CITY OF BREMERTON

West Kitsap Way Planning Study

Appendix H

Stormwater Analysis

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Memorandum

To: Katie Ketterer, Project Manager – City of Bremerton

CC: John Davies, Project Manager – KPG Psomas

From: Madeleine Marx, EIT Design Engineer – KPG Psomas

Brian L. Taylor, PE Senior Surface Water Engineer – KPG Psomas

Date: 7/31/2024

Re: West Kitsap Way Planning Study – Stormwater Management Tech Memo

Project No: KPG 21154

This memorandum has been prepared to document the required stormwater Minimum Requirements based on the preliminary design plans for the West Kitsap Way Planning Study, in accordance with the 2021 Kitsap County Surface Water Design Manual (KCSWDM), with considerations for future changes to the KCSWDM pending the 2024 Stormwater Management Manual for Western Washington (SWMMWW) update. This report completes the stormwater improvements design component for Task 5: Preliminary Corridor Design as well as Task 6: Stormwater Review as outlined in the project scope.

Project Overview

The purpose of this project is to identify improvements for multimodal travel on Kitsap Way between Chico Way NW and the SR 3 interchange. The existing project site is a 4-lane minor urban arterial corridor between the western edge of downtown Bremerton and the northwest city limits. The planning study will explore installation of non-motorized facilities including sidewalks, crosswalks, biked lands, and ADA-compliant facilities while maintaining transit, freight, and car travel within the corridor.

This project is located near other City of Bremerton stormwater projects, including the stormwater treatment vault at the intersection of Francis Drive and Lake Drive. As design develops, more information on how this project will interact with this vault will be evaluated and accounted for in the system design.

This report evaluates the stormwater management impacts of the selected layout from a stormwater perspective, and describes the strategies to mitigate those impacts, in conformance with project design standards. A variety of potential stormwater designs that can be considered include, detention vaults, permeable pavements, and bioretention. See Figure 1—Vicinity Map for project location.

Design Assumptions

The following assumptions have been made for the stormwater feasibility study:

- A conceptual layout has been used to estimate the amount of new and replaced impervious surfaces for the project for stormwater mitigation.

- The project site is a transportation redevelopment project.

- The project is subject to the KCSWDM that will incorporate the stormwater minimum requirements outlined in the pending 2024 SWMMWW.

- The project is in an Urban Growth Area. The average daily traffic (AADT) county for Kitsap Way, south of Burchfield Drive, is approximately 10,000 vehicles per day. Since the AADT is greater than 7,500, enhanced runoff treatment is required.

- The project partially drains to Kitsap Lake. Project runoff draining to Kitsap Lake must be treated for phosphorous. A City project is in the design phase for the Francis Street outfall at Kitsap Lake. This project will improve stormwater capacity and add treatment to meet State of Washington Department of Ecology requirements. This project is anticipated to be constructed in 2025.

- New Impervious Surface is defined per the KCSWDM as the addition of a hard or compacted surface like roofs, pavement, gravel, or dirt; or the addition of a more compacted surface, like paving over pre-existing dirt or gravel. Permeable pavement and vegetated roofs are considered new impervious surface for purposes of determining whether the thresholds for application of minimum requirements are exceeded, as are lawns, landscaping, sports fields, golf courses, and other areas that have modified runoff characteristics resulting from the addition of underdrains designed to collect stormwater runoff. Open, uncovered retention/detention facilities are not considered impervious surfaces for purposes of determining whether the thresholds for application of minimum requirements are exceeded. Open, uncovered retention/detention facilities are considered impervious surfaces for purposes of runoff modeling.

- New Pollution Generating Impervious Surface (PGIS), per KCSWDM, means new impervious surface that is pollution-generating impervious surface or any alteration of existing pollution-generating impervious surface that changes the type of pollutants or results in increased pollution loads and/or concentrations.

- Existing impervious surfaces constructed after January 8, 2001, that are not yet mitigated means impervious surfaces that were added to the project site after January 8, 2001, that is not confirmed by City of Bremerton staff to be already mitigated by a City-approved and inspected flow control facility or BMP.

- Four locations exist within the project site where impervious surface was added after January 8, 2001. The first location includes the new sidewalk at the south end of the project near the intersection of SR 3. The second location is at Crawford Drive and includes new sidewalk. The third location includes frontage improvements (sidewalk and driveway) at the Public Storage property. The fourth location is a driveway at 2004 Chico Way NW. Verification whether these surfaces were previously mitigated will occur at a later design phase.

- Any detention or treatment facilities to be constructed for this project will be for purposes of meeting stormwater Minimum Requirements generated by the project. No regional facilities will be used or proposed, and future development of adjacent parcels will not be included.

- The Natural Resources Conservation Service (NRCS) Web Soil Survey indicates that the site is predominantly Alderwood gravelly sandy loam, Harstine gravelly ashy sandy loam, and Kitsap silt loam. These three soils are hydrologic soil group type C soils. Based on this, the soils are assumed to have modest potential for infiltration, although infiltration testing for soil suitability and design is not scoped for this phase of the project.

- The City of Bremerton (COB) Stormwater Comprehensive Plan (SWCP) indicates that the site is in areas rated with rapid, moderately rapid, and moderate soil percolation rates according to Figure 3-5 Infiltration Potential. Based on this, there will need to be testing performed locally throughout the project to determine where infiltration will be feasible.

Applicability of the Minimum Requirements (Minimum)

For projects located primarily within dedicated right-of-way, the project site consists of the full width of right-of-way for the total project length. Any additional work performed outside of the right-of-way is also included in the project limits up to the proposed limit of disturbance. Table 1 summarizes the project characteristics used in determining which Minimum Requirements apply to the project and which target surfaces must be assessed for the project.

Table 1 – Project Overview

	Kitsap Lake	**Ostrich Bay**
Area	495,779 sf	741,133 sf
Existing Hard Surface	290,549 sf	390,369 sf
Percent Existing Impervious Surface	59%	53%
Total New HS	41,564 sf	58,602 sf
Percent New IS over Existing HS	14%	15%

The project is separated by a crest in the project at approximately 400 feet west of Lyle Avenue, as shown on Figure 2. The project area west of the crest consists of the area from Chico Way NW to the project high point west of Lyle Avenue. This western project area slopes generally west, with multiple discharge points on the south side of Kitsap Way. Runoff from these discharge points travel via the City MS4 system to Kitsap Lake and recombine within ¼ mile. The eastern project area consists of the project site from the high point west of Lyle Avenue to the SR-3 offramp and Auto Center Way. Runoff leaves the eastern project area via the existing MS4 system before flowing to open channels and streams and ultimately flowing to Ostrich Bay.

Table 2 below summarize the project areas that are relevant for determining the applicability of the Minimum Requirements.

