins will continue to drain to the pump stations via gravity as the method of outlet. Pumps will operate whenever storm runoff enters the conveyance system.
- The 100-year (1% chance of annual recurrence) storm runoff is used for the pump capacity criteria.
- Only schematic pump station information is included in the scope of this study. Future design will occur prior to the Letter of Map Revision (LOMR) is submitted for the North Shore Levee project.

Schematic pump station details and general basis of design information is included in Appendix C. Proposed storm pump improvement locations are shown on the maps in Appendix A.

CONVEYANCE

Storm conveyance system improvements consist of:

- Increase storm drain sizes at strategic locations to convey the 100-year storm (This will be evaluated prior to LOMR submittal).

It is the intent of the interior drainage plan improvements to continue the gravity systems as much as possible; however, some conveyance lines will need to be either upgraded or added in order to sufficiently convey the 100-year storm. This will be investigated in detail prior to the LOMR is submitted for the project.

4.2 – ALTERNATIVE UPGRADES

The configuration of stormwater interceptor systems will be evaluated as an alternative; allowing for a reduced number of proposed pump stations and conveyance upgrades. For each of the alternatives noted below, a large diameter conveyance pipe would be constructed to intercept and route high flows to a regional pump station.

ABERDEEN ALTERNATIVE #1

- **Market Street Interceptor:** Located along Market Street from Washington Street to B Street. The interceptor is proposed to convey stormwater runoff to a regional pump station located at Franklin Field in Aberdeen. The pump station will pump the stormwater runoff to a new outfall near M Street at the shoreline of Grays Harbor.
- **State Street Interceptor:** Located along State Street from Garfield Street to F Street. The interceptor is proposed to convey stormwater runoff to a regional pump station located near Monroe Street.
- **Arthur Street Interceptor:** Located along Chicago Street. The interceptor is proposed convey stormwater runoff to the upgraded Arthur Street pump station.

The interceptors will allow the existing conveyance system to function as is during normal events, but will provide additional conveyance and storage during a high storm and/or tide event to sufficiently pump out the 100-year storm event. The proposed interceptor will connect to the existing storm basins at strategic points that will maximize conveyance and minimize impacts to the existing road and utilities. At these connections high flows will be diverted into the interceptor system for conveyance to the proposed pumping facilities. This alternative would consist of 11 total pump stations for the entire project.

See Appendix A Drainage Basin Exhibit Aberdeen Alternative #1.

ABERDEEN ALTERNATIVE #2

Aberdeen Alternative #2 will be identical to Aberdeen Alternative #1 with the exception of the removal of the State Street Interceptor. The substitute for the State Street Interceptor is to allow the lower one-third of the Lincoln Street, Jefferson Street, Washington Street, K Street, and H Street basins to operate as is under normal events. Upgraded pump stations located inside the protection of the levee will provide additional pumping and conveyance capacity during high tide and/or storm events. These pump stations would be located in the Lincoln Street basin, the Jefferson Street basin, the K Street basin, and the H Street basin. This alternative would consist of 14 total pump stations for the entire project.

See Appendix A Drainage Basin Exhibit Aberdeen Alternative #2.

ABERDEEN ALTERNATIVE #3

Aberdeen Alternative #3 proposes to insert pump stations at the outfall of every drainage basin east of Division Street to the extents of the project limits and disregard interceptors & regional pump stations. This would be an addition of 8 pumps, and 22 total pump stations overall. The pump stations would be located within the protection of the levee and would outfall to the nearest waterbody.

Aberdeen Alternative #3 is not reflected in the Drainage Basin Exhibits or the Levee Plans.

4.3 – RELATED PROJECTS

Related projects such as the Fry Creek and Canyon Ct. Sediment Basin projects are either in design or are identified as a future project. These projects have been identified and are intended to enhance the existing stormwater quality, fish barriers, and aquatic habitat within the levee protection limits.

FRY CREEK

The Fry Creek Flood Restoration and Flood Reduction project is currently in motion, and proposes to enhance Fry Creek along its entire corridor from the headwaters to Grays Harbor. The purpose of this project is to design a restoration plan that will include optimizing flood storage, minimizing culvert constrictions that impede fish passage and hinder flows, and enhancing habitat and public amenity features. The Fry Creek Flood Restoration and Flood Reduction project concerns the North Shore Levee since it will breach the levee, impact the overall discharge values, and will affect proposed pump station location, configuration, and sizing. KPFF is working directly on the Fry Creek project and will select a pumping facility that satisfies the needs for flows from both the Cities conveyance system and the Fry Creek drainage basin. Since the levee will cross over Fry Creek it is proposed for the North Shore Levee project to install a system of tide gates to stop backwatering during high tides. However, a different hydrologic system may be designed in order to comply with restoration goals and regulatory requirements.

Figure 2 shows a concept design of the restoration of Fry Creek at Oak Street.

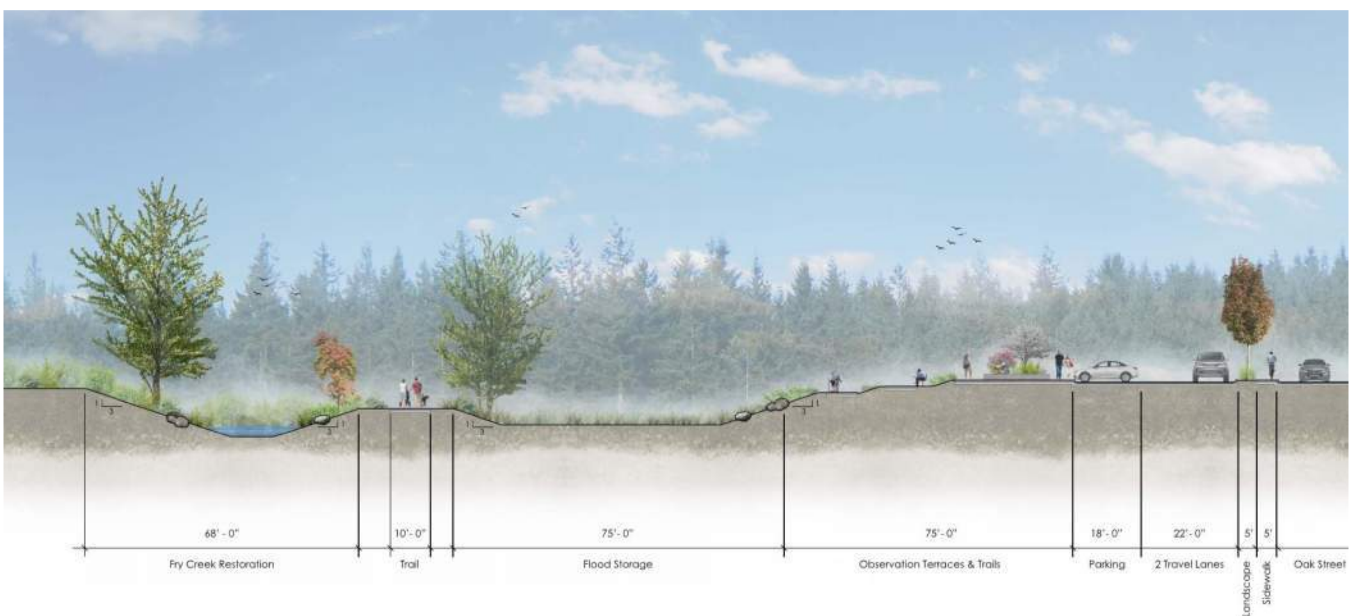


Figure 2 – Fry Creek Concept Design

CANYON COURT SEDIMENT BASIN

The Canyon Court sediment basin is located north of Canyon Court and collects a majority of the Cherry Street basin storm runoff. The tributary area of the sediment basin consists of a variety of forested runoff from the north and a residential runoff everywhere else. The existing sediment basin was constructed in the last 50 years and is comprised of a series of steps and weirs for flow and sediment control. The City of Aberdeen has identified this as a future stormwater quality project and a future design will be investigated to return this system to compliance with Washington State Department of Ecology standards.

4.4 – SEEPAGE AND LEAKAGE

SEEPAGE THROUGH LEVEE

The rate of expected seepage through earthen portions of the levee has been analyzed by GeoEngineers and is discussed in the *Geotechnical Analysis and Levee Certification Report* in section *3.4 Embankment Seepage*. The rate through the earthen portion was determined to be minimal and has no influence on the findings of the interior drainage analysis.

In areas where leakage and seepage is expected, such as utility trenches (existing and proposed), a filter soil layer will be provided on the landward side of the levee. The recommended soil layer consists of WSDOT Specification 9-03.1(2) (Fine Aggregate for Portland Concrete Cement). The filter material should be placed from the utility penetration or other seepage source up to the elevation of existing ground. The filter should extend about 1 foot beyond the seepage source parallel to the levee and should extend at least 5 feet perpendicular to the levee. This material will reduce and or eliminate the potential for water intrusion through these penetrations.

LEAKAGE THROUGH PIPES

Leakage through pipes that pass under the levee is possible and steps will be taken to mitigate the risk. The following table shows leakage solutions for different utilities.

Table 4 – Leakage for Utilities Passing Under Levee

Utility Type	Mitigation Measures to Prevent Leakage
Dry Utilities	Seal Large Conduits
Storm Drainage	Install In-line Check Valves
Water and Gas	Maintain Pressure
Sanitary Sewer	Install Locking Water-Tight Lids

In-line check valves designed for drainage applications (such as the Tideflex CheckMate® valve) will be installed on storm drainage pipes in basins that pass under the levee. Pressurized utilities such as water and natural gas mains are not be affected by the levee or inundation by high flow event; therefore no leakage is anticipated or accounted for as these utilities cross under the levee.

Sanitary sewer pipes will be a source of minor seepage at locations where pipes cross under the levee from adjacent unprotected areas. There are nineteen locations where sanitary sewer pipes cross the proposed levee alignment. The continued use of solid locking lids on the sanitary sewer manholes will help mitigate the rate of seepage. Preliminary analysis of the seepage rates indicates that the combined seepage through the sanitary sewer system into the interior drainage basins will be less than 1% of the calculated storm drainage flow for the combined interior basin area. Storm pump stations will be designed with adequate capacity to handle the relatively minor contribution of sanitary sewer seepage.

4.5 – INTERIOR FLOODING ANALYSIS

The proposed levee is designed to prevent intrusion of floodwater from outside the levee. The basis of design of the pumping stations is to provide pumping capacity for the full 100-year storm (1% annual recurrence interval) runoff for the interior basins. Interior ponding areas identified are associated with the following two scenarios:

1. **Ponding resulting from the closure of check valves on storm pipes that pass under the levee**. Small sub-areas within the interior basins near the proposed levee alignment will have storm inlets draining to mains located on the outside of the levee. Pipe check valves are proposed for all storm pipes that pass under the levee. Therefore, these inlets will not convey runoff when the exterior storm system experiences a flood event. Interior ponding was analyzed for these areas.
    - The depth of ponding associated with the identified areas is less than 1.0 foot. As runoff continues the ponding depth does not increase because the runoff overflows to adjacent storm inlets that are connected to an interior basin outfall with a pump station with adequate capacity.
2. **Ponding at existing low areas within the Rail Road Right-of-Way.** This area was analyzed for ponding that occurs at existing low areas currently not served by storm inlets. The ponded water depth associated with the identified areas is less than 1.0 foot. Topography of the area dictates that additional runoff will drain to adjacent storm conveyance system that is served by an interior basin pump station.

The delineation of the ponding areas and ponding surface water elevations for these areas was accomplished through review of site topography and identifying the overflow locations to adjacent sub-basins served by interior storm inlets and conveyance mains.

5.0 – SUMMARY

The North Shore Levee project, once constructed, will result in revisions to the National Flood Insurance Programming in the majority of the areas north of the Chehalis River in the Cities of Aberdeen and Hoquiam. The 5.6 mile long levee consisting of various types of walls and closures will remove the project areas from the 100-year floodplain. The levee structure varies in height from between 0 and 5 feet to establish a top of levee elevation of 15.2 feet. This elevation includes the base flood elevation of 13.2 feet and 2 feet of free board.

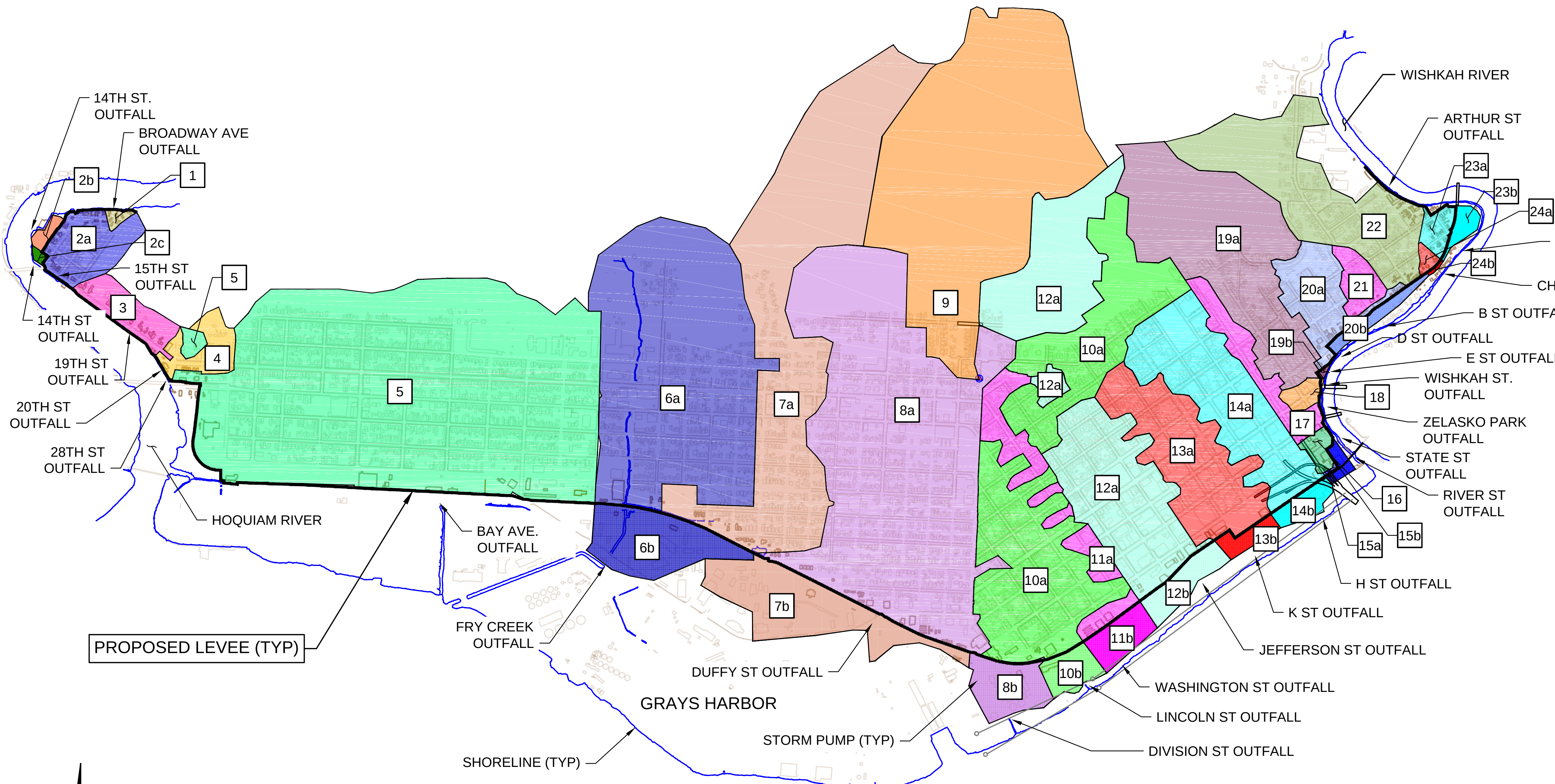
The Cities of Aberdeen and Hoquiam have stormwater drainage systems that include catch basins, pipes, and drainage ditches that convey stormwater runoff to natural waterways or pump stations that collect and discharge water to the nearby waterbodies. The proposed levee will demand upgrades to the existing stormwater system while still allowing the system to gravity flow during most events as it does today. The 1% annual chance rainfall event was evaluated with all tide gates and outfalls submerged. As the *worst case* scenario, these flows were used to determine the necessary pump station capacity. The proposed upgrades and improvements are to install new storm drain inlets, install new check valves, raise and lower existing storm inlet lids, and to install new pump stations at the basins of 15th Street, 19th Street, 28th Street, Duffy Street, and Division Street, that will adequately pump the 100-year storm out of the interior drainage system. In addition, the remaining existing storm drainage basins will be upgraded with various alternatives that consist of combining basins, additional pump stations, and regional interceptors.

Related projects such as the Fry Creek and Canyon Court Sediment Basin projects will run simultaneous to or succeeding the North Shore Levee project. The Fry Creek Flood Restoration and Flood Reduction project is currently in motion and proposes to enhance Fry Creek along its entire corridor from the headwaters to Grays Harbor, while the Canyon Court Sediment Basin is in need of upgrades that the City of Aberdeen will be exploring in the near future.

A detailed study that addresses the interior drainage is anticipated to begin in the near future LOMR and construction documents. This study will provide an in-depth analysis of the complexities of the storm drainage system and the impact on the interior flooding through the protection areas. It is anticipated that this study will provide a greater level of detail and eliminate some of the conservative assumptions used in this study. The study will also evaluate alternatives to reduce the magnitude and duration of predicted flows and potential ponding in the protection area. At this time, the results of that study are expected to supersede this study before the LOMR is submitted for the North Shore Levee project.

Appendix A

Interior Drainage Basin Exhibits



NOTES:

1. STORM BASINS ARE BASED ON STORM DRAINAGE SYSTEM MAPS PROVIDED BY THE CITIES OF ABERDEEN & HOQUIAM.
2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. SEE INDIVIDUAL BASIN SHEETS FOR ADDITIONAL INFORMATION ON PUMP STATIONS.

LEGEND

- STORM PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN	AREA (AC)	BASIN	AREA (AC)	BASIN	AREA (AC)	BASIN	AREA (AC)
1 BROADWAY AVE	1.59	7b DUFFY ST	45.61	13a K ST	59.91	19b E ST	0.30
2a 15TH ST	21.35	8a DIVISION ST	247.02	13b K ST	5.11	20a D ST	25.97
2b SHIPYARD	2.05	8b DIVISION ST	17.37	14a H ST	68.07	20b D ST	5.62
2c 14TH ST	0.74	9 CHERRY ST	214.17	14b H ST	6.51	21 B ST	9.58
3 19TH ST	15.00	10a LINCOLN ST	154.05	15a RIVER ST	0.29	22 ARTHUR ST	77.68
4 20TH ST	12.48	10b LINCOLN ST	9.21	15b RIVER ST	2.55	23a STANTON ST	5.57
5 28TH ST	341.91	11a WASHINGTON ST	29.11	16 STATE ST	4.17	23b STANTON ST	6.13
6a FRY CREEK	183.27	11b WASHINGTON ST	10.66	17 ZELASKO PARK	17.79	24a CHICAGO ST	1.85
6b FRY CREEK	33.07	12a JEFFERSON ST	131.00	18 WISHKAH ST	4.04	24b CHICAGO ST	0.32
7a DUFFY ST	178.52	12b JEFFERSON ST	11.54	19a E ST	101.44		

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ABERDEEN & HOQUIAM, WASHINGTON

DRAINAGE BASIN EXHIBIT OVERALL MAP

EXHIBIT
DB-0
SHEET 1 OF 27

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NOTES:

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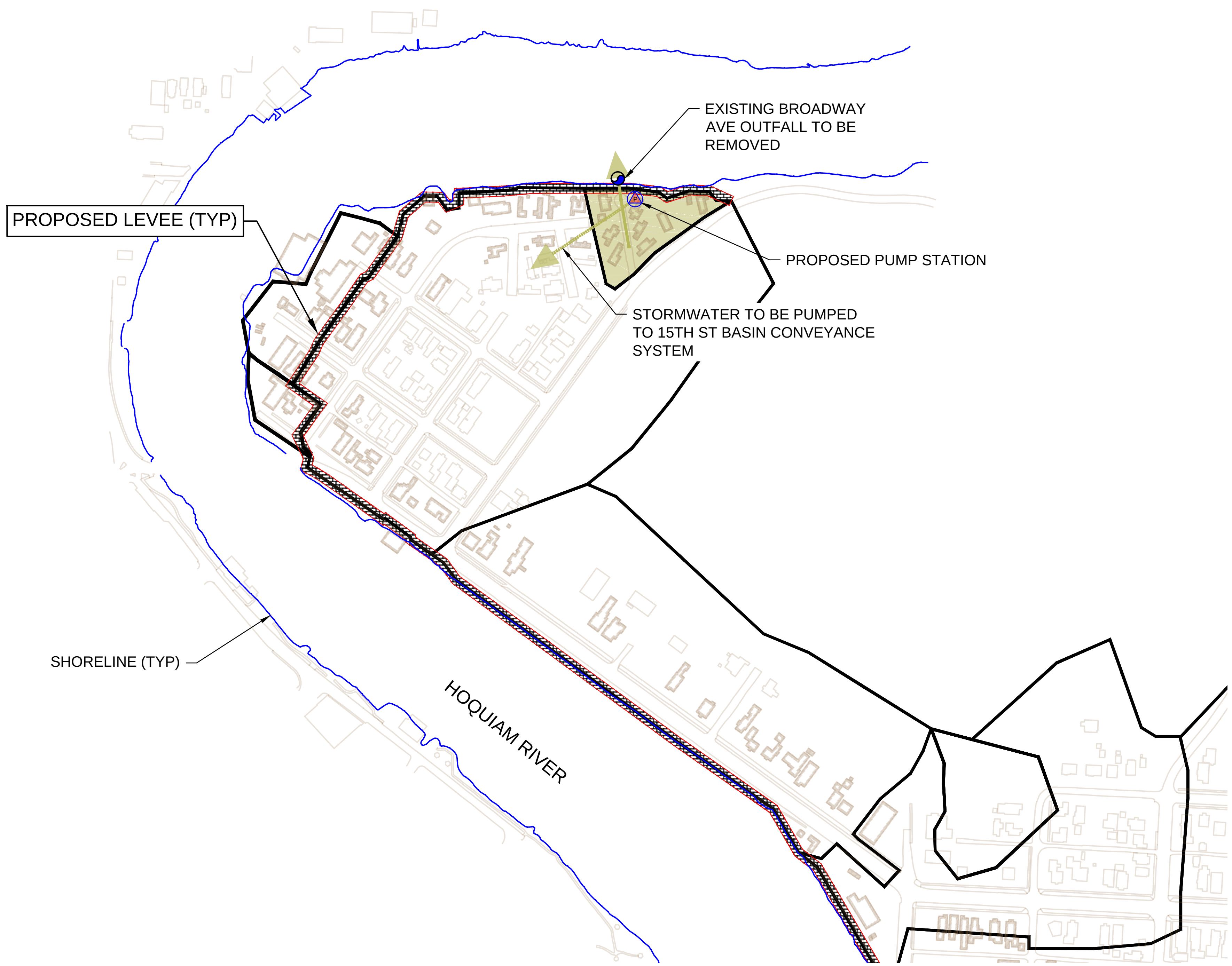
LEGEND

- PROPOSED PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE



DRAINAGE BASIN INFORMATION		
BASIN	AREA (AC)	100-YEAR Q (GPM)
1 BROADWAY AVE	1.59	631

N

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DRAINAGE BASIN EXHIBIT
BROADWAY AVE

EXHIBIT
DB-01
SHEET 02 OF 27

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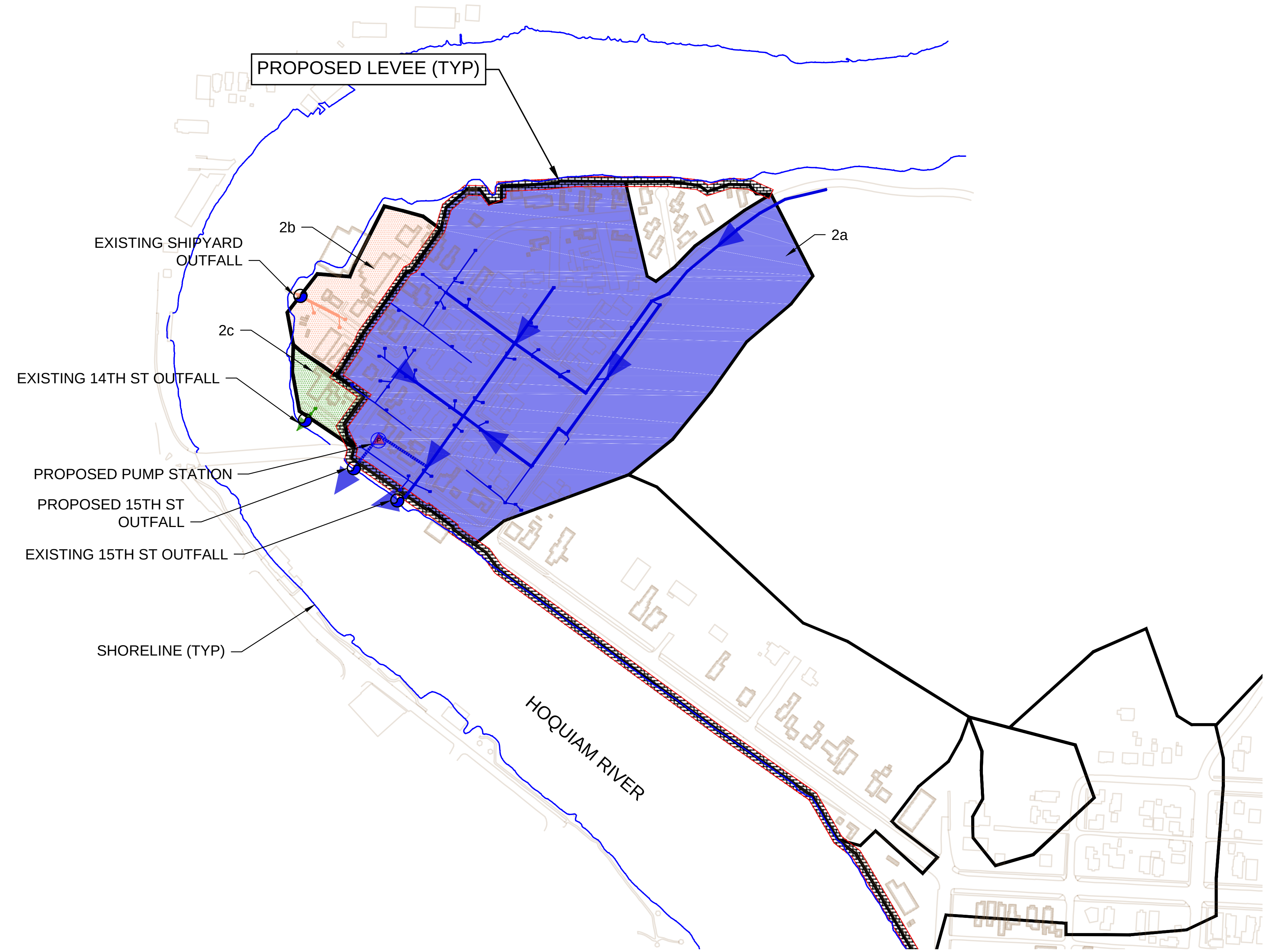

NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. SHIPYARD & 14TH ST BASIN OUTSIDE LEVEE LIMITS.

LEGEND

- PROPOSED PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
2a	15TH ST	21.35	7,639
2b	SHIPYARD	2.05	*
2c	14TH ST	0.74	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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DRAINAGE BASIN EXHIBIT
15TH ST.

EXHIBIT
DB-02
SHEET 03 OF 27

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NOTES:

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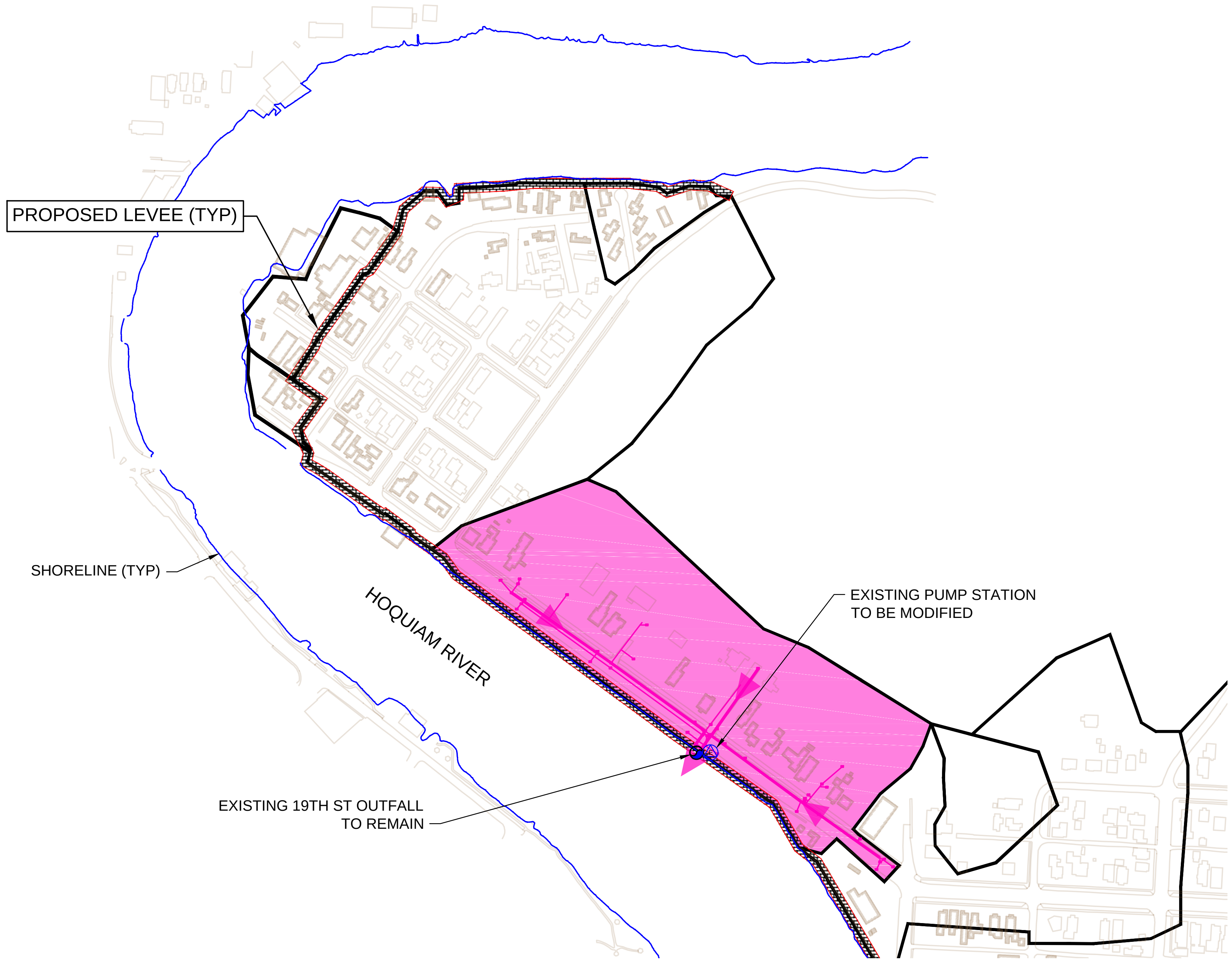
LEGEND

- EXISTING PUMP STATION TO BE MODIFIED
- STORM OUTFALL
- PROPOSED LEVEE



DRAINAGE BASIN INFORMATION		
BASIN	AREA (AC)	100-YEAR Q (GPM)
3 19TH ST	15.00	4,878

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DRAINAGE BASIN EXHIBIT
19TH ST.

EXHIBIT
DB-03
SHEET 04 OF 27

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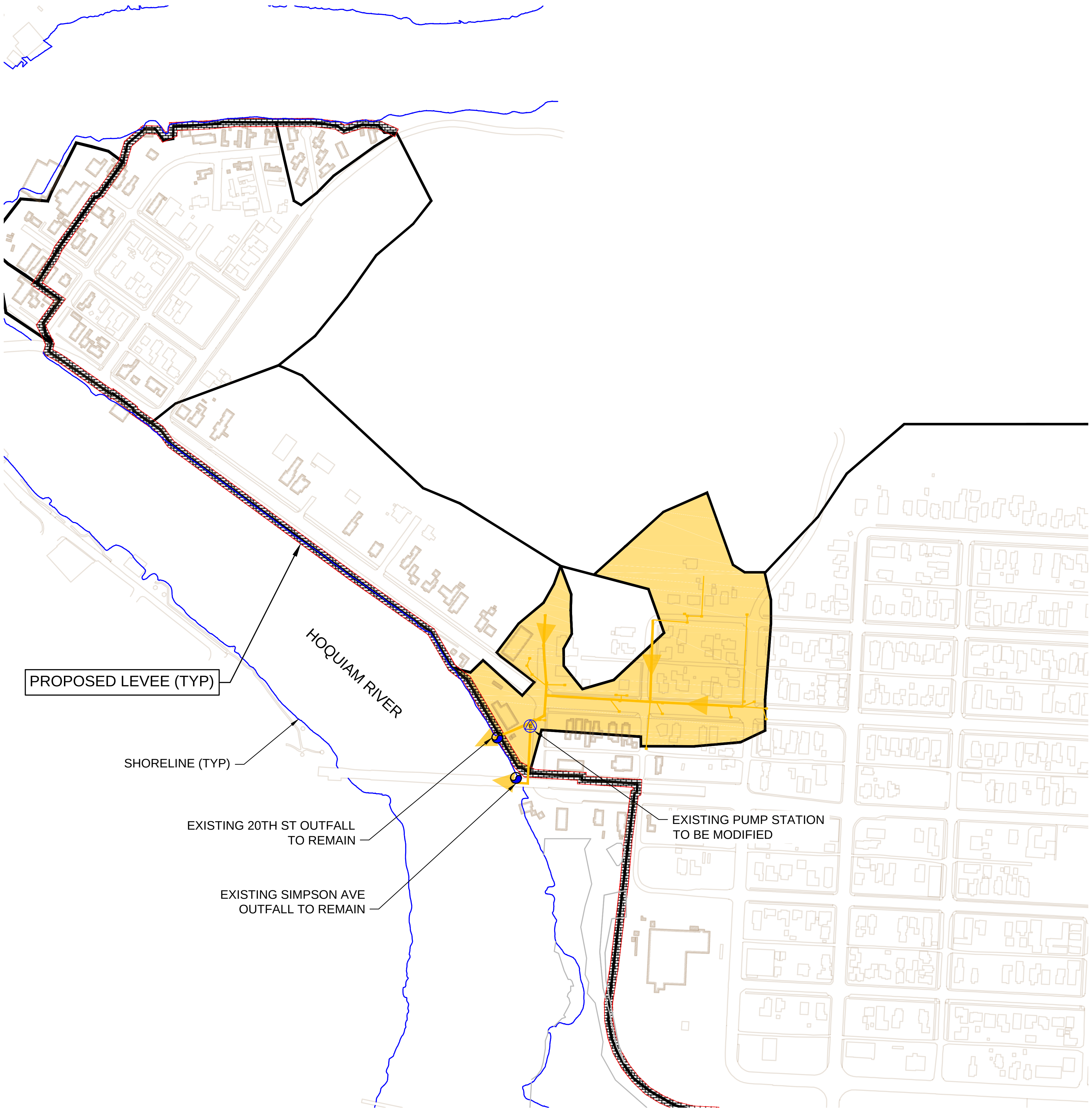

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LEGEND

- EXISTING PUMP STATION TO BE MODIFIED
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION			
BASIN		AREA (AC)	100-YEAR Q (GPM)
4	20TH ST	12.48	4,343

0 400 800
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DRAINAGE BASIN EXHIBIT
20TH ST.

