Stormwater Management Plan Volume 1

TOWN OF

YARROW POINT

2020 STORMWATER MANAGEMENT PLAN

VOLUME 1

Town of Yarrow Point

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2020 Stormwater Comprehensive Plan
Town of Yarrow Point, Washington

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EXECUTIVE SUMMARY

The Town of Yarrow Point is faced with a number of significant stormwater management (SWM) challenges, including some localized flooding issues and aging infrastructure. To assist the Town in addressing these challenges, PACE Engineers, Inc. (PACE) was retained to develop a Stormwater Management Plan Update. The purpose of this Plan is to provide the Town with a planning document that identifies stormwater system deficiencies and prioritizes their replacement through Capital Improvement Projects (CIP)/ The report also serves to address water quality, project funding, and operation and maintenance.

The Plan defines the Town's stormwater drainage program needs by setting priorities and identifying corresponding funding and stormwater capital improvements. Long-term funding strategies are presented to address CIPs and have been developed to help guide the funding and implementation process. Stormwater system hydrologic and hydraulic modeling was also completed as part of the development of the Plan.

This report summarizes the technical information prepared during Plan development and other available data sources including:

- The Town's 2008 Comprehensive Plan
- The Town's GIS Mapping
- Record Drawings for Stormwater System
- Annual Clean and Camera Video Footage

The structure of the Plan is presented in the following chapters and technical Appendices, as outlined below:

VOLUME I

CHAPTERS

Chapter 1 – Introduction

Chapter 2 – Background Review and Study Approach

Chapter 3 – Drainage Basin Characteristics and System Analysis

Chapter 4 – Water Quality Analysis

Chapter 5 – Capital Improvement Plan

Chapter 6 – Operations and Maintenance Program

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APPENDICES

Appendix A – Hydrologic and Hydraulic Calculations

Appendix B – CIP Cost Estimates

To assist in the reading of the document, lists of abbreviations and definitions have been provided following the Table of Contents.

This project was funded and managed through local funding, and administered by Town staff.

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ACRONYMS AND ABBREVIATIONS

BMP	Best Management Practices
CCTV	Closed Circuit Television
CCWF	Centennial Clean Water Fund
CIP	Capital Improvement Project
CWA	Clean Water Act
Ecology	Department of Ecology
EPA	Environmental Protection Agency
GMA	Growth Management Area
HPA	Hydraulic Project Approvals
HSG	Hydrologic Soil Group
NPDES	National Pollution Discharge Elimination System
SEPA	State Environmental Policy Act
SR	State Route
SRF	State Revolving Fund
SWM	Stormwater Management
Town	Town of Yarrow Point, Washington
QA/QC	Quality Assurance/Quality Control
WWHM	2012 Western Washington Hydrologic Model
WRIA	Watershed Resource Inventory Area

DEFINITIONS

Best Management Practice (BMP)	The schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices, that when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts to waters of Washington State.
Bioswale	A shallow drainage conveyance with relatively gentle side slopes, generally manmade that provides water quality treatment.
Catch Basin	A drainage structure which collects water. May be either a structure where water enters from the side or through a grate.
Conveyance System	The drainage facilities, both natural and man-made which collect and carry surface and stormwater flow. Includes gutters, drainage inlets, pipes, catch basins, manholes, channels, swales, ditches, small drainage courses, streams, and rivers.
Critical Areas	At a minimum, areas which include wetlands, areas with a critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas, frequently flooded areas, geologically hazardous areas, including unstable slopes, and associated areas and ecosystems.
Detention	The release of stormwater runoff from the site at a slower rate than it is collected by the stormwater facility system, the difference being held in temporary storage.
Impervious	A surface which cannot be easily penetrated. For instance, rain does not readily penetrate paved surfaces.
Infiltration	Means the downward movement of water from the surface to the subsoil.
Low Impact Development (LID)	Low Impact Development (LID) is an innovative stormwater management approach with a basic principle that is modeled after nature: manage rainfall at the source using uniformly distributed decentralized micro-scale controls. LID's goal is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source. Techniques are based on the premise that stormwater management should not be seen as stormwater disposal.
National Pollutant Discharge Elimination System (NPDES)	The national program for issuing, modifying, revoking, reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Federal Clean Water Act, for the discharge of pollutants to surface waters of the state from point sources. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington Department of Ecology.

Permit	NPDES Western Washington Phase II Municipal Stormwater Permit, issued by the Department of Ecology on January 17, 2007 and modified June 17, 2009. A new Permit was issued on August 1, 2013.
Plan	Stormwater Management Plan: The document that describes the Town's Stormwater Management Program, including capital improvement projects and the enforcement of regulations and requirements of the Department of Ecology and other agencies.
Runoff	Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands as well as shallow ground water. As applied in this manual, it also means the portion of rainfall or other precipitation that becomes surface flow and interflow.
Stormwater	That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes and other features of a stormwater drainage system into a defined surface water body, or a constructed infiltration facility.
Water Quality	The chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular purpose.

REFERENCES AND BIBLIOGRAPHY

City of Bellevue GIS Geodatabases

King County Surface Water Management Manual

Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW)

MGSFlood™ Modeling Software

Hydraflow™ Hydraulic Modeling Software

King County iMAP http://www5.kingcounty.gov/iMAP/viewer.htm?mapset=stormwater

CHAPTER 1
INTRODUCTION

1.1 PROJECT OVERVIEW

The Town of Yarrow Point (Town) covers approximately 232 acres and lies northwest of Bellevue, Washington. It is bordered by Lake Washington on three sides and State Route 520 to the south (see Figure 1-1 Vicinity Map). Yarrow Point is bordered to Kirkland to the east, Clyde Hill to the south, and Hunts Point to the west.

This report is intended to inventory and hydraulically model the existing stormwater systems within the Town, and develop a corresponding prioritized capital improvement plan. The scope of work is defined in greater detail below

1.2 SCOPE OF WORK

1.2.1 Task 1 – Update Existing Data

This task will include reviewing the CCTV inspection videography and reports for conditions assessment of underground piping and conducting onsite visual inspections of suspect structures identified in the inspection reports. The capacity of the Town's existing SWM system will be assessed by documenting a prioritized listing of drainage system deficiencies.

- Check every catch basin in Volume II of the current Stormwater Plan for accuracy, (approximately 200 units).
- Inventory all new catch basins installed since the previous conditions assessment in Volume II (approximately 20 structures).
- Review current CCTV inspection of the collection system and identify deficiencies.

1.2.2 Task 2 – Update Storm Drainage Facilities Mapping

PACE will prepare a GIS product for the Town of a system map and geodatabase in this scope of work. A system map will be prepared that includes the basin boundaries, topography, rights-of-way, parcel information, drainage structures and piping locations, and details within the basins, outfall locations, and existing streams.

- Develop drainage basin mapping update.
- Show private systems on the updated system map, but do not analyze them as part of the Hydrologic/Hydraulic modeling efforts.
- Do not map basins K and I, due to lack of accurate data.

1.2.3 Task 3 – Study Area Characteristics Update

Develop a current description of the study area characteristics including demographics, land use, basin information, soils mapping, critical areas, major water bodies, and developed land use, along with updating the overall system description. This work includes developing the following Figures for the plan: Vicinity Map, Topography Map, Soils Map, and Aerial Basin Map.

1.2.4 Task 4 – Hydrologic/Hydraulic Modeling

PACE will use MGSFlood™ and Hydraflow™ to perform the hydrologic and hydraulic modeling for this plan update. Building an AutoCAD® model of the existing stormwater system to utilize the Hydraflow™ modeling software is included in this subtask. The Town Engineer has expressed a desire to maximize direct discharge to Lake Washington. The modeling efforts will explore additional opportunities to meet the ¼-mile restriction provided in the Ecology Stormwater Manual[1].

- Assume 60% impervious coverage on all parcels.
- Assume 90% impervious coverage for all public rights-of-way.
- Provide analysis for both the 25-year and 100-year events.
- Define opportunities to expand direct discharge in the Town's service area.
- Define impacts to existing collection system capacity and determine most cost-effective option to meet direct discharge requirements.

1.2.5 Task 5 – Water Quality Analysis

Review NPDES Phase II permit requirements and define possible opportunities for reasonable implementation.

1.2.6 Task 6 – Develop Capital Improvement Program

The intent is to update the Town's capital improvement program and include the following:

- Adopt a guidance manual (Ecology equivalent) and prepare an addendum specific to the Town of Yarrow Point.
- Develop an annual budget for cleaning and inspecting the collection system (possibly $20,000/year, depending on revenue).
- Develop an annual budget for spot repairs identified in annual cleaning and inspection practices.
- Develop a maintenance program addressing all private detention facilities and provide direction on implementation and enforcement. Include a discussion on steep slope analysis as it relates to existing detention facilities and a recommendation regarding any further action to be taken.

[1] Stormwater Management Manual for Western Washington, State of Washington Department of Ecology, July 2019

- Update current development standards for stormwater improvements.
- Develop capital improvement project to address root intrusion for piping at the west end of 37th Place, possibly sliplining due to limited access (5-foot utility easement).
- Develop projects for undersized piping determined during the hydraulic modeling analysis.

1.2.7 Task 7 – Prepare Operation and Maintenance Program

PACE will prepare the Town's Annual Stormwater Maintenance Program by documenting the Town's existing Operation and Maintenance practices, identifying appropriate and needed O&M activities and methods to address local needs, and identifying what additional activities, equipment, staffing, resources, and funding are needed. This task will provide the Town with a comprehensive O&M Plan to address the unique needs of the Town's stormwater system. The O&M plan will include defining levels and frequency of services of each major type of stormwater facility within the Town.

1.2.8 Task 8 – Develop Financial Funding Program

PACE will provide a summary of the financial program for the Stormwater Utility and define existing funding sources used to finance the Stormwater Utility.

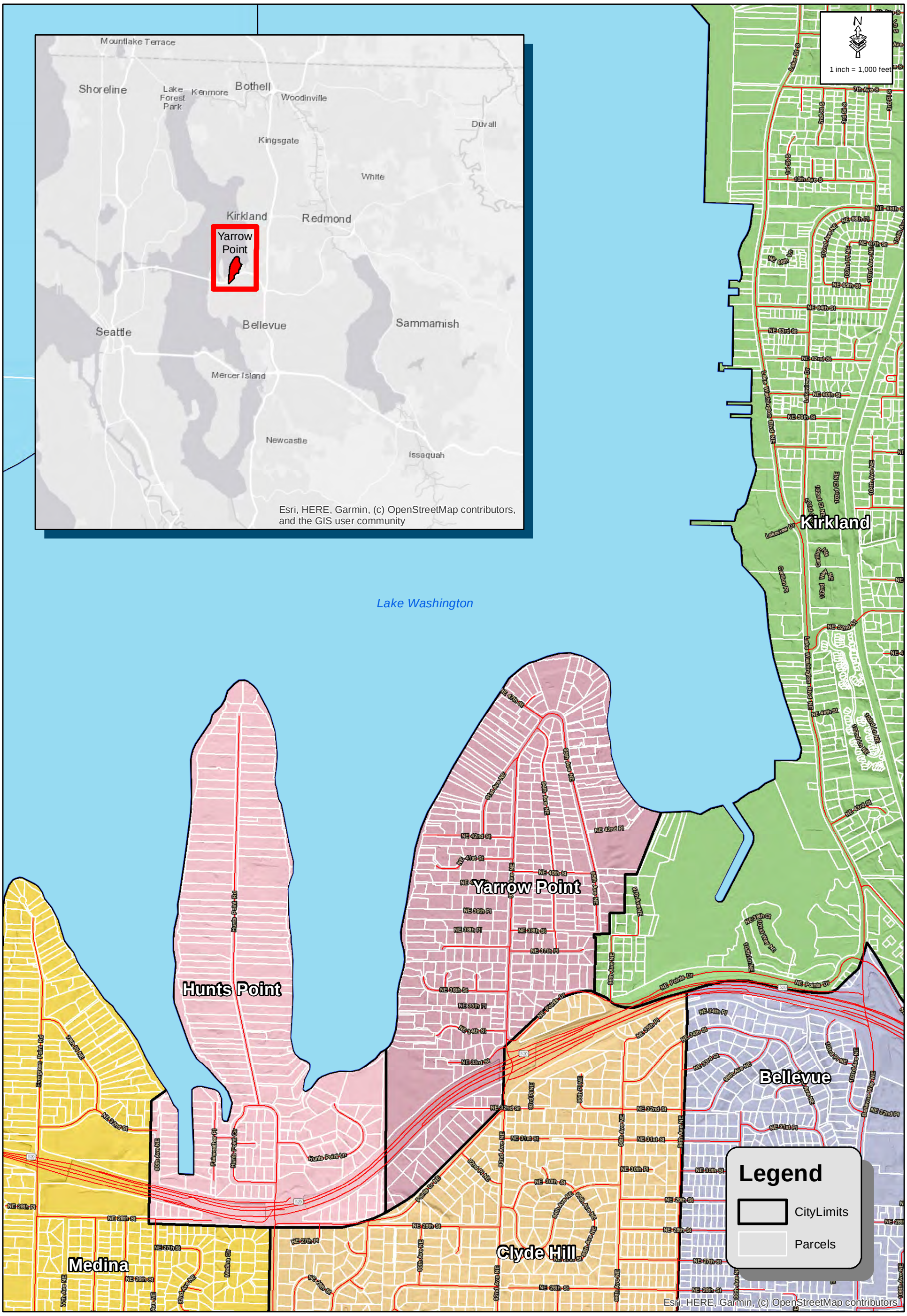
PACE will document financial strategies available to the Town including, but not limited to:

- Stormwater Utility
- Development Review Fees
- Grants
- Loans
- Revenue Bonds
- Special Purpose Districts
- Future Coordination with Other Agencies
- Heavy Truck Fee

1.2.9 Task 9 – Prepare Draft Stormwater Management Plan

- Development of Draft SWMP:
  The draft SWMP (final report) will be developed by integrating the results of Task 2 to define the Town's existing and future CIP and O&M needs and costs.
- Review and Comment by Town Staff:
  The draft SWMP will undergo a detailed review by Town staff. A single consolidated set of edits with advance resolution of any internal conflicting comments by Town staff, will be presented to PACE.

- Developing the Final SWMP (Final Report):
  Once the funding and implementation plans are reviewed and approved by the Stormwater Utility Advisory Committee and Town staff, final edits from the Town will be incorporated, and the final SWMP report will be written and transmitted to the Town along with the electronic copies of the geodatabase and the written work products on a CD.