Table 2 – Project Area Summary

	Kitsap Lake	Ostrich Bay
New Pollution Generating Hard Surface	18,915 sf	14,692 sf
	0.43 ac	0.34 ac
Replaced PGHS[1]	137,263 sf	214,514 sf
	3.15 ac	4.92 ac
New Non-PGHS	22,649 sf	29,674 sf
	0.52 ac	0.68 ac
Replaced Non-PGHS	83,655 sf	100,067 sf
	1.92 ac	2.30 ac
Percent Added Hard Surface	-28%	-31%
Is the New and Replaced Hard Surface > 50% of the Existing Hard Surface	Yes	Yes
Target Surface for MR 5, 6, 7	New and Replaced HS	New and Replaced HS
Target Hard Surface (to be mitigated for MR 5 & MR 7)	262,482 sf	358,947 sf
	6.03 ac	8.24 ac
Target PGHS (to be mitigated for MR 6)	156,178 sf	229,206 sf
	3.59 ac	5.26 ac
Notes: 1. PGHS = Pollution-generating hard surface. 2. See Figure 5 for location of new and replaced hard surfaces		

Analysis of Minimum Stormwater Requirements

For the purposes of this preliminary stormwater analysis, the requirements for runoff treatment (MR #6), flow control (MR #7), and on-site stormwater management (MR #5) have been analyzed due to potential impacts to the project budget and right-of-way needs. The remaining six MRs will be analyzed as part of the project's later design phases and documented in a Stormwater Site Plan report.

This project will be required to comply with MR #1-5 for all new and replaced hard surfaces as more than 2,000 square feet of new hard surfaces are proposed and will disturb more than 7,000 square feet of land. Since this project lies within a UGA, it will need to comply with MR #6-9 for all new hard surfaces and converted vegetation areas because more than 5,000 square feet of new hard surface is proposed. Per Section 4.1.2.1, road-related projects shall comply with MR #1-9 for new and replaced hard surfaces and converted vegetation areas if the total new hard surface is over 5,000 square feet and total 50% or more of the existing hard surface within the project limits. This project proposes over 5,000 square feet of new hard surface and 50% or more of hard surface than existing, so this project is subject to this MR #1-9 for all new and replaced hard surfaces.

Runoff Treatment (MR #6)

Runoff treatment is required for the project because the new and replaced pollution-generating hard surface (PGHS), as shown in Table 2, is more than 5,000 square feet in the project area. Runoff treatment facilities are required to be chosen from the Enhanced menu because the average daily traffic volume (ADT) of Kitsap Way exceeds 7,500 vehicles. Facilities in TDA 1 (Kitsap Lake basin) must also provide phosphorous treatment.

Ecology-approved proprietary media filter units (e.g. BioPod with an upstream CDS unit to pre-treat flow to reduce maintenance) are proposed to provide enhanced treatment for an area equivalent to the project's approximate 385,384 square feet of new and replaced PGHS. Potential locations for these facilities are shown on Figure 3 and design discussion is provided in this report. There are several existing water quality BMPs that will be reviewed during future design phases; these will be maintained and incorporated into the design of new stormwater systems where practicable. The proposed roundabouts may provide an opportunity to provide detention or flow control, this option will be explored with input from City maintenance crews to the maximum extent feasible.

A current important regional topic in stormwater is the targeting of high priority pollutants, and the Department of Ecology is developing guidance for 6PPD treatment in roadway runoff. This compound used in tire rubber, when exposed to ozone, forms 6PPD-quinone that is very highly toxic to certain fish species. Specific BMP technologies are being evaluated through ongoing research for the capacity to remove 6PPD. Projects receiving Federal funding are being required to implement appropriate treatments for 6PPD from PGIS; we expect that eventually all projects in the Puget Sound watershed will have to meet these requirements. BMPs appropriate for this treatment typically involve filtering stormwater through media that has organic material to bind the 6PPD compounds. This potential requirement will be taken into consideration when selecting the treatment BMPs to advance in the design process, along with other considerations such as surface slope, depth, maintenance, and cost.

Flow Control (MR #7)

Flow control will be required for both project TDAs because the new effective impervious surface exceeds 5,000 square feet. As shown on Table 2, the target surface areas based on the current conceptual design are as follows:

- 262,482 square feet (6.03 acre) of new and replaced hard surface for the Kitsap Lake Basin, and;
- 358,947 square feet (8.24 acre) of new and replaced hard surface for the Ostrich Bay Basin.

Flow control is required to be provided for an area of the project equivalent to the project's TSA, such that developed condition discharge durations are matched to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow (flow control performance standard). The pre-developed condition to be matched is required to be a forested land cover. Design discussion for flow control is provided in this report and proposed facility locations are shown in Figure 3.

On-Site Stormwater Management (MR #5)

This MR requires projects to employ onsite stormwater management BMPs to convey, infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible without causing flooding or erosion impacts.

Since the project triggers Minimum Requirements 1-9 and is classified as Redevelopment within the Urban Growth Area, the project is required to either:

- Achieve the low impact development performance standard and BMP T5.13 for target surfaces, or
- Apply List #2

At the time of preparation of this memorandum, subsurface geotechnical explorations had not been performed for the project area. Subsurface exploration is necessary to verify if the underlying soils at the project has sufficient infiltration capacity to achieve the LID performance standard. However, the presence of till soils at the site suggests that the underlying soils will have moderate infiltration capacity.

Kitsap County Department of Community Development mapping shows that the project is not located in a Category I or Category II critical aquifer recharge area. Kitsap County Critical Areas mapping shows that a portion of the site is adjacent to areas designated as moderate geological hazard areas. Portions of the project site, near Austin Drive and south of Burchfield Drive, are mapped as a high geological hazard area.

Following is a preliminary BMP feasibility analysis based on List #2. If geotechnical analysis reveals significant on-site infiltration capacity, additional alternative stormwater management concepts will be investigated at that time.

Lawn and Landscape Areas: Post Construction Soil Quality and Depth BMP T5.13 is required.

Roofs: Not applicable.

Other Hard Surfaces:

1. Full dispersion in accordance with BMP T5.30: *Infeasible due to lack of suitable area for dispersion.* The project site lacks the required 100-foot flow paths through native vegetation.

2. Permeable pavement in accordance with BMP T5.15:
    a. Roadway: *Infeasible because the roadway has an ADT greater than 400.*
    b. Sidewalk: Determining the feasibility or infeasibility of permeable sidewalks (or functionally equivalent BMP) for this project will require project site-specific subsurface exploration and analysis to determine if the native soil measured infiltration rate is 0.3 inch per hour or greater and if a minimum separation of one foot or more exists from groundwater. Infiltration is not feasible in portions of the project that lie within areas designated as geological hazard areas.

3. Bioretention BMPs (surface area at least 5% of the total surface area draining to it):
    a. Roadway: Bioretention could be considered at 7 ft subsurface soil exploration reveals soils with a native soil measured infiltration rate of 0.3 inch per hour or greater and a minimum separation of one foot or more to groundwater.

b. Sidewalks: If permeable pavement is feasible for the sidewalk, bioretention is not required to be considered. If permeable pavement is infeasible due to unsuitable soil conditions, it is unlikely that bioretention would be feasible either.

4. Sheet Flow or Concentrated Flow Dispersion in accordance with BMPs T5.12 & T5.11:
Infeasible due to lack of suitable flow paths for dispersion.