EXHIBIT
DB-04
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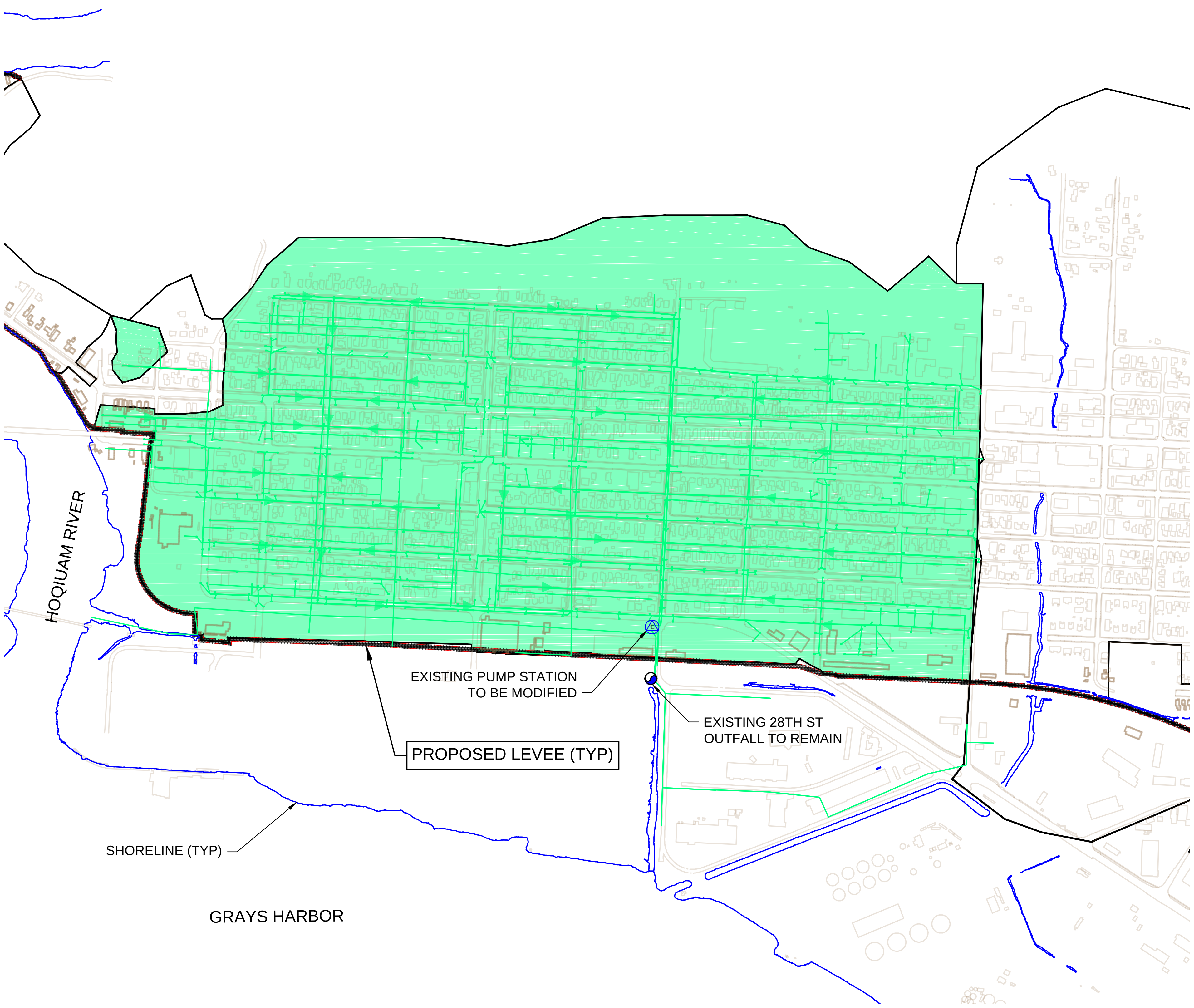

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LEGEND

- EXISTING PUMP STATION TO BE MODIFIED
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION			
BASIN		AREA (AC)	100-YEAR Q (GPM)
5	28TH ST	341.91	125,888

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DRAINAGE BASIN EXHIBIT
28TH ST

EXHIBIT
DB-05
SHEET 06 OF 27

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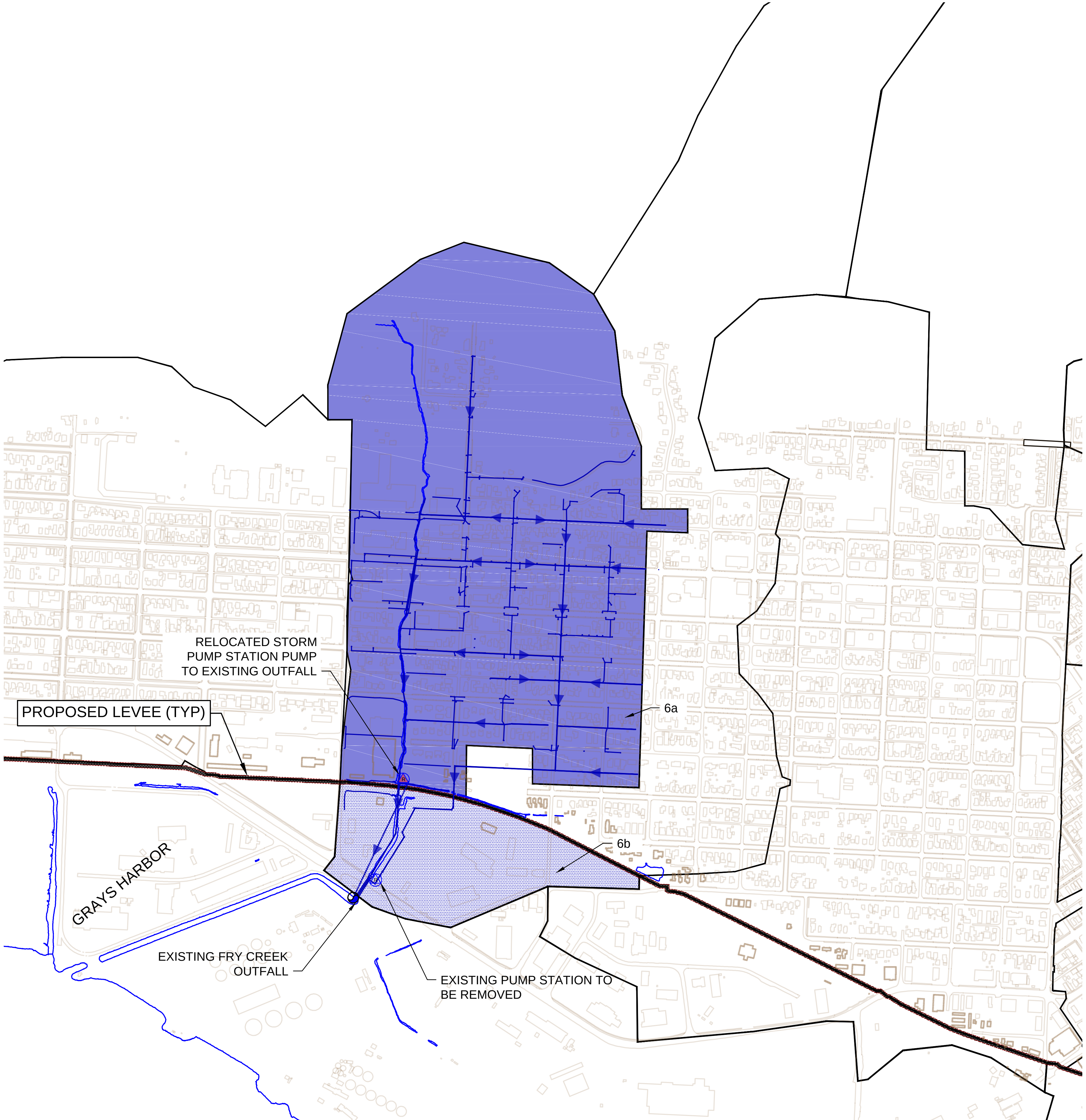

NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (6b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (6a) REQUIRES A PROPOSED PUMP STATION.
4. THE FRY CREEK BASIN INCLUDES THE FRY CREEK WATERSHED WHICH EXTENDS INTO THE HILLSIDE. THE FULL WATERSHED BASIN WAS NOT TAKEN INTO ACCOUNT FOR THIS ANALYSIS, THEREFORE IT IS NOT SHOWN IN THESE EXHIBITS. ONLY 20% OF THE ENTIRE BASIN CONTRIBUTES TO THE STORM CONVEYANCE AND IS SHOWN IN THESE EXHIBITS.

LEGEND

- RELOCATED PUMP STATION
- REMOVE EXISTING PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
6a	FRY CREEK	183.27	55,940
6b	FRY CREEK	33.07	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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DRAINAGE BASIN EXHIBIT
FRY CREEK

EXHIBIT
DB-06
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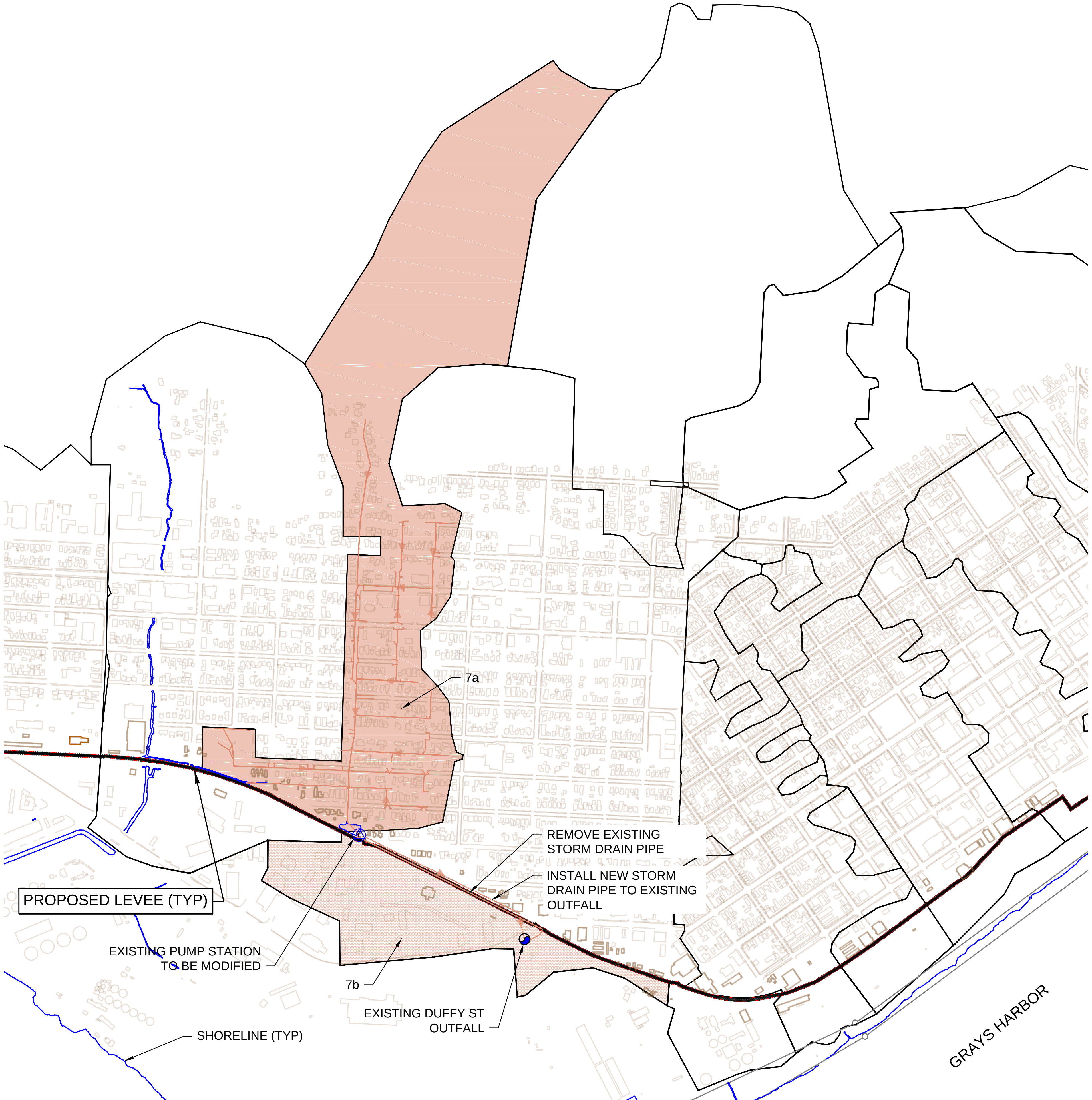

NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (7b)OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (7a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- EXISTING PUMP STATION TO BE MODIFIED
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN	AREA (AC)	100-YEAR Q (GPM)
7a DUFFY ST	178.52	37,180
7b DUFFY ST	45.61	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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DRAINAGE BASIN EXHIBIT DUFFY ST.

EXHIBIT
DB-07
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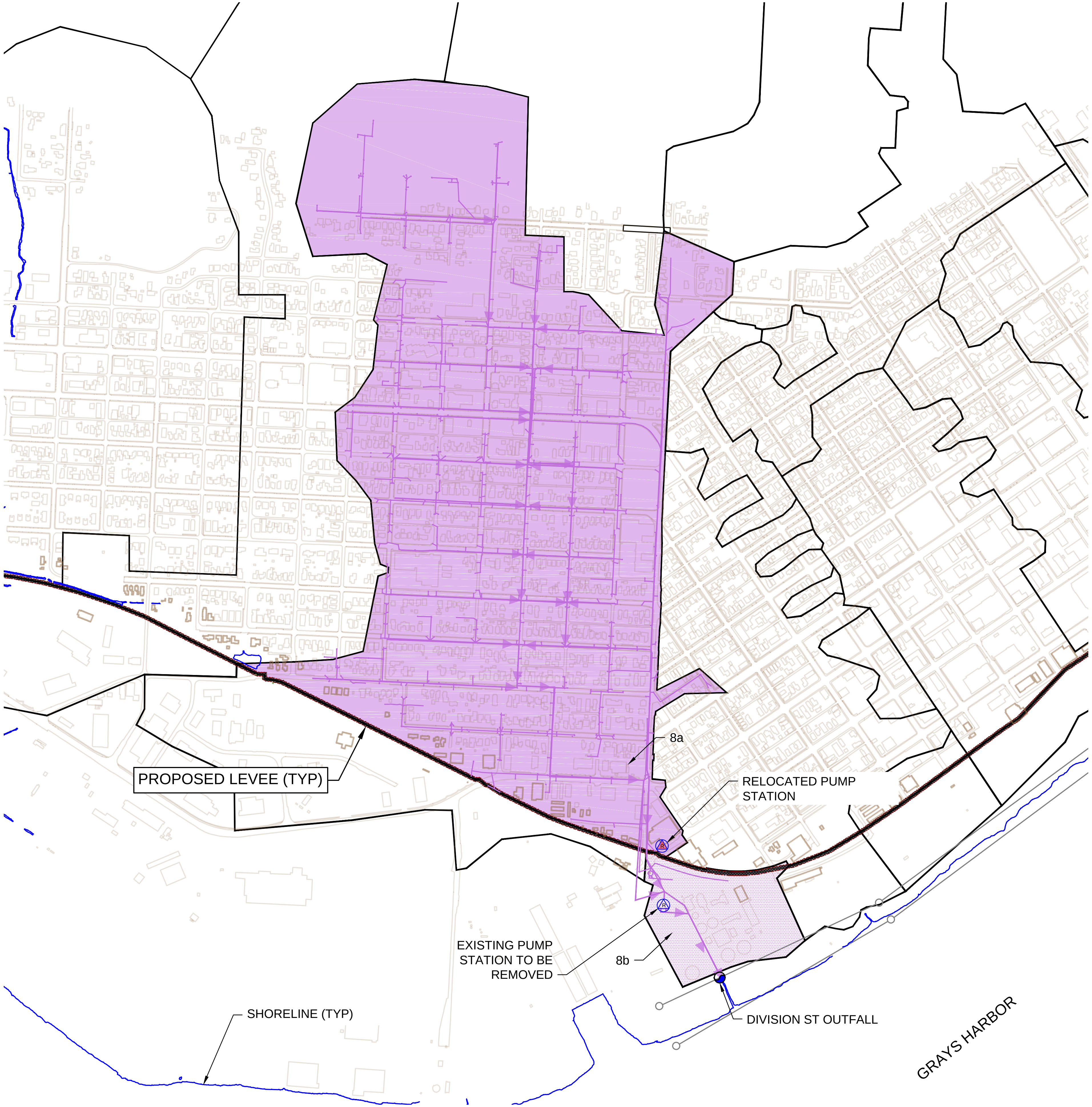

NOTES:

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3. BASIN (8b)OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (8a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- RELOCATED PUMP STATION
- REMOVE EXISTING PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION			
BASIN		AREA (AC)	100-YEAR Q (GPM)
8a	DIVISION ST	247.02	102,154
8b	DIVISION ST	17.37	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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DRAINAGE BASIN EXHIBIT
DIVISION ST.

EXHIBIT
DB-08
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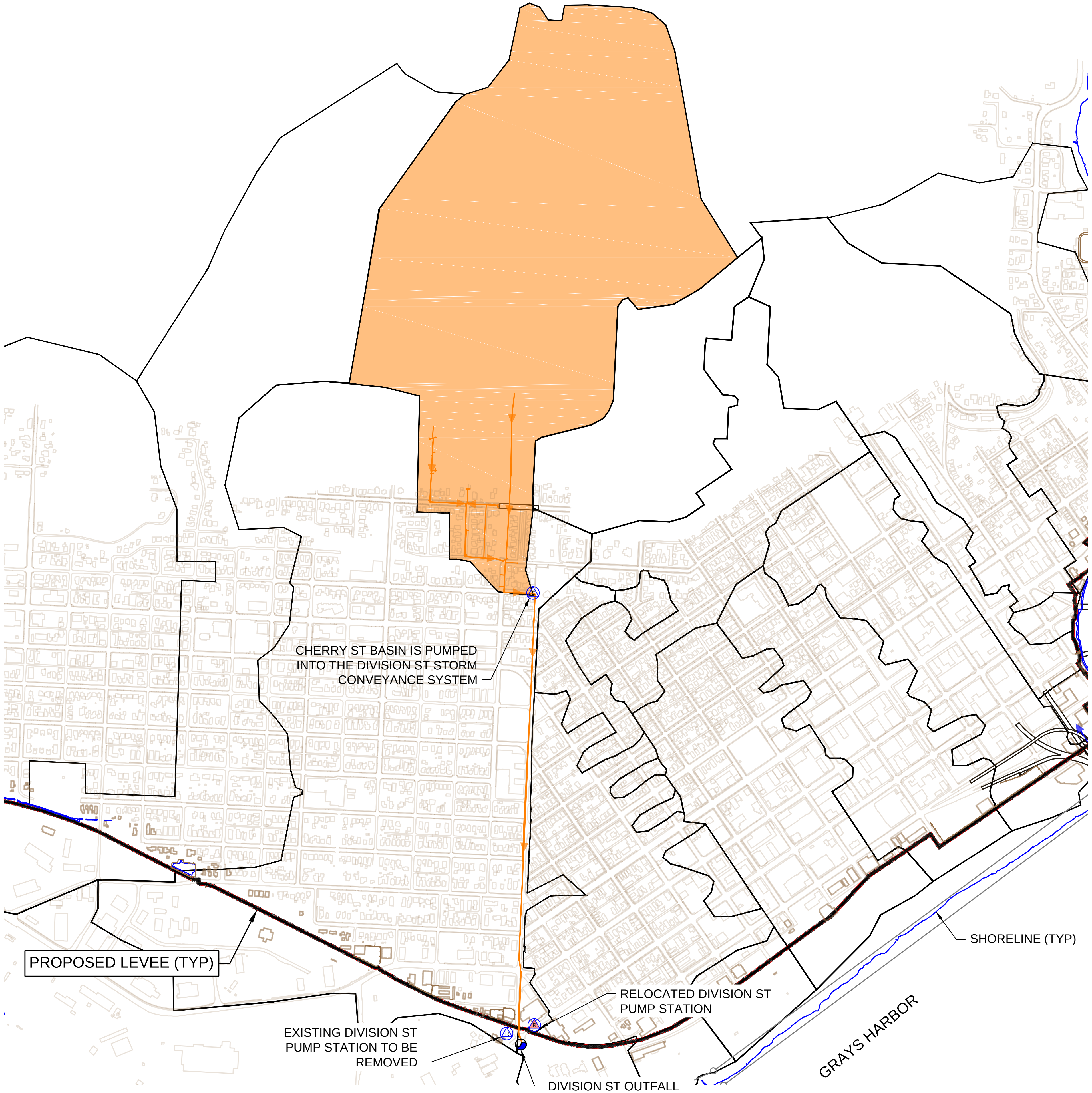

NOTES:

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LEGEND

- EXISTING PUMP STATION TO BE MODIFIED
- REMOVE EXISTING PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION		
BASIN	AREA (AC)	100-YEAR Q (GPM)
9 CHERRY ST	214.17	36,347

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DRAINAGE BASIN EXHIBIT
CHERRY ST.

EXHIBIT
DB-09

SHEET 10 OF 27

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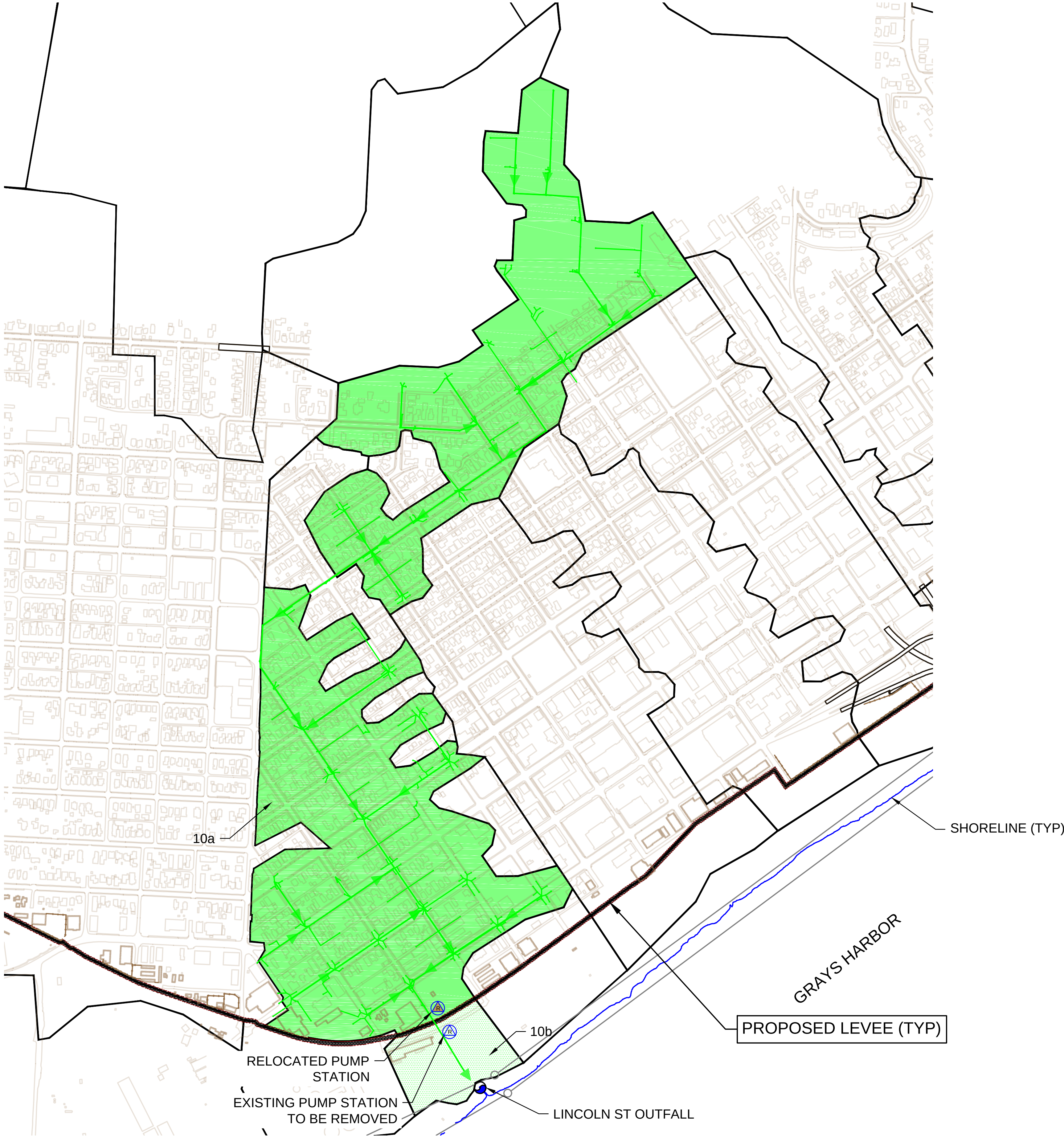

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (10b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (10a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- RELOCATED PUMP STATION
- REMOVE EXISTING PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
10a	LINCOLN ST	154.05	61,685
10b	LINCOLN ST	9.21	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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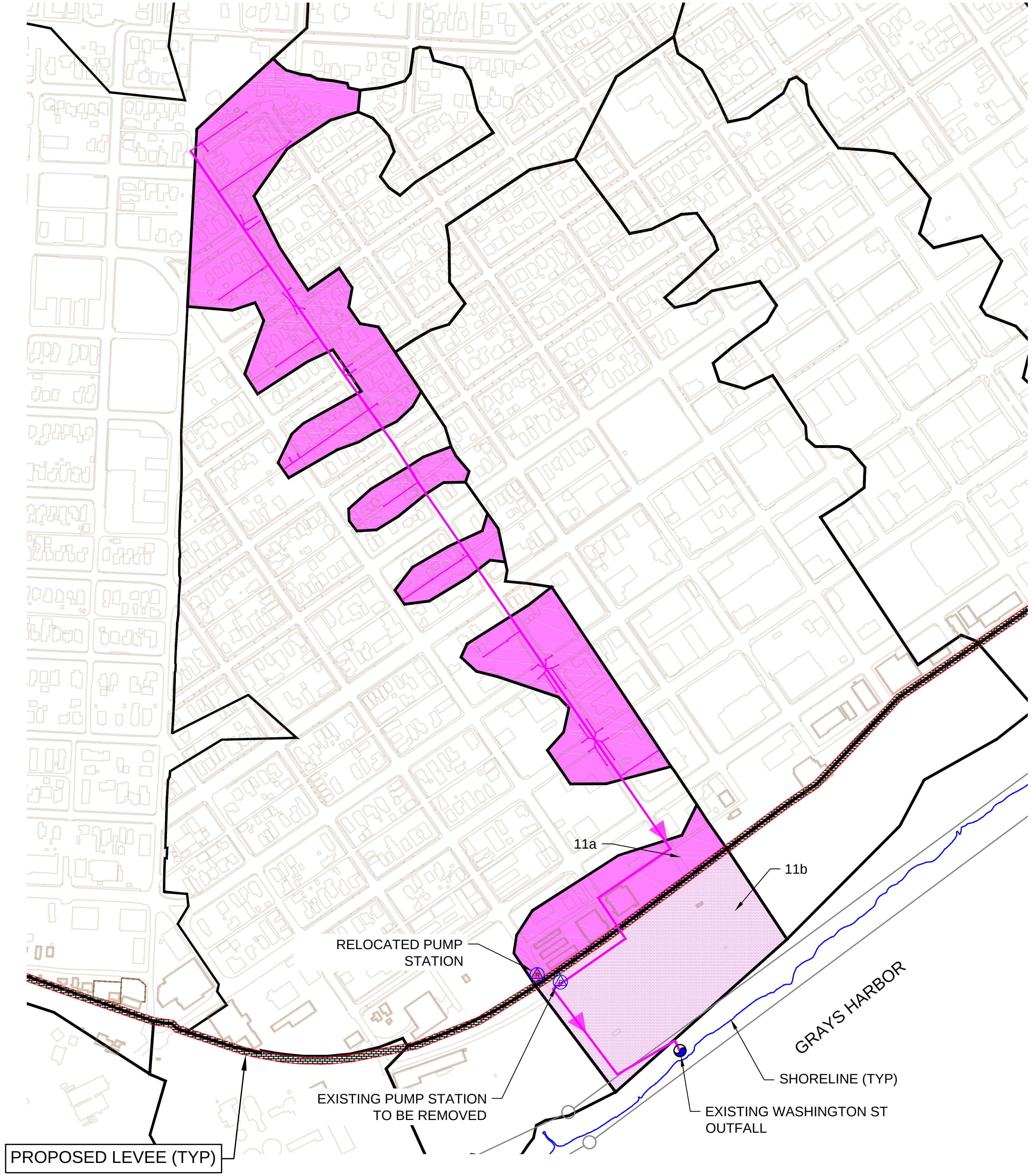
DRAINAGE BASIN EXHIBIT
LINCOLN ST

EXHIBIT
DB-10
SHEET 11 OF 27



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3. BASIN (11b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (11a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- RELOCATED PUMP STATION
- REMOVE EXISTING PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN	AREA (AC)	100-YEAR Q (GPM)
11a WASHINGTON ST	29.11	12,389
11b WASHINGTON ST	10.66	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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DRAINAGE BASIN EXHIBIT
WASHINGTON ST

EXHIBIT
DB-11

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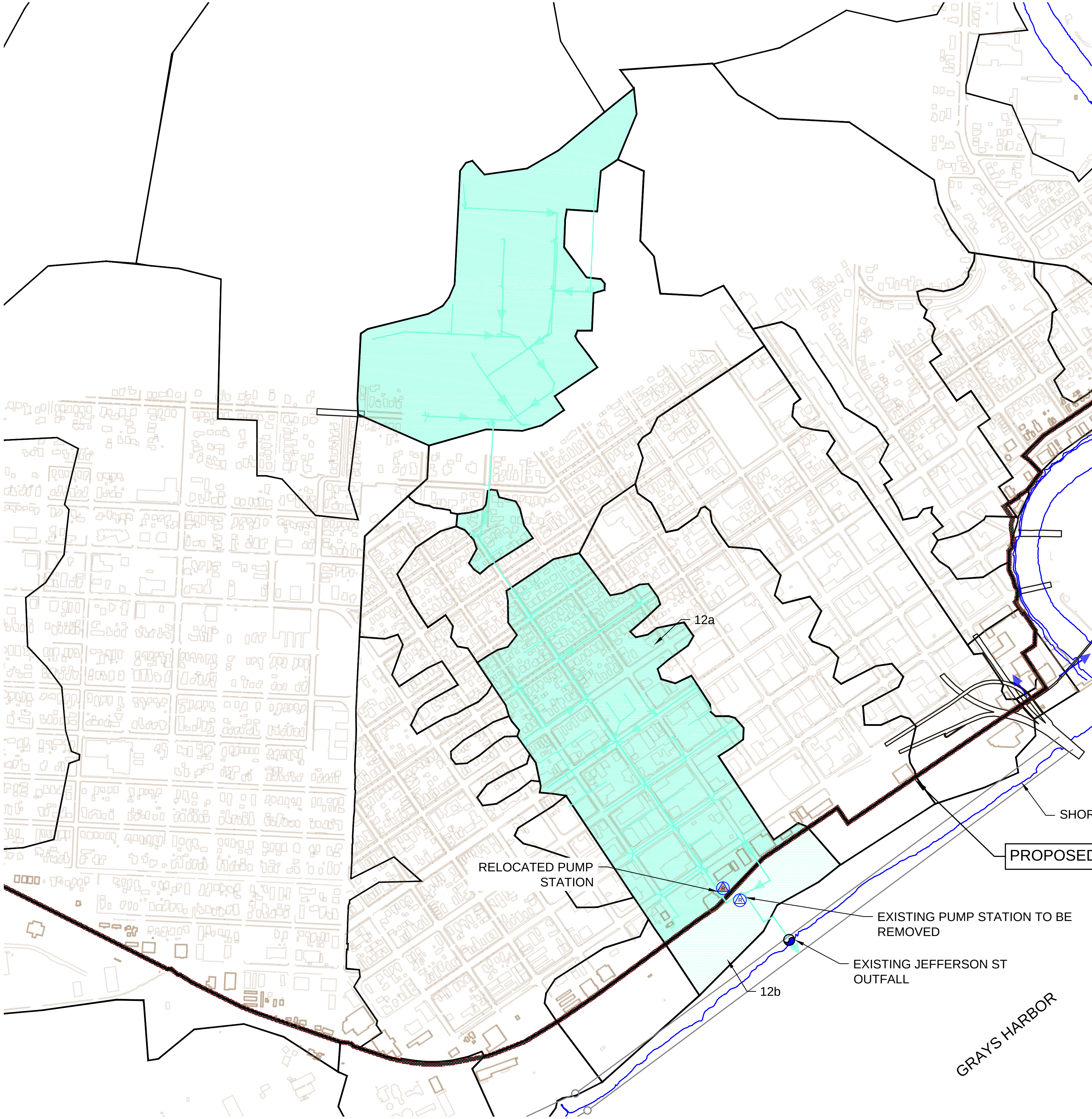

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3. BASIN (12b) OUTSIDE LEVEE LIMTIS. BASIN INSIDE LEVEE (12a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- RELOCATED PUMP STATION
- REMOVE EXISTING PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
12a	JEFFERSON ST	131.00	56,034
12b	JEFFERSON ST	11.54	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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DRAINAGE BASIN EXHIBIT JEFFERSON ST

EXHIBIT
DB-12
SHEET 13 OF 27

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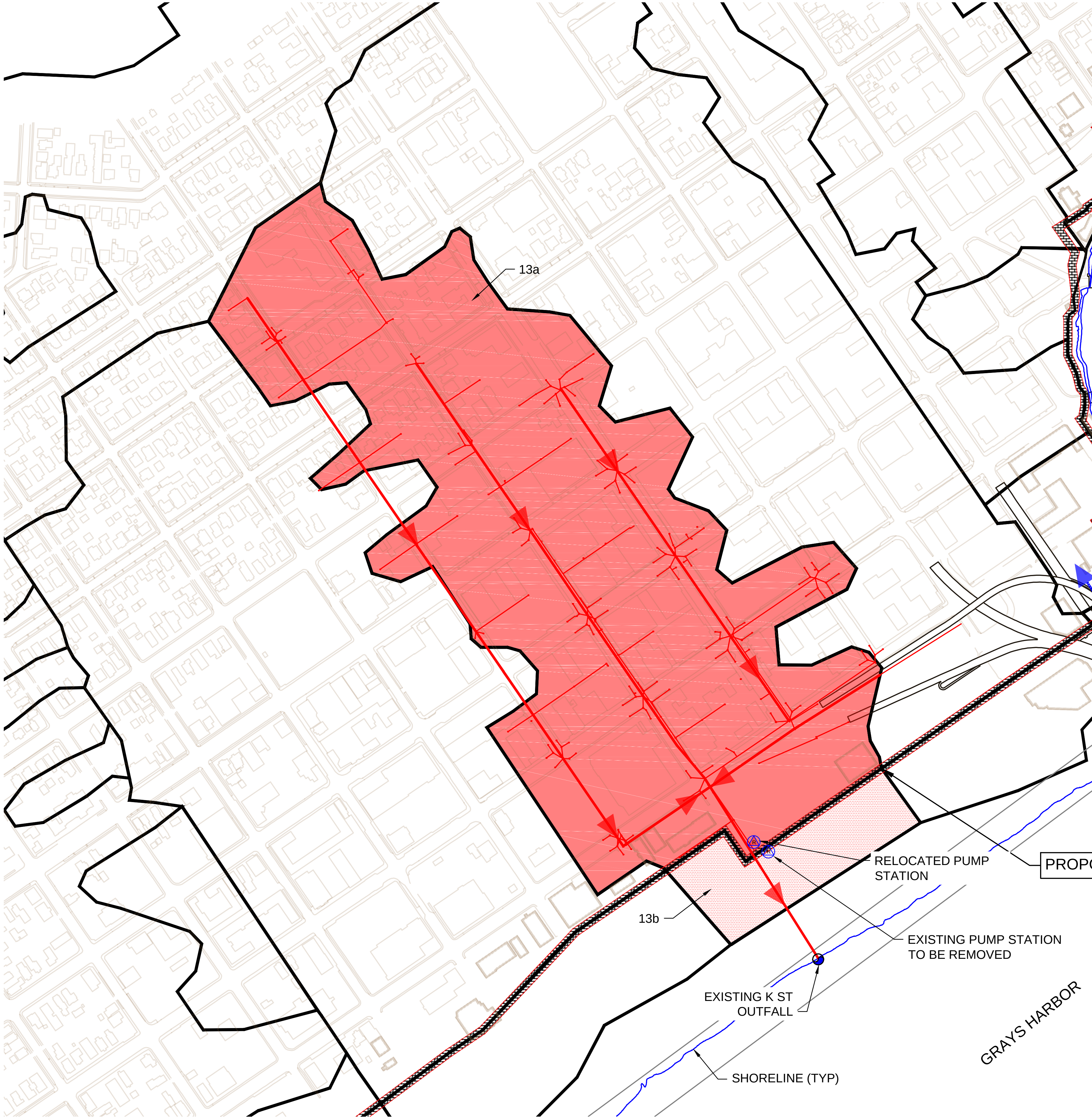

NOTES:

