City of Brentwood Drainage Basin Master Plan Study – Tier 1 Watersheds

Prepared for:
City of Brentwood, Tennessee

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Executive Summary

The City of Brentwood commissioned Neel-Schaffer, Inc. to perform a citywide Drainage Basin Master Plan Study. The City was subdivided into a total of forty (40) sub-watersheds. These sub-watersheds were prioritized, with those sub-watersheds experiencing greater volumes of work orders and complaints receiving the highest ranking. Finally, the ranked watersheds were grouped into eight (8) tiers of five (5) sub-watersheds each, with Tier 1 representing the highest priority watershed. Refer to **Exhibit A.1** for a location map depicting the Tier 1 study limits, and refer to **Exhibits A.2** through **A.6** for location maps of the major sub-watersheds within Tier 1. Refer to maps of the City's 40 sub-watersheds included in **Appendix B**. Specific locations of historical/current complaint information relevant to the Tier 1 study area are listed in **Table 2** within this report.

This study includes an evaluation of the existing hydrologic and hydraulic properties within the City's Tier 1 sub-watersheds, as well as a determination of the existing conditions flooding level of service at both residential/commercial properties and roadway crossings/intersections within the Tier 1 study area. To evaluate the frequency of flooding of the existing system and drainage improvement alternatives, a hydrologic/hydraulic computer model was developed to determine existing peak runoff discharges and volumes for the 2-, 5-, 10-, 25-, 50-, and 100-year-24-hour recurrence interval flood events. The model included field-surveyed drainage infrastructure within key areas, supplemented with the City's GIS data and other measurements collected during the field reconnaissance phase of this study.

The existing frequency of flooding within the study area was determined and used to evaluate the benefit of proposed improvement designs. This study identifies conceptual-level improvement designs at thirty (30) select locations, which are intended to reduce the frequency and severity of ponding and flooding at these locations to the maximum extent practicable. These projects have been grouped into two separate categories; those projects which provide benefits/reductions to residential property flooding (12 total) and those projects which provide benefits/reductions to roadway flooding only (18 total).

Within the Phase 1 grouping of projects, Neel-Schaffer has listed the projects in a manner that prioritizes those projects which will benefit multiple residential properties, listed in order of lowest cost to highest cost; followed by the remainder of Phase 1 projects benefiting single residential properties, listed in order of lowest cost to highest cost.

Within the Phase 2 grouping of projects, Neel-Schaffer has prioritized those roadway improvement projects that coincide with documented complaints and/or have been classified as arterial and collector roadways; the remainder of Phase 2 projects benefit local roadways and have no documented complaints. Refer to individual project cost estimates in **Appendix C**, as well as, summaries of costs shown in the table below:

Summary of Phase 1 and Phase 2 Implementation Costs	
Total Estimated Cost to Implement Phase 1 Projects with Residential Benefits (12 Projects):	$3,797,144
Total Estimated Cost to Implement Phase 2 Projects with Only Roadway Benefits (18 Projects):	$2,805,312
Total Estimated Cost to Implement Both Phases (30 Projects Total):	**$6,602,456**

Schematic layouts and details of the thirty (30) recommended improvement projects have been prepared and included within this report in **Appendix A**. These conceptual-level design layouts depict those improvements which, once constructed, are anticipated to reduce the frequency of flooding at the identified points of interest to the maximum extent practicable.

The recommended drainage improvement projects and associated cost estimates provided as part of this Tier 1 City of Brentwood Drainage Basin Master Plan Study are conceptual in nature and are not based on detailed design. Standard engineering practice was used to inventory, study, develop computer models, develop concept designs, and develop budgetary-level cost estimates required to solve drainage and flooding problems for drainage systems within the Tier 1 sub-watersheds described in this report. It should be noted that the suggested order of project implementation contained in this report may be adjusted based on the City's and/or the public's needs.

Prior to construction of the recommended capital improvement projects, Neel-Schaffer recommends that design-level topographic survey data be obtained for the project locations and surrounding vicinity at each project site, and full detailed design be performed for the proposed systems to ensure that potential constraints and constructability issues are identified and no adverse impacts will be imposed to adjacent properties.

In addition to the 30 recommended capital improvement projects listed in this report, Neel-Schaffer also identified $5.5M in maintenance needs within Tier 1 sub-watersheds during the field reconnaissance phase of this study. The maintenance locations, consisting of channel cleanouts, channel regrading, headwall/structure repairs, bank/channel stabilization, and damaged inlet replacement sites were provided to the City in a digital geo-database. These maintenance project sites, presented in the separate geo-database, should be performed as funding and resources allow.

It should be noted that this Drainage Basin Master Plan only studied the top five priority sub-watersheds within the City of Brentwood, which comprise the Tier 1 watershed. Seven more tiers containing 5 sub-watersheds each still remain to be studied. It is recommended that the City undertake studies of the remaining watersheds as soon as possible in order to identify capital improvement projects within Tiers 2 through 8.

Introduction

The City of Brentwood (City) has received numerous complaints from citizens and business owners regarding drainage concerns related to roadway, nuisance/yard, and structure flooding throughout the City limits. Therefore, the City commissioned Neel-Schaffer, Inc. (NSI) to perform a citywide Drainage Basin Master Plan Study. Utilizing available GIS data provided by the City, as well as publicly available LiDAR/GIS datasets, NSI defined all locations where concentrated runoff discharges outside the City limits. Then, using these defined outfall locations, the City was subdivided into a total of forty (40) sub-watersheds. The 40 sub-watersheds were prioritized using the City's historical drainage work order and flooding complaint data, with those sub-watersheds experiencing greater volumes of work orders and complaints given the highest ranking. These sub-watersheds and outfalls are shown in maps contained in **Appendix B**. Finally, the ranked watersheds were grouped into eight (8) tiers of five (5) sub-watersheds each, with Tier 1 representing the highest priority watershed. Maps of Tier 1 watersheds studied in this report are included in **Appendix A**.

Upon receiving City concurrence on the watershed rankings and tier groupings, NSI commenced with development of detailed hydrologic and hydraulic analyses of the Tier 1 sub-watersheds (i.e., the 5 highest-ranked sub-watersheds). Refer to **Exhibit A.1 in Appendix A** for a map which depicts the location of the Tier 1 sub-watersheds. Specific locations of historical/current complaint information relevant to the Tier 1 study area are listed in **Table 2** below. It should be noted that the City has completed maintenance and infrastructure improvement projects to alleviate flooding issues at some of these individual locations.

This study includes an evaluation of the existing hydrologic and hydraulic properties within the City's Tier 1 sub-watersheds, as well as a determination of the existing conditions flooding level of service (LOS) at a total of twenty-one (21) residential/commercial properties and ninety-seven (97) roadway crossings/intersections. Several of these locations are the subject of historical/current citizens' complaints. This study also identifies conceptual-level improvement designs at thirty (30) select locations, which are intended to reduce the frequency and severity of ponding and flooding at these locations to the maximum extent practicable.

The existing frequency of flooding within the study area was determined and used to evaluate the benefit of each improvement design. To evaluate the frequency of flooding of the existing system and drainage improvement alternatives, a hydrologic/hydraulic computer model was developed to determine existing peak runoff discharges and volumes for the 2-, 5-, 10-, 25-, 50-, and 100-year-24-hour recurrence interval flood events.

Schematic layouts of the recommended improvements have been prepared and included within this report (see below for project narratives and layouts; refer to **Exhibits A.2** through **A.6** in **Appendix A** for project locations; refer to **Exhibits A.7** through **A.18** in

Appendix A for schematic layouts). These conceptual-level design layouts depict those improvements which, once constructed, are anticipated to reduce the frequency of flooding at the identified points of interest to the maximum extent practicable. Final engineering design and associated final modeling/analyses will need to be performed prior to construction of any alternative selected for implementation.

Watershed Description

As shown on **Exhibit A.1,** the Tier 1 study limits generally extend from beyond the Brentwood City limits on the north to an existing topographic divide west of Lookout Ridge Drive, Hunters Lane, and Grand Oaks Drive to the south, and from Skyline Drive and Franklin Road on the east to Granny White Pike and Grand Oaks Drive on the west. The study limits have been divided into five (5) major sub-watersheds, each of which constitutes a defined contributing drainage area where runoff is collected and conveyed towards distinct outfall locations into the Little Harpeth River, which bisects the study area and serves as the primary receiving waterbody for the study. For ease of analysis, these major sub-watersheds were assigned a naming convention which references the associated priority ranking (as described above). The major sub-watershed names and total drainage areas, as well as a quantification of the number of defined runoff outfall locations per sub-watershed, is provided below. Refer to **Exhibits A.2** through **A.6** in **Appendix A** for location maps of the major sub-watersheds within the Tier 1 study area:

- **Priority Area 1 (PA1): 928.08 acres (1.45 square miles)**;
  - 10 distinct outfall locations into the Little Harpeth River;
  - 1 distinct outfall location at northern City limits, within CSX Railroad right-of-way;
- **Priority Area 2 (PA2): 980.06 acres (1.53 square miles)**;
  - 25 distinct outfall locations into the Little Harpeth River;
- **Priority Area 3 (PA3): 1,065.86 acres (1.67 square miles)**;
  - 10 distinct outfall locations into the Little Harpeth River;
- **Priority Area 4 (PA4): 468.60 acres (0.73 square miles)**;
  - 15 distinct outfall locations into the Little Harpeth River; and
- **Priority Area 5 (PA5): 433.77 acres (0.68 square miles)**;
  - 6 distinct outfall locations into the Little Harpeth River.

As described above, the Tier 1 study area encompasses a total drainage area of approximately 3,876.37 acres (6.06 square miles). Land uses within the study limits are primarily residential, with commercial and institutional land uses along Franklin Road, Virginia Way, Maryland Way, Church Street, and Wilson Pike Circle corridors, as well as, surrounding the Granny White Pike / Murray Lane intersection.

The Tier 1 sub-watersheds consist of a network of open channels, lakes, above-ground/underground detention ponds, roadway cross drains, and closed conveyance systems that generally flow from the north (PA1 ad PA3) and south (PA2, PA4, and PA5) and discharge into the Little Harpeth River. Each of the major sub-watersheds consists

of separate main stormwater collection and conveyance systems which direct runoff to the outfall locations described above.

Within Priority Area 1, runoff is collected and conveyed into a system of open channels and cross drains within the residential areas located east of Interstate 65. This runoff is conveyed underneath the interstate and CSX Railroad, and then enters a closed storm sewer system within the developed corridor along Franklin Road. Runoff which originates north of the City limits is conveyed into this same closed system, which eventually discharges into an existing residential area west of Franklin Road, south of Williamsburg Road. The runoff is then conveyed southward through the Brentwood Country Club property before discharging into the Little Harpeth River. Refer to **Exhibit A.2** in **Appendix A** for a location map of Priority Area 1.

Within Priority Area 2, runoff originates within the higher, upland portions of the watershed south of Lookout Ridge Drive and Heathrow Boulevard and is conveyed northward via a minor closed storm sewer network within the residential areas west of Franklin Road and south of Murray Lane. These residential closed storm sewer systems discharge into open channels within the neighborhoods; runoff is then conveyed northward and underneath Murray Lane through reinforced concrete box culverts at multiple crossing locations. Runoff conveyance continues northward through open channel and cross drain systems, which ultimately discharge into the Little Harpeth River west of Franklin Road. Additionally, roadway runoff collected from Franklin Road, as well as from new residential development east of Franklin Road, is conveyed towards and discharged into the Little Harpeth River at the existing Franklin Road bridge crossing. Refer to **Exhibit A.3** in **Appendix A** for a location map of Priority Area 2.

Within Priority Area 3, runoff which originates north of the City limits is conveyed underneath Old Hickory Boulevard and into the commercial areas between Old Hickory Boulevard and Virginia Way, east of Granny White Pike. Within these developed commercial areas, existing closed storm sewer systems collect local runoff and convey it into open channels, which convey the localized runoff as well as runoff from north of the City limits southward through the watershed. Multiple wet detention ponds are located within the watershed, which serve to attenuate the runoff prior to discharging it into existing open channel segments located within residential areas south of Virginia Way, downstream of the commercial areas. The runoff conveyance continues southward through the residential neighborhoods, eventually discharging into the Little Harpeth River between the Brentwood Country Club and Granny White Pike. Refer to **Exhibit A.4** in **Appendix A** for a location map of Priority Area 3.

Within Priority Area 4, runoff originates within the higher, upland portions of the watershed south of Grand Oaks Drive and Turtle Creek Drive. This runoff is collected and conveyed northward via minor closed storm sewer networks located within the residential areas south of Belle Rive Drive. These closed systems eventually discharge into open channel / roadside swale systems that cross underneath Belle Rive Drive via cross drains at multiple locations along the roadway. From there, runoff continues northward, ultimately

discharging into the Little Harpeth River west of Granny White Pike. Refer to **Exhibit A.5** in **Appendix A** for a location map of Priority Area 4.

Within Priority Area 5, runoff originates along an existing topographic ridge along Murray Lane and west of Wendover Glen and is conveyed generally northward via a system of inlets, cross drains, and open channel segments towards the Granny White Pike corridor. In addition, runoff from a portion of the Brass Lantern development and the Brentwood Middle and High School properties is collected and conveyed northward along Granny White Pike and through Granny White Park. This runoff eventually discharges into the Little Harpeth River, adjacent to the existing Granny White Pike bridge crossing. Refer to **Exhibit A.6** in **Appendix A** for a location map of Priority Area 5.

The five major sub-watersheds described above and shown on **Exhibits A.2** through **A.6** in **Appendix A** have been divided into a total of 887 sub-basins to account for watershed timing, proper flow distributions, flow confluences, and to provide model comparison points at which to evaluate existing flooding and proposed improvements. These sub-basins represent areas located within City limits, as well as areas that are located outside of City limits but contribute runoff to the study area.

Within the subject study limits, the Little Harpeth River is located within a FEMA Zone AE Special Flood Hazard Area (SFHA; floodway boundaries delineated) as indicated on Flood Insurance Rate Maps (FIRM) Panels:

- 47187C0093G (effective date: December 22, 2016);
- 47187C0089F (effective date: September 29, 2006); and
- 47187C0087F (effective date: September 29, 2006).

While NSI utilized some information from FEMA's FIRMs to establish potential boundary conditions and model calibration data, it should be noted that the hydrologic and hydraulic modeling performed for this Drainage Basin Master Plan are in no way intended to have implications toward the FEMA Flood Insurance Program, determination of flood hazard areas, flood insurance ratings, etc. The type of modeling analyses performed for this study are different in nature and not comparable to those studies performed by FEMA for flood insurance purposes.

Hydraulic Modeling Methodology

EPA's Stormwater Management Model (SWMM) is used worldwide for planning, analysis, and design related to stormwater runoff, open channels, detention ponds, and other drainage systems in both urban and non-urban areas. SWMM is a dynamic unsteady flow hydrologic & hydraulic simulation model. It is used for single event or long-term (continuous) simulation of runoff quantity and quality from urban and/or rural areas. The runoff component operates on a collection of sub-basins that receive precipitation and generate runoff volumes. The flow routing component transports the runoff through a system of pipes, channels, storage facilities, water reservoirs, treatment devices, pumps,

and regulators. A variety of boundary conditions can be utilized in SWMM, which makes it a desirable hydraulic modeling platform.

SWMM reports the quantity (i.e., volume) of runoff calculated for each sub-basin in the form of a timeseries hydrograph. The flow rate, flow depth, and flow velocity in each pipe and channel are also reported for each time step specified during the simulation window.

There are two widely known and accepted versions of SWMM that are available – EPA-SWMM5 and PCSWMM. The latest EPA version is referred to as SWMM5, which is the public domain version of the software. SWMM5 provides an integrated environment for editing study area input data; running hydrologic, hydraulic, and water quality simulations; viewing color-coded drainage area and conveyance system maps, time series graphs, tables, profile plots, and statistical frequency analyses, which are housed within a graphical user interface.

A second version is called PCSWMM, which was used in this study and is commercially available through Computational Hydraulics International, Inc. (CHIwater.com). PCSWMM uses the same computational engine as SWMM5. However, this modeling system has additional enhanced features not available in SWMM5. One particularly advantageous feature is the GIS engine built into the PCSWMM software platform. This feature allows for easy exchange with GIS software, such as ESRI ArcGIS or QGIS, and for importing GIS-based survey data into the model. Additionally, PCSWMM creates an input file that can be opened and executed in the public domain SWMM5, if desired.

Data Acquisition

Data used for the hydrologic/hydraulic analysis of existing conditions was obtained from a variety of sources. Detailed topographic survey was collected by multiple surveying firms: Civil Infrastructure Associates, Wilson & Associates, P.C., and Wiser Consultants, LLC throughout the project area and was provided for use during this analysis. Additionally, Light Detection and Ranging (LiDAR) data collected by the USGS in 2018 was used to supplement the survey data and aid in watershed delineation. A field reconnaissance was performed within the Tier 1 sub-watersheds to inventory the drainage system components, determine their condition, identify maintenance/repair needs, and to collect qualitative and quantitative data used to develop the hydrologic/hydraulic data for input to the computer models developed for this study. Recent aerial photography, obtained from ESRI Maps, was used to supplement information gathered during field reconnaissance efforts and to delineate existing land uses within the study area.

In addition to the topographic survey data described above, the City also supplied available GIS mapping, development plans, master plans, and historical/current citizen complaint information relevant to the project area that was utilized during the watershed study.

Soil data, including hydrologic soil groupings, were obtained in spatial and tabular format from the Natural Resource Conservative Service (NRCS, formerly SCS) Web Soil Survey. This data was used to calculate the runoff Curve Number for hydrologic computations (infiltration rates).

24-hour rainfall depths for various recurrence intervals were obtained from NOAA Atlas 14, the standard repository for precipitation intensity and depth-duration-frequency data.

Drainage System Maintenance Needs

As part of the field inventory, Neel-Schaffer identified and collected information at locations of perceived drainage system maintenance needs. These locations, consisting of channel cleanouts, channel regrading, headwall/structure repairs, bank/channel stabilization, and damaged inlet replacement sites, were provided to the City in a digital geo-database. These maintenance needs were quantified, categorized, and estimated to require $5.5M in costs, based on the assumption that the work would be let out to contractors.

Existing Hydrologic Parameters

For the 887 sub-basins delineated for this study (i.e., total number of sub-basins within Tier 1 study area), the primary hydrologic parameters identified were: drainage area of the sub-basin, length/width of overland flow path, average surface slope, percent of impervious area, roughness of impervious and pervious areas, depth of depression storage within impervious and pervious areas, percent of impervious areas with no depression storage, subarea routing, and infiltration rates (Curve Number).

For the Brentwood Drainage Basin Master Plan Study models, the average surface slope for each sub-basin was calculated using the Digital Elevation Model (DEM) terrain created from LiDAR data. The percent of impervious area for each sub-basin was estimated using aerial photography by delineating and measuring impervious areas. Roughness (Manning's "N") values were estimated from field inspection and by visual inspection of aerial photography for areas not inspected in the field.

The land use data was intersected with soil grouping data using GIS procedures to compute the composite runoff Curve Number for each sub-basin. The runoff Curve Number is an empirical value used to predict infiltration and runoff from rainfall excess. Runoff Curve Numbers within the sub-basins ranged from 47 to 95.

As stated previously, 24-hour rainfall depths for various return periods were obtained from NOAA Atlas 14 and input into the PCSWMM model. An SCS Type II distribution was used to simulate rainfall distribution over a 24-hour duration. **Table 1** presents rainfall depths used for the existing conditions hydrologic analysis for the various recurrence intervals. The evaluation of drainage improvements at points of interest throughout the watersheds were based on the 2-, 5-, 10-, 25-, 50-, and 100-year-24-hour rainfall depths.

Table 1. NOAA Atlas 14 Rainfall Depths (24-hour Duration)

Recurrence Interval (year)	Depth (in)
2	3.55
5	4.62
10	4.95
25	5.82
50	6.52
100	7.25

Existing Conditions Hydrologic and Hydraulic Model Constraints

Synthetic frequency-based design storms were used to generate existing conditions peak flows and hydrographs for each recurrence interval listed above at various design locations and points of interest (junctions) where flooding has been reported. This approach was used since there are no rainfall or streamflow gauge data available within the study area. The frequency design storm assumes, on average, a storm of any given frequency occurring over a drainage basin will produce flooding depths of the same frequency for normal runoff conditions. Normal runoff conditions typically mean there has been no long period of dry conditions or previous rainfall that resulted in the ground being saturated.

Calibration techniques were considered during existing conditions model generation and execution to ensure that the model reproduced observed flooding conditions for frequent events, to the maximum extent practicable. As described above, there are no rainfall or streamflow gauge data available within the study area which could be used to calibrate the model. Additionally, historic flooding depth/elevation data within the study area which could be correlated to a specific storm event was not available for use on this study. Therefore, FEMA effective flowrate and base flood elevation (BFE) data represented the best available information which could potentially be used for model calibration. However, as described in detail in the following section, the available FEMA effective data was not able to be used to calibrate the Tier 1 study models.

Existing Conditions Modeling and Analysis

Topographic survey data provided by Civil Infrastructure Associates, Wilson & Associates, P.C., and Wiser Consultants, LLC was obtained and used in conjunction with available GIS and LiDAR data to model the existing stormwater system. The existing system comprised the points of interest, roadside swales, open channels (streams), inlets, closed storm sewers, driveway culverts, and roadway cross drain culverts. General existing flow patterns can be seen on **Exhibits A.2** through **A.6** in **Appendix A**.

Within the subject study limits, the Little Harpeth River is located within a FEMA Zone AE Special Flood Hazard Area (SFHA; floodway boundaries delineated). According to the

effective Flood Insurance Study (FIS Number 47187CV001D; effective date February 26, 2021), the total drainage area for the Little Harpeth River at a location approximately 0.6 miles upstream of U.S. Highway 431 (Hillsboro Road) is 27.40 square miles, and the 100-year peak discharge is 12,500 cfs. This reference location is approximately 1.55 miles downstream (west) of the western-most Tier 1 modeled outfall location, within Priority Area 4. At this aforementioned outfall location, the total drainage area for the Little Harpeth River is 25.03 square miles (obtained via the USGS StreamStats website), and the 100-year BFE is approximately 628.0 (per FIRM Map Number 47187C0087F).

The Tier 1 study limits encompass a total drainage area of approximately 6.06 square miles, which represents 24% of the total drainage area contributing to the Little Harpeth River at the downstream study limits. In other words, the Little Harpeth River conveys runoff from an additional 18.97 square miles of land south (upstream) of the Tier 1 study limits. Since the Tier 1 study limits lie at the downstream portion of this overall drainage area and represent a small percentage (24%) of the total drainage area (25.03 square miles), discharge of runoff from the study area will likely enter the Little Harpeth River prior to the arrival of the peak discharge and occurrence of the BFE within the Little Harpeth River. Furthermore, calibration of model parameters in an attempt to mimic the FEMA BFEs at the model outfall locations for the 100-year storm event would result in an overestimation of tailwater conditions within the river, which would cause modeled water surface elevations that are higher than actual conditions (due to timing of the watersheds). Therefore, the available FEMA effective data was not used to calibrate the Tier 1 study models.

Rather, standard engineering practice was used to calibrate the existing conditions models to ensure that the models were stable and flow routing continuity errors were generally within ± 0.1%. The calibrated models were validated in order to verify that locations of reported flooding (as received via citizen's complaints) coincided with locations where the model results indicate stormwater network surcharging/ponding. The calibrated hydrologic and hydraulic models were then executed to determine peak discharges and maximum water surface elevations (WSELs) of stormwater runoff for the 2-year (50% annual chance) through 100-year (1% annual chance) storm events at various points of interest throughout the Tier 1 study area.

Upon completion of modeling of existing conditions throughout the Tier 1 watersheds, the TDOT Functional Classification Maps (Functional Classification Maps (tn.gov)) and Williamson County Major Thoroughfare Plan Update Roadway Functional Classification Map (MTP-Classification-Map (williamsoncounty-tn.gov)) were utilized to classify each of roadways within the watersheds as either a local, collector, or arterial roadway. Then, using Table 5 of the City of Brentwood Subdivision Regulations, the design storm event for each roadway classification (10-, 25-, and 50-year storm event for local, collector, and arterial roads, respectively) was determined. Using this information, results of the existing conditions modeling were reviewed and roadway locations flooded by the design storm event were noted. Additionally, locations where the modeling indicated that surveyed/estimated residential or commercial structure elevations are flooded by the 100-

year, 24-hour storm event were also noted. This information was compiled into a tabular format; refer to **Table 2** below for additional information. Also, refer to **Exhibit A.1** in **Appendix A** for a depiction of the aforementioned roadway classifications.

The noted locations of roadway and structure flooding were then designated as candidate project sites, and the existing conditions LOS was determined for all model junctions coinciding with these project sites. The existing depth of flooding above the maximum/critical elevation during the design storm event for each model junction was also tabulated; this maximum flooding depth at each project site was used as a metric to rank the projects. The initial project ranking involved sorting the following types of projects from highest flooding depth above design storm event to lowest:

- Arterial roadways;
- Collector roadways;
- Residential structures;
- Commercial structures;
- All project locations that are either:
    - Subject of a complaint from the 2/17/22 storm event;
    - Included with the City's storm damage survey data; or
    - Represents a project site specifically mentioned by the City during or after project scoping.

The remaining projects, which consist of local roadways only, were then ranked from highest flooding depth above design storm event to lowest and were added to the project list immediately following the initial project rankings described above.

Please refer to **Table 2** for a summary of the candidate project locations which have been identified as part of the aforementioned modeling and analysis, as well as a ranking of these projects. In total, 118 candidate project locations have been identified, where surcharging/flooding exceeds the City's minimum design storm level. Of these, twenty-one (21) locations coincide with residential/commercial properties and ninety-seven (97) locations coincide with roadway crossings/intersections. Several of these project sites coincide with locations of historical and recent citizens' complaints, where property owners have witnessed and/or experienced nuisance/yard and structure flooding during intense storm events.

Table 2 – Candidate Project List: LOS Quantification and Project Ranking Table

Project Site and Point of Interest Information									Existing Conditions						Existing Surcharge Depth Above Critical Elevation During Design Year Event (ft)
Project Priority Ranking	Project Site ID	Project Site Description	POI (Point of Interest) Location Description	POI Type	Critical Elevation Value	Critical Elevation Source *FFE: Finished Floor Elevation LAG: Lowest Adjacent Grade*	Corresponding Junction	Required Minimum Level of Service (Storm Event)	2-Year Max. WSEL at POI (ft.)	5-Year Max. WSEL at POI (ft.)	10-Year Max. WSEL at POI (ft.)	25-Year Max. WSEL at POI (ft.)	50-Year Max. WSEL at POI (ft.)	100-Year Max. WSEL at POI (ft.)	
1	PA1-001	Wilson Pike Circle / Peach Ct *(Subject of complaint from 2/17/22 storm event)*	Roadway Overtopping on Wilson Pike Circle (headwall upstream of roadway)	Collector Roadway	705.80	Roadway Overtopping Elev. Estimated from LiDAR	HW_11_244	25	702.27	704.03	704.43	705.30	705.86	706.04	0.00
			Headwall Overtopping on downstream side of Wilson Pike Circle - once headwall is overtopped, surcharged flow conveys towards office building (surveyed FFE = 698.74)	Commercial Structure	700.18	Surveyed Headwall Elev.	HW_11_243	100	699.71	700.27	700.37	700.82	701.63	702.68	2.50
			Parking area west of Commercial Building		698.74	Surveyed FFE	PO_Peach_Ct	100	698.10	698.76	699.19	700.42	701.51	702.62	3.88
			Model node within channel - once channel is overtopped, surcharged flow conveys towards office building (surveyed FFE = 698.74)		700.48	Surveyed FFE	J44	100	698.36	699.05	699.36	700.50	701.56	702.64	2.16
			Upstream side of RCBC - once channel is overtopped, surcharged flow conveys towards office building (surveyed FFE = 698.74)		698.74	Surveyed FFE	HW_11_245	100	698.12	698.90	699.33	700.50	701.55	702.64	3.90
			Footbridge downstream of Peach Ct RCBC. Inverts and dimensions taken from field measurements. Not surveyed.		698.58	Weir Overtopping Elev. Estimated from LiDAR	2573	100	697.23	698.40	698.96	700.30	701.45	702.57	3.99
			Upstream railroad HW node downstream of Peach Ct	Railroad	698.74	Railroad Overtopping Elev. Estimated from LiDAR	1313	100	696.50	698.23	698.89	700.29	701.44	702.56	3.82
2	PA2-001	828 Princeton Hills Dr *(Included within City storm damage survey data)*	828 Princeton Hills Dr	Residential Structure	731.00	LAG Estimated from LiDAR	2167	100	742.16	742.19	742.20	742.23	742.25	742.23	11.23
3	PA1-002	9032 Meadowlawn Dr *(Included within City storm damage survey data)*	Equipment pad flooding at 9032 Meadowlawn Dr. (when flow overtops banks of adjacent channel, it conveys towards residence)	Residential Structure	739.33	Surveyed HVAC. FFE=741.93	J39	100	746.73	746.93	746.97	747.08	747.16	747.23	7.90
					739.33	Surveyed HVAC. FFE=741.93	J60	100	743.25	743.44	743.49	743.60	743.68	743.75	4.42
					739.33	Surveyed HVAC. FFE=741.93	J40	100	741.58	741.76	741.80	741.87	741.93	741.98	2.65
					739.33	Surveyed HVAC. FFE=741.93	J59	100	739.38	739.38	739.38	739.38	739.38	739.38	0.05
					739.33	Surveyed HVAC. FFE=741.93	J61	100	738.27	738.50	738.54	738.63	738.68	738.73	0.00
4	PA3-001	5212 Williamsburg Ct *(Included within City storm damage survey data)*	5212 Williamsburg Ct	Residential Structure	668.58	Surveyed LAG Elevation	2162	100	674.69	674.74	674.75	674.78	674.80	674.82	6.24
5	PA2-002	5165 Remington Dr *(Included within City storm damage survey data)*	5165 Remington Dr	Residential Structure	689.95	Surveyed Garage FFE	852	100	687.55	688.77	690.05	693.08	694.32	694.55	4.60
6	PA2-003	Residential Structures on Post Oak Circle and Old Orchard Rd *(Included within City storm damage survey data)*	651 Post Oak Circle	Residential Structure	643.23	Surveyed Garage FFE	HW_12_113	100	642.24	643.21	643.37	643.71	643.95	644.15	0.92
			692 Old Orchard Rd		650.92	LAG Estimated from LiDAR	CB_12_361		648.42	650.70	651.30	651.56	651.72	651.88	0.96
			680 Old Orchard Rd		648.36	Surveyed Crawl Space Elevation	2146		650.06	651.14	651.36	651.82	652.16	652.41	4.05
					656.40	Surveyed FFE	2146		650.06	651.14	651.36	651.82	652.16	652.41	0.00
			649 Post Oak Circle		649.99	Surveyed Garage FFE	J7		653.61	653.73	653.75	653.80	653.83	653.86	3.87
			651 Post Oak Circle		643.23	Surveyed Garage FFE	HW_12_113		642.24	643.21	643.37	643.71	643.95	644.15	0.92
7	PA1-003	Williamsburg Circle / 206 Williamsburg Circle (downstream of Maryland Park) *(Included within City storm damage survey data)*	206 Williamsburg Circle	Residential Structure	701.87	Surveyed LFE Garage	HW_11_226	100	703.71	704.51	704.70	705.04	705.28	705.55	3.68
					701.87	Surveyed LFE Garage	J3	100	703.58	704.34	704.52	704.86	705.11	705.39	3.52
					703.10	Weir Overtopping Elev. Estimated from LiDAR	HW_11_227	100	703.56	704.31	704.49	704.84	705.09	705.37	2.27
					701.87	Surveyed LFE Garage	HW_11_228	100	702.09	702.96	703.11	703.36	703.52	703.69	1.82
					701.87	Surveyed LFE Garage	J24	100	701.91	702.81	702.95	703.18	703.33	703.48	1.61
			Williamsburg Circle, near 206 Williamsburg	Local Residential Roadway	702.28	Roadway Overtopping Elev. Estimated from LiDAR	HW_11_44	10	701.83	702.75	702.88	703.09	703.23	703.37	0.60
8	PA1-004	Wilson Pike near Karen Ct *(Subject of complaint from 2/17/22 storm event)*	Roadway Overtopping on Wilson Pike	Arterial Roadway	706.65	Roadway Overtopping Elev. Estimated from LiDAR	HW_11_77	50	705.44	706.99	707.13	708.31	709.40	710.44	2.75
					708.02	Roadway Overtopping Elev. Estimated from LiDAR	1325	50	706.50	707.39	707.88	708.39	709.40	710.44	1.38
					719.47	Roadway Overtopping Elev. Estimated from LiDAR	HW_11_88	50	719.83	720.35	720.44	720.65	720.81	720.97	1.34
9	PA1-005	Wilson Pike @ Church St (east of I-65)	Existing Storm Sewer System	Arterial Roadway	747.83	Surveyed overtopping Elev.	PO_5	50	749.01	749.62	749.75	750.09	750.30	750.39	2.47
					757.63	Weir Overtopping Elev. Estimated from LiDAR	HW_11_320	50	758.10	758.34	758.40	758.48	758.70	758.91	1.07
					757.02	Rim Elev. Estimated from LiDAR	CB_11_1034	50	757.63	757.79	757.83	757.93	758.01	758.07	0.99
					762.75	Rim Elev. Estimated from LiDAR	CB_11_357	50	763.40	763.63	763.70	763.86	763.99	764.09	1.24
10	PA3-002	Granny White Pike from 316 Granny White Pike to Little Harpeth River	Inlet on Granny White Pike	Arterial Roadway	644.58	Grate Elevation at Inlet estimated from Lidar	CB_12_744	50	643.40	646.90	646.93	646.99	647.03	647.07	2.45
					642.18	Grate Elevation at Inlet estimated from Lidar	CB_12_742	50	640.86	642.32	642.39	642.43	642.46	642.47	0.28
					637.18	Grate Elevation at Inlet estimated from Lidar	CB_12_740	50	637.32	637.46	637.50	637.57	637.62	637.67	0.44
					636.76	Grate Elevation at Inlet estimated from Lidar	CB_12_737	50	636.26	636.47	636.51	636.61	636.66	636.77	0.00
					634.94	Grate Elevation at Inlet estimated from Lidar	CB_12_734	50	634.86	635.02	635.03	635.05	635.06	635.08	0.12
					634.18	Grate Elevation at Inlet estimated from Lidar	CB_12_732	50	634.01	634.39	634.43	634.50	634.55	634.59	0.37
					631.72	Grate Elevation at Inlet estimated from Lidar	CB_12_731	50	631.15	632.56	632.72	632.72	632.72	632.72	1.00
					631.58	Grate Elevation at Inlet estimated from Lidar	CB_12_731	50	631.15	632.56	632.72	632.72	632.72	632.72	1.14
					632.94	Grate Elevation at Inlet estimated from Lidar	CB_12_727	50	629.34	630.81	631.02	631.12	631.19	631.26	0.00

LEGEND:

XXX.XX Indicates that the Max. WSEL at the POI exceeds the Critical Elevation at said POI.

XXX.XX Improvement Projects with Associated Residential Benefits.

XXX.XX Improvement Projects Providing Roadway Benefits Only.

Table 2 – Candidate Project List: LOS Quantification and Project Ranking Table (cont.)

Project Site and Point of Interest Information									Existing Conditions						Existing Surcharge Depth Above Critical Elevation During Design Year Event (ft)
Project Priority Ranking	Project Site ID	Project Site Description	POI (Point of Interest) Location Description	POI Type	Critical Elevation Value	Critical Elevation Source *FFE: Finished Floor Elevation LAG: Lowest Adjacent Grade*	Corresponding Junction	Required Minimum Level of Service (Storm Event)	2-Year Max. WSEL at POI (ft.)	5-Year Max. WSEL at POI (ft.)	10-Year Max. WSEL at POI (ft.)	25-Year Max. WSEL at POI (ft.)	50-Year Max. WSEL at POI (ft.)	100-Year Max. WSEL at POI (ft.)	
11	PA1-006	Williamsburg Circle / 219 & 220 Williamsburg Circle *(Subject of complaint from 2/17/22 storm event)*	Pond Outlet Upstream of 219 Williamsburg Circle	Residential Structure	697.36	Weir Overtopping Elev. Estimated from LiDAR	PO_92	100	697.37	697.61	697.67	697.81	697.91	698.01	0.65
			Pond Outlet Upstream of 219 Williamsburg Circle		696.00	Weir Overtopping Elev. Estimated from LiDAR	HW_11_299	100	695.96	696.20	696.22	696.28	696.30	696.32	0.32
			220 Williamsburg Circle		692.03	Surveyed LFE Garage	J50	100	692.55	692.72	692.77	692.85	692.91	692.97	0.94
					692.03	Surveyed LFE Garage	J27	100	690.97	691.71	692.01	692.56	692.76	692.88	0.85
			Overtopping on Williamsburg Circle, near 219 Williamsburg	Local Residential Roadway	692.34	Roadway Overtopping Elev. Estimated from LiDAR	HW_11_39	10	690.58	691.68	692.02	692.58	692.77	692.88	0.00
			219 Williamsburg Circle	Residential Structure	687.38	Surveyed LFE Garage	HW_11_40	100	688.29	688.48	688.52	688.84	689.36	689.79	2.41
					687.38	Surveyed LFE Garage	J26	100	687.74	688.17	688.30	688.80	689.35	689.78	2.40
					687.38	Surveyed LFE Garage	2174	100	687.70	688.14	688.27	688.78	689.34	689.78	2.40
			Overtopping on Williamsburg Rd, near 5015 Williamsburg Rd	Local Residential Roadway	689.12	Roadway Overtopping Elev. Estimated from LiDAR	HW_11_45	10	686.34	687.66	688.04	688.73	689.30	689.74	0.00
12	PA3-003	Maryland Way east of Continental Pl	Maryland Way east of Continental Pl	Arterial Roadway	696.99	Surveyed Grate Elevation at Inlet	2577	50	698.32	698.56	698.65	698.90	699.08	699.16	2.09
13	PA1-007	Meadowlawn Dr / 9020 & 9022 Meadowlawn Dr *(City-requested project location)*	Roadway Overtopping on Meadowlawn Dr	Local Residential Roadway	722.36	Roadway Overtopping Elev. Estimated from LiDAR	HW_11_114	10	722.50	722.54	722.55	722.59	722.61	722.64	0.19
					721.27	Roadway Overtopping Elev. Estimated from LiDAR	1327	10	721.31	721.32	721.32	721.32	721.33	721.33	0.05
			9020 & 9022 Meadowlawn Dr	Residential Structure	720.58	Surveyed HVAC	J43	100	719.68	719.69	719.69	719.69	719.70	719.70	0.00
					720.58	Surveyed HVAC	J62	100	719.28	719.29	719.29	719.30	719.32	719.53	0.00
					721.39	Surveyed LFE Garage	J62	100	719.28	719.29	719.29	719.30	719.32	719.53	0.00
					723.33	Surveyed FFE	J62	100	719.28	719.29	719.29	719.30	719.32	719.53	0.00
					717.71	Surveyed HVAC	J4	100	718.55	718.78	718.87	719.13	719.34	719.56	1.85
					719.03	Surveyed LFE Garage	J4	100	718.55	718.78	718.87	719.13	719.34	719.56	0.53
					721.14	Surveyed FFE	J4	100	718.55	718.78	718.87	719.13	719.34	719.56	0.00
14	PA3-004	Maryland Way from Brentwood Blvd to Ward Circle	Inlet on Maryland Way	Arterial Roadway	713.07	Grate Elevation at Inlet estimated from Lidar	CB_11_618	50	713.64	713.68	713.70	713.74	713.77	713.80	0.70
			Gutter on Maryland Way		715.00	Curb/Gutter Elevation estimated from Lidar	J17	50	715.30	715.32	715.33	715.39	715.42	715.44	0.42
					710.80	Curb/Gutter Elevation estimated from Lidar	J_11_36	50	711.29	711.34	711.35	711.40	711.42	711.45	0.62
					707.14	Curb/Gutter Elevation estimated from Lidar	J_11_28	50	707.79	707.89	707.91	707.95	707.95	707.95	0.81
					704.41	Curb/Gutter Elevation estimated from Lidar	J_11_23	50	706.15	706.15	706.15	706.15	706.15	706.15	1.74
					704.96	Curb/Gutter Elevation estimated from Lidar	J_11_24	50	705.99	706.00	706.00	706.00	706.00	706.00	1.04
					703.47	Curb/Gutter Elevation estimated from Lidar	J_11_26	50	704.41	704.44	704.44	704.45	704.46	704.46	0.99
			Inlet on Maryland Way	Arterial Roadway	702.78	Surveyed Grate Elevation at Inlet	J_11_27	50	703.89	703.92	703.93	703.94	703.95	703.96	1.17
15	PA4-001	Partridge Ct / 6200 Partridge Ct. *(Included within City storm damage survey data)*	6200 Partridge Ct	Residential Structure	659.13	Surveyed HVAC Elev.	CB_12_44	100	657.94	658.22	658.32	659.89	660.60	660.77	1.64
					665.55	Surveyed FFE Backdoor	CB_12_44	100	657.94	658.22	658.32	659.89	660.60	660.77	0.00
			Partridge Ct	Local Residential Roadway	665.64	Roadway Overtopping Elev. Estimated from Lidar	CB_12_29	10	665.46	665.98	666.03	666.22	666.37	666.52	0.39
					665.74	Weir Crest esimated from LiDAR	CB_12_30	10	665.41	665.97	666.01	666.20	666.34	666.48	0.27
					671.00	Roadway Overtopping Elev. Estimated from Lidar	CB_12_45	10	668.65	670.15	671.15	671.34	671.41	671.47	0.15
					670.58	Roadway Overtopping Elev. Estimated from Lidar	CB_12_46	10	667.78	669.29	670.22	670.52	670.56	670.60	0.00
16	PA3-005	Maryland Way at Bancorp	Maryland Way at Bancorp	Arterial Roadway	690.31	Surveyed Grate Elevation at Inlet	CB_12_529	50	691.59	691.77	691.83	691.91	691.95	691.99	1.64
17	PA1-008	Wilson Pike @ Church St (west of I-65)	Existing Storm Sewer System	Arterial Roadway	731.19	Roadway Overtopping Elev. Estimated from LiDAR	CB_11_946	50	731.77	732.30	732.40	732.63	732.83	733.03	1.64
					729.74	Roadway Overtopping Elev. Estimated from LiDAR	CB_11_971	50	727.05	730.07	730.19	730.43	730.65	730.84	0.91
					726.13	Roadway Overtopping Elev. Estimated from LiDAR	CB_11_968	50	722.38	726.39	726.54	726.78	726.97	727.13	0.84
					719.21	Roadway Overtopping Elev. Estimated from LiDAR	CB_11_1233	50	718.30	719.75	720.03	720.49	720.82	721.12	1.61
					726.59	Roadway Overtopping Elev. Estimated from LiDAR	1438	50	723.40	726.69	726.80	726.92	727.07	727.22	0.48
18	PA3-006	Maryland Way at Maryland Commons Dr / Ward Circle	Maryland Way at Maryland Commons Dr/Ward Circle	Arterial Roadway	699.20	Surveyed Gutter Elevation	J14	50	699.19	699.26	699.27	699.31	699.34	699.37	0.14
			Ward Circle at Maryland Way	Arterial Roadway	696.76	Grate Elevation at Inlet estimated from Lidar	CB_11_598	50	698.08	698.24	698.27	698.35	698.37	698.37	1.61
19	PA4-002	Belle Rive Drive between Dekemont Lane and Abbey Court	Roadway Overtopping - impacts adjacent residence	Collector Roadway	640.72	Roadway Overtopping Elev. Estimated from Lidar	CB_12_487	25	641.47	641.93	641.95	642.24	642.44	642.63	1.52
					641.40	Spillway Crest esimated from LiDAR	CB_12_488	25	641.30	641.68	641.70	641.86	641.96	642.05	0.46
20	PA4-003	Grand Oaks Dr @ Shadow Ridge Ct *(City-requested project location)*	Inlet at Intersection	Local Residential Roadway	713.87	Surveyed Rim Elevation	CB_12_400	10	714.17	714.91	715.02	715.34	715.56	715.76	1.15
					713.70	Rim Elevation estimated from LiDAR	CB_12_399	10	714.59	715.09	715.17	715.45	715.64	715.82	1.47
					731.65	Surveyed Rim Elevation	CB_12_90	10	728.42	731.04	731.75	732.00	732.10	732.18	0.10
21	PA2-004	Murray Ln Storm Sewer System, in front of Brentwood High School	Inlet on Murray Lane (westbound)	Arterial Roadway	679.10	Grate Elevation at Inlet Estimated from LiDAR	CB_28_68	50	676.50	679.17	679.22	679.35	679.41	679.46	0.31
			Inlets on Murray Lane (eastbound)		677.00	Grate Elevation at Inlet Estimated from LiDAR	CB_28_67	50	673.24	673.66	673.89	676.87	677.13	677.14	0.13
					668.50	Grate Elevation at Inlet Estimated from LiDAR	CB_28_59	50	668.43	668.64	668.67	668.74	668.80	668.86	0.30
					665.06	Grate Elevation at Inlet Estimated from LiDAR	CB_28_58	50	663.43	665.68	665.77	665.96	666.52	666.93	1.46
22	PA3-007	302/304 Arnold Rd *(Included within City storm damage survey data)*	302/304 Arnold Rd (Swale)	Residential Structure	672.44	Surveyed Crawl Space Entry	3009	100	673.27	673.38	673.45	673.63	673.73	673.85	1.41
23	PA3-008	306/308 Arnold Rd *(Included within City storm damage survey data)*	306/308 Arnold Rd (Swale)	Residential Structure	668.77	Surveyed FFE Garage	3010	100	670.06	670.09	670.10	670.12	670.14	670.16	1.39

LEGEND:
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XXX.XX Improvement Projects with Associated Residential Benefits.
XXX.XX Improvement Projects Providing Roadway Benefits Only.