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TOWN OF YARROW POINT

VICINITY MAP

FIGURE 1-1

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CHAPTER 2
BACKGROUND REVIEW AND STUDY APPROACH

2.1 EXISTING DRAINAGE PLAN

The last Comprehensive Stormwater Management Plan was prepared for the Town of Yarrow Point (Town) in January 2008 by ESM Consulting Engineers, LLC. This plan, prepared by PACE Engineers, Inc., was compiled in a similar format present information in a manner already familiar to the Town of Yarrow Point staff. It is assumed most stormwater improvement, post 2008 were designed and constructed in accordance with the governing regulations in effect at that time, and that some of the CIP projects suggested by ESM were completed prior to this plan. Other stormwater projects undertaken since 2008 were most likely evaluated on a case by case basis taking into account the individual project impact only and not a global or comprehensive approach.

2.2 DESIGN CRITERIA

Design criteria are standards which define the level of performance for existing and proposed improvement projects. For example, a design criterion might require that a stormwater conveyance system be designed with enough capacity to accommodate the peak flow expected from a 24-hour duration, 25-year return frequency storm event.

The Town of Yarrow Point, located in King County, Washington, is subject to various county, state, and federal regulations, design criteria, and permit processes. Most municipalities in King County have adopted, through ordinance, either the Ecology 2014 Stormwater Management Manual for Western Washington (SWMMWW) or the 2016 King County Surface Water Design Manual (KCSWDM) for use as their primary stormwater design guide. It is anticipated that all municipalities in western Washington will be required to adopt the 2020 Stormwater Management Manual for Western Washington in the future. Therefore, the Town of Yarrow Point Comprehensive Stormwater Management Plan used the 2019 Ecology SWMMWW as its primary design manual. For situations the 2019 Ecology Manual does not address, other appropriate design criteria will be cited and applied (i.e., 2016 KCSWDM, Chapter 4 – Conveyance System Analysis and Design).

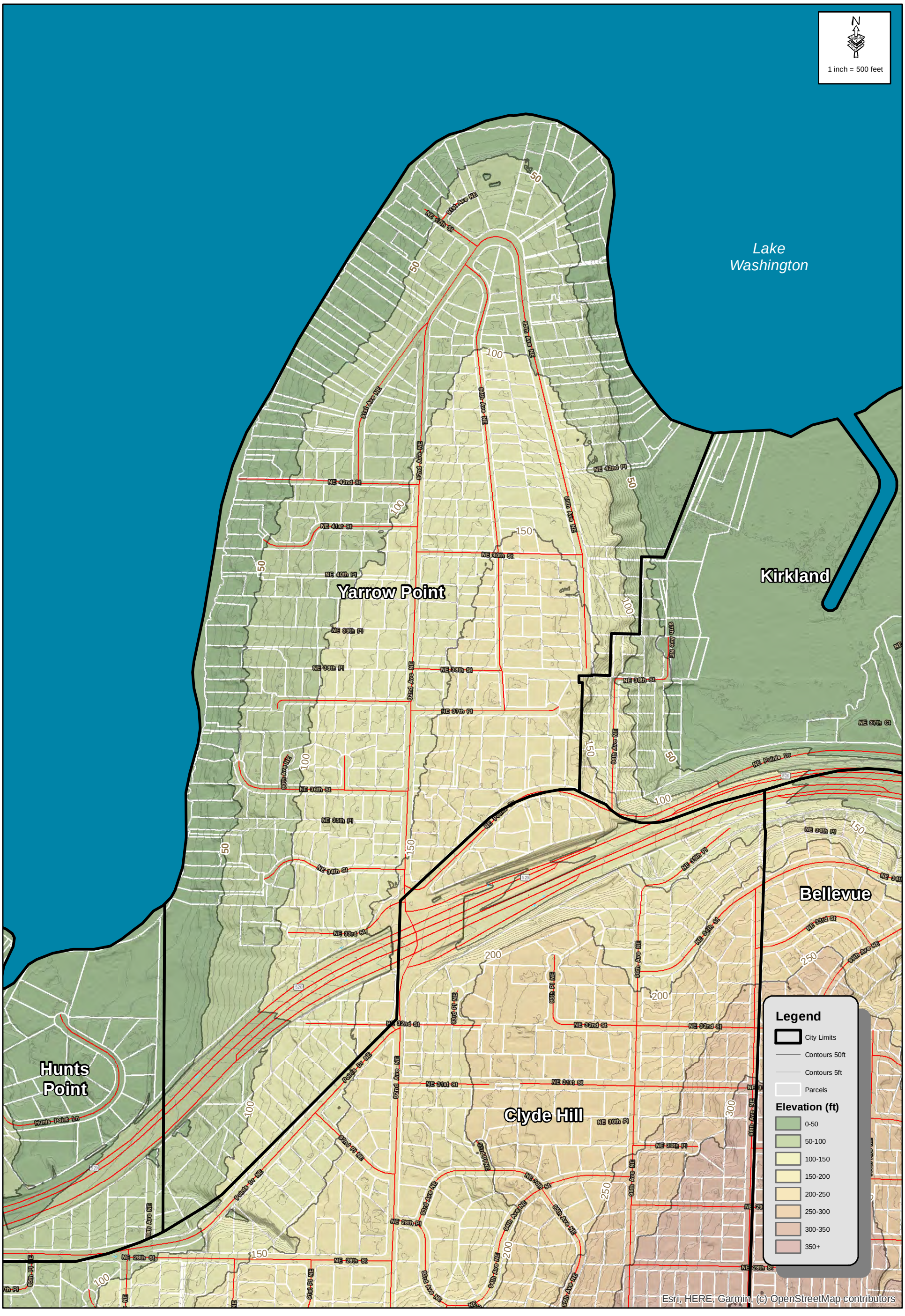
2.2.1 Basin Topography

The Town is located on a peninsula with its highest elevation near the southern Town limits and overall the area slopes west, north, and east towards Lake Washington (see Figure 2-1 Topography Map and Figure 2-2 Slope Analysis Map). Topographic data was obtained from the Department of Natural Resources (DNR) Lidar Portal from an overflight in 2016. King County iMap shows the entire study area is located in the East Lake Washington – Bellevue North drainage basin, the Cedar River/Lake Washington watershed, and the Cedar–Sammamish Water Resource Inventory Area (WRIA No. 8).

Based on topography and existing conveyance systems, the town was divided into 11 drainage basins (see Figure 2-3 Drainage Basins Map). The total area of the 11 basins addressed in this report is approximately 221 acres including 2.7 acres of offsite area within the City of Clyde Hill that is Tributary to Hunts Point. Table 2-1 summarizes the basin areas and known areas upstream of those basins. The modeled basin areas are the same as the total basin area, so they include forested areas and areas that discharge directly to Lake Washington without entering a conveyance system, apart from the Private basins which were not included in the model. Because of this, the model would be considered conservative since not all flows contribute to each basin's conveyance system.

Table 2-1: Basin Summary

Basin	Basin Area (Acres)	Offsite Upstream Area (Acres)
A	16.53	N/A
B	4.37	N/A
C	11.57	N/A
D	12.21	N/A
E	9.22	N/A
F	7.5	N/A
G	40.77	2.70
H	5.88	N/A
J	39.62	N/A
Private	61.96	N/A
Weatherhill Nature Preserve	11.08	N/A
Total	220.71	2.70



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TOWN OF YARROW POINT

TOPOGRAPHY MAP

FIGURE 2-1

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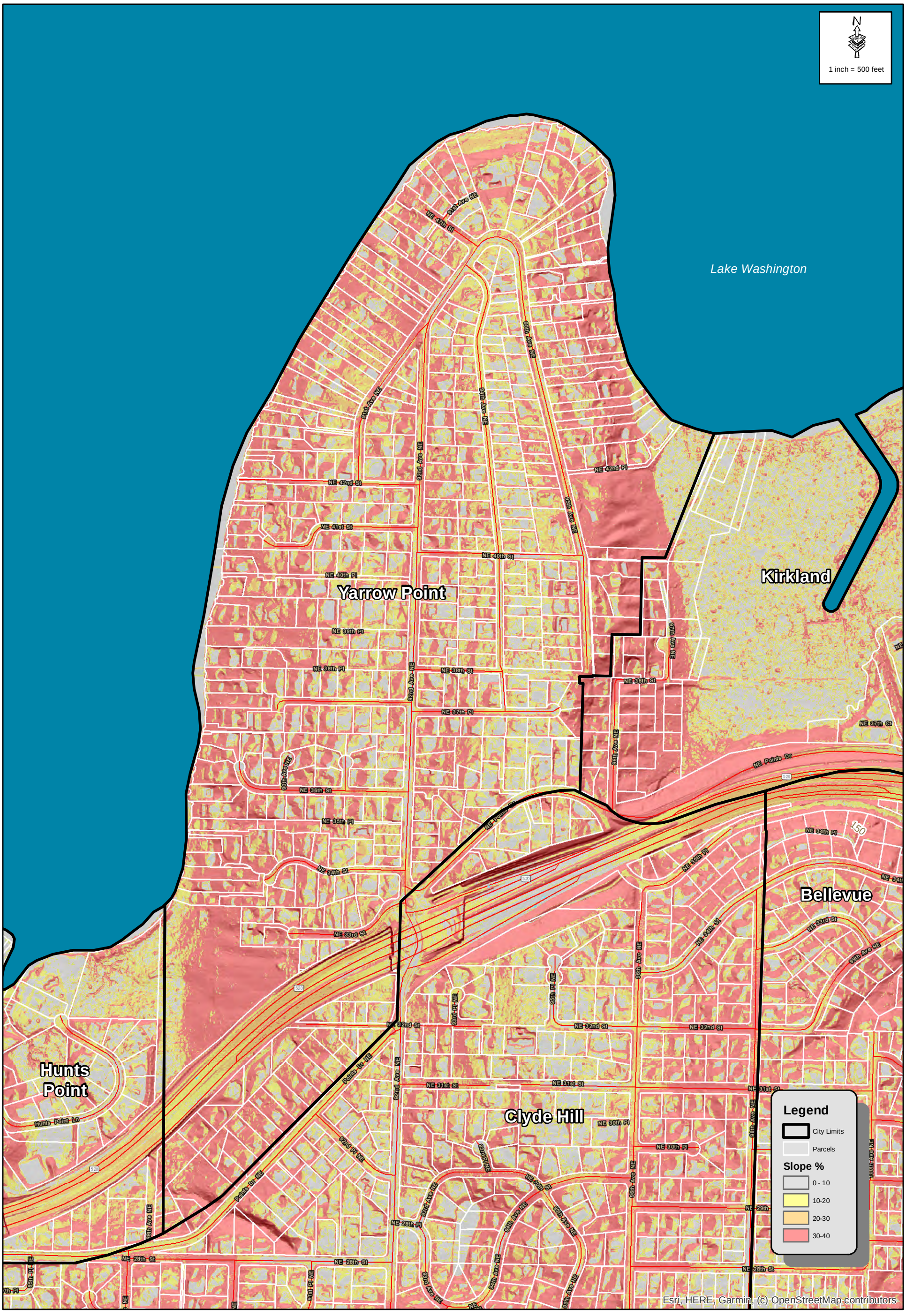

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SLOPE ANALYSIS MAP

FIGURE 2-2

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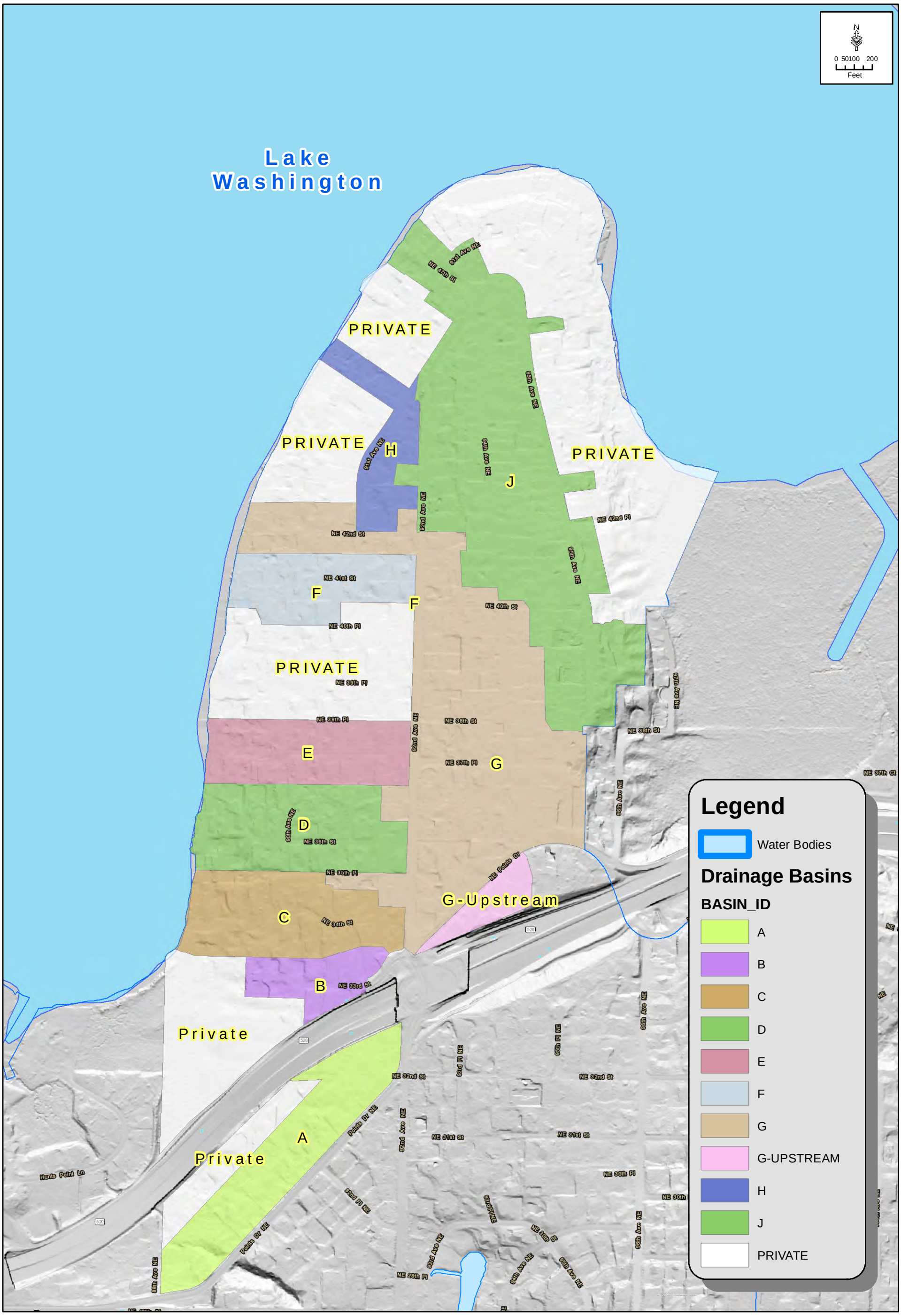

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TOWN OF YARROW POINT

DRAINAGE BASINS MAP

FIGURE 2-3

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2.2.2 Soils/Infiltration

Soil data was obtained from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), and was last updated in 2013. Figure 2-4 Soils Map shows the approximate locations and areas of differing soils types in the study area. The study area is predominately covered by Alderwood series soils, which are in hydrologic soil group C according to the 2019 DOE Manual. All other soils within the town limits are classified as either group C or group D soils.