Stormwater Management Design

Following is a discussion of the options for complying with on-site stormwater management, runoff treatment and flow control requirements for this project. Figure 3 – Stormwater Concept Map shows the stormwater facilities and proposed conveyance network.

We expect the project to be constructed in phases. Stormwater facilities will be evaluated during future design phases to identify which specific phases to construct the new facilities to comply with the Minimum Requirements.

Flow Control Design

The conservation flow control standard may be met for the project's new and replaced impervious surface area in the Kitsap Lake Basin through two underground detention vaults, each sized to detain runoff from 3.10 acres and 8.28 acres of contributing surface area. Three flow control detention vaults are proposed for the Ostrich Bay Basin and are each sized to detain runoff from 11.22, 1.20, and 4.60 acres of contributing areas respectively.

The vault designs are provided below. Upstream areas that drain to the existing roadway systems were considered in the preliminary layout and new conveyance systems may need to be constructed to bypass these flows.

Table 4 – Detention Vault Summary

	Impervious Area to Vault	Required Volume	Length	Width	Depth
Vault 1	1.72 ac	1.903 ac-ft	370 ft	32 ft	7 ft
Vault 2	4.11 ac	3.765 ac-ft	1,233 ft	19 ft	7 ft
Vault 3	4.85 ac	5.481 ac-ft	1,795 ft	19 ft	7 ft
Vault 4	0.71 ac	0.635 ac-ft	208 ft	19 ft	7 ft
Vault 5	2.68 ac	2.259 ac-ft	740 ft	19 ft	7 ft

Note: Vault dimensions are preliminary and will be adjusted during final design. Additional space is needed to meet requirements for access and sediment storage.

Runoff Treatment Design

Runoff treatment is required for the Kitsap Lake and Ostrich Bay project basins for an area of at least 156,178 sf (3.59 ac) and 229,206 sf (5.26 ac) for the Kitsap Lake and Ostrich Bay basins, respectively. Runoff treatment will be sized utilizing Biopod media filter units with upstream CDS units to provide pre-treatment. Biopod media filters are proprietary stormwater media filters approved by the Department of Ecology's TAPE process for General Use Level Designation (GULD). Equivalent treatment devices approved by Ecology may also be

considered with similar footprints but may have different configurations and may not allow for the structure to be placed in the roadway. These devices will be coordinated further with the City as the design progresses. A sizing summary is provided below in Table 5 and WWHM modeling documentation is provided as an attachment. Figure 3 shows the locations and drainage areas to the water quality facilities.

Table 5- Sizing Summary for Runoff Treatment

WQ Unit	PGIS (ac)	NPGIS (ac)	Online/Offline	Water Quality Flow Rate (cfs)	MWS Unit Size
1	1.25	0.67	Online	0.1455	4' x 12' x 4'
2	2.39	1.57	Online	0.2808	8' x 24' x 4'
3	2.68	2.07	Online	0.2870	4' x 12' x 4'
4	0.42	0.29	Online	0.0350	4' x 6' x 4'
5	2.14	0.60	Online	0.1548	8' x 12' x 4'

Flow Control BMPs

CR #9 offers two options for complying with the on-site stormwater management requirements: using on-site stormwater management BMPs from List #2 or by demonstrating compliance with the LID performance standard. List #2 will be evaluated for BMP feasibility.

For lawn and landscaped areas of the project, BMP T5.13: Post-Construction Soil Quality and Depth is required. For paved surfaces, new and replaced impervious surfaces to be evaluated as target surface areas and include roadway pavement, curb and gutter, and sidewalks. Using List #2, the following BMPs are required to be evaluated in the following order:

1. Full Dispersion
2. Permeable Pavement
3. Bioretention with a surface area equal to 5% of the contributing area
4. Sheet Flow Dispersion or Concentrated Flow Dispersion

Specific infeasibly criteria must be evaluated for each BMP before moving down the list to the next. Complete feasibility analysis and FCBMP design is pending additional subsurface investigation by a Geotechnical Engineer.

Full Dispersion is infeasible for either sidewalks or roadway because due to lack of space or native vegetation for a vegetated flow path.

Permeable pavement will not be required for the roadway (since traffic will exceed 400 ADT). Permeable sidewalk could be feasible if the underlying soil characteristics are suitable for infiltration and if no existing underground utility conflicts exist. However, permeable sidewalk is not feasible in locations that are mapped as geologic hazard areas. The following potential infeasibility criteria would need to be verified for the site to determine suitability:

- Geotechnical evaluation expressing reasonable concerns about erosion, slope failure, or down gradient flooding
- Any known soil or ground water contamination
- Seasonal high ground water within one foot of the bottom of the gravel base course
- Underlying soils unsuitable for supporting traffic loads when saturated
- Where native soils saturated, short-term hydraulic conductivity is less than 0.3 inches per hour

Permeable pavement design will be evaluated in future design, pending additional geotechnical soil investigation. Based on the Kitsap Lake Stormwater Treatment Retrofit 90% Design Report - Draft dated May 2022, by Parametrix, infiltration was removed as an option due to space constraints. There are a mix of soil types featured in the report, ranging from A to C, but further soil investigation by the geotechnical engineer is needed. If additional soil investigations reveal suitable depth to the seasonal high groundwater table and suitable infiltration rates, permeable sidewalk may be feasible for sections of each basin.

If permeable pavement is not feasible for the roadway or sidewalks, bioretention will need to be evaluated for new and replaced hard surfaces. Bioretention feasibility is subject to soil suitability analysis, space limitations, and underling utility conflicts. This effort will also be coordinated with the City, roadway and landscape design teams in future design.

Sheet Flow Dispersion or Concentrated Flow Dispersion is infeasible for this project due to the lack of a 50-foot flow path through existing, native vegetation.

Conclusions and Next Steps

Based on this preliminary analysis, it appears that the following conclusions can be made regarding stormwater management:

- Flow control is required for an area equivalent to the project's new and replaced impervious surfaces in the Kitsap Lake and Ostrich Bay Basins. Detention vaults are proposed in both basins at various locations throughout the project area, primarily located within the pedestrian areas. Due to the potential size and costs of the underground vaults, using open ponds is recommended for further evaluation, but would be expected to need property acquisition because there is insufficient room in the current right-of-way.

- Enhanced basic runoff treatment is required for the project's new and replaced pollution-generating impervious surfaces in each drainage basin. Biopod-CDS systems are proposed to provide enhanced runoff treatment from the site. The approach shown on Figure 3 assumes that larger units will be place near the basin outfalls, rather than multiple smaller dispersed units, to allow for more efficient routine maintenance.

- Permeable pavement may be feasible in each Kitsap Lake Basin, pending additional geotechnical investigations on the project site. Permeable pavement may be feasible in small portions of the Ostrich Bay Basin, where geologic hazard areas are not mapped.