1. STORM BASINS ARE BASED ON STORM DRAINAGE SYSTEM MAPS PROVIDED BY THE CITIES OF ABERDEEN & HOQUIAM.
2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (13b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (13a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- RELOCATED PUMP STATION
- REMOVE EXISTING PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
13a	K ST	59.91	27,833
13b	K ST	5.11	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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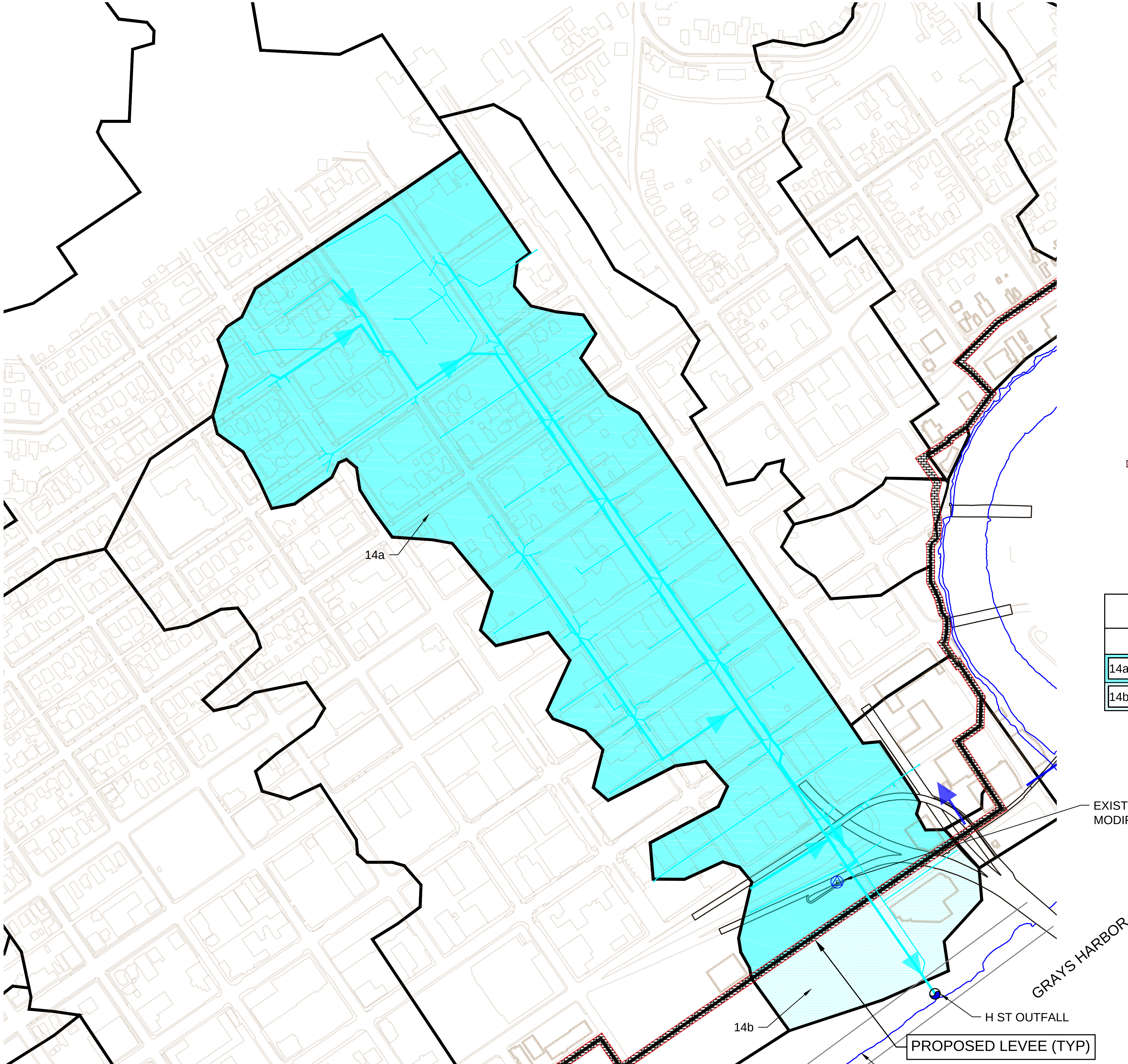
DRAINAGE BASIN EXHIBIT
K ST

EXHIBIT
DB-13
SHEET 14 OF 27



NOTES:

1. STORM BASINS ARE BASED ON STORM DRAINAGE SYSTEM MAPS PROVIDED BY THE CITIES OF ABERDEEN & HOQUIAM.
2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (14b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (14a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- EXISTING PUMP STATION TO BE MODIFIED
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION		
BASIN	AREA (AC)	100-YEAR Q (GPM)
14a H ST	68.07	32,526
14b H ST	6.51	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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DRAINAGE BASIN EXHIBIT H ST

EXHIBIT
DB-14
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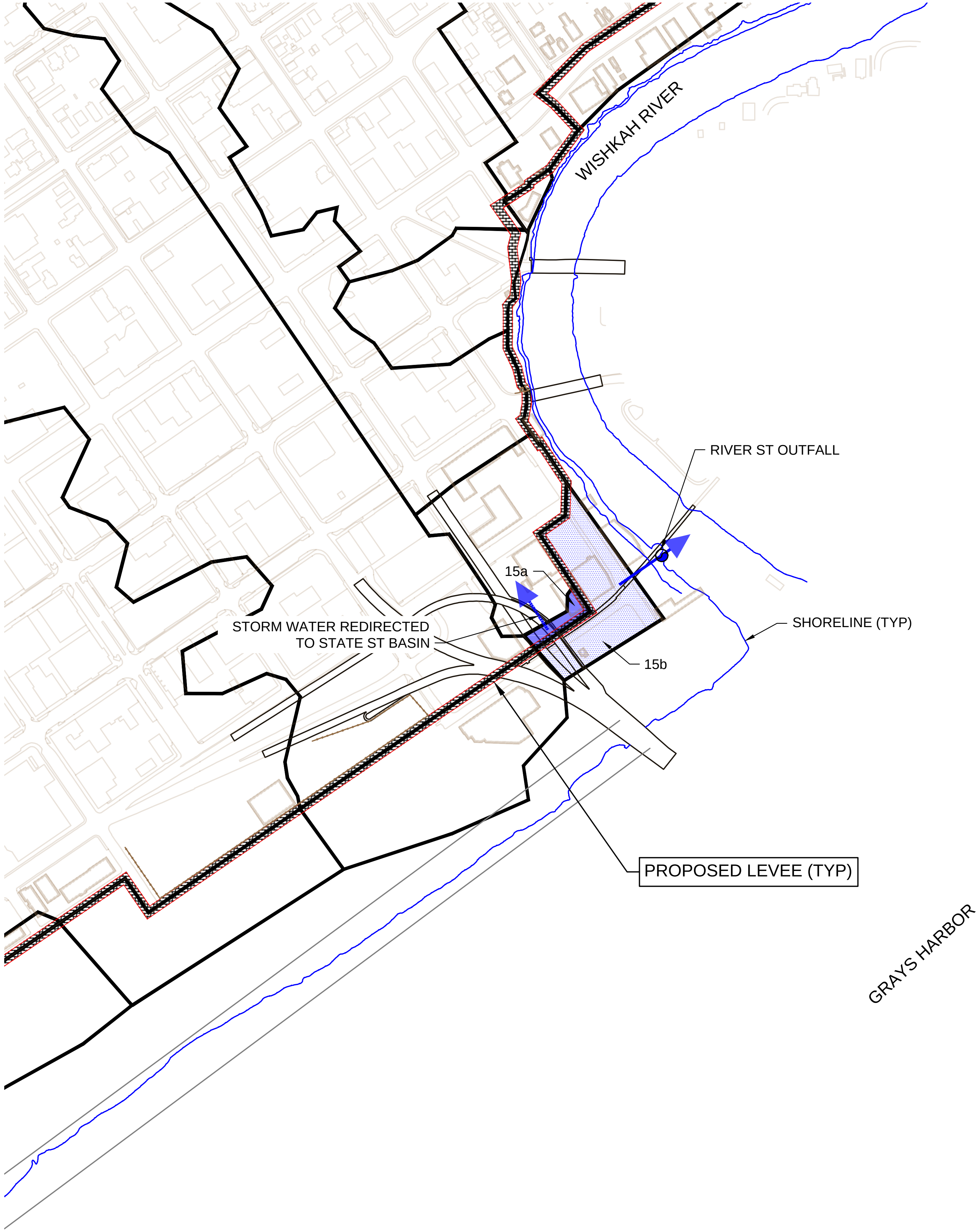

NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (15b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (15a) WILL BE DIRECTED TO THE STATE ST. STORM NETWORK.

LEGEND

- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
15a	RIVER ST	0.29	139
15b	RIVER ST	2.55	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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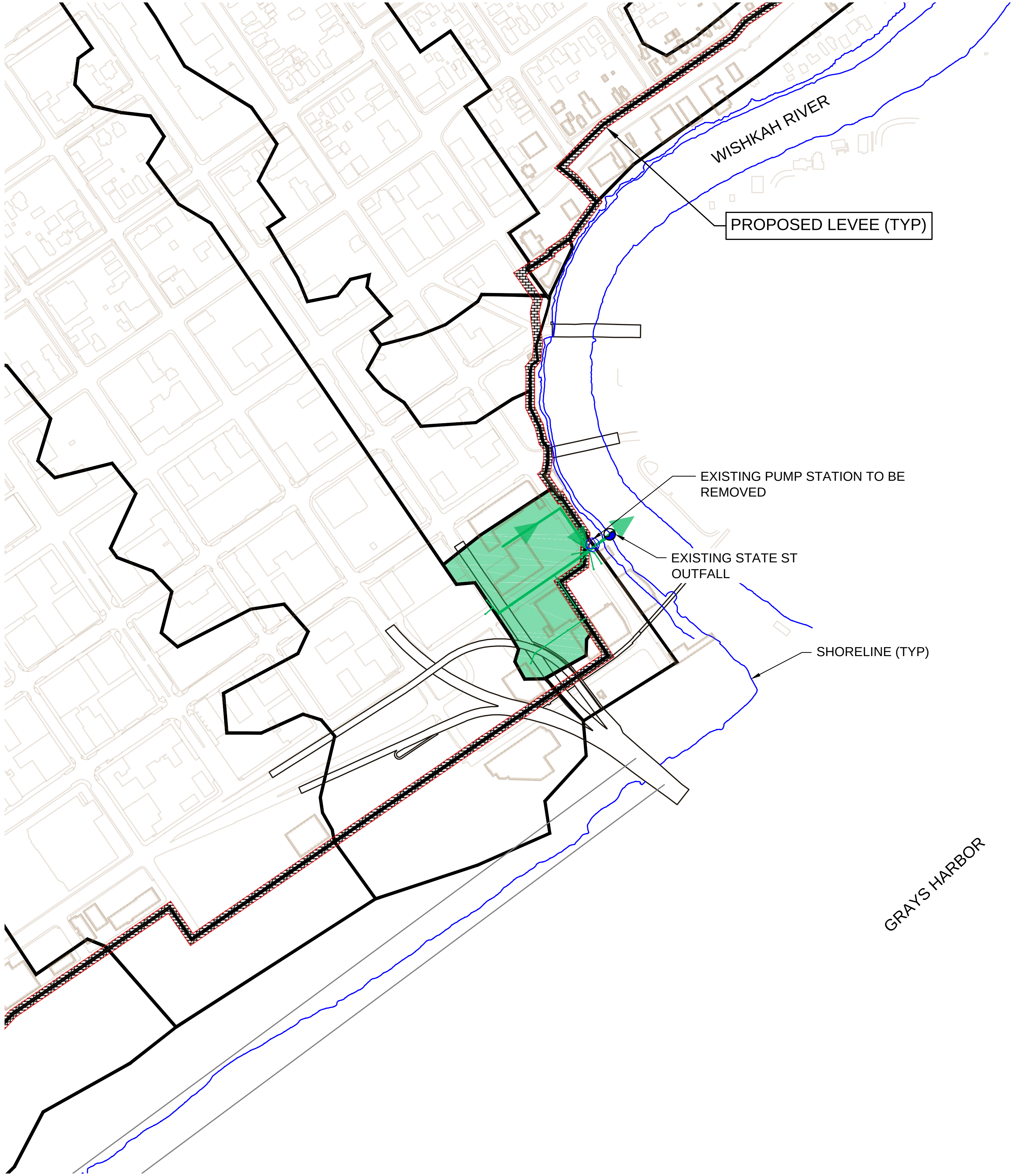
DRAINAGE BASIN EXHIBIT
RIVER ST

EXHIBIT
DB-15



NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.

LEGEND

- RELOCATED PUMP STATION
- REMOVE EXISTING PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION		
BASIN	AREA (AC)	100-YEAR Q (GPM)
16 STATE ST	4.17	2,005

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DRAINAGE BASIN EXHIBIT
STATE ST

EXHIBIT
DB-16

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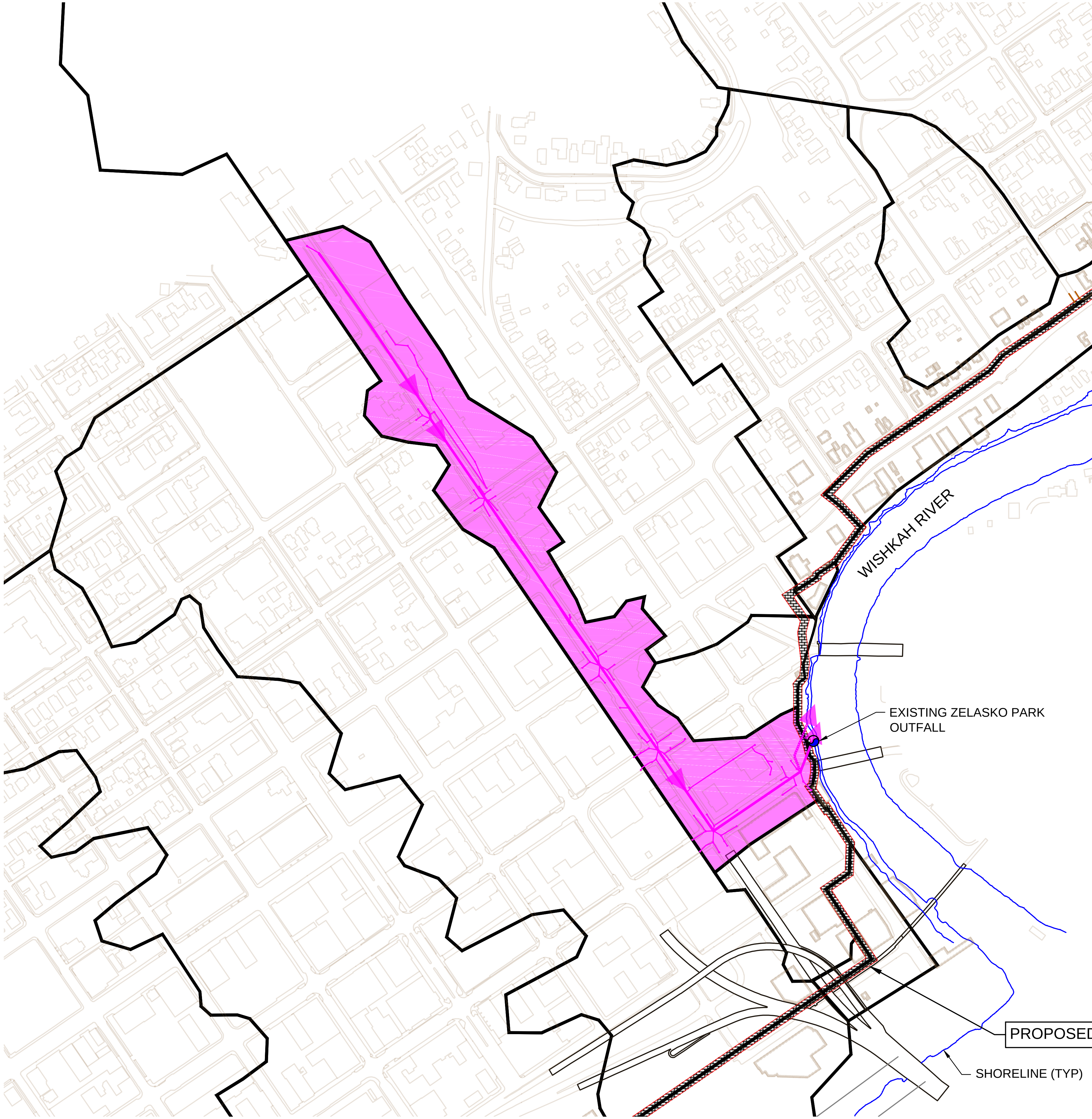

NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.

LEGEND

- PROPOSED PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION		
BASIN	AREA (AC)	100-YEAR Q (GPM)
17 ZELASKO PARK	17.79	8,984

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DRAINAGE BASIN EXHIBIT ZELASKO PARK

EXHIBIT
DB-17
SHEET 18 OF 27

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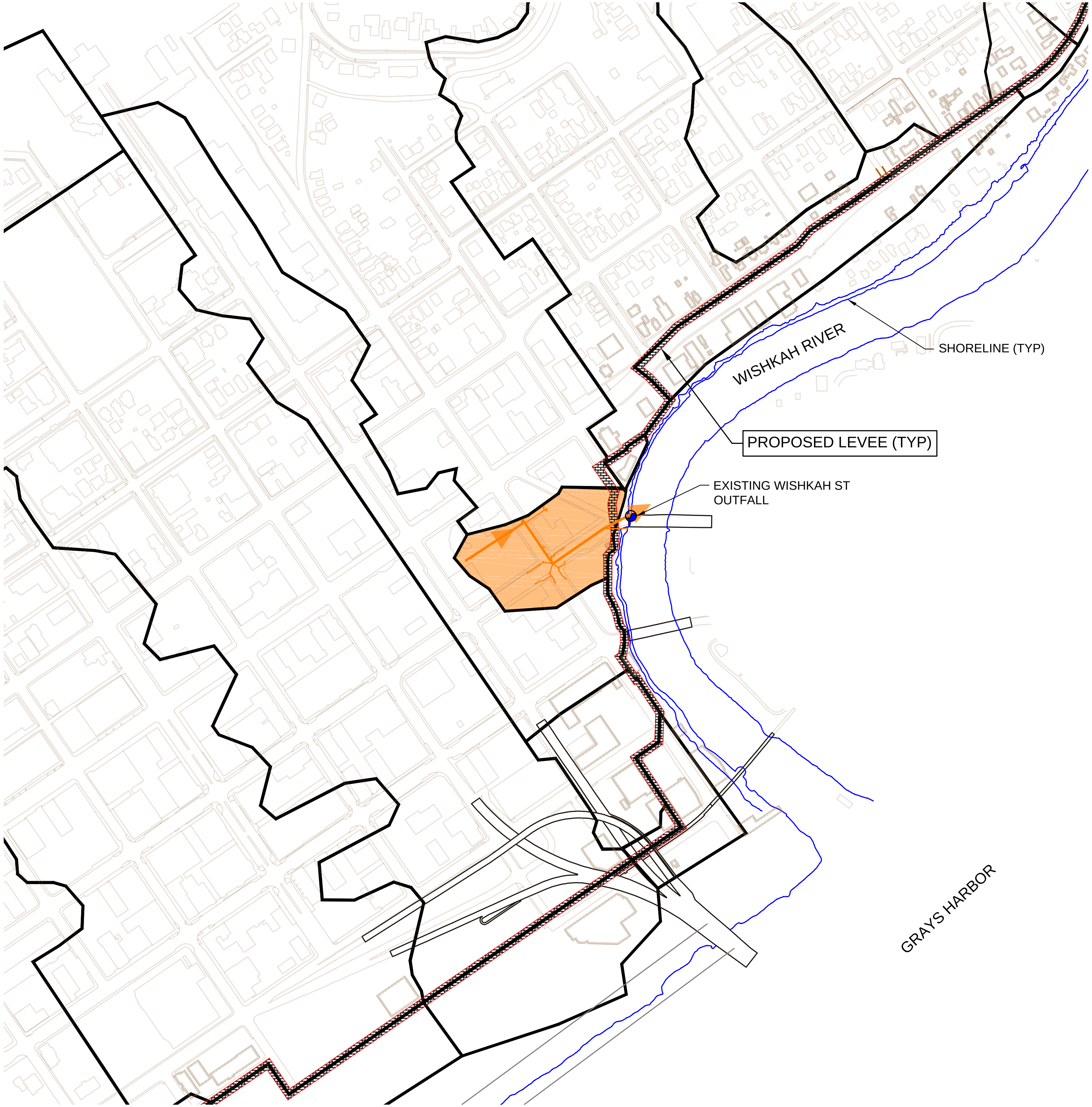

NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.

LEGEND

- PROPOSED PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
9	WISHKAH ST	4.04	1,938

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DRAINAGE BASIN EXHIBIT WISHKAH ST

EXHIBIT
DB-18
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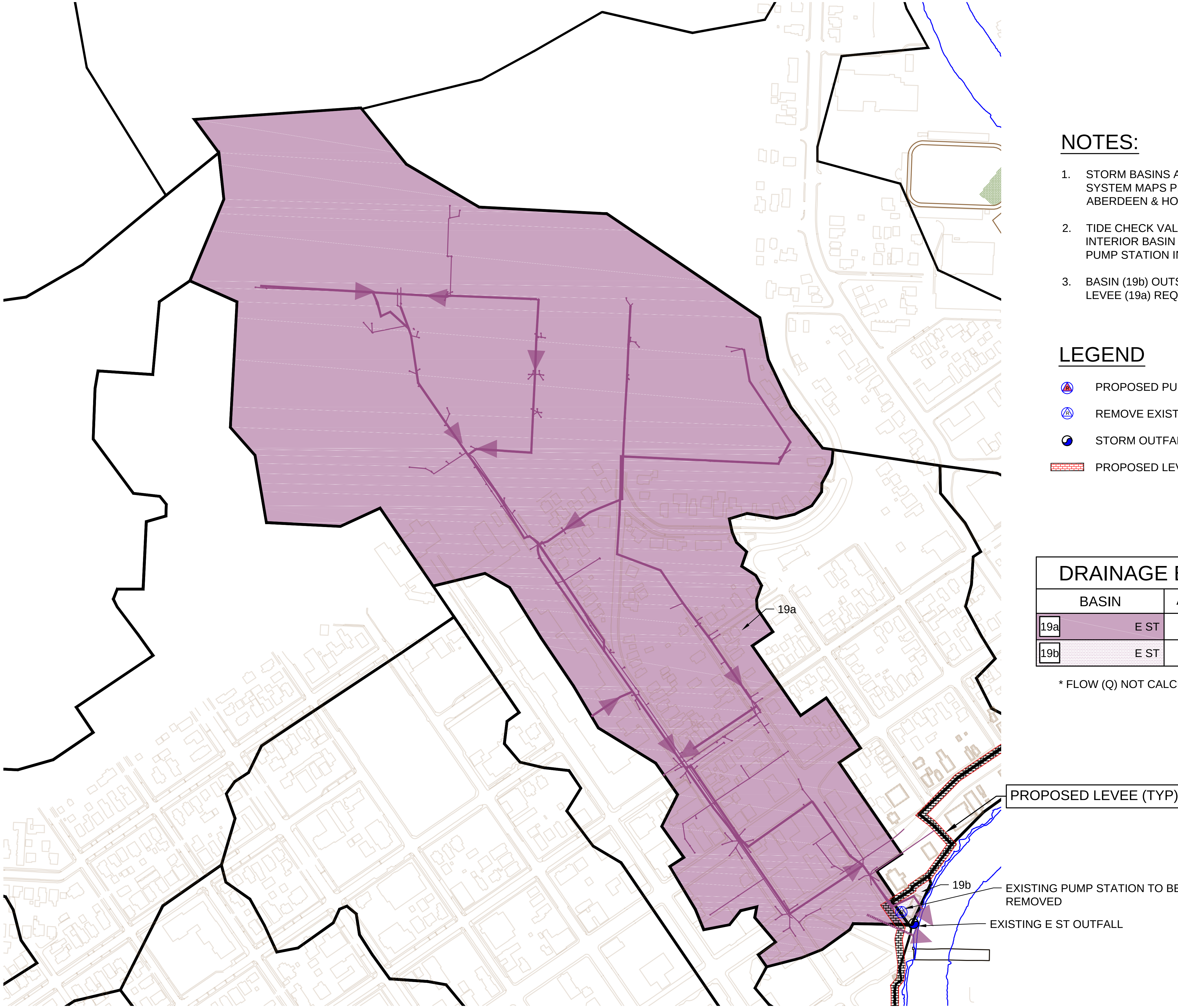

NOTES:

1. STORM BASINS ARE BASED ON STORM DRAINAGE SYSTEM MAPS PROVIDED BY THE CITIES OF ABERDEEN & HOQUIAM.
2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (19b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (19a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- PROPOSED PUMP STATION
- REMOVE EXISTING PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
19a	E ST	101.44	45,609
19b	E ST	0.30	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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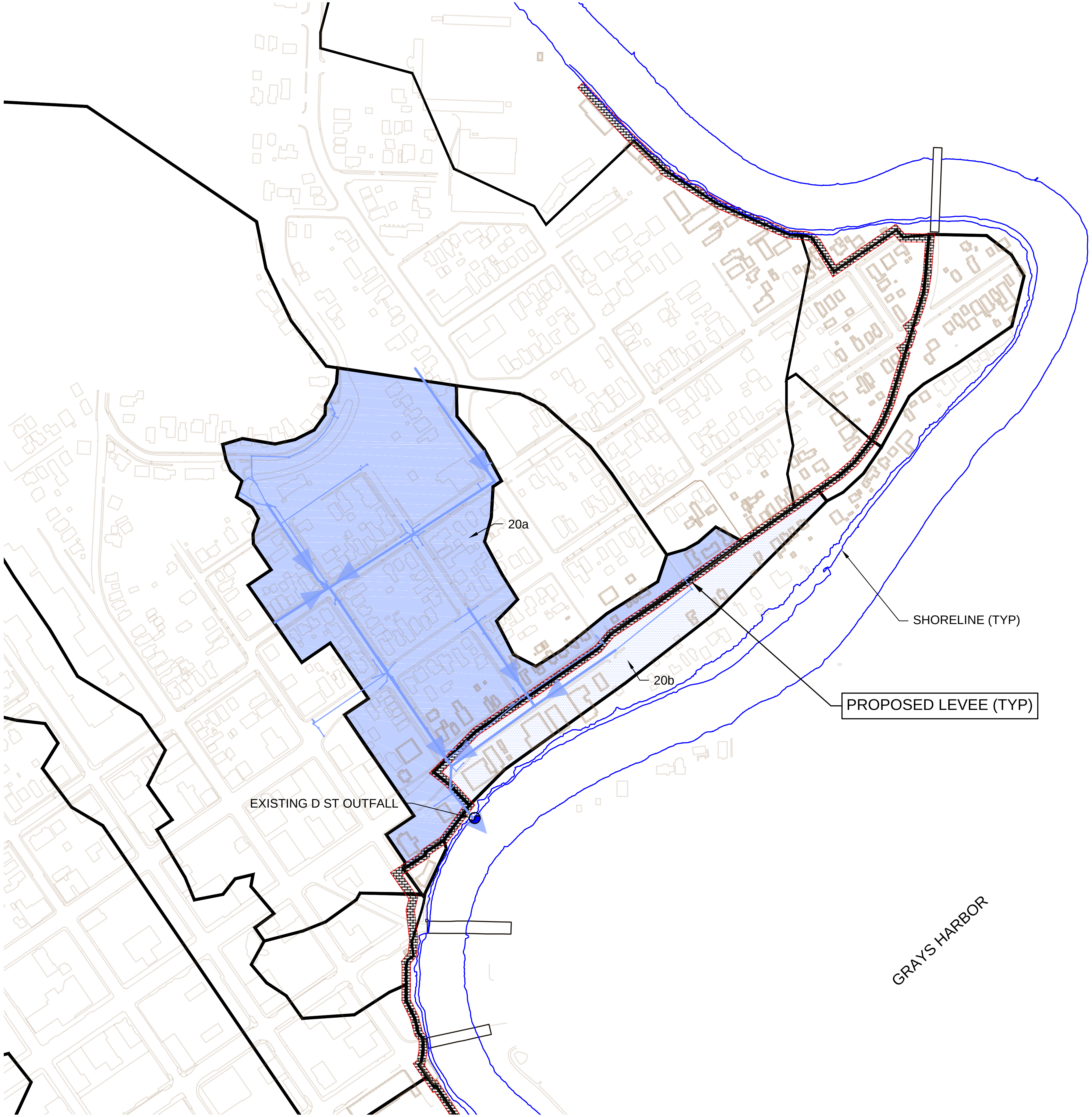
DRAINAGE BASIN EXHIBIT
E ST

EXHIBIT
DB-19
SHEET 20 OF 27



NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (20b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (20a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- STORM PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
20a	D ST	25.97	10,896
20b	D ST	5.62	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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DRAINAGE BASIN EXHIBIT
D ST

EXHIBIT
DB-20
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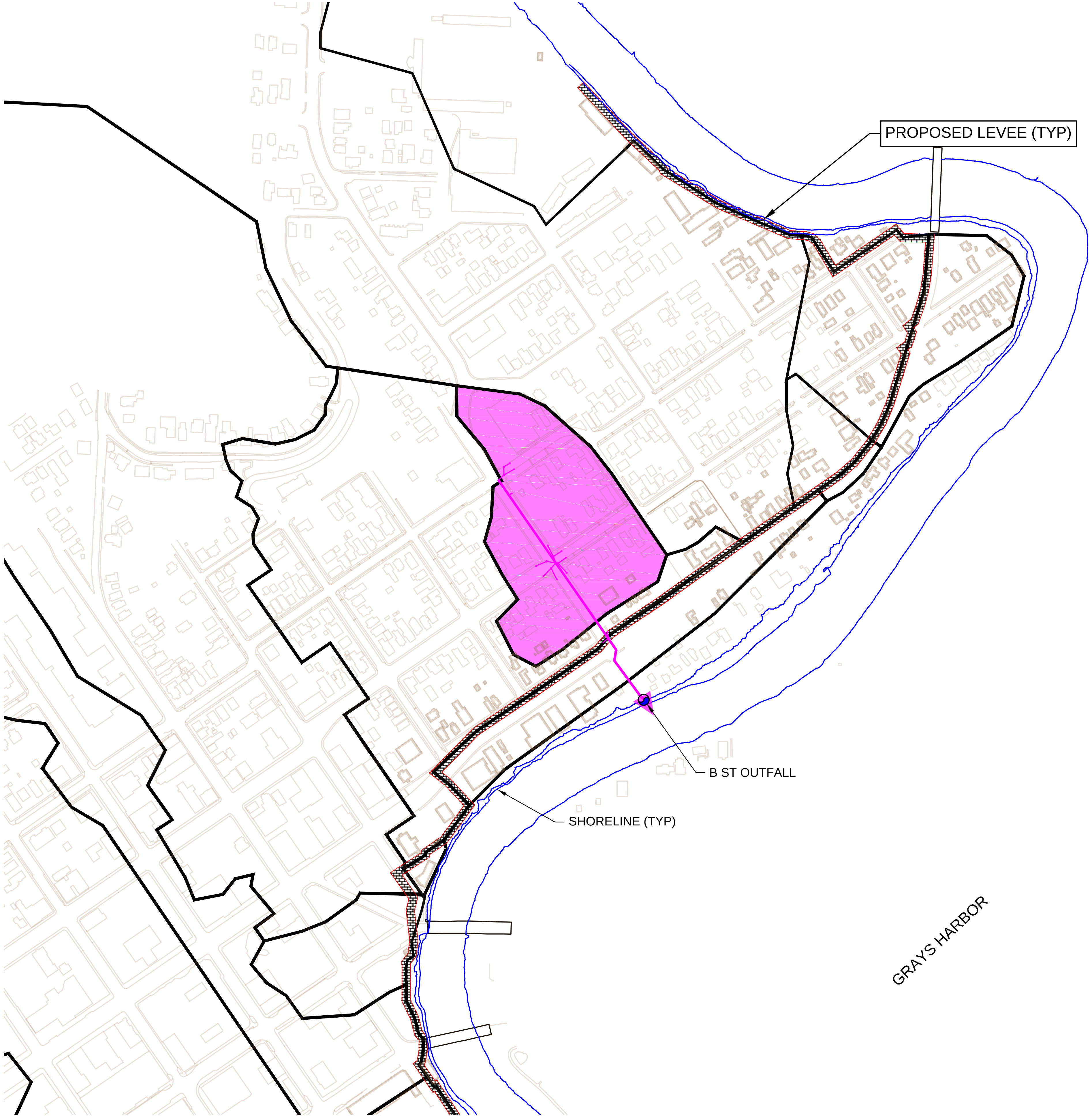

NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.

LEGEND

- PROPOSED PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION		
BASIN	AREA (AC)	100-YEAR Q (GPM)
21 B ST	9.58	3,996

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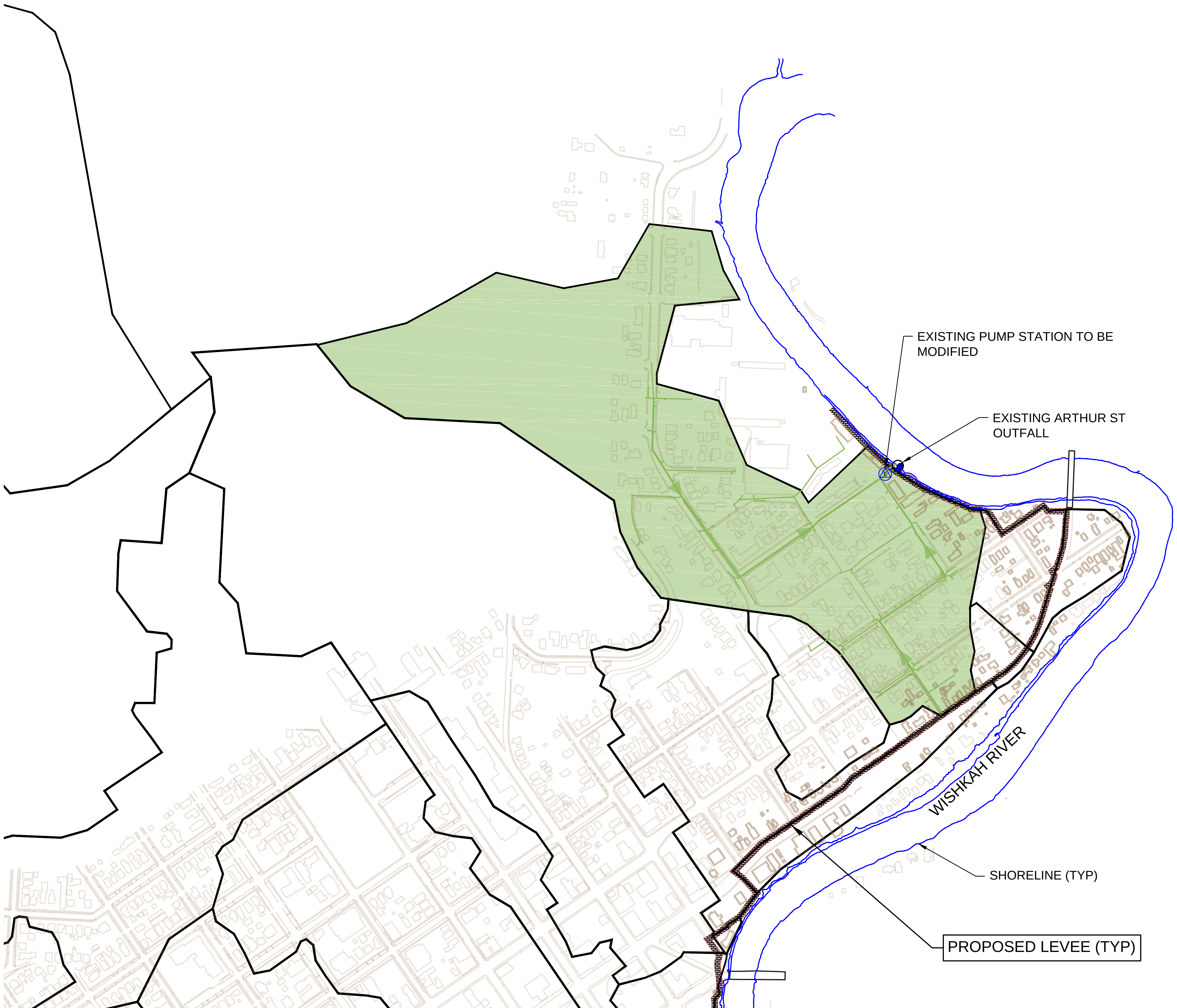
DRAINAGE BASIN EXHIBIT
B ST

EXHIBIT
DB-21
SHEET 22 OF 27



NOTES:

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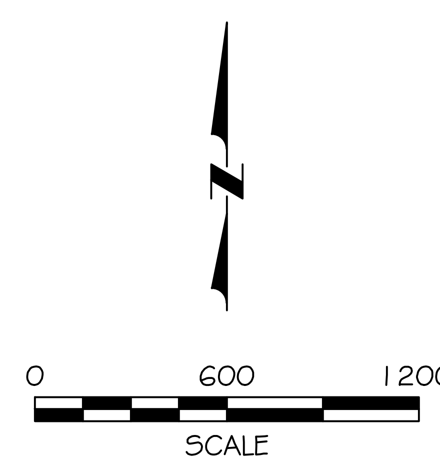
2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.