Table 2 – Candidate Project List: LOS Quantification and Project Ranking Table (cont.)

Project Site and Point of Interest Information									Existing Conditions						Existing Surcharge Depth Above Critical Elevation During Design Year Event (ft)
Project Priority Ranking	Project Site ID	Project Site Description	POI (Point of Interest) Location Description	POI Type	Critical Elevation Value	Critical Elevation Source *FFE: Finished Floor Elevation LAG: Lowest Adjacent Grade*	Corresponding Junction	Required Minimum Level of Service (Storm Event)	2-Year Max. WSEL at POI (ft.)	5-Year Max. WSEL at POI (ft.)	10-Year Max. WSEL at POI (ft.)	25-Year Max. WSEL at POI (ft.)	50-Year Max. WSEL at POI (ft.)	100-Year Max. WSEL at POI (ft.)	
24	PA2-005	Murray Ln, east of Good Springs Rd	Headwall on Murray Lane (eastbound)	Arterial Roadway	663.80	Surveyed Headwall Elevation	HW_28_41	50	664.23	664.51	664.56	664.66	664.73	664.80	0.00
			Inlet on Murray Lane (eastbound)		663.24	Surveyed Inlet Grate Elevation	CB_28_256	50	664.02	664.40	664.45	664.55	664.63	664.68	1.39
			Headwall on Murray Lane (westbound)		665.25	Surveyed Headwall Elevation	HW_28_34	50	661.56	661.75	661.82	661.98	662.35	662.57	0.00
			Inlet on Murray Lane (westbound)		661.50	Surveyed Inlet Grate Elevation	CB_28_53	50	660.35	660.49	660.53	660.64	661.06	661.94	0.00
25	PA1-009	Maryland Way near HG Hill Property *(City-requested project location)*	Inlets on Maryland Way	Arterial Roadway	717.86	Surveyed Rim Elevation	CB_11_963	50	715.25	715.76	716.05	718.25	719.10	719.64	1.24
					718.24	Surveyed Rim Elevation	CB_11_964	50	716.89	718.36	718.39	718.47	719.08	719.62	0.84
					717.02	Surveyed Rim Elevation	CB_11_619	50	713.13	713.13	713.13	713.46	713.74	714.15	0.00
					717.71	Surveyed Rim Elevation	CB_11_620	50	716.08	717.36	717.44	717.62	717.83	717.91	0.12
			Headwall Outlet into Maryland Park	Arterial Roadway	718.40	Surveyed Rim Elevation	HW_11_225	50	712.36	712.93	713.09	713.46	713.77	714.06	0.00
			Roadway Overtopping on Maryland Way	Arterial Roadway	706.92	Weir Overtopping Elev. Estimated from LiDAR	HW_11_414	50	706.89	707.38	707.47	707.63	707.75	707.87	0.83
26	PA3-009	Dyer Lake *(City-requested project location)*	Dyer Lake - Spillway Crest	Natural Lake	646.60	Spillway Crest estimated from Lidar	HW_12_149	100	646.88	647.08	647.16	647.36	647.52	647.68	1.08
27	PA5-001	Belle Rive Dr @ Granny White Pike	Roadway Overtopping on Belle Rive Dr	Collector Roadway	633.32	Weir Overtopping Elev. Estimated from LiDAR	HW_12_378	25	631.55	632.83	633.19	634.36	634.86	635.34	1.04
			Inlets on Belle Rive Dr		632.90	Surveyed Rim Elev.	CB_12_713	25	631.39	632.52	632.82	633.90	634.35	634.77	1.00
					632.74	Surveyed Rim Elev.	CB_12_716	25	631.31	632.25	632.49	633.42	633.81	634.20	0.68
28	PA2-006	5145 Remington Dr *(Included within City storm damage survey data)*	5145 Remington Dr	Residential Structure	676.17	Surveyed Garage FFE	HW_28_124	100	676.18	676.57	676.65	676.86	677.01	677.19	1.02
29	PA4-004	Belle Rive Dr @ Martingale Ln	Intersection Roadway Overtopping	Collector Roadway	635.75	Roadway Overtopping Elev. Estimated from Lidar	CB_12_68	25	634.93	636.10	636.33	636.73	636.88	637.02	0.98
					635.94	Roadway Overtopping Elev. Estimated from Lidar	CB_12_492	25	634.73	636.09	636.33	636.73	636.88	637.03	0.79
					636.45	Weir Crest esimated from LiDAR	J1	25	635.71	635.99	636.28	636.66	636.79	636.90	0.21
30	PA1-010	Meadow Lake Road between Robinhood Road and Franklin Road	Roadway Overtopping on Meadow Lake Rd	Local Residential Roadway	671.18	Roadway Overtopping Elev. Estimated from LiDAR	1288	10	671.31	671.55	671.62	671.79	671.92	672.05	0.44
31	PA1-011	Church Street, near 7028 Church St	Roadway Overtopping at Church St	Arterial Roadway	727.01	Weir Overtopping Elev. Estimated from LiDAR	CB_11_955	50	726.42	727.08	727.33	727.84	727.93	728.00	0.92
					727.30	Weir Overtopping Elev. Estimated from LiDAR	1408	50	721.16	721.23	721.27	721.36	721.48	721.63	0.00
32	PA1-012	400 Centerview Dr *(Subject of complaint from 2/17/22 storm event)*	400 Centerview Dr UG detention entrace	Local Residential Roadway	696.50	Elevation taken from plans	1307	10	693.09	694.47	695.22	696.66	697.21	697.66	0.00
			400 Centerview Footbridge		692.59	Weir Overtopping Elev. Estimated from LiDAR	2575	10	691.47	692.84	693.43	694.46	694.91	695.31	0.84
			400 Centerview Dr crossing		693.15	Roadway Overtopping Elev. Estimated from LiDAR	HW_11_284	10	690.88	692.10	692.73	693.68	694.05	694.36	0.00
					691.81	Weir Overtopping Elev. Estimated from LiDAR	CB_11_864	10	690.60	691.72	692.04	692.73	693.15	693.67	0.23
					693.00	Weir Overtopping Elev. Estimated from LiDAR	HW_11_287	10	690.82	691.83	692.19	693.22	693.51	693.73	0.00
33	PA5-002	Granny White Pike, from Brentwood Middle School to McGavock Rd	Inlets on Granny White Pike	Arterial Roadway	670.78	Surveyed Rim Elevation	CB_12_683	50	670.71	670.93	670.96	671.01	671.05	671.09	0.27
					638.99	Surveyed Rim Elevation	CB_12_700	50	639.19	639.36	639.41	639.52	639.60	639.67	0.61
			Overtopping of Granny White Pike		633.09	Roadway Overtopping Elev. Estimated from LiDAR	CB_12_719	50	630.23	633.29	633.41	633.62	633.92	634.26	0.83
34	PA2-007	5208 Colfax Ct *(Included within City storm damage survey data)*	5208 Colfax Ct	Residential Structure	692.00	LAG Estimated from LiDAR	2141	100	691.81	692.21	692.30	692.51	692.65	692.79	0.79
35	PA3-010	Meadow Lake Subdivision Meadow Lake Rd @ Dyer Ln *(City-requested project location)*	Intersection of Meadow Lake Rd @ Dyer Ln	Local Residential Roadway	665.60	Road Elev. Estimated from Lidar	HW_12_136	10	665.22	666.31	666.37	666.50	666.60	666.70	0.77
36	PA4-005	Belle Rive Dr Cross Drain @ Waxwood Dr	Roadway / Driveway Culvert Overtopping	Collector Roadway	643.36	Roadway Overtopping Elev. Estimated from Lidar	HW_12_72	25	641.42	642.16	642.60	643.38	643.74	644.02	0.02
					643.07	Driveway Culvert Overtopping Elev. Estimated from Lidar	903	25	643.33	643.46	643.50	643.59	643.66	643.73	0.52
					643.36	Roadway Overtopping Elev. Estimated from Lidar	HW_12_73	25	639.10	639.31	639.39	639.60	639.75	639.88	0.00
					648.61	Driveway Culvert Overtopping Elev. Estimated from Lidar	907	25	648.81	648.93	648.96	649.05	649.11	649.17	0.44
					646.33	Driveway Culvert Overtopping Elev. Estimated from Lidar	905	25	646.53	646.65	646.69	646.77	646.84	646.90	0.44
					638.37	Driveway Culvert Overtopping Elev. Estimated from Lidar	900	25	638.44	638.72	638.82	639.08	639.26	639.43	0.71
37	PA2-008	Detention Pond behind Brentwood High School *(City-requested project location)*	Overtopping of Banks at Detention Pond	Existing Pond	658.21	Surveyed Embankment Elevation	PO_284	100	658.53	658.65	658.69	658.77	658.84	658.91	0.70
38	PA2-009	McGavock Rd between Post Oak Circle and Good Springs Rd *(City-requested project location)*	Roadway Overtopping on McGavock Road	Local Residential Roadway	642.88	Surveyed Roadway Overtopping Elevation	HW_12_138	10	641.91	643.34	643.50	643.86	644.13	644.34	0.62
							HW_12_139		640.62	641.18	641.23	641.40	641.46	641.51	0.00
39	PA4-006	Bel Air Pl & Turtle Creek Dr *(City-requested project location)*	509 Turtle Creek Dr	Residential Structure	669.35	Surveyed FFE Garage	J4	100	669.88	669.89	669.90	669.91	669.93	669.95	0.60
			Roadway Inlet	Local Residential Roadway	672.56	Surveyed Rim Elevation	CB_12_36	10	670.71	671.06	671.24	672.67	672.76	672.83	0.00
			Upstream Headwall	Local Residential Roadway	696.25	Weir Crest estimated from Lidar	HW_12_58	10	693.66	694.71	695.33	696.58	696.74	696.89	0.00
40	PA3-011	5306 Williamsburg Rd *(Subject of complaint from 2/17/22 storm event)*	5306 Williamsburg Rd	Residential Structure	643.82	Surveyed LAG Elevation	J4	100	643.92	644.14	644.20	644.32	644.37	644.42	0.60
41	PA4-007	Belle Rive Dr Cross Drain and Driveway Culverts near 6219 Belle Rive Dr	Roadway Overtopping	Collector Roadway	629.20	Roadway Overtopping Elev. Estimated from Lidar	914	25	629.39	629.62	629.68	629.79	629.90	630.01	0.59
					628.89	Roadway Overtopping Elev. Estimated from Lidar	917	25	627.75	628.95	629.19	629.42	629.55	629.52	0.53
					628.89	Roadway Overtopping Elev. Estimated from Lidar	HW_12_61	25	627.50	628.63	628.83	629.07	629.29	629.45	0.18
42	PA3-012	Meadow Lake Subdivision Meadow Lake Rd west of Dyer Ln *(City-requested project location)*	Meadow Lake Rd west of Dyer Lane	Local Residential Roadway	658.13	Surveyed Roadway Overtopping Elevation	HW_12_327	10	657.57	658.54	658.65	658.85	658.97	659.09	0.52
43	PA2-010	Murray Ln, west of Franklin Rd	Inlet on Murray Ln (westbound)	Arterial Roadway	665.14	Grate Elevation at Inlet Estimated from LiDAR	CB_29_25	50	662.27	664.30	665.20	665.48	665.63	665.78	0.49

LEGEND:
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XXX.XX Improvement Projects with Associated Residential Benefits.
XXX.XX Improvement Projects Providing Roadway Benefits Only.

Table 2 – Candidate Project List: LOS Quantification and Project Ranking Table (cont.)

Project Site and Point of Interest Information									Existing Conditions						Existing Surcharge Depth Above Critical Elevation During Design Year Event (ft)
Project Priority Ranking	Project Site ID	Project Site Description	POI (Point of Interest) Location Description	POI Type	Critical Elevation Value	Critical Elevation Source *FFE: Finished Floor Elevation LAG: Lowest Adjacent Grade*	Corresponding Junction	Required Minimum Level of Service (Storm Event)	2-Year Max. WSEL at POI (ft.)	5-Year Max. WSEL at POI (ft.)	10-Year Max. WSEL at POI (ft.)	25-Year Max. WSEL at POI (ft.)	50-Year Max. WSEL at POI (ft.)	100-Year Max. WSEL at POI (ft.)	
44	PA4-008	Belle Rive Dr @ Turtle Creek Dr *(City-requested project location)*	Intersection Roadway Overtopping	Collector Roadway	632.41	Roadway Overtopping Elev. Estimated from Lidar	CB_12_23	25	631.55	632.35	632.45	632.61	632.71	632.80	0.20
			Inlet at Intersection	Collector Roadway	632.91	Surveyed Rim Elevation	935	25	632.52	633.20	633.23	633.27	633.30	633.34	0.36
			Intersection Roadway Overtopping	Collector Roadway	630.78	Roadway Overtopping Elev. Estimated from Lidar	HW_12_46	25	631.09	631.13	631.13	631.12	631.21	631.33	0.34
			Intersection Roadway Overtopping	Collector Roadway	633.69	Roadway Overtopping Elev. Estimated from Lidar	HW_12_69	25	632.73	633.70	633.78	633.91	634.00	634.09	0.22
			Inlet at Intersection	Collector Roadway	658.29	City Rim Elevation	CB_12_392	25	657.19	658.34	658.35	658.38	658.39	658.41	0.09
45	PA1-013	Wilson Pike Circle, north of Church St	Roadway Overtopping on Wilson Pike Circle	Collector Roadway	736.40	Rim Elev. Estimated from LiDAR	CB_11_725	25	736.47	736.52	736.54	736.58	736.61	736.64	0.18
					734.68	Weir Overtopping Elev. Estimated from LiDAR	J56	25	734.86	734.96	734.98	735.02	735.05	735.08	0.34
					727.30	Weir Overtopping Elev. Estimated from LiDAR	CB_11_954	25	723.01	723.39	723.48	723.80	724.93	725.93	0.00
					736.89	Weir Overtopping Elev. Estimated from LiDAR	CB_11_731	25	734.99	735.80	736.06	736.99	737.04	737.09	0.10
					736.95	Weir Overtopping Elev. Estimated from LiDAR	CB_11_729	25	734.94	735.65	735.89	736.92	737.09	737.19	0.00
46	PA1-014	Seward Rd / Meadow Lake Rd / 312 Seward Rd *(City-requested project location)*	312 Seward Rd	Residential Structure	671.94	Surveyed FFE	J31	100	670.39	670.63	670.82	671.14	671.31	671.50	0.00
					671.94	Surveyed FFE	J32	100	670.25	670.57	670.77	671.09	671.24	671.41	0.00
					671.94	Surveyed FFE	J33	100	668.99	669.42	669.71	670.22	670.44	670.67	0.00
			Roadway Overtopping on Meadow Lake Rd near 5014 Meadow Lake rd	Local Residential Roadway	669.75	Roadway Overtopping Elev. Estimated from LiDAR	J34	10	668.49	669.34	669.66	670.18	670.40	670.63	0.00
					669.75	Roadway Overtopping Elev. Estimated from LiDAR	1272	10	668.47	669.33	669.65	670.17	670.39	670.61	0.00
			Roadway Overtopping on Seward Rd @ Meadow Lake Rd	Local Residential Roadway	669.93	Roadway Overtopping Elev. Estimated from LiDAR	HW_11_21	10	670.13	670.23	670.26	670.33	670.44	670.71	0.33
47	PA3-013	Brentwood Blvd north of Juris Ln	Inlet on Brentwood Blvd north of Juris Ln	Collector Roadway	727.50	Grate Elevation at Inlet estimated from Lidar	CB_11_654	25	727.72	727.78	727.79	727.82	727.86	727.89	0.32
48	PA1-015	YMCA / 5100 Williamsburg Rd *(Included within City storm damage survey data)*	YMCA	Private Roadway	694.37	Roadway Overtopping Elev. Estimated from LiDAR	1389	10	694.60	694.70	694.73	694.81	694.87	694.93	0.36
					696.47	Roadway Overtopping Elev. Estimated from LiDAR	1387	10	694.27	694.69	694.80	695.09	695.31	695.52	0.00
			5100 Williamsburg Rd	Residential Structure	688.30	Surveyed HVAC	J25	100	686.44	686.80	686.91	687.19	687.41	687.65	0.00
			Overtopping on Williamsburg Rd, near 5100 Williamsburg Rd	Local Residential Roadway	687.71	Roadway Overtopping Elev. Estimated from LiDAR	1278	10	686.44	686.80	686.91	687.19	687.41	687.65	0.00
49	PA4-009	Belle Rive Dr near 6012 Belle Rive Dr	Roadway Overtopping	Collector Roadway	638.57	Rim Elevation estimated from LiDAR	CB_12_121	25	638.66	638.75	638.78	638.83	638.87	638.91	0.26
					638.46	Rim Elevation estimated from LiDAR	CB_12_496	25	638.51	638.55	638.55	638.57	638.59	638.60	0.11
50	PA3-014	Maryland Way at 5320 Maryland Way	Inlet on Maryland Way	Arterial Roadway	695.44	Grate Elevation at Inlet estimated from Lidar	CB_12_817	50	695.56	695.61	695.62	695.66	695.68	695.71	0.24
51	PA1-016	Wilson Pike Circle, near 246 Wilson Pike Circle	Roadway Overtopping on Wilson Pike Circle	Collector Roadway	719.72	Roadway Overtopping Elev. Estimated from LiDAR	CB_11_786	25	719.74	719.84	719.87	719.94	720.01	720.05	0.22
52	PA4-010	Belle Rive Dr Cross Drain near 6203 Belle Rive Dr	Roadway Overtopping	Collector Roadway	639.72	Roadway Overtopping Elev. Estimated from Lidar	HW_12_67	25	637.47	638.50	638.79	639.47	639.94	640.21	0.00
					639.44	Roadway Overtopping Elev. Estimated from Lidar	HW_12_68	25	638.26	638.77	639.08	639.55	639.61	639.67	0.11
53	PA5-003	Granny White Park, north of Brentwood Middle School *(City-requested project location)*	Overtopping of Park Entrance Drive	Local Residential Roadway	661.84	Weir Crest esimated from LiDAR	HW_12_372	10	659.45	659.71	659.79	660.02	660.22	660.51	0.00
			Overtopping of Grassed Walkway in Park (near beginning of open channel)	Park	664.82	Weir Crest esimated from LiDAR	HW_12_374	10	664.33	664.69	664.80	665.01	665.09	665.16	0.00
			Overtopping of School Parking Lot Entrance Drive	Local Residential Roadway	670.47	Weir Crest esimated from LiDAR	HW_12_375	10	669.89	670.52	670.56	670.66	670.72	670.78	0.09
54	PA4-011	Allibar Pl near 508 Allibar Pl	Roadway Overtopping - impacts adjacent residence	Local Residential Roadway	666.30	Roadway Overtopping Elev. Estimated from Lidar	HW_12_270	10	664.33	664.82	665.47	667.05	667.32	667.56	0.00
					661.72	Roadway Overtopping Elev. Estimated from Lidar	CB_12_48	10	656.44	658.29	661.13	662.66	662.91	663.13	0.00
			508 Allibar Pl	Residential Structure	650.00	Garage elevation estimated from LiDAR	CB_12_49	100	654.99	655.88	658.24	661.45	661.65	661.82	11.82
55	PA2-011	Fountainhead Dr from Pheasant Run Ct N to Stuart Ln / Stuart Ln to Fountainhead Dr	Inlets on Fountainhead Dr	Local Residential Roadway	717.18	Grate Elevation at Inlet Estimated from LiDAR	CB_28_298	10	722.73	722.94	723.01	723.17	724.92	726.63	5.83
					705.69	Grate Elevation at Inlet Estimated from LiDAR	J12	10	705.77	705.78	705.78	705.79	705.79	705.79	0.09
					706.10	Grate Elevation at Inlet Estimated from LiDAR	CB_28_293	10	706.07	706.34	706.37	706.45	706.48	706.55	0.27
			Inlet at Stuart Ln / Fountainhead Dr	Local Residential Roadway	705.95	Surveyed Grate Elevation at Inlet	CB_28_292	10	705.44	705.98	706.05	706.17	706.25	706.39	0.10
56	PA2-012	Remington Dr, from near 5138 Remington Dr to near 5146 Remington Dr	Inlets on Remington Dr	Local Residential Roadway	673.50	Surveyed Grate Elevation at Inlet	CB_28_431	10	673.43	674.60	674.84	675.35	675.76	676.17	1.34
					671.10	Surveyed Grate Elevation at Inlet	CB_28_430	10	670.43	672.47	672.72	673.21	673.59	673.95	1.62
					670.32	Surveyed Grate Elevation at Inlet	CB_28_161	10	670.45	672.45	672.66	673.02	673.27	673.50	2.34
57	PA1-017	Thoroughbred Ln, near 4952 Thoroughbred Ln	Roadway Overtopping on Thoroughbred Ln	Local Residential Roadway	749.53	Roadway Overtopping Elev. Estimated from LiDAR	CB_11_1009	10	749.76	750.40	750.52	750.79	751.04	751.21	0.99
					749.58	Roadway Overtopping Elev. Estimated from LiDAR	CB_11_1006	10	749.28	750.39	750.51	750.79	751.05	751.21	0.93
			Inlet on Thoroughbred Ln		748.39	Surveyed Rim Elevation	CB_11_1001	10	749.15	750.39	750.50	750.77	751.02	751.19	2.11
58	PA3-015	Williamsburg Road west of Dyer Ln	North side of Williamsburg Rd (ditch and driveway cross drains)	Local Residential Roadway	684.59	Surveyed Roadway Overtopping Elevation	603	10	684.54	684.63	684.66	684.75	684.80	684.86	0.07
					684.65	Surveyed Roadway Overtopping Elevation	602	10	682.39	682.50	682.54	682.64	682.71	682.77	0.00
					681.52	Surveyed Roadway Overtopping Elevation	601	10	681.68	681.82	681.86	681.97	682.03	682.09	0.34
					681.03	Surveyed Roadway Overtopping Elevation	600	10	679.91	679.93	679.93	679.94	679.99	680.05	0.00
					678.67	Surveyed Roadway Overtopping Elevation	HW_12_398	10	678.96	679.05	679.06	679.07	679.08	679.10	0.39
					678.71	Surveyed Roadway Overtopping Elevation	HW_12_400	10	679.44	680.63	680.73	680.93	681.07	681.20	2.02
			South side of Williamsburg Rd (ditch and driveway cross drains)	Local Residential Roadway	684.00	Overflow Elevation estimated from Lidar	3003	10	684.00	684.11	684.14	684.23	684.28	684.32	0.14
					680.60	Overflow Elevation estimated from Lidar	3002	10	680.51	680.66	680.70	680.80	680.86	680.91	0.10

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Table 2 – Candidate Project List: LOS Quantification and Project Ranking Table (cont.)

Project Site and Point of Interest Information									Existing Conditions						Existing Surcharge Depth Above Critical Elevation During Design Year Event (ft)
Project Priority Ranking	Project Site ID	Project Site Description	POI (Point of Interest) Location Description	POI Type	Critical Elevation Value	Critical Elevation Source *FFE: Finished Floor Elevation LAG: Lowest Adjacent Grade*	Corresponding Junction	Required Minimum Level of Service (Storm Event)	2-Year Max. WSEL at POI (ft.)	5-Year Max. WSEL at POI (ft.)	10-Year Max. WSEL at POI (ft.)	25-Year Max. WSEL at POI (ft.)	50-Year Max. WSEL at POI (ft.)	100-Year Max. WSEL at POI (ft.)	
59	PA2-013	Detention Basin at Princeton Hills Dr and Remington Dr	Roadway Overtopping of Princeton Hills Dr / Remington Dr from Detention Basin	Detention Basin	673.50	Roadway Overtopping Elevation Estimated from LiDAR	PO_165	100	674.17	674.62	674.73	675.01	675.24	675.46	1.96
60	PA5-004	Post Oak Circle, near 625 Post Oak Circle (east of baseball fields)	Surface and closed conveyance from baseball fields, eastward towards Post Oak Circle	Surface and Closed Conveyance	656.38	Weir Overtopping Elev. Estimated from LiDAR	HW_12_111	100	656.79	657.04	657.10	657.24	657.34	657.45	1.07
					659.27	Weir Overtopping Elev. Estimated from LiDAR	CB_12_824	100	660.10	660.35	660.41	660.58	660.70	660.82	1.55
			Inlet on Post Oak Circle	Local Residential Roadway	655.43	Rim Elevation estimated from LiDAR	CB_12_317	10	655.00	655.49	655.54	655.63	655.69	655.76	0.11
61	PA5-005	Curlybark Pl @ Post Oak Circle	Roadway Overtopping on Curlybark Pl and Post Oak Circle	Local Residential Roadway	651.29	Weir Overtopping Elev. Estimated from LiDAR	CB_12_279	10	652.28	652.69	652.80	653.05	653.24	653.42	1.51
					651.81	Weir Overtopping Elev. Estimated from LiDAR	CB_12_315	10	652.37	652.75	652.85	653.11	653.30	653.49	1.04
					654.56	Weir Overtopping Elev. Estimated from LiDAR	CB_12_274	10	653.31	654.59	654.65	654.73	654.78	654.82	0.09
					655.63	Weir Overtopping Elev. Estimated from LiDAR	CB_12_318	10	655.86	656.17	656.23	656.35	656.45	656.56	0.60
62	PA2-014	Sinclair Circle, north of Pickney Dr	Inlets on Sinclair Circle	Local Residential Roadway	669.30	Surveyed Grate Elevation at Inlet	CB_29_21	10	669.97	670.51	670.60	670.79	670.93	671.13	1.30
					669.80	Surveyed Grate Elevation at Inlet	CB_29_20	10	669.70	670.51	670.61	670.81	670.99	671.24	0.81
					670.20	Surveyed Grate Elevation at Inlet	CB_29_18	10	669.48	670.29	670.42	670.68	670.87	671.09	0.22
63	PA1-018	Existing Pond west of 400 Centerview Dr	Pond Overtopping	Existing Pond	688.07	Weir Overtopping Elev. Estimated from LiDAR	PO_10	100	688.64	688.80	688.84	689.00	689.22	689.46	1.39
64	PA2-015	Stuart Ln, north of Fountain Head Dr	Inlet on Stuart Ln	Local Residential Roadway	699.94	Grate Elevation at Inlet Estimated from LiDAR	CB_28_337	10	699.01	701.10	701.22	701.48	701.62	701.88	1.28
65	PA2-016	Princeton Hills Dr between Murray Ln and Remington Dr	Inlet on Princeton Hills Dr	Local Residential Roadway	681.18	Grate Elevation at Inlet Estimated from LiDAR	CB_28_94	10	678.46	681.96	682.28	682.44	682.51	682.58	1.10
66	PA4-012	Grand Oaks Dr Cross Drain @ Johnson Chapel Rd	Roadway Overtopping	Local Residential Roadway	659.31	Roadway Overtopping Elev. Estimated from Lidar	HW_12_197	10	657.94	660.04	660.39	661.17	661.70	662.17	1.08
					661.99	Roadway Overtopping Elev. Estimated from Lidar	HW_12_197	10	657.94	660.04	660.39	661.17	661.70	662.17	0.00
67	PA2-017	Woodland Hills Dr, near 5106 & 5110 Woodland Hills Dr	Inlet on Woodland Hills Dr	Local Residential Roadway	704.06	Grate Elevation at Inlet Estimated from LiDAR	CB_28_327	10	704.69	704.97	705.06	705.28	705.45	705.62	1.00
68	PA2-018	Shaw Ct	Inlets on Shaw Ct	Local Residential Roadway	684.80	Grate Elevation at Inlet Estimated from LiDAR	CB_28_448	10	682.15	685.09	685.13	685.19	685.24	685.30	0.33
					683.28	Grate Elevation at Inlet Estimated from LiDAR	CB_28_250	10	680.29	684.11	684.26	684.39	684.52	684.62	0.98
69	PA2-019	Sinclair Circle from Remington Dr to east of Remington Dr	Inlets on Sinclair Dr	Local Residential Roadway	673.47	Grate Elevation at Inlet Estimated from LiDAR	CB_28_218	10	672.45	673.50	673.56	673.69	673.76	673.82	0.09
					671.16	Surveyed Grate Elevation at Inlet	CB_28_217	10	671.81	672.09	672.14	672.25	672.33	672.40	0.98
70	PA2-020	Stuart Ln, south of Heathrow Hills Dr	Headwall on Stuart Ln	Local Residential Roadway	738.04	Headwall Elevation Estimated from LiDAR	HW_28_156	10	738.67	738.93	739.00	739.17	739.30	739.45	0.96
			Inlets on Stuart Ln		738.04	Grate Elevation at Inlet Estimated from LiDAR	CB_28_412	10	738.40	738.69	738.75	738.87	739.01	739.19	0.71
					737.80		CB_28_411	10	737.48	738.01	738.08	738.25	738.36	738.68	0.28
71	PA2-021	Calloway Dr, south of Harpeth Ridge Dr	Inlet on Calloway Dr	Local Residential Roadway	724.33	Grate Elevation at Inlet Estimated from LiDAR	CB_28_127	10	721.58	725.14	725.24	725.44	725.63	725.84	0.91
		913 Calloway Dr	Area inlet at end of driveway	Residential Structure	741.00	LAG Estimated from LiDAR	CB_28_128	100	740.57	742.09	742.15	742.19	742.21	742.23	1.23
72	PA2-022	Quail Valley Dr at Woodland Hills Dr	Inlet at Quail Valley Dr at Woodland Hills Dr	Local Residential Roadway	690.22	Grate Elevation at Inlet Estimated from LiDAR	CB_28_286	10	690.89	691.07	691.12	691.25	691.34	691.44	0.90
73	PA2-023	McGavock Rd @ Post Oak Circle	Inlet on McGavock Rd	Local Residential Roadway	643.25	Grate Elevation at Inlet Estimated from LiDAR	CB_12_324	10	643.75	644.03	644.11	644.30	644.45	644.60	0.86
74	PA3-016	Winners Circle S, north of Virginia Way	Inlet on Winners Circle S	Local Residential Roadway	684.38	Grate Elevation at Inlet estimated from Lidar	CB_12_157	10	683.14	684.88	685.26	685.67	685.76	685.79	0.88
75	PA1-019	Executive Center Dr, near 7010 Executive Center Dr.	Roadway Overtopping on Executive Center Dr	Local Residential Roadway	700.41	Surveyed Rim Elevation	CB_11_1282	10	699.17	701.05	701.20	701.58	701.69	701.79	0.79
					700.52	Rim Elev. Estimated from LiDAR	J12	10	700.52	700.71	700.79	700.94	701.07	701.19	0.27
76	PA3-017	Virginia Way at Ward Circle	Inlet at Virginia Way at Ward Circle	Local Residential Roadway	698.74	Grate Elevation at Inlet estimated from Lidar	CB_11_364	10	699.39	699.50	699.53	699.61	699.67	699.74	0.79
77	PA3-018	Virginia Way near 5300 Virginia Way	Inlet at Virginia Way	Local Residential Roadway	684.05	Grate Elevation at Inlet estimated from Lidar	CB_12_166.1	10	683.12	684.29	684.54	684.87	685.13	685.25	0.49
78	PA3-019	Mosley Dr north of Meadowlake Rd	Inlet of Mosley Dr	Local Residential Roadway	671.20	Road Elev. Estimated from Lidar	HW_11_383	10	671.60	671.85	671.92	672.10	672.23	672.36	0.72
					671.20	Road Elev. Estimated from Lidar	HW_11_378	10	669.39	669.58	669.63	669.74	669.82	669.90	0.00
79	PA2-024	Quail Valley Dr, from near 915 Quail Valley Dr to near 920 Quail Valley Dr	915 Quail Valley Dr	Residential Structure	721.00	LAG Elevation estimated from LiDAR	HW_28_140	100	721.27	721.36	721.38	721.42	721.45	721.49	0.49
			Inlets on Quail Valley Dr	Local Residential Roadway	713.32	Grate Elevation at Inlet Estimated from LiDAR	CB_28_111	10	713.63	713.74	713.76	713.83	713.87	713.91	0.44
					711.46	Grate Elevation at Inlet Estimated from LiDAR	CB_28_112	10	712.00	712.15	712.17	712.25	712.30	712.35	0.71
80	PA2-025	Remington Dr, near 5173 Remington Dr, to east of Kirby Pl	Inlets on Remington Dr	Local Residential Roadway	686.51	Grate Elevation at Inlet Estimated from LiDAR	CB_28_446	10	685.59	686.48	686.53	686.57	686.59	686.61	0.02
					683.20	Grate Elevation at Inlet Estimated from LiDAR	CB_28_445	10	683.28	683.47	683.51	683.57	683.63	683.70	0.31
					681.00	Surveyed Grate Elevation at Inlet	CB_28_443	10	681.22	681.66	681.68	681.73	681.77	681.81	0.68
					679.74	Grate Elevation at Inlet Estimated from LiDAR	CB_28_441	10	677.16	680.11	680.21	680.39	680.51	680.65	0.47
81	PA3-020	Meadowlake Rd east of Hayeswood Dr	Meadowlake Rd east of Hayeswood Dr	Local Residential Roadway	653.44	Surveyed Roadway Overtopping Elevation	HW_12_323	10	653.68	654.00	654.06	654.16	654.17	654.18	0.62
					653.76	Roadway Overtopping Elevation estimated from Lidar	2566	10	653.87	654.07	654.12	654.21	654.26	654.30	0.36
					653.76	Roadway Overtopping Elevation estimated from Lidar	2567	10	653.68	654.00	654.06	654.15	654.15	654.15	0.30
82	PA2-026	5290 Colleton Way	5290 Colleton Way	Residential Structure	701.00	LAG Elevation estimated from Survey	HW_28_188	100	699.16	700.42	700.81	701.41	701.52	701.64	0.64
83	PA3-021	Williamsburg Rd at 5316 Williamsburg Rd	Inlet on Williamsburg Rd	Local Residential Roadway	637.75	Surveyed Grate Elevation at Inlet	HW_12_167	10	637.89	638.27	638.36	638.58	638.71	638.84	0.61

LEGEND:
XXX.XX Indicates that the Max. WSEL at the POI exceeds the Critical Elevation at said POI.
XXX.XX Improvement Projects with Associated Residential Benefits.
XXX.XX Improvement Projects Providing Roadway Benefits Only.

Table 2 – Candidate Project List: LOS Quantification and Project Ranking Table (cont.)

Project Site and Point of Interest Information									Existing Conditions						Existing Surcharge Depth Above Critical Elevation During Design Year Event (ft)
Project Priority Ranking	Project Site ID	Project Site Description	POI (Point of Interest) Location Description	POI Type	Critical Elevation Value	Critical Elevation Source *FFE: Finished Floor Elevation LAG: Lowest Adjacent Grade*	Corresponding Junction	Required Minimum Level of Service (Storm Event)	2-Year Max. WSEL at POI (ft.)	5-Year Max. WSEL at POI (ft.)	10-Year Max. WSEL at POI (ft.)	25-Year Max. WSEL at POI (ft.)	50-Year Max. WSEL at POI (ft.)	100-Year Max. WSEL at POI (ft.)	
84	PA1-020	Midway Circle, near 561 Midway Circle	Roadway Overtopping on Midway Circle	Local Residential Roadway	656.39	Roadway Overtopping Elev. Estimated from LiDAR	CB_11_24	10	656.90	656.96	656.98	657.03	657.10	657.15	0.59
					656.83	Weir Overtopping Elev. Estimated from LiDAR	CB_11_25	10	656.87	656.91	656.92	656.95	656.97	656.99	0.09
85	PA3-022	Seward Rd, west of Seward Ct	North side of roadway (ditch and driveway cross drains)	Local Residential Roadway	657.99	Roadway Overtopping Elevation estimated from Lidar	HW_11_16	10	657.89	658.29	658.36	658.53	658.65	658.77	0.37
					657.99	Roadway Overtopping Elevation estimated from Lidar	HW_11_17	10	655.84	656.06	656.12	656.26	656.37	656.47	0.00
					654.40	Roadway Overtopping Elevation estimated from Lidar	438	10	653.78	653.96	653.98	654.12	654.22	654.33	0.00
					654.05	Roadway Overtopping Elevation estimated from Lidar	439	10	652.19	652.46	652.56	652.70	652.85	653.00	0.00
					651.99	Roadway Overtopping Elevation estimated from Lidar	440	10	652.11	652.45	652.56	652.69	652.73	652.79	0.57
					652.50	Roadway Overtopping Elevation estimated from Lidar	441	10	651.77	652.60	652.76	652.95	652.95	652.95	0.26
					653.50	Roadway Overtopping Elevation estimated from Lidar	HW_12_330	10	651.77	652.60	652.77	652.99	653.03	653.09	0.00
86	PA4-013	Martingale Ln near 6102 Martingale Ln	Roadway Overtopping - impacts adjacent residences	Local Residential Roadway	666.16	Roadway Overtopping Elev. Estimated from Lidar	CB_12_62	10	666.39	666.65	666.72	666.87	666.98	667.10	0.56
					666.21	Spillway Crest esimated from LiDAR	CB_12_63	10	666.33	666.60	666.66	666.81	666.92	667.03	0.45
87	PA2-027	Heathrow Blvd at Franklin Rd	Inlets on Heathrow Blvd	Local Residential Roadway	714.77	Grate Elevation at Inlet Estimated from LiDAR	CB_28_143	10	713.63	715.06	715.12	715.26	715.37	715.48	0.35
					714.56	Grate Elevation at Inlet Estimated from LiDAR	CB_28_144	10	713.29	714.86	714.93	715.09	715.18	715.28	0.37
					713.20	Grate Elevation at Inlet Estimated from LiDAR	CB_28_425	10	712.44	713.61	713.67	713.82	713.94	714.06	0.47
					712.83	Grate Elevation at Inlet Estimated from LiDAR	CB_28_426	10	711.73	713.31	713.37	713.52	713.63	713.73	0.54
88	PA4-014	Dekemont Ln near 525 Dekemont Ln	Roadway Overtopping	Local Residential Roadway	679.95	Spillway Crest esimated from LiDAR	CB_12_52	10	680.14	680.33	680.45	680.64	680.79	680.94	0.50
89	PA3-023	Hayeswood Dr at Meadowlake Rd	Intersection of Hayeswood Dr and Meadowlake Rd	Local Residential Roadway	658.39	Roadway Overtopping Elevation estimated from Lidar	HW_12_392	10	658.62	658.76	658.80	658.90	658.97	659.05	0.41
					659.19	Roadway Overtopping Elevation estimated from Lidar	CB_12_299	10	657.28	657.41	657.45	657.61	657.77	657.92	0.00
					656.25	Roadway Overtopping Elevation estimated from Lidar	CB_12_298	10	656.42	656.57	656.61	656.70	656.77	656.83	0.36
					655.77	Roadway Overtopping Elevation estimated from Lidar	HW_12_322	10	653.68	654.00	654.06	654.16	654.18	654.18	0.00
90	PA2-028	Quail Valley Dr at Fountain Head Dr	Inlets on Quail Valley Dr	Local Residential Roadway	711.94	Surveyed Grate Elevation at Inlet	CB_28_347	10	709.85	712.01	712.04	712.09	712.13	712.16	0.10
					707.94	Surveyed Grate Elevation at Inlet	CB_28_348	10	706.18	707.99	708.05	708.12	708.16	708.20	0.11
					704.27	Surveyed Grate Elevation at Inlet	CB_28_301	10	702.49	703.96	704.64	705.03	705.16	705.28	0.37
91	PA2-029	Sinclair Circle from near 753 Sinclair Circle to Pickney Dr	Inlet on Sinclair Circle	Local Residential Roadway	676.13	Grate Elevation at Inlet Estimated from LiDAR	CB_28_233	10	676.07	676.41	676.48	676.64	676.75	676.86	0.35
92	PA2-030	Fountain Head Dr, from near 5111 Fountain Head Dr to near 5107 Fountain Head Dr	Inlets on Fountain Head Dr	Local Residential Roadway	731.12	Grate Elevation at Inlet Estimated from LiDAR	CB_28_338	10	727.65	731.21	731.28	731.38	731.44	731.50	0.16
					728.56	Grate Elevation at Inlet Estimated from LiDAR	CB_28_342	10	725.88	728.46	728.88	729.29	729.44	729.57	0.32
93	PA2-031	Walnut Park Dr	Inlet on Walnut Park Dr	Local Residential Roadway	805.90	Grate Elevation at Inlet Estimated from LiDAR	CB_28_387	10	804.27	806.03	806.19	806.45	806.57	806.69	0.29
94	PA2-032	Harpeth Ridge Dr between Center Ridge Dr and Calloway Dr	Inlet on Harpeth Ridge Dr	Local Residential Roadway	752.00	Surveyed Grate Elevation at Inlet	CB_28_138	10	750.73	751.69	752.28	753.18	753.29	753.38	0.28
95	PA1-021	Chadwick Dr @ Centerview Dr (when inlets surcharge, flow conveys toward 400 Centerview Dr)	Roadway Overtopping on Chadwick Dr @ Centerview Dr	Local Residential Roadway	716.79	Roadway Overtopping Elev. Estimated from LiDAR	CB_11_822	10	715.49	716.25	716.43	716.91	717.05	717.10	0.00
			Inlet on Chadwick Dr @ Centerview Dr		716.65	Rim Elev. Estimated from LiDAR	CB_11_821	10	716.70	716.89	716.92	717.00	717.05	717.10	0.27
					724.25	Rim Elev. Estimated from LiDAR	CB_11_794	10	723.23	724.33	724.35	724.41	724.44	724.47	0.10
					722.01	Rim Elev. Estimated from LiDAR	CB_11_795	10	721.53	722.10	722.12	722.16	722.19	722.21	0.11
					721.75	Rim Elev. Estimated from LiDAR	CB_11_796	10	719.70	720.24	720.30	720.45	720.56	720.67	0.00
96	PA3-024	Cornwall Dr north of Meadowlake Rd	Cornwall Dr north of Meadowlake Rd	Local Residential Roadway	677.70	Roadway Overtopping Elevation estimated from Lidar	HW_11_25	10	677.33	677.91	677.96	678.09	678.19	678.28	0.26
97	PA4-015	Martingdale Ln near 6013 Martingdale Ln	Roadway Overtopping	Local Residential Roadway	651.19	Roadway Overtopping Elev. Estimated from Lidar	CB_12_67	10	651.35	651.42	651.44	651.49	651.52	651.56	0.25
98	PA2-033	Lysander Ln, near 5246 Lysander Ln	Inlet on Lysander Ln	Local Residential Roadway	647.06	Grate Elevation at Inlet Estimated from LiDAR	CB_11_37	10	644.85	647.20	647.31	647.56	647.85	648.04	0.25
99	PA5-006	Foxland Dr, near 6007 Foxland Dr	Roadway Overtopping on Foxland Dr	Local Residential Roadway	664.68	Weir Overtopping Elev. Estimated from LiDAR	HW_12_134	10	663.09	664.52	664.93	665.35	665.64	665.91	0.25
					664.67	Roadway Overtopping Elev. Estimated from LiDAR	CB_12_350	10	661.98	663.80	664.38	665.13	665.47	665.78	0.00
					664.91	Roadway Overtopping Elev. Estimated from LiDAR	CB_12_351	10	661.40	662.87	663.24	664.64	665.16	665.45	0.00
					664.91	Weir Overtopping Elev. Estimated from LiDAR	HW_12_135	10	660.64	661.07	661.15	661.34	661.54	661.79	0.00
100	PA5-007	Foxland Dr, near 6101 Foxland Dr	Roadway Overtopping on Foxland Dr	Local Residential Roadway	698.60	Weir Overtopping Elev. Estimated from LiDAR	HW_12_125	10	696.41	698.46	698.83	698.97	699.05	699.13	0.23
					698.51	Weir Overtopping Elev. Estimated from LiDAR	CB_12_289	10	695.40	697.78	698.59	698.80	698.87	698.94	0.08
101	PA1-022	Seward Rd, near 5106 Seward Rd	Roadway Overtopping on Seward Rd	Local Residential Roadway	661.01	Weir Overtopping Elev. Estimated from LiDAR	HW_11_18	10	661.05	661.20	661.23	661.31	661.36	661.42	0.22
102	PA4-016	Waxwood Ct near 6220 Waxwood Ct	Roadway Overtopping & Inlet Surcharging - impacts adjacent residence	Local Residential Roadway	644.38	Grate Elevation at Inlet estimated from Lidar	CB_12_31	10	641.70	644.48	644.59	644.71	644.80	644.89	0.21
					642.22	Weir Crest esimated from LiDAR	CB_12_21	10	638.69	641.90	642.38	642.62	642.81	642.98	0.16
103	PA2-034	Center Ridge Ct, near 911 Center Ridge Ct	Inlet on Center Ridge Ct	Local Residential Roadway	775.20	Surveyed Grate Elevation at Inlet	CB_28_131	10	772.80	774.98	775.40	775.55	775.61	775.67	0.20
104	PA5-008	Foxland Dr, near 6015 Foxland Dr	Roadway Overtopping on Foxland Dr	Local Residential Roadway	701.63	Weir Overtopping Elev. Estimated from LiDAR	HW_12_100	10	699.61	701.58	701.82	701.99	702.09	702.20	0.19
					701.13	Weir Overtopping Elev. Estimated from LiDAR	CB_12_344	10	698.41	700.81	701.16	701.28	701.33	701.39	0.03
105	PA1-023	Meadowlawn Dr., near 9019 Meadowlawn Dr	Roadway Overtopping on Meadowlawn Dr	Local Residential Roadway	718.09	Weir Overtopping Elev. Estimated from LiDAR	HW_11_146	10	718.14	718.24	718.27	718.33	718.38	718.43	0.18
106	PA3-025	Virginia Way at Brecon Rd	Inlet at Virginia Way at Brecon Road	Local Residential Roadway	671.41	Surveyed Grate Elevation at Inlet	CB_12_567	10	670.58	671.52	671.59	671.72	672.04	672.34	0.18
107	PA2-035	Bliss Rd, from McGavock Rd to Lysander Ln	Inlet on Bliss Rd	Local Residential Roadway	653.05	Grate Elevation at Inlet Estimated from LiDAR	CB_29_9	10	650.97	652.53	653.21	653.88	654.21	654.43	0.16

LEGEND:
XXX.XX Indicates that the Max. WSEL at the POI exceeds the Critical Elevation at said POI.
XXX.XX Improvement Projects with Associated Residential Benefits.
XXX.XX Improvement Projects Providing Roadway Benefits Only.