The 2019 Ecology Manual (Volume III, 2019 Table III-2.4) describes the soils that are used when performing hydrologic modeling using an Ecology-approved continuous hydrology model. These models were developed with three predominant soil types: till, outwash, and saturated.

Till soils have been compacted by glacial action. This is commonly known as “hardpan” which has very poor infiltration capacity. As a result, till soils produce a relatively large amount of surface runoff and interflow. Type C and D soils are classified as till soils.

Outwash soils have high infiltration capacity due to their sand and gravel composition. Outwash soils have little to no surface runoff or interflow, but large amounts of groundwater. Type A and B soils are classified as outwash soils.

Saturated soils are usually found in wetlands. They have a low infiltration rate and high groundwater table. When dry, saturated soils have a high storage capacity and produce very little runoff; however, when they become saturated, they produce surface runoff, interflow, and groundwater in large quantities.

For the general purpose of this report, all basins listed in Chapter 3 were modeled with Type C soils since the small areas of Type D soils are almost entirely located within undeveloped areas (Wetherill Nature Preserve) and other Private Basins

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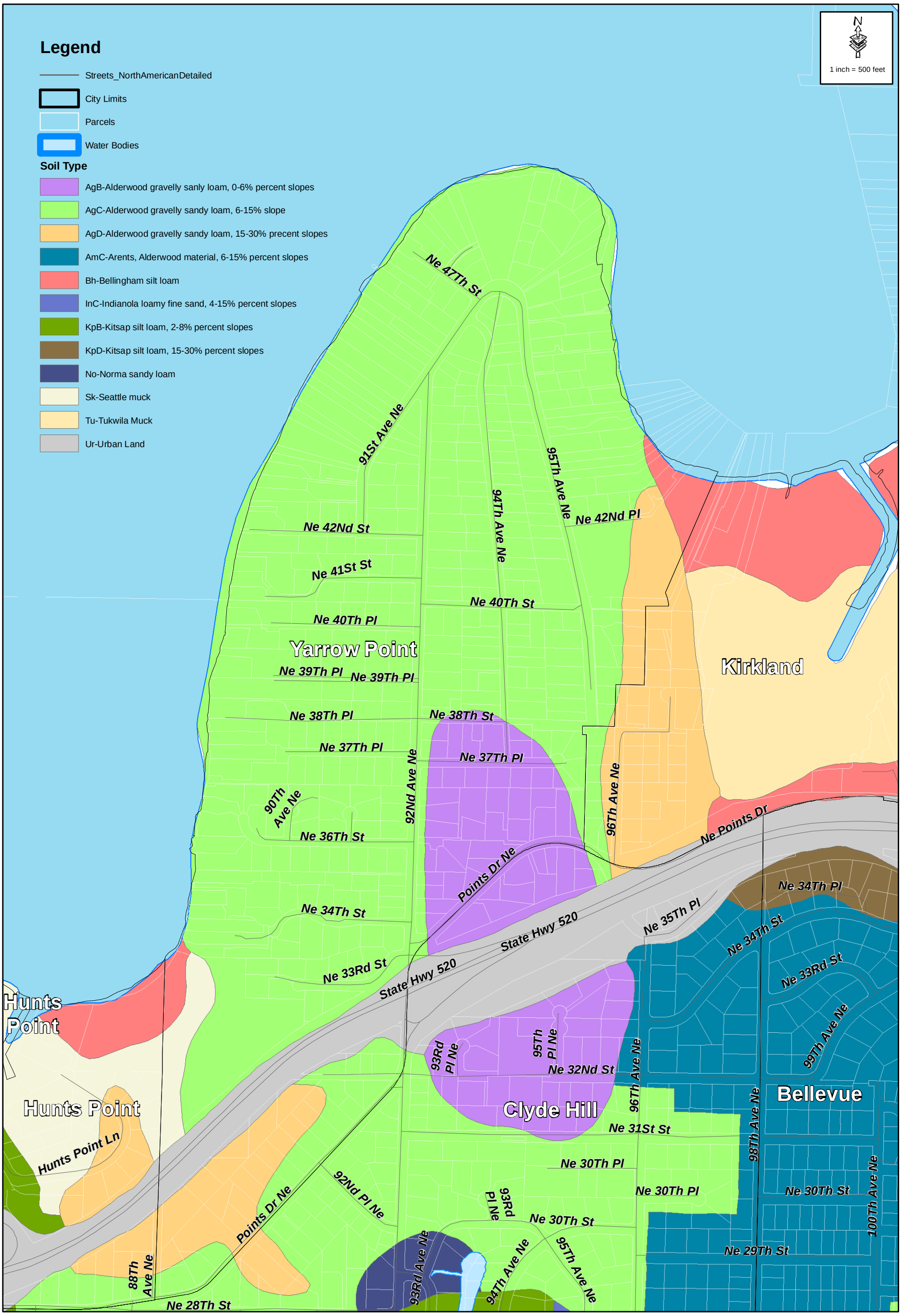

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SOILS MAP

FIGURE 2-4

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Figure 2-5	*Aerial Map*	19357
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2.2.3 Existing Land Use

With the exception of a small number of dispersed, undeveloped lots, the entire Town of Yarrow Point was developed with single-family residences. The Wetherill Nature Preserve in the southwest portion of the town and Morningside Park adjacent to Town Hall are by far the largest undeveloped areas. Table 2-2 provides a summary of existing land uses. On-site impervious area was estimated at 60% of the lot. This is the maximum allowed by the Town's Municipal Code and results in a conservative calculation that allows for full build-out of the lots. The Town's right-of-way (ROW) and all access tracts were conservatively estimated at 90% impervious.

Table 2-2: Town of Yarrow Point Land Use Summary

Basin	Basin Area (Acres)	Basin Area Excluding Direct Discharge/Private (Acres)	ROW/Access Tract Area* (Acres)	Parcel Area* (Acres)	Pervious Area* (Acres)	Impervious Area* (Acres)
A	16.53	16.53**	0.78	15.75	6.38	10.15
B	4.37	2.82	0.49	2.33	0.98	1.84
C	11.57	7.71	0.78	6.94	2.85	4.86
D	12.21	10.27	1.59	8.68	3.63	6.64
E	9.22	7.08	0.81	6.27	2.59	4.49
F	7.5	6.23	0.87	5.42	2.23	4
G	40.77	37.76	7.7	30.06	12.79	24.97
Upstream G***	2.7	2.7	0.55	2.15	1.34	1.36
H	5.88	5.88	1.07	4.81	2.03	3.85
J	39.62	39.62	9.07	30.55	13.13	26.49
Subtotal	150.37	136.6	23.71	112.96	47.95	88.65
Weatherhill Nature Preserve	11.08	11.08	0	11.08	11.08	0
Private	61.96	61.96	0.7	61.26	24.57	37.39
Total	223.41	209.64	24.41	185.3	83.6	126.04

*Does not Include direct discharge areas within the individual basins
**Basin Area includes private area of 3.96 acres as the conveyance system that drains the public basin is located in the private area
***This area is located within the City of Clyde Hill but drains to Basin G

2.3 HYDROLOGIC AND HYDRAULIC MODELING

The hydrologic calculations shown in this report were generated using MGSFlood™. MGSFlood™ is an Ecology-approved continuous modeling software used to compute storm runoff durations as well as peak flow events for drainage areas. Hydraflow™, a hydraulic program, is then used to model pipe networks, routing the resulting flows through the

conveyance network to ensure the system has capacity under peak storm event conditions. Data entered into the Hydraflow™ model includes pipe sizes, invert elevations, pipe lengths, pipe materials, slopes, etc. A detailed discussion on the input data and modeling assumptions used to set up the Hydraflow™ model are included for each basin in Appendix A.

2.3.1 Hydrologic Modeling

Estimated stormwater flows were calculated for the peak events (2-, 10-, 25-, 100-, and 200-year). The existing conditions were divided into two categories: Till soils covered by grass, or impervious surface.

2.3.2 Hydraulic Modeling

The 2019 Ecology Manual does not address the issue of stormwater conveyance and hydraulic modeling. Therefore, an appropriate design standard is the 2016 KCSWDM. Section 1.2.4.1 of the 2016 KCSWDM states:

> "New pipe systems shall be designed with sufficient capacity to convey and contain (at minimum) the 25-year peak flow, assuming developed conditions for onsite tributary areas and existing conditions for any offsite tributary areas. Pipe system structures may overtop for runoff events that exceed the 25-year design capacity, provided the overflow from a 100-year runoff event does not create or aggravate a severe flooding problem or severe erosion problem…"

The 25-year and 100-year peak flows were routed through the Hydraflow™ model that was built for the Town's conveyance system to determine if the pipe network had enough capacity for these peak storm events. Final analysis of the system can be found in Chapter 3: Drainage Basin Characteristics and Analysis.

Note: The model does not include any private detention facilities in order to be conservative.

2.3.3 Direct Discharge Exemptions

The 2019 Ecology Manual (Volume I, Chapter 2) states:

> "Projects must provide flow control to reduce the impacts of stormwater runoff from impervious surfaces and land cover conversions. The requirement below applies to projects that discharge stormwater directly, or indirectly through a conveyance system, into a fresh water - except for projects that discharge to a water in Appendix I-E - Flow Control-Exempt Receiving Waters in accordance with the following restrictions:

- Direct discharge to the exempt receiving water does not result in the diversion of drainage from any perennial stream classified as Types 1, 2, 3, or 4 in the State of Washington Interim Water Typing System, or Types "S", "F", or "Np" in the Permanent Water Typing System, or from any category I, II, or III wetland; and
- Flow splitting devices or drainage BMPs are applied to route natural runoff volumes from the project site to any downstream Type 5 stream or category IV wetland:
    - Design of flow splitting devices or drainage BMP's will be based on continuous hydrologic modeling analysis. The design will assure that flows

delivered to Type 5 stream reaches will approximate, but in no case exceed, durations ranging from 50% of the 2-year to the 50-year peak flow.

- •Flow splitting devices or drainage BMP's that deliver flow to category IV wetlands will also be designed using continuous hydrologic modeling to preserve pre-project wetland hydrologic conditions unless specifically waived or exempted by regulatory agencies with permitting jurisdiction; and
- The project site must be drained by a conveyance system that is comprised entirely of manmade conveyance elements (e.g., pipes, ditches, outfall protection, etc.) and extends to the ordinary high water line of the exempt receiving water; and
- The conveyance system between the project site and the exempt receiving water shall have sufficient hydraulic capacity to convey discharges from future build-out conditions (under current zoning) of the site, and the existing condition from non-project areas from which runoff is or will be collected; and
- Any erodible elements of the manmade conveyance system must be adequately stabilized to prevent erosion under the conditions noted above."

Most future development is not expected to require private detention facilities as much of the town appears to meet the direct discharge exemption criteria set forth by the DOE. Future development in certain areas where the conveyance system capacity is not adequate and/or existing outfalls into Lake Washington do not meet the required criteria are the only areas that would not meet the direct discharge exemption. Completion of the recommended capital improvement projects would remedy the conveyance capacity issues. Any new development which cannot directly discharge to Lake Washington, is upstream of an inadequate conveyance system, or is upstream of an inadequate outfall may require a detention facility or downstream improvements.

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CHAPTER 3
DRAINAGE BASIN CHARACTERISTICS AND SYSTEM ANALYSIS

Analysis for the Town of Yarrow Point (Town) Comprehensive Stormwater Management Plan began with a detailed survey and evaluation of the existing drainage systems throughout the town. Results of the survey and evaluation are located in Volume 2 – System Inventory.

The Town is divided into 12 drainage basins based on topography and existing conveyance systems (see Figure 2-3 Drainage Basins Map). PACE utilized these basins to identify existing and future drainage problems, develop improvement alternatives, and recommend improvements from these alternatives. See Chapter 2 for the methods used in the analysis of individual basins.

The following sections will include a detailed basin description, identified basin problems, and analysis and recommendations. The Town does not have a centralized drainage complaint database. Town staff provided documentation of an inventory of drainage structures previously conducted which included notes about a number of problem areas, as-built drawings, and figures to assist in locating new structures. If a basin is said to have “no known problems” it means the model did not show capacity problems for the design storm event, and PACE was not aware of any recent drainage complaints or did not identify any issues after visual inspection.

Please refer to Figures 3-1 to 3-9 at the end of this chapter for maps of each basin.

3.1 BASIN A

3.1.1 Drainage Basin and System Description

Basin A covers an area of approximately 16.53 acres and is the only basin located south of SR 520. The basin consists of single-family parcels (10,000 to 30,000 square feet) and vertical relief for the basin is about 110 feet. Runoff along Points Drive NE slope moderately to the north and are captured in a private rock lined swale that flows west to structure A-14. See Figures 3-1a and 3-1b for reference.

Conversely residences along NE 32nd Street (public) and NE 32nd Place (private) are directed to a pipe and catch basin system which flows westerly to a detention/water quality pond near the outlet A-09. The detention/water quality facility outlets to a nearby stream that borders the Town of Hunts Point. This stream then enters a culvert that passes beneath SR 520 and into Hunts Point. PACE was unable to gain access to multiple catch basins in the system which are located on private property.

The conveyance system along Points Drive NE flows into the Town of Clyde Hill and is already referenced in their GIS database. Through the hydrology modeling, the 25-year peak flow rate was determined to be 9.34 cfs and the 100-year peak flow rate 13.90 cfs

Any potential upstream flows are intercepted by the conveyance systems in 92nd Avenue NE and Points Drive NE.

3.1.2 Analysis and Identified Basin Problems

Two of the three pipes that discharge into or drain the detention pond were unable to be located because they were either buried, submerged, or overgrown with vegetation. Routine maintenance should be performed on the private system to verify that the pipe and catch basin system are not blocked or clogged and the detention/water quality facility is functioning as intended. Recommendations

There are no recommended capital improvement projects in Basin A for existing or future conditions.

3.2 BASIN B

3.2.1 Drainage Basin and System Description

Basin B encompasses an area of 15.82 acres. The dominant feature of the basin is the Wetherill Nature Preserve which comprises approximately 11.08 acres. Fairweather Short Plat (west of NE 33rd Street cul-de-sac) is a second private basin which serves 4 lots, 1.55 acres, and includes a detention/water quality vault which discharges to the nature preserve on the western side of 8911 NE 33rd Street property. The vertical relief in Basin B is approximately 135 feet. Topography slopes from east to west in most locations.

The remaining 2.82 acres comprises the majority of the NE 33rd Street and adjacent single family lots NE 33rd Street has a pipes and catch basin conveyance system which outlets into the nature preserve. This basin was modeled to verify the capacity of this public system. Through the hydrology modeling the 25-year peak flow rate was determined to be 1.66 cfs and the 100-year peak flow rate was 2.43 cfs.