LEGEND

- EXISTING PUMP STATION TO BE MODIFIED
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
22	ARTHUR ST	77.68	22,101



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DRAINAGE BASIN EXHIBIT
ARTHUR ST

EXHIBIT
DB-22
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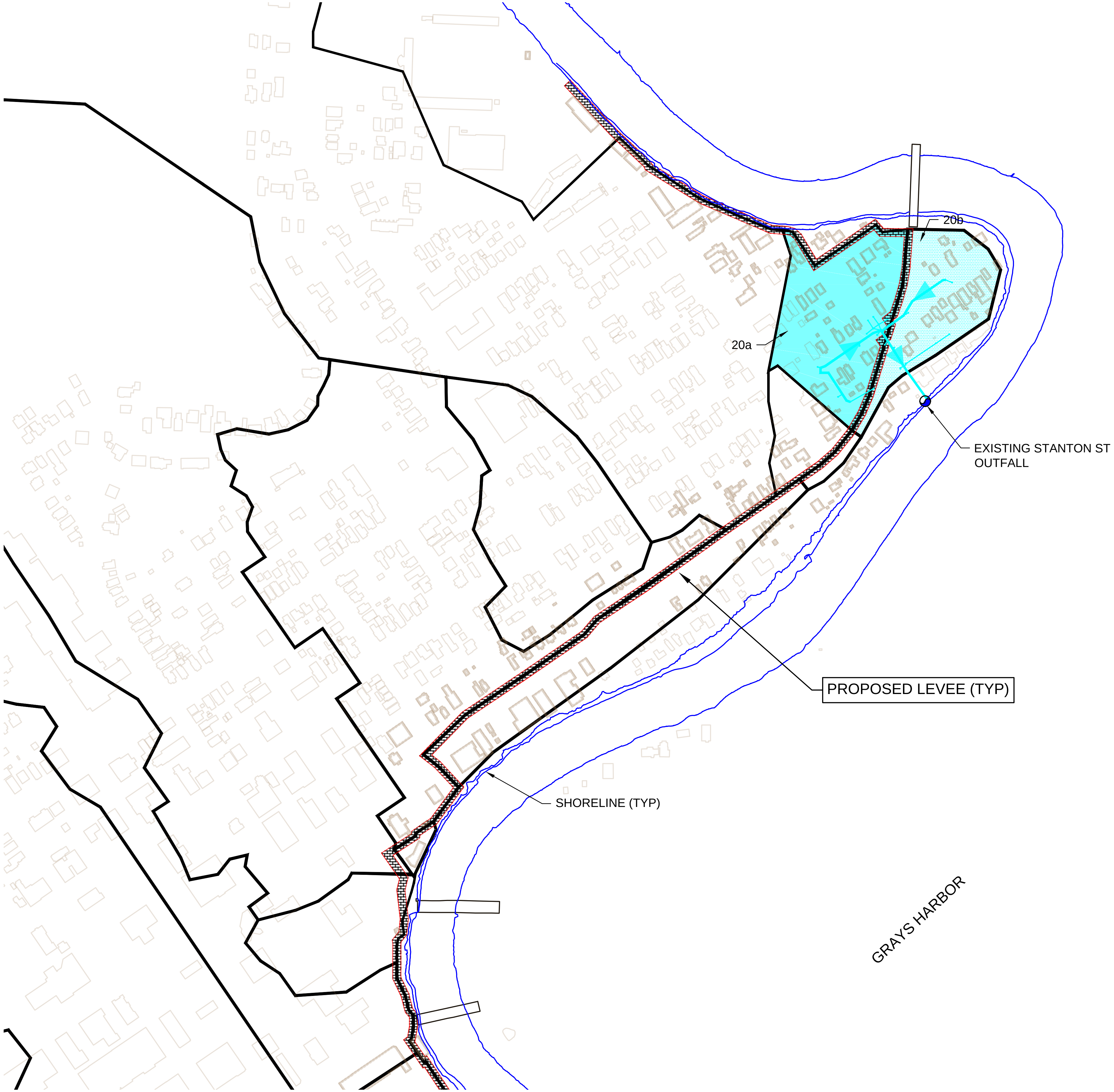

NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (23b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (23a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- PROPOSED PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)	100-YEAR Q (GPM)
23a	STANTON ST	5.57	2,217
23b	STANTON ST	6.13	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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DRAINAGE BASIN EXHIBIT
STANTON ST

EXHIBIT
DB-23
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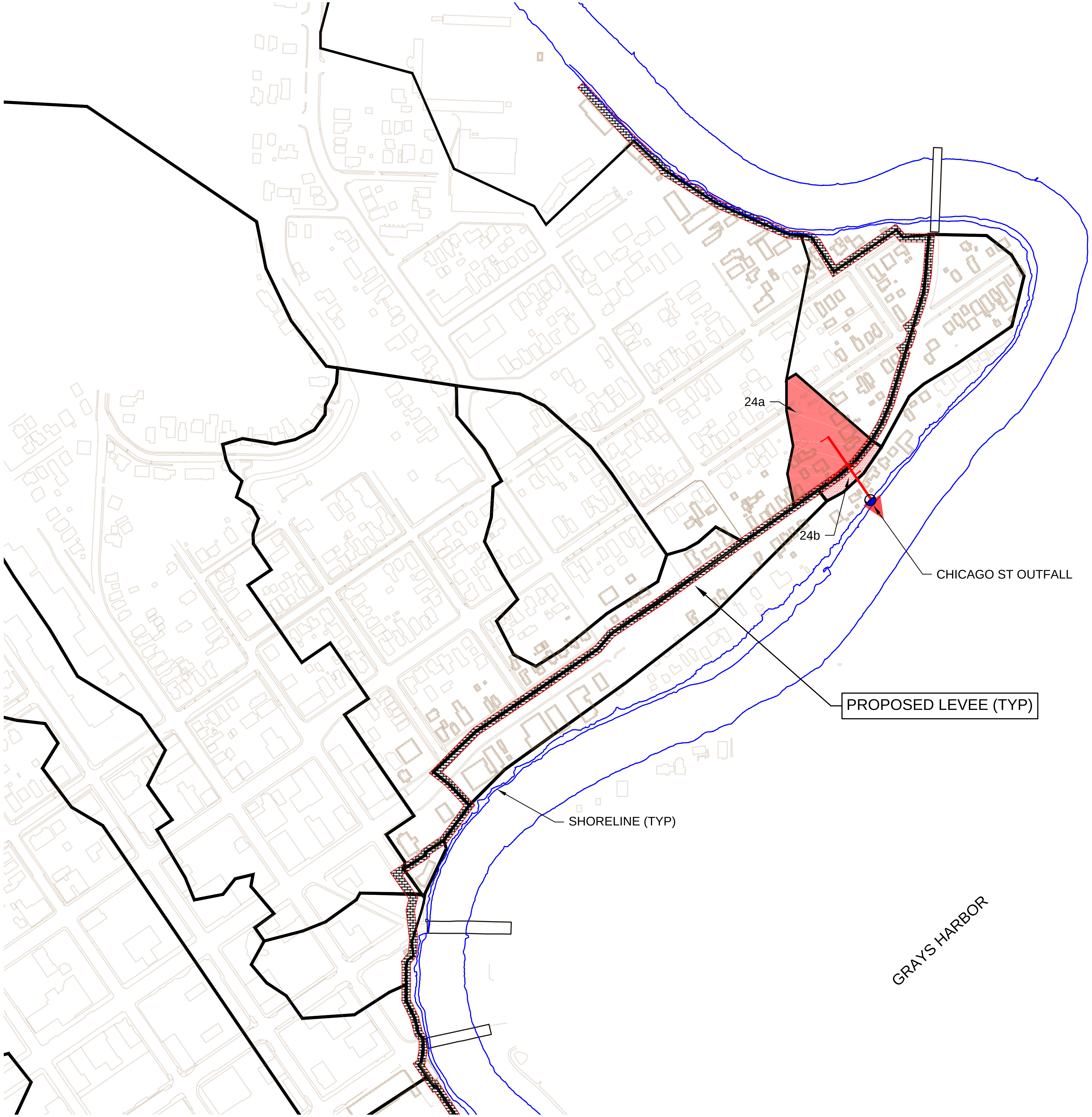

NOTES:

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2. TIDE CHECK VALVES WILL BE INSTALLED ON ALL INTERIOR BASIN STORM OUTFALLS AS PART OF PUMP STATION INSTALLATION / UPGRADES.
3. BASIN (24b) OUTSIDE LEVEE LIMITS. BASIN INSIDE LEVEE (24a) REQUIRES A PROPOSED PUMP STATION.

LEGEND

- PROPOSED PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE

DRAINAGE BASIN INFORMATION

BASIN	AREA (AC)	100-YEAR Q (GPM)
24a CHICAGO ST	1.85	737
24b CHICAGO ST	0.32	*

* FLOW (Q) NOT CALCULATED FOR CLOMR SUBMITTAL

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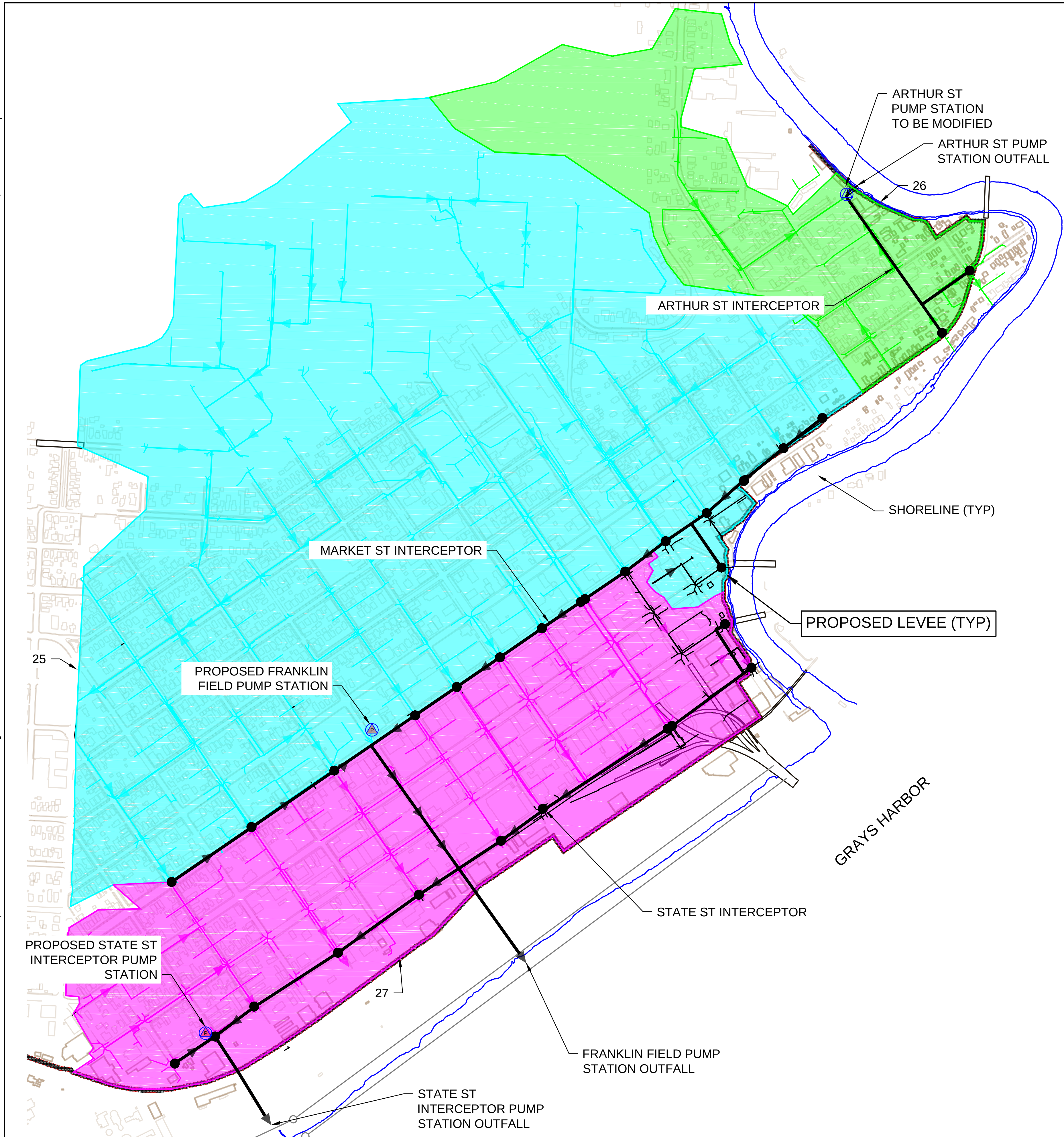
DRAINAGE BASIN EXHIBIT
CHICAGO ST

EXHIBIT
DB-24



ABERDEEN ALTERNATIVE #1:

1. THREE PROPOSED INTERCEPTORS, MARKET ST, STATE ST, AND CHICAGO ST TO PROVIDE ADDITIONAL CONVEYANCE AND STORAGE FOR EXISTING SYSTEM.
2. BASINS WILL CONTINUE TO CONVEY WATER VIA GRAVITY/EXISTING STATE UNDER NORMAL TIDAL EVENTS.
3. INTERCEPTORS TO BE EVALUATED AT DETAILED DESIGN.

LEGEND

- PROPOSED PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE
- INTERCEPTOR CONNECTION TO EXISTING BASIN

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)
25	MARKET ST INTERCEPTOR	431.4
26	ARTHUR ST INTERCEPTOR	85.7
27	STATE ST INTERCEPTOR	172.9

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DRAINAGE BASIN EXHIBIT ABERDEEN ALTERNATIVE #1

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DB-25
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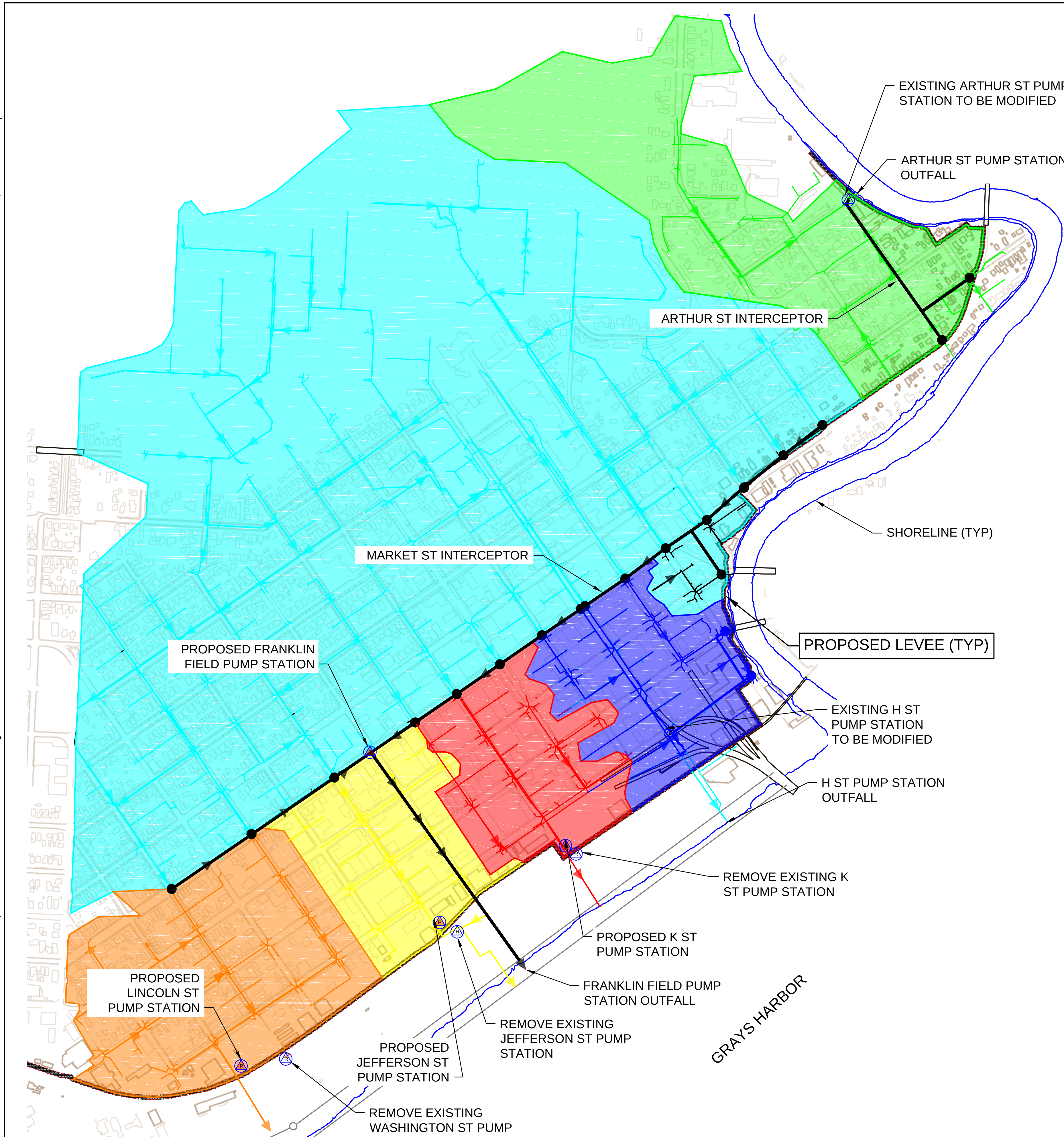

ABERDEEN ALTERNATIVE #2:

1. TWO PROPOSED INTERCEPTORS, MARKET ST AND CHICAGO ST, TO PROVIDE ADDITIONAL CONVEYANCE AND STORAGE FOR EXISTING SYSTEM DURING A HIGH STORM AND/OR TIDE EVENT.
2. BASINS WILL CONTINUE TO CONVEY WATER VIA GRAVITY/EXISTING STATE UNDER NORMAL TIDAL EVENTS .
3. INTERCEPTORS TO BE EVALUATED AT DETAILED DESIGN.
4. FOUR PUMP STATIONS, LINCOLN ST, JEFFERSON ST, K ST, AND H ST TO PROVIDE ADDITIONAL CONVEYANCE AND STORAGE FOR STORM BASINS DOWNSTREAM OF MARKET ST INTERCEPTOR.

LEGEND

- PROPOSED PUMP STATION
- STORM OUTFALL
- PROPOSED LEVEE
- INTERCEPTOR CONNECTION TO EXISTING BASIN

DRAINAGE BASIN INFORMATION

BASIN		AREA (AC)
25	MARKET ST INTERCEPTOR	431.4
26	ARTHUR ST INTERCEPTOR	85.7
29	LINCOLN ST	65.7
30	JEFFERSON ST	36.1
31	K ST	33.9
32	H ST	37.2

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DRAINAGE BASIN EXHIBIT
ABERDEEN ALTERNATIVE #2

EXHIBIT
DB-26
SHEET 27 OF 27

Appendix B

Stormwater Model Input and Results

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	North Shore Levee
Site Name:	
Site Address:	
City:	
Report Date:	5/30/2017
Gage:	Montesano
Data Start:	1955/10/01
Data End:	2009/09/30
Timestep:	Hourly
Precip Scale:	1.100
Version Date:	2017/04/14
Version:	4.2.13

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year
Low Flow Threshold for POC3:	50 Percent of the 2 Year
High Flow Threshold for POC3:	50 Year
Low Flow Threshold for POC4:	50 Percent of the 2 Year
High Flow Threshold for POC4:	50 Year
Low Flow Threshold for POC5:	50 Percent of the 2 Year
High Flow Threshold for POC5:	50 Year
Low Flow Threshold for POC6:	50 Percent of the 2 Year
High Flow Threshold for POC6:	50 Year
Low Flow Threshold for POC7:	50 Percent of the 2 Year
High Flow Threshold for POC7:	50 Year
Low Flow Threshold for POC8:	50 Percent of the 2 Year
High Flow Threshold for POC8:	50 Year
Low Flow Threshold for POC9:	50 Percent of the 2 Year
High Flow Threshold for POC9:	50 Year

Low Flow Threshold for POC10:	50 Percent of the 2 Year
High Flow Threshold for POC10:	50 Year
Low Flow Threshold for POC11:	50 Percent of the 2 Year
High Flow Threshold for POC11:	50 Year
Low Flow Threshold for POC12:	50 Percent of the 2 Year
High Flow Threshold for POC12:	50 Year
Low Flow Threshold for POC13:	50 Percent of the 2 Year
High Flow Threshold for POC13:	50 Year
Low Flow Threshold for POC14:	50 Percent of the 2 Year
High Flow Threshold for POC14:	50 Year
Low Flow Threshold for POC15:	50 Percent of the 2 Year
High Flow Threshold for POC15:	50 Year
Low Flow Threshold for POC16:	50 Percent of the 2 Year
High Flow Threshold for POC16:	50 Year
Low Flow Threshold for POC17:	50 Percent of the 2 Year
High Flow Threshold for POC17:	50 Year
Low Flow Threshold for POC18:	50 Percent of the 2 Year
High Flow Threshold for POC18:	50 Year
Low Flow Threshold for POC19:	50 Percent of the 2 Year
High Flow Threshold for POC19:	50 Year
Low Flow Threshold for POC20:	50 Percent of the 2 Year
High Flow Threshold for POC20:	50 Year
Low Flow Threshold for POC21:	50 Percent of the 2 Year
High Flow Threshold for POC21:	50 Year
Low Flow Threshold for POC22:	50 Percent of the 2 Year
High Flow Threshold for POC22:	50 Year
Low Flow Threshold for POC23:	50 Percent of the 2 Year
High Flow Threshold for POC23:	50 Year
Low Flow Threshold for POC24:	50 Percent of the 2 Year
High Flow Threshold for POC24:	50 Year

Landuse Basin Data
Predeveloped Land Use

Broadway Ave.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.825
Pervious Total	0.825
Impervious Land Use	acre
PARKING FLAT	0.7615
Impervious Total	0.7615
Basin Total	1.5865

Element Flows To:

Surface	Interflow	Groundwater

15th St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	2.942
A B, Lawn, Flat	9.5724
Pervious Total	12.5144
Impervious Land Use	acre
PARKING FLAT	8.83605
Impervious Total	8.83605
Basin Total	21.35045

Element Flows To:

Surface	Interflow	Groundwater

19th St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	3.80503
A B, Lawn, Flat	5.82103
Pervious Total	9.62606
Impervious Land Use	acre
PARKING FLAT	5.3733
Impervious Total	5.3733
Basin Total	14.99936

Element Flows To:

Surface	Interflow	Groundwater

Riverside Ave.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	2.34824
A B, Lawn, Flat	4.73886
Pervious Total	7.0871
Impervious Land Use	acre
PARKING FLAT	5.39492
Impervious Total	5.39492
Basin Total	12.48202

Element Flows To:

Surface	Interflow	Groundwater

28th St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	30.783
A B, Lawn, Mod	2.6176
A B, Lawn, Flat	112.8542
Pervious Total	146.2548
Impervious Land Use	acre
PARKING FLAT	175.6279
Impervious Total	175.6279
Basin Total	321.8827

Element Flows To:

Surface	Interflow	Groundwater

Fry Creek

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	45.03
A B, Lawn, Mod	11.5
A B, Forest, Steep	14.25
Pervious Total	70.78
Impervious Land Use	acre
PARKING FLAT	83.98
PARKING MOD	28.94
Impervious Total	112.92
Basin Total	183.7

Element Flows To:

Surface	Interflow	Groundwater

Duffy St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	66.142
A B, Lawn, Mod	14.157
A B, Lawn, Flat	42.47
C, Forest, Steep	3.481
Pervious Total	126.25
Impervious Land Use	acre
PARKING FLAT	39.203
PARKING MOD	13.068
Impervious Total	52.271
Basin Total	178.521

Element Flows To:

Surface	Interflow	Groundwater

Division St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	4.9216
A B, Lawn, Mod	11.6702
A B, Lawn, Flat	88.8296
Pervious Total	105.4214
Impervious Land Use	acre
PARKING FLAT	129.8878
PARKING MOD	10.7725
Impervious Total	140.6603
Basin Total	246.0817

Element Flows To:

Surface	Interflow	Groundwater

Cherry St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	126.36
A B, Lawn, Mod	26.027
A B, Lawn, Flat	19.634
Pervious Total	172.021
Impervious Land Use	acre
PARKING FLAT	18.124
PARKING MOD	24.024
Impervious Total	42.148
Basin Total	214.169

Element Flows To:

Surface	Interflow	Groundwater

Lincoln St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	76.7764
Pervious Total	76.7764
Impervious Land Use	acre
PARKING FLAT	77.2755
Impervious Total	77.2755
Basin Total	154.0519

Element Flows To:

Surface	Interflow	Groundwater

Washington St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	10.71699
Pervious Total	10.71699
Impervious Land Use	acre
PARKING FLAT	18.38945
Impervious Total	18.38945
Basin Total	29.10644

Element Flows To:

Surface	Interflow	Groundwater

Jefferson St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	8.82121
A B, Lawn, Flat	41.2188996
Pervious Total	50.0401096
Impervious Land Use	acre
PARKING FLAT	72.81228
PARKING MOD	8.14265
Impervious Total	80.95493
Basin Total	130.9950396

Element Flows To:

Surface	Interflow	Groundwater

K St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	1.49047
A B, Lawn, Flat	7.615306
Pervious Total	9.105776
Impervious Land Use	acre
PARKING FLAT	48.576928
PARKING MOD	2.22373
Impervious Total	50.800658
Basin Total	59.906434

Element Flows To:

Surface	Interflow	Groundwater

H St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	5.726112
A B, Lawn, Flat	3.05502
Pervious Total	8.781132
Impervious Land Use	acre
PARKING FLAT	47.86191
PARKING MOD	11.42772
Impervious Total	59.28963
Basin Total	68.070762

Element Flows To:

Surface	Interflow	Groundwater

River St.

Bypass:	No	
GroundWater:	No	
Pervious Land Use	acre	
A B, Lawn, Flat	0.017314	
Pervious Total	0.017314	
Impervious Land Use	acre	
PARKING FLAT	0.271256	
Impervious Total	0.271256	
Basin Total	0.28857	

Element Flows To:

Surface	Interflow	Groundwater

State St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.250493
Pervious Total	0.250493
Impervious Land Use	acre
PARKING FLAT	3.92439
Impervious Total	3.92439
Basin Total	4.174883

Element Flows To:

Surface	Interflow	Groundwater

Zelasko Park

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	0.341475
A B, Lawn, Flat	0.72563
Pervious Total	1.067105
Impervious Land Use	acre
PARKING FLAT	11.36828
PARKING MOD	5.34978
Impervious Total	16.71806
Basin Total	17.785165

Element Flows To:

Surface	Interflow	Groundwater

Wishkah St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.242165
Pervious Total	0.242165
Impervious Land Use	acre
PARKING FLAT	3.79392
Impervious Total	3.79392
Basin Total	4.036085

Element Flows To:

Surface	Interflow	Groundwater

E St

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	34.173112
A B, Lawn, Flat	9.2432
Pervious Total	43.416312
Impervious Land Use	acre
PARKING FLAT	20.37727
PARKING MOD	37.64642
Impervious Total	58.02369
Basin Total	101.440002

Element Flows To:

Surface	Interflow	Groundwater

D St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	1.312681
A B, Lawn, Flat	9.92239
Pervious Total	11.235071
Impervious Land Use	acre
PARKING FLAT	13.5243
PARKING MOD	1.21171
Impervious Total	14.73601
Basin Total	25.971081

Element Flows To:

Surface	Interflow	Groundwater

B St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	4.099363
Pervious Total	4.099363
Impervious Land Use	acre
PARKING FLAT	5.47859
Impervious Total	5.47859
Basin Total	9.577953

Element Flows To:

Surface	Interflow	Groundwater

Chicago St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.964
Pervious Total	0.964
Impervious Land Use	acre
PARKING FLAT	0.889
Impervious Total	0.889
Basin Total	1.853

Element Flows To:

Surface	Interflow	Groundwater

Stanton St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	2.898
Pervious Total	2.898
Impervious Land Use	acre
PARKING FLAT	2.67483
Impervious Total	2.67483
Basin Total	5.57283

Element Flows To:

Surface	Interflow	Groundwater

Arthur St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	10.099
A B, Lawn, Flat	30.296
Pervious Total	40.395
Impervious Land Use	acre
PARKING FLAT	27.966
PARKING MOD	9.322
Impervious Total	37.288
Basin Total	77.683

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Broadway Ave.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.825
Pervious Total	0.825
Impervious Land Use	acre
PARKING FLAT	0.7615
Impervious Total	0.7615
Basin Total	1.5865

Element Flows To:

Surface	Interflow	Groundwater

15th St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	2.942
A B, Lawn, Flat	9.572
Pervious Total	12.514
Impervious Land Use	acre
PARKING FLAT	8.83605
Impervious Total	8.83605
Basin Total	21.35005

Element Flows To:

Surface	Interflow	Groundwater

19th St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	3.80503
A B, Lawn, Flat	5.82103
Pervious Total	9.62606
Impervious Land Use	acre
PARKING FLAT	5.3733
Impervious Total	5.3733
Basin Total	14.99936

Element Flows To:

Surface	Interflow	Groundwater

Riverside Ave.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	2.34824
A B, Lawn, Flat	4.73886
Pervious Total	7.0871
Impervious Land Use	acre
PARKING FLAT	5.39492
Impervious Total	5.39492
Basin Total	12.48202

Element Flows To:

Surface	Interflow	Groundwater

28th St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	30.783
A B, Lawn, Mod	2.6176
A B, Lawn, Flat	112.8542
Pervious Total	146.2548
Impervious Land Use	acre
PARKING FLAT	175.6279
Impervious Total	175.6279
Basin Total	321.8827

Element Flows To:

Surface	Interflow	Groundwater

Fry Creek

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	45.03
A B, Forest, Steep	14.25
A B, Lawn, Mod	11.5
Pervious Total	70.78
Impervious Land Use	acre
PARKING FLAT	83.98
PARKING MOD	28.94
Impervious Total	112.92
Basin Total	183.7

Element Flows To:

Surface	Interflow	Groundwater

Duffy St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	66.142
A B, Lawn, Mod	14.157
A B, Lawn, Flat	42.47
C, Forest, Steep	3.481
Pervious Total	126.25
Impervious Land Use	acre
PARKING FLAT	39.203
PARKING MOD	13.068
Impervious Total	52.271
Basin Total	178.521

Element Flows To:

Surface	Interflow	Groundwater

Division St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	4.9216
A B, Lawn, Mod	11.6702
A B, Lawn, Flat	88.8296
Pervious Total	105.4214
Impervious Land Use	acre
PARKING FLAT	129.8878
PARKING MOD	10.7725
Impervious Total	140.6603
Basin Total	246.0817

Element Flows To:

Surface	Interflow	Groundwater

Cherry St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Steep	126.36
A B, Lawn, Mod	26.027
A B, Lawn, Flat	19.634
Pervious Total	172.021
Impervious Land Use	acre
PARKING FLAT	18.124
PARKING MOD	24.024
Impervious Total	42.148
Basin Total	214.169

Element Flows To:

Surface	Interflow	Groundwater

Lincoln St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	76.7764
Pervious Total	76.7764
Impervious Land Use	acre
PARKING FLAT	77.2755
Impervious Total	77.2755
Basin Total	154.0519

Element Flows To:

Surface	Interflow	Groundwater

Washington St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	10.71699
Pervious Total	10.71699
Impervious Land Use	acre
PARKING FLAT	18.38945
Impervious Total	18.38945
Basin Total	29.10644

Element Flows To:

Surface	Interflow	Groundwater

Jefferson St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	8.8212
A B, Lawn, Flat	41.2188996
Pervious Total	50.0400996
Impervious Land Use	acre
PARKING FLAT	72.81228
PARKING MOD	8.14265
Impervious Total	80.95493
Basin Total	130.9950296

Element Flows To:

Surface	Interflow	Groundwater

K St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	1.49047
A B, Lawn, Flat	7.615306
Pervious Total	9.105776
Impervious Land Use	acre
PARKING FLAT	48.576928
PARKING MOD	2.22373
Impervious Total	50.800658
Basin Total	59.906434

Element Flows To:

Surface	Interflow	Groundwater

H St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	5.726112
A B, Lawn, Flat	3.05502
Pervious Total	8.781132
Impervious Land Use	acre
PARKING FLAT	47.86191
PARKING MOD	11.42772
Impervious Total	59.28963
Basin Total	68.070762

Element Flows To:

Surface	Interflow	Groundwater

River St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.017314
Pervious Total	0.017314
Impervious Land Use	acre
PARKING FLAT	0.271256
Impervious Total	0.271256
Basin Total	0.28857

Element Flows To:

Surface	Interflow	Groundwater

State St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.250493
Pervious Total	0.250493
Impervious Land Use	acre
PARKING FLAT	3.92439
Impervious Total	3.92439
Basin Total	4.174883

Element Flows To:

Surface	Interflow	Groundwater

Zelasko Park

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	0.341475
A B, Lawn, Flat	0.72563
Pervious Total	1.067105
Impervious Land Use	acre
PARKING FLAT	11.36828
PARKING MOD	5.34978
Impervious Total	16.71806
Basin Total	17.785165

Element Flows To:

Surface	Interflow	Groundwater

Wishkah St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.242165
Pervious Total	0.242165
Impervious Land Use	acre
PARKING FLAT	3.79392
Impervious Total	3.79392
Basin Total	4.036085

Element Flows To:

Surface	Interflow	Groundwater

E St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	34.173112
A B, Lawn, Flat	9.2432
Pervious Total	43.416312
Impervious Land Use	acre
PARKING FLAT	20.37727
PARKING MOD	37.64642
Impervious Total	58.02369
Basin Total	101.440002

Element Flows To:

Surface	Interflow	Groundwater

D St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Mod	1.312681
A B, Lawn, Flat	9.92239
Pervious Total	11.235071
Impervious Land Use	acre
PARKING FLAT	13.5243
PARKING MOD	1.21171
Impervious Total	14.73601
Basin Total	25.971081

Element Flows To:

Surface	Interflow	Groundwater

B St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	4.099363
Pervious Total	4.099363
Impervious Land Use	acre
PARKING FLAT	5.47859
Impervious Total	5.47859
Basin Total	9.577953

Element Flows To:

Surface	Interflow	Groundwater

Chicago St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.964
Pervious Total	0.964
Impervious Land Use	acre
PARKING FLAT	0.889
Impervious Total	0.889
Basin Total	1.853

Element Flows To:

Surface	Interflow	Groundwater

Stanton St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	2.89774
Pervious Total	2.89774
Impervious Land Use	acre
PARKING FLAT	2.67483
Impervious Total	2.67483
Basin Total	5.57257

Element Flows To:

Surface	Interflow	Groundwater

Arthur St.