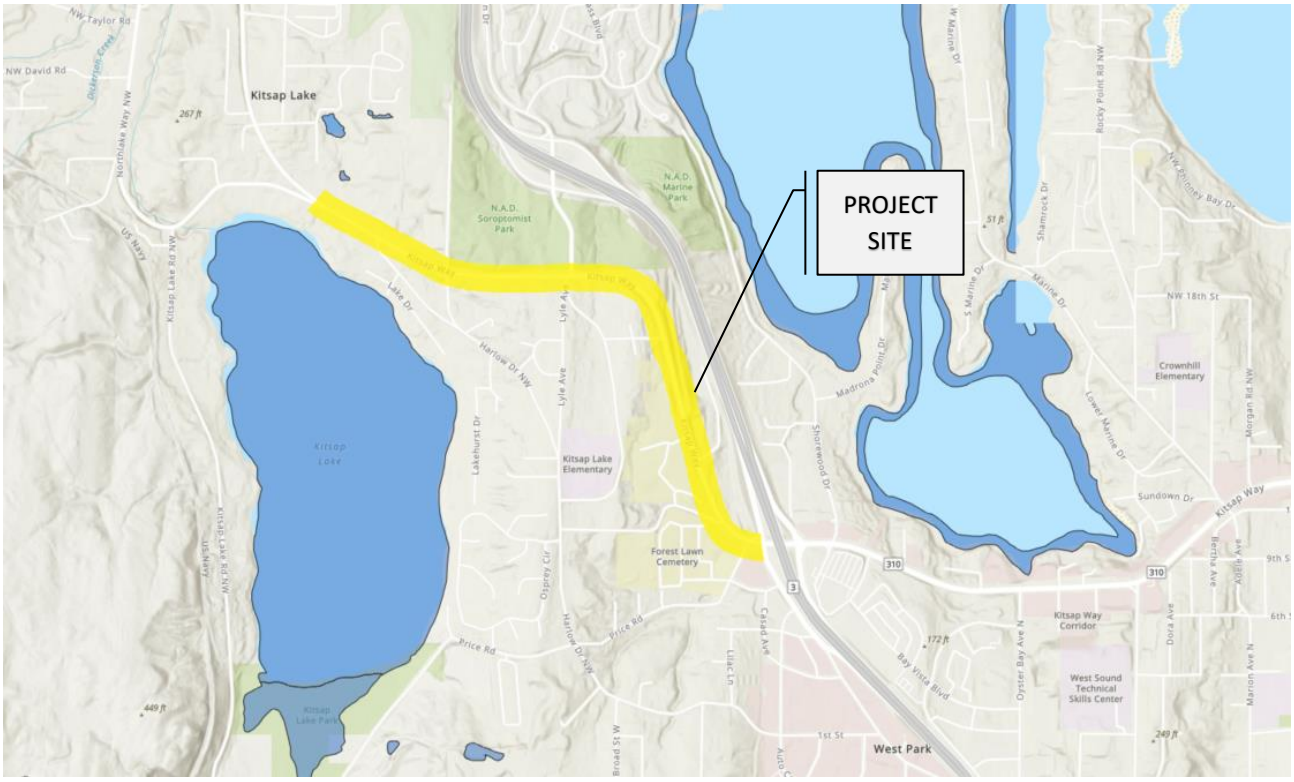
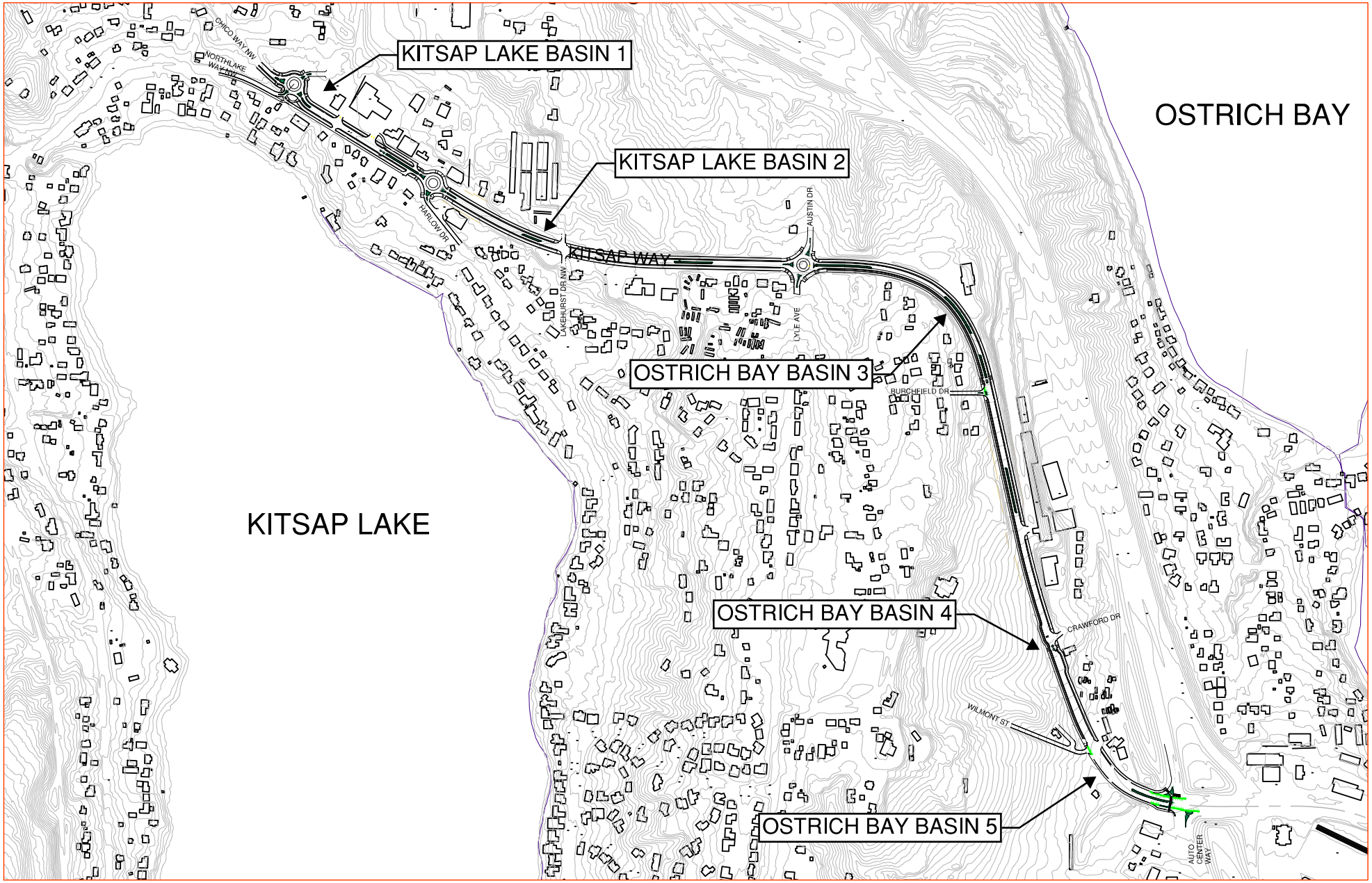