Table 2 – Candidate Project List: LOS Quantification and Project Ranking Table (cont.)

Project Site and Point of Interest Information									Existing Conditions						Existing Surcharge Depth Above Critical Elevation During Design Year Event (ft)
Project Priority Ranking	Project Site ID	Project Site Description	POI (Point of Interest) Location Description	POI Type	Critical Elevation Value	Critical Elevation Source *FFE: Finished Floor Elevation LAG: Lowest Adjacent Grade*	Corresponding Junction	Required Minimum Level of Service (Storm Event)	2-Year Max. WSEL at POI (ft.)	5-Year Max. WSEL at POI (ft.)	10-Year Max. WSEL at POI (ft.)	25-Year Max. WSEL at POI (ft.)	50-Year Max. WSEL at POI (ft.)	100-Year Max. WSEL at POI (ft.)	
108	PA3-026	Virginia Way at Powell Pl	Inlet at Virginia Way at Powell Pl	Local Residential Roadway	668.60	Surveyed Grate Elevation at Inlet	CB_12_215	10	664.97	667.84	668.75	669.48	669.82	669.90	0.15
109	PA2-036	Princeton Hills Dr from west of Duncan Ct (roadway and detention basin) to Duncan Ct	Inlet on Princeton Hills Dr from west of Duncan Ct to Duncan Ct	Local Residential Roadway	682.94	Grate Elevation at Inlet Estimated from LiDAR	CB_28_270	10	679.80	683.03	683.09	683.26	683.35	683.44	0.15
			Inlet on Princeton Hills Dr from west of Duncan Ct Detention Basin		677.88	Grate Elevation at Inlet Estimated from LiDAR	CB_28_245	10	675.53	677.90	678.03	678.21	678.32	678.42	0.15
110	PA4-017	Martingdale Ln near 6021 Martingdale Ln	Inlets on Martingdale Ln	Local Residential Roadway	665.25	Rim Elevation estimated from LiDAR	CB_12_65	10	665.03	665.27	665.30	665.36	665.40	665.43	0.05
					664.83	Rim Elevation estimated from LiDAR	CB_12_64	10	664.88	664.96	664.97	664.99	665.00	665.02	0.14
111	PA1-024	Forest Lawn Dr, near 9040 Forest Lawn Dr	Roadway Overtopping on Forest Lawn Dr	Local Residential Roadway	781.53	Weir Overtopping Elev. Estimated from LiDAR	HW_11_115	10	781.19	781.60	781.64	781.73	781.79	781.85	0.11
112	PA2-037	Good Springs Rd, south of McGavock Rd	Inlet on Good Springs Rd	Local Residential Roadway	655.70	Grate Elevation at Inlet Estimated from LiDAR	CB_12_135	10	654.87	655.76	655.80	655.86	655.90	655.94	0.10
113	PA4-018	Turtle Creek Dr near 503 Turtle Creek Dr	Inlets on Turtle Creek Dr	Local Residential Roadway	644.32	Rim Elevation estimated from LiDAR	CB_12_26	10	644.32	644.38	644.39	644.42	644.43	644.45	0.07
					644.42	Rim Elevation estimated from LiDAR	CB_12_27	10	644.46	644.50	644.51	644.54	644.55	644.58	0.09
114	PA2-038	Woodland Hills Dr, near 5114 & 5116 Woodland Hills Dr	Inlets and Headwalls on Woodland Hills Dr	Local Residential Roadway	724.12	Headwall Elevation Estimated from LiDAR	HW_28_129	10	723.35	724.17	724.20	724.28	724.33	724.38	0.08
					722.46	Grate Elevation at Inlet Estimated from LiDAR	CB_28_330	10	722.51	722.54	722.55	722.57	722.59	722.60	0.09
115	PA2-039	Woodland Hills Dr, near 5110 & 5112 Woodland Hills Dr	Inlet on Woodland Hills Dr	Local Residential Roadway	708.92	Grate Elevation at Inlet Estimated from LiDAR	CB_28_328	10	708.32	708.99	709.01	709.05	709.07	709.10	0.09
116	PA1-025	Midway Circle (near 507 Midway) and Country Club Dr (near 5012 Country Club)	Roadway Overtopping near Intersection	Local Residential Roadway	661.83	Weir Overtopping Elev. Estimated from LiDAR	CB_11_13	10	657.81	661.06	661.90	662.06	662.12	662.17	0.07
					655.52	Weir Overtopping Elev. Estimated from LiDAR	HW_11_11	10	653.19	654.06	654.34	655.13	655.63	655.78	0.00
117	PA2-040	Stuart Ln, near 916 Stuart Ln	Inlet on Stuart Ln	Local Residential Roadway	757.80	Grate Elevation at Inlet Estimated from LiDAR	838	10	756.17	757.71	757.82	757.89	757.92	757.95	0.02
118	PA5-009	McGavock Rd, near 5412 McGavock Rd *(City-requested project location)*	Inlet on McGavock Rd	Local Residential Roadway	635.90	Rim Elevation estimated from LiDAR	CB_12_307	10	630.53	631.10	632.10	633.93	635.35	635.51	0.00
					635.29	Surveyed Rim Elevation	CB_12_306	10	628.53	631.52	633.00	633.89	635.29	635.42	0.00
					634.99	Surveyed Rim Elevation	CB_12_305	10	628.52	631.15	632.01	633.80	635.16	635.27	0.00

LEGEND:

XXX.XX Indicates that the Max. WSEL at the POI exceeds the Critical Elevation at said POI.

XXX.XX Improvement Projects with Associated Residential Benefits.

XXX.XX Improvement Projects Providing Roadway Benefits Only.

Table 2 – Candidate Project List: LOS Quantification and Project Ranking Table (cont.)

Proposed Conditions Modeling and Hydraulic Analysis

Using the ranked list of candidate project locations provided in **Table 2** above, thirty (30) sites were selected and analyzed to evaluate options for improving the current flooding conditions and associated Level of Service (LOS) at these sites. These selected sites represent those locations where improvements can be readily implemented without additional hydrologic and hydraulic analysis. It should be noted that some of the candidate project sites that are ranked highest on the above list will require extensive additional modeling and analysis to determine feasible recommendations to improve LOS. Because of the complexities associated with these project sites, improvements have not been analyzed as part of this study and should be considered for future study and project development (refer to the *Future Considerations* section of this report for more information).

To begin evaluating recommended improvement alternatives, the existing conditions hydrologic/hydraulic model was duplicated and then revised to reflect implementation of improvements at each of the selected sites. The goal of the recommended improvements was to achieve at least the design storm event LOS for roadway crossings (dependent upon the roadway's classification) and at least a 100-year LOS at residential/commercial structures.

Details of the thirty (30) recommended improvement projects are provided in the following sections. These projects have been grouped into two separate categories; those projects which provide benefits to adjacent residential properties (12 total) and those projects which provide roadway benefits only (18 total).

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA2-003

692 Old Orchard Road – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	6
➢ Watershed:	Priority Area 2
➢ Recommended Improvements:	Replace 115 LF of 30" CMP with 36" RCP.
➢ Existing Flooding Issues:	Curb inlet has a 5-year LOS (0.96' surcharging at 100-year event). Potential for residential flooding if inlet surcharges during infrequent storm events.
➢ Proposed Flood Reduction:	2.41' (100-year LOS).
➢ Project Cost:	$97,234
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design.
➢ Assoc. Residential Benefits:	692 Old Orchard Rd • Existing 5-year LOS, • Proposed 100-year LOS 688 Old Orchard Rd • Existing 5-year LOS • Proposed 100-year LOS

The curb inlet located in front of 692 Old Orchard Road intercepts stormwater discharges from the road and residential areas to the southeast. A 30" corrugated metal pipe (CMP) currently conveys the discharges northwest to a shallow swale. The outfall of the system is located approximately 115-feet northwest of the inlet. Old Orchard Road is classified as a local road and has a required 10-year storm Level of Service (LOS). However, the existing drainage system has a 5-year storm LOS. This project location drains to McGavock Road between Post Oak Circle and Good Springs Road. During the field reconnaissance, it was noted that it may be possible for runoff to spill over the curb near the residential structure at 692 Old Orchard Road if the inlet surcharges during large storms. Such spillover has the potential to cause residential flooding at that address. Therefore, it is recommended that this location be sized for a 100-year storm LOS.

To achieve a 100-year LOS, it will be necessary to replace the existing 115 LF of 30" CMP pipe with 36" reinforced concrete pipe (RCP). Elevations used within the modeling analysis were taken from aerial topographic data (LiDAR). A detailed survey will be required for design.

Refer to **Exhibit A.7** for detailed location of the proposed PA2-003 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA4-001

6200 Partridge Court – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	15
➢ Watershed:	Priority Area 4
➢ Recommended Improvements:	Replace 150 LF of 1 – 18" HDPE with 2 – 24" RCP
➢ Existing Flooding Issues:	Existing 10-year LOS (1.64' surcharging at 100-year event).
➢ Proposed Flood Reduction:	2.68' (100-year LOS).
➢ Project Cost:	$124,891
➢ Comments:	Elevations determined from LiDAR. Detailed topographic survey will be required for design.
➢ Assoc. Residential Benefits:	6200 Partridge Court ▪ Existing 10-year LOS. ▪ Proposed 100-year LOS.

The existing 18" corrugated high-density polyethylene (HDPE) pipe near 6200 Partridge Court is undersized. The nearby existing road inlet (within the cul-de-sac) surcharges during the 25-year event and floods the home at 6200 Partridge Court. This existing inlet is the only one present on Partridge Court, and it serves to capture street flow from Turtle Creek Drive to the west as well as all of Partridge Court.

Even though the roadway's storm system meets the required 10-year storm Level of Service (LOS), it is recommended to mitigate the frequent residential structure flooding. To provide a 100-year storm LOS to the residence at 6200 Partridge Court, the existing pipe must be replaced with 150 LF of double 24" RCP. The proposed slope must be 0.5% to meet City Stormwater Regulations and cover requirements.

The recommended improvements achieve a 100-year storm LOS for both the roadway and at 6200 Partridge Court (i.e., no storm events surcharge the subject inlet).

Refer to **Exhibit A.8** for detailed location of the proposed PA4-001 improvement project. Refer to **Exhibit A.5** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C for budgetary-level project cost tabulations**.

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA4-002

Belle Rive Drive between Dekemont Lane and Abbey Court – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	19
➢ Watershed:	Priority Area 4
➢ Recommended Improvements:	Replace 350 LF of 1 – 2.5'x3.5' CMP with 3.167'x5' Elliptical Reinforced Concrete (ERCP)
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (Approx. 1.5' overtopping at 25-year event).
➢ Proposed Flood Reduction:	1.69' (25-year LOS).
➢ Project Cost:	$417,060
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design.
➢ Assoc. Residential Benefits:	6103 & 6105 Belle Rive Drive ▪ Existing 5-year LOS. ▪ Proposed 100-year LOS.

The existing drainage system located on Belle Rive Drive between Dekemont Lane and Abbey Court consists of three single barrel segments of 2.5'x3.5' CMP which convey runoff from south to north under Belle Rive Drive and toward the Little Harpeth River. The existing 2.5'x3.5' CMPs are undersized, which cause roadway flooding on Bell Rive Drive during the 2-year event. The existing system has an inverse slope with contributes to the surcharging of the inlets on Belle Rive Drive. The system is located in a sag, meaning the surcharged flow ponds in the low point of Bell Rive Drive. Bell Rive Drive is a collector road, which requires a 25-year storm Level of Service (LOS).

The proposed system of 350 LF 3.167'x5' ERCP at a 0.5% slope achieves a 25-year storm LOS. The proposed design alleviates all roadway ponding for the 2 through 25-year event storms. The inverts of all segments, including the outlet headwall, will need to be lowered to achieve positive slope (0.5%) and therefore meet pipe cover requirements.

Refer to **Exhibit A.9** for detailed location of the proposed PA4-002 improvement project. Refer to **Exhibit A.5** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA4-003

Grand Oaks Drive at Shadow Ridge Court – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	20
➢ Watershed:	Priority Area 4
➢ Recommended Improvements:	Replace 131 LF of 36” RCP with 42” RCP Replace 84 LF of 36” RCP with 48” RCP Replace 116 LF of 36” RCP with 48” RCP Replace 251 LF of 36” CMP with 48” RCP
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (Approx. 1.5’ surcharging at 10-year event).
➢ Proposed Flood Reduction:	4.0’ (10-year LOS).
➢ Project Cost:	$465,392
➢ Comments:	Inverts of the 131 LF and 84 LF segments need to be lowered to meet cover requirements. Potential constructability issues between residential properties.
➢ Assoc. Residential Benefits:	6330 Shadow Ridge Court ▪ Existing less than 2-year LOS. ▪ Proposed 25-year LOS.

The existing system at the intersection of Grand Oaks Drive and Shadow Ridge Court is undersized, causing roadway surcharging and residential home flooding. From the field investigation, the homeowner at 6330 Shadow Ridge Court reported that roadway surcharging gets high enough to flow over their driveway. Grand Oaks Drive and Shadow Ridge Court are classified as local roads, which have a required 10-year storm Level of Service (LOS).

To achieve a 10-year storm LOS, it is necessary to replace the 131 LF of 36” RCP with 42” RCP at 2.2% slope. The invert was lowered to meet pipe cover requirements. Similarly, it is necessary to replace 84 LF of 36” RCP with 48” RCP at 3% slope to meet pipe cover requirements. The recommended improvements also consist of replacement of 116 LF of 36” RCP with 48” RCP and 251 LF of 36” CMP with 48” RCP.

The aforementioned recommendations lower the water surface elevation by 4’ during the 10-year storm event.

Refer to the **Exhibit A.10** for detailed location of the proposed PA4-003 improvement project. Refer to **Exhibit A.5** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA2-005

Murray Lane, East of Good Springs Road – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	24
➢ Watershed:	Priority Area 2
➢ Recommended Improvements:	Replace 41 LF of 42" RCP with 6 x 4 RCB (eastbound) Replace 67 LF 42" RCP with 6 x 4 RCB (westbound)
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (1.39' overtopping at 50-year event).
➢ Proposed Flood Reduction:	1.59' (50-year LOS)
➢ Project Cost:	$314,048
➢ Comments:	Existing cross drain under eastbound lanes is undersized. Cross drain under westbound lanes must also be improved to accommodate eastbound lane improvements.
➢ Assoc. Residential Benefits:	5134 Remington Dr • Existing 5-year LOS • Proposed 10-year LOS

The existing cross drain conveys stormwater discharge under Murray Lane north to McGavock Road. Murray Lane is classified as an arterial road and has a required 50-year storm Level of Service (LOS). The existing structure has less than a 2-year storm LOS. The goal of this project is to achieve the required LOS for the road crossing.

The existing cross drain system consists of a single 42" reinforced concrete pipe (RCP) underneath both the eastbound and westbound lanes. Catch basins intercept runoff from the roadway and drain into the cross drains. The existing cross drain has less than a 2-year storm LOS.

To achieve the required 50-year storm LOS for the entire cross drain, it is necessary to replace the 42" RCP beneath both the eastbound and westbound lanes with a 6' wide x 4' high reinforced concrete box culvert (RCBC).

The cross drain improvements described above will result in a proposed 50-year storm LOS for this road crossing.

Refer to **Exhibit A.11** for detailed location of the proposed PA2-005 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA2-006

5145 Remington Drive (includes PA2-012, Remington Drive) – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	28
➢ Watershed:	Priority Area 2
➢ Recommended Improvements:	Replace 67 LF of 18" RCP with 30" RCP. Replace 351 LF of 30" RCP with 54" RCP. Replace 255 LF of 42" RCP with 60" RCP.
➢ Existing Flooding Issues:	Less than 2-year LOS at both 5145 Remington Drive and Remington Drive (roadway drainage). 1.2' overtopping at the 100-year event at 5145 Remington Drive. 1.62' overtopping at the 10-year event on Remington Drive.
➢ Proposed Flood Reduction:	1.3' at 5145 Remington Drive (100-year LOS). 4.12' on Remington Drive (25-year LOS).
➢ Project Cost:	$737,658
➢ Comments:	Elevations determined from survey. Detailed utility survey required for final design. Constructability of the proposed drainage improvements next to the residential structures at 5138 & 5145 Remington Dr should be addressed during final design.
➢Assoc. Residential Benefits:	5145 Remington Dr • Existing < 2-year LOS • Proposed 100-year LOS

The drainage system at 5145 Remington Drive collects stormwater runoff from areas south of that address and conveys the runoff north to Remington Drive, then east along Remington drive, and then north to the system outfall located behind 5142/5146 Remington Drive. The homeowner at 5145 Remington Drive has reported prior flooding based upon the Known Drainage Issues database provided by the City. Based on the surveyed finished floor elevation (FFE) of the house, the existing drainage system provides less than a 2-year storm Level of Service (LOS). Analysis of the drainage system at Remington Drive shows that the roadway also has less than a 2-year storm LOS. Remington Drive is classified as a local road and has a required 10-year storm LOS. The goal of this project is to provide a 100-year storm LOS for the residential structure, as well as a minimum 10-year storm LOS for the roadway.

The existing drainage system is undersized and allows surcharged flow from the headwall behind 5145 Remington Drive to convey northward toward Remington Drive. The homeowner has reported that mud and debris has previously entered the swimming pool as well as the garage and basement. The current drainage network on

Project Site ID: PA2-006 – Cont.

Remington Drive intercepts runoff from the roadway as well as the residential areas to the south. To achieve a 100-year storm LOS at the house, as well as a minimum 10-year storm LOS on Remington Drive, it will be necessary to replace 67 LF of 18" RCP with 30" RCP, 351 LF of 30" RCP with 54" RCP, and 255 LF of 42" RCP with 60" RCP. Portions of the storm system run away from the street right-of-way and between homes. These systems must be upgraded in order to achieve the required 100-year LOS at 5145 Remington Drive.

Elevations used within the PCSWMM model were taken from field survey data. It should be noted that the southern segment of the existing drainage system runs north from the headwall and between two residential driveways. Constructability and utility conflict issues will need to be considered during final design of the recommended improvements.

Refer to **Exhibit A.12** for detailed location of the proposed PA2-006 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA2-009

McGavock Road between Post Oak Circle and Good Springs Road – PROJECT HIGHLIGHTS:

- Project Priority Ranking: 38
- Watershed: Priority Area 2
- Recommended Improvements: Replace 62 LF of 2–10.17' x 4' RCB with 3–12 x 4 RCBC
- Existing Flooding Issues: Exist. 2-yr LOS (0.62' overtopping at 10-yr event).
- Proposed Flood Reduction: 0.66' (10-year LOS)
- Project Cost: $613,518
- Comments: Existing cross drain is undersized and induces backwater upstream, which contributes to residential flooding at 651 Post Oak Circle.
- Assoc. Residential Benefits: 651 Post Oak Circle
  - Existing 5-year LOS
  - Proposed 25-year LOS

  661 Post Oak Circle
  - Existing 2-year LOS
  - Proposed 10-year LOS

The existing cross drain conveys stormwater discharge under McGavock Road to the watershed outfall at the Little Harpeth River. McGavock Road is classified as a local road and has a required 10-year storm Level of Service (LOS). The existing roadway has a 2-year storm LOS. The goal of this project is to achieve the required LOS for the road crossing and reduce the localized residential flooding that has been reported upstream of McGavock Road.

The existing cross drain is a double barrel reinforced concrete box culvert (RCBC), with each barrel measuring 10.17' wide x 4' high. The right barrel is silted in by approximately 1'. Stormwater discharges in excess of the cross drain's capacity convey northwesterly and flow over McGavock Road at a point approximately 125' northwest of the cross drain. To achieve the required 10-year storm LOS, it will be necessary to replace the existing double barrel 10.17' x 4' RCB with a triple barrel 12' x 4' RCB.

The existing McGavock Road cross drain induces backwater on the property at 651 Post Oak Circle. The residential structure has an existing 5-year storm LOS; currently, floodwater from the creek enters the garage of the house during the 10-year storm event. The proposed cross drain improvement will reduce the backwater elevations at McGavock Road and will result in an improved 25-year storm LOS at 651 Post Oak Circle.

Project Site ID: PA2-009 – Cont.

Refer to **Exhibit A.13** for detailed location of the proposed PA2-009 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA1-015

YMCA/5100 Williamsburg Road – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	48
➢ Watershed:	Priority Area 1
➢ Recommended Improvements:	Replace 42 LF of 48" CMP with 48" RCP. Construct 455 LF of earthen diversion berm.
➢ Existing Flooding Issues:	Homeowner at 5100 Williamsburg Rd. reports flooding in lower level of home (according to city-provided storm damage survey data).
➢ Proposed Flood Reduction:	0.81' (100-yr LOS at HVAC pad at 5100 Williamsburg Rd.)
➢ Project Cost:	$137,955
➢ Comments:	As described above, homeowner has reported flooding in lower level of home. However, existing conditions modeling demonstrates that runoff from the conveyance east of the property does not adversely impact/flood the residential structure. Review of adjacent topography indicates that runoff from the north and west has the ability to sheet flow into the property and potentially impact the home. The proposed earthen diversion berm is intended to intercept runoff from the north and direct it away from the backyard/home and into the improved cross drain.

The existing drainage conveyance behind 5100 Williamsburg Road begins at the outlet of an existing detention pond on the YMCA property and flows southward through the city-owned Maryland Farm Greenway property. From there, the conveyance enters the property at 5100 Williamsburg Road and eventually enters an existing 48" corrugated metal pipe (CMP) under Williamsburg Road. The existing drainage conveyance is poorly defined along its reach, and the existing topography indicates that this feature runs though the fenced-in side yard of 5100 Williamsburg Road.

Additionally, the existing 48" CMP cross drain under Williamsburg Road is silted in approximately 24"; the inverse longitudinal channel slope immediately downstream of the cross drain is likely the primary cause of this siltation / blockage. This blockage, in addition to the current runoff flow patterns into and through the residential property, possibly contribute to reported flooding conditions at 5100 Williamsburg Road.

Project Site ID: PA1-015 – Cont.

Based on existing conditions modeling results, the residential structure at 5100 Williamsburg Road currently experiences a 100-year storm Level of Service (LOS) (i.e., no flooding of home). However, the homeowner at the property has reported flooding in the lower level of the home (according to city-provided storm damage survey data).

Based upon review of adjacent topographic data, it appears that runoff has the ability to sheet flow into the property from the north and west and potentially adversely impact the subject residence.

The existing conditions modeling results indicate high water surface elevations within and adjacent to the subject property, namely near the northeastern fence corner and at the upstream end of the Williamsburg Road cross drain. Therefore, it was determined that residential flooding was possible due to runoff which originates at both the existing drainage conveyance as well as the cross drain.

Improvements were evaluated with the goal of reducing the depth of flow within the existing drainage conveyance to the extent practicable, thus reducing the likelihood of residential structure flooding and magnitude of inundation within and adjacent to the subject property.

Implementation of a proposed trapezoidal channel along the entire conveyance reach was considered. However, it was determined that in order to provide a channel large enough to be convey the current volume of runoff with adequate freeboard, property would have to be acquired or easements obtained from 5100 Williamsburg Road to construct the channel and allow a proper grade tie-in at the cross drain. Additionally, the existing topography allows for a minimal longitudinal channel slope, which could promote future siltation within the channel. Encapsulation of a portion of the conveyance was also considered, but the need for easement acquisition and minimal longitudinal slopes made this option less desirable, as well.

To achieve the desired goals at this project site, it is recommended to construct approximately 455 LF of earthen diversion berm along the rear property lines of 5100 and 5102 Williamsburg Road. The diversion berm dimensions are as follows:

- Height: 2 feet
- Side slopes: 3:1 (H:V)
- Top width: 5 feet

The diversion berm will direct runoff which originates between the YMCA property and these two residential properties toward the east and around the residential properties

Project Site ID: PA1-015 – Cont.

(instead of through the backyards and toward the houses). It should be noted that local runoff originating directly west of the subject property will still have the ability to sheet flow easterly toward the residential structure.

In addition, the existing cross drain under Williamsburg Road is recommended to be replaced with 42 LF of 48" reinforced concrete pipe (RCP). The existing channel immediately downstream of the cross drain will need to be regraded to establish positive drainage from the new culvert.

Refer to **Exhibit A.14** for detailed location of the proposed PA1-015 improvement project. Refer to **Exhibit 2** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA2-021

913 Calloway Drive – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	71
➢ Watershed:	Priority Area 2
➢ Recommended Improvements:	Replace 228 LF 30" CMP with 30" RCP Replace 125 LF 36" CMP with 42" RCP
➢ Existing Flooding Issues:	Existing 2-year residential LAG LOS (1.23' residential LAG inundation at 100-year event). Existing 2-year Roadway LOS (0.91' roadway overtopping at 10-year event)
➢ Proposed Flood Reduction:	1.5' (residential LAG 100-year LOS) 3.38' (roadway 10-year LOS)
➢ Project Cost:	$275,036
➢ Comments:	Elevations determined from LiDAR. Detailed topographic and utility survey will be required for design.

The drainage system located near 913 Calloway Drive conveys stormwater runoff from approximately 27.4 acres of residential areas and paved roadway surfaces. A 30" corrugated metal pipe (CMP) intercepts runoff from an upstream drainage system at the western end of the driveway at 913 Calloway Drive. The CMP runs eastward and into a 36" CMP that conveys the runoff under Calloway Drive. From the eastern side of Calloway Drive, another 36" CMP conveys the runoff eastward toward the system outfall located between 910 and 912 Calloway Drive. Calloway Drive is classified as a local residential roadway and has a required 10-year storm Level of Service (LOS). The existing drainage system has a 2-year storm LOS. Analysis of the drainage system shows that the lowest adjacent grade (LAG) of the residential structure at 913 Calloway Drive may become inundated by flood waters during frequent storms. Residential structures have a required 100-year LOS. The existing LOS at 913 Calloway Drive is the 2-year storm event based on the estimated LAG elevation.

To achieve a 10-year LOS for the roadway and a 100-year LOS for the residence, it will be necessary to replace 228 LF of the existing 30" CMP with 30" reinforced concrete pipe (RCP), and to replace 125 LF of existing 36" CMP with 42" RCP. Elevations used within the modeling analysis were taken from the LiDAR data. It should be noted that no field-run topographic survey data was collected at this location, and existing utilities are likely located within the City Right-of-Way. A detailed topographic and utility survey will be required for the design of the recommended improvements. Refer to **Exhibit A.15** for detailed location of the proposed PA2-021 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA2-024

Quail Valley Drive from near 915 to near 920 Quail Valley Drive – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	79
➢ Watershed:	Priority Area 2
➢ Recommended Improvements:	Replace 163 LF 24" CMP with 36" RCP Replace 166 LF 30" CMP with 42" RCP
➢ Existing Flooding Issues:	Existing less than 2-year LOS (0.49' residential LAG inundation at 100-year event) Existing less than 2-year LOS (0.71' roadway surcharging at 10-year event)
➢ Proposed Flood Reduction:	1.85' (residential LAG 100-year LOS) 1.62' (roadway 10-year LOS)
➢ Project Cost:	$258,552
➢ Comments:	Elevations determined from LiDAR. Detailed topographic and utility survey will be required for design.

The drainage system located near 915 and 920 Quail Valley Drive conveys stormwater runoff from approximately 36.7 acres of residential areas and paved roadway surfaces. A 24" corrugated metal pipe (CMP), adjacent to 915 Quail Valley Drive, intercepts runoff from a grass swale and conveys the runoff north to a curb inlet on Quail Valley Drive. A 30" CMP then conveys runoff northeast under Quail Valley Drive, ultimately discharging to an outfall located adjacent to 920 Quail Valley Drive. Quail Valley Drive is classified as a local residential roadway and has a required 10-year storm Level of Service (LOS). The existing drainage system LOS is less than the 2-year storm. Analysis of the drainage system shows that the low adjacent grade (LAG) of the residential structure at 915 Quail Valley Drive may become inundated by flood waters during frequent storms. Residential structures have a required 100-year LOS. The existing LOS at 915 Quail Valley Drive is less than the 2-year storm event based on the estimated LAG elevation.

To achieve a 10-year LOS for the roadway and a 100-year LOS for the residence, it will be necessary to replace the existing 163 LF of 24" CMP with 36" reinforced concrete pipe (RCP) and to replace 166 LF of existing 30" CMP with 42" RCP. Elevations used within the modeling analysis were taken from LiDAR data. It should be noted that no field-run topographic survey data was collected at this location, and existing utilities are likely located withing the City Right-of-Way. A detailed topographic and utility survey will be required for the design of the recommended improvements.

Refer to **Exhibit A.16** for detailed location of the proposed PA2-024 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA4-013

Martingale Lane near 6102 Martingale Lane – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	86
➢ Watershed:	Priority Area 4
➢ Recommended Improvements:	Replace 24 LF of 2'x3' CMP with 2.417'x3.75' ERCP Replace 163 LF of 2'x3' CMP with 2.417'x3.75' ERCP
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (0.75' surcharging in the 10-year event).
➢ Proposed Flood Reduction:	1.43' (10-year LOS).
➢ Project Cost:	$248,684
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design. Inlet and outlet inverts of the 24 LF segment will need to be raised to ensure 0.5% slope. Outlet elevation of 163 LF segment remains unchanged.
➢ Assoc. Residential Benefits:	6100 & 6102 Martingale Lane • Existing 25-year LOS. • Proposed 100-year LOS.

The existing storm network at this location is undersized and consists of adverse pipe slopes; as a result, the roadway frequently overtops, and surcharged flow is able to collect/pond within the roadway sag near 6102 Martingale Lane. Martingale Lane is classified as a local road and has a required 10-year Level of Service (LOS); however, the existing drainage system has less than a 2-year LOS.

To achieve a 10-year storm LOS, the recommended improvements include:

- Replacement of 24 LF of 2'x3' corrugated metal pipe (CMP) with 2.417'x3.75' elliptical reinforced concrete pipe (ERCP) at 0.5% slope;
- Replacement of 163 LF of 2'x3' CMP with 2.417'x3.75' ERCP at 0.5% slope.

The inlet and outlet inverts of the 24 LF segment will need to be raised in order to achieve a proposed pipe slope of 0.5%. The outlet invert of the 163 LF segment will remain unchanged.

Refer to **Exhibit A.17** for detailed location of the proposed PA4-013 improvement project. Refer to **Exhibit A.5** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects with Associated Residential Benefits

Project Site ID: PA4-014

Dekemont Lane near 525 Dekemont Lane – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	88
➢ Watershed:	Priority Area 4
➢ Recommended Improvements:	Replace 125 LF of 24” CMP with 36” RCP.
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (0.50’ surcharging in the 10-year event).
➢ Proposed Flood Reduction:	1.13’ (10-year LOS).
➢ Project Cost:	$107,116
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design. Lower upstream inlet invert of 125 LF segment to meet cover requirements.
➢ Assoc. Residential Benefits:	525 Dekemont Lane ▪ Existing less than 2-year LOS. ▪ Proposed 10-year LOS.

The existing 24” corrugated metal pipe (CMP) near 525 Dekemont Lane is undersized. The nearby existing road inlet (within the cul-de-sac) surcharges in less than the 2-year storm event. Dekemont Lane is classified as a local road and has a required 10-year Level of Service (LOS); however, the existing drainage system has less than a 2-year LOS.

To meet the required 10-year storm LOS, the existing pipe must be replaced with 125 LF of 36” reinforced concrete pipe (RCP). The upstream inlet invert elevation must be lowered to meet cover requirements. The downstream outlet invert will remain unchanged.

Refer to **Exhibit A.18** for detailed location of the proposed PA4-014 improvement project. Refer to **Exhibit A.5** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA1-009

Maryland Way near HG Hill Property – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	25
➢ Watershed:	Priority Area 1
➢ Recommended Improvements:	Install new curb inlets directly into existing cross drain.
➢ Existing Flooding Issues:	Curb inlets on Maryland Way have a 10-year LOS (1.24' surcharging at the 50-year event).
➢ Proposed Flood Reduction:	2.40' (50-year LOS).
➢ Project Cost:	$117,419
➢ Comments:	Detailed topographic survey data along the roadway at the location of the proposed inlets should be collected prior to final design. A full spread width analysis should be conducted as part of final design. Structural tie-in of the proposed inlets to the existing ERCP cross drain should be considered during final design.

The existing curb inlet, lateral, and cross drain system, which is located within a sag along Maryland Way near HG Hill property, is undersized and induces roadway ponding within the sag. Maryland Way is classified as an arterial road and has a required 50-year storm Level of Service (LOS). The existing system has a 10-year LOS. The goal of this project is to eliminate roadway ponding within the travel lanes for the 50-year storm.

To achieve the required 50-year storm LOS, it is necessary to install new curb inlets directly into the existing Elliptical Reinforced Concrete Pipe (ERCP) underneath Maryland Way. The cross drain under Maryland Way is a 4.833'x7.583' ERCP and has sufficient capacity to accept the direct inflow from the proposed curb inlets. A full spread width analysis will need to be conducted to determine the amount/type of inlets necessary to meet the required 50-year storm LOS.

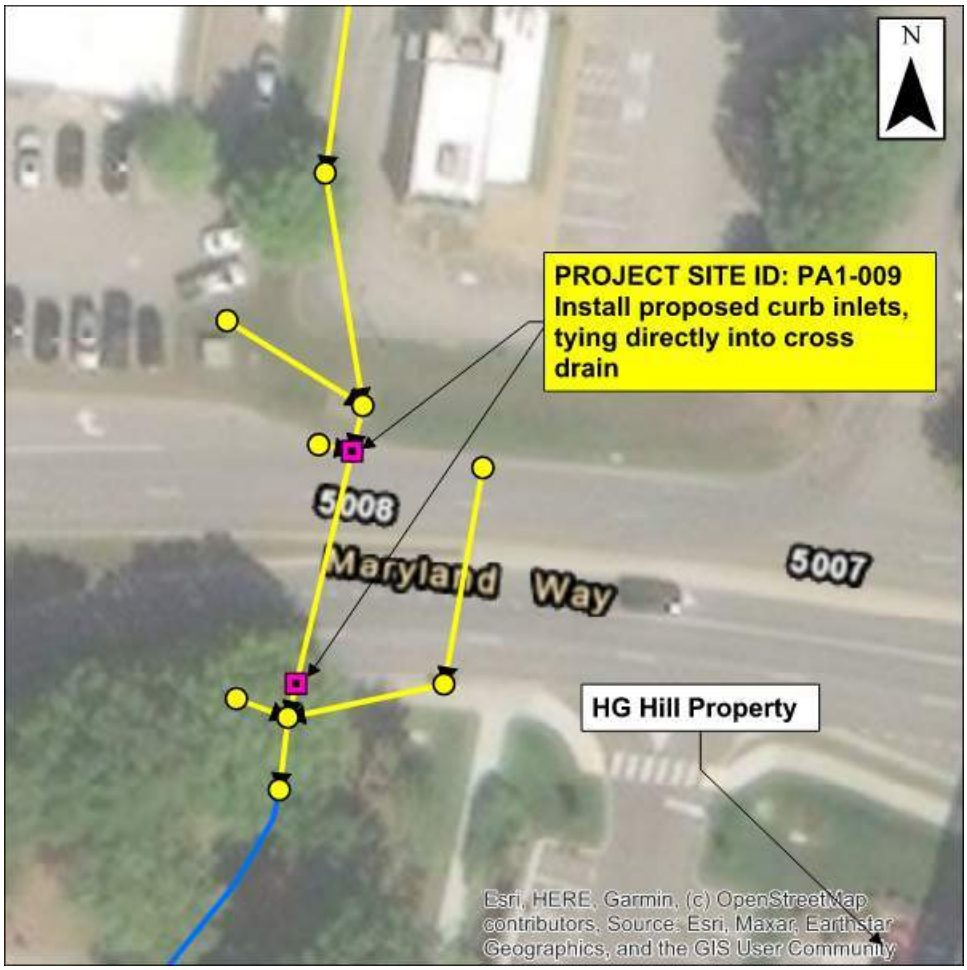
A portion of the existing cross drain will need to be removed for construction of the proposed inlets and associated junction boxes, and the remaining segments of the cross drain will need to structurally tie into the proposed junctions. The structural tie-in into the existing ERCP should be considered during final design.

Refer to the map on the following page for detailed location of the proposed PA1-009 improvement project. Refer to **Exhibit 2** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA1-009 – Cont.

Maryland Way near HG Hill Property:



NOTES:
Blue Lines represent open channels.
Yellow dots represent existing junction points such as open channel nodes, headwalls, inlets, or manholes.
Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.
Pink boxes represent proposed curb inlets.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA5-001

Belle Rive Drive and Granny White Pike – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	27
➢ Watershed:	Priority Area 5
➢ Recommended Improvements:	Replace 71 LF of 2 – 8'x4' RCBC with 2 – 10'x5' RCBC
➢ Existing Flooding Issues:	Existing 10-year LOS (1.04' overtopping at 25-year event).
➢ Proposed Flood Reduction:	1.22' (25-year LOS).
➢ Project Cost:	$418,981
➢ Comments:	Proposed slope = 0.5%. Outlet side of channel to be lowered to meet slope requirements.

The existing cross drain is located at the intersection of Belle Rive Drive and Granny White Pike. The existing double 8'x4' RCBC conveys stormwater discharges from south to north under Belle Rive Drive. Belle Rive Drive is classified as a collector road and has a required 25-year storm Level of Service (LOS).

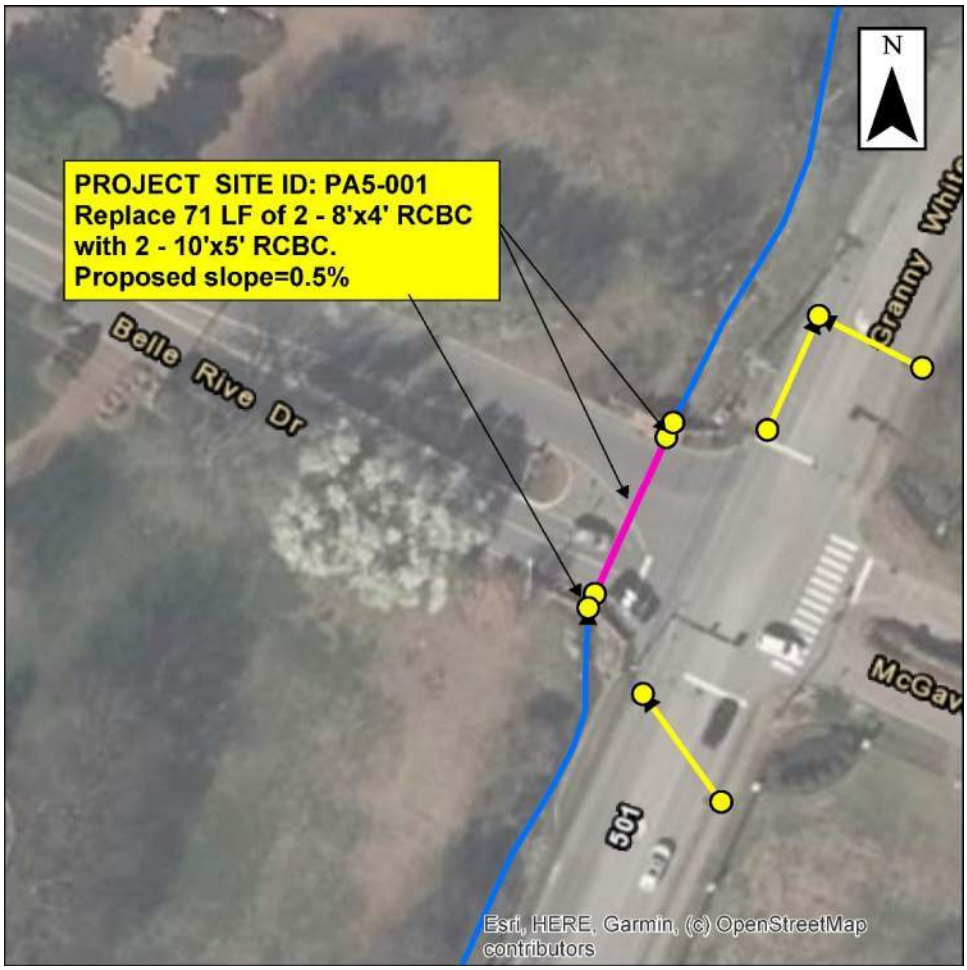
To achieve a 25-year storm LOS, it will be necessary to replace the existing cross drain with a double barrel 10'x5' RCBC at a proposed slope of 0.5%. The existing cross drain has an inverse slope. Therefore, the outlet side of the RCBC will need to be lowered to achieve the 0.5% slope.

Refer to the map on the following page for detailed location of the proposed PA5-001 improvement project. Refer to **Exhibit A.6** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA5-001 – Cont.

Belle Rive Drive and Granny White Pike:



NOTES:
Blue Lines represent open channels.
Yellow dots represent existing junction points such as open channel nodes, headwalls, inlets, or manholes.
Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA4-004

Belle Rive Drive and Martingale Lane Intersection – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	29
➢ Watershed:	Priority Area 4
➢ Recommended Improvements:	Replace 30 LF of 1.67'x2.33' CMP with 2.83'x4.42' ERCP Replace 32 LF of 2.5'x3.5' CMP with 2.83'x4.42' ERCP Replace 158 LF of 2.5'x3.5' CMP with 3.167'x5' ERCP
➢ Existing Flooding Issues:	Existing 2-year LOS (0.98' overtopping at 25-year event).
➢ Proposed Flood Reduction:	1.98' (25-year LOS).
➢ Project Cost:	$319,809
➢ Comments:	All inverts will need to be lowered to meet pipe cover and slope requirements. Elevations determined from LiDAR. Detailed topographic survey will be required for design.