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	30.296
A B, Lawn, Mod	10.099
Pervious Total	40.395
Impervious Land Use	acre
PARKING FLAT	27.966
PARKING MOD	9.322
Impervious Total	37.288
Basin Total	77.683

Element Flows To:

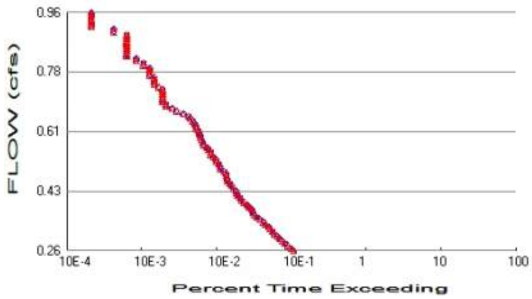
Surface	Interflow	Groundwater

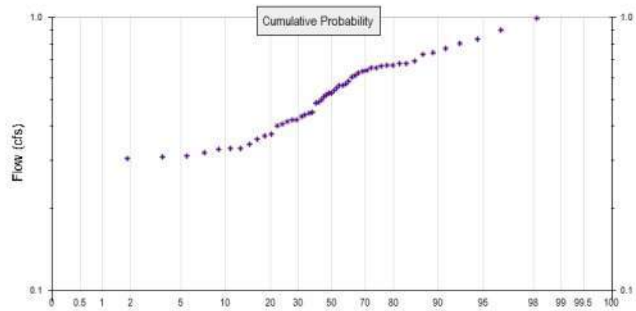
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1 (Broadway Ave)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.825
Total Impervious Area: 0.7615

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.825
Total Impervious Area: 0.7615

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.514712
5 year	0.667986
10 year	0.763252
25 year	0.877925
50 year	0.959856
100 year	1.039235

Flow Frequency Return Periods for Mitigated. POC #1

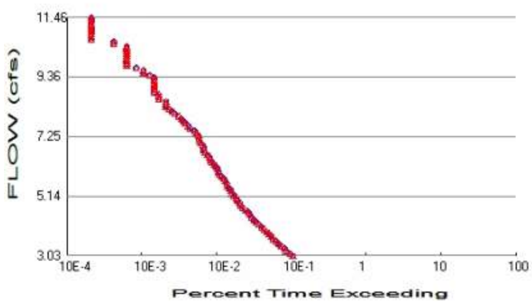
Return Period	**Flow(cfs)**
2 year	0.514712
5 year	0.667986
10 year	0.763252
25 year	0.877925
50 year	0.959856
100 year	1.039235

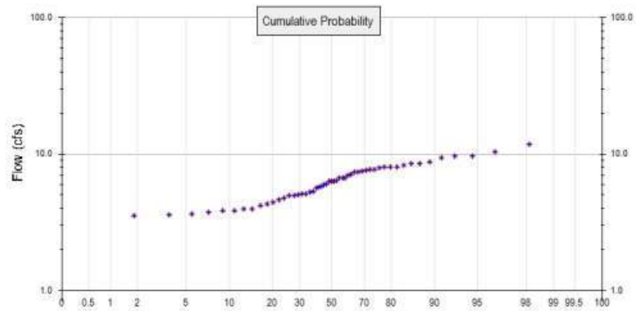
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.732	0.732
1957	0.654	0.654
1958	0.407	0.407
1959	0.677	0.677
1960	0.679	0.679
1961	0.415	0.415
1962	0.746	0.746
1963	0.571	0.571
1964	0.604	0.604
1965	0.693	0.693

POC 2 (16th St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 12.5144
Total Impervious Area: 8.83605

Mitigated Landuse Totals for POC #2
Total Pervious Area: 12.514
Total Impervious Area: 8.83605

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	**Flow(cfs)**
2 year	6.060002
5 year	7.911983
10 year	9.06818
25 year	10.464312
50 year	11.464436
100 year	12.435275

Flow Frequency Return Periods for Mitigated. POC #2

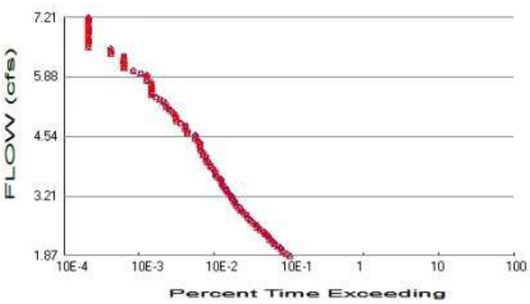
Return Period	**Flow(cfs)**
2 year	6.059936
5 year	7.911874
10 year	9.068042
25 year	10.464136
50 year	11.464232
100 year	12.435042

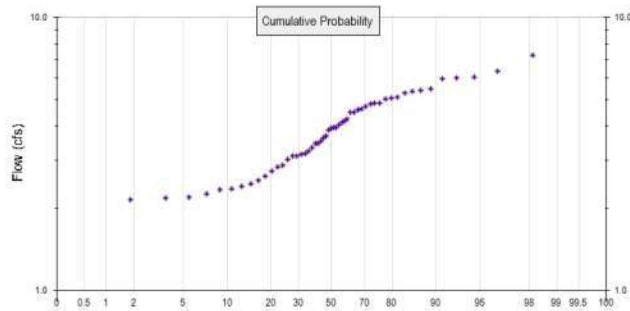
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	**Predeveloped**	**Mitigated**
1956	8.520	8.520
1957	7.669	7.669
1958	4.726	4.726
1959	8.081	8.081
1960	7.939	7.939
1961	4.992	4.992
1962	8.762	8.762
1963	6.641	6.641
1964	7.004	7.004
1965	8.489	8.489
1966	8.023	8.023

POC 3 (19th St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #3
Total Pervious Area: 9.62606
Total Impervious Area: 5.3733

Mitigated Landuse Totals for POC #3
Total Pervious Area: 9.62606
Total Impervious Area: 5.3733

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #3

Return Period	Flow(cfs)
2 year	3.74527
5 year	4.926264
10 year	5.667615
25 year	6.566304
50 year	7.212169
100 year	7.840625

Flow Frequency Return Periods for Mitigated. POC #3

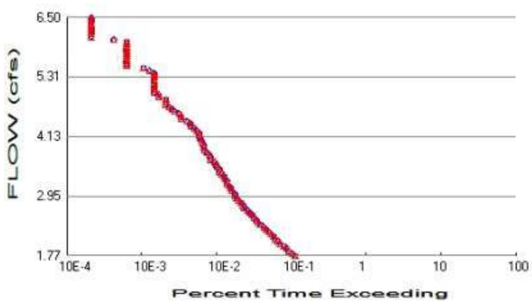
Return Period	Flow(cfs)
2 year	3.74527
5 year	4.926264
10 year	5.667615
25 year	6.566304
50 year	7.212169
100 year	7.840625

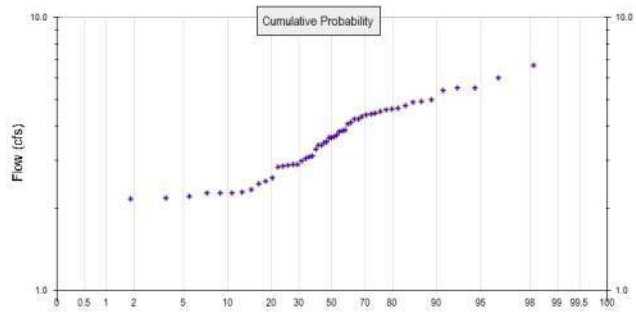
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #3

Year	Predeveloped	Mitigated
1956	5.288	5.288
1957	4.718	4.718
1958	2.874	2.874
1959	5.072	5.072
1960	4.868	4.868
1961	3.153	3.153
1962	5.403	5.403
1963	4.053	4.053
1964	4.260	4.260
1965	5.468	5.468
1966	5.118	5.118

POC 4 (20th St)





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #4
Total Pervious Area: 7.0871
Total Impervious Area: 5.39492

Mitigated Landuse Totals for POC #4
Total Pervious Area: 7.0871
Total Impervious Area: 5.39492

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #4

Return Period	**Flow(cfs)**
2 year	3.53499
5 year	4.559317
10 year	5.193059
25 year	5.953429
50 year	6.495232
100 year	7.019101

Flow Frequency Return Periods for Mitigated. POC #4

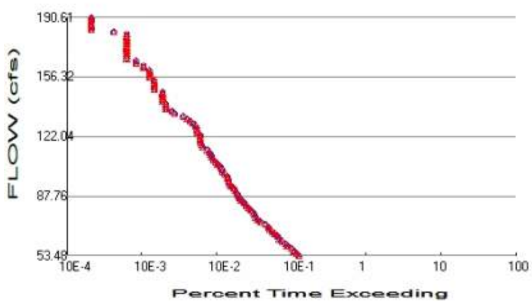
Return Period	**Flow(cfs)**
2 year	3.53499
5 year	4.559317
10 year	5.193059
25 year	5.953429
50 year	6.495232
100 year	7.019101

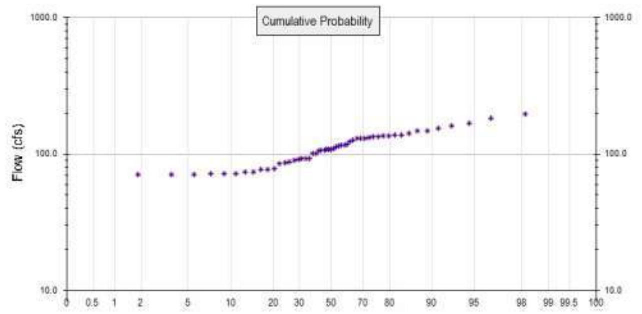
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #4

Year	**Predeveloped**	**Mitigated**
1956	4.895	4.895
1957	4.396	4.396
1958	2.873	2.873
1959	4.668	4.668
1960	4.537	4.537
1961	2.899	2.899
1962	4.997	4.997
1963	3.817	3.817
1964	4.130	4.130
1965	4.915	4.915
1966	4.616	4.616

POC 5 (28th St)





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #5
Total Pervious Area: 146.2548
Total Impervious Area: 175.6279

Mitigated Landuse Totals for POC #5
Total Pervious Area: 146.2548
Total Impervious Area: 175.6279

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #5

Return Period	**Flow(cfs)**
2 year	106.956006
5 year	135.530501
10 year	153.3872
25 year	175.029064
50 year	190.607079
100 year	205.800383

Flow Frequency Return Periods for Mitigated. POC #5

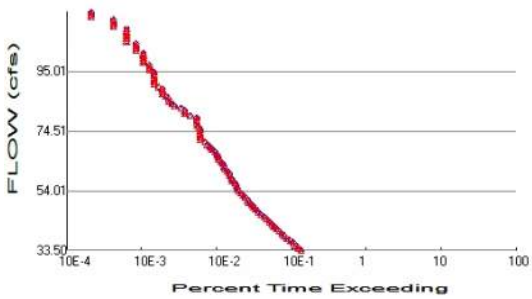
Return Period	**Flow(cfs)**
2 year	106.956006
5 year	135.530501
10 year	153.3872
25 year	175.029064
50 year	190.607079
100 year	205.800383

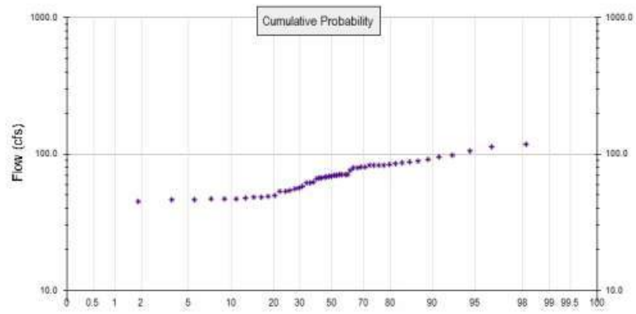
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #5

Year	**Predeveloped**	**Mitigated**
1956	148.101	148.101
1957	134.014	134.014
1958	93.063	93.063
1959	137.611	137.611
1960	135.556	135.556
1961	85.414	85.414
1962	147.883	147.883
1963	115.462	115.462
1964	129.352	129.352
1965	140.842	140.842
1966	132.714	132.714

POC 6 (Fry Creek)





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #6
Total Pervious Area: 70.78
Total Impervious Area: 112.92

Mitigated Landuse Totals for POC #6
Total Pervious Area: 70.78
Total Impervious Area: 112.92

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #6

Return Period	**Flow(cfs)**
2 year	67.003077
5 year	83.759257
10 year	94.124806
25 year	106.595727
50 year	115.517118
100 year	124.177955

Flow Frequency Return Periods for Mitigated. POC #6

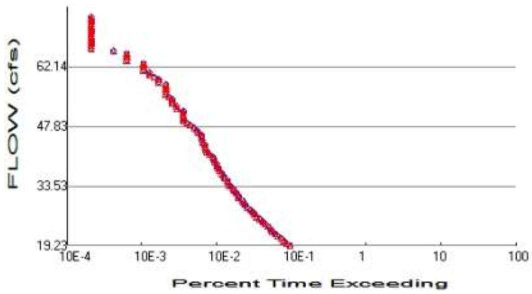
Return Period	**Flow(cfs)**
2 year	67.003077
5 year	83.759257
10 year	94.124806
25 year	106.595727
50 year	115.517118
100 year	124.177955

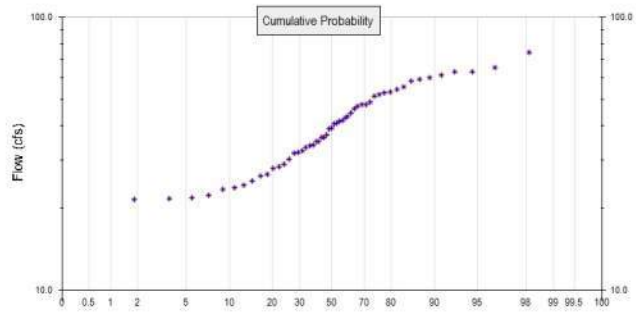
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #6

Year	**Predeveloped**	**Mitigated**
1956	90.643	90.643
1957	83.728	83.728
1958	61.069	61.069
1959	84.699	84.699
1960	82.370	82.370
1961	53.366	53.366
1962	89.093	89.093
1963	70.819	70.819
1964	82.347	82.347
1965	87.338	87.338
1966	82.207	82.207

POC 7 (Duffy St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #7
Total Pervious Area: 126.25
Total Impervious Area: 52.271

Mitigated Landuse Totals for POC #7
Total Pervious Area: 126.25
Total Impervious Area: 52.271

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #7

Return Period	Flow(cfs)
2 year	38.45028
5 year	51.253992
10 year	59.370906
25 year	69.279619
50 year	76.442259
100 year	83.441936

Flow Frequency Return Periods for Mitigated. POC #7

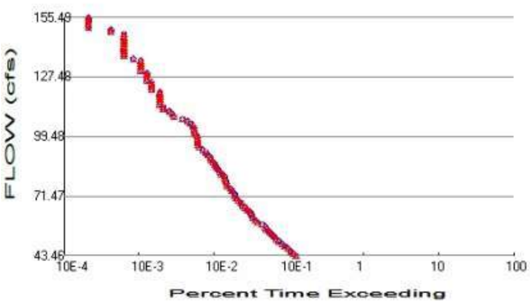
Return Period	Flow(cfs)
2 year	38.45028
5 year	51.253992
10 year	59.370906
25 year	69.279619
50 year	76.442259
100 year	83.441936

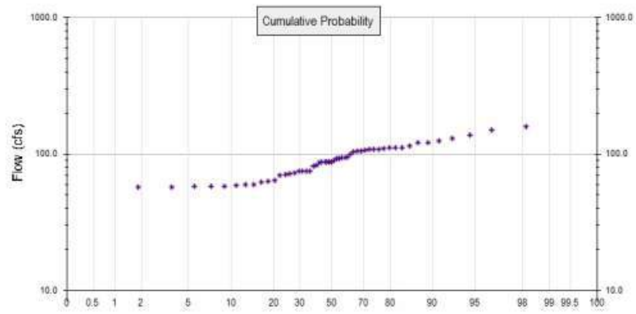
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #7

Year	Predeveloped	Mitigated
1956	58.303	58.303
1957	47.332	47.332
1958	28.941	28.941
1959	53.122	53.122
1960	48.927	48.927
1961	33.427	33.427
1962	54.503	54.503
1963	40.681	40.681
1964	42.862	42.862
1965	60.075	60.075
1966	55.595	55.595

POC 8 (Division St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #8
Total Pervious Area: 105.4214
Total Impervious Area: 140.6603

Mitigated Landuse Totals for POC #8
Total Pervious Area: 105.4214
Total Impervious Area: 140.6603

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #8

Return Period	**Flow(cfs)**
2 year	86.925561
5 year	110.316883
10 year	124.951197
25 year	142.702252
50 year	155.488504
100 year	167.96549

Flow Frequency Return Periods for Mitigated. POC #8

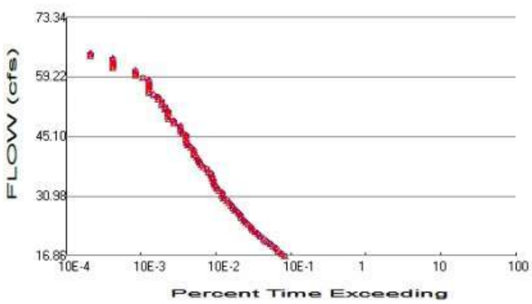
Return Period	**Flow(cfs)**
2 year	86.925561
5 year	110.316883
10 year	124.951197
25 year	142.702252
50 year	155.488504
100 year	167.96549

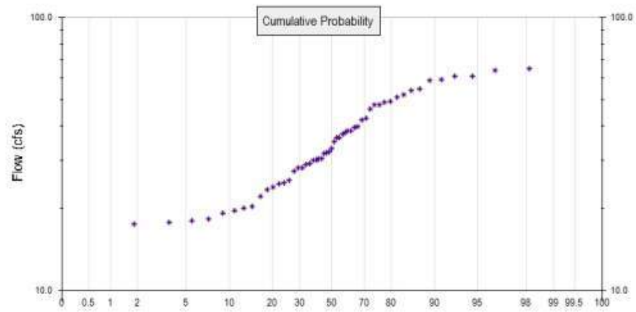
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #8

Year	**Predeveloped**	**Mitigated**
1956	120.947	120.947
1957	109.651	109.651
1958	75.183	75.183
1959	111.665	111.665
1960	110.733	110.733
1961	69.186	69.186
1962	120.528	120.528
1963	94.331	94.331
1964	105.332	105.332
1965	113.778	113.778
1966	107.850	107.850

POC 9 (Cherry St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #9
Total Pervious Area: 172.021
Total Impervious Area: 42.148

Mitigated Landuse Totals for POC #9
Total Pervious Area: 172.021
Total Impervious Area: 42.148

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #9

Return Period	Flow(cfs)
2 year	33.712913
5 year	46.664315
10 year	55.105984
25 year	65.616945
50 year	73.340542
100 year	80.980799

Flow Frequency Return Periods for Mitigated. POC #9

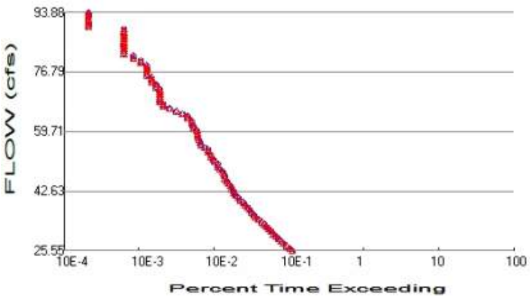
Return Period	Flow(cfs)
2 year	33.712913
5 year	46.664315
10 year	55.105984
25 year	65.616945
50 year	73.340542
100 year	80.980799

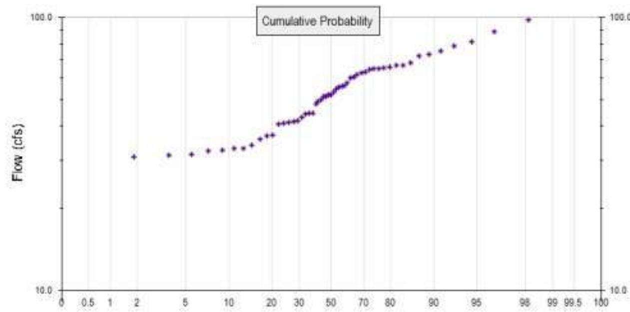
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #9

Year	Predeveloped	Mitigated
1956	59.320	59.320
1957	39.838	39.838
1958	23.818	23.818
1959	49.134	49.134
1960	42.224	42.224
1961	31.822	31.822
1962	46.252	46.252
1963	33.069	33.069
1964	38.461	38.461
1965	60.845	60.845
1966	54.787	54.787

POC 10 (Lincoln St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #10
Total Pervious Area: 76.7764
Total Impervious Area: 77.2755

Mitigated Landuse Totals for POC #10
Total Pervious Area: 76.7764
Total Impervious Area: 77.2755

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #10

Return Period	Flow(cfs)
2 year	51.090082
5 year	65.894907
10 year	75.054577
25 year	86.044488
50 year	93.875407
100 year	101.447124

Flow Frequency Return Periods for Mitigated. POC #10

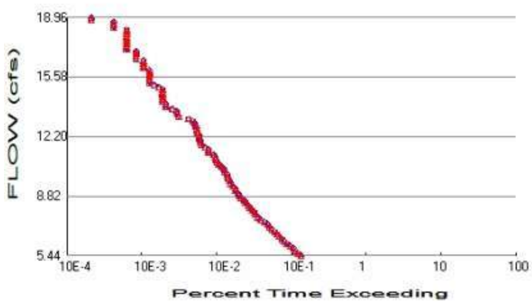
Return Period	Flow(cfs)
2 year	51.090082
5 year	65.894907
10 year	75.054577
25 year	86.044488
50 year	93.875407
100 year	101.447124

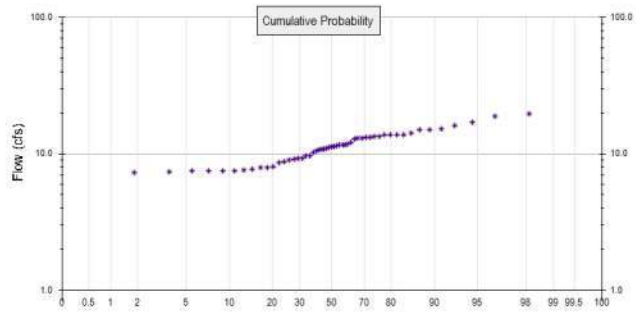
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #10

Year	Predeveloped	Mitigated
1956	72.352	72.352
1957	64.488	64.488
1958	41.248	41.248
1959	66.719	66.719
1960	66.899	66.899
1961	41.022	41.022
1962	73.329	73.329
1963	56.379	56.379
1964	60.326	60.326
1965	68.132	68.132
1966	64.934	64.934

POC 11 (Washington St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #11
Total Pervious Area: 10.71699
Total Impervious Area: 18.38945

Mitigated Landuse Totals for POC #11
Total Pervious Area: 10.71699
Total Impervious Area: 18.38945

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #11

Return Period	**Flow(cfs)**
2 year	10.884396
5 year	13.663254
10 year	15.387656
25 year	17.46699
50 year	18.957324
100 year	20.406194

Flow Frequency Return Periods for Mitigated. POC #11

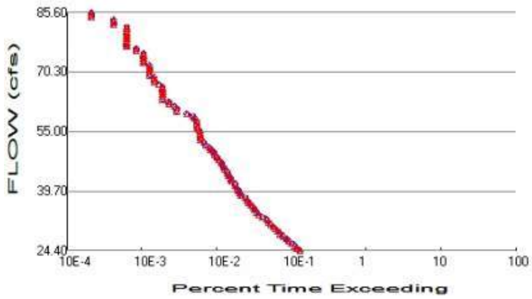
Return Period	**Flow(cfs)**
2 year	10.884396
5 year	13.663254
10 year	15.387656
25 year	17.46699
50 year	18.957324
100 year	20.406194

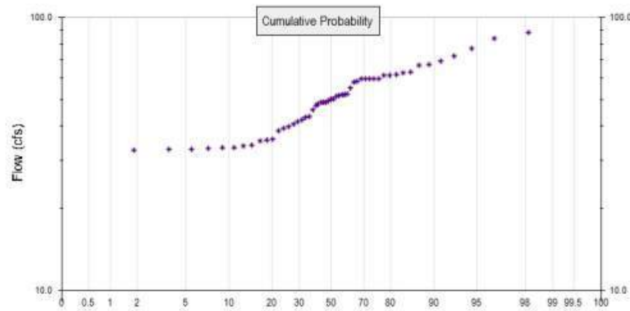
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #11

Year	**Predeveloped**	**Mitigated**
1956	15.092	15.092
1957	13.734	13.734
1958	9.727	9.727
1959	13.766	13.766
1960	13.728	13.728
1961	8.673	8.673
1962	14.899	14.899
1963	11.763	11.763
1964	13.356	13.356
1965	13.812	13.812
1966	13.072	13.072

POC 12 (Jefferson St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #12
Total Pervious Area: 50.0401096
Total Impervious Area: 80.95493

Mitigated Landuse Totals for POC #12
Total Pervious Area: 50.0400996
Total Impervious Area: 80.95493

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #12

Return Period	**Flow(cfs)**
2 year	48.798141
5 year	61.434837
10 year	69.293499
25 year	78.784604
50 year	85.596222
100 year	92.224904

Flow Frequency Return Periods for Mitigated. POC #12

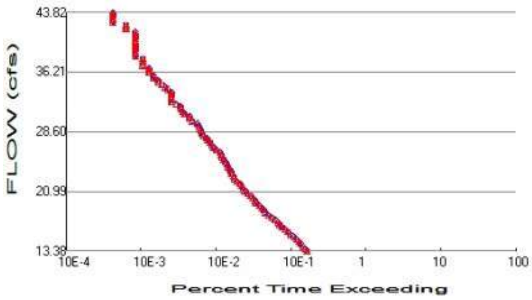
Return Period	**Flow(cfs)**
2 year	48.798141
5 year	61.434837
10 year	69.293499
25 year	78.784604
50 year	85.596222
100 year	92.224904

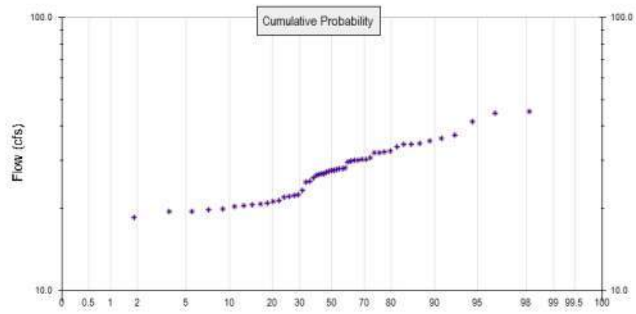
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #12

Year	**Predeveloped**	**Mitigated**
1956	67.437	67.437
1957	61.574	61.574
1958	43.280	43.280
1959	62.011	62.011
1960	61.456	61.456
1961	38.495	38.495
1962	66.651	66.651
1963	52.611	52.611
1964	59.719	59.719
1965	62.843	62.843
1966	59.538	59.538

POC 13 (K St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #13
Total Pervious Area: 9.105776
Total Impervious Area: 50.800658

Mitigated Landuse Totals for POC #13
Total Pervious Area: 9.105776
Total Impervious Area: 50.800658

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #13

Return Period	**Flow(cfs)**
2 year	26.764853
5 year	32.626969
10 year	36.265631
25 year	40.662114
50 year	43.822141
100 year	46.903091

Flow Frequency Return Periods for Mitigated. POC #13

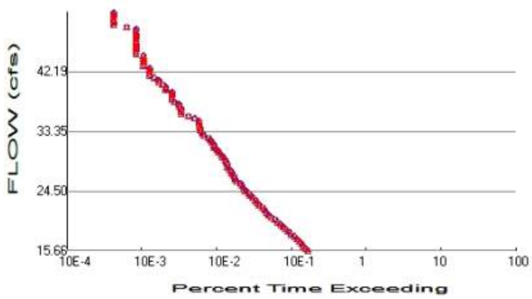
Return Period	**Flow(cfs)**
2 year	26.764853
5 year	32.626969
10 year	36.265631
25 year	40.662114
50 year	43.822141
100 year	46.903091

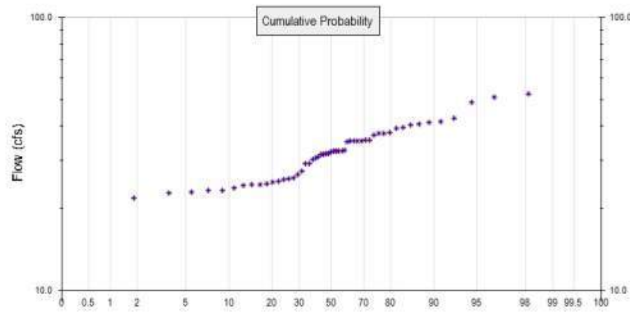
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #13

Year	**Predeveloped**	**Mitigated**
1956	35.965	35.965
1957	33.712	33.712
1958	26.742	26.742
1959	32.439	32.439
1960	32.015	32.015
1961	23.292	23.292
1962	34.254	34.254
1963	28.055	28.055
1964	34.313	34.313
1965	31.916	31.916
1966	29.915	29.915

POC 14 (H St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #14
Total Pervious Area: 8.781132
Total Impervious Area: 59.28963

Mitigated Landuse Totals for POC #14
Total Pervious Area: 8.781132
Total Impervious Area: 59.28963

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #14

Return Period	**Flow(cfs)**
2 year	31.323065
5 year	38.107652
10 year	42.312578
25 year	47.387637
50 year	51.031956
100 year	54.582535

Flow Frequency Return Periods for Mitigated. POC #14

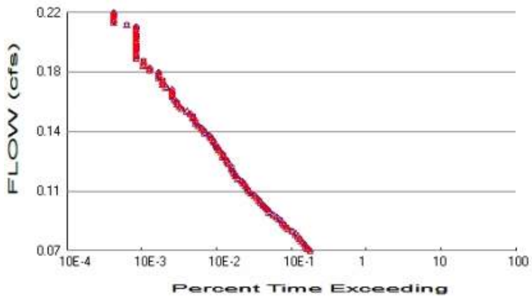
Return Period	**Flow(cfs)**
2 year	31.323065
5 year	38.107652
10 year	42.312578
25 year	47.387637
50 year	51.031956
100 year	54.582535

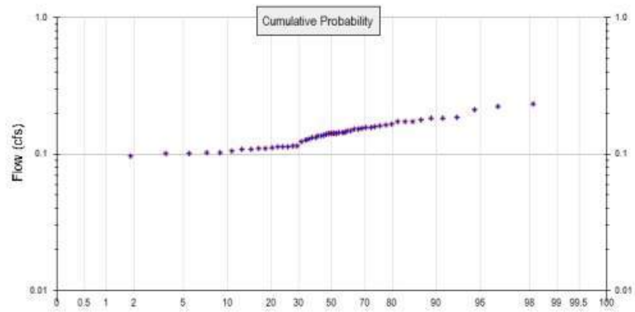
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #14

Year	**Predeveloped**	**Mitigated**
1956	41.604	41.604
1957	39.379	39.379
1958	31.633	31.633
1959	37.860	37.860
1960	36.982	36.982
1961	27.254	27.254
1962	39.422	39.422
1963	32.501	32.501
1964	40.287	40.287
1965	37.690	37.690
1966	35.319	35.319

POC 15 (River St)





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #15
Total Pervious Area: 0.017314
Total Impervious Area: 0.271256

Mitigated Landuse Totals for POC #15
Total Pervious Area: 0.017314
Total Impervious Area: 0.271256

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #15

Return Period	**Flow(cfs)**
2 year	0.137275
5 year	0.165878
10 year	0.183514
25 year	0.204719
50 year	0.219897
100 year	0.234649

Flow Frequency Return Periods for Mitigated. POC #15

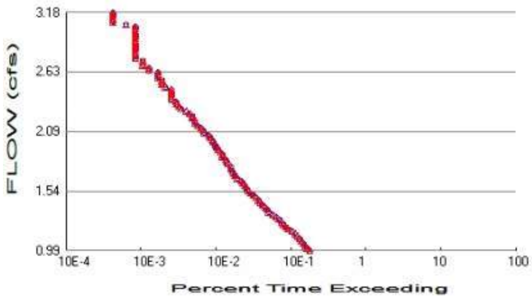
Return Period	**Flow(cfs)**
2 year	0.137275
5 year	0.165878
10 year	0.183514
25 year	0.204719
50 year	0.219897
100 year	0.234649

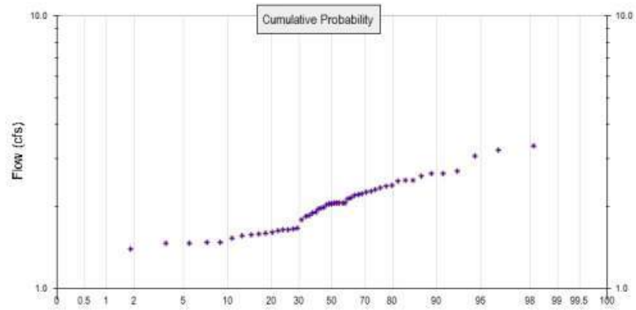
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #15

Year	**Predeveloped**	**Mitigated**
1956	0.183	0.183
1957	0.173	0.173
1958	0.142	0.142
1959	0.164	0.164
1960	0.162	0.162
1961	0.123	0.123
1962	0.172	0.172
1963	0.143	0.143
1964	0.178	0.178
1965	0.159	0.159
1966	0.148	0.148

POC 16 (State St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #16
Total Pervious Area: 0.250493
Total Impervious Area: 3.92439

Mitigated Landuse Totals for POC #16
Total Pervious Area: 0.250493
Total Impervious Area: 3.92439

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #16

Return Period	**Flow(cfs)**
2 year	1.986027
5 year	2.399832
10 year	2.654984
25 year	2.961773
50 year	3.181363
100 year	3.394782

Flow Frequency Return Periods for Mitigated. POC #16

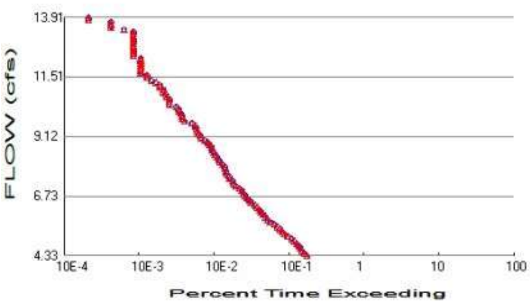
Return Period	**Flow(cfs)**
2 year	1.986027
5 year	2.399832
10 year	2.654984
25 year	2.961773
50 year	3.181363
100 year	3.394782

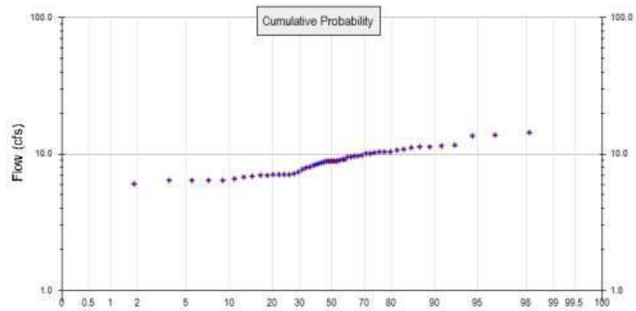
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #16

Year	**Predeveloped**	**Mitigated**
1956	2.648	2.648
1957	2.499	2.499
1958	2.052	2.052
1959	2.368	2.368
1960	2.338	2.338
1961	1.781	1.781
1962	2.492	2.492
1963	2.065	2.065
1964	2.581	2.581
1965	2.300	2.300
1966	2.148	2.148

POC 17 (Zelasko Park)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #17
Total Pervious Area: 1.067105
Total Impervious Area: 16.71806

Mitigated Landuse Totals for POC #17
Total Pervious Area: 1.067105
Total Impervious Area: 16.71806

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #17

Return Period	**Flow(cfs)**
2 year	8.663821
5 year	10.478321
10 year	11.597897
25 year	12.944713
50 year	13.909132
100 year	14.846746

Flow Frequency Return Periods for Mitigated. POC #17

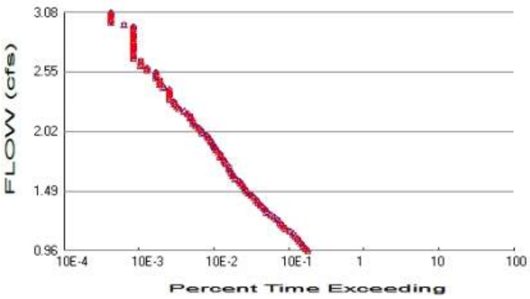
Return Period	**Flow(cfs)**
2 year	8.663821
5 year	10.478321
10 year	11.597897
25 year	12.944713
50 year	13.909132
100 year	14.846746

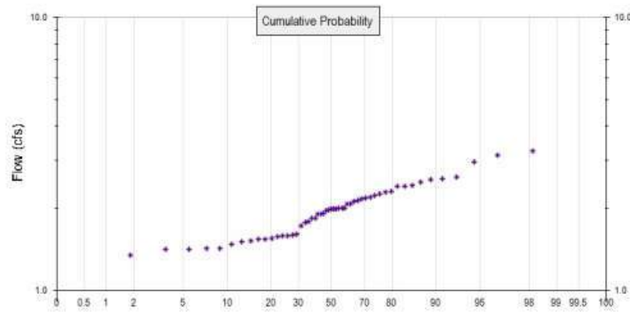
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #17

Year	**Predeveloped**	**Mitigated**
1956	11.346	11.346
1957	10.857	10.857
1958	9.002	9.002
1959	10.347	10.347
1960	10.033	10.033
1961	7.654	7.654
1962	10.642	10.642
1963	8.873	8.873
1964	11.248	11.248
1965	10.349	10.349
1966	9.674	9.674

POC 18 (Wishkah St)





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #18
Total Pervious Area: 0.242165
Total Impervious Area: 3.79392

Mitigated Landuse Totals for POC #18
Total Pervious Area: 0.242165
Total Impervious Area: 3.79392

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #18

Return Period	**Flow(cfs)**
2 year	1.92
5 year	2.320047
10 year	2.566716
25 year	2.863304
50 year	3.075594
100 year	3.281917

Flow Frequency Return Periods for Mitigated. POC #18

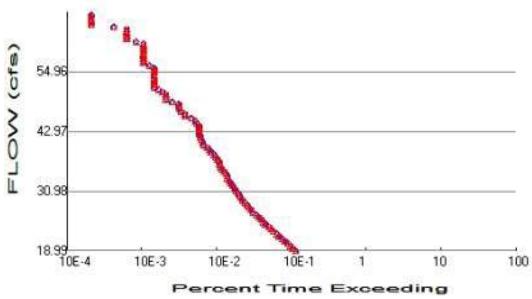
Return Period	**Flow(cfs)**
2 year	1.92
5 year	2.320047
10 year	2.566716
25 year	2.863304
50 year	3.075594
100 year	3.281917

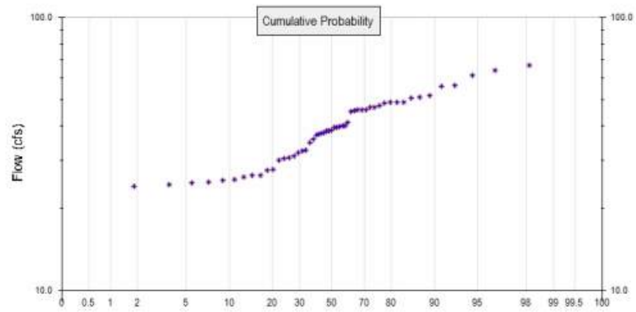
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #18

Year	**Predeveloped**	**Mitigated**
1956	2.560	2.560
1957	2.416	2.416
1958	1.984	1.984
1959	2.290	2.290
1960	2.261	2.261
1961	1.722	1.722
1962	2.409	2.409
1963	1.996	1.996
1964	2.495	2.495
1965	2.224	2.224
1966	2.076	2.076

POC 19 (E St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #19
Total Pervious Area: 43.416312
Total Impervious Area: 58.02369

Mitigated Landuse Totals for POC #19
Total Pervious Area: 43.416312
Total Impervious Area: 58.02369

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #19

Return Period	Flow(cfs)
2 year	37.980718
5 year	48.143638
10 year	54.351057
25 year	61.731268
50 year	66.950411
100 year	71.968576

Flow Frequency Return Periods for Mitigated. POC #19

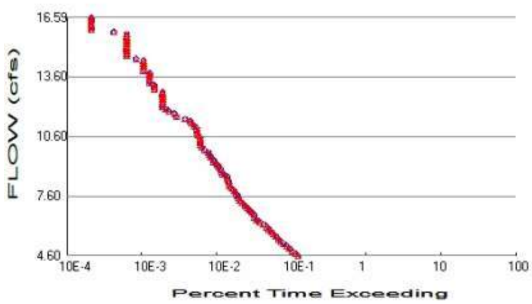
Return Period	Flow(cfs)
2 year	37.980718
5 year	48.143638
10 year	54.351057
25 year	61.731268
50 year	66.950411
100 year	71.968576