Figure 1. Vicinity Map

Attachments:

- Figure 2. Basin Map
- Figure 3. Stormwater Concept Map
- Figure 4. Outfall Map
- Figure 5. New and Replaced Hard Surfaces Map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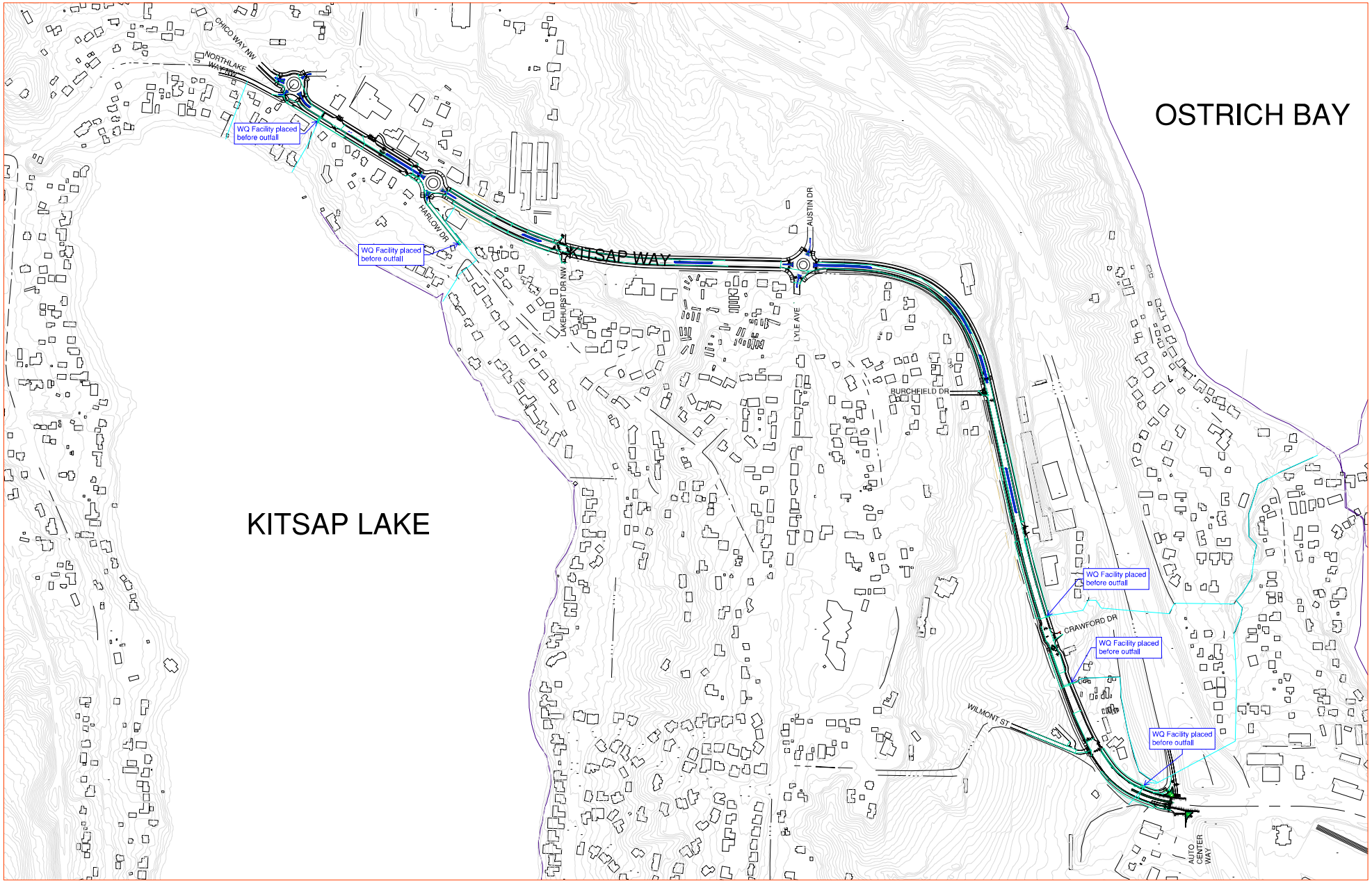
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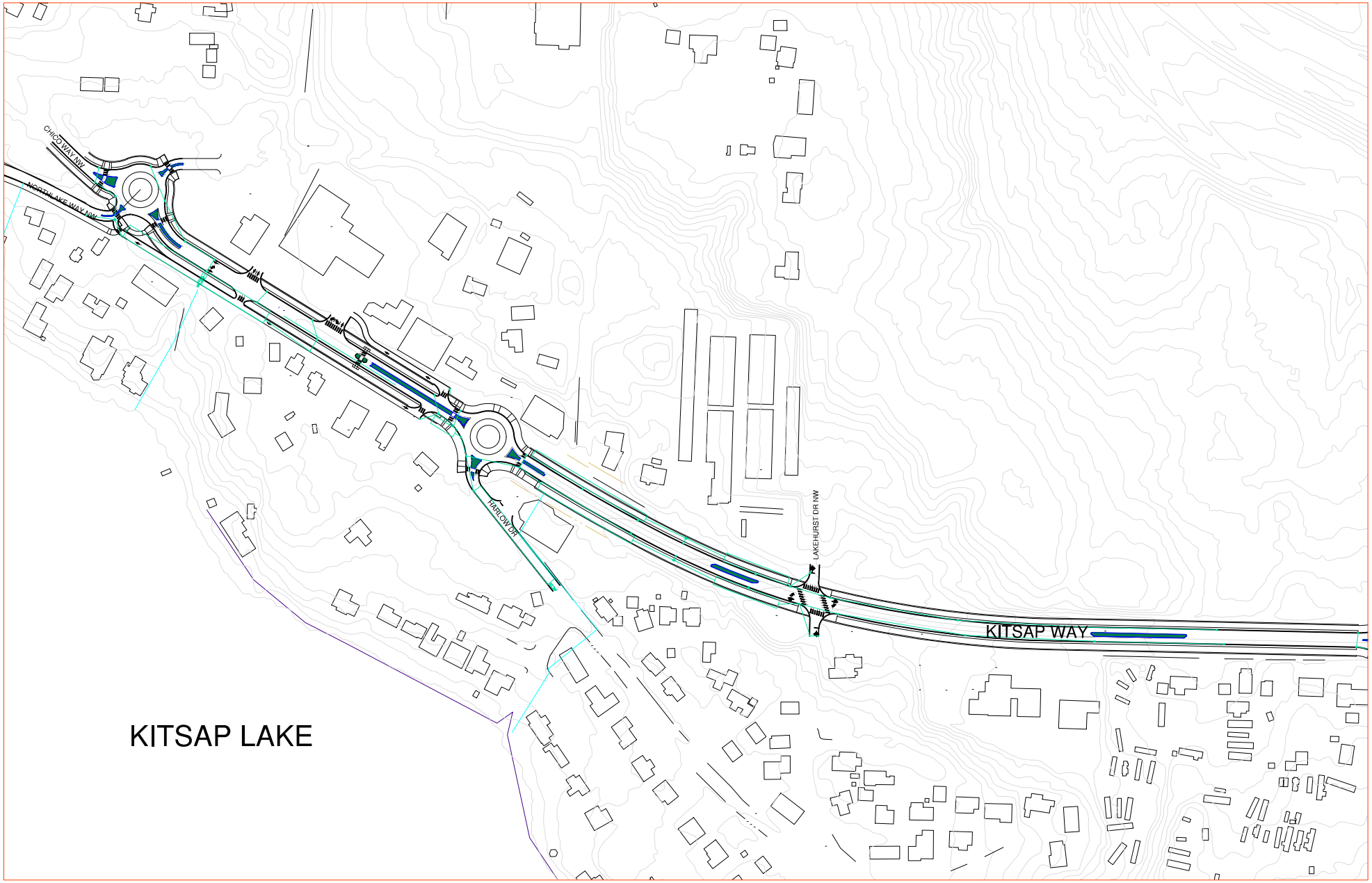