Any potential upstream flows are intercepted by 92nd Avenue NE.

3.2.2 Analysis and Identified Basin Problems

The pipe that discharges water from the detention/water quality vault is significantly blocked with sediment. Routine maintenance should be performed on the private system to verify that the detention/water quality facility and associated conveyance system (including inlets and outlets) are functioning as intended. In regards to the public system in NE 33rd Street there were no problems were identified as the conveyance system has the capacity to fully contain both the existing and developed conditions for the 25-year design storm event.

Figure 3-1a	*Basin A*	19357
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Figure 3-1b	*Basin A*	19357
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Figure 3-2	*Basin B*	19357
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3.2.3 Recommendations

There are no recommended capital improvement projects in Basin B for existing or future conditions, although routine maintenance described in Section 3.2.1 of the private system should be performed

3.3 BASIN C

3.3.1 Drainage Basin and System Description

Basin C covers an area of 11.57 acres. The basin consists mainly of 15,000 square feet or larger single-family lots. Topography slopes from east to west and the vertical relief for the basin is approximately 140 feet. Some of the westernmost lots in the basin totaling 3.86 acres have their own direct discharge outfalls to Lake Washington and were not included in the hydrologic/hydraulic modeling as they do not drain to the trunk line outfall. Please see Figure 3-3 for more information.

NE 34th Street has a pipe and catch basin conveyance system which flows through private property before emptying into Lake Washington. PACE verified system elements in public right-of-way and Yarrow Point Town Staff has confirmed pipe sizes and catch basin locations/conditions on private property. Through the hydrology modeling, the 25-year peak flow was determined to be 4.44 cfs, and the 100-year peak flow rate was 6.57 cfs

Any potential upstream flows are intercepted by 92nd Avenue NE.

3.3.2 Analysis and Identified Basin Problems

There were no known problems identified in Basin C. The conveyance system has the capacity to fully contain both the 25-year and 100-year peak flow rates.

3.3.3 Recommendations

There are no recommended capital improvement projects in Basin C for existing or future conditions.

3.4 BASIN D

3.4.1 Drainage Basin and System Description

Basin D encompasses an area of 12.21 acres. The basin consists mainly of 15,000 square feet or larger single-family lots. Vertical relief for the basin is approximately 125 feet and topography generally slopes from east to west. Some of the westernmost lots in the basin totaling 1.94 acres have their own direct discharge outfalls to Lake Washington and were not included in the hydrologic/hydraulic modeling as they do not drain to the trunk line outfall. Please see Figure 3-4 for more information.

NE 36th Street and the interior cul-de-sacs accessing it are drained by pipes and catch basin conveyance system which flows through private property before out-falling to Lake Washington. PACE verified system elements in public right-of-way and Yarrow Point Town Staff has confirmed pipe sizes and catch basin locations/conditions on private property.

Through the hydrology modeling, the 25-year peak flow was determined to be 5.99 cfs and the 100-year peak flow rate was 8.81 cfs.

Any potential upstream flows are intercepted by 92nd Avenue NE.

3.4.2 Analysis and Identified Basin Problems

Routine maintenance activities are needed for Basin D. Multiple catch basins have a large accumulation of sediment in their sump and require cleaning to allow for ample storage during a storm event. There are also 6 catch basins that have cracks and/or loose bricks in their walls which allow water to seep through. These catch basins require grouting or more extensive repair, i.e. catch basin replacement, to seal these openings.

There were no known problems identified in Basin D as the conveyance system has the capacity to fully contain both the 25-year and 100-year peak flow rates.

3.4.3 Recommendations

It is recommended that the damaged catch basins D-3, D-4, D-8, D-11, D-13 and D-15 should be replaced. If funds are not available to replace all 6 catch basins the catch basins closest to proposed CIP that diverts runoff from Basin G to Basin D (CIP G-1) should be prioritized to allow combination of the projects.

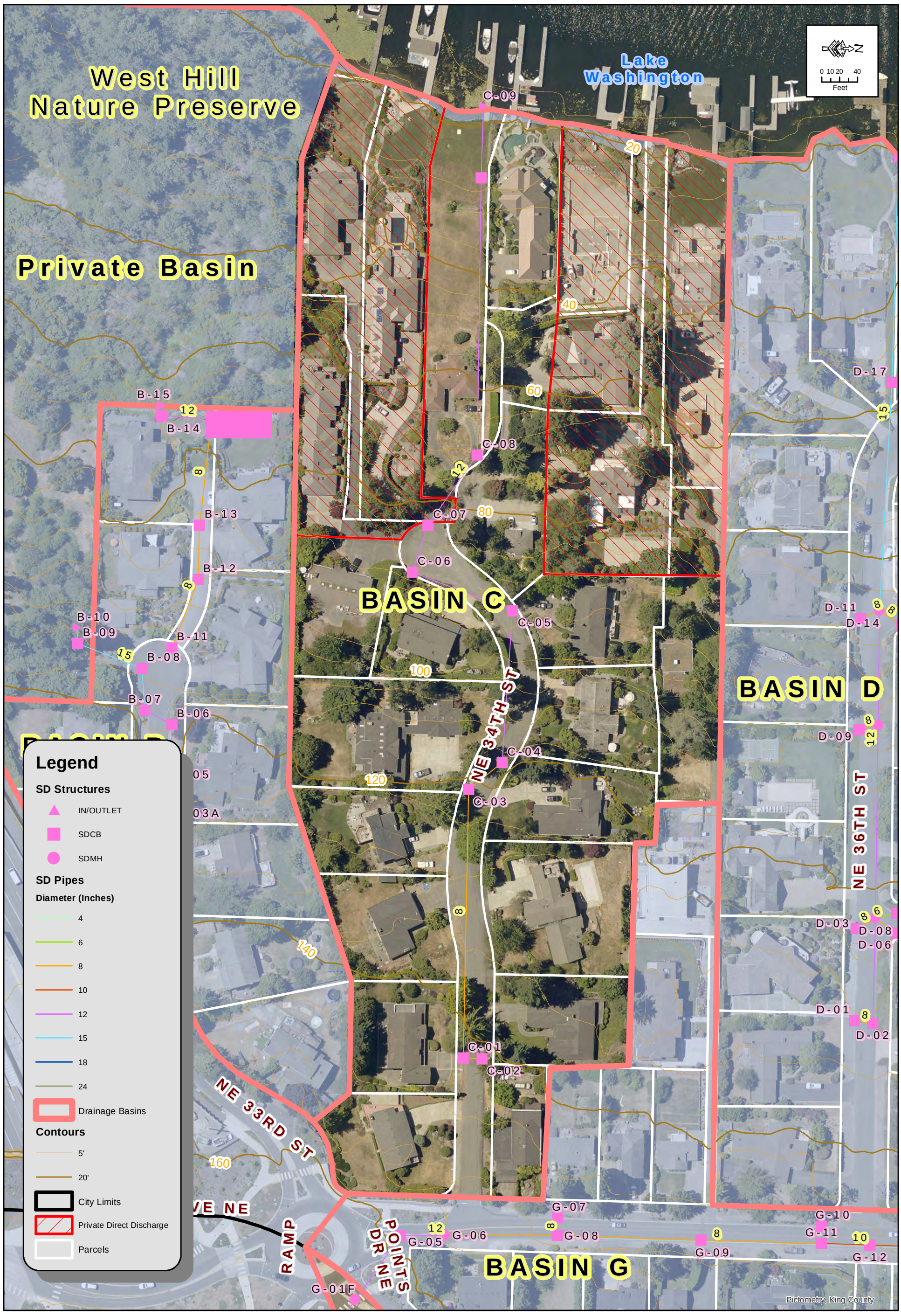

Figure 3-3	*Basin C*	19357
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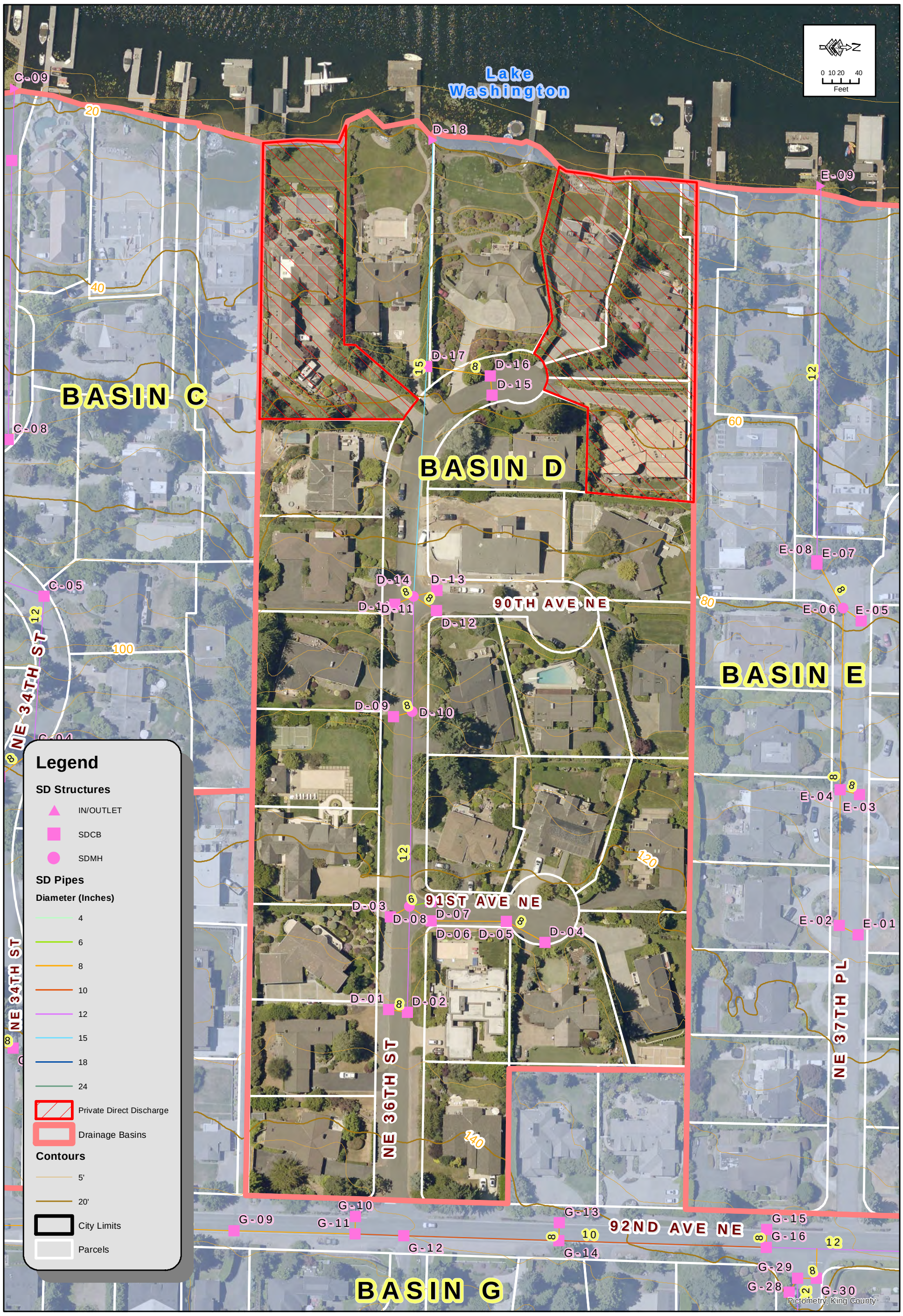

Figure 3-4	*Basin D*	19357
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3.5 BASIN E

3.5.1 Drainage Basin and System Description

Basin E covers an area of 9.22 acres. The basin consists mainly of 15,000 square feet or larger single-family lots, all of which have been previously developed. Vertical relief for the basin is approximately 120 feet and topography slopes from east to west. Some of the westernmost lots in the basin totaling 2.14 acres have their own direct discharge outfalls to Lake Washington and were not included in the hydrologic/hydraulic modeling as they do not drain to the trunk line outfall. Please see Figure 3-5 for more information.

NE 37th Place has pipe and catch basin conveyance system which flows through private property before out-falling to Lake Washington. PACE verified system elements in public right-of-way and Yarrow Point Town Staff has confirmed pipe sizes and catch basin locations/conditions on private property. Through the hydrology modeling, the 25-year peak flow rate was determined to be 4.08 cfs, and the 100-year peak flow rate was 6.03 cfs.

Any potential upstream flows are intercepted by 92nd Avenue NE.

3.5.2 Analysis and Identified Basin Problems

It is apparent when reviewing the Town's clean and camera records that the 12" diameter pipe from the western terminus of NE 37th Street to the outfall at Lake Washington has the potential for fine to medium root intrusion. The town first noticed this in September 2011. In the summer of 2013, the Town replaced the lower 100 linear feet of 12" corrugated metal pipe with PVC. Routine maintenance in the fall of 2018 again revealed lite to medium root intrusion. Typical maintenance activities removed the roots and the pipe was clear upon final inspection.

3.5.3 Recommendations

The conveyance system has the capacity to fully contain both the 25-year and 100-year peak flow rates. However routine maintenance should regularly be performed to determine if root blockage is reducing the hydraulic capacity and if roots are present, they should be removed.

3.6 BASIN F

3.6.1 Drainage Basin and System Description

Basin F encompasses an area of 7.5 acres. The basin consists mainly of 15,000 square feet or larger single-family lots. Vertical relief for the basin is approximately 95 feet and the topography generally slopes from east to west. Some of the westernmost lots in the basin totaling 1.98 acres have their own direct discharge outfalls to Lake Washington and were not included in the hydrologic/hydraulic modeling as they do not drain to the trunk line outfall. Please see Figure 3-6 for more information.

NE 41st Street contains a pipe and catch basin conveyance system which flows through private property before out-falling to Lake Washington. PACE verified system elements in public right-of-way and Yarrow Point Town Staff has confirmed pipe sizes and catch basin

locations/conditions on private property. Through the hydrology modeling, the 25-year peak flow was determined to be 3.62 cfs, and the 100-year peak flow rate was 5.33 cfs. Any potential upstream flows are intercepted by 92nd Avenue NE.

3.6.2 Analysis and Identified Basin Problems

PACE was unable to locate structure F-09. It is apparent when reviewing the Towns clean and camera videos that this structure is a Type 2 storm drain manhole. Main line pipe segments in and out of this structure are assumed to match the upstream and downstream elements. In addition, there are two incoming shallow 4”-6” CPEP pipes from the east. Future routine maintenance activities should include locating/uncovering the solid lid for this structure and raising it to current ground level if necessary. There are no other significant problems identified in Basin F as the conveyance system has the capacity to fully contain both the 25-year peak flow rate (although the 100-year peak flow rate does overtop the system no adverse downstream effects are likely).