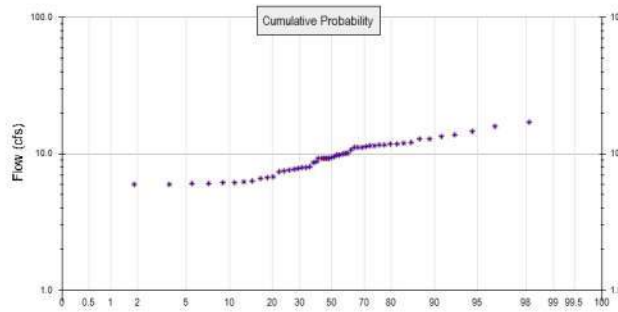
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #19

Year	Predeveloped	Mitigated
1956	51.141	51.141
1957	47.570	47.570
1958	32.753	32.753
1959	48.773	48.773
1960	46.928	46.928
1961	30.633	30.633
1962	50.652	50.652
1963	40.074	40.074
1964	45.802	45.802
1965	51.618	51.618
1966	49.080	49.080

POC 20 (D St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #20
Total Pervious Area: 11.235071
Total Impervious Area: 14.73601

Mitigated Landuse Totals for POC #20
Total Pervious Area: 11.235071
Total Impervious Area: 14.73601

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #20

Return Period	**Flow(cfs)**
2 year	9.209119
5 year	11.722042
10 year	13.297696
25 year	15.211999
50 year	16.592755
100 year	17.941483

Flow Frequency Return Periods for Mitigated. POC #20

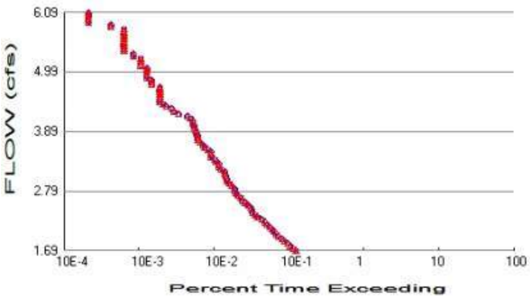
Return Period	**Flow(cfs)**
2 year	9.209119
5 year	11.722042
10 year	13.297696
25 year	15.211999
50 year	16.592755
100 year	17.941483

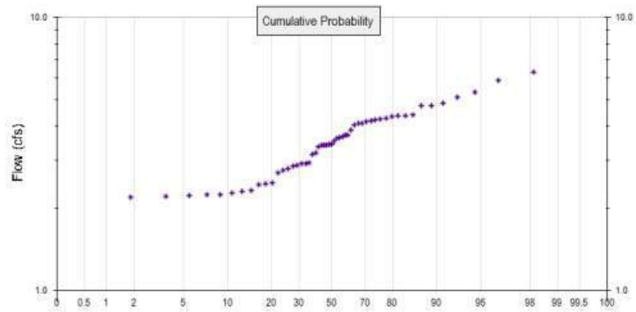
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #20

Year	**Predeveloped**	**Mitigated**
1956	12.867	12.867
1957	11.642	11.642
1958	7.889	7.889
1959	11.862	11.862
1960	11.797	11.797
1961	7.339	7.339
1962	12.847	12.847
1963	10.035	10.035
1964	11.134	11.134
1965	12.078	12.078
1966	11.471	11.471

POC 21 (B St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #21
Total Pervious Area: 4.099363
Total Impervious Area: 5.47859

Mitigated Landuse Totals for POC #21
Total Pervious Area: 4.099363
Total Impervious Area: 5.47859

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #21

Return Period	**Flow(cfs)**
2 year	3.387255
5 year	4.307452
10 year	4.884026
25 year	5.58416
50 year	6.088937
100 year	6.581846

Flow Frequency Return Periods for Mitigated. POC #21

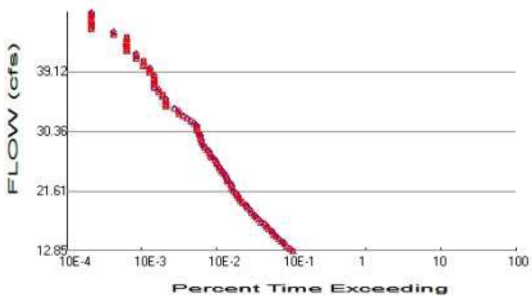
Return Period	**Flow(cfs)**
2 year	3.387255
5 year	4.307452
10 year	4.884026
25 year	5.58416
50 year	6.088937
100 year	6.581846

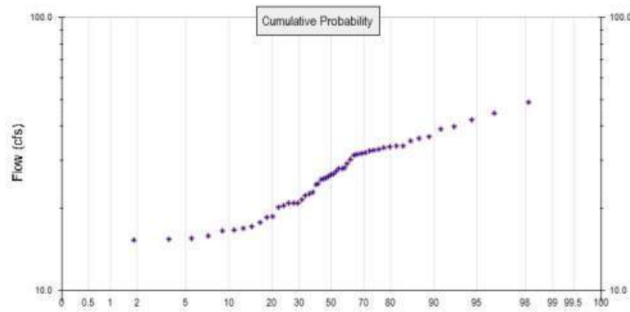
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #21

Year	**Predeveloped**	**Mitigated**
1956	4.751	4.751
1957	4.284	4.284
1958	2.909	2.909
1959	4.354	4.354
1960	4.353	4.353
1961	2.688	2.688
1962	4.745	4.745
1963	3.703	3.703
1964	4.099	4.099
1965	4.403	4.403
1966	4.180	4.180

POC 22 (Arthur St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #22
Total Pervious Area: 40.395
Total Impervious Area: 37.288

Mitigated Landuse Totals for POC #22
Total Pervious Area: 40.395
Total Impervious Area: 37.288

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #22

Return Period	Flow(cfs)
2 year	25.706274
5 year	33.342425
10 year	38.086577
25 year	43.795509
50 year	47.873426
100 year	51.823536

Flow Frequency Return Periods for Mitigated. POC #22

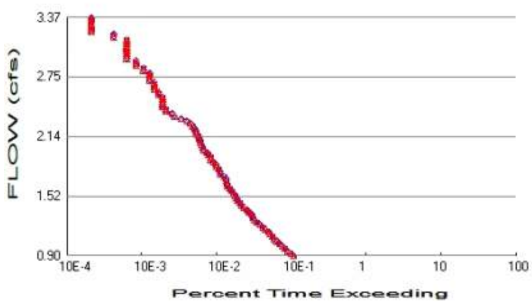
Return Period	Flow(cfs)
2 year	25.706274
5 year	33.342425
10 year	38.086577
25 year	43.795509
50 year	47.873426
100 year	51.823536

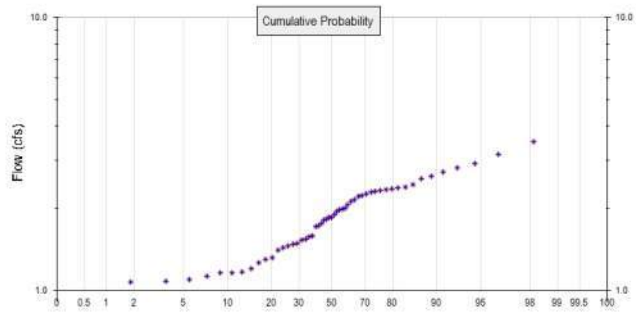
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #22

Year	Predeveloped	Mitigated
1956	36.075	36.075
1957	32.386	32.386
1958	20.431	20.431
1959	33.831	33.831
1960	33.474	33.474
1961	20.912	20.912
1962	36.624	36.624
1963	28.165	28.165
1964	30.175	30.175
1965	35.232	35.232
1966	33.636	33.636

POC 23 (Stanton St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #23
Total Pervious Area: 2.898
Total Impervious Area: 2.67483

Mitigated Landuse Totals for POC #23
Total Pervious Area: 2.89774
Total Impervious Area: 2.67483

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #23

Return Period	Flow(cfs)
2 year	1.807986
5 year	2.346389
10 year	2.681026
25 year	3.083835
50 year	3.371635
100 year	3.650466

Flow Frequency Return Periods for Mitigated. POC #23

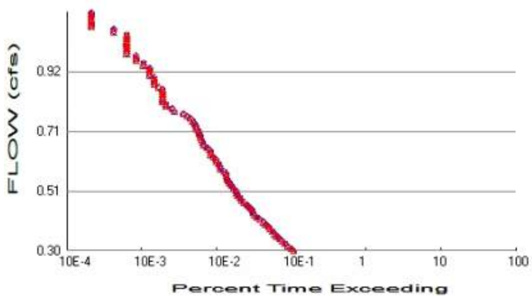
Return Period	Flow(cfs)
2 year	1.807944
5 year	2.346318
10 year	2.680936
25 year	3.083721
50 year	3.371503
100 year	3.650316

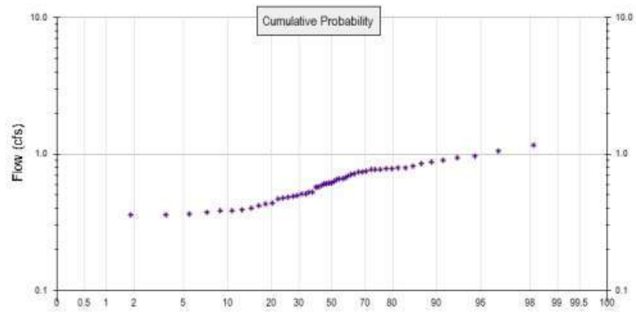
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #23

Year	Predeveloped	Mitigated
1956	2.572	2.572
1957	2.298	2.298
1958	1.431	1.431
1959	2.377	2.377
1960	2.385	2.385
1961	1.459	1.459
1962	2.619	2.619
1963	2.004	2.004
1964	2.120	2.120
1965	2.435	2.435
1966	2.323	2.323

POC 24 (Chicago St)





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #24
Total Pervious Area: 0.964
Total Impervious Area: 0.889

Mitigated Landuse Totals for POC #24
Total Pervious Area: 0.964
Total Impervious Area: 0.889

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #24

Return Period	**Flow(cfs)**
2 year	0.601034
5 year	0.780066
10 year	0.891347
25 year	1.025302
50 year	1.121013
100 year	1.213743

Flow Frequency Return Periods for Mitigated. POC #24

Return Period	**Flow(cfs)**
2 year	0.601034
5 year	0.780066
10 year	0.891347
25 year	1.025302
50 year	1.121013
100 year	1.213743

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #24

Year	**Predeveloped**	**Mitigated**
1956	0.855	0.855
1957	0.764	0.764
1958	0.475	0.475
1959	0.790	0.790
1960	0.793	0.793
1961	0.485	0.485
1962	0.871	0.871
1963	0.666	0.666
1964	0.705	0.705
1965	0.809	0.809
1966	0.772	0.772

Model Default Modifications

Total of 0 changes have been made.

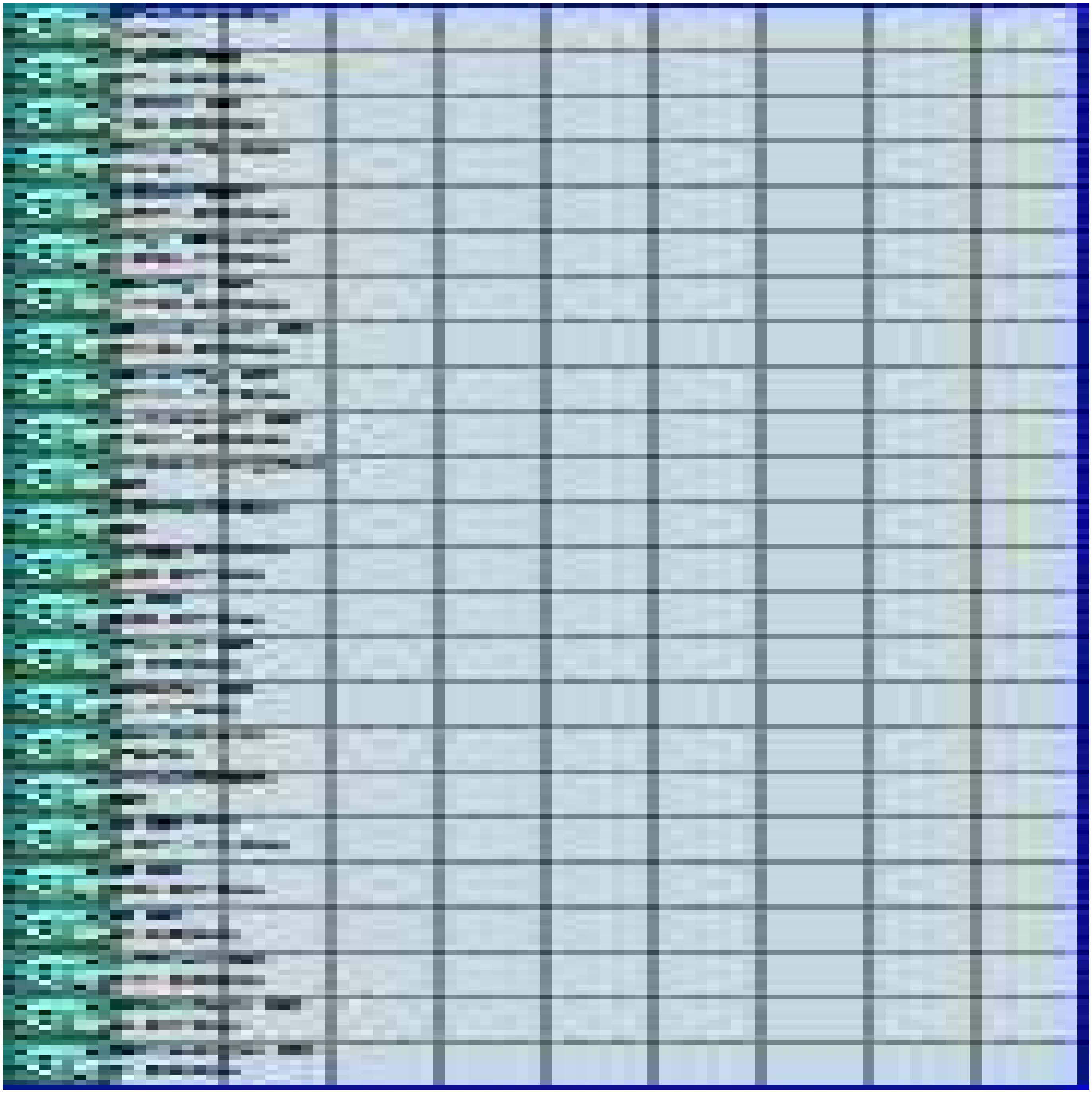
PERLND Changes

No PERLND changes have been made.

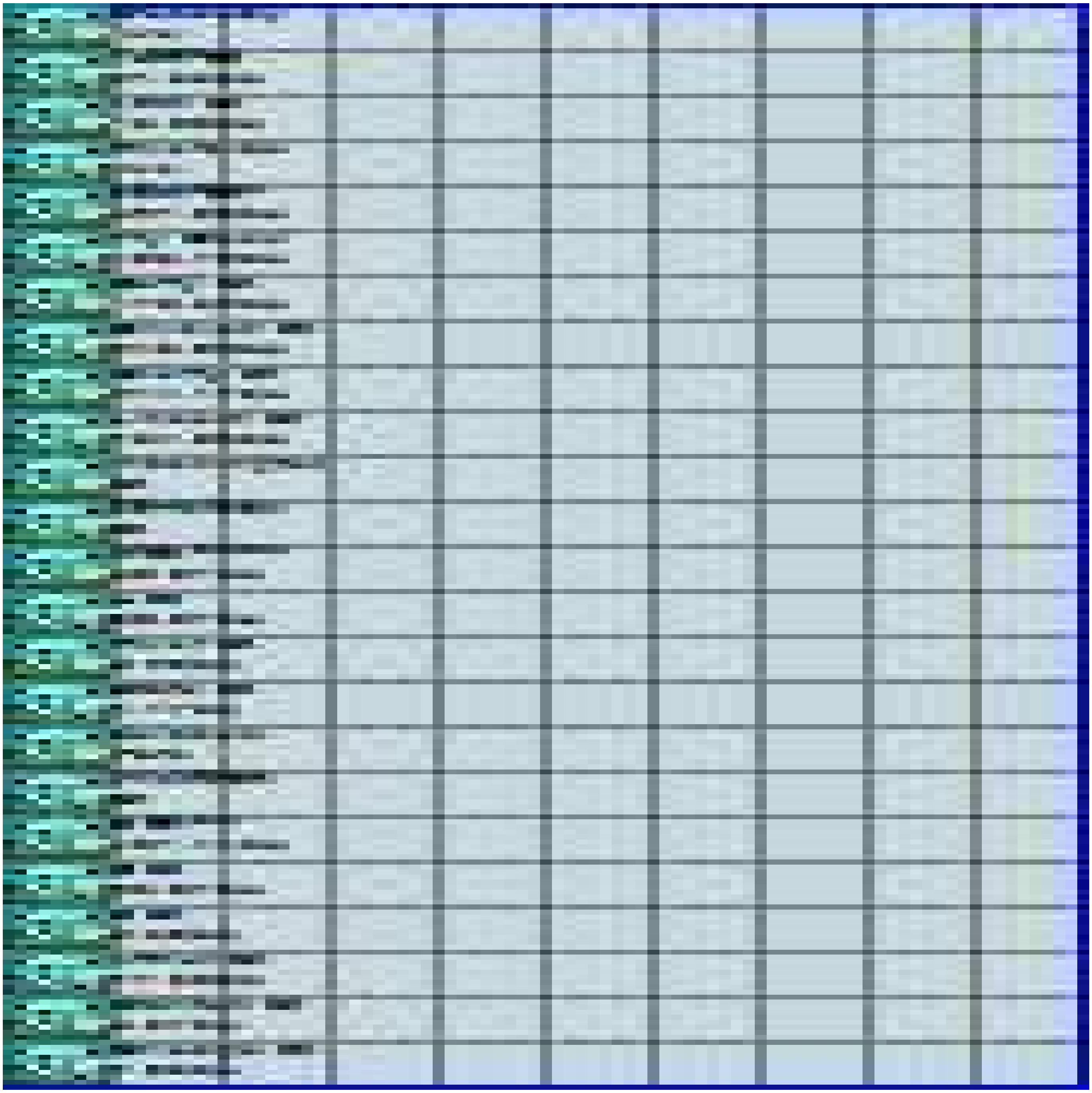
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

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  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

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MESSU      25   PreNorth Shore Levee.MES
           27   PreNorth Shore Levee.L61
           28   PreNorth Shore Levee.L62
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           31   POCNorth Shore Levee2.dat
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    3        19th St.                     MAX                   1    2   32    9
    4        Riverside Ave.               MAX                   1    2   33    9
    5        28th St.                     MAX                   1    2   34    9
    6        Fry Creek                    MAX                   1    2   35    9
    7        Duffy St.                    MAX                   1    2   36    9
    8        Division St.                 MAX                   1    2   37    9
    9        Cherry St.                   MAX                   1    2   38    9
   10        Lincoln St.                  MAX                   1    2   39    9
   11        Washington St.               MAX                   1    2   40    9
   12        Jefferson St.                MAX                   1    2   41    9
   13        K St.                        MAX                   1    2   42    9
   14        H St.                        MAX                   1    2   43    9
   15        River St.                    MAX                   1    2   44    9
   16        State St.                    MAX                   1    2   45    9
   17        Zelasko Park                 MAX                   1    2   46    9
   18        Wishkah St.                  MAX                   1    2   47    9
   19        E St                         MAX                   1    2   48    9
   20        D St.                        MAX                   1    2   49    9
   21        B St.                        MAX                   1    2   50    9
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   23        Stanton St.                  MAX                   1    2   52    9
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    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
    7     A/B, Lawn, Flat        1    1    1    1   27    0
    3     A/B, Forest, Steep     1    1    1    1   27    0
    8     A/B, Lawn, Mod         1    1    1    1   27    0
   12     C, Forest, Steep       1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7         0    0    1    0    0    0    0    0    0    0    0    0
    3         0    0    1    0    0    0    0    0    0    0    0    0
    8         0    0    1    0    0    0    0    0    0    0    0    0
   12         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    3         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    8         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   12         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    7         0    0    0    0    0    0    0    0    0    0    0
    3         0    0    0    0    0    0    0    0    0    0    0
    8         0    0    0    0    0    0    0    0    0    0    0
   12         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
```

```
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    7            0         5       0.8       400      0.05       0.3     0.996
    3            0         5         2       400      0.15       0.3     0.996
    8            0         5       0.8       400       0.1       0.3     0.996
   12            0       4.5      0.08       400      0.15       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    7            0         0         2         2         0         0         0
    3            0         0         2         2         0         0         0
    8            0         0         2         2         0         0         0
   12            0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                   ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7            0.1       0.5      0.25         0       0.7      0.25
    3            0.2       0.5      0.35         0       0.7       0.7
    8            0.1       0.5      0.25         0       0.7      0.25
   12            0.2       0.3      0.35         6       0.3       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    7            0         0         0         0         3         1         0
    3            0         0         0         0         3         1         0
    8            0         0         0         0         3         1         0
   12            0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name-------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out            ***
   11      PARKING/FLAT           1    1    1   27    0
   12      PARKING/MOD            1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   11         0    0    1    0    0    0
   12         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   11         0    0    4    0    0    0    1    9
   12         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
   11         0    0    0    0    0
   12         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
```

```
   11             400      0.01       0.1       0.1
   12             400      0.05       0.1      0.08
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   11              0         0
   12              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   11              0         0
   12              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Broadway Ave.***
PERLND   7                       0.825     COPY   501     12
PERLND   7                       0.825     COPY   501     13
IMPLND  11                      0.7615     COPY   501     15
15th St.***
PERLND   3                       2.942     COPY   502     12
PERLND   3                       2.942     COPY   502     13
PERLND   7                      9.5724     COPY   502     12
PERLND   7                      9.5724     COPY   502     13
IMPLND  11                     8.83605     COPY   502     15
19th St.***
PERLND   3                     3.80503     COPY   503     12
PERLND   3                     3.80503     COPY   503     13
PERLND   7                     5.82103     COPY   503     12
PERLND   7                     5.82103     COPY   503     13
IMPLND  11                      5.3733     COPY   503     15
Riverside Ave.***
PERLND   3                     2.34824     COPY   504     12
PERLND   3                     2.34824     COPY   504     13
PERLND   7                     4.73886     COPY   504     12
PERLND   7                     4.73886     COPY   504     13
IMPLND  11                     5.39492     COPY   504     15
28th St.***
PERLND   3                      30.783     COPY   505     12
PERLND   3                      30.783     COPY   505     13
PERLND   8                      2.6176     COPY   505     12
PERLND   8                      2.6176     COPY   505     13
PERLND   7                    112.8542     COPY   505     12
PERLND   7                    112.8542     COPY   505     13
IMPLND  11                    175.6279     COPY   505     15
Fry Creek ***
PERLND   7                       45.03     COPY   506     12
PERLND   7                       45.03     COPY   506     13
PERLND   8                        11.5     COPY   506     12
PERLND   8                        11.5     COPY   506     13
PERLND   3                       14.25     COPY   506     12
PERLND   3                       14.25     COPY   506     13
IMPLND  11                       83.98     COPY   506     15
IMPLND  12                       28.94     COPY   506     15
Duffy St.***
PERLND   3                      66.142     COPY   507     12
PERLND   3                      66.142     COPY   507     13
PERLND   8                      14.157     COPY   507     12
PERLND   8                      14.157     COPY   507     13
PERLND   7                       42.47     COPY   507     12
PERLND   7                       42.47     COPY   507     13
PERLND  12                       3.481     COPY   507     12
```

PERLND 12	3.481	COPY	507	13
IMPLND 11	39.203	COPY	507	15
IMPLND 12	13.068	COPY	507	15
Division St.***				
PERLND 3	4.9216	COPY	508	12
PERLND 3	4.9216	COPY	508	13
PERLND 8	11.6702	COPY	508	12
PERLND 8	11.6702	COPY	508	13
PERLND 7	88.8296	COPY	508	12
PERLND 7	88.8296	COPY	508	13
IMPLND 11	129.8878	COPY	508	15
IMPLND 12	10.7725	COPY	508	15
Cherry St.***				
PERLND 3	126.36	COPY	509	12
PERLND 3	126.36	COPY	509	13
PERLND 8	26.027	COPY	509	12
PERLND 8	26.027	COPY	509	13
PERLND 7	19.634	COPY	509	12
PERLND 7	19.634	COPY	509	13
IMPLND 11	18.124	COPY	509	15
IMPLND 12	24.024	COPY	509	15
Lincoln St.***				
PERLND 7	76.7764	COPY	510	12
PERLND 7	76.7764	COPY	510	13
IMPLND 11	77.2755	COPY	510	15
Washington St.***				
PERLND 7	10.71699	COPY	511	12
PERLND 7	10.71699	COPY	511	13
IMPLND 11	18.38945	COPY	511	15
Jefferson St. ***				
PERLND 8	8.82121	COPY	512	12
PERLND 8	8.82121	COPY	512	13
PERLND 7	41.2188996	COPY	512	12
PERLND 7	41.2188996	COPY	512	13
IMPLND 11	72.81228	COPY	512	15
IMPLND 12	8.14265	COPY	512	15
K St.***				
PERLND 8	1.49047	COPY	513	12
PERLND 8	1.49047	COPY	513	13
PERLND 7	7.615306	COPY	513	12
PERLND 7	7.615306	COPY	513	13
IMPLND 11	48.576928	COPY	513	15
IMPLND 12	2.22373	COPY	513	15
H St.***				
PERLND 8	5.726112	COPY	514	12
PERLND 8	5.726112	COPY	514	13
PERLND 7	3.05502	COPY	514	12
PERLND 7	3.05502	COPY	514	13
IMPLND 11	47.86191	COPY	514	15
IMPLND 12	11.42772	COPY	514	15
River St.***				
PERLND 7	0.017314	COPY	515	12
PERLND 7	0.017314	COPY	515	13
IMPLND 11	0.271256	COPY	515	15
State St.***				
PERLND 7	0.250493	COPY	516	12
PERLND 7	0.250493	COPY	516	13
IMPLND 11	3.92439	COPY	516	15
Zelasko Park***				
PERLND 8	0.341475	COPY	517	12
PERLND 8	0.341475	COPY	517	13
PERLND 7	0.72563	COPY	517	12
PERLND 7	0.72563	COPY	517	13
IMPLND 11	11.36828	COPY	517	15
IMPLND 12	5.34978	COPY	517	15
Wishkah St. ***				
PERLND 7	0.242165	COPY	518	12
PERLND 7	0.242165	COPY	518	13
IMPLND 11	3.79392	COPY	518	15
E St***				

```
PERLND   8                    34.173112     COPY   519      12
PERLND   8                    34.173112     COPY   519      13
PERLND   7                       9.2432     COPY   519      12
PERLND   7                       9.2432     COPY   519      13
IMPLND  11                     20.37727     COPY   519      15
IMPLND  12                     37.64642     COPY   519      15
D St. ***
PERLND   8                     1.312681     COPY   520      12
PERLND   8                     1.312681     COPY   520      13
PERLND   7                      9.92239     COPY   520      12
PERLND   7                      9.92239     COPY   520      13
IMPLND  11                      13.5243     COPY   520      15
IMPLND  12                      1.21171     COPY   520      15
B St.***
PERLND   7                     4.099363     COPY   521      12
PERLND   7                     4.099363     COPY   521      13
IMPLND  11                      5.47859     COPY   521      15
Chicago St. ***
PERLND   7                        0.964     COPY   524      12
PERLND   7                        0.964     COPY   524      13
IMPLND  11                        0.889     COPY   524      15
Stanton St.***
PERLND   7                        2.898     COPY   523      12
PERLND   7                        2.898     COPY   523      13
IMPLND  11                      2.67483     COPY   523      15
Arthur St.***
PERLND   8                       10.099     COPY   522      12
PERLND   8                       10.099     COPY   522      13
PERLND   7                       30.296     COPY   522      12
PERLND   7                       30.296     COPY   522      13
IMPLND  11                       27.966     COPY   522      15
IMPLND  12                        9.322     COPY   522      15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1
COPY   502 OUTPUT MEAN   1 1   12.1        DISPLY   2     INPUT  TIMSER 1
COPY   503 OUTPUT MEAN   1 1   12.1        DISPLY   3     INPUT  TIMSER 1
COPY   504 OUTPUT MEAN   1 1   12.1        DISPLY   4     INPUT  TIMSER 1
COPY   505 OUTPUT MEAN   1 1   12.1        DISPLY   5     INPUT  TIMSER 1
COPY   506 OUTPUT MEAN   1 1   12.1        DISPLY   6     INPUT  TIMSER 1
COPY   507 OUTPUT MEAN   1 1   12.1        DISPLY   7     INPUT  TIMSER 1
COPY   508 OUTPUT MEAN   1 1   12.1        DISPLY   8     INPUT  TIMSER 1
COPY   509 OUTPUT MEAN   1 1   12.1        DISPLY   9     INPUT  TIMSER 1
COPY   510 OUTPUT MEAN   1 1   12.1        DISPLY  10     INPUT  TIMSER 1
COPY   511 OUTPUT MEAN   1 1   12.1        DISPLY  11     INPUT  TIMSER 1
COPY   512 OUTPUT MEAN   1 1   12.1        DISPLY  12     INPUT  TIMSER 1
COPY   513 OUTPUT MEAN   1 1   12.1        DISPLY  13     INPUT  TIMSER 1
COPY   514 OUTPUT MEAN   1 1   12.1        DISPLY  14     INPUT  TIMSER 1
COPY   515 OUTPUT MEAN   1 1   12.1        DISPLY  15     INPUT  TIMSER 1
COPY   516 OUTPUT MEAN   1 1   12.1        DISPLY  16     INPUT  TIMSER 1
COPY   517 OUTPUT MEAN   1 1   12.1        DISPLY  17     INPUT  TIMSER 1
COPY   518 OUTPUT MEAN   1 1   12.1        DISPLY  18     INPUT  TIMSER 1
COPY   519 OUTPUT MEAN   1 1   12.1        DISPLY  19     INPUT  TIMSER 1
COPY   520 OUTPUT MEAN   1 1   12.1        DISPLY  20     INPUT  TIMSER 1
COPY   521 OUTPUT MEAN   1 1   12.1        DISPLY  21     INPUT  TIMSER 1
COPY   524 OUTPUT MEAN   1 1   12.1        DISPLY  24     INPUT  TIMSER 1
COPY   523 OUTPUT MEAN   1 1   12.1        DISPLY  23     INPUT  TIMSER 1
COPY   522 OUTPUT MEAN   1 1   12.1        DISPLY  22     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK
```

```
RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                          in  out                           ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                     ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                        ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC      ENGL    1.1       SUM  PERLND   1 999 EXTNL  PREC
WDM      2 PREC      ENGL    1.1       SUM  IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP      ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP      ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     12.1       WDM    501 FLOW     ENGL       REPL
COPY   502 OUTPUT MEAN   1 1     12.1       WDM    502 FLOW     ENGL       REPL
COPY   503 OUTPUT MEAN   1 1     12.1       WDM    503 FLOW     ENGL       REPL
COPY   504 OUTPUT MEAN   1 1     12.1       WDM    504 FLOW     ENGL       REPL
COPY   505 OUTPUT MEAN   1 1     12.1       WDM    505 FLOW     ENGL       REPL
COPY   506 OUTPUT MEAN   1 1     12.1       WDM    506 FLOW     ENGL       REPL
COPY   507 OUTPUT MEAN   1 1     12.1       WDM    507 FLOW     ENGL       REPL
COPY   508 OUTPUT MEAN   1 1     12.1       WDM    508 FLOW     ENGL       REPL
COPY   509 OUTPUT MEAN   1 1     12.1       WDM    509 FLOW     ENGL       REPL
COPY   510 OUTPUT MEAN   1 1     12.1       WDM    510 FLOW     ENGL       REPL
COPY   511 OUTPUT MEAN   1 1     12.1       WDM    511 FLOW     ENGL       REPL
COPY   512 OUTPUT MEAN   1 1     12.1       WDM    512 FLOW     ENGL       REPL
COPY   513 OUTPUT MEAN   1 1     12.1       WDM    513 FLOW     ENGL       REPL
COPY   514 OUTPUT MEAN   1 1     12.1       WDM    514 FLOW     ENGL       REPL
COPY   515 OUTPUT MEAN   1 1     12.1       WDM    515 FLOW     ENGL       REPL
```

```
COPY    516 OUTPUT MEAN   1 1      12.1       WDM    516 FLOW      ENGL       REPL
COPY    517 OUTPUT MEAN   1 1      12.1       WDM    517 FLOW      ENGL       REPL
COPY    518 OUTPUT MEAN   1 1      12.1       WDM    518 FLOW      ENGL       REPL
COPY    519 OUTPUT MEAN   1 1      12.1       WDM    519 FLOW      ENGL       REPL
COPY    520 OUTPUT MEAN   1 1      12.1       WDM    520 FLOW      ENGL       REPL
COPY    521 OUTPUT MEAN   1 1      12.1       WDM    521 FLOW      ENGL       REPL
COPY    524 OUTPUT MEAN   1 1      12.1       WDM    524 FLOW      ENGL       REPL
COPY    523 OUTPUT MEAN   1 1      12.1       WDM    523 FLOW      ENGL       REPL
COPY    522 OUTPUT MEAN   1 1      12.1       WDM    522 FLOW      ENGL       REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   North Shore Levee.wdm
MESSU      25   MitNorth Shore Levee.MES
           27   MitNorth Shore Levee.L61
           28   MitNorth Shore Levee.L62
           30   POCNorth Shore Levee1.dat
           31   POCNorth Shore Levee2.dat
           32   POCNorth Shore Levee3.dat
           33   POCNorth Shore Levee4.dat
           34   POCNorth Shore Levee5.dat
           35   POCNorth Shore Levee6.dat
           36   POCNorth Shore Levee7.dat
           37   POCNorth Shore Levee8.dat
           38   POCNorth Shore Levee9.dat
           39   POCNorth Shore Levee10.dat
           40   POCNorth Shore Levee11.dat
           41   POCNorth Shore Levee12.dat
           42   POCNorth Shore Levee13.dat
           43   POCNorth Shore Levee14.dat
           44   POCNorth Shore Levee15.dat
           45   POCNorth Shore Levee16.dat
           46   POCNorth Shore Levee17.dat
           47   POCNorth Shore Levee18.dat
           48   POCNorth Shore Levee19.dat
           49   POCNorth Shore Levee20.dat
           50   POCNorth Shore Levee21.dat
           53   POCNorth Shore Levee24.dat
           52   POCNorth Shore Levee23.dat
           51   POCNorth Shore Levee22.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND       7
      IMPLND      11
      PERLND       3
      PERLND       8
      IMPLND      12
      PERLND      12
      COPY       501
      COPY       502
      COPY       503
      COPY       504
      COPY       505
      COPY       506
      COPY       507
      COPY       508
      COPY       509
      COPY       510
      COPY       511
      COPY       512
      COPY       513
      COPY       514
      COPY       515
      COPY       516
      COPY       517
      COPY       518
```

```
      COPY       519
      COPY       520
      COPY       521
      COPY       524
      COPY       523
      COPY       522
      DISPLY       1
      DISPLY       2
      DISPLY       3
      DISPLY       4
      DISPLY       5
      DISPLY       6
      DISPLY       7
      DISPLY       8
      DISPLY       9
      DISPLY      10
      DISPLY      11
      DISPLY      12
      DISPLY      13
      DISPLY      14
      DISPLY      15
      DISPLY      16
      DISPLY      17
      DISPLY      18
      DISPLY      19
      DISPLY      20
      DISPLY      21
      DISPLY      24
      DISPLY      23
      DISPLY      22
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Broadway Ave.               MAX                        1    2   30    9
    2        15th St.                    MAX                        1    2   31    9
    3        19th St.                    MAX                        1    2   32    9
    4        Riverside Ave.              MAX                        1    2   33    9
    5        28th St.                    MAX                        1    2   34    9
    6        Fry Creek                   MAX                        1    2   35    9
    7        Duffy St.                   MAX                        1    2   36    9
    8        Division St.                MAX                        1    2   37    9
    9        Cherry St.                  MAX                        1    2   38    9
   10        Lincoln St.                 MAX                        1    2   39    9
   11        Washington St.              MAX                        1    2   40    9
   12        Jefferson St.               MAX                        1    2   41    9
   13        K St.                       MAX                        1    2   42    9
   14        H St.                       MAX                        1    2   43    9
   15        River St.                   MAX                        1    2   44    9
   16        State St.                   MAX                        1    2   45    9
   17        Zelasko Park                MAX                        1    2   46    9
   18        Wishkah St.                 MAX                        1    2   47    9
   19        E St.                       MAX                        1    2   48    9
   20        D St.                       MAX                        1    2   49    9
   21        B St.                       MAX                        1    2   50    9
   24        Chicago St.                 MAX                        1    2   53    9
   23        Stanton St.                 MAX                        1    2   52    9
   22        Arthur St.                  MAX                        1    2   51    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  502         1    1
  503         1    1
  504         1    1
  505         1    1
```