The current culvert system at this project location receives bypass flow from adjoining roadside drainage networks along Belle Rive Drive and Martingale Lane. This existing system is undersized and has an inverse slope; therefore, the roadway frequently overtops and surcharged flow is able to collect/pond within the roadway sag located at the intersection. Belle Rive Drive is classified as a collector road and has a required 25-year storm Level of Service (LOS); however, the existing drainage system has a 2-year storm LOS.

To achieve the required 25-year storm LOS, the recommended improvements include:

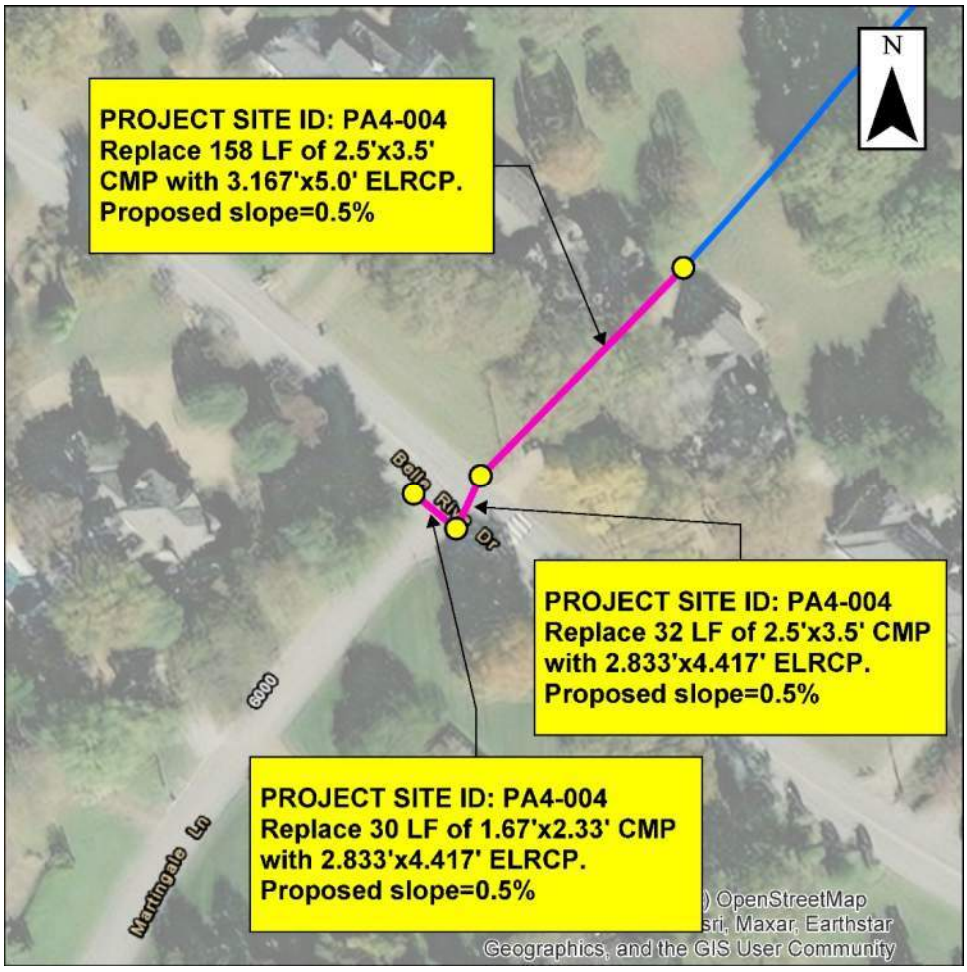
- Replacement of 30 LF of 1.67'x2.33' CMP with 2.833'x4.417' ERCP at 0.5% slope;
- Replacement of 32 LF of 2.5'x3.5' CMP with 2.833'x4.417' ERCP at 0.5% slope; and
- Replacement of 158 LF of 2.5'x3.5' CMP with 3.167'x5.0' ERCP at 0.5% slope.

The inverse slope of the existing system was corrected with a 0.5% slope throughout the proposed system. It will be necessary to lower all culvert inverts (including the outlet pipe) to meet pipe slope and cover requirements.

Refer to the map on the following page for detailed location of the proposed PA4-004 improvement project. Refer to **Exhibit A.5** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA4-004 – Cont.

Belle Rive Drive and Martingale Lane Intersection



NOTES:
Blue Lines represent open channels.
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Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA1-010

Meadow Lake Road between Robinhood Road and Franklin Road – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	30
➢ Watershed:	Priority Area 1
➢ Recommended Improvements:	Replace 38 LF of 1 – 15' x 6' RCB with 2 – 12 x 6 RCB
➢ Existing Flooding Issues:	Less than 2-year LOS (0.44' overtopping at 10-year event).
➢ Proposed Flood Reduction:	1.00' (10-year LOS).
➢ Project Cost:	$299,555
➢ Comments:	Existing cross drain is undersized and induces overtopping of Meadow Lake Rd.

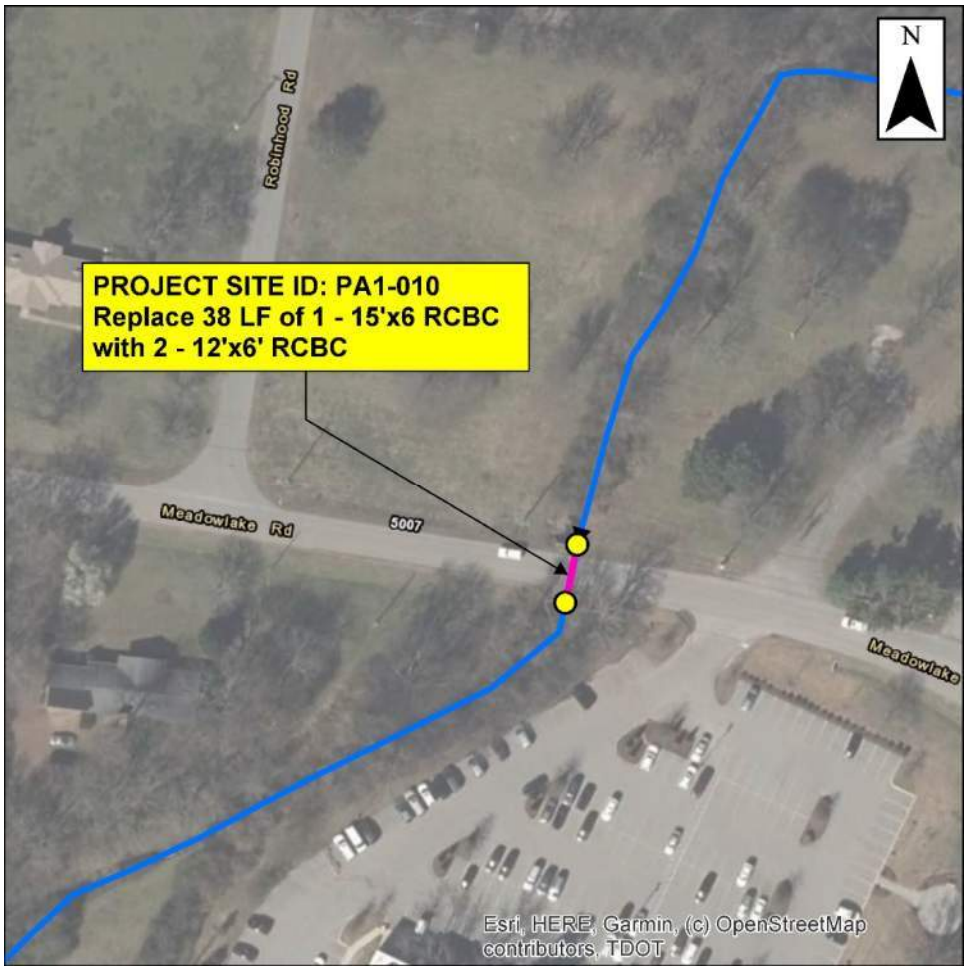
The existing cross drain is located on Meadow Lake Road between Robinhood Road and Franklin Road, just upstream of Otter Creek Church. The existing single-barrel 15'x6' reinforced concrete box culvert (RCBC) conveys stormwater discharges from north to south under Meadow Lake Road. Meadow Lake Road is classified as a local road and has a required 10-year storm Level of Service (LOS). The existing cross drain has a < 2-year storm LOS.

To achieve a 10-year LOS, it will be necessary to replace the existing cross drain with a double-barrel 12'x6' RCBC. The proposed improvements achieve a 10-year LOS while providing approximately 0.6-feet of freeboard from roadway overtopping.

Refer to the map on the following page for detailed location of the proposed PA1-010 improvement project. Refer to **Exhibit 2** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA1-010 – Cont.

Meadow Lake Road between Robinhood Road and Franklin Road:



NOTES:
Blue Lines represent open channels.
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Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA3-010

Intersection of Meadow Lake Road at Dyer Lane – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	35
➢ Watershed:	Priority Area 3
➢ Recommended Improvements:	Replace 45 LF of 24" CMP with 30" RCP
➢ Existing Flooding Issues:	Existing 2-year LOS (0.77' overtopping at 10-year event)
➢ Proposed Flood Reduction:	1.61' (10-year LOS)
➢ Project Cost:	$77,645
➢ Comments:	Detailed topographic and utility surveys will be required for design.

The existing drainage system is located at the intersection of Meadow Lake Road and Dyer Lane and consists of a single 24" corrugated metal pipe (CMP) cross drain that conveys stormwater discharges from north to south under Meadow Lake Road. Meadow Lake Road is classified as a local road and has a required 10-year storm Level of Service (LOS). The existing system has a 2-year storm LOS.

It will be necessary to replace the existing cross drain with a 30" reinforced concrete pipe (RCP) cross drain to achieve the required 10-year storm LOS.

Refer to the map on the following page for detailed location of the proposed PA3-010 improvement project. Refer to **Exhibit A.4** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA3-010 – Cont.

Intersection of Meadow Lake Road at Dyer Lane:

NOTES:
Blue Lines represent open channels.
Yellow dots represent existing junction points such as open channel nodes, headwalls, inlets, or manholes.
Yellow lines represent existing pipes/culverts
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA3-012

Meadow Lake Road West of Dyer Lane – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	42
➢ Watershed:	Priority Area 3
➢ Recommended Improvements:	Replace 68 LF of 30" x 59" elliptical CMP with 2 - 36" RCP.
➢ Existing Flooding Issues:	Existing 2-year LOS (0.52' roadway overtopping at 10-year event).
➢ Proposed Flood Reduction:	0.6' (10-year LOS).
➢ Project Cost:	$97,454
➢ Comments:	Elevations determined from survey.

The cross drain located in front of 5212 Meadow Lake Road conveys stormwater discharges from approximately 44.4 acres of residential and commercial areas to the north. A 30" high x 59" wide elliptical corrugated metal pipe (CMP) currently conveys the runoff under Meadow Lake Road and into a ditch which runs along the south side of the road. The outfall of the ditch is Dyer Lake. Meadow Lake Road is classified as a local residential roadway and has a required 10-year storm Level of Service (LOS). However, the existing drainage system has a 2-year storm LOS. Therefore, it is recommended that the cross drain at this location be sized for the required 10-year storm LOS. During the field reconnaissance, it was noted that the inside top of the existing elliptical CMP is collapsing, and the ditch downstream (on the south side of Meadow Lake Road) has silted in. This was reported to the City as part of the Maintenance Needs Package, transmitted via email on May 27, 2022. The poor condition of the existing CMP may also be contributing to the low LOS.

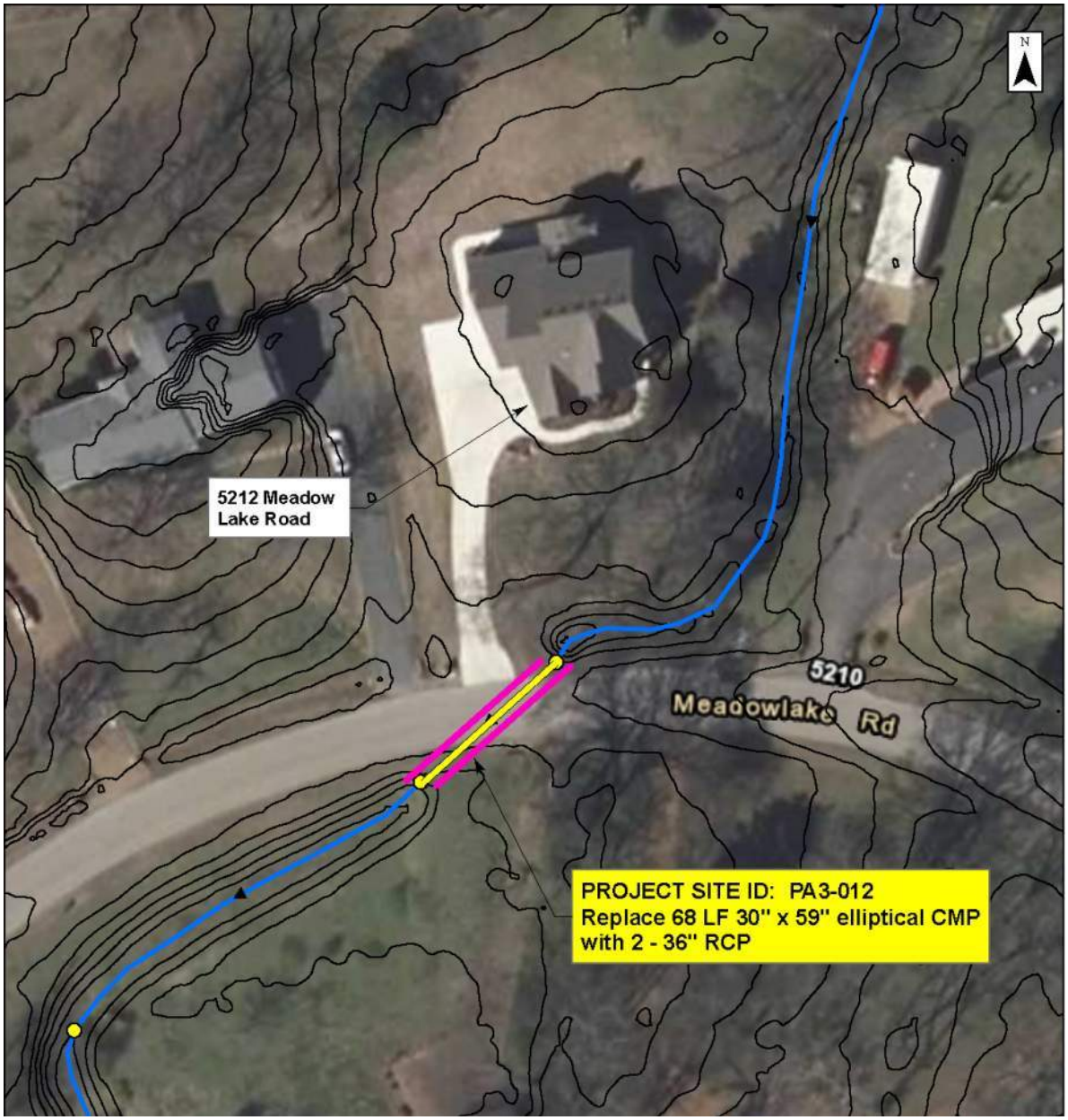
To achieve a 10-year LOS, it will be necessary to replace the existing 68 LF of 30" high x 59" wide elliptical CMP with two 36" reinforced concrete pipes (RCP). Elevations used within the modeling analysis were taken from the field survey data.

Refer to the map on the following page for detailed location of the proposed PA3-012 improvement project. Refer to **Exhibit A.4** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA3-012 – Cont.

Meadow Lake Road West of Dyer Lane :



NOTES:

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Yellow lines represent existing pipes/culverts
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA2-010

Murray Lane West of Franklin Road – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	43
➢ Watershed:	Priority Area 2
➢ Recommended Improvements:	Replace 250 LF of 24" RCP with 30" RCP.
➢ Existing Flooding Issues:	Curb inlet has a 5-year LOS (0.49' surcharging at 50-year event).
➢ Proposed Flood Reduction:	1.2' (100-year LOS).
➢ Project Cost:	$187,422
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design.

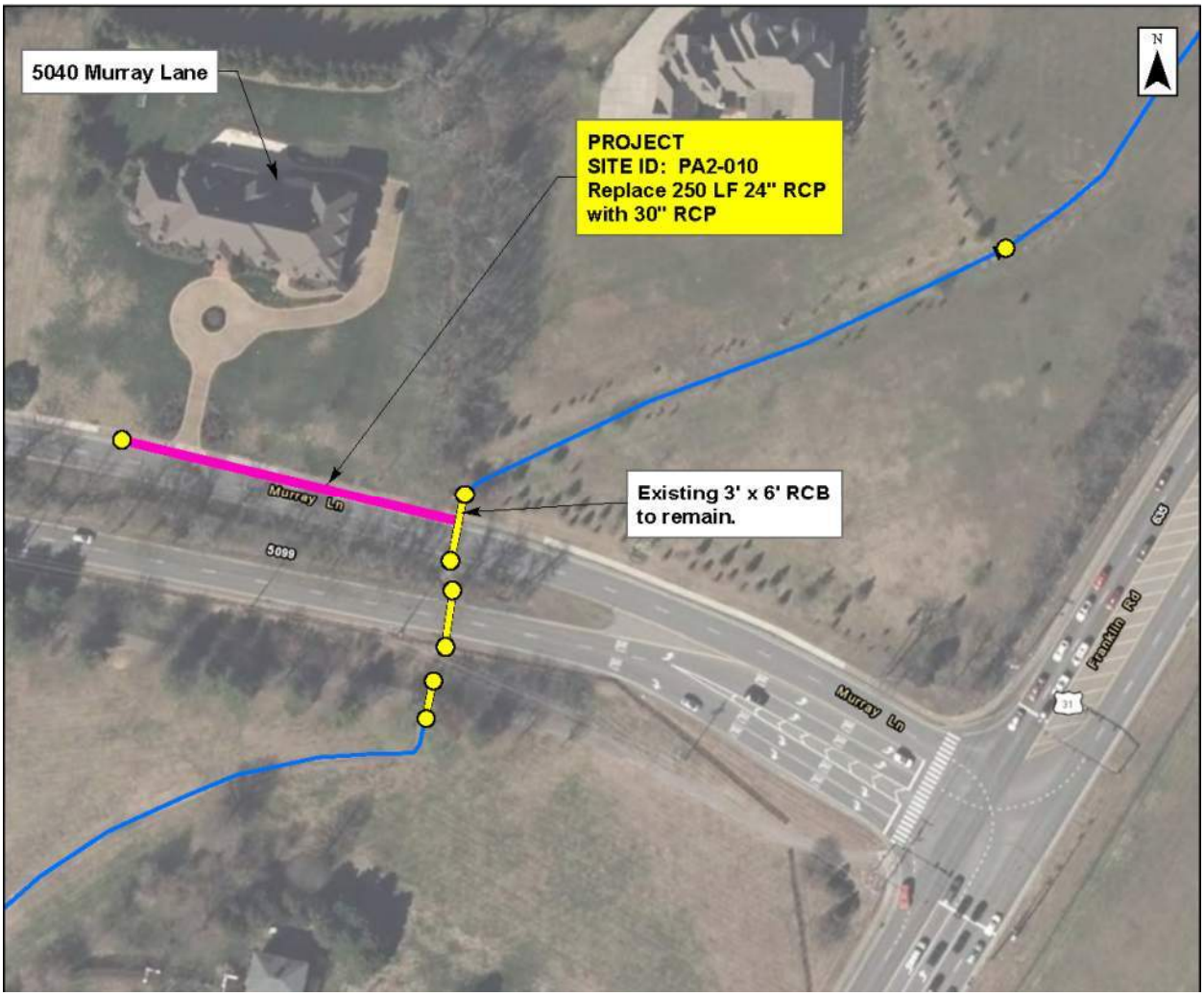
The curb inlet located in front of 5040 Murray Lane intercepts stormwater discharges from the road and adjacent residential areas. A 24" reinforced concrete pipe (RCP) currently conveys the intercepted discharges eastward, discharging into the 3' high x 6' wide reinforced concrete box (RCB) cross drain under Murray Lane. The outfall of the 24" RCP is located in the interior of the RCB. Murray Lane is classified as an arterial road in this location and has a required 50-year storm Level of Service (LOS). However, the existing drainage system has a 5-year storm LOS. During the field reconnaissance, it was noted that flooding of westbound Murray Lane may potentially impede the ingress/egress of emergency response vehicles. Therefore, it is recommended that this location be sized for the required 50-year storm LOS.

To achieve a 50-year LOS, it will be necessary to replace the existing 250 LF of 24" RCP pipe with a 30" RCP. Elevations used within the modeling analysis were taken from aerial topographic data (LiDAR). A detailed survey will be required for design.

Refer to the map on the following page for detailed location of the proposed PA2-010 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA2-010 – Cont.

Murray Lane West of Franklin Road:



NOTES:
Blue Lines represent open channels.
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Yellow lines represent existing pipes/culverts
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA4-008

Belle Rive Drive and Turtle Creek Drive Intersection – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	44
➢ Watershed:	Priority Area 4
➢ Recommended Improvements:	Replace 109 LF of 15" RCP with 24" RCP. Replace 18 LF of 15" RCP with 24" RCP.
➢ Existing Flooding Issues:	Existing 2-year LOS (0.36' overtopping at 25-year event).
➢ Proposed Flood Reduction:	0.69' (25-year LOS).
➢ Project Cost:	$98,061
➢ Comments:	Existing system is undersized and induces roadway ponding at the intersection of Belle Rive Drive and Turtle Creek Drive.

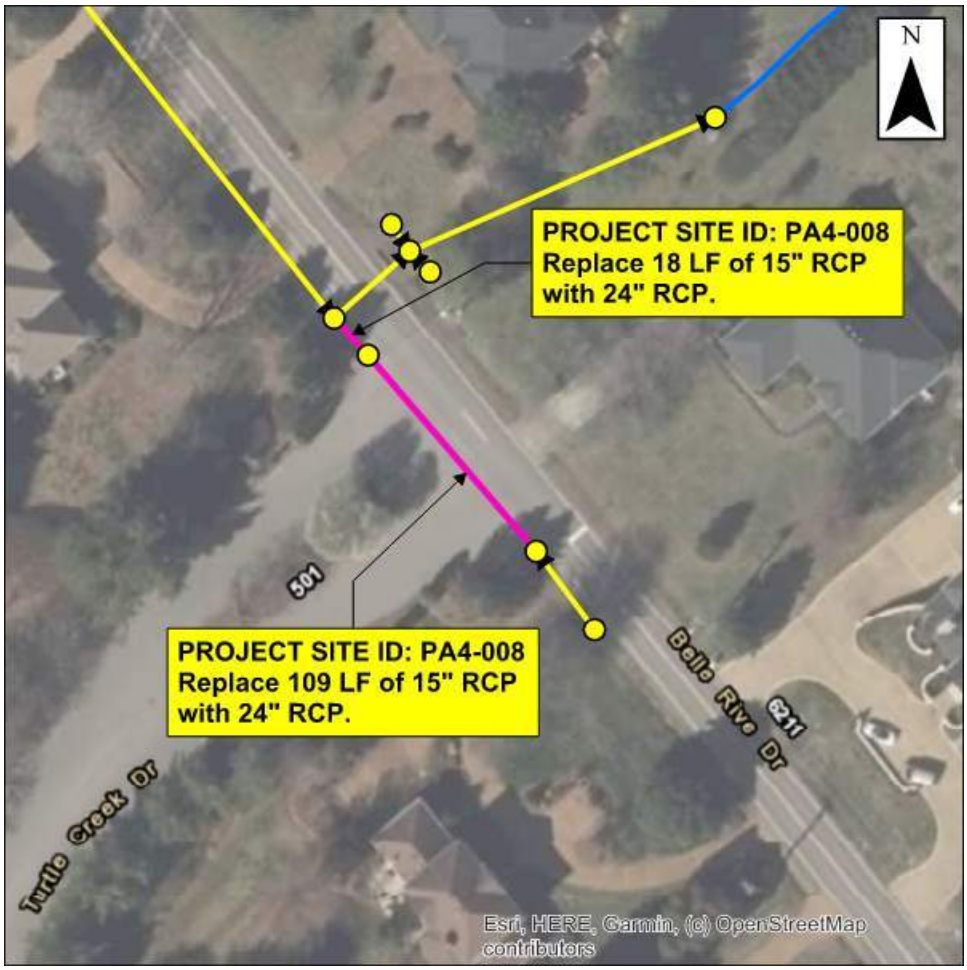
The current drainage system at this project location receives bypass flow from the south along Turtle Creek Drive. The existing system is undersized; therefore, the roadway at this intersection frequently surcharges. Belle Rive Drive is classified as a collector road and has a 25-year storm Level of Service (LOS); however, the existing drainage system has a 5-year storm LOS.

It will be necessary to replace the existing system with 24" reinforced concrete pipe (RCP) to achieve the required 25-year storm LOS.

Refer to the map on the following page for detailed location of the proposed PA4-008 improvement project. Refer to **Exhibit A.5** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA4-008 – Cont.

Belle Rive Drive and Turtle Creek Drive Intersection:



NOTES:
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Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA1-014

Seward Road and Meadow Lake Road Intersection – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	46
➢ Watershed:	Priority Area 1
➢ Recommended Improvements:	Replace 50 LF of 1 – 1.79'x2.67' CMP with 2.0'x3.167' Elliptical Reinforced Concrete (ERCP)
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (0.33 overtopping at 10-year event).
➢ Proposed Flood Reduction:	0.45 (10-year LOS)
➢ Project Cost:	$86,493
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design. Inlet and outlet side of channel to be lowered to meet slope requirements. Proposed culvert slope: 0.5%.

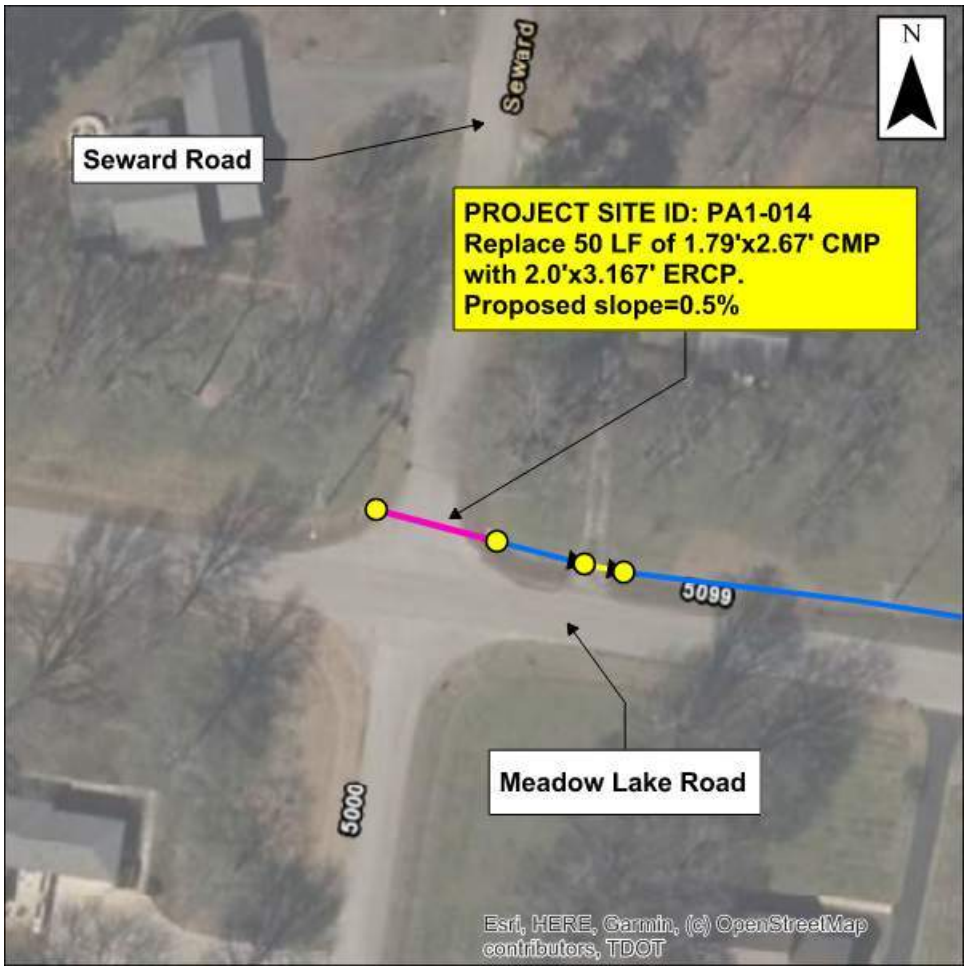
The existing drainage system is located at the intersection of Seward Road and Meadow Lake Road and consists of a single 1.79'x2.67' elliptical corrugated metal pipe (CMP) cross drain that conveys stormwater discharge from west to east under Seward Road. The upstream headwall on the west side Seward Road receives discharge from roadway swales located to the north and west. Seward Road is classified as a local road and has a required 10-year storm Level of Service (LOS). The existing system has less than a 2-year LOS.

It will be necessary to replace the existing cross drain with a 2.0'x3.167' elliptical reinforced concrete pipe (ERCP). The existing cross drain has an inverse slope due to major siltation. The inlet and outlet inverts of the proposed culvert will need to be lowered to achieve a 0.5% slope.

Refer to the map on the following page for detailed location of the proposed PA1-014 improvement project. Refer to **Exhibit 2** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA1-014 – Cont.

Seward Road and Meadow Lake Road Intersection:



NOTES:
Blue Lines represent open channels.
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Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA4-009

Belle Rive Drive near 6012 Belle Rive Drive – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	49
➢ Watershed:	Priority Area 4
➢ Recommended Improvements:	Replace 31 LF of 20”x28” CMP with 24” RCP. Replace 164 of 20”x28” CMP with 24” RCP.
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (0.26’ surcharging at 25-year event).
➢ Proposed Flood Reduction:	1.66’ (25-year LOS).
➢ Project Cost:	$151,424
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design.

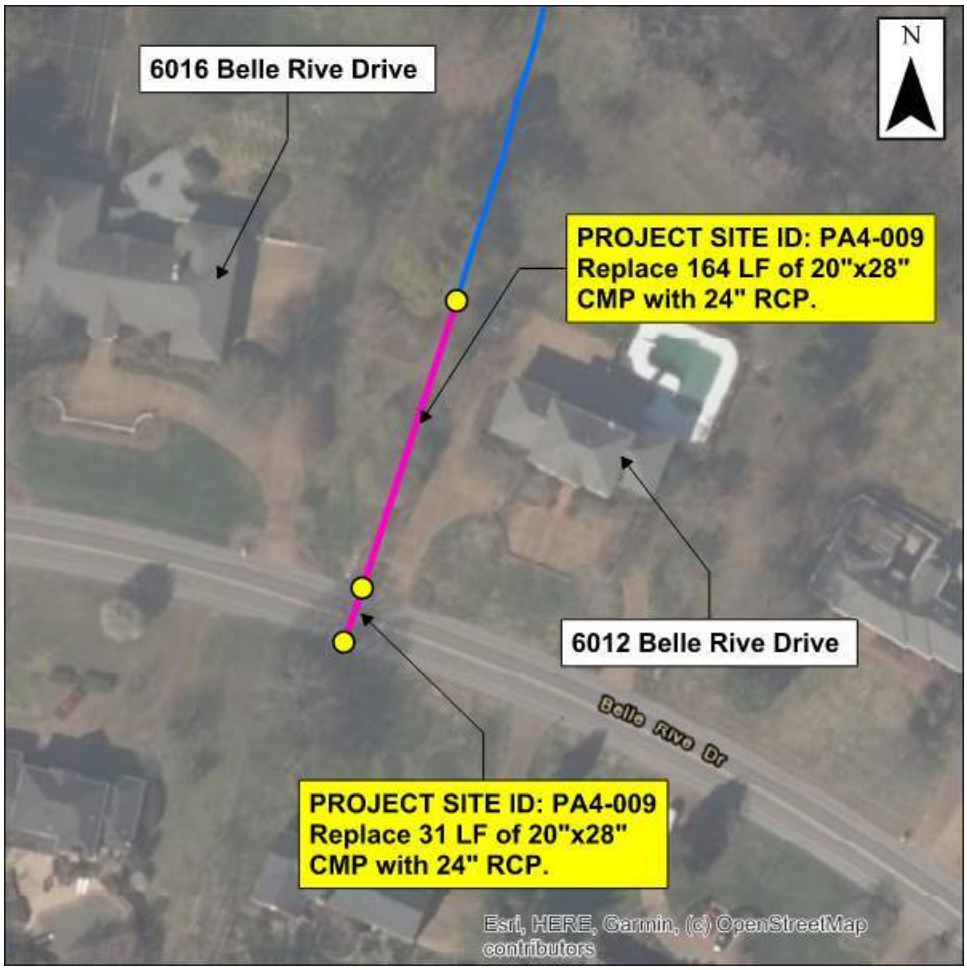
The existing drainage system is located near 6012 Belle Rive Drive and consists of 20”x28” elliptical corrugated metal pipe (CMP) that conveys runoff originating from the west, as well as from Belle Rive Drive, underneath the roadway and towards the north. The existing system is undersized; therefore, existing inlets along the roadway frequently surcharge. Belle Rive Drive is classified as a collector road and has a 25-year storm Level of Service (LOS); however, the existing drainage system has less than a 2-year storm LOS.

It will be necessary to replace the existing system with 24” reinforced concrete pipe (RCP) to achieve the required 25-year storm LOS.

Refer to the map on the following page for detailed location of the proposed PA4-009 improvement project. Refer to **Exhibit A.5** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA4-009 – Cont.

Belle Rive Drive near 6012 Belle Rive Drive:



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Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA1-016

Wilson Pike Circle, near 246 Wilson Pike Circle – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	51
➢ Watershed:	Priority Area 1
➢ Recommended Improvements:	Install additional barrel (36 LF of 14”x22” ERCP).
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (0.22’ overtopping at 25-year event).
➢ Proposed Flood Reduction:	1.16’ (25-year LOS).
➢ Project Cost:	$66,885
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design. Install additional barrel parallel to existing culvert (to remain).

The existing 14”x22” Elliptical Reinforced Concrete Pipe (ERCP) under Wilson Pike Circle, near 246 Wilson Pike Circle, is undersized and causes roadway overtopping onto Wilson Pike Circle during storm events more frequent than the 2-year event. Wilson Pike Circle is a collector road, which requires a 25-year storm Level of Service (LOS).

To achieve a 25-year storm LOS, it is necessary to install an additional 36 LF of 14”x22” ERCP parallel to the existing cross drain (to remain). It may also be necessary to replace the existing inlet on the upstream (east) side of the roadway, to accommodate the addition culvert.

The aforementioned recommendations lower the water surface elevation by 1.16’ during the 25-year storm event.

Refer to the map on the following page for detailed location of the proposed PA1-016 improvement project. Refer to **Exhibit 2** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA1-016 – Cont.

Wilson Pike Circle, Near 246 Wilson Pike Circle:

NOTES:
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Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA2-011

Stuart Lane at Fountainhead Drive – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	55
➢ Watershed:	Priority Area 2
➢ Recommended Improvements:	Replace 43 LF of 24" HDPE with 36" RCP and Replace 52 LF of 30" CMP with 36" RCP
➢ Existing Flooding Issues:	Existing 2-year LOS (0.27' surcharging at 10-year event)
➢ Proposed Flood Reduction:	1.04' (10-year LOS)
➢ Project Cost:	$92,451
➢ Comments:	Existing storm sewer network consists of smaller pipes downstream of larger pipes (i.e., the existing network includes a constriction in pipe diameter) and estimated from LiDAR.

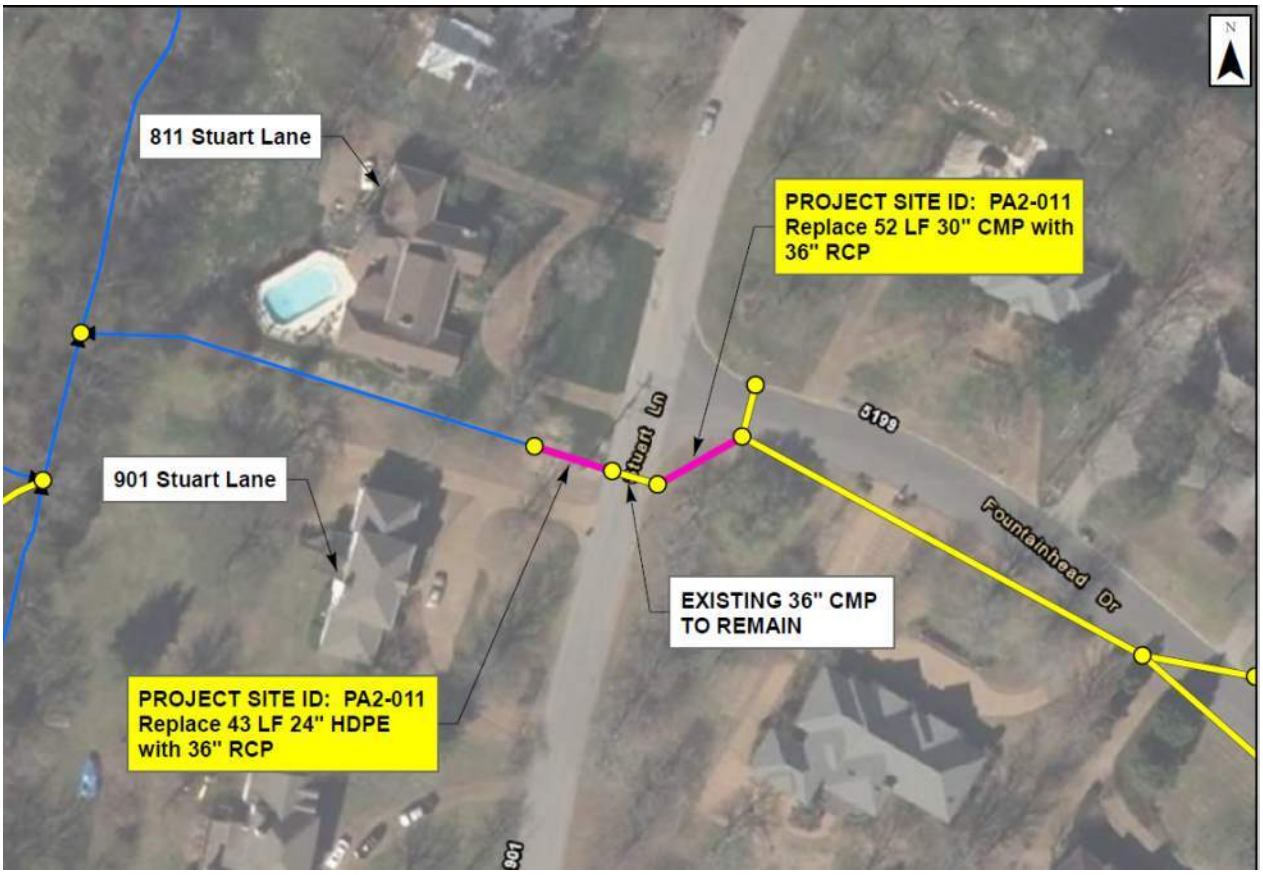
The existing storm sewer network conveys intercepted stormwater runoff from residential areas along Fountainhead Drive and Stuart Lane. The storm sewer outfall is located between 811 and 901 Stuart Lane. From the outfall of the storm sewer network, the discharge flows through a grass swale to the confluence with the creek behind 811 Stuart Lane. The storm sewer system is comprised of various sizes and types of pipes, with the last segment (i.e., at the system outfall) being the smallest. This results in a reduction in the capacity of the system and surcharging of the upstream inlets. Stuart Lane and Fountainhead Drive are both classified as local residential roadways and have a required 10-year storm event LOS. The existing structure has less than 2-year storm event LOS. The goal of this project is to achieve the desired LOS for the subject roadways.

The existing pipe segment leading to the storm sewer outfall is a 24" HDPE pipe. The existing pipe segment under Stuart Lane is a 36" corrugated metal pipe (CMP) and the existing pipe between Stuart Lane and Fountainhead Drive is a 30" CMP. To achieve the required 10-year LOS for local residential roadways, it will be necessary to replace the existing 24" HDPE pipe upstream of the storm sewer outfall with a 36 reinforced concrete pipe (RCP) and replace the existing 30" CMP with a 36" RCP. These improvements will give the storm sewer system the capacity to meet the 10-year storm event LOS requirement.

Refer to the map on the following page for detailed location of the proposed PA2-011 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA2-011 – Cont.

Stuart Lane at Fountainhead Drive:



NOTES:
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Yellow lines represent existing pipes/culverts
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA5-005

Curlybark Place – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	61
➢ Watershed:	Priority Area 5
➢ Recommended Improvements:	Replace 45 LF of 48" CMP with 48" RCP, and Replace 104 LF of 48" CMP with 48" RCP
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (1.51' surcharging at 10-year event).
➢ Proposed Flood Reduction:	2.97' (10-year LOS).
➢ Project Cost:	$158,721
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design. Outlet side of closed storm system to be lowered to meet slope requirements.

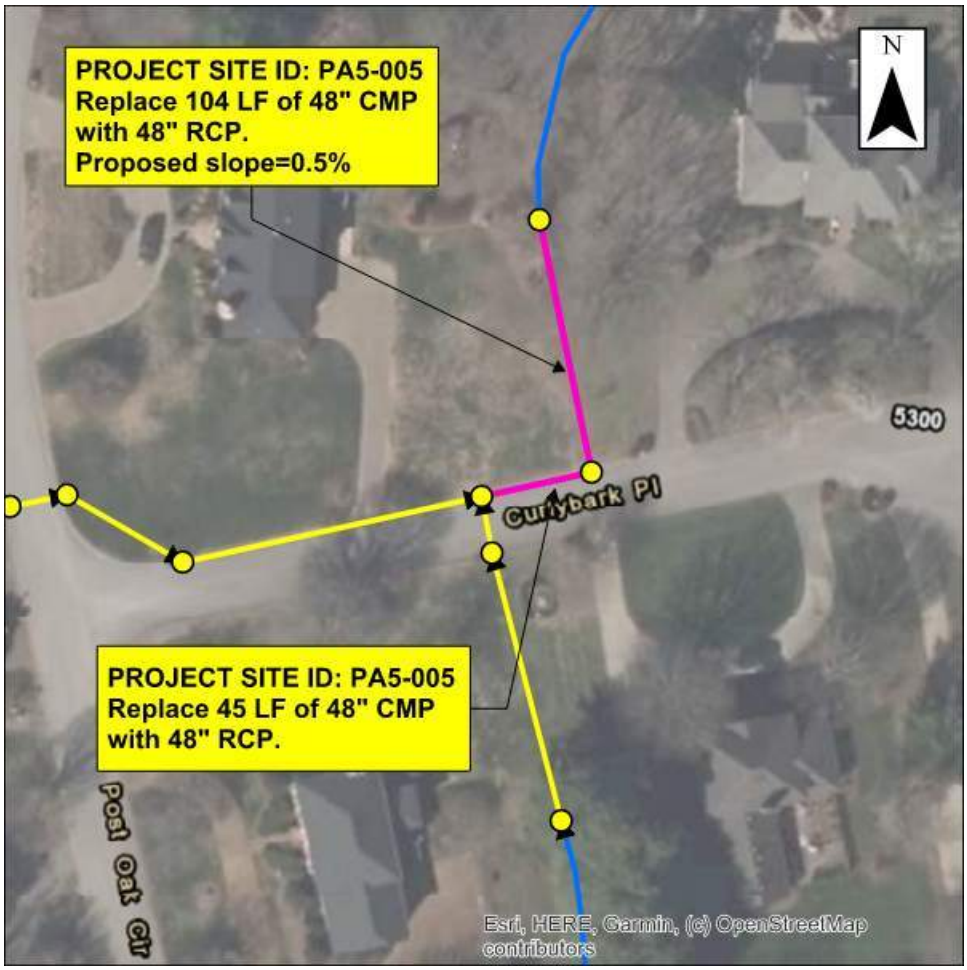
The existing system is located on Curlybark Place near Post Oak Circle. The existing system is undersized and has an inverse slope; as a result, inlet surcharging frequently overtops, and surcharged flow is able to collect/pond in the roadway along Curlybark Place. The 104 LF segment of 48" corrugated metal pipe (CMP) has an inverse slope due to heavy siltation. Curlybark Place is classified as a local road and has a required 10-year Level of Service (LOS); however, the existing drainage system has less than a 2-year LOS.