3.6.3 Recommendations

There are no recommended capital improvement projects in Basin F as the conveyance system has the capacity to convey the flows for the existing and future conditions.

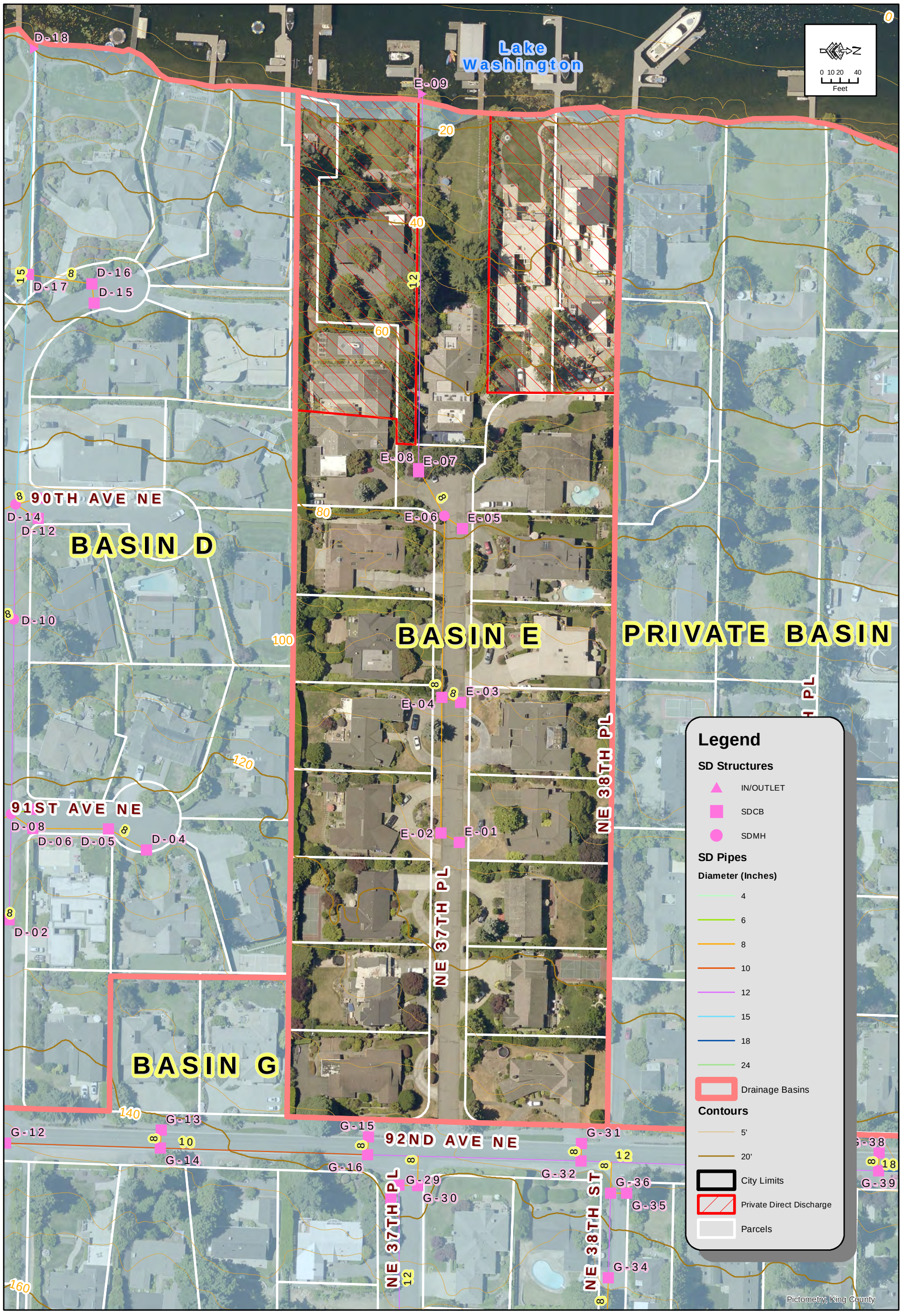

Figure 3-5	Basin E	19357
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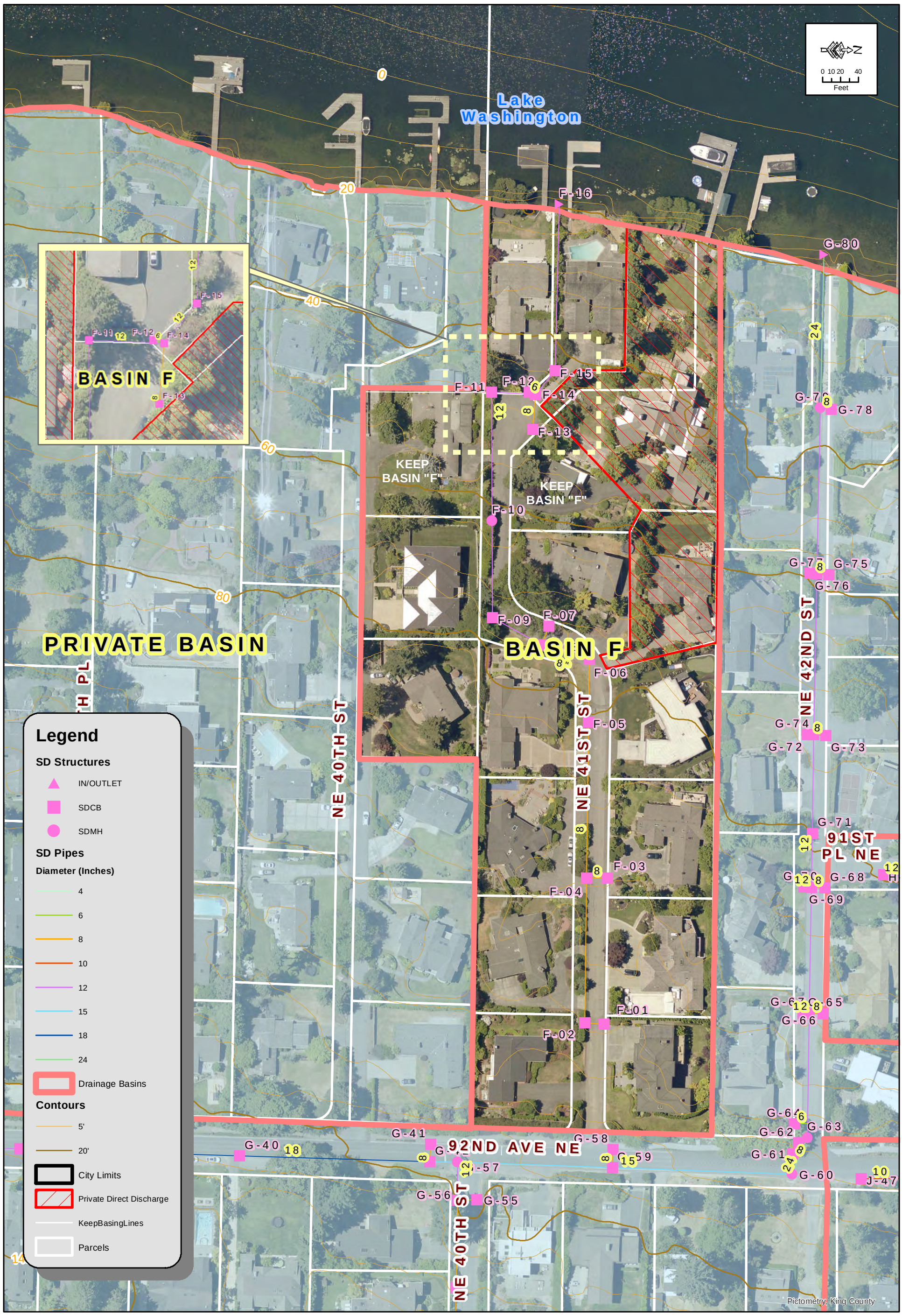

Figure 3-6	*Basin F*	19357
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3.7 BASIN G

3.7.1 Drainage Basin and System Description

Basin G is the town's largest basin and covers an area of 40.77 acres. The basin consists mainly of 10,000 to 15,000 square feet or larger fully developed single-family lots. Vertical relief for the basin is approximately 170 feet and the topography generally slopes to the north and west, but there are local variations in slope direction. Some of the westernmost lots in the basin totaling 3.01acres have their own direct discharge outfalls to Lake Washington and two of the most eastern lots along Points Drive NE (1.03 acres) discharge to the City of Kirkland. These areas were not included in the hydrologic/hydraulic modeling as they do not drain to the trunk line outfall. Please see Figures 3-7a, 3-7b and 3-7c for more information.

An extensive pipe and catch basin conveyance system is present in Points Drive NE, 92nd Avenue NE, 94th Avenue NE, NE 37th Place, NE 38th Street, NE 40th Street, and NE 42nd Street. The conveyance system is a series of 8"-24" diameter pipes that outfall to Lake Washington at the western end of NE 42nd Street. Structure G-60 (identified in 2008 SWMP as #1026) was replaced in 2016 and no longer overflows towards Basin J. Through the hydrology modeling the 25-year peak flow was determined to be 22.34 cfs, and the 100-year peak flow rate was 32.62 cfs.

Most potential upstream flows are intercepted by nearby conveyance systems in adjacent basins. However, at the south end of the basin offsite flows stem from a portion of the area south of Points Drive NE within Clyde Hill City Limits. This upstream area was included in the analysis of Basin G

3.7.2 Analysis and Identified Basin Problems

Routine maintenance is overdue for many areas in Basin G. For instance there are numerous catch basins along 92nd Avenue NE, NE 37th Place, 94th Avenue NE, and NE 42nd Street whose sump is inundated with sediment. Also, there are multiple catch basins along 92nd Avenue NE and NE 37th Place that show severe signs of cracking and crumbling the catch basin walls allowing water to seep through. The catch basins should be grouted or replaced as soon as possible to seal these openings.

Structure G-57 at the intersection of 92nd Avenue NE and NE 40th Street appears to have both the South inlet and North outlet grouted shut and instead outlets to the West connecting to an existing 15" pipe between G-42 and G-59. Without a drainage structure at this connection, the system is more susceptible to clogging.

Similarly there are two additional locations along 92nd Avenue NE where catch basins would be expected but tee connections were used instead (NE 37th Pl. and NE 38th Street).

The existing outfall to Lake Washington for Basin G was upsized to a 24" diameter pipe 2015 and the City is in the process of upsizing approximately 860 linear feet of 12" concrete pipe to 24-inch pipe between structures G-63 and G-79.

Assuming the Town completes this project modeling determined that the stormwater system in NE 42nd Street will not overtop under the 25-year or 100-year peak flow events. Existing

pipes upstream of NE 42nd Street however will overtop starting at G-60 under the 25-year peak flow event without upsizing additional existing pipes.

3.7.3 Recommendations

Modeling shows that the system upstream of the NE 42nd Street overtops at G-60 during the 25-year storm event. Table 3-1 below details that includes the recommendations for Basin G.

Table 3-1: Basin G Recommendations

Recommendation	Project Description	Size and Length of Proposed Pipe Installation
#1	Divert G-5 through G-12 to Basin D	250 LF 12" Pipe
#2	Upsize between G-32 and G-60	1,050 LF 18" Pipe
#3	Upsize between G-53 and G-56	420 LF 12" Pipe
#4	Upsize between G-29 and Tee 5	50 LF 12" Pipe
#5	Replace Broken Pipe Between G-33 and G-36 and install CB in 92nd over main line to reduce clogging potential *	180 LF 12” Pipe
#6	Replace Mismatched Pipe Between G-6 and G-8	125 LF 8” Pipe
#7	Replace CMP Between G-48 and G-49	4 LF 8” Pipe

PACE Engineers has prioritized these recommendations based on the effect that completing the project would have on the system, as well as the impact on public/private property if the recommended project were not completed. For instance, containing the 100-year flow within the system in NE 42nd Street is essential to protecting the sanitary sewer pump station at the western terminus of NE 42nd Street. Further information on all proposed recommendations is provided below.

<u>Recommendation G-1</u>

In the existing condition the Basin D public storm system collects runoff from approximately 10.27 acres and generates 6.0 cfs during the 25-year peak flow and 8.8 cfs during the 100-year peak flow event. This project will divert approximately 12.90 acres (4.53 cfs during the 25-year peak flow event and 6.63 cfs during the 100-year peak flow event) from Basin G. The additional anticipated flows after the diversion can easily be contained in the existing 12" diameter storm system and only minor upgrades to the outfall are required. Challenges include open trenching across 92nd Avenue NE and public outreach.

Recommendation G-2

This project will replace approximately 1,050 linear feet of 12"-15" diameter concrete pipe with 18" diameter PVC pipe, six type 1 catch basins and one storm drain manhole along 92nd Ave NE. It will also install two additional storm drain manholes in lieu of tee connections at the intersections of 92nd Ave with NE 38th Street and NE 40th Street which will reduce the likelihood of clogging.

Recommendation G-3

This project will replace approximately 420 linear feet of 8" diameter concrete pipe with 12 diameter PVC pipe along NE 40th Street.

Recommendation G-4

This project will replace approximately 50 linear feet of 8" diameter concrete pipe with 12 diameter PVC pipe and one type 1 catch basin along NE 37th Place.

Recommendation G-5

This project will replace approximately 180 linear feet of 8"-12" diameter concrete pipe with 8"-12" diameter PVC pipe and three type 1 crumbling catch basins along NE 38th Street.

Recommendation G-6

This project will replace approximately 420 linear feet of 8" diameter concrete pipe with 12" diameter PVC pipe and one type 1 crumbling catch basins (G-08) along 92nd Ave NE near the Town entrance.

Recommendation G-7

This project will replace CMP pipe between G-48 and G-49 in 94th Ave. NE

Please see Chapter 5: Capital Improvement Plan for more information.