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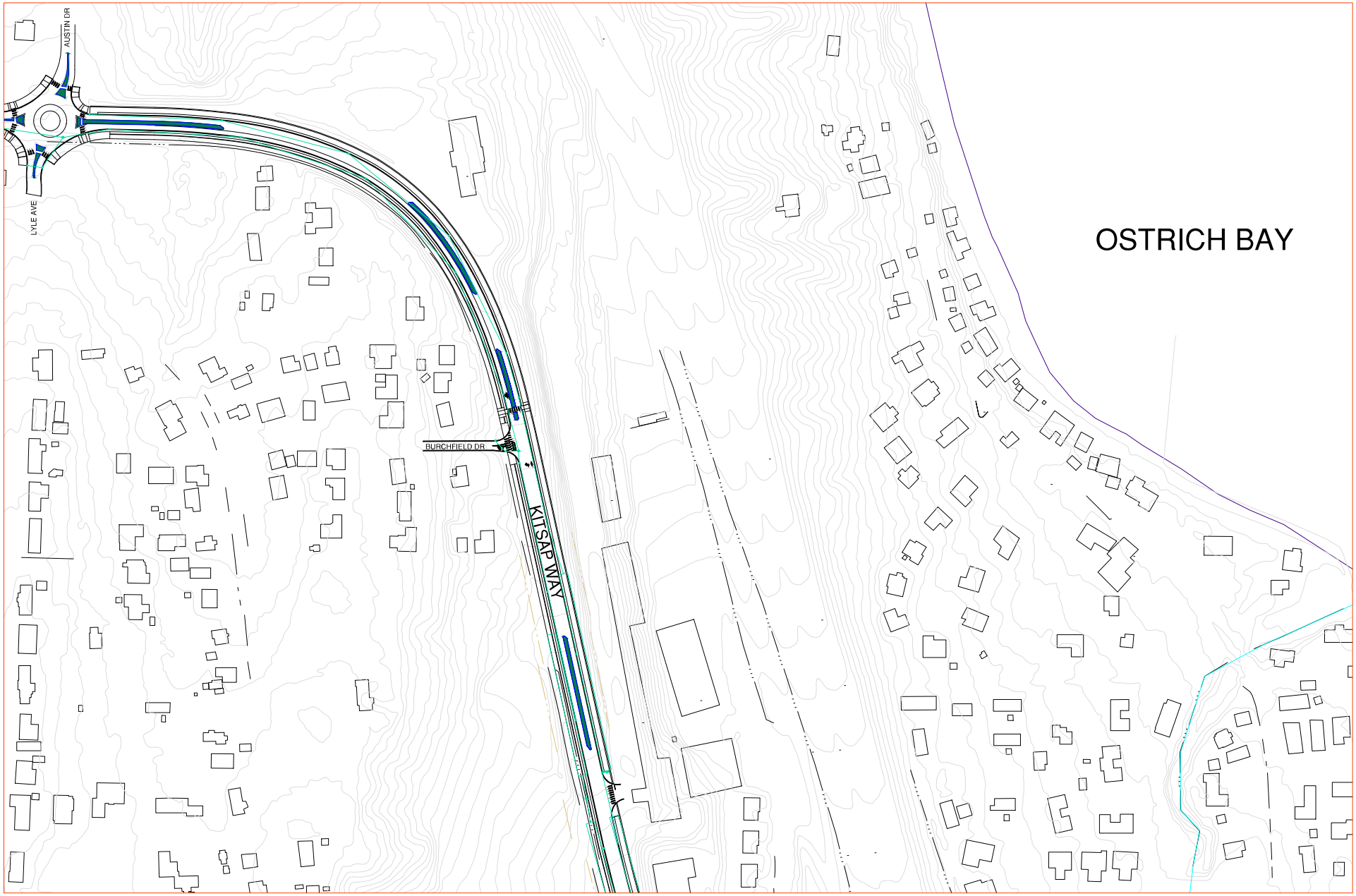
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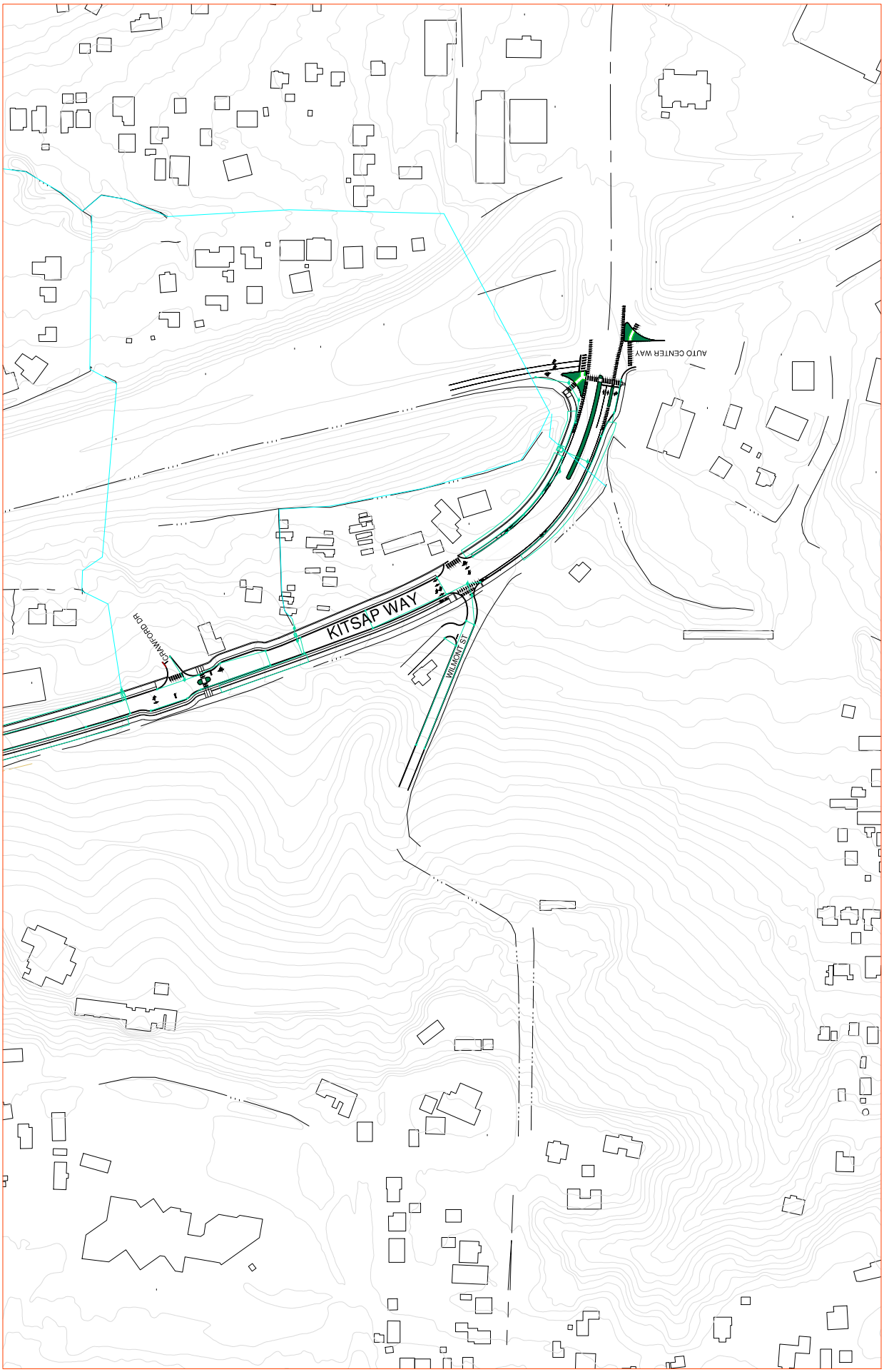
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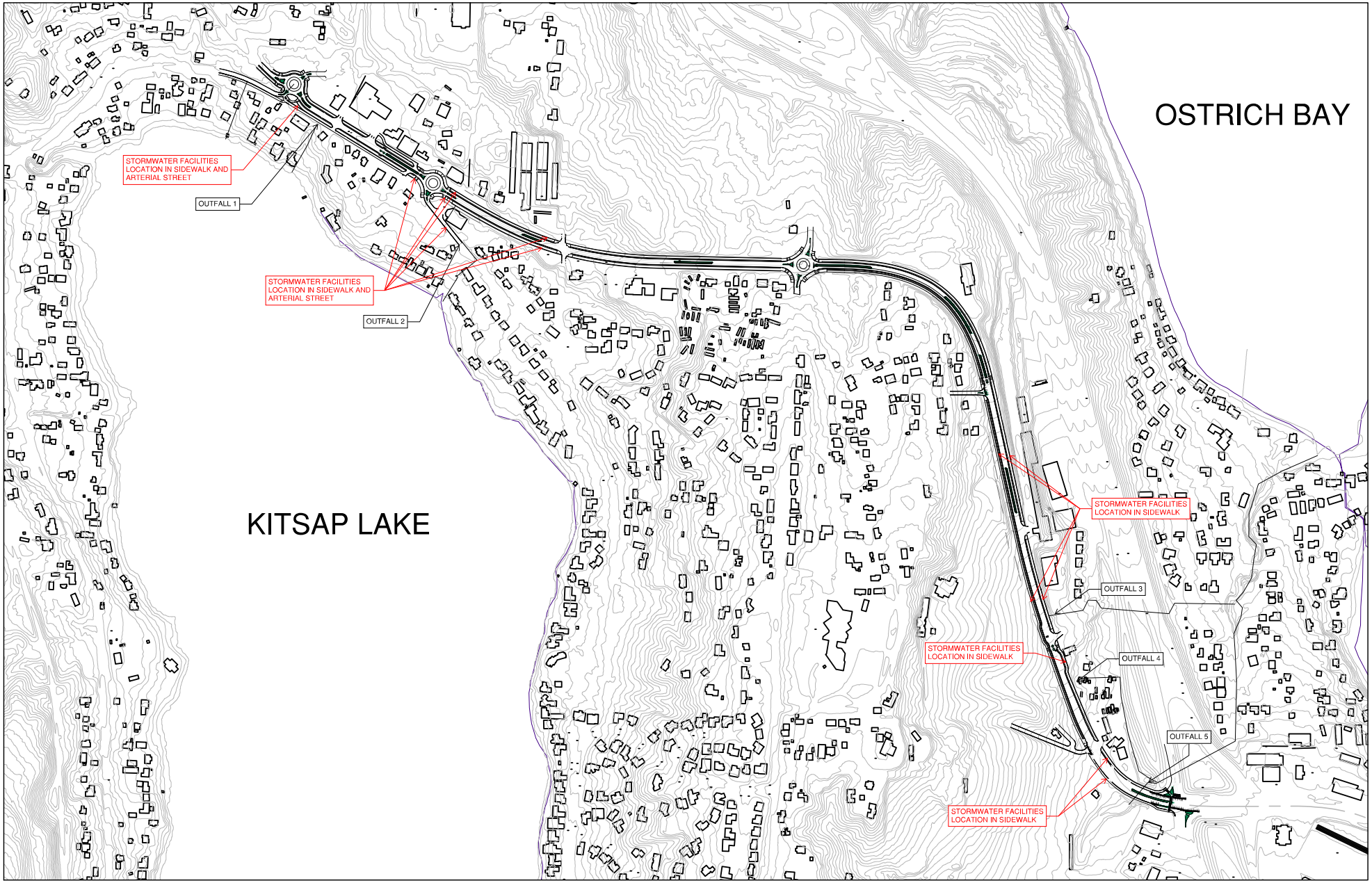
OSTRICH BAY
KITSAP LAKE
STORMWATER FACILITIES LOCATION IN SIDEWALK AND ARTERIAL STREET
OUTFALL 1
STORMWATER FACILITIES LOCATION IN SIDEWALK AND ARTERIAL STREET
OUTFALL 2
STORMWATER FACILITIES LOCATION IN SIDEWALK
OUTFALL 3
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OUTFALL 4
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FIGURE 5A