To achieve the required 10-year storm LOS for the roadway, it is necessary to replace the 45 LF of 48" CMP segment with a 48" RCP and the 104 LF of 48" CMP segment with 48" RCP at a 0.5% slope. The inverts of the 45 LF segment will remain unchanged. The outlet side of the 104 LF segment will need to be lowered to achieve the proposed slope.

Refer to the map on the following page for detailed location of the proposed PA5-005 improvement project. Refer to **Exhibit A.6** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA5-005 – Cont.

Curlybark Place:



NOTES:
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Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA2-015

Stuart Lane North of Fountain Head Drive – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	64
➢ Watershed:	Priority Area 2
➢ Recommended Improvements:	Replace 26 LF 24" CMP with 36" RCP Replace 21 LF 24" CMP with 42" RCP
➢ Existing Flooding Issues:	Existing 2-year LOS (1.28' roadway surcharging at 10-year event)
➢ Proposed Flood Reduction:	2.48' (roadway 10-year LOS)
➢ Project Cost:	$106,191
➢ Comments:	Elevations determined from Lidar. Detailed topographic and utility survey will be required for design.

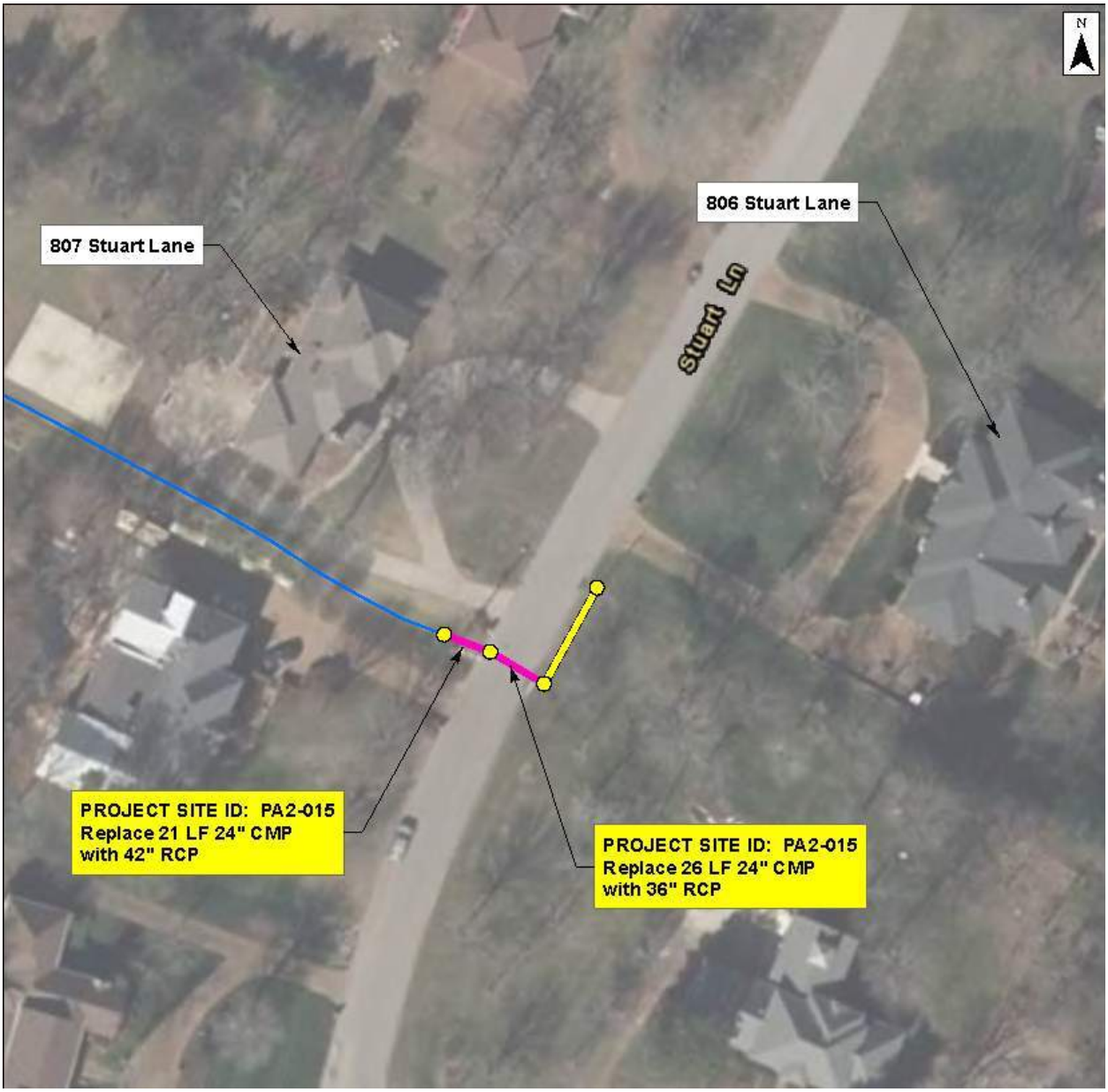
The drainage system located on Stuart Lane, north of Fountain Head Drive, conveys stormwater runoff from approximately 5.2 acres of residential areas and paved roadway surfaces. A 24" corrugated metal pipe (CMP) conveys storm water runoff south from 806 Stuart Lane and then west to the system outfall adjacent to 807 Stuart Lane. The outfall discharges into a drainage ditch with a concrete pilot channel. Stuart Lane is classified as a local residential roadway and has a required 10-year storm Level of Service (LOS). The existing drainage system LOS has a 2-year storm LOS.

To achieve a 10-year LOS for the roadway it will be necessary to replace the existing 26 LF of 24" CMP with 36" reinforced concrete pipe (RCP), and to replace 21 LF of existing 24" CMP with 42" RCP. Elevations used within the modeling analysis were taken from the Lidar data. It should be noted that no field-run topographic survey data was collected at this location, and existing utilities are likely located within the City Right-of-Way. A detailed topographic and utility survey will be required for the design of the recommended improvements.

Refer to the map on the following page for detailed location of the proposed PA2-015 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA2-015 – Cont.

Stuart Lane north of Fountain Head Drive:



NOTES:
Blue Lines represent open channels.
Yellow dots represent existing junction points such as open channel nodes, headwalls, inlets, or manholes.
Yellow lines represent existing pipes/culverts
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA2-016

Princeton Hills Drive between Murray Lane and Remington Drive– PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	65
➢ Watershed:	Priority Area 2
➢ Recommended Improvements:	Replace 137 LF 24" CMP with 24" RCP
➢ Existing Flooding Issues:	Existing 2-year LOS (1.10' roadway surcharging at 10-year event)
➢ Proposed Flood Reduction:	1.11' (10-year LOS)
➢ Project Cost:	$92,107
➢ Comments:	Elevations determined from Lidar. Detailed topographic and utility survey will be required for design.

The drainage system located on Princeton Hills Drive southwest of Murray Lane conveys stormwater runoff from approximately 4.3 acres of residential areas and paved roadway surfaces. A 24" corrugated metal pipe (CMP) conveys storm water runoff from the south side of Princeton Hills Drive toward the north side of the roadway, then eastward for approximately 73 feet, then northward toward the system outfall located just south of Murray Lane. The outfall discharges into a poorly defined swale which conveys westward. Princeton Hills Drive is classified as a local residential roadway and has a required 10-year storm Level of Service (LOS). The existing drainage system LOS has a 2-year storm LOS.

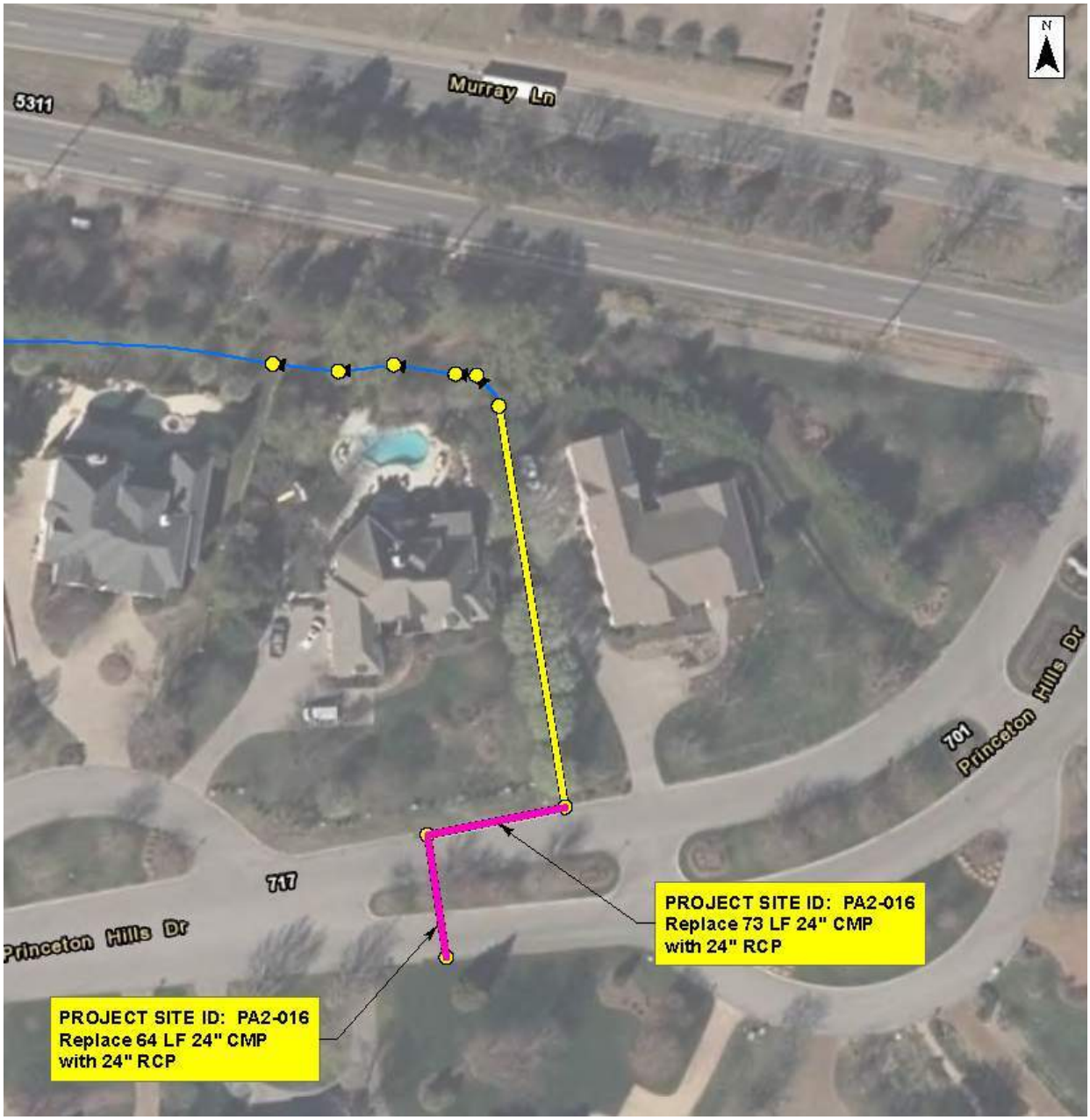
To achieve a 10-year LOS for the roadway it will be necessary to replace the two upstream segments of existing 24" CMP (total of 137 LF) with 24" reinforced concrete pipe (RCP). The increased smoothness of the RCP improves the efficiency of the drainage system and reduces surcharge elevations enough to obtain the required 10-year LOS. Elevations used within the modeling analysis were taken from the Lidar data. It should be noted that no field-run topographic survey data was collected at this location, and existing utilities are likely located within the City Right-of-Way. A detailed topographic and utility survey will be required for the design of the recommended improvements.

Refer to the map on the following page for detailed location of the proposed PA2-016 improvement project. Refer to **Exhibit A.3** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA2-016 – Cont.

Princeton Hills Drive between Murray Lane and Remington Drive:



NOTES:
Blue Lines represent open channels.
Yellow dots represent existing junction points such as open channel nodes, headwalls, inlets, or manholes.
Yellow lines represent existing pipes/culverts
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA3-017

Virginia Way at Ward Circle – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	76
➢ Watershed:	Priority Area 3
➢ Recommended Improvements:	Replace 47 LF of 24" CMP with 30" RCP Replace 8 LF of 24" RCP with 30" RCP, and Replace 317 LF 18" CMP with 30" RCP.
➢ Existing Flooding Issues:	Existing less than 2-year LOS (0.79' surcharging at 10-year event).
➢ Proposed Flood Reduction:	1.12' (10-year LOS)
➢ Project Cost:	$225,362
➢ Comments:	Existing storm sewer system has decreasing / constricting pipe diameters. Elevations determined from LiDAR. Detailed survey required for final design.

The existing storm sewer network begins at the intersection of Virginia Way and Ward Circle and extends southeast to an outfall into the existing detention pond immediately south of Ward Circle. Virginia Way and Ward Circle are both classified as local residential roadways and have required 10-year storm event Level of Service (LOS). The existing system has less than a 2-year storm event LOS. The goal of this project is to achieve the desired LOS for Virginia Way and Ward Circle at the subject project location.

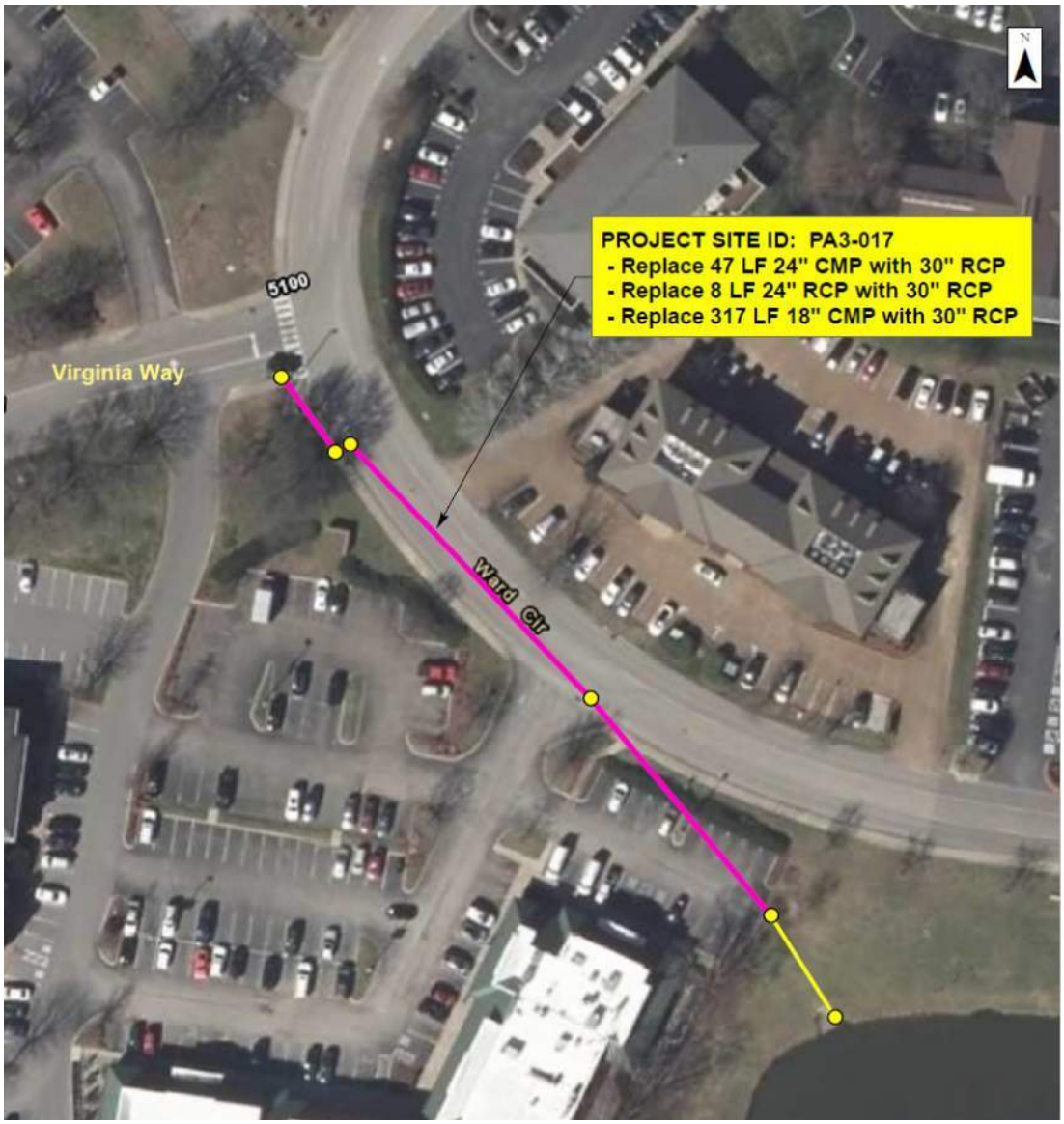
The existing storm network begins at the intersection of Virginia Way and Ward Circle with 47 LF of 24" corrugated metal pipe (CMP) that conveys southeast towards an existing storm manhole / junction box. From there, 8 LF of 24" reinforced concrete pipe (RCP) conveys east towards an inlet on Ward Circle. From this inlet, 176 LF of 18" CMP conveys southeast along Ward Circle to another inlet, and then 141 LF of additional 18" CMP conveys southeast into a parking lot inlet. Finally, an existing 36" CMP segment extends from the parking lot inlet into the system outfall at the detention pond. Not only does the subject storm sewer network lack adequate capacity to convey the volume of intercepted stormwater runoff, but the decreasing pipe diameters in the downstream direction further limits the conveyance capacity of the system.

To achieve the required 10-year LOS, it is necessary to replace all segments of the storm sewer system as described above, except the final / downstream-most 36" CMP segment, with 30" diameter RCP. It is also recommended that consideration be given during the design of the proposed improvements to re-aligning the storm sewer system to eliminate the manhole or junction box adjacent to Ward Circle.

Project Site ID: PA3-017 – Cont.

Refer to the map on the following page for detailed location of the proposed PA3-017 improvement project. Refer to **Exhibit A.4** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Virginia Way at Ward Circle:



NOTES:
Blue Lines represent open channels.
Yellow dots represent existing junction points such as open channel nodes, headwalls, inlets, or manholes.
Yellow lines represent existing pipes/culverts
Pink lines represent proposed infrastructure

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA3-018

Virginia Way Near 5300 Virginia Way – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	77
➢ Watershed:	Priority Area 3
➢ Recommended Improvements:	Replace 52 LF 36" CMP with 36" RCP
➢ Existing Flooding Issues:	Existing 2-year LOS (0.49' roadway surcharging at 10-year event)
➢ Proposed Flood Reduction:	0.74' (10-year LOS)
➢ Project Cost:	$77,406
➢ Comments:	Elevations determined from Lidar. Detailed topographic and utility survey will be required for design.

The storm sewer network located near 5300 Virginia Way conveys stormwater runoff from approximately 8.3 acres of commercial areas as well as from paved roadway surfaces. A 36" corrugated metal pipe (CMP) conveys the runoff under Virginia Way north to the system outfall. The outfall discharges into the large detention pond north of Virginia Way. Virginia Way is classified as a local residential roadway and has a required 10-year storm Level of Service (LOS). The existing drainage system has a 2-year storm LOS.

To achieve a 10-year LOS, it will be necessary to replace the existing 52 LF of 36" CMP with 36" reinforced concrete pipe (RCP). Elevations used within the modeling analysis were taken from the Lidar data. It should be noted that no field-run topographic survey data was collected at this location, and existing utilities are likely located withing the City Right-of-Way. A detailed topographic and utility survey will be required for the design of the recommended improvements.

Refer to the map on the following page for detailed location of the proposed PA3-018 improvement project. Refer to **Exhibit A.4** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA3-018 – Cont.

Virginia Way Near 5300 Virginia Way:

NOTES:
Blue Lines represent open channels.
Yellow dots represent existing junction points such as
open channel nodes, headwalls, inlets, or manholes.
Yellow lines represent existing pipes/culverts
Pink lines represent proposed infrastructure replacements.

Recommended Improvement Projects Providing Roadway Benefits Only

Project Site ID: PA1-020

Midway Circle, Near 561 Midway Circle – PROJECT HIGHLIGHTS:

➢ Project Priority Ranking:	84
➢ Watershed:	Priority Area 1
➢ Recommended Improvements:	Replace 25 LF of 1 – 1'x1.83' CMP with 24" RCP Replace 98 LF of 1 – 1'x1.83' CMP with 24" RCP
➢ Existing Flooding Issues:	Existing system has less than 2-year LOS (0.59' surcharging at 10-year event).
➢ Proposed Flood Reduction:	2.29' (Proposed 10-year LOS).
➢ Project Cost:	$131,926
➢ Comments:	Elevations determined from LiDAR. Detailed survey required for final design. Inverts of the 25 LF and 98 LF segments will need to be modified to meet pipe cover and slope requirements. Proposed slope = 0.5%.

The existing storm network at this location is undersized and consists of inverse pipe slopes; as a result, the inlets along the roadway frequently surcharge, and surcharged flow is able to collect/pond in the roadway near 561 Midway Circle. Midway Circle is classified as local road and has a required 10-year Level of Service (LOS); however, the existing drainage system has less than a 2-year LOS.

To achieve the required 10-year storm LOS, the recommended improvements include:

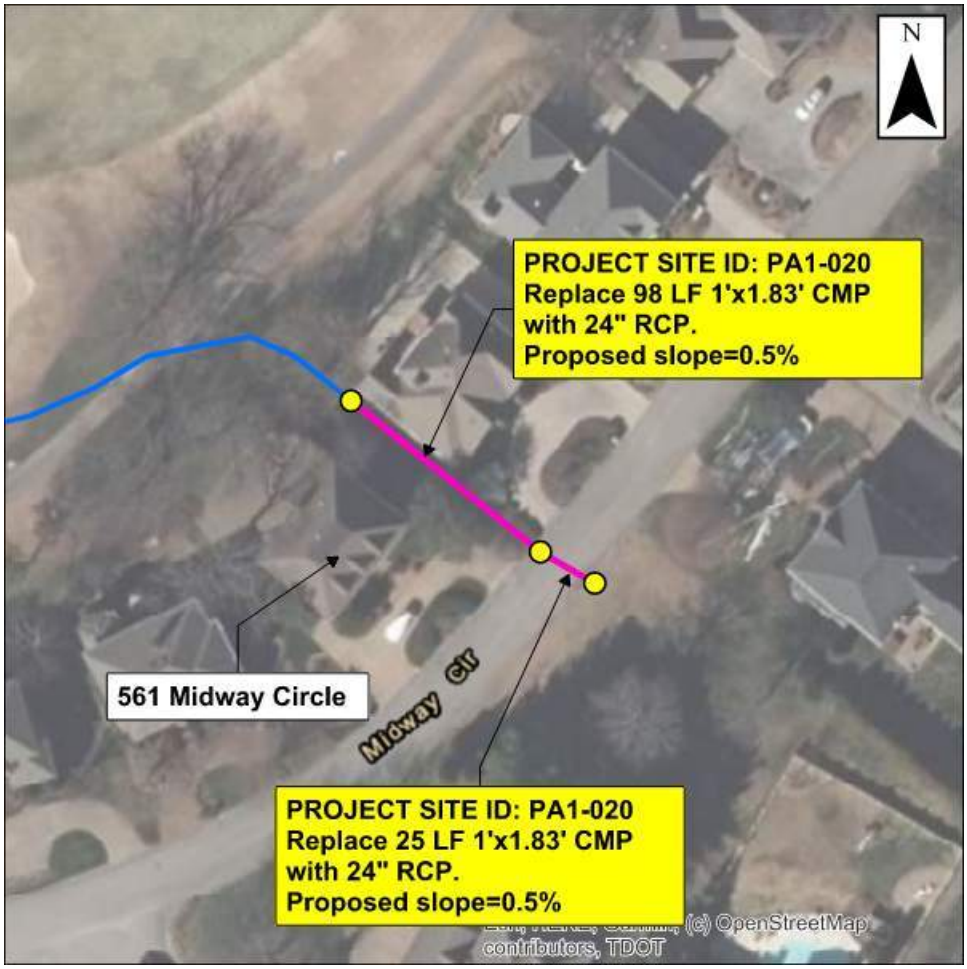
- Replacement of 25 LF of 1'x1.83' corrugated metal pipe (CMP) with 24" RCP at 0.5% slope;
- Replacement of 98 LF of 1'x1.83' CMP with 24" RCP at 0.5% slope.

The inverse slope of the existing system will be corrected to a 0.5% slope by raising the inlet and outlet inverts of the 25 LF segment and lowering the outlet invert of the 98 LF segment.

Refer to the map on the following page for detailed location of the proposed PA1-020 improvement project. Refer to **Exhibit 2** for an aerial overlay map which shows the overall watershed as well as the location of the subject improvement project. Also, refer to **Appendix C** for budgetary-level project cost tabulations.

Project Site ID: PA1-020 – Cont.

Midway Circle, Near 561 Midway Circle:



NOTES:
Blue Lines represent open channels.
Yellow dots represent existing junction points such as open channel nodes, headwalls, inlets, or manholes.
Yellow lines represent existing pipes/culverts.
Pink lines represent proposed infrastructure replacements.

Downstream Impacts

It can sometimes be perceived by the public that installing larger drainage culverts could worsen flooding conditions to downstream properties. It should be noted that while the recommended drainage improvement projects include replacing existing undersized culverts with larger culverts, the unsteady-flow hydraulic modeling performed as part of this study included an analysis of downstream conveyance systems to ensure that downstream flooding would not be worsened after culvert replacements. In some cases, Neel-Schaffer eliminated certain project sites from consideration due to worsening of downstream flooding. The resultant list of recommended projects have been determined to not impose additional flooding downstream. While the proposed larger culverts themselves will allow more flow through than existing culverts, the total volume of water being conveyed downstream will be similar to current conditions, because the excess flows are currently conveyed over roadways and still make it downstream. The proposed larger culverts will convey flow downstream more efficiently than current conditions, but the slight difference in timing is not enough to cause flooding at the selected recommended project sites.

Engineer's Opinion of Probable Construction Cost

A concept-level opinion of probable construction costs (i.e., cost estimate) has been prepared for each of the thirty (30) aforementioned recommended capital improvement project sites. Please refer to **Appendix C** for budgetary-level cost tabulations for these 30 projects.

Future Considerations

As described above, some of the project sites that are ranked highest on the Candidate Project List (refer to **Table 2**) will require extensive additional modeling and analysis to determine feasible recommendations to improve the drainage LOS. While many of these sites were preliminarily investigated, the complexities associated with these project sites constrained the ability to perform full analysis and conceptual improvement designs within the bounds of this study.

Please see below for a summary of higher-ranking candidate project sites, where improvement options were investigated but extensive additional analysis was deemed necessary. Neel-Schaffer recommends that the City consider additional detailed analysis for these projects as part of a future drainage study:

Project Site ID: PA1-001

Wilson Pike Circle / Peach Court (Project Priority Ranking: 1):

As part of this study, Neel-Schaffer evaluated improvement options to alleviate the current flooding issues at the commercial building at 7113 Peach Court, adjacent to an existing open channel. Proposed iterations involving removal of the existing driveway culvert and footbridge were analyzed, which did not improve the current flooding LOS at the building.

Additionally, a proposed iteration was analyzed which included converting the existing natural channel to a large (10'x20') rectangular concrete-lined channel. However, this option is infeasible because of the channel's size, constructability concerns, and the fact that local drainage would not be able to enter the channel due to adverse local slopes into the channel. Upon executing this option by itself, it was determined that the building at 7113 Peach Court would still experience flooding.

Next, an iteration was performed which included implementing an additional 70" diameter steel culvert under the railroad. This improvement, in addition to the aforementioned concrete channel, provided a 25-year LOS in the channel. However, the building at 7113 Peach Court could possibly still be adversely impacted since local runoff would not have the ability to drain into the channel due to adverse local slopes. A pumping system could be implemented to ensure that ponded water adjacent to the channel is conveyed into the channel.

One option that was not evaluated as part of this analysis, but may be feasible, is implementation of a regional detention pond on the property; this would require significant property acquisition to implement, adding to the cost and difficulty of the project.

Project Site ID: PA1-003

Williamsburg Circle / 206 Williamsburg Circle (Project Priority Ranking: 7):

As part of this study, Neel-Schaffer evaluated improvement options to alleviate the current flooding within the residential neighborhood along Williamsburg Circle, specifically at 206 Williamsburg Circle. Implementation of an additional culvert barrel under Williamsburg Circle was evaluated; this improvement did not alleviate the current garage/basement flooding at 206 Williamsburg Circle, but it provided a 10-year LOS for Williamsburg Circle. In addition, removal of an existing 48" CMP (i.e., a potential constriction) was considered, which produced similar results.

Upon further evaluation, it appears that flooding in this location is likely a result of outlet structure configuration, along with a lack of storage capacity in the detention pond within Maryland Way Park. While not explicitly modeled and analyzed as part of this study, grading of the existing pond and reconfiguration of the outlet control structure may alleviate the current downstream flooding along Williamsburg Circle.

Project Site ID: PA1-004

Wilson Pike near Karen Court (Project Priority Ranking: 8):

As part of this study, Neel-Schaffer evaluated improvement options to alleviate the current flooding along the Wilson Pike roadway and nearby residential areas, located immediately east of Interstate 65. Implementation of three additional barrels to the existing double 3'x5' reinforced concrete box culvert beneath Wilson Pike did not lower the water surface elevation to the required 50-year (i.e., design event) LOS. However, implementing an additional barrel to the existing 5'x6' reinforced concrete box culvert under the interstate

lowered the water surface elevation enough at the project site to achieve the design event LOS without requiring any modifications to the current structure beneath Wilson Pike. However, it is acknowledged that adding a new box culvert crossing under the interstate is not a feasible option.

Project Site ID: PA1-015

5100 Williamsburg Road / YMCA (Project Priority Ranking: 48):

Flooding has been reported downstream of the YMCA property near 5100 Williamsburg Road. However, the hydraulic modeling performed for this study did not replicate the flooding; Williamsburg Road was determined to have more than a 100-year LOS. It has been reported that the YMCA property will be redeveloped in the future. It is recommended that the future anticipated development of the YMCA property (engineered by Ragan Smith) should adhere to pre-existing (i.e., undeveloped) flow conditions due to the lack of stormwater regulations in place when the property was originally developed. Both Neel-Schaffer and the City of Brentwood believe that Ragan Smith's proposed stormwater management system should over-detain stormwater runoff to help alleviate flooding along Williamsburg Road and downstream areas. To prevent any adverse effects on downstream areas, the City of Brentwood wants to explore the potential for detention on the Maryland Farms Greenway located downstream of the YMCA property. Once received, Neel-Schaffer will be conducting a review of the proposed stormwater detention plans to ensure that the proposed development is complying with pre-existing stormwater flow conditions.

Project Site: Andrews Cadillac Dealership

(Project Priority Ranking: N/A):

Andrews Cadillac car dealership, located at the intersection of Cadillac Drive and Brentwood Boulevard, has previously reported flooding of the building on the property. Specifically, several inches of water were reported in the part of the building near the southwest portion of the property during the major rainfall even of February 17, 2022.

Examination of the site topography during the field investigation shows that most of the runoff that contributes to the structural flooding is generated on the northeast part of the commercial property. However, the property does receive runoff from Old Hickory Boulevard Right-of-Way to the north. The onsite drainage area is approximately 1.1 acres, and the off-site area (Old Hickory Right-of-Way) that drains to the site is approximately 0.25 acre.

Brentwood Boulevard does not drain directly onto the property. The storm sewer system on Brentwood Boulevard is 15" reinforced concrete pipe (RCP) that begins approximately 370' north of the east entrance to the dealership and runs south to the intersection of Brentwood Boulevard and Cadillac Drive. The system drains 0.28 acres of mostly paved areas of the Brentwood Boulevard and Old Hickory Boulevard Right-of-Ways. There is

one inlet on the Brentwood Boulevard storm sewer located at the beginning of the system (approximately 370' north of the east entrance). The modeling of existing conditions shows that this system has a 100-year level of service.

This study does not include an inlet capacity analysis. It is possible that the one catch basin inlet north of the east entrance does not have the capacity to capture 100% of the runoff during rare event storms. Any stormwater discharges that bypass the inlet will continue south on Brentwood Boulevard to the east entrance. A portion of the stormwater discharge may then flow west through the entrance and into the building in question.

The City should conduct an inlet analysis and consider adding additional inlets on Brentwood Boulevard north of the east entrance to Andrews Cadillac to ensure that stormwater discharges from City Right-of-Ways do not enter the commercial property.

Project Site ID: 5215 Williamsburg Road

(Project Priority Ranking: N/A):

The homeowner at 5215 Williamsburg Road has previously reported minor damage due to stormwater discharges crossing Williamsburg Road from the north. New construction on the north side of Williamsburg Road may be a contributing factor. The PCSWMM analysis of existing conditions shows that the driveway cross drain and ditch on the north side of Williamsburg Road are undersized with an existing Level of Service (LOS) of less than the 2-year storm. The ditch on the south side of Williamsburg Road, in front of 5215, has a 2-year existing LOS. The undersized ditch and driveway cross drains force the stormwater discharges to flow over Williamsburg Road from north to south. When the ditch on the south side of the road becomes surcharged, the spillover flows to the south between houses and eventually drains to a shallow grossed swale behind 5212 Williamsburg Court. The homeowner at that address has also reported minor damage in the basement of the structure, and the discharge received from Williamsburg Road may be a contributing factor.

It is recommended that the City consider this site for future drainage improvements. Improved roadside ditches and driveway culverts, especially on the north side of Williamsburg Road, may be able to mitigate existing flooding issues to the south of the road.

Conclusions and Recommendations

As discussed above, the City of Brentwood has received numerous complaints from citizens and business owners regarding drainage concerns related to roadway, nuisance/yard, and structure flooding throughout the City limits. As part of this Drainage Basin Master Plan Study, the City's overall watershed was broken into eight (8) Tiers of five (5) sub-watersheds each. This study included an evaluation of the existing hydrologic and hydraulic properties of the Tier 1 watershed, which included the 5 sub-watersheds determined to have the highest priority.

This study determined the existing conditions flooding level of service (LOS) at a total of twenty-one (21) residential/commercial properties and ninety-seven (97) roadway crossings/intersections. Several of these locations are the subject of historical/current citizens' complaints. This study also identified conceptual-level improvement designs at thirty (30) locations, which were intended to reduce the frequency and severity of flooding at those locations to the maximum extent practicable.

The selected sites represent those locations where improvements could be readily implemented without additional hydrologic and hydraulic analyses. The 30 recommended improvement projects have been grouped into two separate categories: twelve (12) projects which will provide associated benefits to adjacent residential properties and eighteen (18) projects that will provide roadway LOS benefits only.

Based upon the nature and degree of benefits realized by implementation of the selected improvement projects, as well as the City's desire to alleviate current residential flooding to the extent practicable, Neel-Schaffer recommends that the City commence with implementation of the selected projects in phases. Phase 1 of project implementation consists of the 12 improvement projects that will provide associated benefits to adjacent residential properties, while Phase 2 implementation consists of the 18 improvement projects that will provide roadway benefits only.

Within the Phase 1 grouping of projects, Neel-Schaffer has listed the projects in a manner that prioritizes those projects that will benefit multiple residential properties, listed in order of lowest cost to highest cost; followed by the remainder of Phase 1 projects benefiting single residential properties, listed in order of lowest cost to highest cost. The Phase 1 cost summaries are listed below in **Table 3**.

Within the Phase 2 grouping of projects, Neel-Schaffer has prioritized those roadway improvement projects that coincide with documented complaints and/or arterial and collector roadways; the remainder of Phase 2 projects benefit local roadways and have no documented complaints. The Phase 2 cost summaries are listed below in **Table 4**.

Cost summaries of both Phase 1 and Phase 2 are included in **Table 5**.

Table 3 – Phase 1 – Estimated Costs of Projects Providing Associated Residential Benefits				
Recommended Order of Implementation	Project Site ID	Project Site Description	Summary of Benefits	Estimated Project Cost
1	PA2-003	692 Old Orchard Rd.	Roadway: Exist. 5-yr LOS improved to 100-yr LOS Residential: 692 Old Orchard Rd – Exist. 5-yr LOS improved to 100-yr LOS 688 Old Orchard Rd – Exist. 5-yr LOS improved to 100-yr LOS	$97,234
2	PA4-013	Martingale Lane near 6102 Martingale Lane	Roadway: Exist. < 2-yr LOS improved to 10-yr LOS Residential: 6100 Martingale Ln - Exist. 25-yr LOS improved to 100-yr LOS 6102 Martingale Ln - Exist. 25-yr LOS improved to 100-yr LOS	$248,684
3	PA4-002	Belle Rive Drive between Dekemont Lane and Abbey Court	Roadway: Exist. < 2-yr LOS improved to 25-yr LOS Residential: 6103 Belle Rive Dr. - Exist. 5-yr LOS improved to 100-yr LOS 6105 Belle Rive Dr. - Existing 5-yr LOS improved to 100-yr LOS	$417,060
4	PA2-009	McGavock Road between Post Oak Circle and Good Springs Road	Roadway: Exist. 2-yr LOS improved to 10-yr LOS Residential: 651 Post Oak Circle - Exist. 5-yr LOS improved to 25-yr LOS 661 Post Oak Circle - Exist. 2-yr LOS improved to 10-yr LOS	$613,518
5	PA4-014	Dekemont Lane near 525 Dekemont Lane	Roadway: Exist. < 2-yr LOS improved to 10-yr LOS Residential: 525 Dekemont Ln - Exist. < 2-yr LOS improved to 10-yr LOS	$107,116
6	PA4-001	6200 Partridge Court	Roadway: Exist. 10-yr LOS improved to 100-yr LOS Residential: 6200 Partridge Court - Exist. 10-yr LOS improved to 100-yr LOS	$124,891
7	PA1-015	YMCA / 5100 Williamsburg Road	Roadway: n/a Residential: 5100 Williamsburg Rd – 100-yr LOS established at HVAC pad	$137,955
8	PA2-024	Quail Valley Dr., from near 915 to near 920 Quail Valley Dr.	Roadway: Exist. < 2-yr LOS improved to 10-yr LOS Residential: 915 Quail Valley Dr - Exist. < 2-yr LOS improved to 100-yr LOS	$258,552
9	PA2-021	913 Calloway Drive	Roadway: Exist. 2-yr LOS improved to 10-yr LOS Residential: 913 Calloway Dr – Exist. 2-yr LOS improved to 100-yr LOS	$275,036
10	PA2-005	Murray Lane, east of Good Springs Road	Roadway: Exist. < 2-yr LOS improved to 50-yr LOS Residential: 5134 Remington Dr. - Exist. 5-yr LOS improved to 10-yr LOS	$314,048
11	PA4-003	Grand Oaks Drive at Shadow Ridge Court	Roadway: Exist. < 2-yr LOS improved to 10-yr LOS Residential: 6300 Shadow Ridge Ct - Exist. <2-yr LOS improved to 25-yr LOS	$465,392
12	PA2-006	5145 Remington Drive	Roadway: Exist. < 2-yr LOS improved to 25-yr LOS Residential: 5145 Remington Dr. - Exist. < 2-yr LOS improved to 100-yr LOS	$737,658
			Total Estimated Cost to Implement Phase 1 Projects:	**$3,797,144**

Table 4 – Phase 2 – Estimated Costs of Projects Providing Roadway Benefits Only				
Recommended Order of Implementation	Project Site ID	Project Site Description	Summary of Benefits	Estimated Project Cost
13	PA1-009	Maryland Way near HG Hill Property	Roadway: Exist. 10-yr LOS improved to 50-yr LOS	$117,419
14	PA5-001	Belle Rive Drive and Granny White Pike	Roadway: Exist. 10-yr LOS improved to 25-yr LOS	$418,981
15	PA4-004	Belle Rive Drive and Martingale Lane Intersection	Roadway: Exist. 2-yr LOS improved to 25-yr LOS	$319,809
16	PA1-010	Meadow Lake Road between Robinhood Rd. and Franklin Rd.	Roadway: Exist. < 2-yr LOS improved to 10-yr LOS	$299,555
17	PA3-010	Intersection of Meadow Lake Road at Dyer Lane	Roadway: Exist. 2-yr LOS improved to 10-yr LOS	$77,645
18	PA3-012	Meadow Lake Road west of Dyer Lane	Roadway: Exist. 2-yr LOS improved to 10-yr LOS	$97,454
19	PA2-010	Murray Lane west of Franklin Road	Roadway: Exist. 5-yr LOS improved to 100-yr LOS	$187,422
20	PA4-008	Belle Rive Drive and Turtle Creek Drive intersection	Roadway: Exist. 2-yr LOS improved to 25-yr LOS	$98,061
21	PA1-014	Seward Road and Meadow Lake Road intersection	Roadway: Exist. < 2-yr LOS improved to 10-yr LOS	$86,493
22	PA4-009	Belle Rive Drive near 6012 Belle Rive Drive	Roadway: Exist. < 2-yr LOS improved to 25-yr LOS	$151,424
23	PA1-016	Wilson Pike Circle, near 246 Wilson Pike Circle	Roadway: Exist. < 2-yr LOS improved to 25-yr LOS	$66,885
24	PA2-011	Stuart Lane at Fountainhead Drive	Roadway: Exist. 2-yr LOS improved to 10-yr LOS	$92,451
25	PA5-005	Curlybark Place	Roadway: Exist. < 2-yr LOS improved to 10-yr LOS	$158,721
26	PA2-015	Stuart Lane north of Fountain Head Drive	Roadway: Exist. 2-yr LOS improved to 10-yr LOS	$106,191
27	PA2-016	Princeton Hills Drive between Murray Lane and Remington Drive	Roadway: Exist. 2-yr LOS improved to 10-yr LOS	$92,107
28	PA3-017	Virginia Way and Ward Circle	Roadway: Exist. < 2-yr LOS improved to 10-yr LOS	$225,362
29	PA3-018	Virginia Way near 5300 Virginia Way	Roadway: Exist. 2-yr LOS improved to 10-yr LOS	$77,406
30	PA1-020	Midway Circle, near 561 Midway Circle	Roadway: Exist. < 2-yr LOS improved to 10-yr LOS	$131,926
			Total Estimated Cost to Implement Phase 2 Projects:	**$2,805,312**

Table 5 – Summary of Phase 1 and Phase 2 Implementation Costs	
Total Estimated Cost to Implement Phase 1 Projects with Residential Benefits (12 Projects):	$3,797,144
Total Estimated Cost to Implement Phase 2 Projects with Only Roadway Benefits (18 Projects):	$2,805,312
Total Estimated Cost to Implement Both Phases (30 Projects Total):	**$6,602,456**

Next Steps

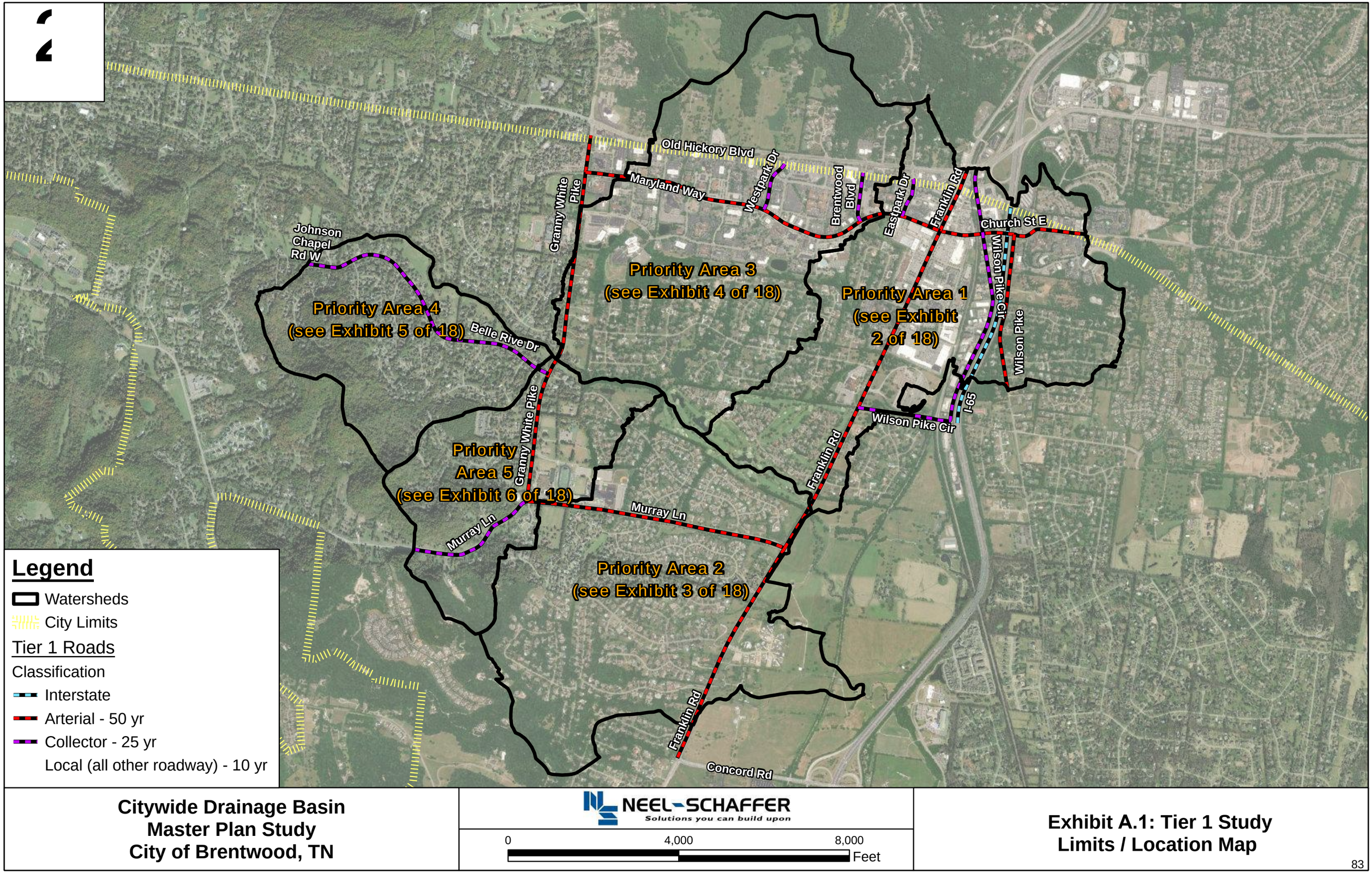
The recommended drainage improvement projects and associated cost estimates provided as part of this Tier 1 City of Brentwood Drainage Basin Master Plan Study are conceptual in nature and are not based on detailed design. Standard engineering practice was used to inventory, study, develop computer models, develop concept designs, and develop budgetary-level cost estimates required to solve drainage and flooding problems for drainage systems within the Tier 1 sub-watersheds described in this report. Further, the suggested order of project implementation contained in this report may be adjusted based on the City's and/or the public's needs.