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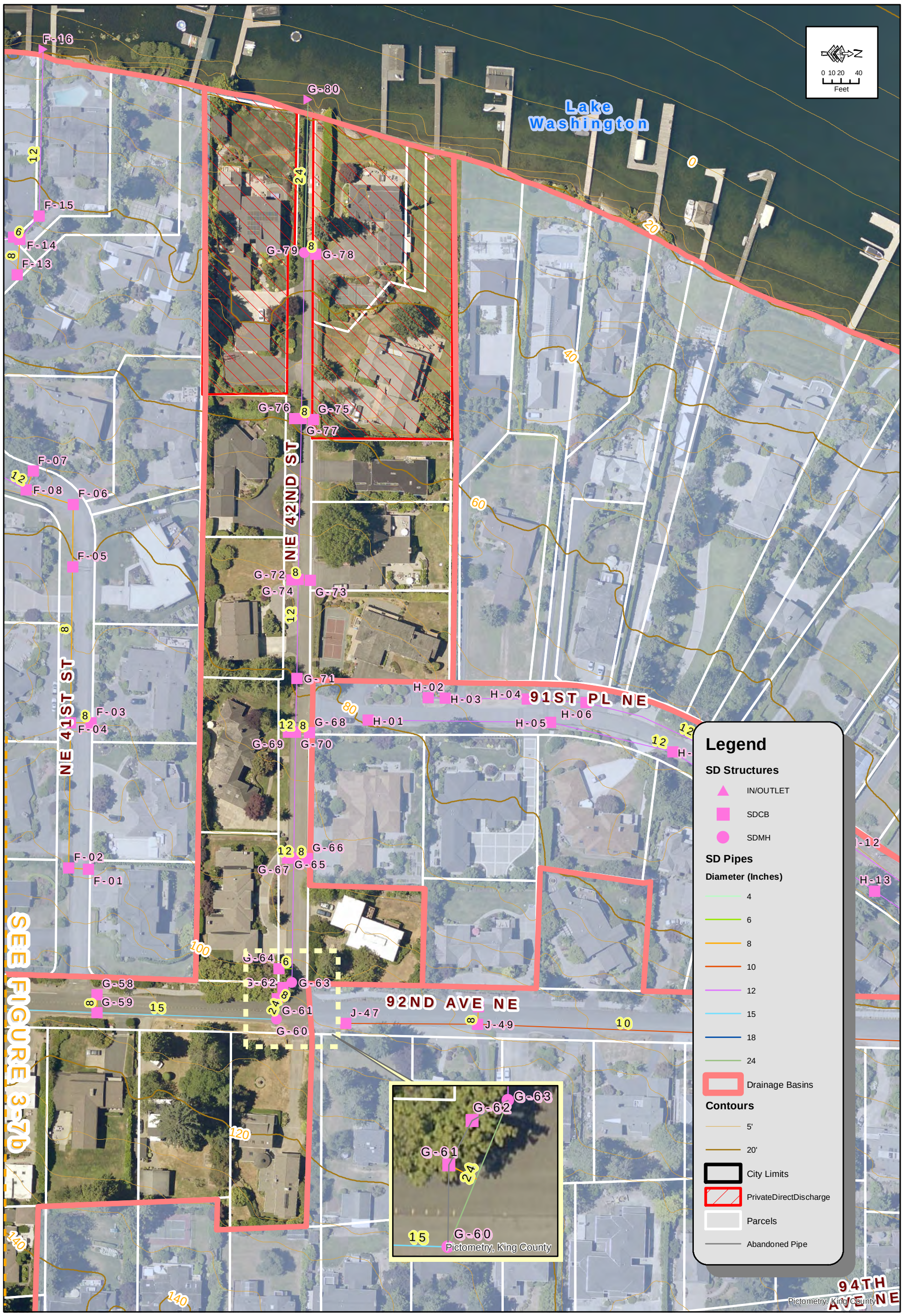

Figure 3-7a	*Basin G*	19357
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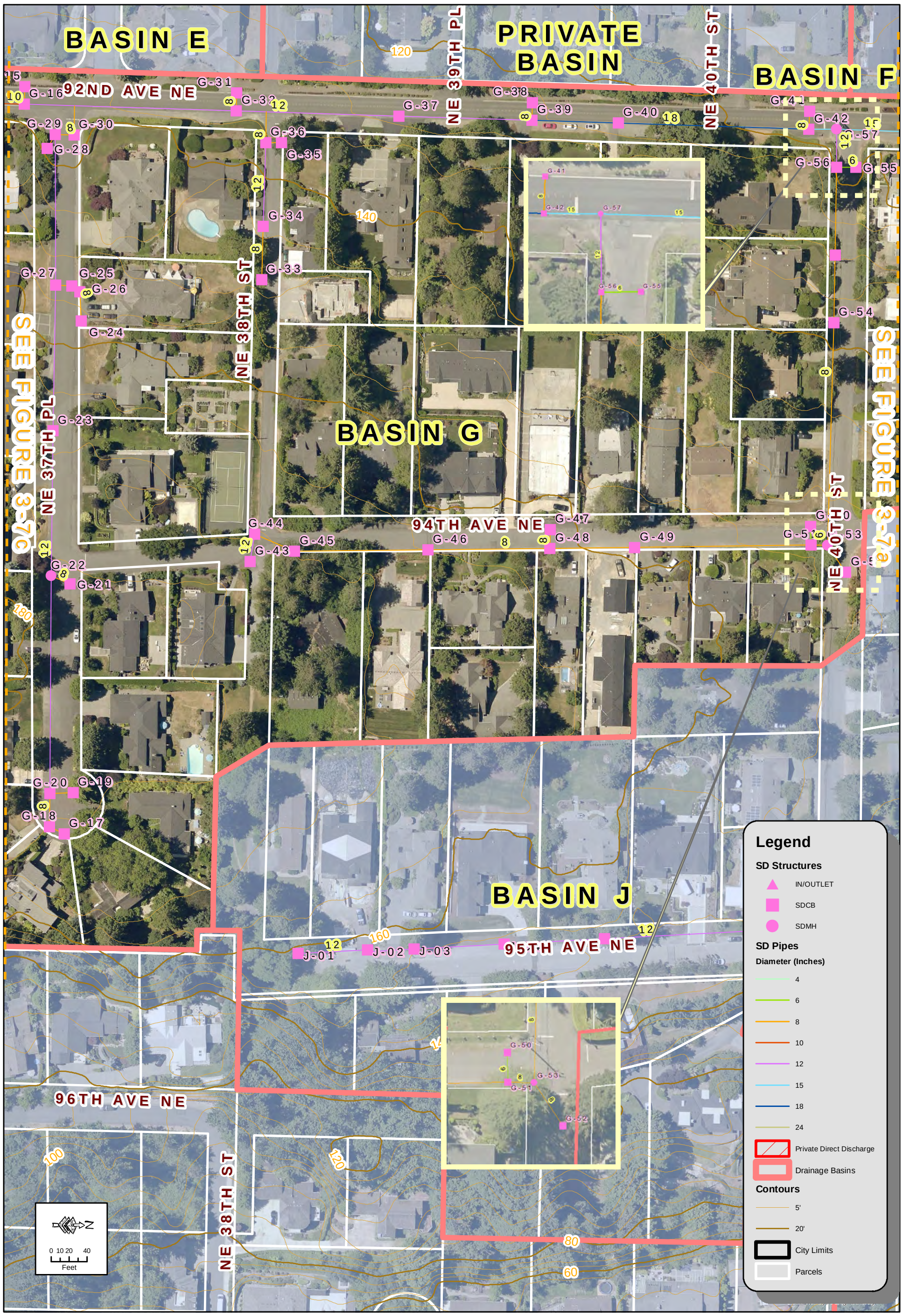

Figure 3-7b	*Basin G*	19357
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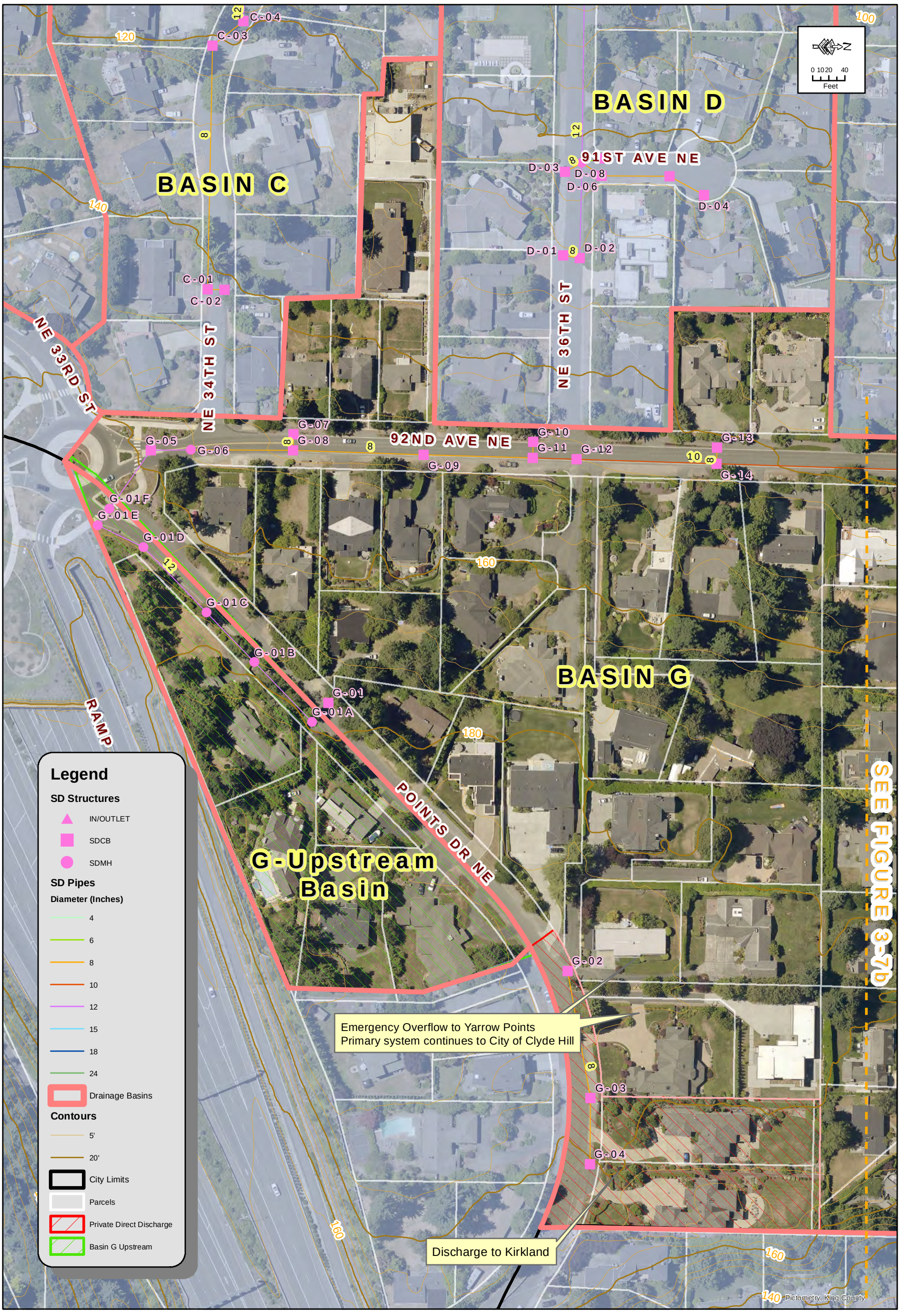

Figure 3-7c	*Basin G*	19357
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3.8 BASIN H

3.8.1 Drainage Basin and System Description

Basin H encompasses an area of 5.88 acres. The basin consists of three 15,000 square feet or larger developed single-family parcels and right-of-way within 91st Avenue NE. Vertical relief for the basin is approximately 60 feet and the topography generally slopes down to the north and west. Please see Figure 3-8 for more information.

The basin contains pipes and catch basin conveyance system and catch basins in 91st Avenue NE which ultimately flow through private property before out-falling to Lake Washington. PACE verified system elements in public right-of-way and Yarrow Point Town Staff has confirmed pipe sizes and catch basin locations/conditions on private property. The developed 25-year peak flow is 3.46 cfs and the 100-year peak flow rate 5.06 cfs

3.8.2 Analysis and Identified Basin Problems

Structure H-10 has an unconventional lid of metal bars directly attached to the concrete rim. This structures is inaccessible for any maintenance work and should be replaced.

The conveyance system in Basin H has the capacity to fully contain both the existing and developed conditions for the 25-year and 100-year design storm events, the main line between H-3 to H-10 however is a perforated pipe. A perforated pipe is not typically used in conveyance applications because exfiltration from this pipe can cause saturated ground conditions and damage to adjacent roadways.

Additionally, routine maintenance performed in the fall of 2018 revealed the 12” diameter storm system between H-17 and H-22 is in poor condition. The concrete pipe and brick/mortar catch basins have deteriorated and show cracks, breaks and often heavy root intrusion.

3.8.3 Recommendations

<u>Recommendation H-1</u>

This project will replace approximately 535 linear feet of 12” diameter concrete pipe with 12” diameter PVC pipe and five type 1 catch basins with 3 storm drain manhole between H-17 to H-22 (private property). This project would also replace the deficient H-10 lid.

<u>Recommendation H-2</u>

It is recommended the town abandon the 12” perforated pipe on the west side of 91st Avenue NE in lieu of an asphalt thickened edge and catch basins which will direct the runoff to the system to the east side of 91st Ave NE

3.9 BASIN J

3.9.1 Drainage Basin and System Description

Basin J covers an area of 39.62 acres. The basin consists mostly of 10,000- to 15,000-square-foot single-family lots, though there are some parcels considerably larger. One vacant lot remains, but several other parcels could be subdivided in the future. Vertical relief for the basin is approximately 140 feet and topography generally slope down to the north. Please see Figures 3-9a, 3-9b, and 3-9c for more information.

An extensive pipe and catch basin conveyance system is present in 92nd Avenue NE, 94th Avenue NE, 95th Avenue NE, and NE 47th Street. The conveyance system outlets to Lake Washington at the end of NE 47th Street. The developed 25-year peak flow is 23.61 cfs and the 100-year peak flow is 34.35 cfs.

Most potential upstream flows are intercepted by conveyance systems in other basins. \

NOTE: A small portion of Basin G may contribute flow to Basin J, but for modeling purposes the additional runoff is negligible.

3.9.2 Analysis and Identified Basin Problems

There are numerous catch basins along in Basin J where sediment have completely filled the sump. Routine maintenance is required.

In Structure J-67 there is a flow restrictor which to limits the flow being discharged to Lake Washington. The Frop-T structure is missing the handle for the shear gate which is essential to ensure that the gate can be easily opened in an emergency.

The modeling process determined the system overtops at J-26 and J-46 under the 25-year peak flow event. While the system does not overtop as significantly as Basin G, approximately 950 linear feet of 8”-12” conveyance piping needs to be upsized to provide additional flow capacity.