```
  506         1    1
  507         1    1
  508         1    1
  509         1    1
  510         1    1
  511         1    1
  512         1    1
  513         1    1
  514         1    1
  515         1    1
  516         1    1
  517         1    1
  518         1    1
  519         1    1
  520         1    1
  521         1    1
  524         1    1
  523         1    1
  522         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
    7     A/B, Lawn, Flat         1    1    1    1   27    0
    3     A/B, Forest, Steep      1    1    1    1   27    0
    8     A/B, Lawn, Mod          1    1    1    1   27    0
   12     C, Forest, Steep        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7         0    0    1    0    0    0    0    0    0    0    0    0
    3         0    0    1    0    0    0    0    0    0    0    0    0
    8         0    0    1    0    0    0    0    0    0    0    0    0
   12         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    3         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    8         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   12         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    7         0    0    0    0    0    0    0    0    0    0    0
    3         0    0    0    0    0    0    0    0    0    0    0
    8         0    0    0    0    0    0    0    0    0    0    0
   12         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
```

```
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    7            0         5       0.8       400      0.05       0.3     0.996
    3            0         5         2       400      0.15       0.3     0.996
    8            0         5       0.8       400       0.1       0.3     0.996
   12            0       4.5      0.08       400      0.15       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    7            0         0         2         2         0         0         0
    3            0         0         2         2         0         0         0
    8            0         0         2         2         0         0         0
   12            0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                     ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7          0.1       0.5      0.25         0       0.7      0.25
    3          0.2       0.5      0.35         0       0.7       0.7
    8          0.1       0.5      0.25         0       0.7      0.25
   12          0.2       0.3      0.35         6       0.3       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    7            0         0         0         0         3         1         0
    3            0         0         0         0         3         1         0
    8            0         0         0         0         3         1         0
   12            0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                    User  t-series Engl Metr ***
                                     in  out           ***
   11      PARKING/FLAT          1    1    1   27    0
   12      PARKING/MOD           1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   11         0    0    1    0    0    0
   12         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   11         0    0    4    0    0    0    1    9
   12         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
   11         0    0    0    0    0
   12         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
```

```
   11            400      0.01       0.1       0.1
   12            400      0.05       0.1      0.08
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   11             0         0
   12             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   11             0         0
   12             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Broadway Ave.***
PERLND   7                       0.825     COPY   501     12
PERLND   7                       0.825     COPY   501     13
IMPLND  11                      0.7615     COPY   501     15
15th St.***
PERLND   3                       2.942     COPY   502     12
PERLND   3                       2.942     COPY   502     13
PERLND   7                       9.572     COPY   502     12
PERLND   7                       9.572     COPY   502     13
IMPLND  11                     8.83605     COPY   502     15
19th St.***
PERLND   3                     3.80503     COPY   503     12
PERLND   3                     3.80503     COPY   503     13
PERLND   7                     5.82103     COPY   503     12
PERLND   7                     5.82103     COPY   503     13
IMPLND  11                      5.3733     COPY   503     15
Riverside Ave.***
PERLND   3                     2.34824     COPY   504     12
PERLND   3                     2.34824     COPY   504     13
PERLND   7                     4.73886     COPY   504     12
PERLND   7                     4.73886     COPY   504     13
IMPLND  11                     5.39492     COPY   504     15
28th St.***
PERLND   3                      30.783     COPY   505     12
PERLND   3                      30.783     COPY   505     13
PERLND   8                      2.6176     COPY   505     12
PERLND   8                      2.6176     COPY   505     13
PERLND   7                    112.8542     COPY   505     12
PERLND   7                    112.8542     COPY   505     13
IMPLND  11                    175.6279     COPY   505     15
Fry Creek ***
PERLND   7                       45.03     COPY   506     12
PERLND   7                       45.03     COPY   506     13
PERLND   3                       14.25     COPY   506     12
PERLND   3                       14.25     COPY   506     13
PERLND   8                        11.5     COPY   506     12
PERLND   8                        11.5     COPY   506     13
IMPLND  11                       83.98     COPY   506     15
IMPLND  12                       28.94     COPY   506     15
Duffy St.***
PERLND   3                      66.142     COPY   507     12
PERLND   3                      66.142     COPY   507     13
PERLND   8                      14.157     COPY   507     12
PERLND   8                      14.157     COPY   507     13
PERLND   7                       42.47     COPY   507     12
PERLND   7                       42.47     COPY   507     13
PERLND  12                       3.481     COPY   507     12
```

```
PERLND  12                      3.481     COPY   507      13
IMPLND  11                     39.203     COPY   507      15
IMPLND  12                     13.068     COPY   507      15
Division St.***
PERLND   3                     4.9216     COPY   508      12
PERLND   3                     4.9216     COPY   508      13
PERLND   8                    11.6702     COPY   508      12
PERLND   8                    11.6702     COPY   508      13
PERLND   7                    88.8296     COPY   508      12
PERLND   7                    88.8296     COPY   508      13
IMPLND  11                   129.8878     COPY   508      15
IMPLND  12                    10.7725     COPY   508      15
Cherry St.***
PERLND   3                     126.36     COPY   509      12
PERLND   3                     126.36     COPY   509      13
PERLND   8                     26.027     COPY   509      12
PERLND   8                     26.027     COPY   509      13
PERLND   7                     19.634     COPY   509      12
PERLND   7                     19.634     COPY   509      13
IMPLND  11                     18.124     COPY   509      15
IMPLND  12                     24.024     COPY   509      15
Lincoln St.***
PERLND   7                    76.7764     COPY   510      12
PERLND   7                    76.7764     COPY   510      13
IMPLND  11                    77.2755     COPY   510      15
Washington St.***
PERLND   7                   10.71699     COPY   511      12
PERLND   7                   10.71699     COPY   511      13
IMPLND  11                   18.38945     COPY   511      15
Jefferson St.***
PERLND   8                     8.8212     COPY   512      12
PERLND   8                     8.8212     COPY   512      13
PERLND   7                 41.2188996     COPY   512      12
PERLND   7                 41.2188996     COPY   512      13
IMPLND  11                   72.81228     COPY   512      15
IMPLND  12                    8.14265     COPY   512      15
K St.***
PERLND   8                    1.49047     COPY   513      12
PERLND   8                    1.49047     COPY   513      13
PERLND   7                   7.615306     COPY   513      12
PERLND   7                   7.615306     COPY   513      13
IMPLND  11                  48.576928     COPY   513      15
IMPLND  12                    2.22373     COPY   513      15
H St.***
PERLND   8                   5.726112     COPY   514      12
PERLND   8                   5.726112     COPY   514      13
PERLND   7                    3.05502     COPY   514      12
PERLND   7                    3.05502     COPY   514      13
IMPLND  11                   47.86191     COPY   514      15
IMPLND  12                   11.42772     COPY   514      15
River St.***
PERLND   7                   0.017314     COPY   515      12
PERLND   7                   0.017314     COPY   515      13
IMPLND  11                   0.271256     COPY   515      15
State St.***
PERLND   7                   0.250493     COPY   516      12
PERLND   7                   0.250493     COPY   516      13
IMPLND  11                    3.92439     COPY   516      15
Zelasko Park***
PERLND   8                   0.341475     COPY   517      12
PERLND   8                   0.341475     COPY   517      13
PERLND   7                    0.72563     COPY   517      12
PERLND   7                    0.72563     COPY   517      13
IMPLND  11                   11.36828     COPY   517      15
IMPLND  12                    5.34978     COPY   517      15
Wishkah St.***
PERLND   7                   0.242165     COPY   518      12
PERLND   7                   0.242165     COPY   518      13
IMPLND  11                    3.79392     COPY   518      15
E St. ***
```

```
PERLND   8                   34.173112     COPY   519      12
PERLND   8                   34.173112     COPY   519      13
PERLND   7                      9.2432     COPY   519      12
PERLND   7                      9.2432     COPY   519      13
IMPLND  11                    20.37727     COPY   519      15
IMPLND  12                    37.64642     COPY   519      15
D St.***
PERLND   8                    1.312681     COPY   520      12
PERLND   8                    1.312681     COPY   520      13
PERLND   7                     9.92239     COPY   520      12
PERLND   7                     9.92239     COPY   520      13
IMPLND  11                     13.5243     COPY   520      15
IMPLND  12                     1.21171     COPY   520      15
B St.***
PERLND   7                    4.099363     COPY   521      12
PERLND   7                    4.099363     COPY   521      13
IMPLND  11                     5.47859     COPY   521      15
Chicago St. ***
PERLND   7                       0.964     COPY   524      12
PERLND   7                       0.964     COPY   524      13
IMPLND  11                       0.889     COPY   524      15
Stanton St.***
PERLND   7                     2.89774     COPY   523      12
PERLND   7                     2.89774     COPY   523      13
IMPLND  11                     2.67483     COPY   523      15
Arthur St. ***
PERLND   7                      30.296     COPY   522      12
PERLND   7                      30.296     COPY   522      13
PERLND   8                      10.099     COPY   522      12
PERLND   8                      10.099     COPY   522      13
IMPLND  11                      27.966     COPY   522      15
IMPLND  12                       9.322     COPY   522      15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1
COPY   502 OUTPUT MEAN   1 1   12.1        DISPLY   2     INPUT  TIMSER 1
COPY   503 OUTPUT MEAN   1 1   12.1        DISPLY   3     INPUT  TIMSER 1
COPY   504 OUTPUT MEAN   1 1   12.1        DISPLY   4     INPUT  TIMSER 1
COPY   505 OUTPUT MEAN   1 1   12.1        DISPLY   5     INPUT  TIMSER 1
COPY   506 OUTPUT MEAN   1 1   12.1        DISPLY   6     INPUT  TIMSER 1
COPY   507 OUTPUT MEAN   1 1   12.1        DISPLY   7     INPUT  TIMSER 1
COPY   508 OUTPUT MEAN   1 1   12.1        DISPLY   8     INPUT  TIMSER 1
COPY   509 OUTPUT MEAN   1 1   12.1        DISPLY   9     INPUT  TIMSER 1
COPY   510 OUTPUT MEAN   1 1   12.1        DISPLY  10     INPUT  TIMSER 1
COPY   511 OUTPUT MEAN   1 1   12.1        DISPLY  11     INPUT  TIMSER 1
COPY   512 OUTPUT MEAN   1 1   12.1        DISPLY  12     INPUT  TIMSER 1
COPY   513 OUTPUT MEAN   1 1   12.1        DISPLY  13     INPUT  TIMSER 1
COPY   514 OUTPUT MEAN   1 1   12.1        DISPLY  14     INPUT  TIMSER 1
COPY   515 OUTPUT MEAN   1 1   12.1        DISPLY  15     INPUT  TIMSER 1
COPY   516 OUTPUT MEAN   1 1   12.1        DISPLY  16     INPUT  TIMSER 1
COPY   517 OUTPUT MEAN   1 1   12.1        DISPLY  17     INPUT  TIMSER 1
COPY   518 OUTPUT MEAN   1 1   12.1        DISPLY  18     INPUT  TIMSER 1
COPY   519 OUTPUT MEAN   1 1   12.1        DISPLY  19     INPUT  TIMSER 1
COPY   520 OUTPUT MEAN   1 1   12.1        DISPLY  20     INPUT  TIMSER 1
COPY   521 OUTPUT MEAN   1 1   12.1        DISPLY  21     INPUT  TIMSER 1
COPY   524 OUTPUT MEAN   1 1   12.1        DISPLY  24     INPUT  TIMSER 1
COPY   523 OUTPUT MEAN   1 1   12.1        DISPLY  23     INPUT  TIMSER 1
COPY   522 OUTPUT MEAN   1 1   12.1        DISPLY  22     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK
```

```
RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                          in  out                            ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC      ENGL    1.1       SUM  PERLND   1 999 EXTNL  PREC
WDM      2 PREC      ENGL    1.1       SUM  IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP      ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP      ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     12.1       WDM    701 FLOW     ENGL       REPL
COPY   501 OUTPUT MEAN   1 1     12.1       WDM    801 FLOW     ENGL       REPL
COPY     2 OUTPUT MEAN   1 1     12.1       WDM    702 FLOW     ENGL       REPL
COPY   502 OUTPUT MEAN   1 1     12.1       WDM    802 FLOW     ENGL       REPL
COPY     3 OUTPUT MEAN   1 1     12.1       WDM    703 FLOW     ENGL       REPL
COPY   503 OUTPUT MEAN   1 1     12.1       WDM    803 FLOW     ENGL       REPL
COPY     4 OUTPUT MEAN   1 1     12.1       WDM    704 FLOW     ENGL       REPL
COPY   504 OUTPUT MEAN   1 1     12.1       WDM    804 FLOW     ENGL       REPL
COPY     5 OUTPUT MEAN   1 1     12.1       WDM    705 FLOW     ENGL       REPL
COPY   505 OUTPUT MEAN   1 1     12.1       WDM    805 FLOW     ENGL       REPL
COPY     6 OUTPUT MEAN   1 1     12.1       WDM    706 FLOW     ENGL       REPL
COPY   506 OUTPUT MEAN   1 1     12.1       WDM    806 FLOW     ENGL       REPL
COPY     7 OUTPUT MEAN   1 1     12.1       WDM    707 FLOW     ENGL       REPL
COPY   507 OUTPUT MEAN   1 1     12.1       WDM    807 FLOW     ENGL       REPL
COPY     8 OUTPUT MEAN   1 1     12.1       WDM    708 FLOW     ENGL       REPL
```

```
COPY   508 OUTPUT MEAN   1 1      12.1       WDM    808 FLOW      ENGL       REPL
COPY     9 OUTPUT MEAN   1 1      12.1       WDM    709 FLOW      ENGL       REPL
COPY   509 OUTPUT MEAN   1 1      12.1       WDM    809 FLOW      ENGL       REPL
COPY    10 OUTPUT MEAN   1 1      12.1       WDM    710 FLOW      ENGL       REPL
COPY   510 OUTPUT MEAN   1 1      12.1       WDM    810 FLOW      ENGL       REPL
COPY    11 OUTPUT MEAN   1 1      12.1       WDM    711 FLOW      ENGL       REPL
COPY   511 OUTPUT MEAN   1 1      12.1       WDM    811 FLOW      ENGL       REPL
COPY    12 OUTPUT MEAN   1 1      12.1       WDM    712 FLOW      ENGL       REPL
COPY   512 OUTPUT MEAN   1 1      12.1       WDM    812 FLOW      ENGL       REPL
COPY    13 OUTPUT MEAN   1 1      12.1       WDM    713 FLOW      ENGL       REPL
COPY   513 OUTPUT MEAN   1 1      12.1       WDM    813 FLOW      ENGL       REPL
COPY    14 OUTPUT MEAN   1 1      12.1       WDM    714 FLOW      ENGL       REPL
COPY   514 OUTPUT MEAN   1 1      12.1       WDM    814 FLOW      ENGL       REPL
COPY    15 OUTPUT MEAN   1 1      12.1       WDM    715 FLOW      ENGL       REPL
COPY   515 OUTPUT MEAN   1 1      12.1       WDM    815 FLOW      ENGL       REPL
COPY    16 OUTPUT MEAN   1 1      12.1       WDM    716 FLOW      ENGL       REPL
COPY   516 OUTPUT MEAN   1 1      12.1       WDM    816 FLOW      ENGL       REPL
COPY    17 OUTPUT MEAN   1 1      12.1       WDM    717 FLOW      ENGL       REPL
COPY   517 OUTPUT MEAN   1 1      12.1       WDM    817 FLOW      ENGL       REPL
COPY    18 OUTPUT MEAN   1 1      12.1       WDM    718 FLOW      ENGL       REPL
COPY   518 OUTPUT MEAN   1 1      12.1       WDM    818 FLOW      ENGL       REPL
COPY    19 OUTPUT MEAN   1 1      12.1       WDM    719 FLOW      ENGL       REPL
COPY   519 OUTPUT MEAN   1 1      12.1       WDM    819 FLOW      ENGL       REPL
COPY    20 OUTPUT MEAN   1 1      12.1       WDM    720 FLOW      ENGL       REPL
COPY   520 OUTPUT MEAN   1 1      12.1       WDM    820 FLOW      ENGL       REPL
COPY    21 OUTPUT MEAN   1 1      12.1       WDM    721 FLOW      ENGL       REPL
COPY   521 OUTPUT MEAN   1 1      12.1       WDM    821 FLOW      ENGL       REPL
COPY    24 OUTPUT MEAN   1 1      12.1       WDM    724 FLOW      ENGL       REPL
COPY   524 OUTPUT MEAN   1 1      12.1       WDM    824 FLOW      ENGL       REPL
COPY    23 OUTPUT MEAN   1 1      12.1       WDM    723 FLOW      ENGL       REPL
COPY   523 OUTPUT MEAN   1 1      12.1       WDM    823 FLOW      ENGL       REPL
COPY    22 OUTPUT MEAN   1 1      12.1       WDM    722 FLOW      ENGL       REPL
COPY   522 OUTPUT MEAN   1 1      12.1       WDM    822 FLOW      ENGL       REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

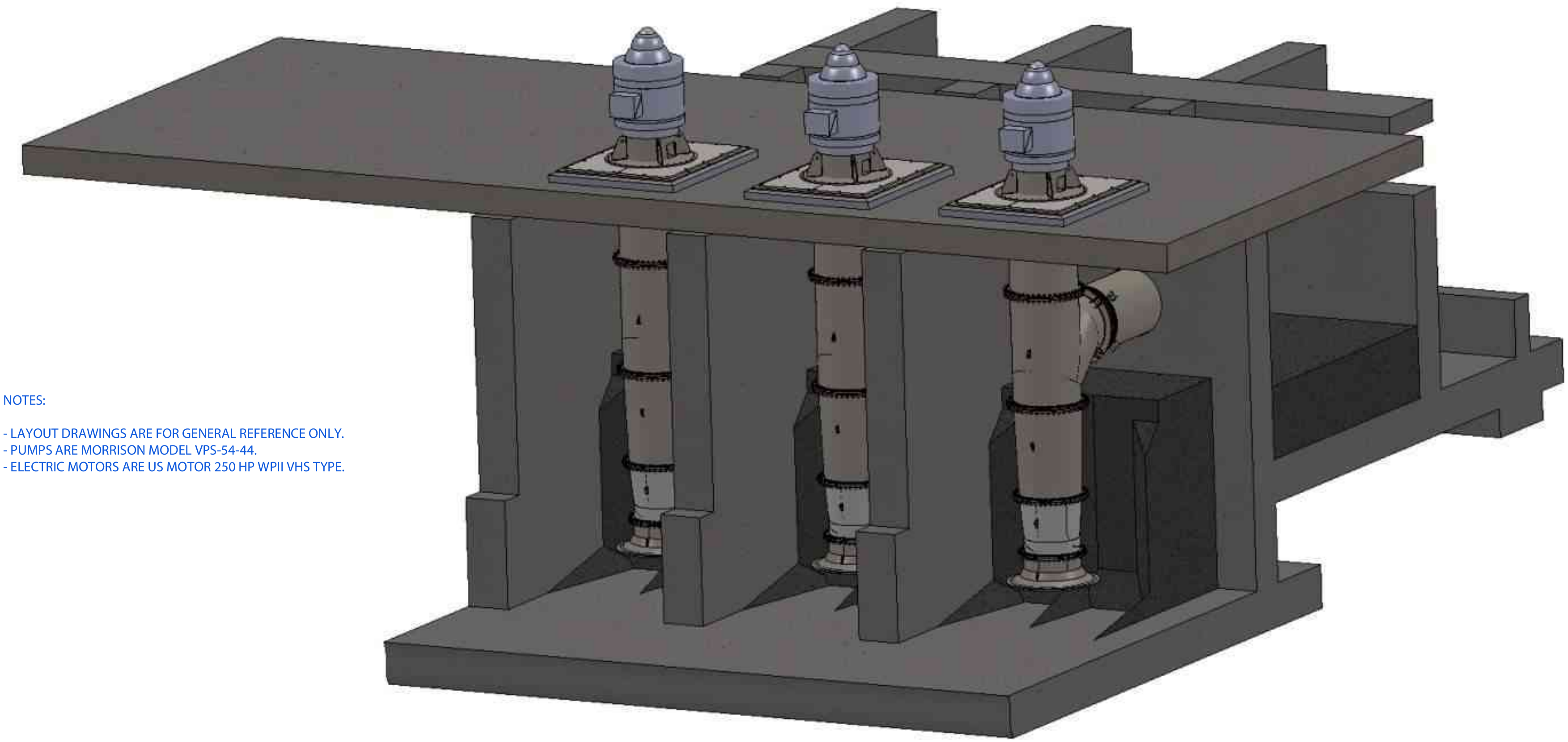
www.clearcreeksolutions.com

Appendix C

Schematic Storm Pump Station Informat

STATION GENERAL LAYOUT

ISOMETRIC VIEW



NOTES:

- LAYOUT DRAWINGS ARE FOR GENERAL REFERENCE ONLY.
- PUMPS ARE MORRISON MODEL VPS-54-44.
- ELECTRIC MOTORS ARE US MOTOR 250 HP WPII VHS TYPE.

MORRISON PUMP COMPANY
2514 Hollywood Blvd.
Hollywood, FL USA
Tel (954) 922-5880
Fax (954) 922- 7729
www. morrisonpump.com

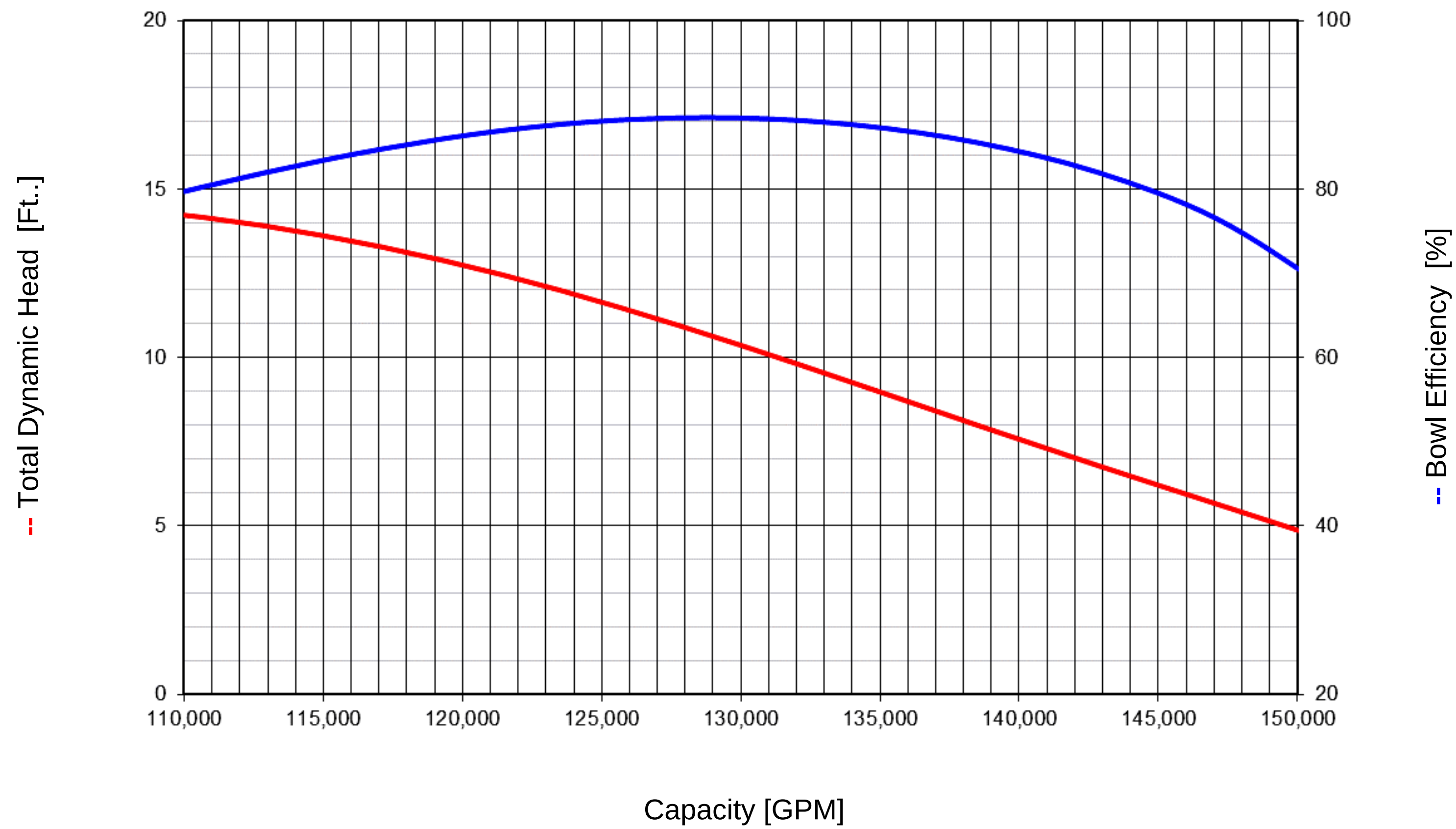
Project:	Dwg Title:	Scale:	Sheet:	Drawn by:	Date:
CLOSE CONSTRUCTION / SFWMD COMPARTMENT B, G-435 PUMP STATION CONTRACT NO. 4600001852 MORRISON PROJECT J29142	PUMP EQUIPMENT GENERAL LAYOUT MORRISON PUMP MODEL VPS-54-44	1:80	1 OF 3	D.J.H.	22-OCTOBER-2009
		Units: N/A	Rev: -	Checked by: J.M.C.	File: J29142-GENLAYOUT-SUBM

Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No.: MPC 57112
Project Name: PumpTech #121631 – Aberdeen & Hoquiam
Date: 17-January-2017

Morrison Pump Model VPS-72-63
Design Condition = 130,000 GPM @ 10.0 Ft. TDH



Morrison Pump Bowl No.: MP-63-02-MH
Impeller Diameter: 62.5 inches
Shaft Speed: 252 RPM

MORRISON PUMP COMPANY

The curve provided is proprietary and for general reference use only. Pump performance is based on open sump testing on clean water with a specific gravity 1.00 at 76ºF.

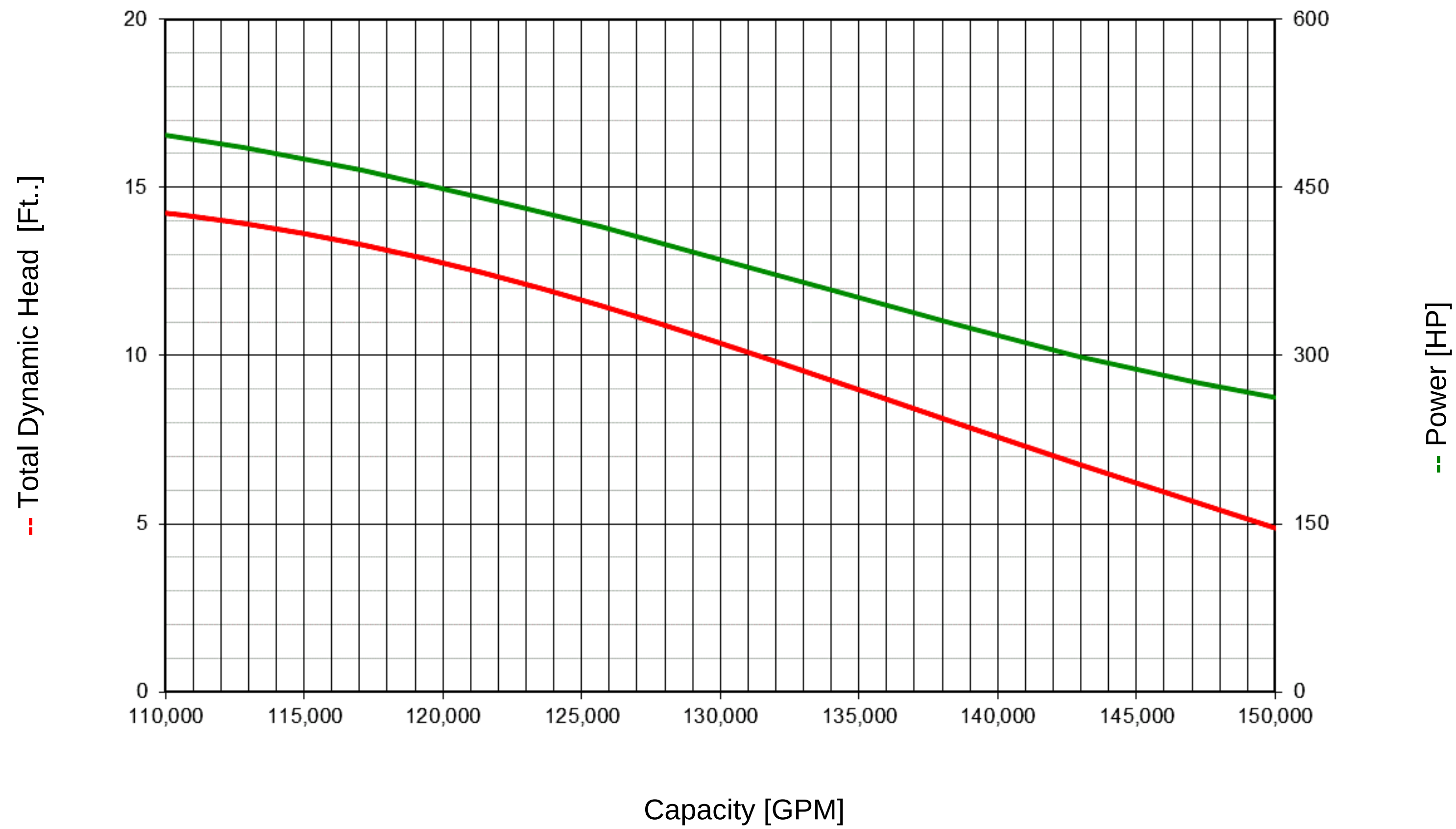
Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No.:	MPC 57112
Project Name:	PumpTech #121631 – Aberdeen & Hoquiam
Date:	17-January-2017

Morrison Pump Model VPS-72-63

Design Condition = 130,000 GPM @ 10.0 Ft. TDH



Morrison Pump Bowl No.:	MP-63-02-MH
Impeller Diameter:	62.5 inches
Shaft Speed:	252 RPM

MORRISON PUMP COMPANY

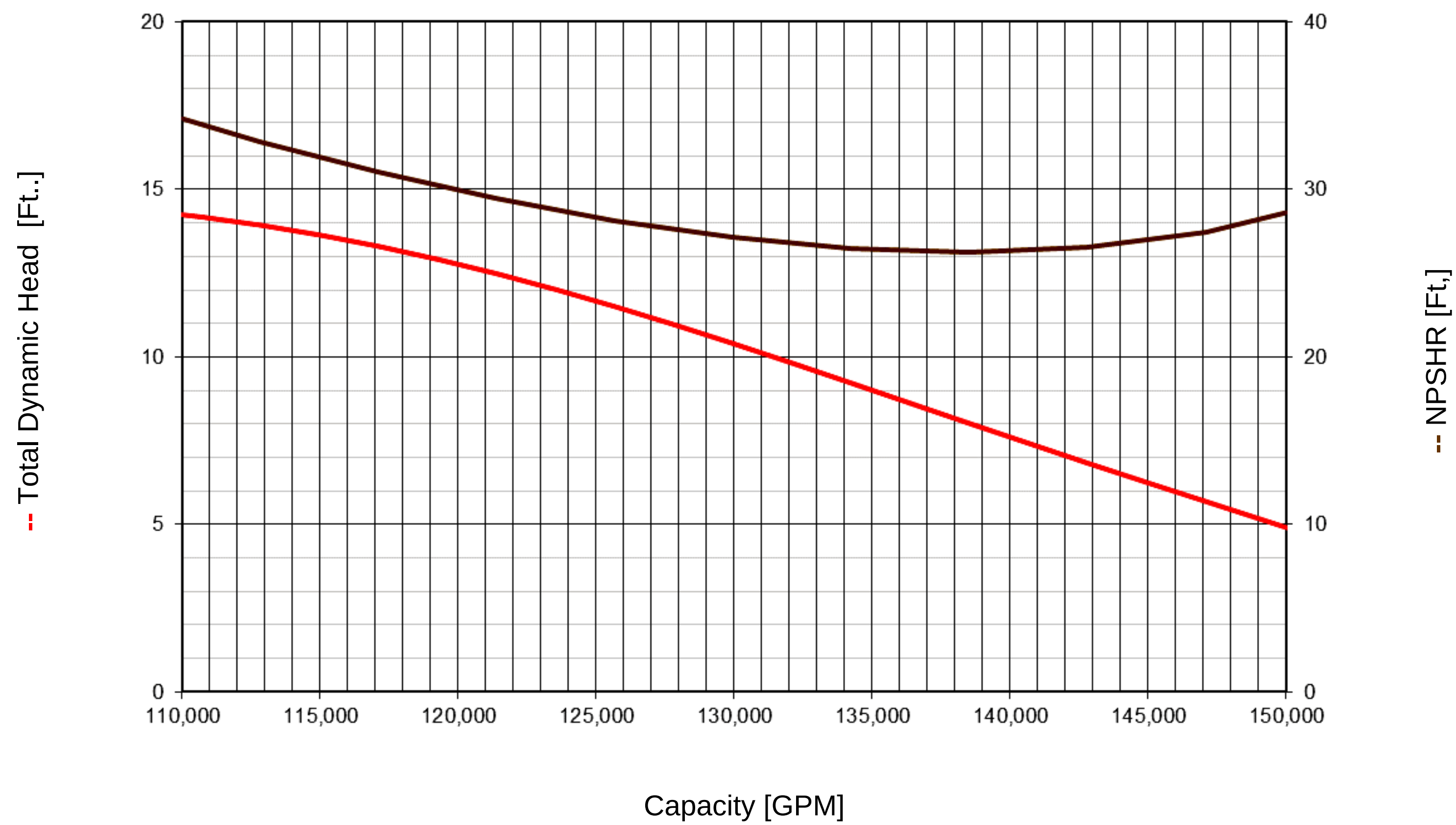
The curve provided is proprietary and for general reference use only. Pump performance is based on open sump testing on clean water with a specific gravity 1.00 at 76°F.

Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No.:	MPC 57112
Project Name:	PumpTech #121631 – Aberdeen & Hoquiam
Date:	17-January-2017

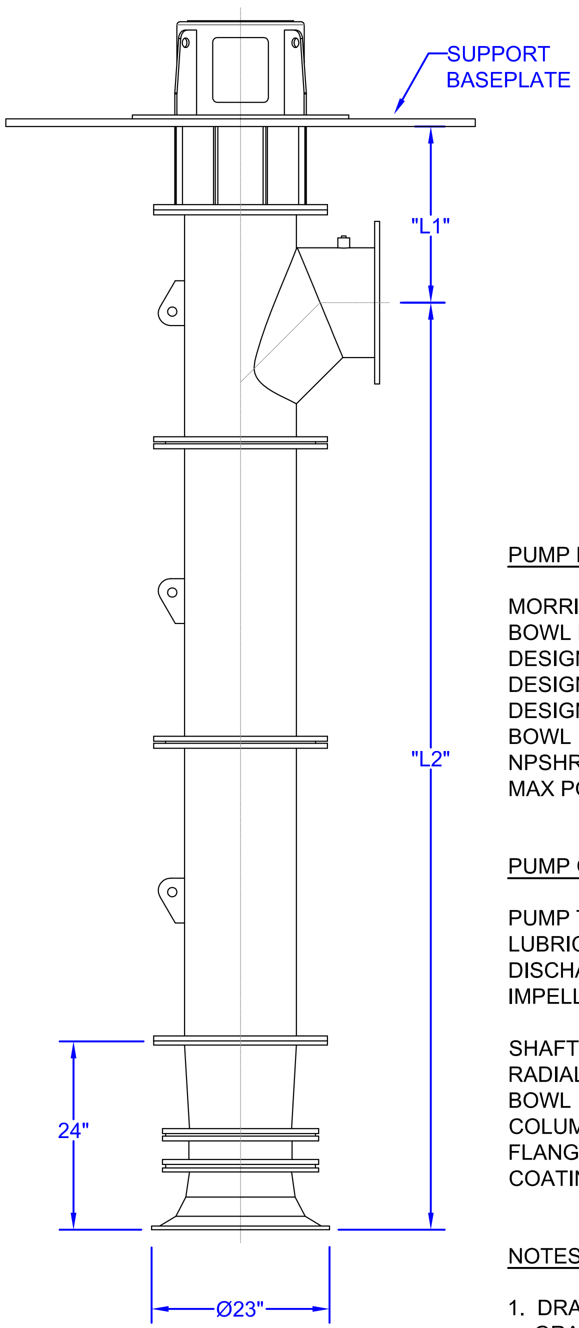
Morrison Pump Model VPS-72-63
Design Condition = 130,000 GPM @ 10.0 Ft. TDH

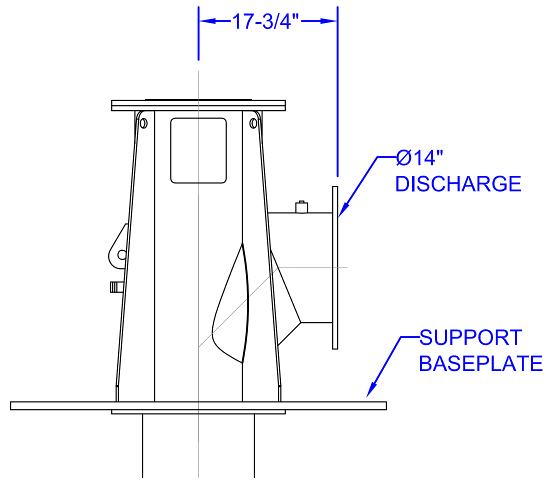


Morrison Pump Bowl No.:	MP-63-02-MH
Impeller Diameter:	62.5 inches
Shaft Speed:	252 RPM

MORRISON PUMP COMPANY

The curve provided is proprietary and for general reference use only. Pump performance is based on open sump testing on clean water with a specific gravity 1.00 at 76°F.