In addition to the 30 recommended capital improvement projects listed in this report, Neel-Schaffer also identified $5.5M in maintenance needs during the field reconnaissance phase of this study. The maintenance locations, consisting of channel cleanouts, channel regrading, headwall/structure repairs, bank/channel stabilization, and damaged inlet replacement sites were provided to the City in a digital geo-database. These maintenance projects presented in the separate geo-database should be performed as funding and resources allow.

Prior to construction of the recommended capital improvement projects, Neel-Schaffer recommends that design-level topographic survey data be obtained for the project locations and surrounding vicinity at each project site, and full detailed design be performed for the proposed systems to ensure that potential constraints and constructability issues are identified and no adverse impacts will be imposed to adjacent properties.

It should be noted that this Drainage Basin Master Plan only studied the top five priority sub-watersheds within the City of Brentwood, which comprise the Tier 1 watershed. Seven more tiers containing 5 sub-watersheds each still remain to be studied. It is recommended that the City undertake studies of the remaining watersheds as soon as possible in order to identify capital improvement projects within Tiers 2 through 8.

APPENDIX A –
Maps of Tier 1 Watersheds and Proposed Improvement Schematics

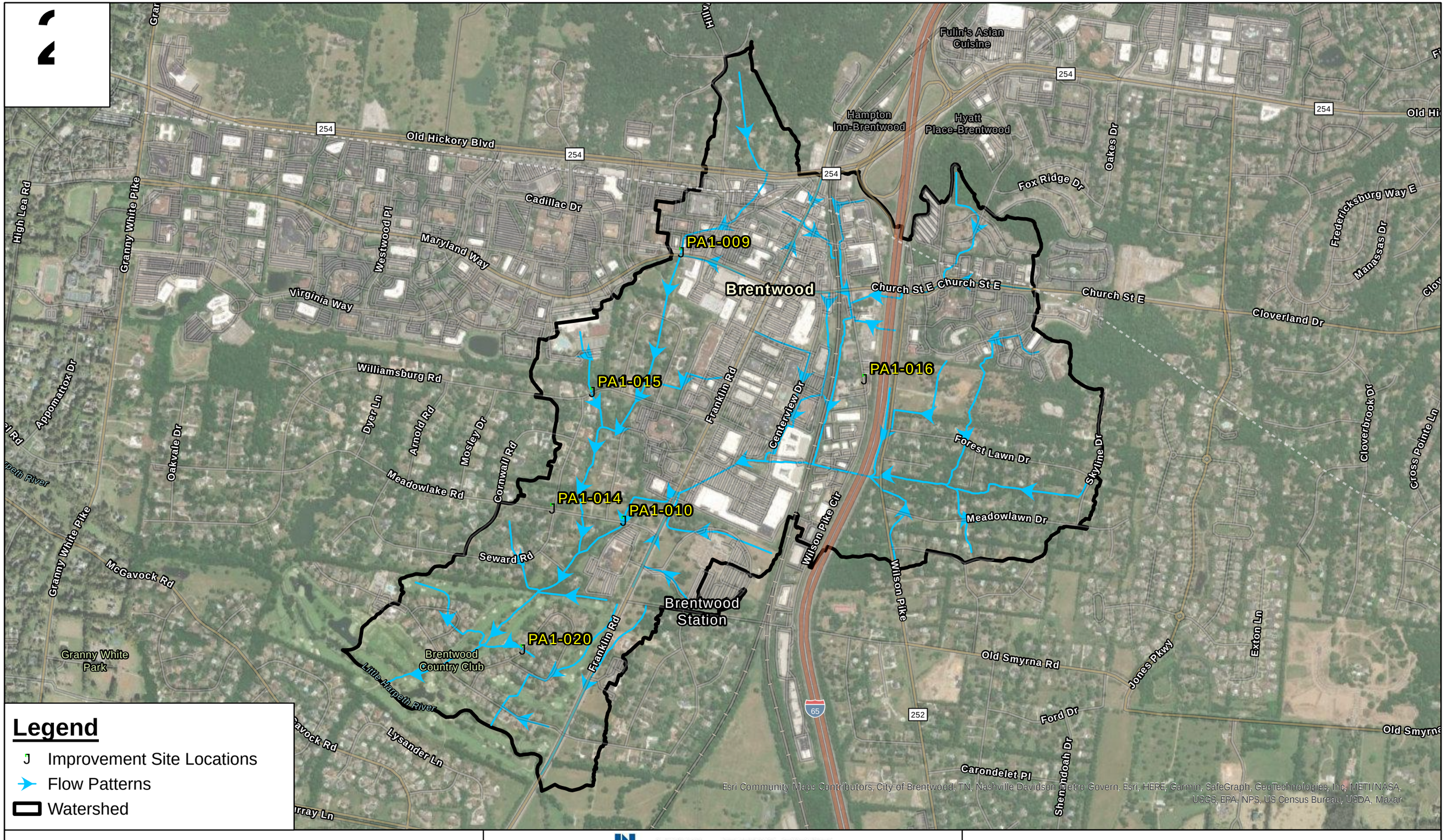


Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 4,000 8,000 Feet

Exhibit A.1: Tier 1 Study Limits / Location Map



Legend

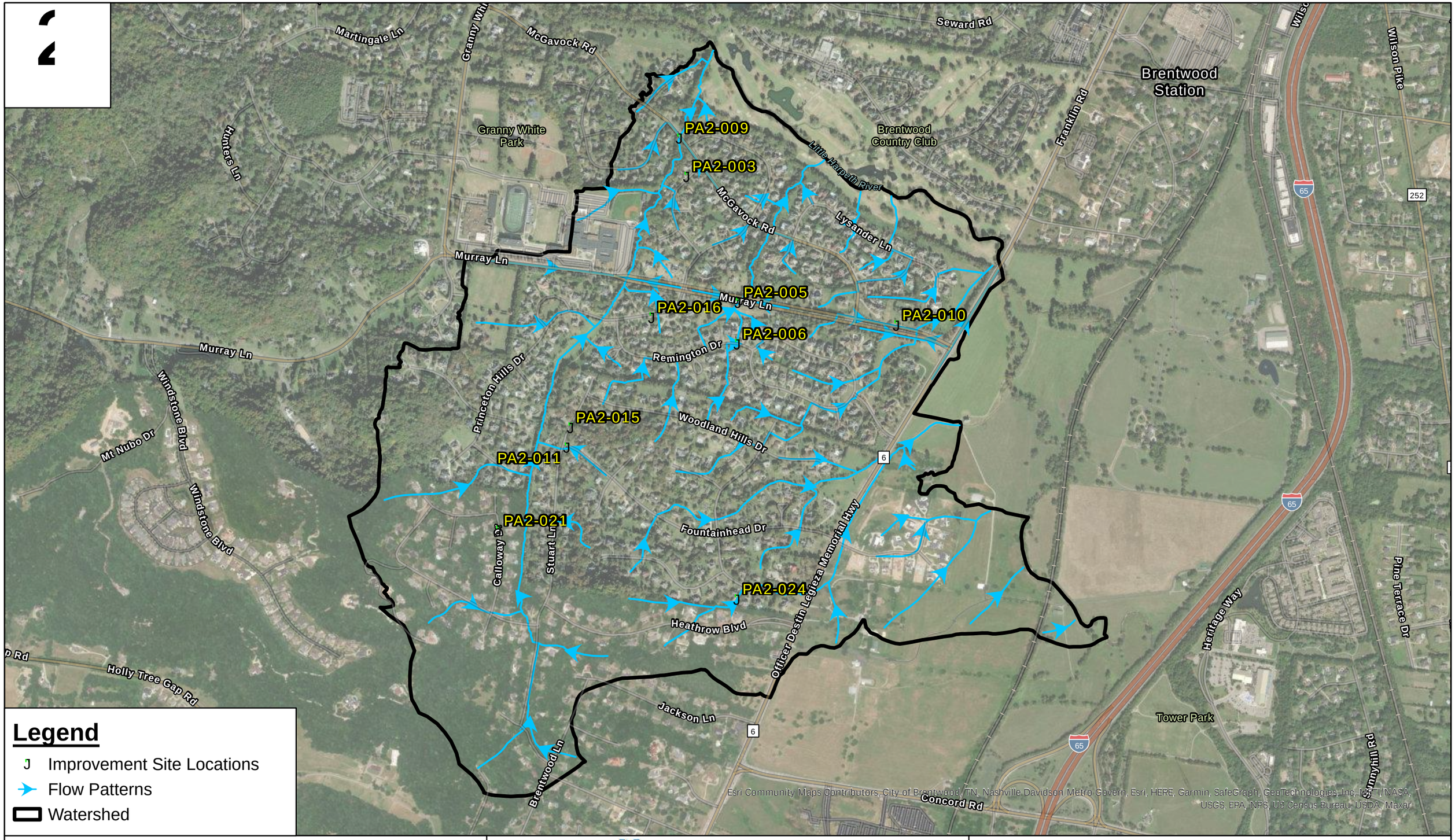
- J Improvement Site Locations
- Flow Patterns
- Watershed

Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 2,500 5,000 Feet

Exhibit A.2: Priority Area 1 Watershed Map



Legend

- J Improvement Site Locations
- Flow Patterns
- Watershed

Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 2,000 4,000 Feet

Exhibit A.3: Priority Area 2 Watershed Map

Legend

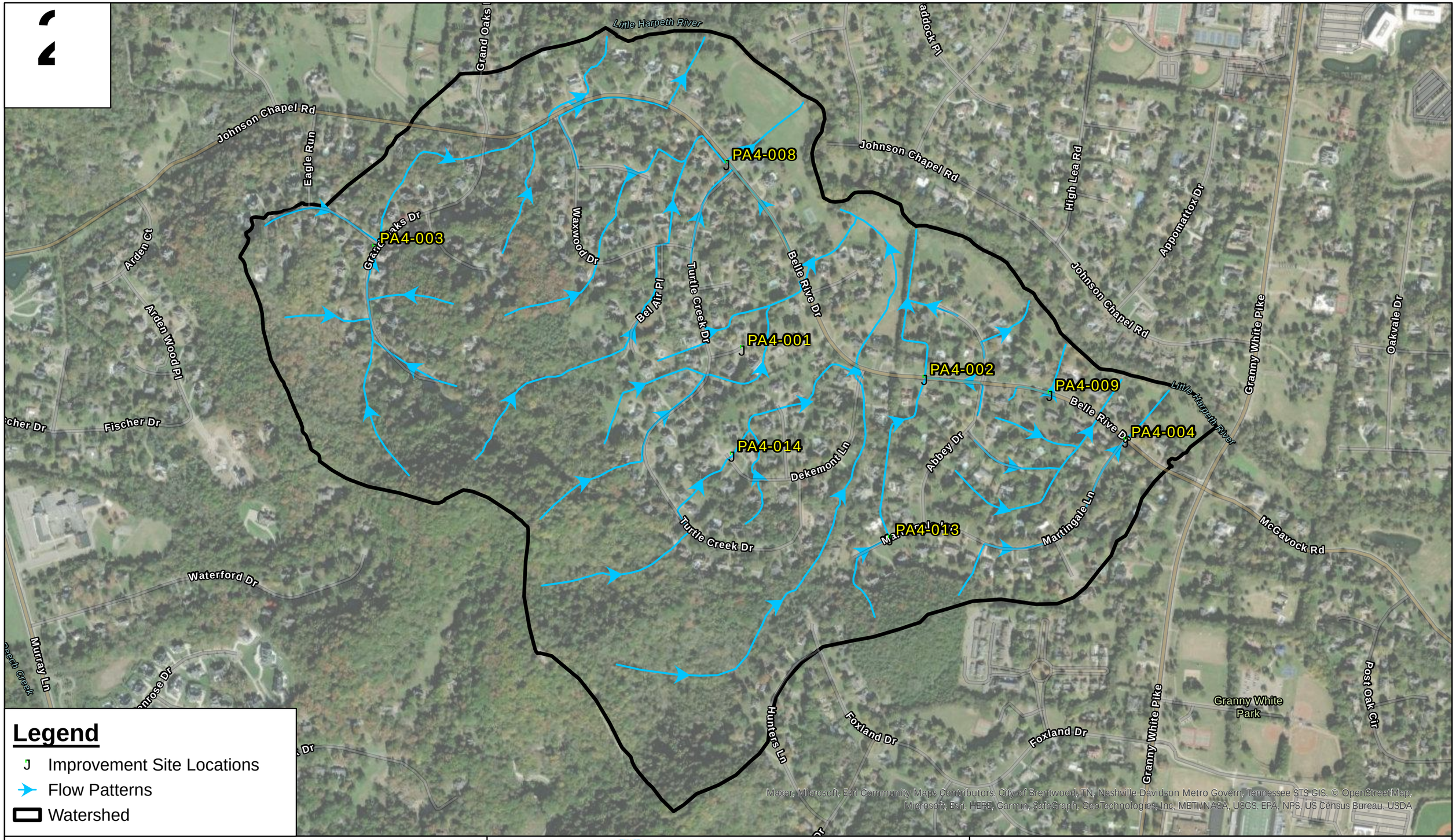
- J Improvement Site Locations
- Flow Patterns
- Watershed

Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 2,000 4,000 Feet

Exhibit A.4 Priority Area 3 Watershed Map



Legend

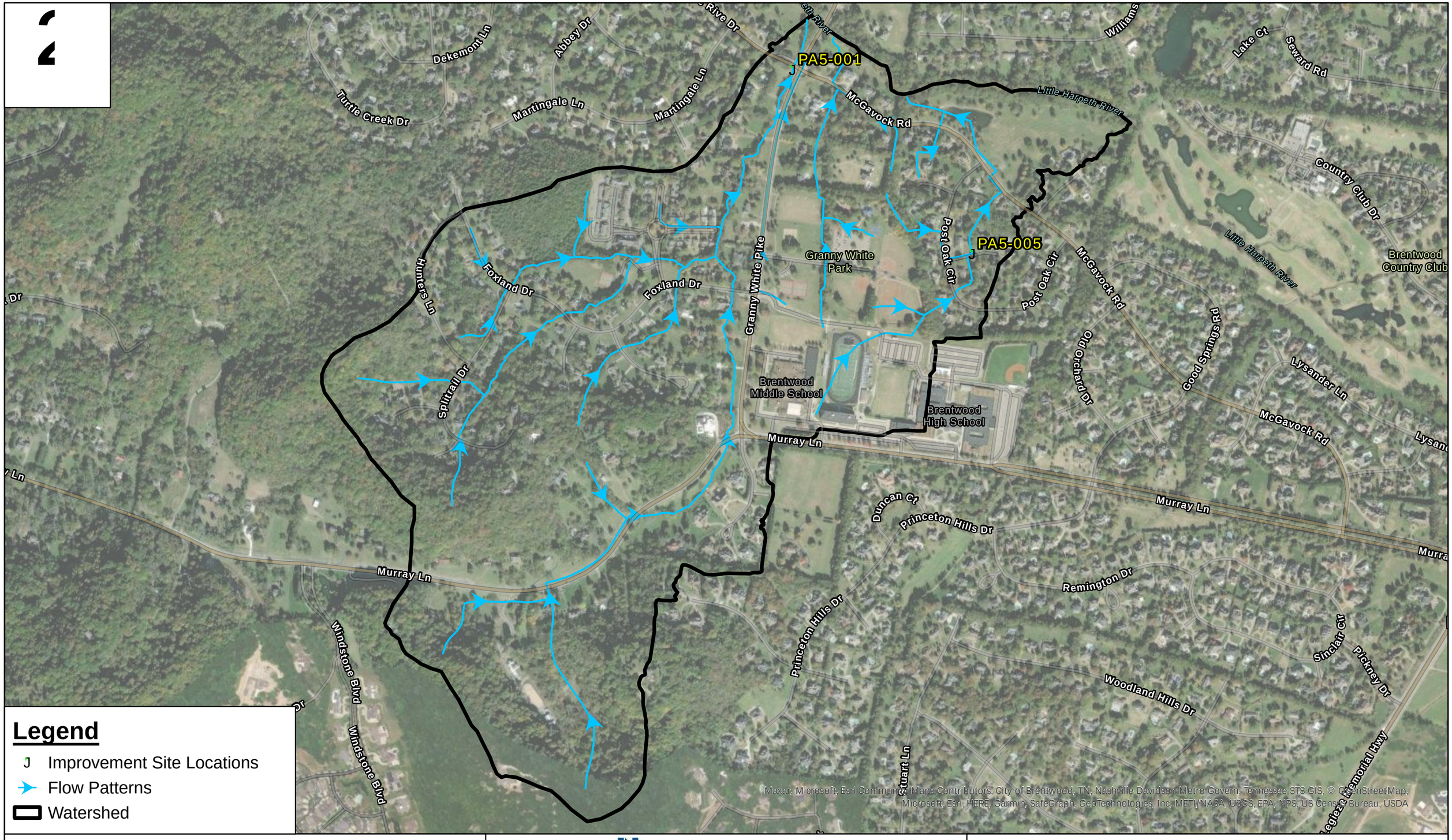
- J Improvement Site Locations
- Flow Patterns
- Watershed

Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 1,000 2,000 Feet

Exhibit A.5: Priority Area 4 Watershed Map



Legend

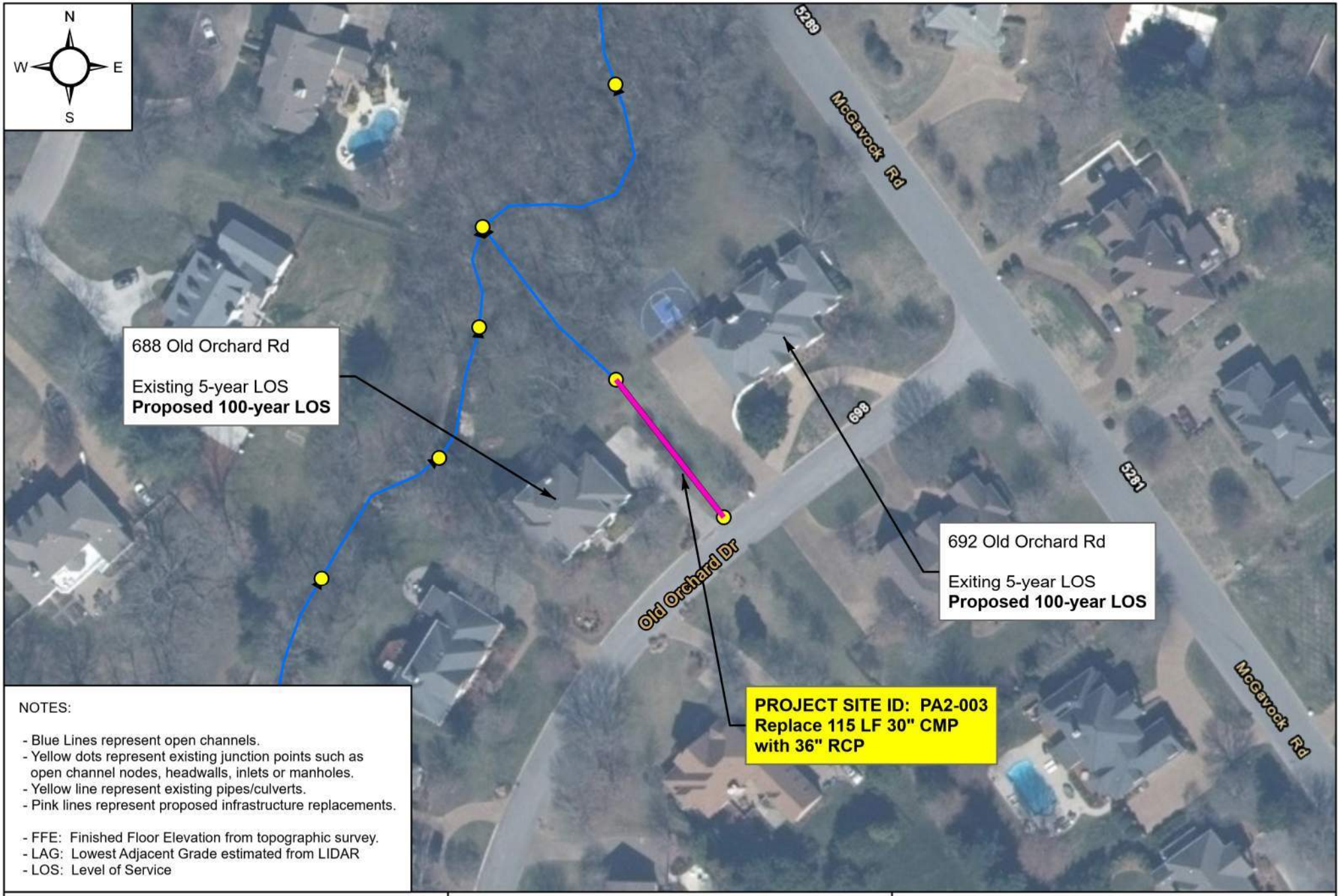
- Improvement Site Locations
- Flow Patterns
- Watershed

Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 1,000 2,000 Feet

Exhibit A.6: Priority Area 5 Watershed Map



NOTES:

- Blue Lines represent open channels.
- Yellow dots represent existing junction points such as open channel nodes, headwalls, inlets or manholes.
- Yellow line represent existing pipes/culverts.
- Pink lines represent proposed infrastructure replacements.

- FFE: Finished Floor Elevation from topographic survey.
- LAG: Lowest Adjacent Grade estimated from LIDAR
- LOS: Level of Service

Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 100 200 Feet

EXHIBIT A.7
PA2-003
692 Old Orchard Rd

NOTES:

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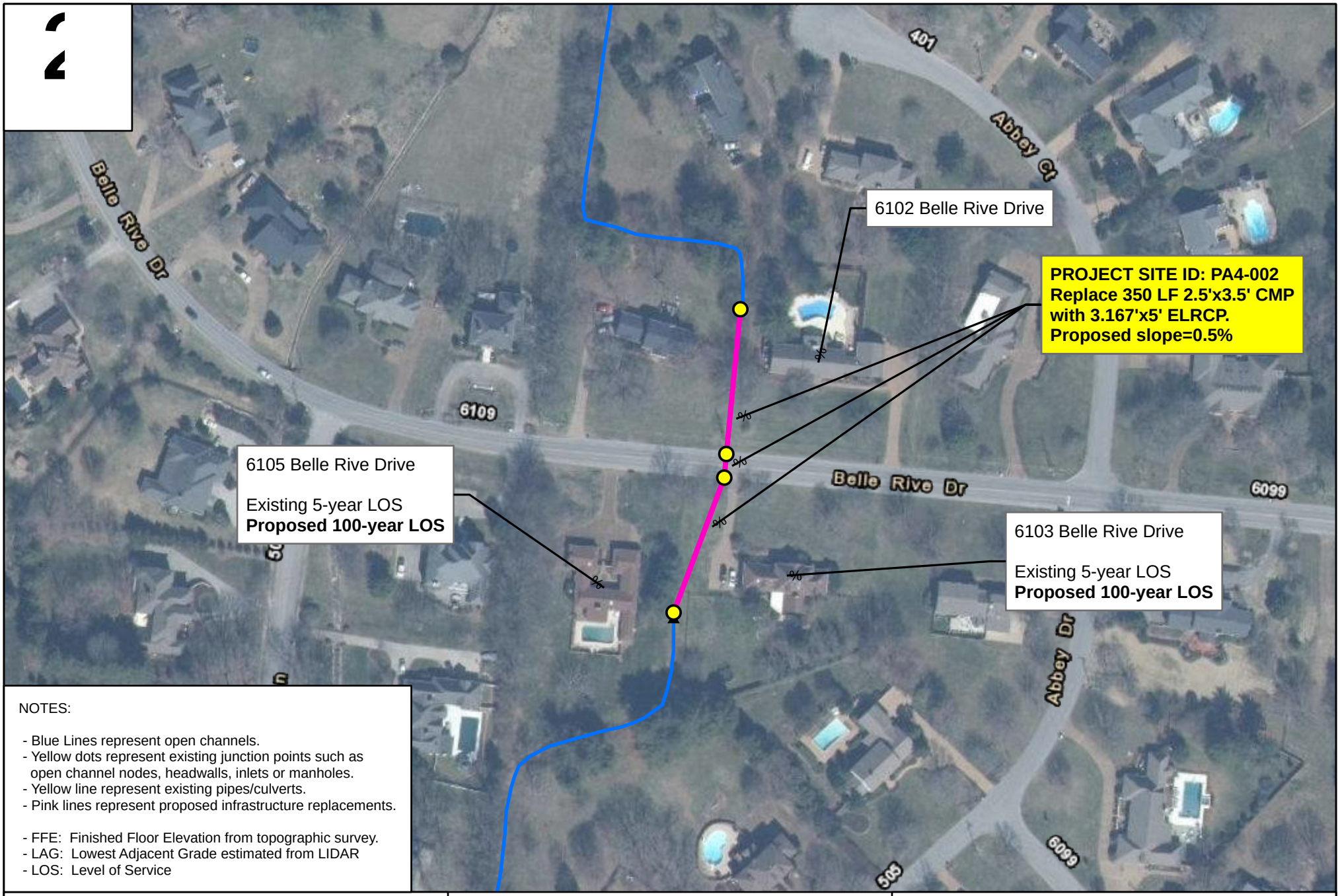
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 100 200 Feet

EXHIBIT A.8
PA4-001
6200 Partridge Ct



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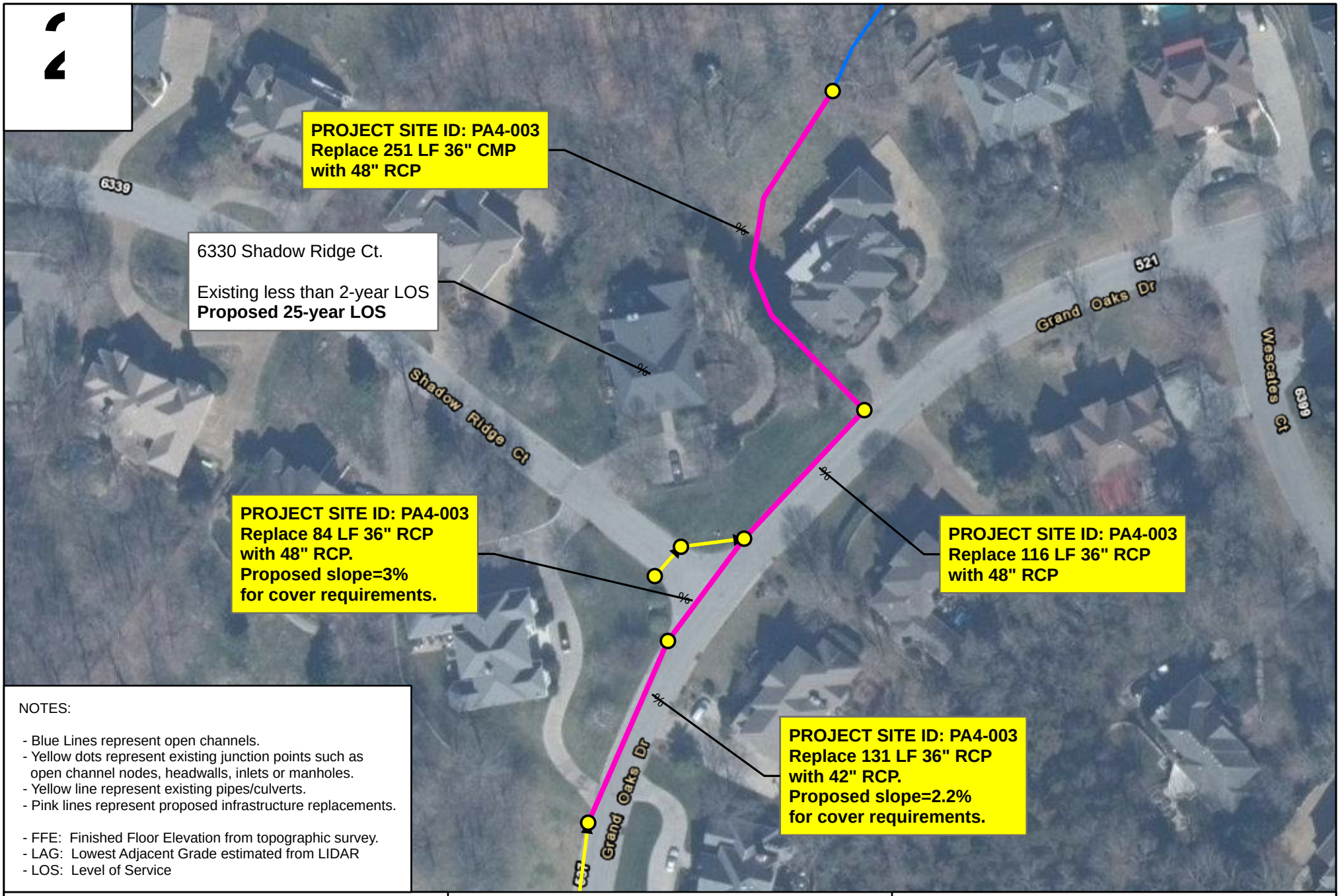
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 180 360 Feet

EXHIBIT A.9
PA4-002
Belle Rive Dr. between Dekemont Ln. and Abbey Ct.



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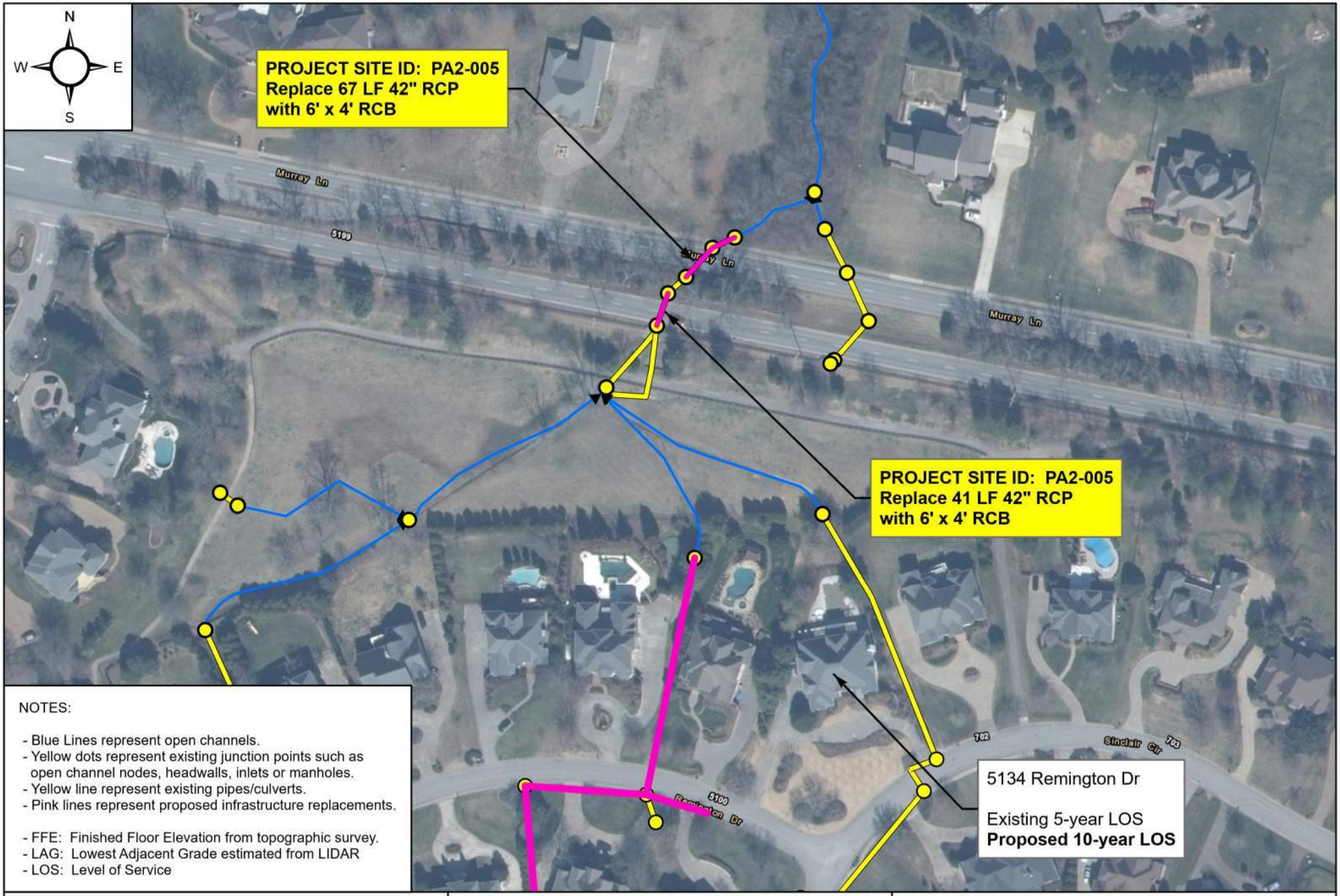
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 100 200 Feet

EXHIBIT A.10
PA4-003
Grand Oaks Dr. at Shadow Ridge Ct.



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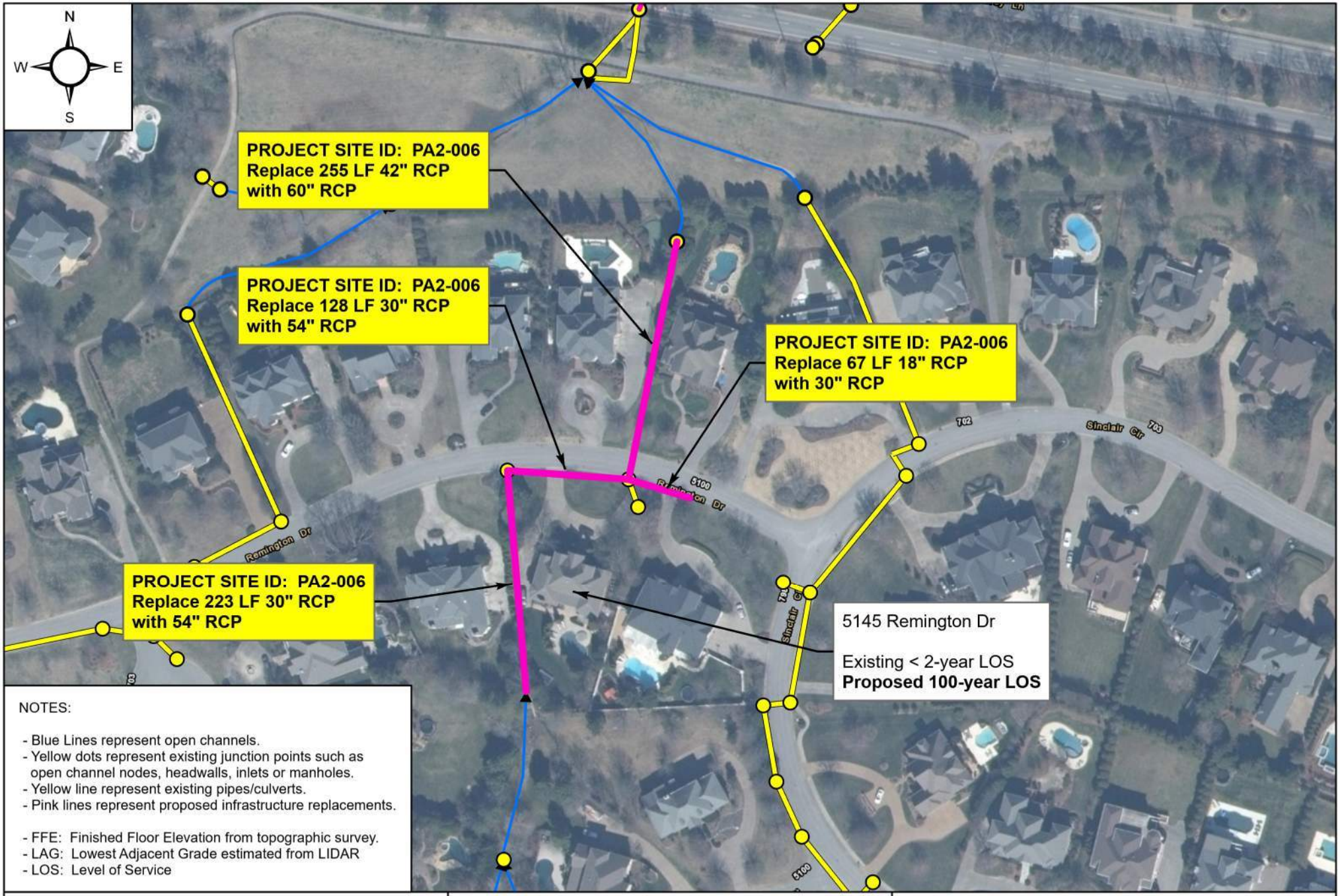
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 170 340 Feet

EXHIBIT A.11
PA2-005
Murray Lane east of Good Springs Road



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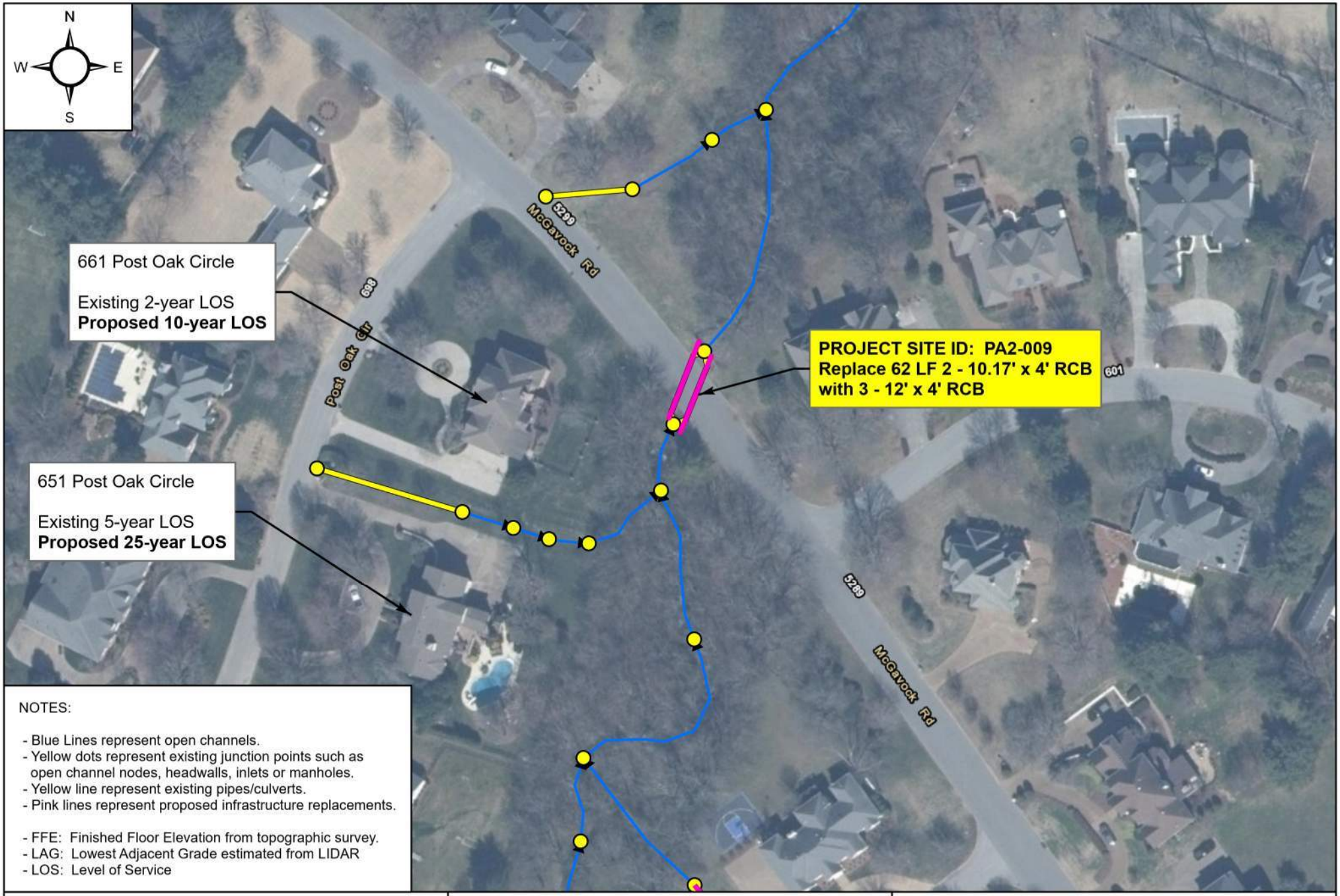
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 170 340 Feet

EXHIBIT A.12
PA2-006
5145 Remington Dr



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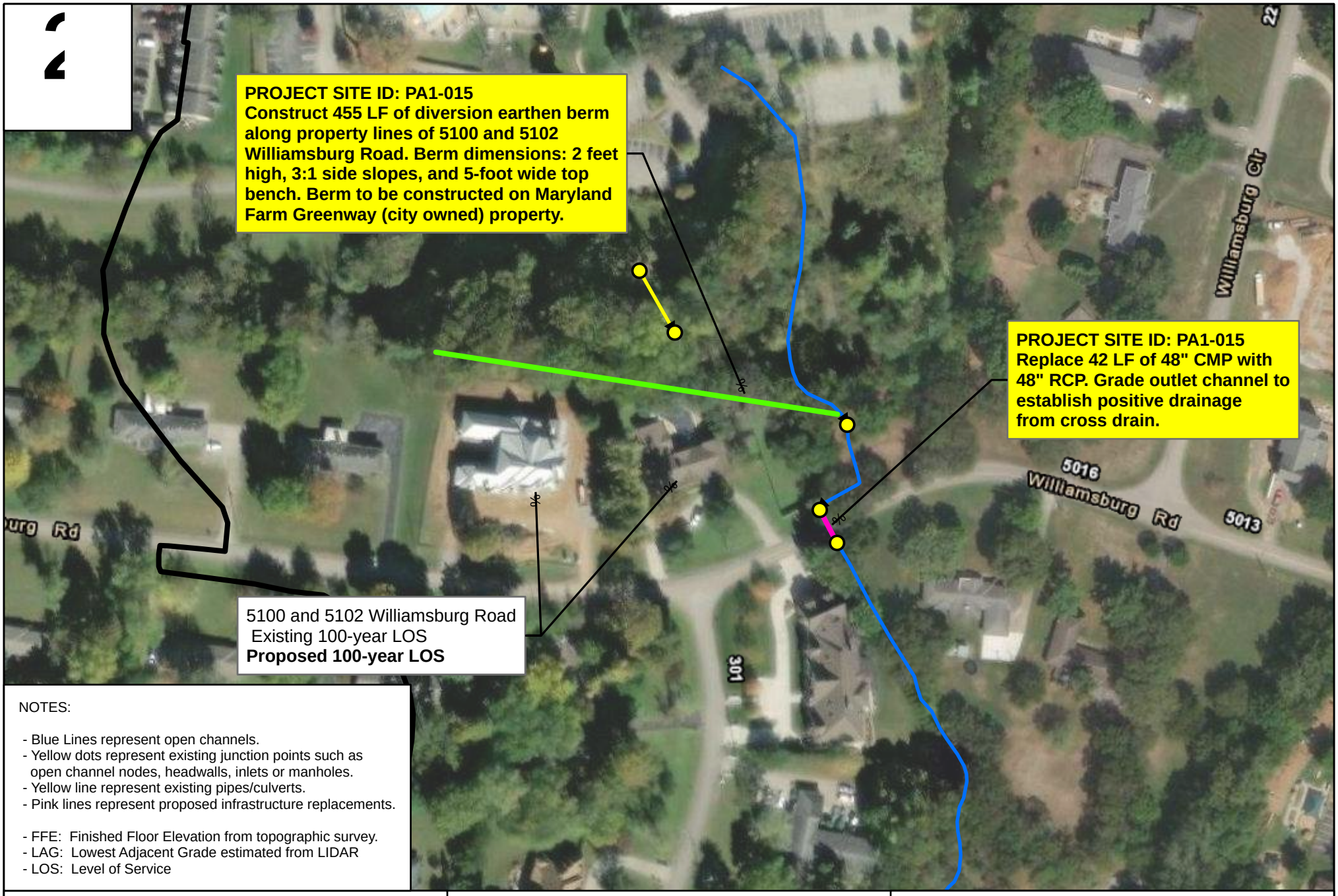
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 130 260 Feet