3.9.3 Analysis and Recommendations

<u>Recommendation J-1</u>

This project will replace 550 linear feet of existing pipe with larger 15” diameter pipe between structures J-21 and J-57 at the north end of 95th Avenue NE to fully contain flows from developed conditions

<u>Recommendation J-2</u>

This project will replace approximately 690 linear feet of 8” diameter pipe between drainage structures J-37 and a Tee in 94th Avenue NE as well as the pipe downstream of J-46 that tees into the 15-inch trunk line in 92nd Avenue NE. and a new structure also needs to be added at this junction

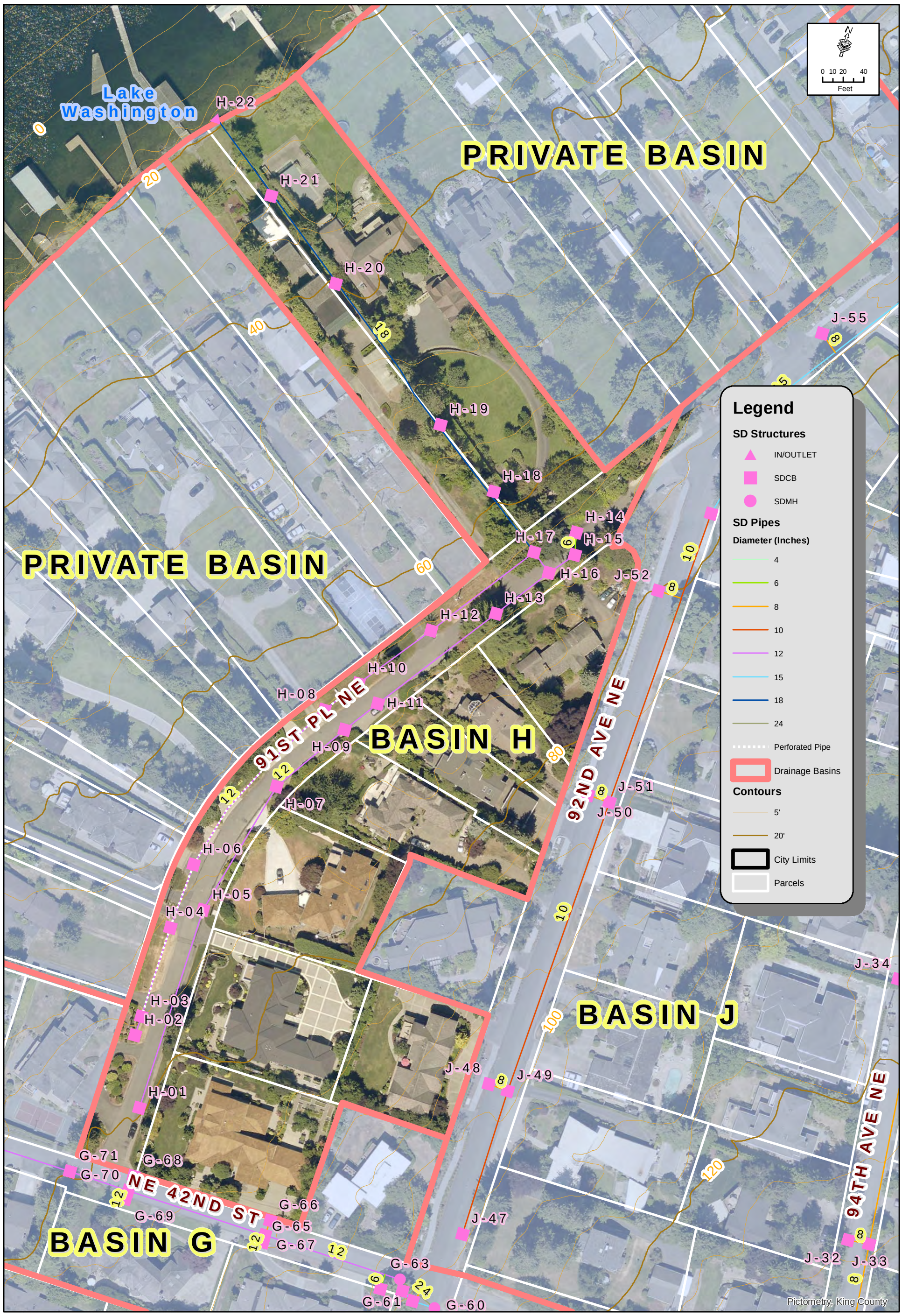

Figure 3-8	*Basin H*	19357
		May 2020

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Figure 3-9a	*Basin J*	19357
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Figure 3-9b	*Basin J*	19357
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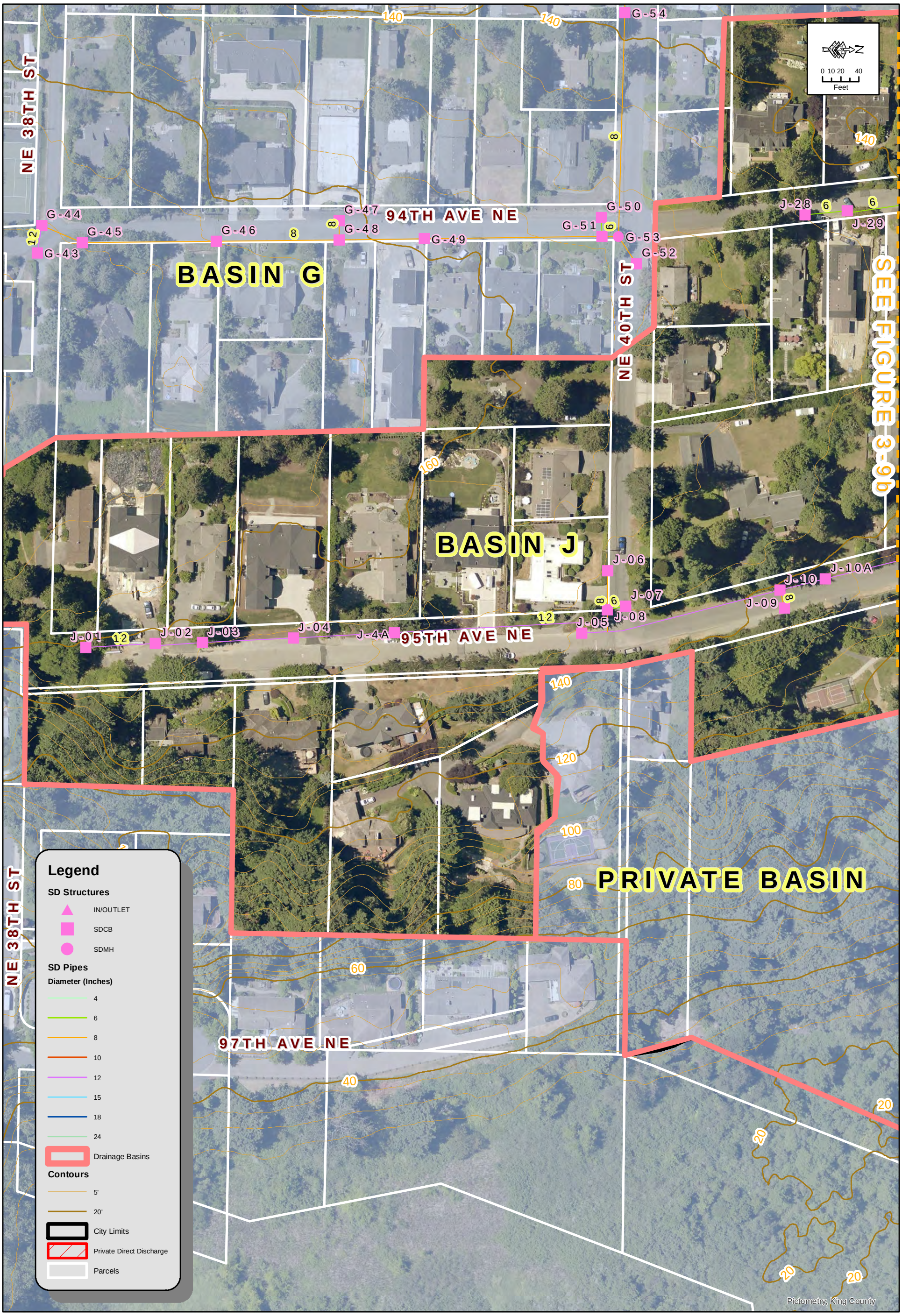

Figure 3-9c	*Basin J*	19357
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3.10 PRIVATE BASINS

A private drainage basin often exists where the surrounding area is only served by a private road/street or where the private residence, and often those just upstream of it directly discharge into a large water body (i.e. Lake Washington). In short private basins do not enter the public stormwater system and individual homeowners are required maintenance.

These stormwater maintenance responsibilities are often detailed in legal documents and recorded at the time the lot was developed. A title report specific to a given parcel number might reveal any homeowner obligations related to stormwater maintenance.

There are 6 private drainage basins shown on figure 2-3. Basin A (Yarrow Grace Plat) and Basin B (Fairweather Trails Short Plat) are referenced in sections 3.1 and 3.2 respectively. The remaining 4 private basins are shown in Table 3-2 below and illustrated in figures 3-10a, 3-10b and 3-10c.

Table 3-2: Private Basins

ID #	Figure #	Area (Acres)	Description
#1	3-10a	15.11	NE 38th Place NE 39th Place NE 40th Place
#2	3-10b	8.3	4215-4429 West of 91st Avenue NE
#3	3-10b	5.6	4601-4639 West of 92nd Avenue NE 4023 NE 47th Street
#4	3-10c	32.96	4707-4721 West of 91st Avenue NE 3829-4464 North and East of 95th Avenue NE

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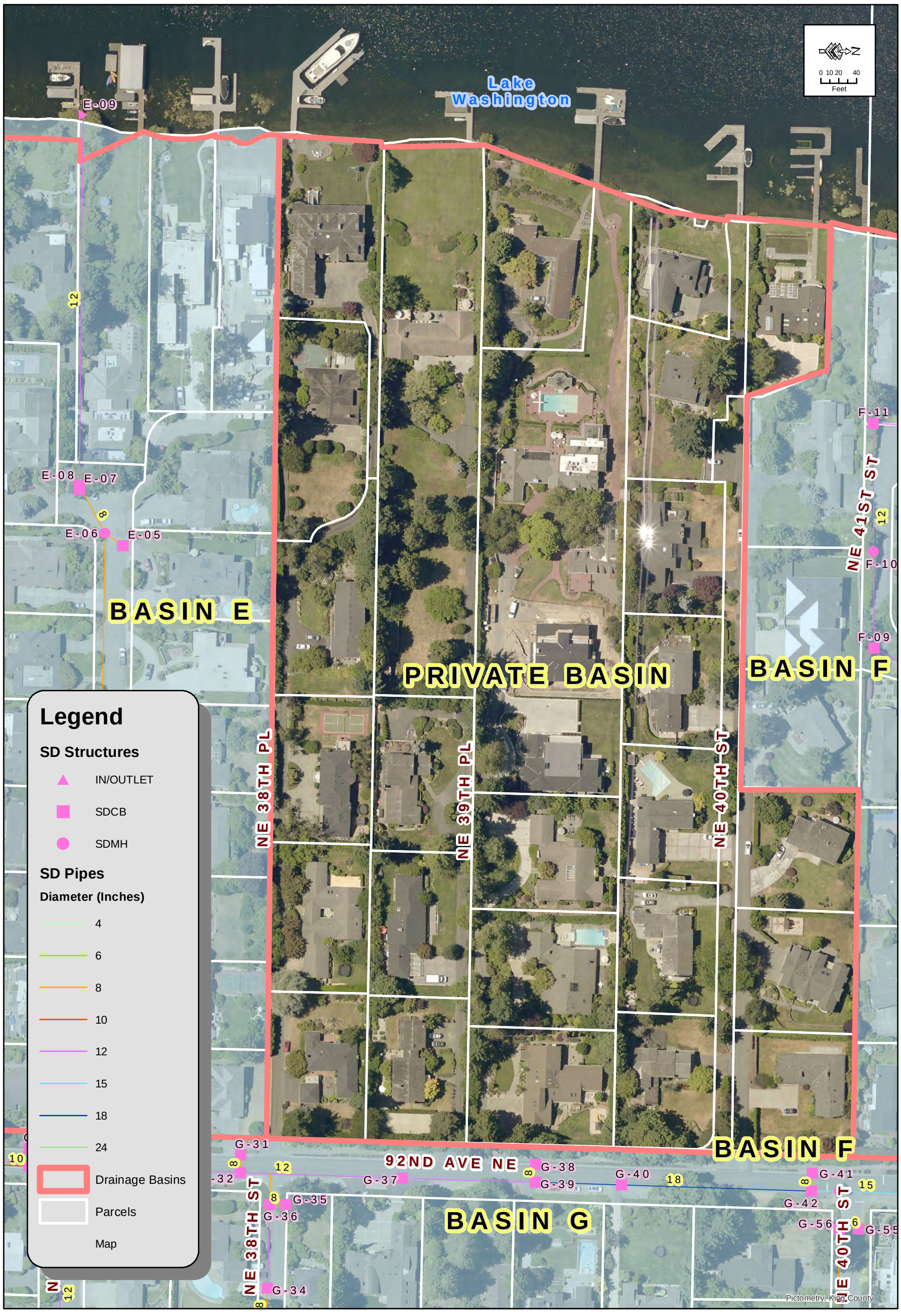

Figure 3-10a	*Private Basin - 92nd Ave NE*	19357
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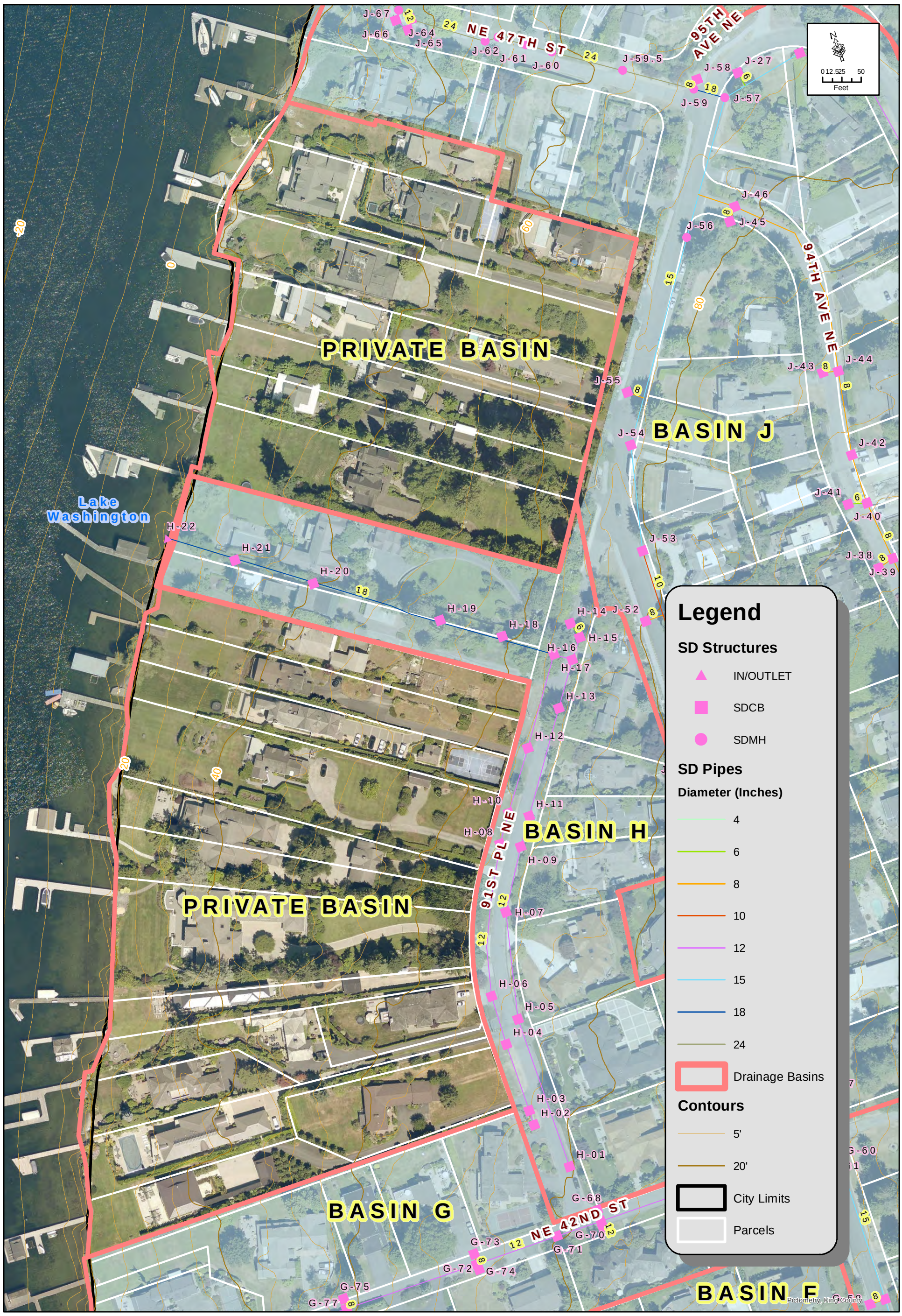

Figure 3-10b	*Private Basin - 91st Pl NE*	19357
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Figure 3-10c	*Private Basin - 95th Ave NE*	19357
		May 2020

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CHAPTER 4
WATER QUALITY ANALYSIS

4.1 INTRODUCTION AND DEFINITIONS

Surface water quality protection has become a significant issue in recent years. The effects of stormwater runoff pollution on receiving water quality can be heightened due to many factors such as modified drainage area land use conditions, increased runoff rates and volumes, and the extent of source and structural control measures. Renewed emphasis on water quality control is being seen throughout the Puget Sound region and the State of Washington.