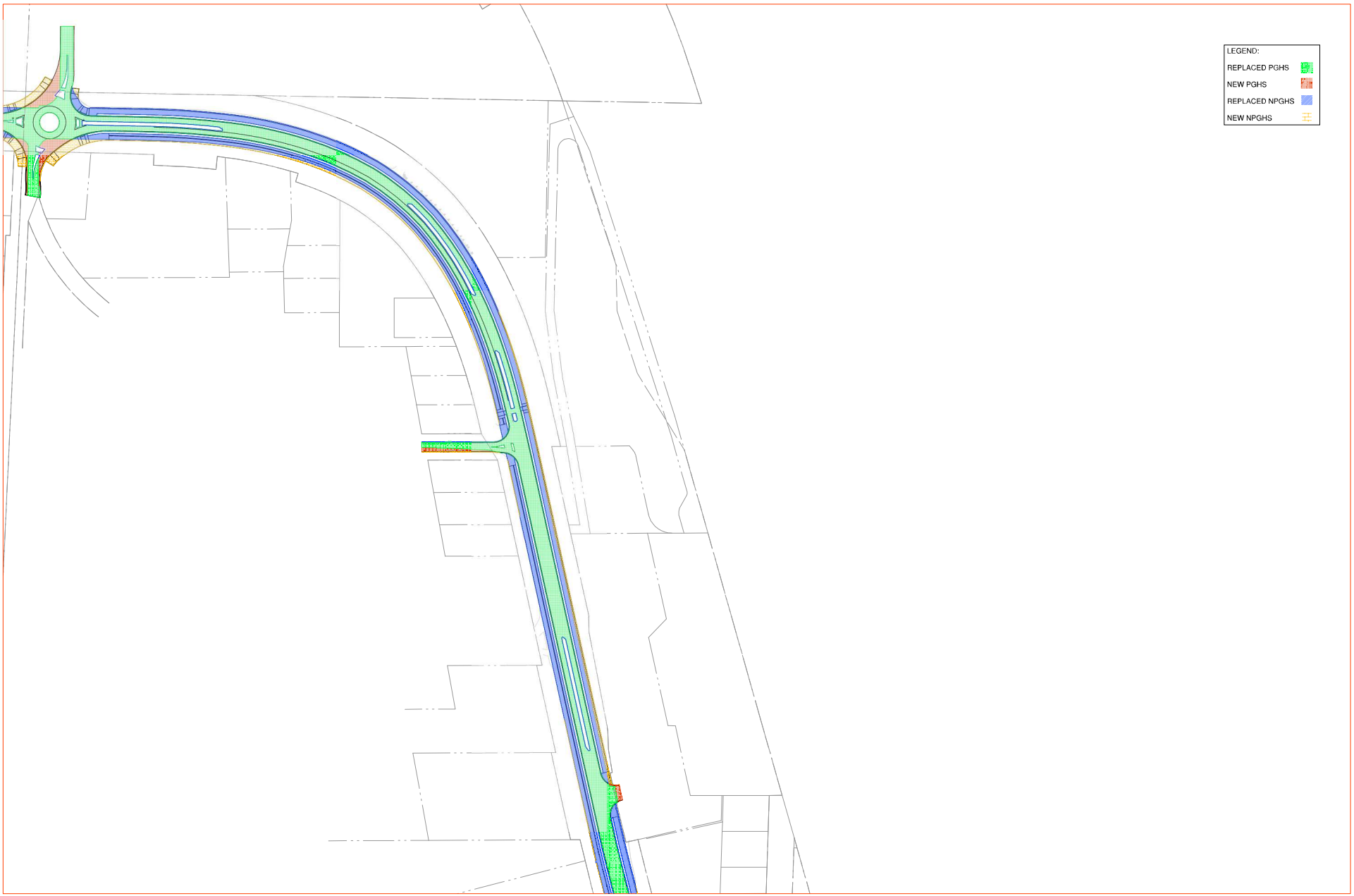

FIGURE 5B

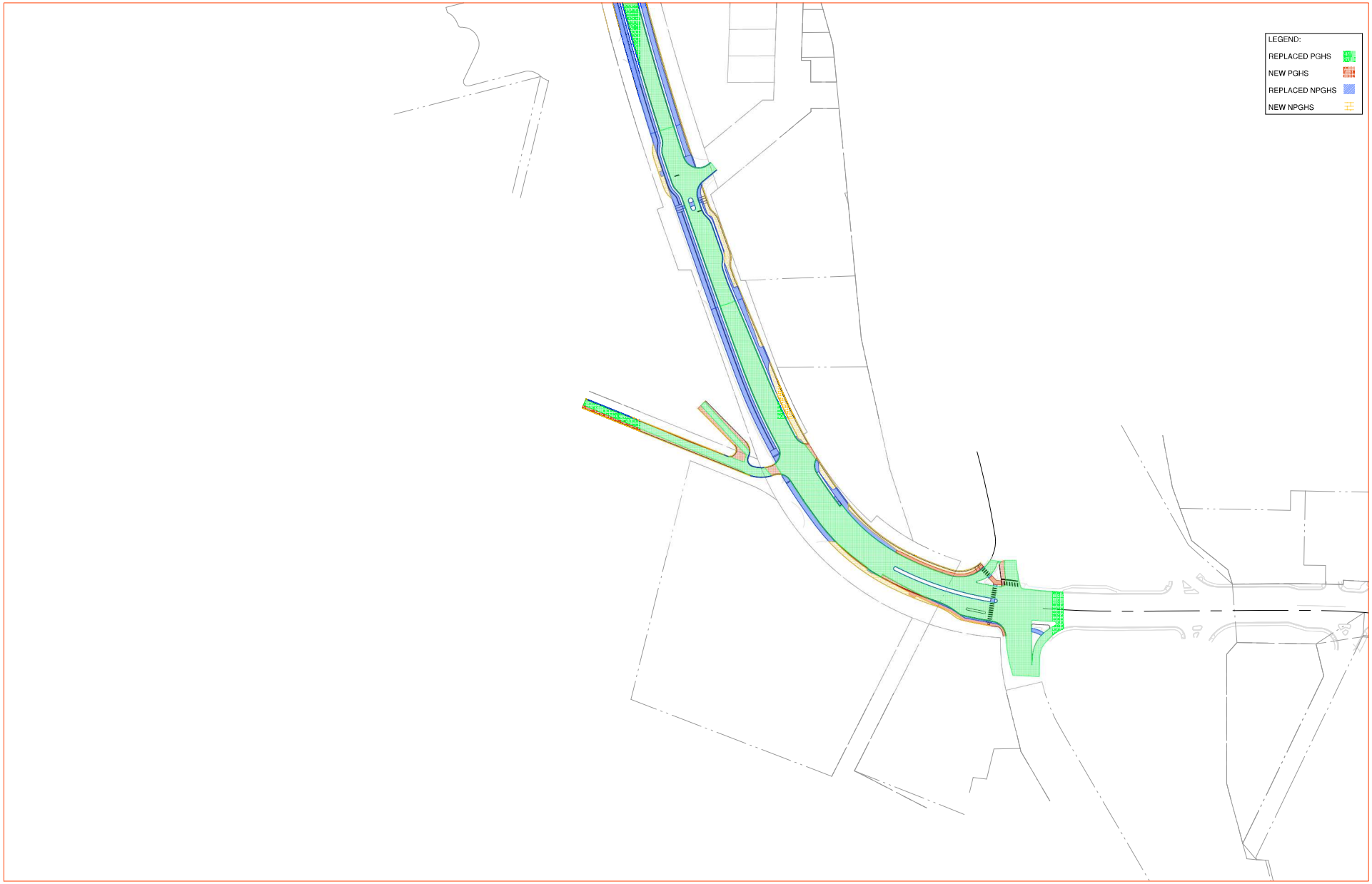

FIGURE 5C