EXHIBIT A.13
PA2-009
McGavock Rd Between Post Oak Circle and Good Springs Rd



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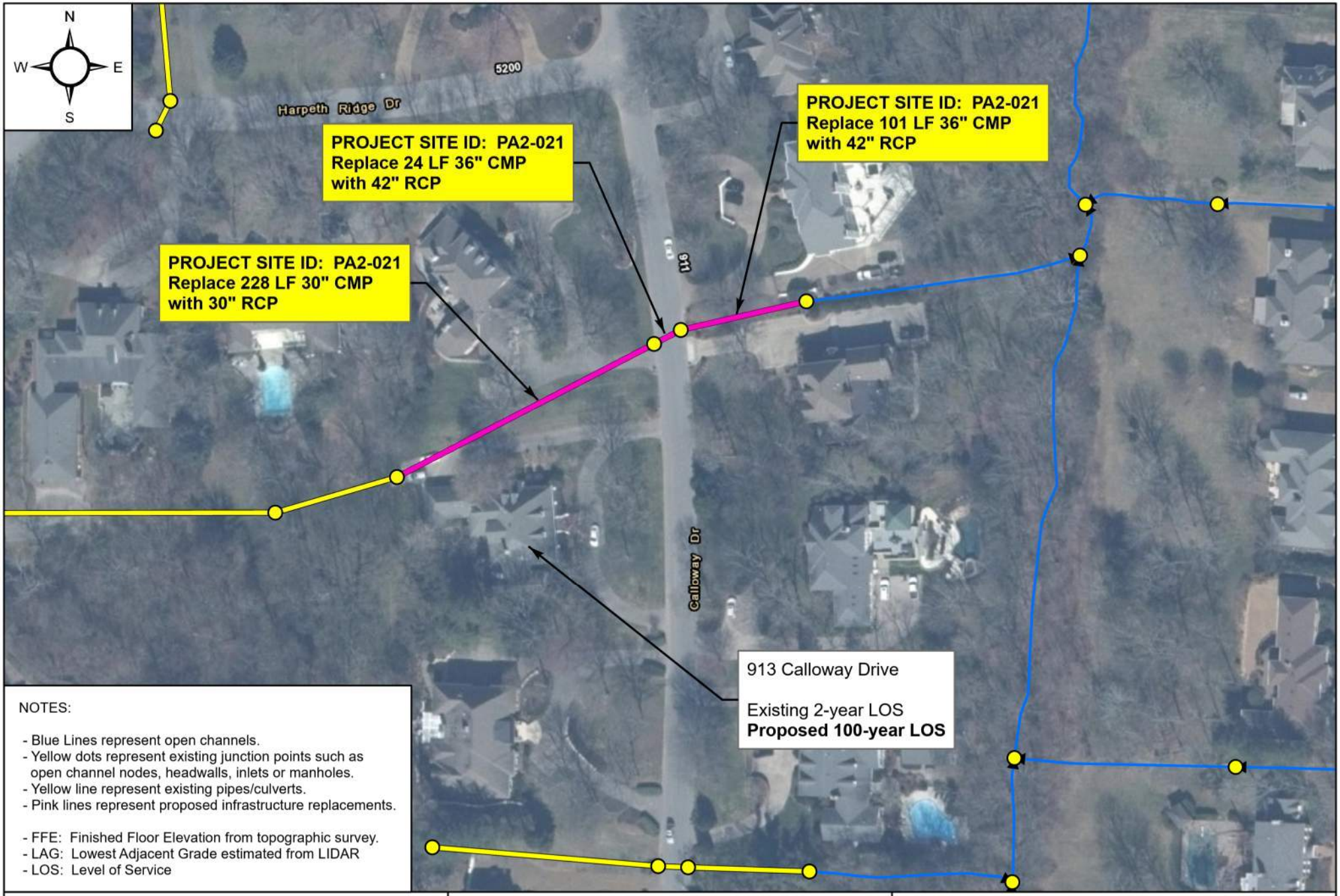
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 180 360 Feet

EXHIBIT A.14
PA1-015
YMCA/5100 Williamsburg Road



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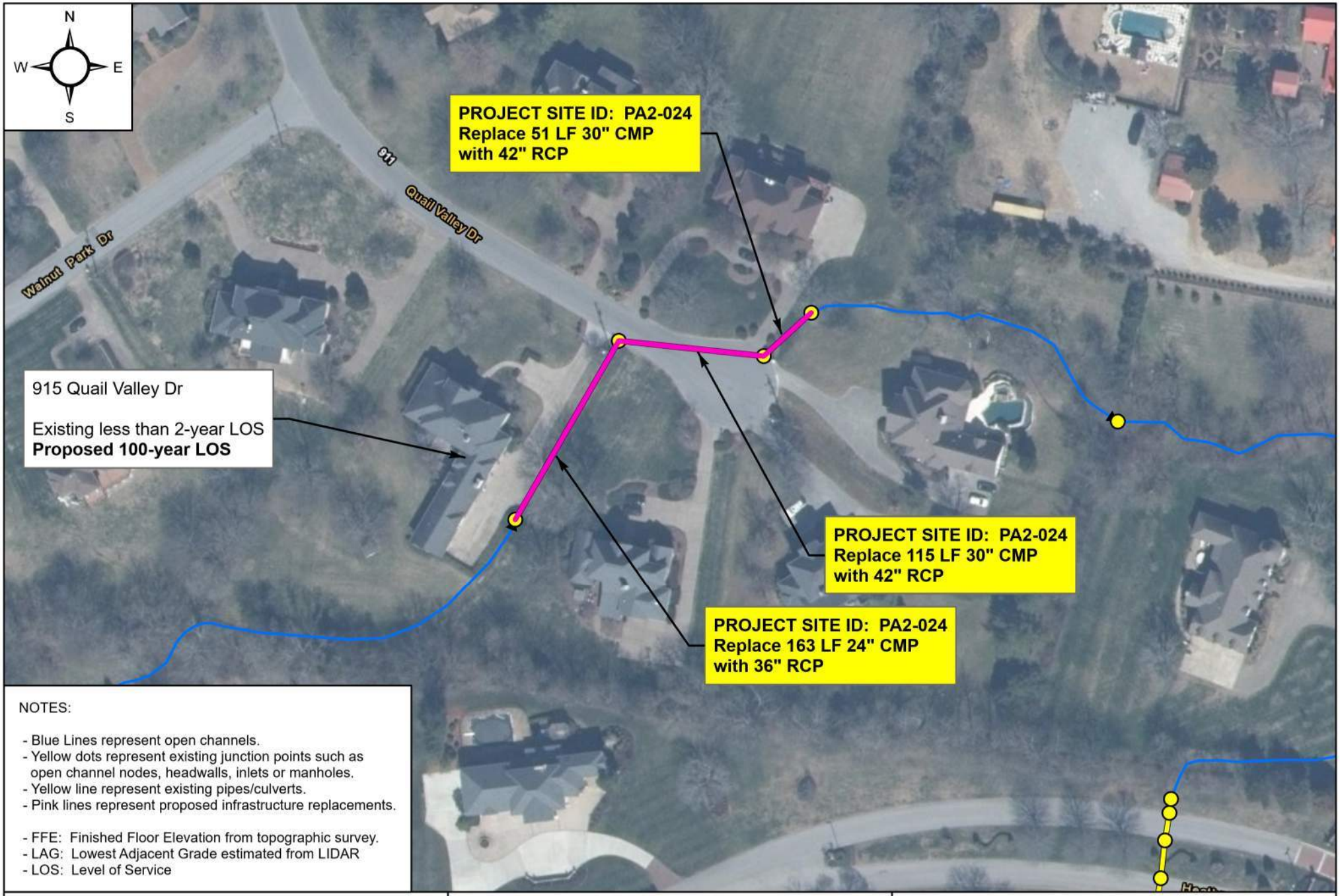
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 130 260 Feet

EXHIBIT A.15
PA2-021
913 Calloway Drive



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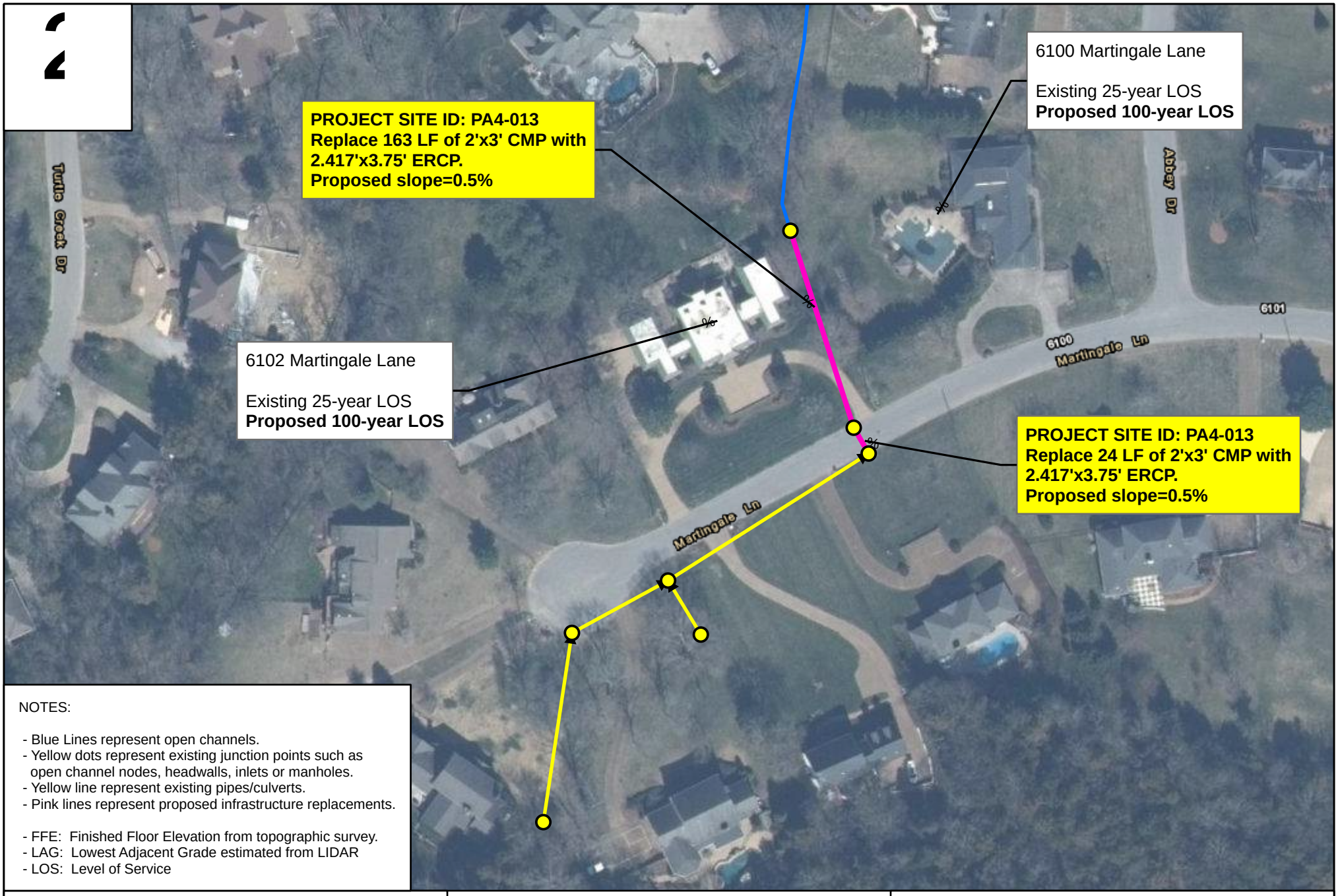
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 130 260 Feet

EXHIBIT A.16
PA2-024
Quail Valley Dr from near 915 to near 920 Quail Valley Drive



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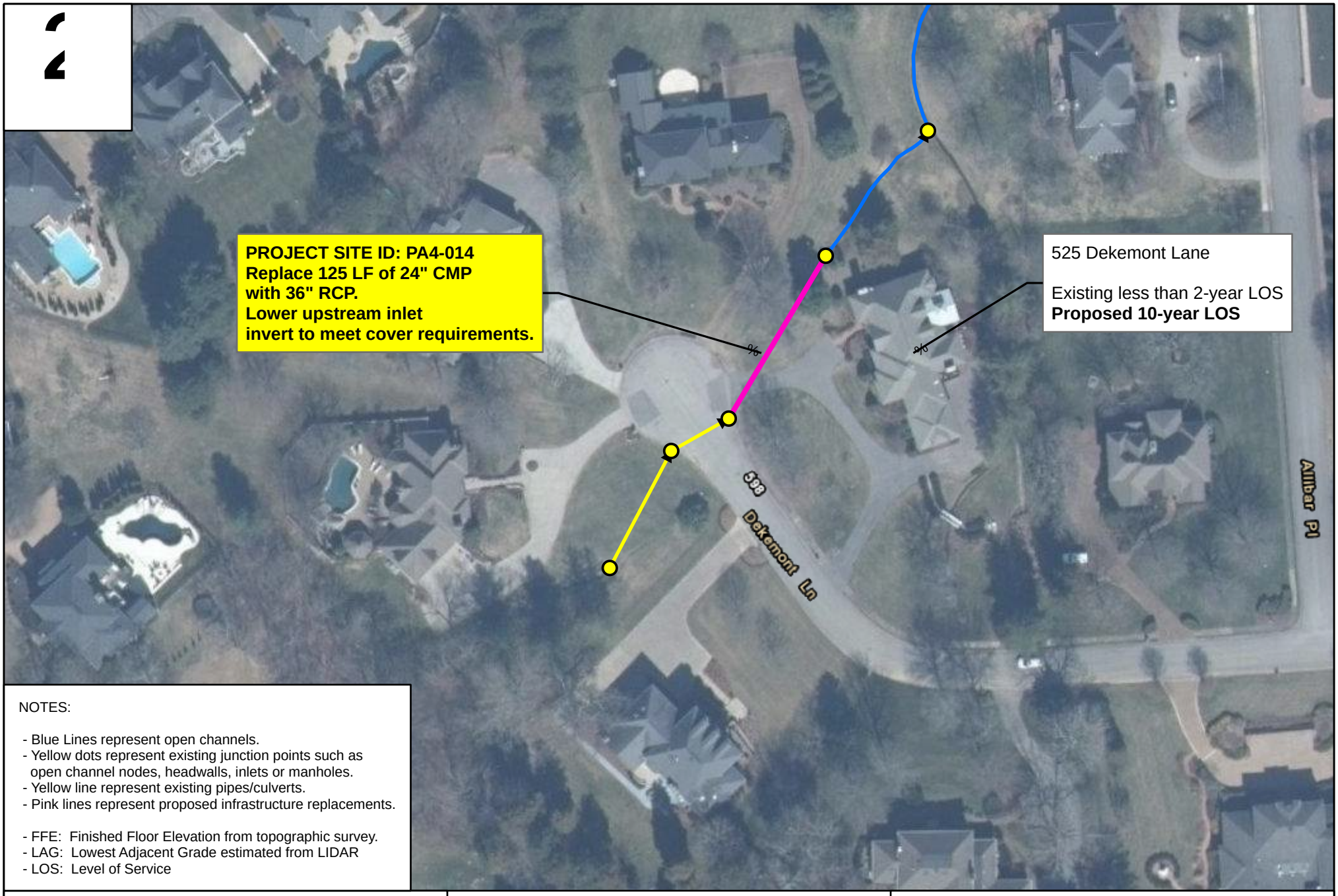
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 130 260 Feet

EXHIBIT A.17
PA4-013
Martingale Ln. near 6102 Martingale Ln.



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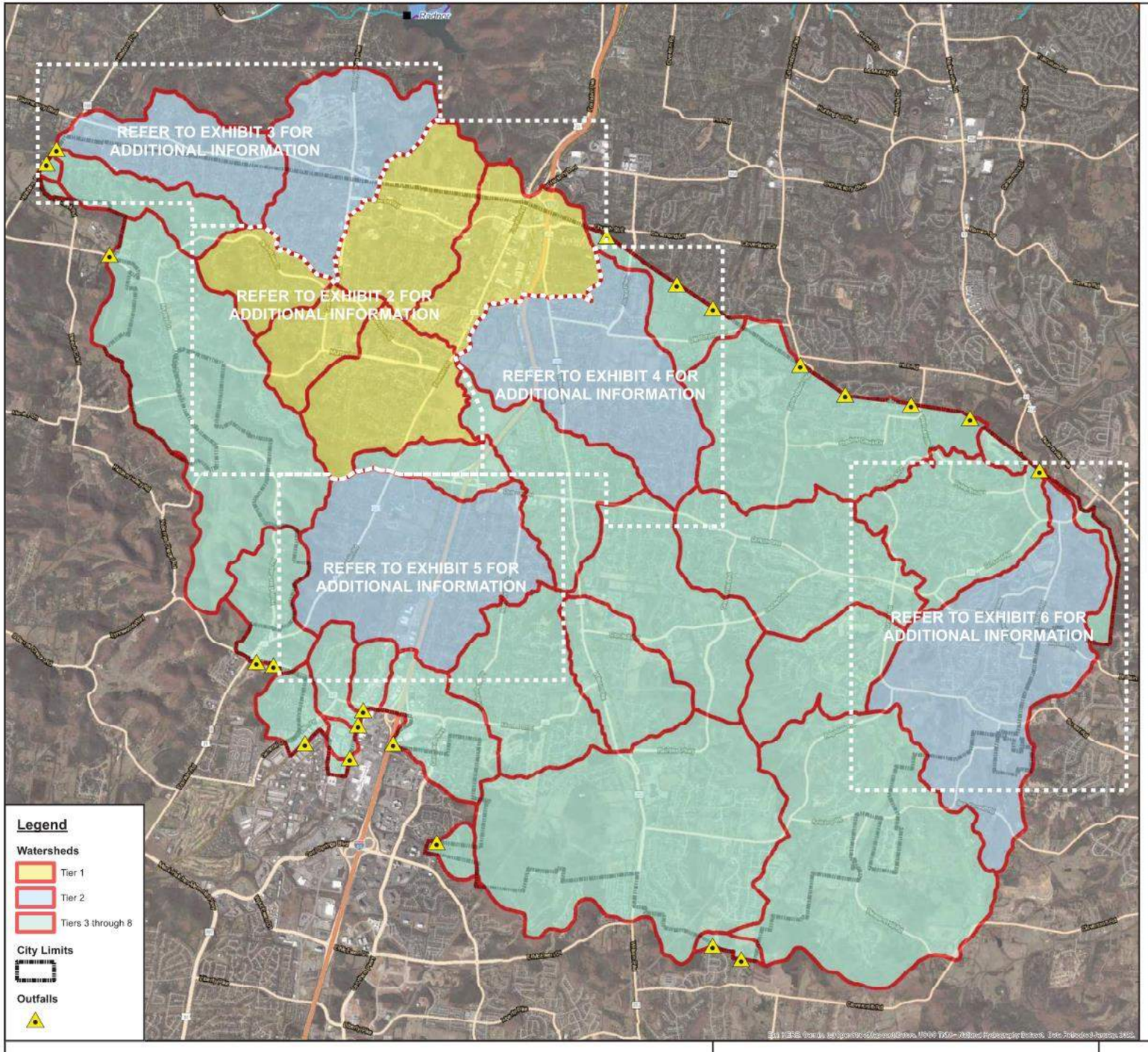
Citywide Drainage Basin Master Plan Study
City of Brentwood, TN

NEEL-SCHAFFER
Solutions you can build upon

0 100 200 Feet

EXHIBIT A.18
PA4-014
Dekemont Lane near 525 Dekemont Lane

APPENDIX B –
Sub-Watershed Prioritization Maps



TIER 1 - Subdivisions / developments located within the Tier 1 study sub-watersheds:
BEL AIR ESTATES
BELLE GLEN
BELLE RIVE
BELLE RIVE II
BRASS LANTERN FARM
BRENTWOOD COUNTRY CLUB
BRENTWOOD ESTATES (WEST OF SKYLINE DRIVE)
BRENTWOOD HILLS (WEST OF BRENTWOOD LANE)
BRENTWOOD PARK
BRENTWOOD PLACE
CAMBRIDGE HILLS
CANNON
CASTLEMAN
CHAPEL HILL
CHURCH STREET COMMONS
DEKEMONT DOWNS
FOREST OF BRENTWOOD
FOUNTAINHEAD
FOXLAND HALL
GRANNY WHITE ESTATES
H G HILL COMMERCIAL PARK
HEATHROW HILLS
HIGHLANDS OF BELLE RIVE
IROQUOIS ESTATES
KOGER EXECUTIVE CENTER
MARYLAND COMMONS
MARYLAND FARMS (EAST OF POWELL COURT)
MARYLAND FARMS EAST PARK
MARYLAND FARMS SOUTH
MARYLAND FARMS/NEW ALPHABET
MAYFIELD (NORTH OF MAYFIELD COURT)
MCGAVOCK FARMS
MEADOW LAKE
OESER PROPERTY
OMAN
OVERLOOK PARK
PARK CENTER PROPERTIES
PEACH PARK
PEARTREE VILLAGE
PLC BUSINESS PARK
PLC PROPERTIES/VIRGINIA SPRINGS
PRINCETON HILLS
ROBERTS PROP
ROBIN HOOD ESTATES
SHARONDALE PARK
WILLIAMSBURG ESTATES
WILSON PIKE HOMES
WOODWAY

TIER 2 - Subdivisions / developments located within the Tier 2 study sub-watersheds:
ANNA
ANNANDALE
BAIN
BLUFF ROAD ACRES
BORGATA
BRENTHAVEN
BRENTHAVEN EAST
BRENTHAVEN PLACE
BRENTMEADE ESTATES
BRENTWOOD BAPTIST CHURCH
BRENTWOOD CLOSE
BRENTWOOD ESTATES (EAST OF SKYLINE DRIVE)
BRENTWOOD HILLS (EAST OF BRENTWOOD LANE)
BRENTWOOD MEADOWS
BRENTWOOD SOUTH LTD
BRIDGETON PARK
BROOKFIELD
CARONDELET
CHATFIELD
CHENOWETH
CHESTNUT SPRINGS
CHEVOIT HILLS
CLOVERLAND ACRES
CONCORD COUNTRY ESTATES
CONCORD CROSSING
CONCORD FOREST
CONCORD GREEN
CONCORD PASS
CONCORD RIDGE
COPPERSTONE AT BROOKFIELD
COUNTRY CLUB ESTATES
DELFINO
DERBY GLEN CLOSE
FELLOWSHIP BIBLE CHURCH
FOXBORO ESTATES
FOXVIEW ESTATES
GATEWAY
GOLDEN PROP
GUTHRIE
KINGS CROSSING
LANDMARK OF BRENTWOOD
LANSDOWNE
LAURELWOOD
LENOX PARK
LITTLE HARPETH RIVER PARK
MALLORY PARK
MARSHALL PLACE
MARYLAND FARMS (WEST OF POWELL COURT)
MAYFIELD (SOUTH OF MAYFIELD COURT)
MAYFIELD CORNER
MAYFIELD PLACE
MAYNARD
MAYWOOD PLACE
MCCOLL MANOR
MILES CROSSING
MOCKINGBIRD HILL
OAKHAMPTON
OLSEN PROPERTY
OWL CREEK (NEW)
OWL LANDING
OWL VALLEY
PARKSIDE AT BRENTHAVEN
PARSONS H G & ROSA PROPERTY
PROVIDENT ESTATES
REMNANT FELLOWSHIP
RIVER OAKS
ROSEBROOK
SARATOGA HILLS
SMYRNA ROAD HOMES
SNEED MANOR
ST REGIS PLACE
STONEHENGE
TOMLINSON
TWIN SPRINGS
VALLEY VIEW
WILDWOOD ESTATES
WILDWOOD VALLEY ESTATES
WILLOWICK
WILSON RUN
WOODLANDS AT COPPERSTONE

APPENDIX B - SUB-WATERSHED PRIORITIZATION MAPS

CITYWIDE DRAINAGE BASIN MASTER PLAN STUDY

CITY OF BRENTWOOD, TENNESSEE

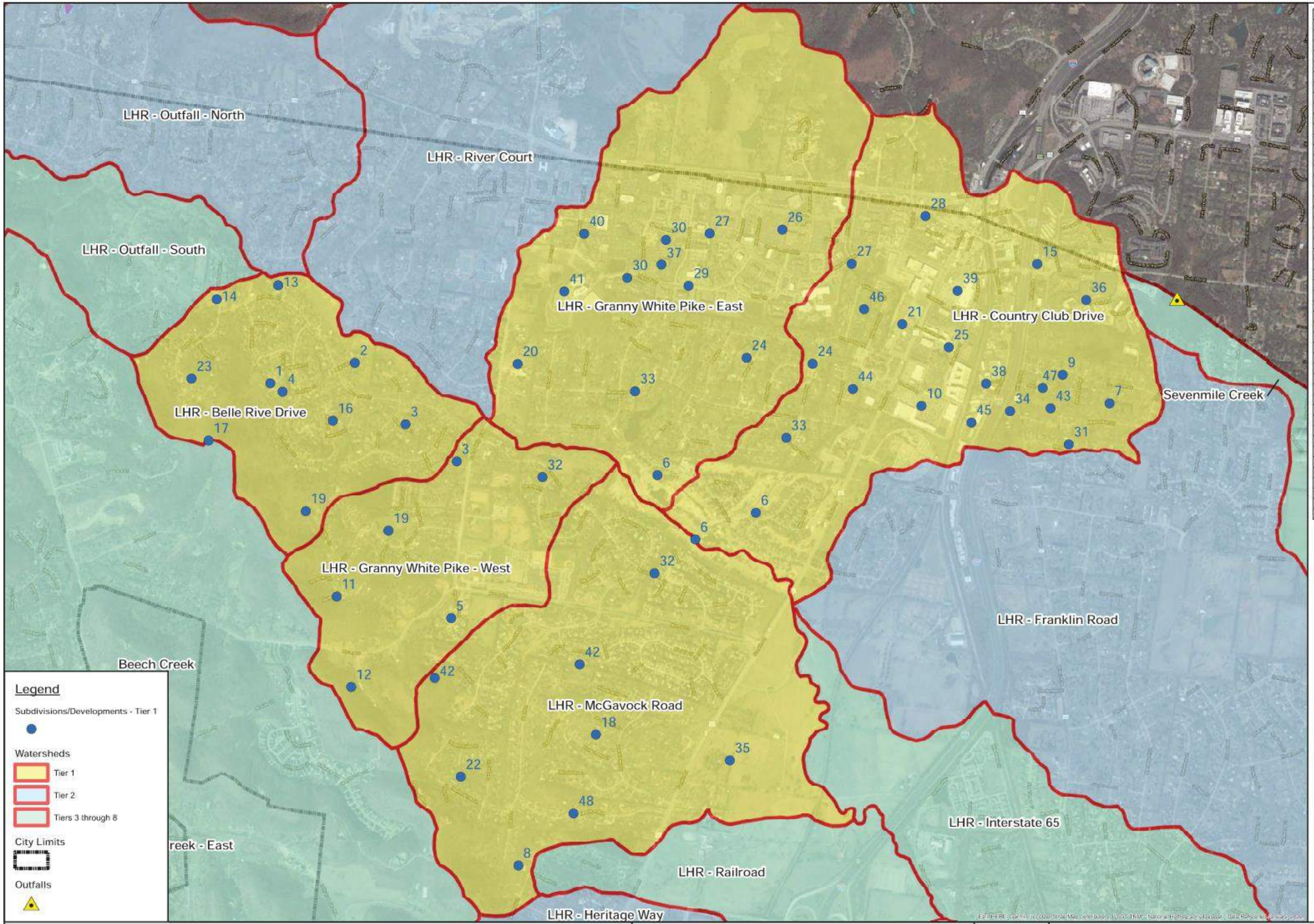
N W E S

NEEL-SCHAFFER

0 0.5 1 2 Miles

WATERSHED DELINEATIONS AND PRIORITIZATION (WITH TIER 1 AND TIER 2 SUBDIVISIONS / DEVELOPMENTS)

EXHIBIT B.1



TIER 1 - Subdivisions / developments located within the Tier 1 study sub-watersheds:

1. BEL AIR ESTATES
2. BELLE GLEN
3. BELLE RIVE
4. BELLE RIVE II
5. BRASS LANTERN FARM
6. BRENTWOOD COUNTRY CLUB
7. BRENTWOOD ESTATES (WEST OF SKYLINE DRIVE)
8. BRENTWOOD HILLS (WEST OF BRENTWOOD LANE)
9. BRENTWOOD PARK
10. BRENTWOOD PLACE
11. CAMBRIDGE HILLS
12. CANNON
13. CASTLEMAN
14. CHAPEL HILL
15. CHURCH STREET COMMONS
16. DEKEMONT DOWNS
17. FOREST OF BRENTWOOD
18. FOUNTAINHEAD
19. FOXLAND HALL
20. GRANNY WHITE ESTATES
21. H G HILL COMMERCIAL PARK
22. HEATHROW HILLS
23. HIGHLANDS OF BELLE RIVE
24. IROQUOIS ESTATES
25. KOGER EXECUTIVE CENTER
26. MARYLAND COMMONS
27. MARYLAND FARMS (EAST OF POWELL COURT)
28. MARYLAND FARMS EAST PARK
29. MARYLAND FARMS SOUTH
30. MARYLAND FARMS/NEW ALPHABET
31. MAYFIELD (NORTH OF MAYFIELD COURT)
32. MCGAVOCK FARMS
33. MEADOW LAKE
34. OESER PROPERTY
35. OMAN
36. OVERLOOK PARK
37. PARK CENTER PROPERTIES
38. PEACH PARK
39. PEARTREE VILLAGE
40. PLC BUSINESS PARK
41. PLC PROPERTIES/VIRGINIA SPRINGS
42. PRINCETON HILLS
43. ROBERTS PROP
44. ROBIN HOOD ESTATES
45. SHARONDALE PARK
46. WILLIAMSBURG ESTATES
47. WILSON PIKE HOMES
48. WOODWAY

APPENDIX B - SUB-WATERSHED PRIORITIZATION MAPS

CITYWIDE DRAINAGE BASIN
MASTER PLAN STUDY

CITY OF BRENTWOOD, TENNESSEE

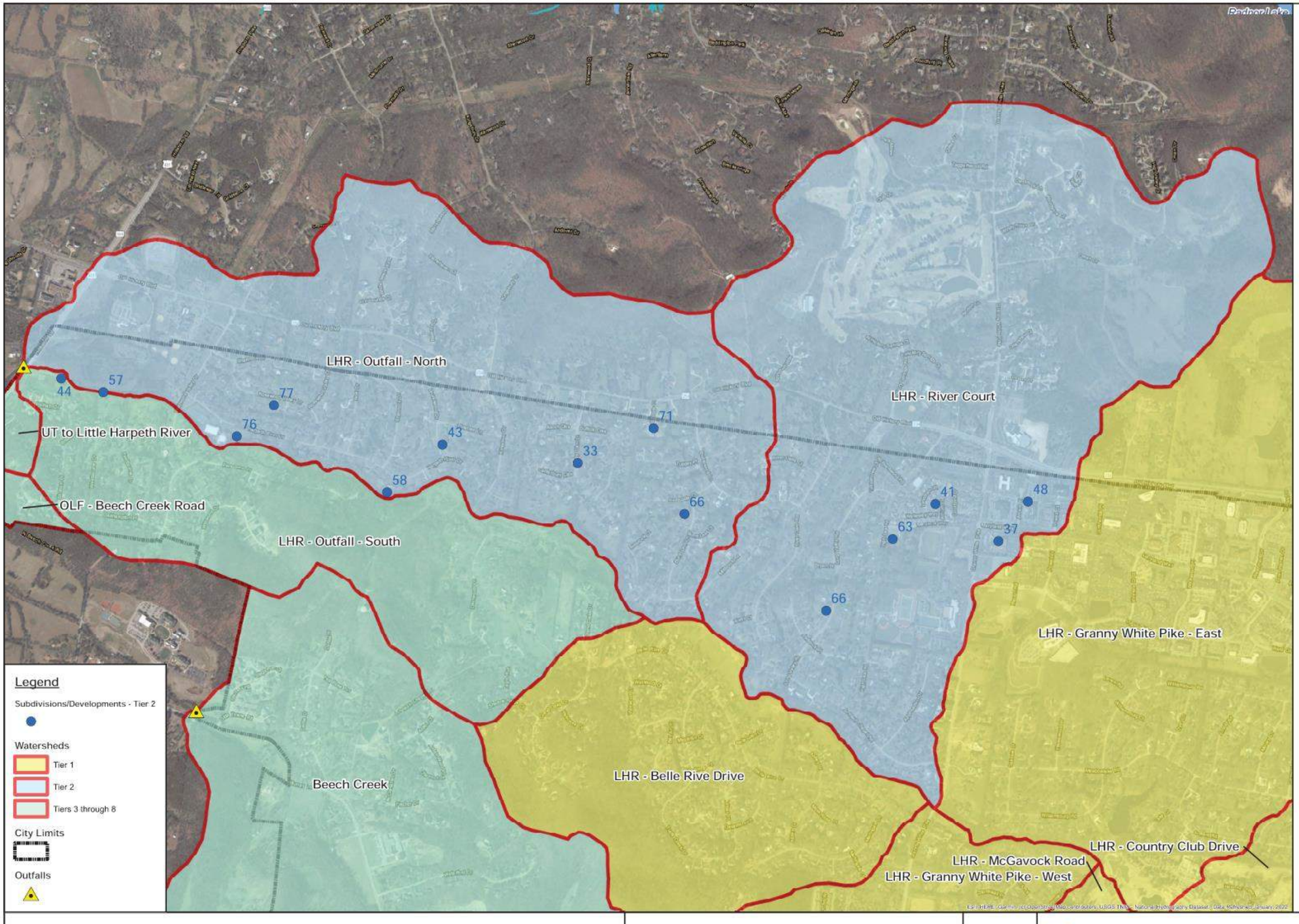
N W E S

NEEL-SCHAFFER

0 0.5 1 Miles

TIER 1 SUBDIVISIONS / DEVELOPMENTS - DETAILED LOCATION MAP

EXHIBIT B.2



TIER 2 - Subdivisions / developments located within the Tier 2 study sub-watersheds:
1. ANNA
2. ANNANDALE
3. BAIN
4. BLUFF ROAD ACRES
5. BORGATA
6. BRENTHAVEN
7. BRENTHAVEN EAST
8. BRENTHAVEN PLACE
9. BRENTMEADE ESTATES
10. BRENTWOOD BAPTIST CHURCH
11. BRENTWOOD CLOSE
12. BRENTWOOD ESTATES (EAST OF SKYLINE DRIVE)
13. BRENTWOOD HILLS (EAST OF BRENTWOOD LANE)
14. BRENTWOOD MEADOWS
15. BRENTWOOD SOUTH LTD
16. BRIDGETON PARK
17. BROOKFIELD
18. CARONDELET
19. CHATFIELD
20. CHENOWETH
21. CHESTNUT SPRINGS
22. CHEVOIT HILLS
23. CLOVERLAND ACRES
24. CONCORD COUNTRY ESTATES
25. CONCORD CROSSING
26. CONCORD FOREST
27. CONCORD GREEN
28. CONCORD PASS
29. CONCORD RIDGE
30. COPPERSTONE AT BROOKFIELD
31. COUNTRY CLUB ESTATES
32. DELFINO
33. DERBY GLEN CLOSE
34. FELLOWSHIP BIBLE CHURCH
35. FOXBORO ESTATES
36. FOXVIEW ESTATES
37. GATEWAY
38. GOLDEN PROP
39. GUTHRIE
40. KINGS CROSSING
41. LANDMARK OF BRENTWOOD
42. LANSDOWNE
43. LAURELWOOD
44. LENOX PARK
45. LITTLE HARPETH RIVER PARK
46. MALLORY PARK
47. MARSHALL PLACE
48. MARYLAND FARMS (WEST OF POWELL COURT)
49. MAYFIELD (SOUTH OF MAYFIELD COURT)
50. MAYFIELD CORNER
51. MAYFIELD PLACE
52. MAYNARD
53. MAYWOOD PLACE
54. MCCOLL MANOR
55. MILES CROSSING
56. MOCKINGBIRD HILL
57. OAKHAMPTON
58. OLSEN PROPERTY
59. OWL CREEK (NEW)
60. OWL LANDING
61. OWL VALLEY
62. PARKSIDE AT BRENTHAVEN
63. PARSONS H G & ROSA PROPERTY
64. PROVIDENT ESTATES
65. REMNANT FELLOWSHIP
66. RIVER OAKS
67. ROSEBROOK
68. SARATOGA HILLS
69. SMYRNA ROAD HOMES
70. SNEED MANOR
71. ST REGIS PLACE
72. STONEHENGE
73. TOMLINSON
74. TWIN SPRINGS
75. VALLEY VIEW
76. WILDWOOD ESTATES
77. WILDWOOD VALLEY ESTATES
78. WILLOWICK
79. WILSON RUN
80. WOODLANDS AT COPPERSTONE

APPENDIX B - SUB-WATERSHED PRIORITIZATION MAPS

CITYWIDE DRAINAGE BASIN
MASTER PLAN STUDY

CITY OF BRENTWOOD, TENNESSEE

N W E S

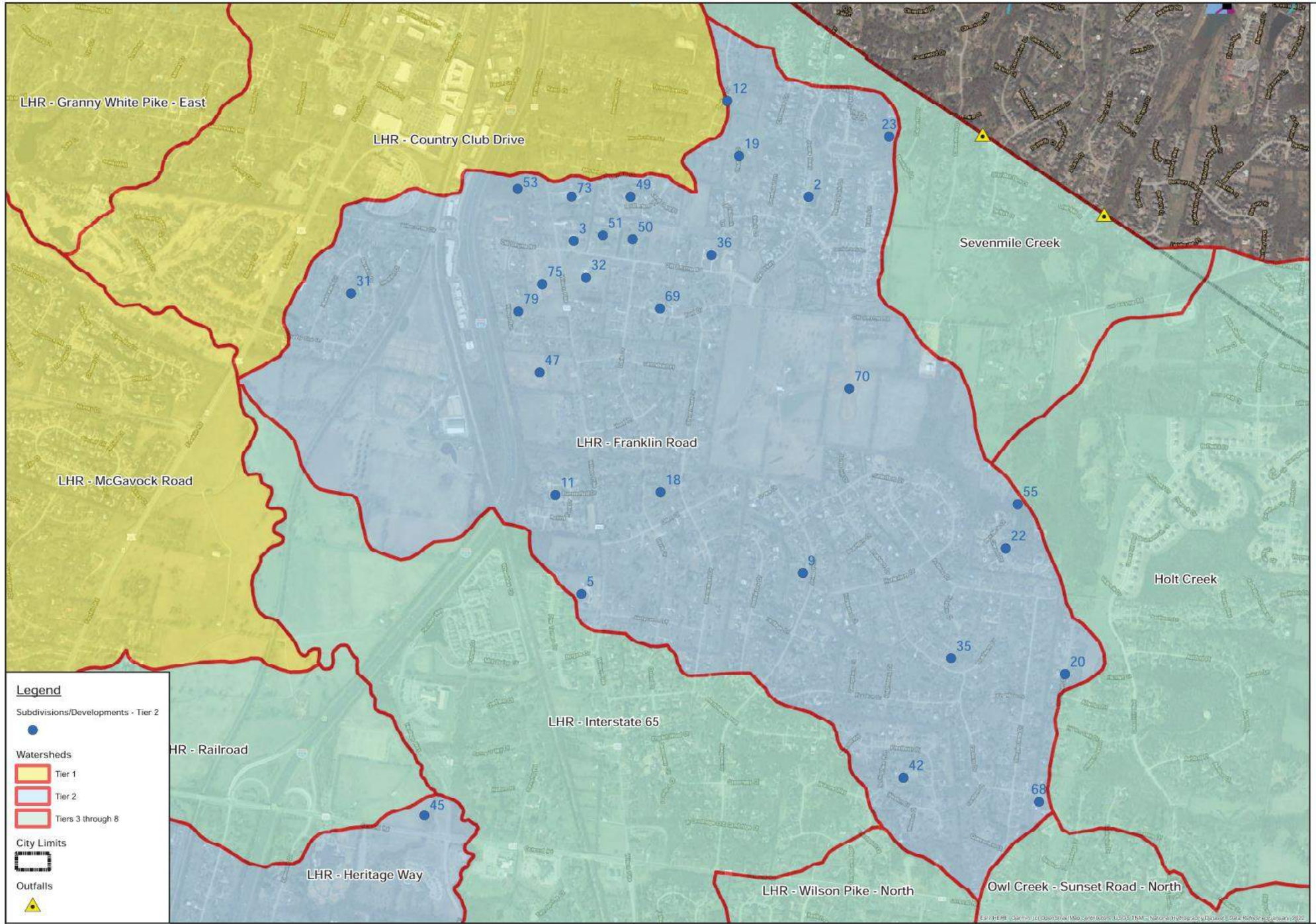
NEEL-SCHAFFER

0 0.25 0.5 Miles

TIER 2 SUBDIVISIONS / DEVELOPMENTS - DETAILED LOCATION MAP

EXHIBIT B.3

INTENDED FOR PLANNING PURPOSES ONLY.