PUMP PERFORMANCE:

MORRISON PUMP MODEL	:	VPS-14-13
BOWL MODEL	:	MP-13-02-LH
DESIGN CAPACITY	:	4,000 GPM
DESIGN HEAD	:	10.7 FT. TDH
DESIGN SPEED	:	1185 RPM
BOWL EFFICIENCY	:	82.6% @ DESIGN POINT
NPSHR	:	26 FT.
MAX POWER	:	15.5 BHP @ 13 FT TDH

PUMP CONSTRUCTION:

PUMP TYPE	:	VERTICAL AXIAL FLOW LINESHAFT
LUBRICATION	:	PRODUCT LUBRICATION
DISCHARGE	:	Ø14-INCH ANSI FLANGE
IMPELLER	:	FORGED 304L STAINLESS STEEL, DYNAMICALLY BALANCED
SHAFT	:	304 STAINLESS STEEL
RADIAL BEARINGS	:	NITRILE RUBBER
BOWL	:	STAINLESS STEEL & FORGED STEEL
COLUMN & ELBOW	:	A36 CARBON STEEL
FLANGES	:	MACHINED WITH REGISTERS
COATING	:	12 MILS 2-PART EPOXY

NOTES:

1. DRAWING IS FOR GENERAL REFERENCE ONLY, AND SHOWS ABOVE GRADE AND BELOW GRADE DISCHARGES.

SCHEMATIC

MORRISON PUMP COMPANY

DWG. TITLE: MORRISON PUMP MODEL VPS-14-13 GENERAL DIMENSIONS

PROJECT: MPC 55164 - PUMP TECH, CITY OF ABERDEEN, WASHINGTON

DATE: 03-AUG-2015

FILE: DWG-55164-VPS-14

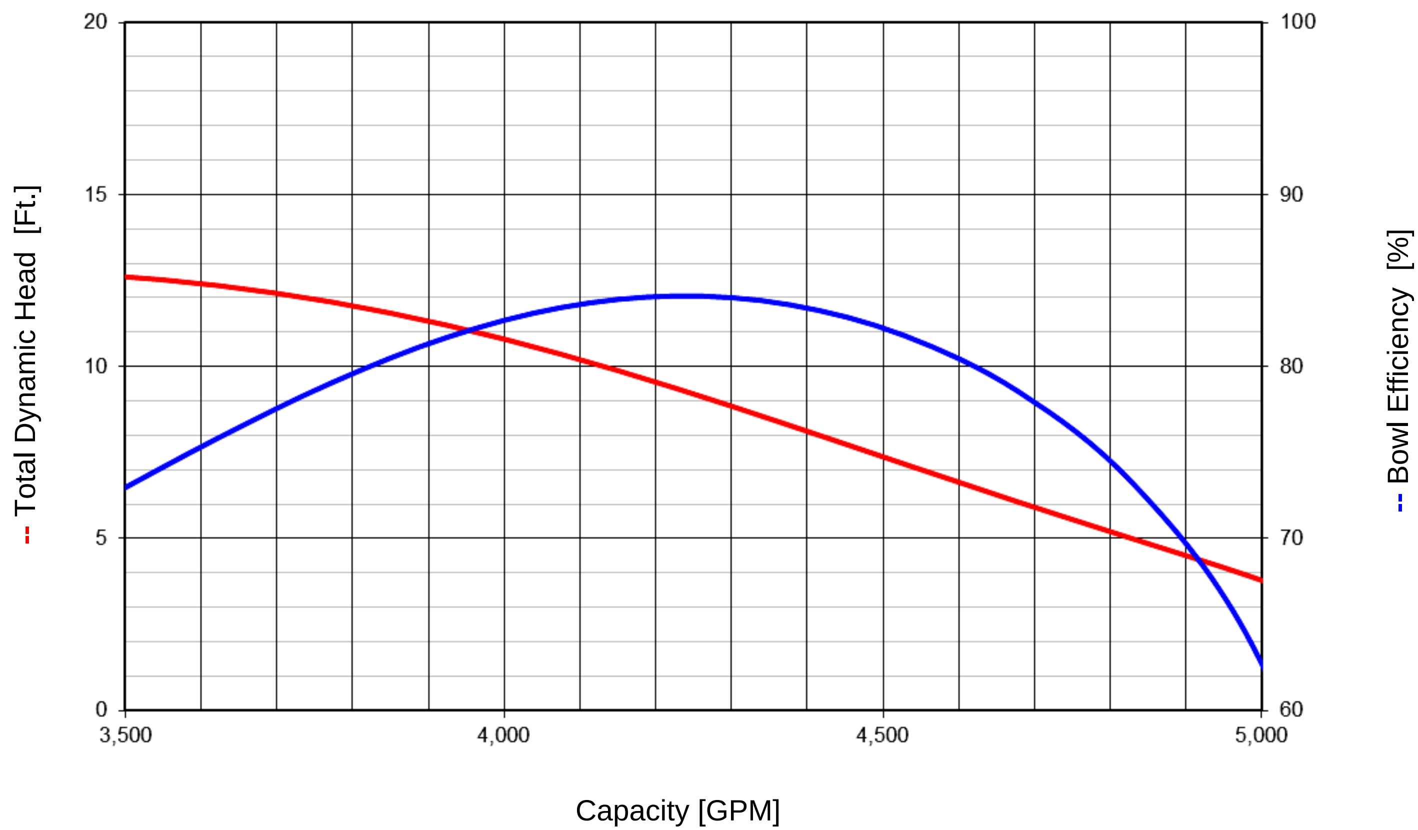
Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No.:	MPC 55164
Project Name:	KPFF Consulting Engineers – Aberdeen Northside Levee Project
Date:	03-August-2015

MORRISON PUMP MODEL VPS-14-13

Design Condition = 4,000 GPM @ 10.7 Ft. TDH, 82.6% Eff.



Morrison Pump Bowl No.:	MP-13-02-LH
Impeller Diameter:	12.4 inches
Shaft Speed:	1185 RPM

SCHEMATIC

MORRISON PUMP COMPANY

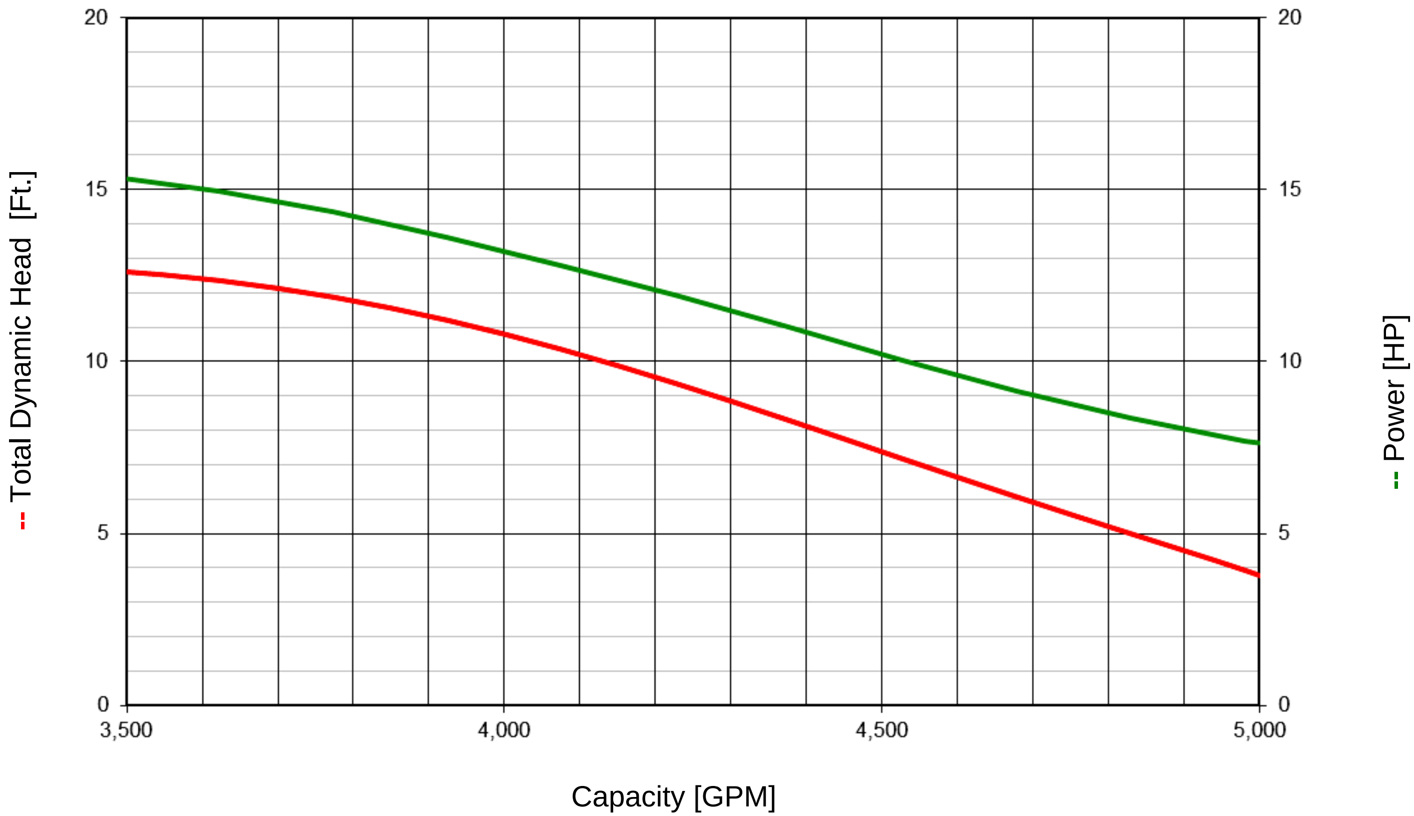
The curve provided is proprietary and for general reference use only. Pump performance is based on open sump testing on clean water with a specific gravity 1.00 at 76ºF.

Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No.: MPC 55164
Project Name: KPFF Consulting Engineers – Aberdeen Northside Levee Project
Date: 03-August-2015

MORRISON PUMP MODEL VPS-14-13
Design Condition = 4,000 GPM @ 10.7 Ft. TDH



Morrison Pump Bowl No.: MP-13-02-LH
Impeller Diameter: 12.4 inches
Shaft Speed: 1185 RPM

SCHEMATIC

MORRISON PUMP COMPANY

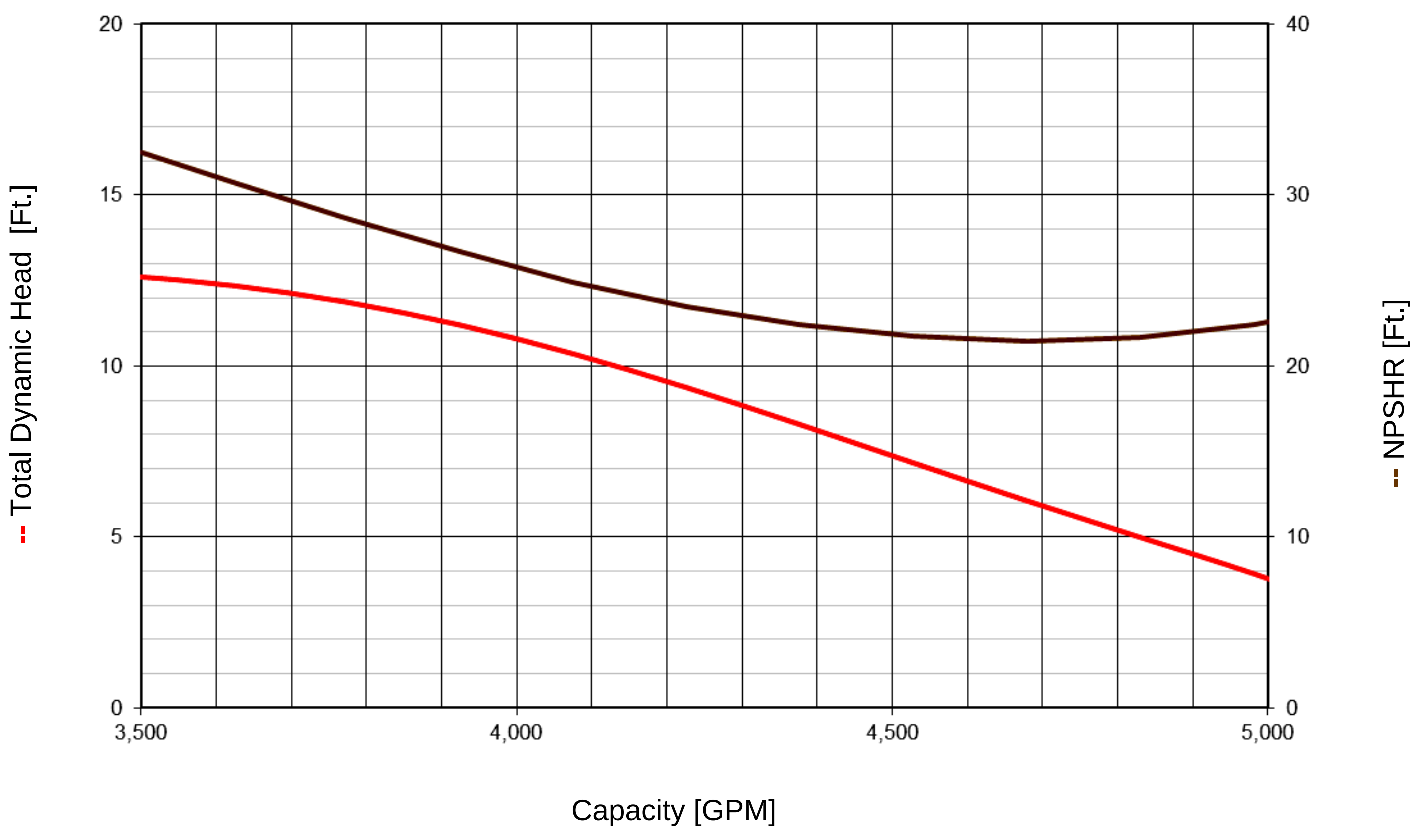
Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No.:	MPC 55164
Project Name:	KPFF Consulting Engineers – Aberdeen Northside Levee Project
Date:	03-August-2015

MORRISON PUMP MODEL VPS-14-13

Design Condition = 4,000 GPM @ 10.7 Ft. TDH



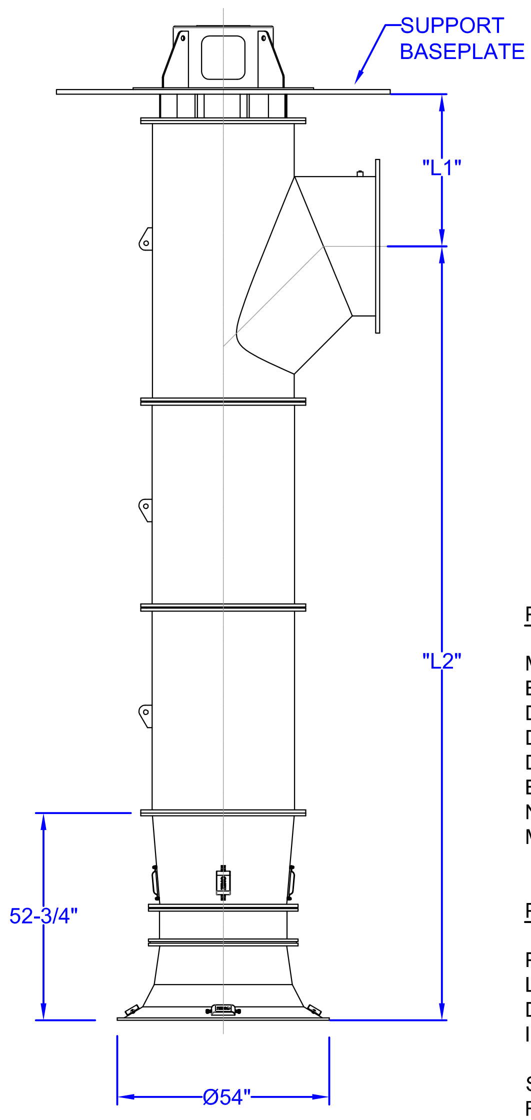
Morrison Pump Bowl No.:	MP-13-02-LH
Impeller Diameter:	12.4 inches
Shaft Speed:	1185 RPM

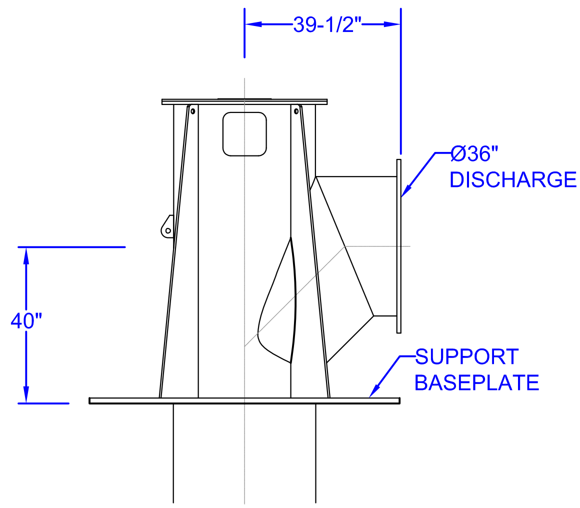
SCHEMATIC

MORRISON PUMP COMPANY

The curve provided is proprietary and for general reference use only. Pump performance is based on open sump testing on clean water with a specific gravity 1.00 at 76°F.

MORRISON MODEL VPS-36-32
GENERAL DIMENSIONS





PUMP PERFORMANCE:

MORRISON PUMP MODEL	:	VPS-36-32
BOWL MODEL	:	MP-32-02-MH
DESIGN CAPACITY	:	34,000 GPM
DESIGN HEAD	:	10.2 FT. TDH
DESIGN SPEED	:	510 RPM
BOWL EFFICIENCY	:	86.2% @ DESIGN POINT
NPSHR	:	28 FT.
MAX POWER	:	130 BHP @ 14 FT TDH

PUMP CONSTRUCTION:

PUMP TYPE	:	VERTICAL AXIAL FLOW LINESHAFT
LUBRICATION	:	PRODUCT LUBRICATION
DISCHARGE	:	Ø36-INCH ANSI FLANGE
IMPELLER	:	FORGED 304L STAINLESS STEEL, DYNAMICALLY BALANCED
SHAFT	:	304 STAINLESS STEEL
RADIAL BEARINGS	:	NITRILE RUBBER
BOWL	:	STAINLESS STEEL & FORGED STEEL
COLUMN & ELBOW	:	A36 CARBON STEEL
FLANGES	:	MACHINED WITH REGISTERS
COATING	:	12 MILS 2-PART EPOXY

NOTES:

1. DRAWING IS FOR GENERAL REFERENCE ONLY, AND SHOWS ABOVE GRADE AND BELOW GRADE DISCHARGES.

SCHEMATIC

MORRISON PUMP COMPANY

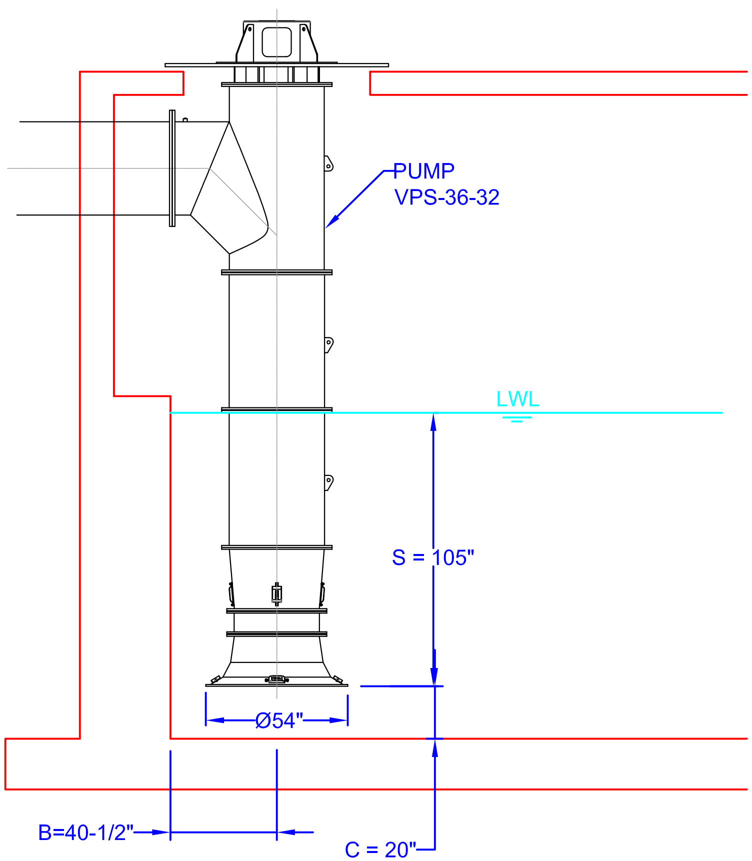
DWG. TITLE: MORRISON PUMP VPS-36-32 GENERAL DIMENSIONS

PROJECT: MPC 55164 - PUMPTECH, CITY OF ABERDEEN, WASHINGTON

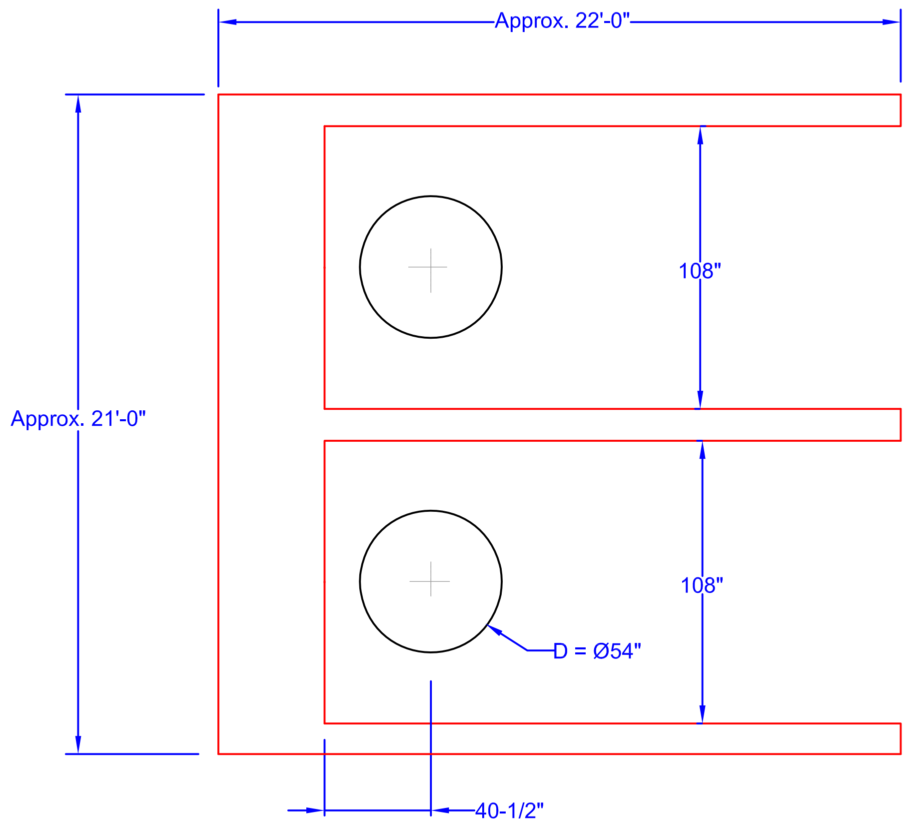
DATE: 03-AUG-2015

FILE: DWG-55164-VPS-36

ELEVATION VIEW



PLAN VIEW



NOTES:

1. PUMP MODEL VPS-36-32 WITH 34,000 GPM CAPACITY. MOTOR NOT SHOWN.
2. LWL = LOW WATER LEVEL; D = SUCTION BELL DIAMETER.
3. S = SUBMERGENCE; B = BACK WALL SPACING; C = BELL CLEARANCE

MORRISON PUMP COMPANY

DWG. TITLE: MORRISON PUMP VPS-36-32 GENERAL LAYOUT	DATE: 03-AUG-2015
PROJECT: MPC 55164 - PUMPTECH, CITY OF ABERDEEN, WASHINGTON	FILE: DWG-55164-001

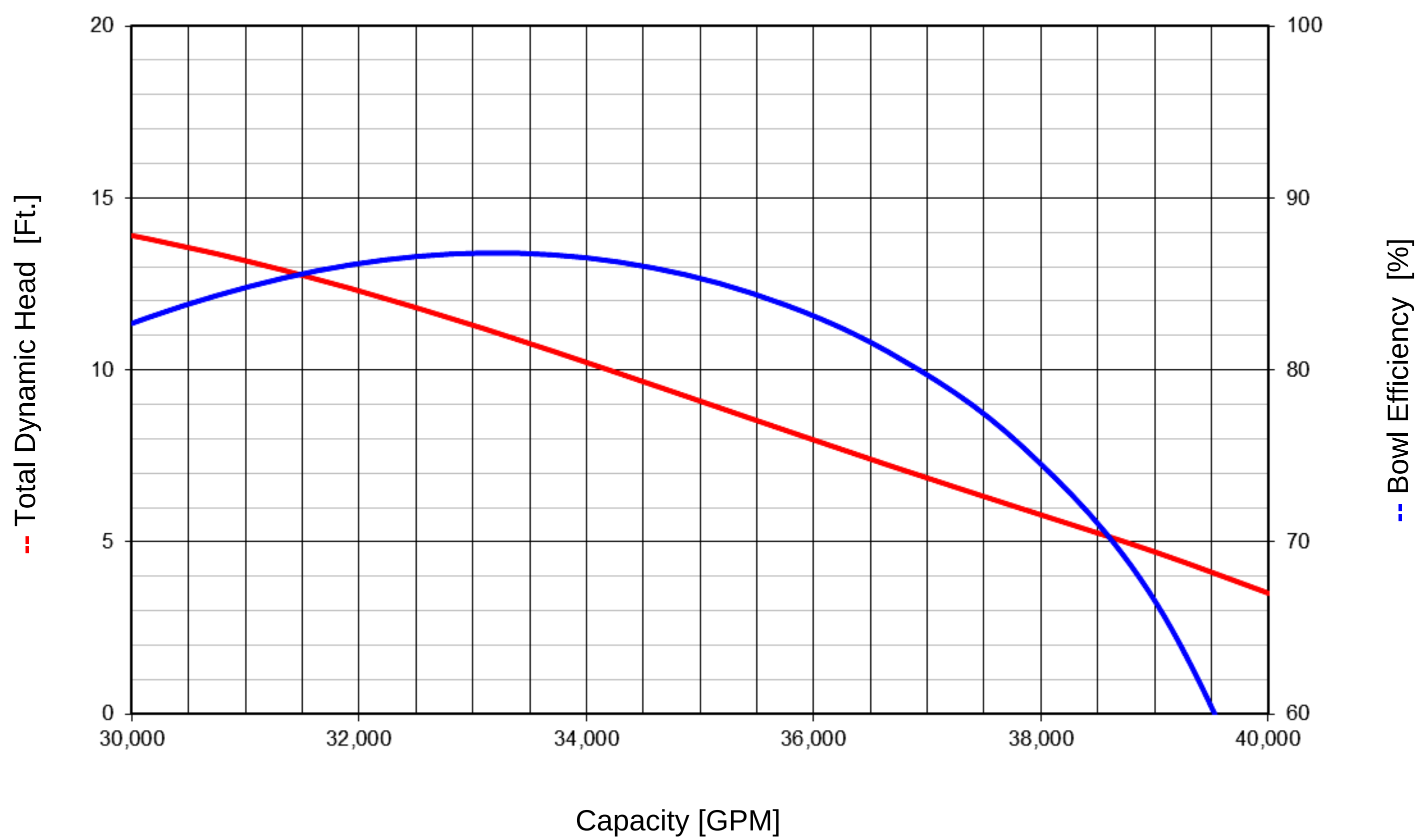
SCHEMATIC

Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No.: MPC 55164
Project Name: KPFF Consulting Engineers – Aberdeen Northside Levee Project
Date: 03-August-2015

MORRISON PUMP MODEL VPS-36-32
Design Condition = 34,000 GPM @ 10.2 Ft. TDH, 86.2% Eff.



Morrison Pump Bowl No.: MP-32-02-MH
Impeller Diameter: 31.5 inches
Shaft Speed: 510 RPM

SCHEMATIC

MORRISON PUMP COMPANY

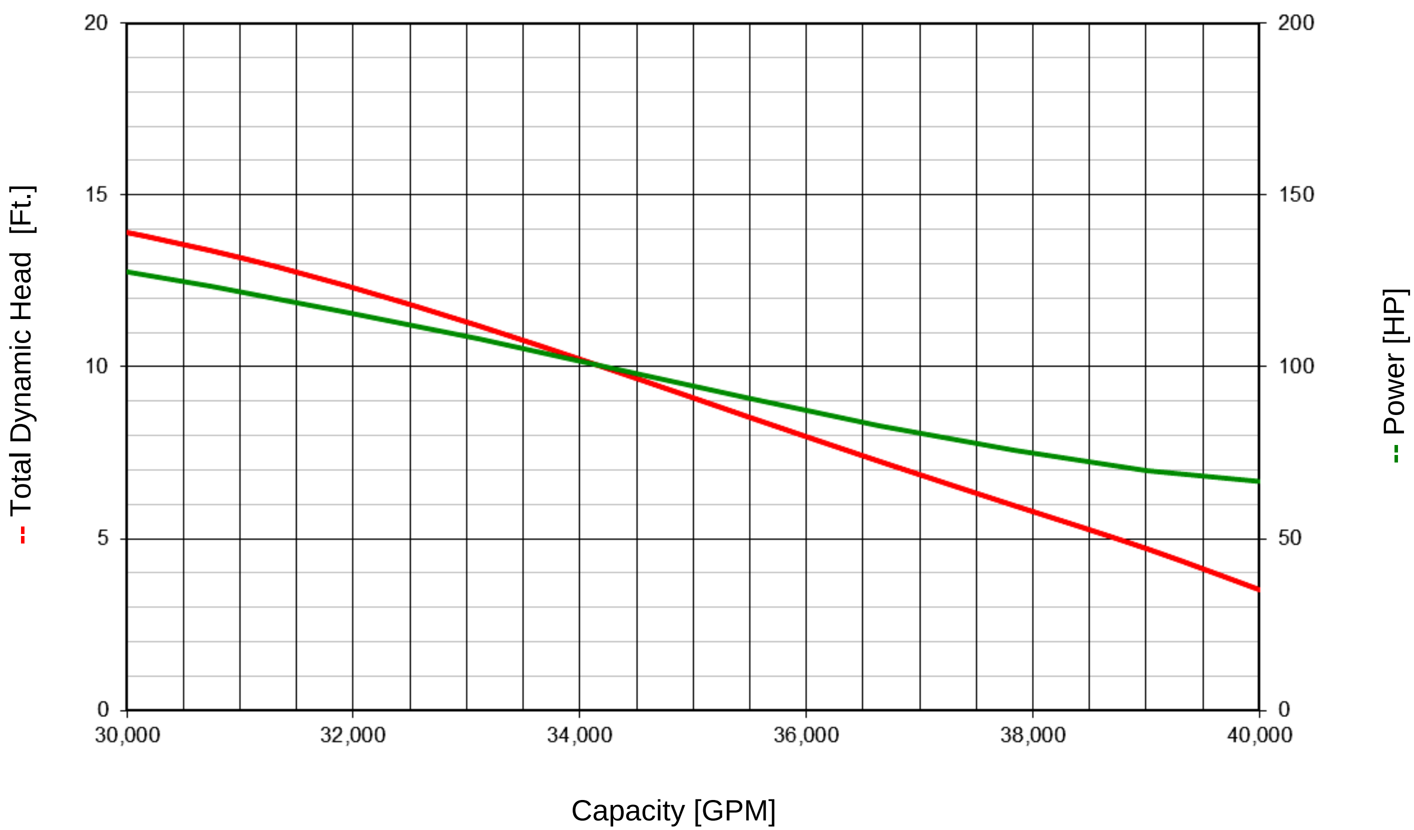
Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No.:	MPC 55164
Project Name:	KPFF Consulting Engineers – Aberdeen Northside Levee Project
Date:	03-August-2015

MORRISON PUMP MODEL VPS-36-32

Design Condition = 34,000 GPM @ 10.2 Ft. TDH



Morrison Pump Bowl No.:	MP-32-02-MH
Impeller Diameter:	31.5 inches
Shaft Speed:	510 RPM

SCHEMATIC

MORRISON PUMP COMPANY

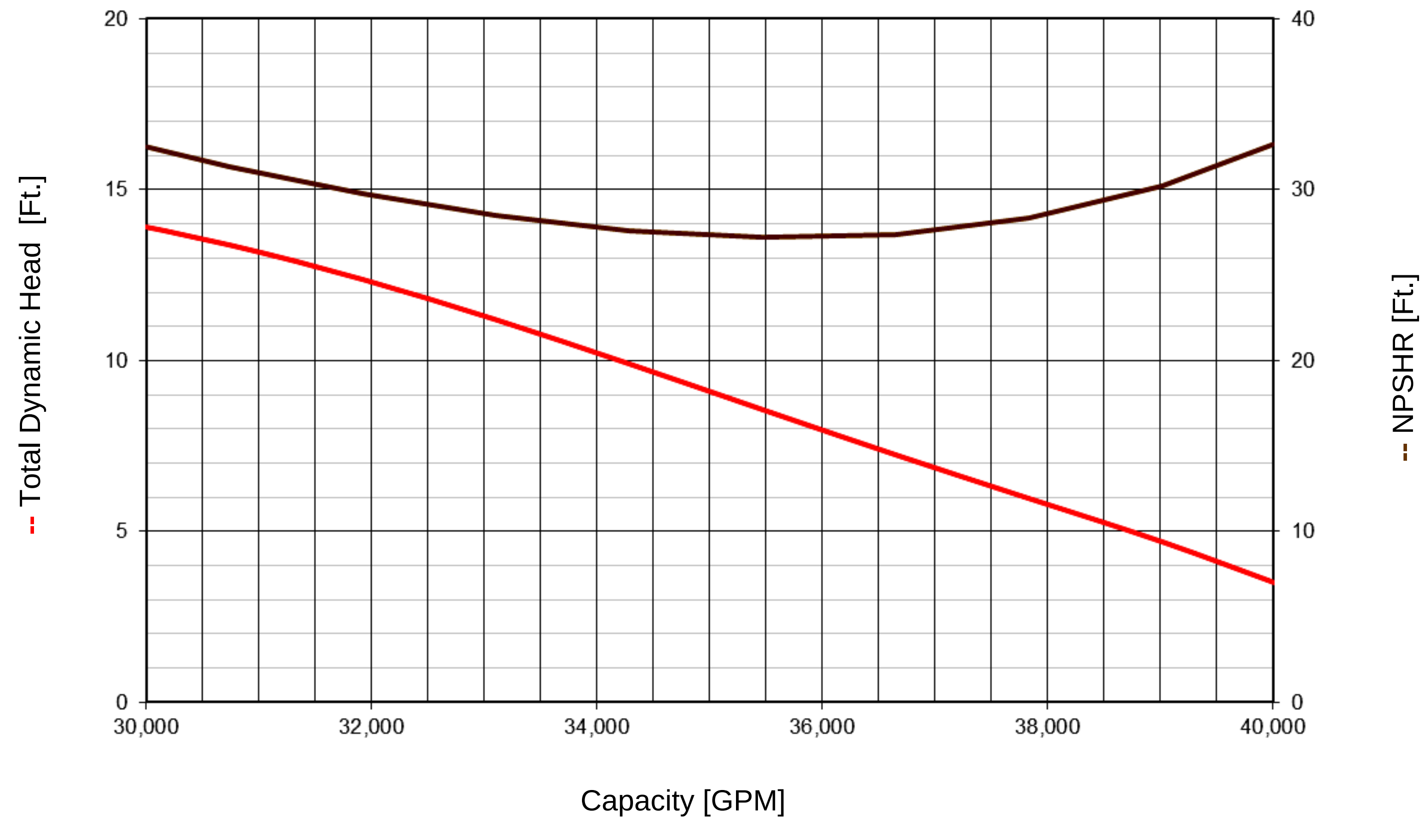
Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No.:	MPC 55164
Project Name:	KPFF Consulting Engineers – Aberdeen Northside Levee Project
Date:	03-August-2015

MORRISON PUMP MODEL VPS-36-32

Design Condition = 34,000 GPM @ 10.2 Ft. TDH



Morrison Pump Bowl No.:	MP-32-02-MH
Impeller Diameter:	31.5 inches
Shaft Speed:	510 RPM

SCHEMATIC

MORRISON PUMP COMPANY

The curve provided is proprietary and for general reference use only. Pump performance is based on open sump testing on clean water with a specific gravity 1.00 at 76°F.