TIER 2 - Subdivisions / developments located within the Tier 2 study sub-watersheds:

1. ANNA
2. ANNANDALE
3. BAIN
4. BLUFF ROAD ACRES
5. BORGATA
6. BRENTHAVEN
7. BRENTHAVEN EAST
8. BRENTHAVEN PLACE
9. BRENTMEADE ESTATES
10. BRENTWOOD BAPTIST CHURCH
11. BRENTWOOD CLOSE
12. BRENTWOOD ESTATES (EAST OF SKYLINE DRIVE)
13. BRENTWOOD HILLS (EAST OF BRENTWOOD LANE)
14. BRENTWOOD MEADOWS
15. BRENTWOOD SOUTH LTD
16. BRIDGETON PARK
17. BROOKFIELD
18. CARONDELET
19. CHATFIELD
20. CHENOWETH
21. CHESTNUT SPRINGS
22. CHEVOIT HILLS
23. CLOVERLAND ACRES
24. CONCORD COUNTRY ESTATES
25. CONCORD CROSSING
26. CONCORD FOREST
27. CONCORD GREEN
28. CONCORD PASS
29. CONCORD RIDGE
30. COPPERSTONE AT BROOKFIELD
31. COUNTRY CLUB ESTATES
32. DELFINO
33. DERBY GLEN CLOSE
34. FELLOWSHIP BIBLE CHURCH
35. FOXBORO ESTATES
36. FOXVIEW ESTATES
37. GATEWAY
38. GOLDEN PROP
39. GUTHRIE
40. KINGS CROSSING
41. LANDMARK OF BRENTWOOD
42. LANSDOWNE
43. LAURELWOOD
44. LENOX PARK
45. LITTLE HARPETH RIVER PARK
46. MALLORY PARK
47. MARSHALL PLACE
48. MARYLAND FARMS (WEST OF POWELL COURT)
49. MAYFIELD (SOUTH OF MAYFIELD COURT)
50. MAYFIELD CORNER
51. MAYFIELD PLACE
52. MAYNARD
53. MAYWOOD PLACE
54. MCCOLL MANOR
55. MILES CROSSING
56. MOCKINGBIRD HILL
57. OAKHAMPTON
58. OLSEN PROPERTY
59. OWL CREEK (NEW)
60. OWL LANDING
61. OWL VALLEY
62. PARKSIDE AT BRENTHAVEN
63. PARSONS H G & ROSA PROPERTY
64. PROVIDENT ESTATES
65. REMNANT FELLOWSHIP
66. RIVER OAKS
67. ROSEBROOK
68. SARATOGA HILLS
69. SMYRNA ROAD HOMES
70. SNEED MANOR
71. ST REGIS PLACE
72. STONEHENGE
73. TOMLINSON
74. TWIN SPRINGS
75. VALLEY VIEW
76. WILDWOOD ESTATES
77. WILDWOOD VALLEY ESTATES
78. WILLOWICK
79. WILSON RUN
80. WOODLANDS AT COPPERSTONE

APPENDIX B - SUB-WATERSHED PRIORITIZATION MAPS

CITYWIDE DRAINAGE BASIN
MASTER PLAN STUDY

CITY OF BRENTWOOD, TENNESSEE

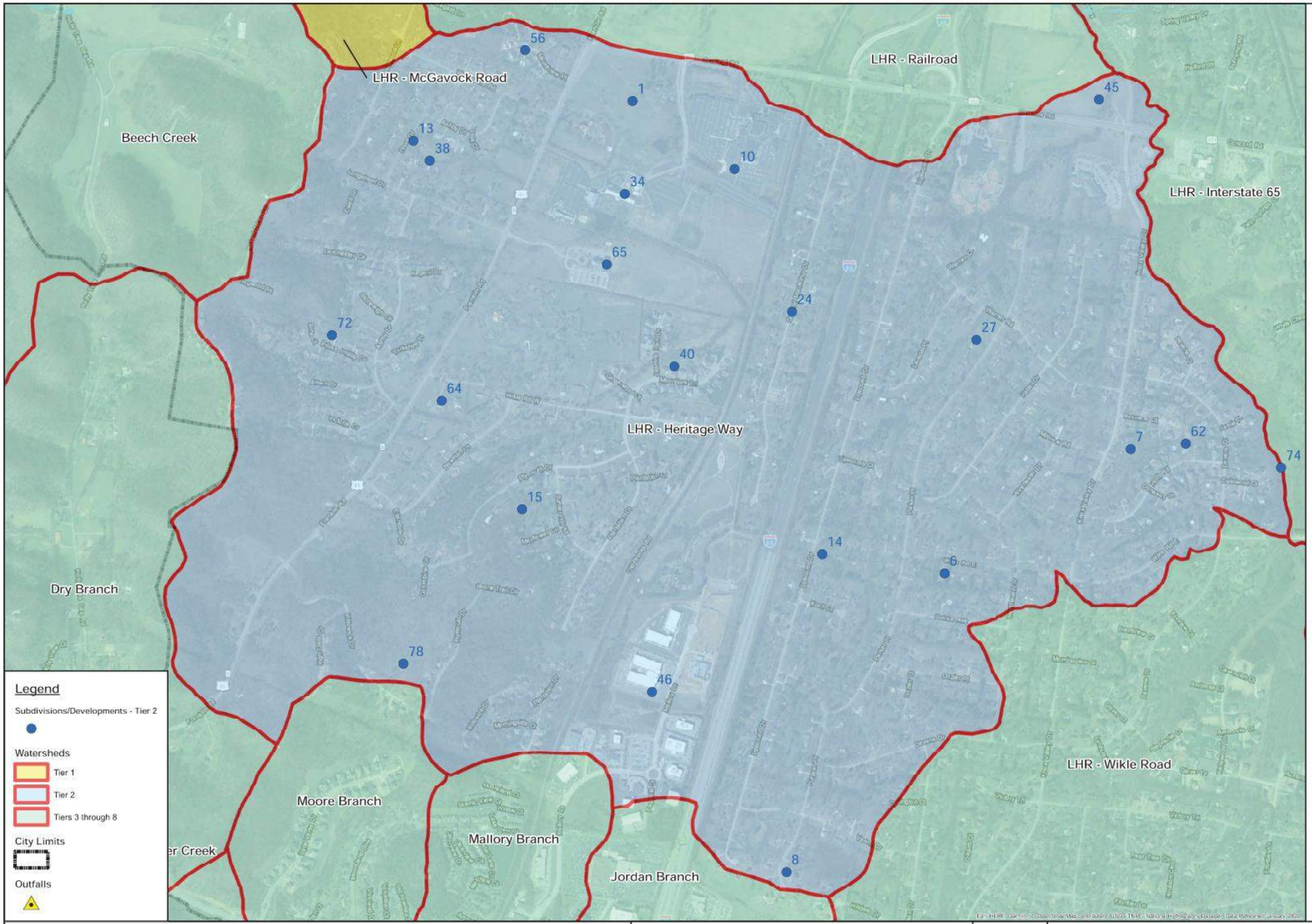
N W E S

NEEL-SCHAFFER

0 0.25 0.5 Miles

TIER 2 SUBDIVISIONS / DEVELOPMENTS - DETAILED LOCATION MAP

EXHIBIT B.4



TIER 2 - Subdivisions / developments located within the Tier 2 study sub-watersheds:

1. ANNA
2. ANNANDALE
3. BAIN
4. BLUFF ROAD ACRES
5. BORGATA
6. BRENTHAVEN
7. BRENTHAVEN EAST
8. BRENTHAVEN PLACE
9. BRENTMEADE ESTATES
10. BRENTWOOD BAPTIST CHURCH
11. BRENTWOOD CLOSE
12. BRENTWOOD ESTATES (EAST OF SKYLINE DRIVE)
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14. BRENTWOOD MEADOWS
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17. BROOKFIELD
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50. MAYFIELD CORNER
51. MAYFIELD PLACE
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53. MAYWOOD PLACE
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55. MILES CROSSING
56. MOCKINGBIRD HILL
57. OAKHAMPTON
58. OLSEN PROPERTY
59. OWL CREEK (NEW)
60. OWL LANDING
61. OWL VALLEY
62. PARKSIDE AT BRENTHAVEN
63. PARSONS H G & ROSA PROPERTY
64. PROVIDENT ESTATES
65. REMNANT FELLOWSHIP
66. RIVER OAKS
67. ROSEBROOK
68. SARATOGA HILLS
69. SMYRNA ROAD HOMES
70. SNEED MANOR
71. ST REGIS PLACE
72. STONEHENGE
73. TOMLINSON
74. TWIN SPRINGS
75. VALLEY VIEW
76. WILDWOOD ESTATES
77. WILDWOOD VALLEY ESTATES
78. WILLOWICK
79. WILSON RUN
80. WOODLANDS AT COPPERSTONE

APPENDIX B - SUB-WATERSHED PRIORITIZATION MAPS

CITYWIDE DRAINAGE BASIN
MASTER PLAN STUDY

CITY OF BRENTWOOD, TENNESSEE

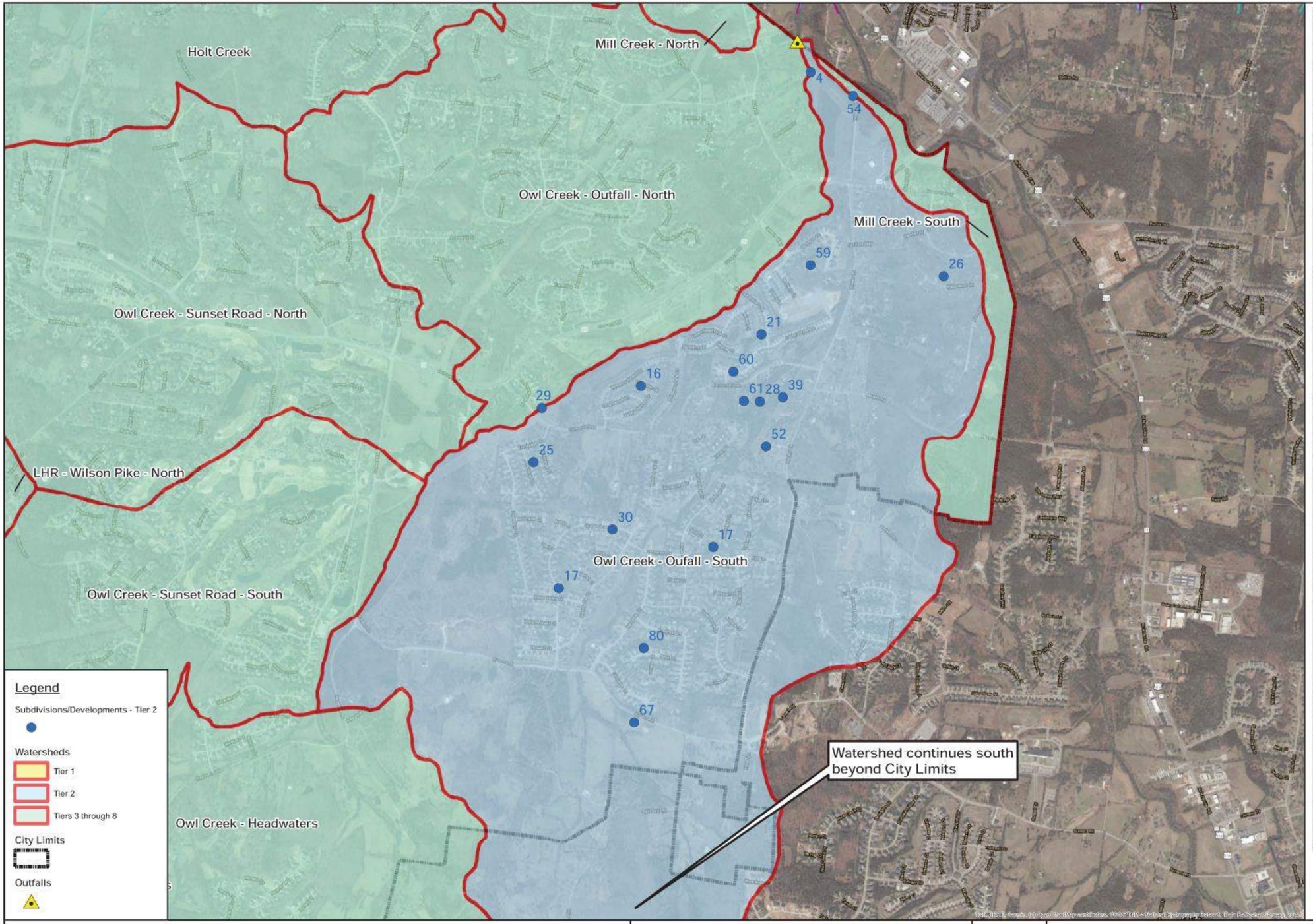
N W E S

NEEL-SCHAFFER

0 0.25 0.5 Miles

TIER 2 SUBDIVISIONS / DEVELOPMENTS - DETAILED LOCATION MAP

EXHIBIT B.5



TIER 2 - Subdivisions / developments located within the Tier 2 study sub-watersheds:

1. ANNA
2. ANNANDALE
3. BAIN
4. **BLUFF ROAD ACRES**
5. BORGATA
6. BRENTHAVEN
7. BRENTHAVEN EAST
8. BRENTHAVEN PLACE
9. BRENTMEADE ESTATES
10. BRENTWOOD BAPTIST CHURCH
11. BRENTWOOD CLOSE
12. BRENTWOOD ESTATES (EAST OF SKYLINE DRIVE)
13. BRENTWOOD HILLS (EAST OF BRENTWOOD LANE)
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15. BRENTWOOD SOUTH LTD
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17. **BROOKFIELD**
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22. CHEVOIT HILLS
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24. CONCORD COUNTRY ESTATES
25. **CONCORD CROSSING**
26. **CONCORD FOREST**
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28. **CONCORD PASS**
29. **CONCORD RIDGE**
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32. DELFINO
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50. MAYFIELD CORNER
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52. **MAYNARD**
53. MAYWOOD PLACE
54. **MCCOLL MANOR**
55. MILES CROSSING
56. MOCKINGBIRD HILL
57. OAKHAMPTON
58. OLSEN PROPERTY
59. **OWL CREEK (NEW)**
60. **OWL LANDING**
61. **OWL VALLEY**
62. PARKSIDE AT BRENTHAVEN
63. PARSONS H G & ROSA PROPERTY
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76. WILDWOOD ESTATES
77. WILDWOOD VALLEY ESTATES
78. WILLOWICK
79. WILSON RUN
80. **WOODLANDS AT COPPERSTONE**

APPENDIX B - SUB-WATERSHED PRIORITIZATION MAPS

CITYWIDE DRAINAGE BASIN
MASTER PLAN STUDY

CITY OF BRENTWOOD, TENNESSEE

N W E S

NEEL-SCHAFFER

0 0.25 0.5 Miles

TIER 2 SUBDIVISIONS / DEVELOPMENTS - DETAILED LOCATION MAP

EXHIBIT B.6

APPENDIX C –
Opinions of Probable Construction Cost (Concept-Level)

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA2-003 (Project Priority Ranking: 6)		PA4-001 (Project Priority Ranking: 15)		PA4-002 (Project Priority Ranking: 19)	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	300	$ 900.00	300	$ 900.00	600	$ 1,800.00
CLEARING AND GRUBBING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	0	$ -	0	$ -
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	5	$ 240.74	5	$ 273.15	61	$ 3,055.56
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	3	$ 88.22	3	$ 88.02	26	$ 842.07
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	0	$ -	0	$ -	0	$ -
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	10	$ 240.00	10	$ 240.00	50	$ 1,200.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	1	$ 272.96	1	$ 218.37	3	$ 1,364.79
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	1	$ 3,000.00	1	$ 3,000.00	2	$ 6,000.00
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	2	$ 10,000.00
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	350	$ 17,500.00
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	0	$ -	150	$ 3,750.00	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	115	$ 4,025.00	0	$ -	0	$ -
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	0	$ -	0	$ -	0	$ -
24" RCP	L.F.	$ 120.00	0	$ -	300	$ 36,000.00	0	$ -
30" RCP	L.F.	$ 150.00	0	$ -	0	$ -	0	$ -
36" RCP	L.F.	$ 160.00	115	$ 18,400.00	0	$ -	0	$ -
42" RCP	L.F.	$ 245.00	0	$ -	0	$ -	0	$ -
48" RCP	L.F.	$ 340.00	0	$ -	0	$ -	0	$ -
54" RCP	L.F.	$ 400.00	0	$ -	0	$ -	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	0	$ -	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	0	$ -	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	0	$ -	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	0	$ -	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	0	$ -
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	350	$ 175,000.00
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
REMOVAL OF HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	0	$ -	0	$ -	1	$ 5,000.00
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.00	$ -	0.00	$ -	0.04	$ 28.41
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	1	$ 210.00	0	$ -	0	$ -
EROSION CONTROL (15% CONSTRUCTION COST)				$ 7,857.00		$ 10,421.00		$ 36,269.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)				$ 6,000.00		$ 7,000.00		$ 25,000.00
TRAFFIC CONTROL				$ 5,000.00		$ 5,000.00		$ 5,000.00
SUB-TOTAL				*$ 71,233.92*		*$ 91,890.53*		*$ 308,059.83*
20% CONTINGENCY				$ 15,000.00		$ 19,000.00		$ 62,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)				$ 11,000.00		$ 14,000.00		$ 47,000.00
TOTAL				**$ 97,233.92**		**$ 124,890.53**		**$ 417,059.83**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA4-003 (Project Priority Ranking: 20)		PA2-005 (Project Priority Ranking: 24)		PA1-009 (Project Priority Ranking: 25)	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	500	$ 1,500.00	0	$ -	50	$ 150.00
CLEARING AND GRUBBING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	0	$ -	0	$ -
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	362	$ 18,082.41	146	$ 7,300.00	50	$ 2,500.00
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	150	$ 4,806.84	69	$ 2,194.20	25	$ 805.99
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	0	$ -	17	$ 566.67	11	$ 377.78
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	0	$ -	150	$ 1,500.00	100	$ 1,000.00
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	0	$ -	0	$ -	0	$ -
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	247	$ 5,928.00	120	$ 2,880.00	40	$ 960.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	16	$ 6,742.06	8	$ 3,275.50	3	$ 1,091.83
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	0	$ -	0	$ -	2	$ 10,000.00
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	2	$ 30,000.00
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	582	$ 23,280.00	0	$ -	0	$ -
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	0	$ -	108	$ 21,600.00	0	$ -
24" RCP	L.F.	$ 120.00	0	$ -	0	$ -	0	$ -
30" RCP	L.F.	$ 150.00	0	$ -	0	$ -	0	$ -
36" RCP	L.F.	$ 160.00	0	$ -	0	$ -	0	$ -
42" RCP	L.F.	$ 245.00	131	$ 32,095.00	0	$ -	0	$ -
48" RCP	L.F.	$ 340.00	451	$ 153,340.00	0	$ -	0	$ -
54" RCP	L.F.	$ 400.00	0	$ -	0	$ -	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	0	$ -	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	0	$ -	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	0	$ -	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	0	$ -	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	0	$ -
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	101	$ 95,798.00	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	20514	$ 30,771.00	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
REMOVAL OF HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	0	$ -	0	$ -
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	0	$ -	0	$ -
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	0	$ -
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.00	$ -	0.03	$ 25.57	0.00	$ -
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
EROSION CONTROL (15% CONSTRUCTION COST)			$	40,617.00	$	27,137.00	$	8,533.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)			$	28,000.00	$	19,000.00	$	6,000.00
TRAFFIC CONTROL			$	5,000.00	$	5,000.00	$	15,000.00
SUB-TOTAL			*$*	*344,391.31*	*$*	*232,047.94*	*$*	*86,418.59*
20% CONTINGENCY			$	69,000.00	$	47,000.00	$	18,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)			$	52,000.00	$	35,000.00	$	13,000.00
TOTAL			**$**	**465,391.31**	**$**	**314,047.94**	**$**	**117,418.59**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA5-001 (Project Priority Ranking: 27)		PA2-006 (Project Priority Ranking: 28)		PA4-004 (Project Priority Ranking: 29)	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	0	$ -	1150	$ 3,450.00	316	$ 948.00
CLEARING AND GRUBBING	L.S.	$ 5,000.00	0	$ -	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	0	$ -	0	$ -
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	225	$ 11,241.67	260	$ 13,020.83	72	$ 3,587.96
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	88	$ 2,831.17	112	$ 3,577.31	28	$ 885.18
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	17	$ 566.67	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	150	$ 1,500.00	0	$ -	0	$ -
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	0	$ -	0	$ -	1	$ 8,700.00
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	60	$ 1,440.00	210	$ 5,040.00	30	$ 720.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	4	$ 1,637.75	14	$ 5,732.12	2	$ 818.87
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	0	$ -	3	$ 9,000.00	1	$ 3,000.00
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	0	$ -	0	$ -	2	$ 6,000.00
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	0	$ -	3	$ 15,000.00	3	$ 15,000.00
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	0	$ -	0	$ -	30	$ 1,260.00
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	190	$ 9,500.00
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	0	$ -	67	$ 1,675.00	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	0	$ -	351	$ 12,285.00	0	$ -
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	255	$ 11,475.00	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	71	$ 14,200.00	0	$ -	0	$ -
24" RCP	L.F.	$ 120.00	0	$ -	0	$ -	0	$ -
30" RCP	L.F.	$ 150.00	0	$ -	67	$ 10,050.00	0	$ -
36" RCP	L.F.	$ 160.00	0	$ -	0	$ -	0	$ -
42" RCP	L.F.	$ 245.00	0	$ -	0	$ -	0	$ -
48" RCP	L.F.	$ 340.00	0	$ -	0	$ -	0	$ -
54" RCP	L.F.	$ 400.00	0	$ -	351	$ 140,400.00	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	255	$ 165,750.00	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	0	$ -	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	0	$ -	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	0	$ -	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	62	$ 29,760.00
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	158	$ 79,000.00
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	164	$ 156,066.00	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	32640	$ 48,960.00	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
REMOVAL OF HEADWALL	EACH	$ 5,000.00	0	$ -	2	$ 10,000.00	1	$ 5,000.00
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	0	$ -	2	$ 10,000.00	1	$ 5,000.00
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	0	$ -	1	$ 5,000.00	1	$ 5,000.00
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.02	$ 17.05	0.00	$ -	0.00	$ -
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	0	$ -	2	$ 420.00	0	$ -
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
EROSION CONTROL (15% CONSTRUCTION COST)			$	36,520.00	$	64,782.00	$	27,628.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)			$	25,000.00	$	44,000.00	$	19,000.00
TRAFFIC CONTROL			$	5,000.00	$	5,000.00	$	5,000.00
SUB-TOTAL			*$*	*309,980.30*	*$*	*545,657.26*	*$*	*235,808.02*
20% CONTINGENCY			$	62,000.00	$	110,000.00	$	48,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)			$	47,000.00	$	82,000.00	$	36,000.00
TOTAL			**$**	**418,980.30**	**$**	**737,657.26**	**$**	**319,808.02**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA1-010 (Project Priority Ranking: 30)		PA3-010 (Project Priority Ranking: 35)		PA2-009 (Project Priority Ranking: 38)	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	0	$ -	0	$ -	0	$ -
CLEARING AND GRUBBING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	0	$ -	0	$ -
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	145	$ 7,248.15	40	$ 2,020.83	357	$ 17,853.70
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	49	$ 1,569.47	14	$ 437.58	132	$ 4,226.81
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	0	$ -	0	$ -	0	$ -
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	0	$ -	0	$ -	100	$ 2,400.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	0	$ -	0	$ -	6	$ 2,729.58
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	0	$ -	45	$ 1,350.00	0	$ -
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	38	$ 7,600.00	0	$ -	125	$ 25,000.00
24" RCP	L.F.	$ 120.00	0	$ -	0	$ -	0	$ -
30" RCP	L.F.	$ 150.00	0	$ -	45	$ 6,750.00	0	$ -
36" RCP	L.F.	$ 160.00	0	$ -	0	$ -	0	$ -
42" RCP	L.F.	$ 245.00	0	$ -	0	$ -	0	$ -
48" RCP	L.F.	$ 340.00	0	$ -	0	$ -	0	$ -
54" RCP	L.F.	$ 400.00	0	$ -	0	$ -	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	0	$ -	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	0	$ -	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	0	$ -	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	0	$ -	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	0	$ -
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	117	$ 110,998.00	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	22914	$ 34,371.00	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	241	$ 229,197.00
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	44869	$ 67,303.50
REMOVAL OF HEADWALL	EACH	$ 5,000.00	0	$ -	2	$ 10,000.00	0	$ -
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	0	$ -	2	$ 10,000.00	0	$ -
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	0	$ -	0	$ -	0	$ -
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.00	$ -	0.00	$ -	0.00	$ -
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
EROSION CONTROL (15% CONSTRUCTION COST)				$ 25,768.00		$ 6,084.00		$ 53,807.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)				$ 18,000.00		$ 5,000.00		$ 36,000.00
TRAFFIC CONTROL				$ 5,000.00		$ 5,000.00		$ 5,000.00
SUB-TOTAL				*$ 220,554.61*		*$ 56,642.41*		*$ 453,517.59*
20% CONTINGENCY				$ 45,000.00		$ 12,000.00		$ 91,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)				$ 34,000.00		$ 9,000.00		$ 69,000.00
TOTAL				**$ 299,554.61**		**$ 77,642.41**		**$ 613,517.59**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA3-012 (Project Priority Ranking: 42)		PA2-010 (Project Priority Ranking: 43)		PA4-008 (Project Priority Ranking: 44)	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	200	$ 600.00	250	$ 750.00	100	$ 300.00
CLEARING AND GRUBBING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	0	$ -	0	$ -
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	101	$ 5,037.04	225	$ 11,226.85	106	$ 5,291.67
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	34	$ 1,090.69	151	$ 4,836.91	38	$ 1,218.00
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	0	$ -	139	$ 4,722.22	0	$ -
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	0	$ -	1250	$ 12,500.00	0	$ -
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	0	$ -	0	$ -	0	$ -
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	0	$ -	250	$ 6,000.00	20	$ 480.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	0	$ -	16	$ 6,823.95	1	$ 545.92
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	0	$ -	0	$ -	2	$ 6,000.00
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	0	$ -	0	$ -	2	$ 10,000.00
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	68	$ 4,080.00	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	127	$ 3,810.00
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	0	$ -	250	$ 7,500.00	0	$ -
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	0	$ -	0	$ -	0	$ -
24" RCP	L.F.	$ 120.00	0	$ -	0	$ -	127	$ 15,240.00
30" RCP	L.F.	$ 150.00	0	$ -	250	$ 37,500.00	0	$ -
36" RCP	L.F.	$ 160.00	136	$ 21,760.00	0	$ -	0	$ -
42" RCP	L.F.	$ 245.00	0	$ -	0	$ -	0	$ -
48" RCP	L.F.	$ 340.00	0	$ -	0	$ -	0	$ -
54" RCP	L.F.	$ 400.00	0	$ -	0	$ -	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	0	$ -	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	0	$ -	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	0	$ -	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	0	$ -	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	0	$ -
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
REMOVAL OF HEADWALL	EACH	$ 5,000.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	2	$ 10,000.00	0	$ -	0	$ -
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	0	$ -	0	$ -	0	$ -
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.00	$ -	0.05	$ 35.51	0.00	$ -
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	0	$ -	1	$ 210.00	0	$ -
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	0	$ -	0	$ -	1	$ 210.00
EROSION CONTROL (15% CONSTRUCTION COST)				$ 7,886.00		$ 15,316.00		$ 7,965.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)				$ 6,000.00		$ 11,000.00		$ 6,000.00
TRAFFIC CONTROL				$ 5,000.00		$ 10,000.00		$ 5,000.00
SUB-TOTAL				*$ 71,453.72*		*$ 138,421.45*		*$ 72,060.58*
20% CONTINGENCY				$ 15,000.00		$ 28,000.00		$ 15,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)				$ 11,000.00		$ 21,000.00		$ 11,000.00
TOTAL				**$ 97,453.72**		**$ 187,421.45**		**$ 98,060.58**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA1-014 (Project Priority Ranking: 46)		PA1-015 (Project Priority Ranking: 48)		PA4-009 (Project Priority Ranking: 49)	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	50	$ 150.00	600	$ 1,800.00	225	$ 675.00
CLEARING AND GRUBBING	L.S.	$ 5,000.00	1	$ 5,000.00	3	$ 15,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	0	$ -	0	$ -
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	49	$ 2,461.53	46	$ 2,294.44	27	$ 1,358.64
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	17	$ 533.00	16	$ 496.82	11	$ 366.37
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	0	$ -	0	$ -	1	$ 8,700.00
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	0	$ -	0	$ -	20	$ 480.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	0	$ -	0	$ -	1	$ 545.92
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	0	$ -	0	$ -	2	$ 6,000.00
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	0	$ -	0	$ -	2	$ 10,000.00
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	10	$ 300.00	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	10	$ 350.00	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	10	$ 400.00	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	10	$ 400.00	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	10	$ 420.00	0	$ -	195	$ 8,190.00
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	50	$ 2,250.00	0	$ -	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	42	$ 2,100.00	0	$ -
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	0	$ -	0	$ -	0	$ -
24" RCP	L.F.	$ 120.00	0	$ -	0	$ -	195	$ 23,400.00
30" RCP	L.F.	$ 150.00	0	$ -	0	$ -	0	$ -
36" RCP	L.F.	$ 160.00	0	$ -	0	$ -	0	$ -
42" RCP	L.F.	$ 245.00	0	$ -	0	$ -	0	$ -
48" RCP	L.F.	$ 340.00	0	$ -	42	$ 14,280.00	0	$ -
54" RCP	L.F.	$ 400.00	0	$ -	0	$ -	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	0	$ -	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	0	$ -	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	50	$ 9,250.00	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	0	$ -	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	0	$ -
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
REMOVAL OF HEADWALL	EACH	$ 5,000.00	2	$ 10,000.00	1	$ 5,000.00	1	$ 5,000.00
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	2	$ 10,000.00	1	$ 5,000.00	1	$ 5,000.00
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	371	$ 10,010.00	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	19	$ 500.00	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	0	$ -	3	$ 15,000.00	1	$ 5,000.00
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.00	$ -	0.00	$ -	0.00	$ -
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
EROSION CONTROL (15% CONSTRUCTION COST)			$	6,978.00	$	11,473.00	$	12,708.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)			$	5,000.00	$	8,000.00	$	9,000.00
TRAFFIC CONTROL			$	5,000.00	$	5,000.00	$	5,000.00
SUB-TOTAL			*$*	*63,492.53*	*$*	*100,954.27*	*$*	*111,423.93*
20% CONTINGENCY			$	13,000.00	$	21,000.00	$	23,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)			$	10,000.00	$	16,000.00	$	17,000.00
TOTAL			**$**	**86,492.53**	**$**	**137,954.27**	**$**	**151,423.93**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA1-016 (Project Priority Ranking: 51)		PA2-011 (Project Priority Ranking: 55)		PA5-005 (Project Priority Ranking: 61)	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	150	$ 450.00	250	$ 750.00	250	$ 750.00
CLEARING AND GRUBBING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	0	$ -	0	$ -
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	29	$ 1,461.11	0	$ -	49	$ 2,458.33
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	12	$ 370.51	5	$ 144.36	22	$ 694.71
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	0	$ -	1	$ 8,700.00	0	$ -
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	15	$ 360.00	40	$ 960.00	45	$ 1,080.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	1	$ 409.44	3	$ 1,091.83	3	$ 1,228.31
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	1	$ 3,000.00	0	$ -	0	$ -
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	1	$ 5,000.00	0	$ -	0	$ -
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	0	$ -	43	$ 1,290.00	0	$ -
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	0	$ -	52	$ 1,820.00	0	$ -
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	0	$ -	149	$ 7,450.00
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	0	$ -	0	$ -	0	$ -
24" RCP	L.F.	$ 120.00	0	$ -	0	$ -	0	$ -
30" RCP	L.F.	$ 150.00	0	$ -	0	$ -	0	$ -
36" RCP	L.F.	$ 160.00	0	$ -	95	$ 15,200.00	0	$ -
42" RCP	L.F.	$ 245.00	0	$ -	0	$ -	0	$ -
48" RCP	L.F.	$ 340.00	0	$ -	0	$ -	149	$ 50,660.00
54" RCP	L.F.	$ 400.00	0	$ -	0	$ -	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	0	$ -	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	36	$ 3,420.00	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	0	$ -	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	0	$ -	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	0	$ -
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
REMOVAL OF HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	0	$ -	0	$ -	1	$ 5,000.00
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.00	$ -	0.00	$ -	0.00	$ -
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	1	$ 210.00	0	$ -	0	$ -
EROSION CONTROL (15% CONSTRUCTION COST)			$	5,203.00	$	7,494.00	$	13,399.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)			$	4,000.00	$	5,000.00	$	9,000.00
TRAFFIC CONTROL			$	5,000.00	$	5,000.00	$	5,000.00
SUB-TOTAL			*$*	*48,884.06*	*$*	*67,450.19*	*$*	*116,720.36*
20% CONTINGENCY			$	10,000.00	$	14,000.00	$	24,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)			$	8,000.00	$	11,000.00	$	18,000.00
TOTAL			**$**	**66,884.06**	**$**	**92,450.19**	**$**	**158,720.36**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA2-015 *(Project Priority Ranking: 64)*		PA2-016 *(Project Priority Ranking: 65)*		PA2-021 *(Project Priority Ranking: 71)*	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	60	$ 180.00	100	$ 300.00	675	$ 2,025.00
CLEARING AND GRUBBING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	111	$ 1,111.11
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	0	$ -	1000	$ 12,000.00
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	25	$ 1,251.85	114	$ 5,708.33	25	$ 1,233.33
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	11	$ 343.25	53	$ 1,687.16	49	$ 1,578.29
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	1	$ 8,700.00	0	$ -	0	$ -
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	2	$ 10,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	20	$ 480.00	125	$ 3,000.00	30	$ 720.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	1	$ 545.92	8	$ 3,411.98	2	$ 818.87
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	2	$ 6,000.00	0	$ -	2	$ 6,000.00
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	2	$ 10,000.00	0	$ -	2	$ 10,000.00
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	47	$ 1,410.00	137	$ 4,110.00	0	$ -
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	0	$ -	0	$ -	228	$ 7,980.00
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	0	$ -	0	$ -	125	$ 5,000.00
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	0	$ -	0	$ -	0	$ -
24" RCP	L.F.	$ 120.00	0	$ -	137	$ 16,440.00	0	$ -
30" RCP	L.F.	$ 150.00	0	$ -	0	$ -	228	$ 34,200.00
36" RCP	L.F.	$ 160.00	26	$ 4,160.00	0	$ -	0	$ -
42" RCP	L.F.	$ 245.00	21	$ 5,145.00	0	$ -	125	$ 30,625.00
48" RCP	L.F.	$ 340.00	0	$ -	0	$ -	0	$ -
54" RCP	L.F.	$ 400.00	0	$ -	0	$ -	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	0	$ -	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	0	$ -	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	0	$ -	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	0	$ -	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	0	$ -
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
REMOVAL OF HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	0	$ -	2	$ 10,000.00
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	0	$ -	2	$ 10,000.00
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	0	$ -	1	$ 5,000.00	2	$ 10,000.00
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.00	$ -	0.00	$ -	0.00	$ -
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	1	$ 210.00	0	$ -	0	$ -
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
EROSION CONTROL (15% CONSTRUCTION COST)			$	8,764.00	$	7,449.00	$	23,744.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)			$	6,000.00	$	5,000.00	$	16,000.00
TRAFFIC CONTROL			$	5,000.00	$	5,000.00	$	5,000.00
SUB-TOTAL			*$*	*78,190.01*	*$*	*67,106.46*	*$*	*203,035.61*
20% CONTINGENCY			$	16,000.00	$	14,000.00	$	41,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)			$	12,000.00	$	11,000.00	$	31,000.00
TOTAL			**$**	**106,190.01**	**$**	**92,106.46**	**$**	**275,035.61**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA3-017 (Project Priority Ranking: 76)		PA3-018 (Project Priority Ranking: 77)		PA2-024 (Project Priority Ranking: 79)	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	0	$ -	20	$ 60.00	450	$ 1,350.00
CLEARING AND GRUBBING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	0	$ -	0	$ -
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	292	$ 14,594.91	50	$ 2,503.70	118	$ 5,909.72
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	129	$ 4,122.65	21	$ 674.46	45	$ 1,424.01
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	39	$ 1,322.22	6	$ 188.89	0	$ -
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	350	$ 3,500.00	50	$ 500.00	0	$ -
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	2	$ 17,400.00	0	$ -	1	$ 8,700.00
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	150	$ 3,600.00	20	$ 480.00	40	$ 960.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	10	$ 4,094.37	1	$ 545.92	3	$ 1,091.83
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	0	$ -	0	$ -	2	$ 6,000.00
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	0	$ -	0	$ -	0	$ -
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	0	$ -	0	$ -	2	$ 10,000.00
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	317	$ 7,925.00	0	$ -	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	55	$ 1,650.00	0	$ -	163	$ 4,890.00
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	0	$ -	0	$ -	166	$ 5,810.00
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	0	$ -	52	$ 2,080.00	0	$ -
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	0	$ -	0	$ -	0	$ -
24" RCP	L.F.	$ 120.00	0	$ -	0	$ -	0	$ -
30" RCP	L.F.	$ 150.00	372	$ 55,800.00	0	$ -	0	$ -
36" RCP	L.F.	$ 160.00	0	$ -	52	$ 8,320.00	163	$ 26,080.00
42" RCP	L.F.	$ 245.00	0	$ -	0	$ -	166	$ 40,670.00
48" RCP	L.F.	$ 340.00	0	$ -	0	$ -	0	$ -
54" RCP	L.F.	$ 400.00	0	$ -	0	$ -	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	0	$ -	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	0	$ -	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	0	$ -	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	0	$ -	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	0	$ -
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
REMOVAL OF HEADWALL	EACH	$ 5,000.00	0	$ -	1	$ 5,000.00	2	$ 10,000.00
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	0	$ -	1	$ 5,000.00	2	$ 10,000.00
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.00	$ -	0.00	$ -	0.00	$ -
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	0	$ -	0	$ -	2	$ 420.00
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
EROSION CONTROL (15% CONSTRUCTION COST)			$	19,352.00	$	6,053.00	$	22,246.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)			$	13,000.00	$	5,000.00	$	15,000.00
TRAFFIC CONTROL			$	5,000.00	$	5,000.00	$	5,000.00
SUB-TOTAL			*$*	*166,361.15*	*$*	*56,405.97*	*$*	*190,551.56*
20% CONTINGENCY			$	34,000.00	$	12,000.00	$	39,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)			$	25,000.00	$	9,000.00	$	29,000.00
TOTAL			**$**	**225,361.15**	**$**	**77,405.97**	**$**	**258,551.56**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**

Appendix C – Opinion of Probable Construction Cost (Concept-Level) (cont.)

ITEM DESCRIPTION	UNIT	UNIT PRICE	PA1-020 *(Project Priority Ranking: 84)*		PA4-013 *(Project Priority Ranking: 86)*		PA4-014 *(Project Priority Ranking: 88)*	
			QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
TEMPORARY HIGH VISIBILITY CONSTRUCTION FENCE	L.F.	$ 3.00	250	$ 750.00	375	$ 1,125.00	250	$ 750.00
CLEARING AND GRUBBING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF ASPHALT DRIVEWAY	S.Y.	$ 10.00	0	$ -	0	$ -	0	$ -
REMOVAL OF CONCRETE DRIVEWAY	S.Y.	$ 34.00	0	$ -	33	$ 1,133.33	12	$ 396.67
CONSTRUCT PROPOSED CONCRETE DRIVEWAY	S.F.	$ 12.00	0	$ -	300	$ 3,600.00	105	$ 1,260.00
ASPHALT REMOVAL AND REPLACEMENT	S.Y.	$ 50.00	21	$ 1,041.67	25	$ 1,272.22	0	$ -
MINERAL AGGREGATE, TYPE A BASE, GRADING D	TON	$ 32.00	12	$ 369.91	24	$ 780.72	8	$ 270.67
REMOVAL OF EXISTING SIDEWALK	S.Y.	$ 34.00	0	$ -	0	$ -	8	$ 283.33
CONSTRUCT PROPOSED CONCRETE SIDEWALK (4" THICK; 5'	S.F.	$ 10.00	0	$ -	0	$ -	75	$ 750.00
REMOVAL AND RELOCATION OF EXISTING LIGHT POLE (IN CONFLICT WITH PROPOSED STORM SEWER UPGRADES)	EACH	$ 8,700.00	1	$ 8,700.00	0	$ -	0	$ -
LOCAL GRADING	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
REMOVAL OF EXISTING CURB AND GUTTER	L.F.	$ 24.00	40	$ 960.00	40	$ 960.00	15	$ 360.00
CONSTRUCT PROPOSED CURB AND GUTTER	C.Y.	$ 420.00	3	$ 1,091.83	3	$ 1,091.83	1	$ 409.44
REMOVE EXISTING CURB INLET	EACH	$ 3,000.00	2	$ 6,000.00	2	$ 6,000.00	1	$ 3,000.00
REMOVE EXISTING AREA / YARD INLET	EACH	$ 3,000.00	0	$ -	2	$ 6,000.00	1	$ 3,000.00
CONSTRUCT PROPOSED CURB INLET / NO. 12 CATCH BASIN	EACH	$ 5,000.00	2	$ 10,000.00	0	$ -	0	$ -
CONSTRUCT PROPOSED DRAINAGE MANHOLE (> 12' - 16' DEPTH)	EACH	$ 15,000.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (17"x13" ELLIPTICAL CMP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (21"x15" ELLIPTICAL CMP)	L.F.	$ 35.00	123	$ 4,305.00	0	$ -	0	$ -
REMOVAL OF PIPE (24"x15" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24"x18" ELLIPTICAL CMP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (28"x18" ELLIPTICAL CMP)	L.F.	$ 42.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (32"x22" ELLIPTICAL CMP)	L.F.	$ 45.00	0	$ -	187	$ 8,415.00	0	$ -
REMOVAL OF PIPE (42"x30" ELLIPTICAL CMP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (59"x30" ELLIPTICAL CMP)	L.F.	$ 60.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (15" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (18" CMP/RCP)	L.F.	$ 25.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (24" CMP/RCP)	L.F.	$ 30.00	0	$ -	0	$ -	125	$ 3,750.00
REMOVAL OF PIPE (30" CMP/RCP)	L.F.	$ 35.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (36" CMP/RCP)	L.F.	$ 40.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (42" CMP/RCP)	L.F.	$ 45.00	0	$ -	0	$ -	0	$ -
REMOVAL OF PIPE (48" CMP/RCP)	L.F.	$ 50.00	0	$ -	0	$ -	0	$ -
REMOVAL OF EXISTING REINFORCED CONCRETE BOX CULVERT	L.F.	$ 200.00	0	$ -	0	$ -	0	$ -
24" RCP	L.F.	$ 120.00	123	$ 14,760.00	0	$ -	0	$ -
30" RCP	L.F.	$ 150.00	0	$ -	0	$ -	0	$ -
36" RCP	L.F.	$ 160.00	0	$ -	0	$ -	125	$ 20,000.00
42" RCP	L.F.	$ 245.00	0	$ -	0	$ -	0	$ -
48" RCP	L.F.	$ 340.00	0	$ -	0	$ -	0	$ -
54" RCP	L.F.	$ 400.00	0	$ -	0	$ -	0	$ -
60" RCP	L.F.	$ 650.00	0	$ -	0	$ -	0	$ -
23"x14" ELLIPTICAL RCP	L.F.	$ 95.00	0	$ -	0	$ -	0	$ -
38"x24" ELLIPTICAL RCP	L.F.	$ 185.00	0	$ -	0	$ -	0	$ -
45"x29" ELLIPTICAL RCP	L.F.	$ 465.00	0	$ -	187	$ 86,955.00	0	$ -
53"x34" ELLIPTICAL RCP	L.F.	$ 480.00	0	$ -	0	$ -	0	$ -
60"x38" ELLIPTICAL RCP	L.F.	$ 500.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
6'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 10'x5' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(2) 12'x6' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - CLASS A CONCRETE (604-02.01)	C.Y.	$ 950.00	0	$ -	0	$ -	0	$ -
(3) 12'x4' REINFORCED CONCRETE BOX CULVERT & WINGWALLS - STEEL BAR REINFORCEMENT (604-02.02)	LBS.	$ 1.50	0	$ -	0	$ -	0	$ -
REMOVAL OF HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
CONSTRUCT PROPOSED HEADWALL	EACH	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
GRADING OF PROPOSED EARTHEN BERM	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
CHANNEL REGRADING	C.Y.	$ 27.00	0	$ -	0	$ -	0	$ -
REMOVAL OF TREES IN CONFLICT WITH PROPOSED DRAINAGE IMPROVEMENTS (5 TREES; 4"-6" DIAMETER AT BREAST HEIGHT)	L.S.	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00	1	$ 5,000.00
PAINTED PAVEMENT MARKING (4" LINE)	L.M.	$ 750.00	0.00	$ -	0.00	$ -	0.00	$ -
REMOVE AND RELOCATE EXISTING MAILBOXES	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
REMOVE AND RELOCATE EXISTING ROADWAY SIGNS	EACH	$ 210.00	0	$ -	0	$ -	0	$ -
EROSION CONTROL (15% CONSTRUCTION COST)			$	10,947.00	$	21,350.00	$	8,885.00
MOBILIZATION (10% CONSTRUCTION COST, ROUND UP)			$	8,000.00	$	15,000.00	$	6,000.00
TRAFFIC CONTROL			$	5,000.00	$	5,000.00	$	5,000.00
SUB-TOTAL			*$*	*96,925.41*	*$*	*183,683.11*	*$*	*79,115.10*
20% CONTINGENCY			$	20,000.00	$	37,000.00	$	16,000.00
SURVEYING, ENGINEERING, & CONSTRUCTION ADMIN. (15%)			$	15,000.00	$	28,000.00	$	12,000.00
TOTAL			**$**	**131,925.41**	**$**	**248,683.11**	**$**	**107,115.10**

***PLEASE NOTE - the cost estimate does not include property acquisition, utility relocation, or easement costs.**