This Stormwater Management (SWM) Plan builds on existing Town policies to ensure that the SWM Program goals are being met.

4.1.1 Vision

The Town's Vision for the SWM Program is to preserve and enhance the standard of living for the people of the Town of Yarrow Point by restoring and protecting the unique natural environment and water quality of Lake Washington and the Puget Sound Basin.

4.1.2 Goals

- Ensure Town staff is available to support current and future development activities which protect water quality.
- Prepare, enact, and enforce ordinances and policies as needed to protect water quality in developed areas.
- Enhance water quality to preserve the natural environment and it's unique benefit to people, fish, and wildlife.

4.2 WATER QUALITY POLICIES

The goal of reducing stormwater pollution and protecting water quality throughout the Town is achieved by implementing the following water quality policies:

1. Encourage Low Impact Development (LID) practices in CIP projects and new/redevelopment projects.
2. Encourage onsite stormwater infiltration and the development of landscape and screening standards that facilitate dual use as stormwater facilities.
3. Eliminate illicit discharges and connections throughout the Town.

4. Implement and enforce the Town's ordinances and codes to reduce stormwater pollution.
5. Use the 2012 Puget Sound LID Guidance Manual to facilitate the use of LID types of Best Management Practices (BMPs) throughout the Town.

Currently the Town has prepared and adopted its own stormwater drainage guidelines. These guidelines are based on requirements within the Town's Municipal Code.

4.3 REGULATORY COMPLIANCE

4.3.1 Federal Water and Pollution Control Act

The 1972 amendments to the Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), provide the regulatory and legal basis for the National Pollution Discharge Elimination System Permit (Permit). The CWA includes a series of regulatory guidance documents, permits, and technical requirements to protect water quality in the United States. The Federal Environmental Protection Agency (EPA) provides the basic structure for regulating the discharge of pollutants from point sources to waters of the United States through the NPDES Permit. The CWA authorizes the EPA to delegate authority for the NPDES Permit Program to the state for administration and enforcement of the Permit and associated Total Maximum Daily Load (TMDL) water quality violations. The Permit applies to both industrial and municipal stormwater discharges. The specific purpose of the Permit is to reduce stormwater runoff and the discharge of pollutants into our nation's receiving waters.

Counties, cities, towns, and ports of a certain size and development density that own and operate a stormwater collection/conveyance system, referred to as Municipal Separate Storm Sewer System (MS4), are required to meet the requirements of the Permit, as defined for Western Washington by Ecology. The origin of the Permit is the Federal CWA, as amended in the mid-1990s to include non-point sources of pollution such as stormwater and surface water runoff. Under federal and state law, municipalities that collect stormwater runoff in separate storm sewers and discharge to surface waters are required to have this Permit. This Permit is regulated by the Environmental Protection Agency (EPA) and locally implemented by Ecology through the EPA delegation process. Most states in the Northwest, except for Idaho and Alaska, have assumed the delegation of the Permit from EPA at the state level.

The EPA stormwater regulations are administered through a two-phase Permit program, Phase I for large cities and counties and Phase II for smaller cities. Ecology has been delegated this authority to develop and administer these Permits throughout Washington State. The EPA regulations went into effect in early 2003 and apply to all cities, counties, and ports with regulated stormwater collection/conveyance systems.

For the state of Washington, the Department of Ecology has established separate permits for Eastern Washington and Western Washington. Each permit has a duration of five years. Ecology first issued the Western Washington Phase II Permit in 2007 and modified it in 2009. Ecology extended and reissued the 2007-2012 Permit on August 1, 2012, at legislative direction, to be effective through July 31, 2013. After an extensive public process, Ecology then reissued the updated 2013-2018 Permit on August 1, 2012, effective August 1, 2013. Ecology recently issued the new Permit, effective August 1, 2013, to over 80 cities and the urbanized areas within five counties in Western Washington, excluding the Town of Yarrow Point. After a recent Pollution Control Hearings Board ruling, the current 2013-2018 Permit underwent review.

4.3.2 US Army Corps of Engineers

Construction projects in the Town of Yarrow Point are regulated by the U.S. Army Corps of Engineers in regard to Section 404 permits and the State Department of Fish and Wildlife in regard to Hydraulic Project Approvals (HPAs) related to streams, habitat, water quality, and wetland protection during construction projects within the Town.

4.4 PHASE II MUNICIPAL STORMWATER GENERAL PERMIT AND ECOLOGY MANUAL COMPLIANCE

All existing development is exempt from meeting current water quality treatment standards unless it is determined the NPDES Phase II Permit calls for monitoring (and possibly treatment) of existing outfalls. There is ongoing discussion and debate on what the Phase II Permit actually requires. The town received an exemption of Phase II Permit coverage in August of 2018 (see letter from Ecology on the following pages) as the town is below the 1,000 stormwater connections to the MS4 threshold. PACE agrees with the Ecology recommendation regarding public education of stormwater pollution effects mentioned in the letter.

NOTE: If the Town is required to comply with Phase II requirements in the future it should start to monitor implementation requirements of the Phase II Permit. Some of these requirements include record keeping of all of the inspection and maintenance on every element of the Town's stormwater system, public education regarding water quality, monitoring and recording all illicit discharges, water quality sampling, and adoption of a stormwater manual that is equivalent to the Ecology Stormwater Management Manual for Western Washington (Ecology Manual). The Town's Stormwater Drainage Guidelines have not been reviewed and approved as an equivalent manual to the Ecology Manual. As the Town is exempt from obtaining a Phase II Permit, it is not required to have an equivalent manual. However, given this exemption, the Town is ineligible for any grant funding that may be available from Ecology for projects and programs that could improve water quality.

Some programmatic projects that the Town should consider in the future include:

- Adoption of the Ecology Manual or a manual that Ecology has deemed equivalent such as the King County Surface Water Design Manual
- Create a policies and procedures for the stormwater operations and maintenance program based on the latest Ecology Manual
- Inventory all existing private flow control facilities and create a database using GIS to ensure regular maintenance is performed. If the Town was to become a Phase II permit holder this information must be documented along with the maintenance records that show the facilities receive annual maintenance.

CHAPTER 5
CAPITAL IMPROVEMENT PLAN

5.1 METHODOLOGY

The 2019 Town of Yarrow Point Capital Improvement Plan (CIP) is an essential tool used to organize and prioritize vital storm drainage system improvements. Each basin recommendation made in Chapter 3 was included in the CIP. Each project was then prioritized into categories based on the following criteria: potential flooding, construction impacts, and the effect that completion of the project would have on the rest of the system. All project costs are in 2020 dollars and the unit prices attempt to take into account sales tax on materials. Table 5-1 shows the prioritization of all projects.

5.2 PROJECT RECOMMENDATIONS

The recommended capital improvements for the 2019 Plan are limited to correcting existing conveyance problems and future conveyance problems based on developed conditions, as well as replacing substandard drainage structures. The recommended capital improvements are listed and prioritized in Table 5-1. All projects that are required to convey existing and proposed flows have been sized to convey the 25-year flow (industry standard) unless noted.

Figure 5-1 Capital Improvement Projects is an insert which shows the locations of the projects. Detailed cost estimates are located in Appendix B.

Table 5-1: Recommended Capital Improvement Projects

CONSTRUCTION PROJECTS

Project ID	CIP #	General Description	Estimated Cost[1]	Priority Level
G-1 D-1	1[2]	This project consists of approximately 250 LF of new 12" Pipe between G-12 and D-2 that will divert flows to Basin D. Also includes outfall upgrades at the discharge point of Basin D, as well as replacing or repairing 6 damaged catch basins in Basin D.	$184,000	High
J-2	2	Replaces approximately 690 linear feet of existing 8" pipe with larger 15" diameter pipe between structures J-37 and J-46 plus pipe downstream of J-46 to the tee connection to fully contain flows from developed conditions.	$290,000	Medium-High

CONSTRUCTION PROJECTS				
Project ID	**CIP #**	**General Description**	**Estimated Cost[1]**	**Priority Level**
H-2	3	Install approximately 400 feet of thickened edge while abandoning 400 linear feet of existing perforated pipe between structures H-3 and H-10 and routing water to the existing 12" line on the east side of 91st Ave. NE	$121,000	Medium-High
H-1	4	Replaces approximately 525 linear feet of existing pipe damaged by major root intrusion between structures H-17 and H-22.	$224,000	Medium-High
G-2	5	Upsize between G-32 and G-60 fully contain flows from existing and developed conditions. 1,050 linear feet of new 18" pipe.	$468,000	Medium High
J-1	6	Replaces approximately 550 linear feet of existing pipe with larger 15" diameter pipe between structures J-21 and J-57 to fully contain flows from developed conditions.	$185,000	Medium
G-3	7	Replaces approximately 420 linear feet of existing pipe with 12" diameter pipe between structures G-53 and G-56 to fully contain flows from existing and developed conditions.	$167,000	Medium
G-4	8	Replaces approximately 50 linear feet of existing pipe with 12" diameter pipe between structures G-29 and Tee-5 in NE 37th St. and the pipe downstream of G-30 to fully contain flows from existing and developed conditions.	$35,000	Low
G-6	9	Replace 420 linear feet of pipe between G-6 and G-11 with 12" pipe to fully contain flows from existing and developed conditions.	$160,000	Low
G-5	10	Replace broken 180 linear feet of 8" pipe between G-33 and G-36 in NE 38th St. with 8"-12" PVC pipe and reinstall catch basin over 92nd trunk line to reduce clogging potential	$80,000	Low
G-7	11	Replace CMP pipe between G-48 and G-49 in 94th Ave. NE	$13,000	Low
Construction Projects Total			**$1,924,000**	
[1]All costs are in 2020 dollars				
[2]Required to contain the 100-year storm event in NE 42nd St.				

PROGRAMMATIC PROJECTS				
Project ID	CIP#	General Description	Estimated Cost[1]	Priority Level
PP-1	12	Adopt current Department of Ecology Stormwater Management Manual for Western Washington. Includes review of Municipal Code for conflicts and includes production of a stormwater addendum of the manual specific to the Town. Develop a map for the Town to identify parcels which meet direct discharge requirements.	$30,000	High
PP-2	13	Inventory all existing private flow control facilities and create a database using GIS to ensure regular maintenance is performed.	$30,000	Medium
PP-3	14	Update Town of Yarrow Point 2010 Standard Plans and Notes	$25,000	Medium
PP-4	15	Create Policies and Procedures for the Stormwater Operations and Maintenance Program. See Section 6.2	$25,000	Medium
PP-5	16	Annual Cleaning and Video Inspection Program (6-Year Cycle)	$30,000	Medium
	Programmatic Projects Total		**$140,000**	
	[1]All costs are in 2020 dollars			

5.3 OTHER RECOMMENDATIONS

The following additional recommendations are suggested to the Town of Yarrow Point:

- The Town should verify that easements exist for outfalls to Lake Washington located on private property (Basins A, B, C, D, E, F, and H). If traditional easements do not exist, it is that possible prescriptive easements may. If easements were not previously granted, the Town should attempt to obtain them from the property owners. Additionally, the town should determine if all outfalls to Lake Washington extend to the ordinary high-water line as this is a requirement for the Ecology direct discharge exemption (see Section 2.3.3).
- Results of the field survey and evaluation (see Appendix C, separately bound as Volume 2 – System Inventory) indicate multiple drainage structures in the inventory have large amounts of debris buildup in their sumps and other drainage structures have other identified problems (some structures have significant cracking and are deficient), the majority of these being inoperable lids. The majority of structures located on private property are not included in the inventory. The Town of Yarrow Point Public Works Department should investigate these problem structures and, at the very least, remove sediment buildup in sumps and pipes.

- Volume 2 of this document should be periodically updated as capital improvement projects and other development projects involving the public storm drainage system are completed.
- A centrally managed drainage complaint database should be created and maintained by the Town to aid in developing future projects and correctly prioritizing Town needs.
- The Town should consider implementing a public education program to make residents aware of the negative effects of stormwater pollution. As stated in the Ecology Phase II Permit coverage exemption letter, implementation of stormwater Best Management Practices and public education will maximize the likelihood that Ecology will not bring the Town back under Phase II coverage in the future.
- The Town should consider adopting the current Department of Ecology's Stormwater Management Manual for Western Washington. While the is not an Ecology Phase II Permit Municipality, we feel that by adopting the most current standards will maximize the likelihood that Ecology will not bring the Town back under Phase II coverage in the future. In addition, we believe the Town, its receiving waters, and its residents benefit from using the best and most recent practices and technologies.
- The Town should consider updating the standard plans and notes. This will ensure that construction projects within the Town, both public and private, are using construction methods and practices that are currently the industry standard.

Yarrow Point
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TOWN OF YARROW POINT

CAPITAL IMPROVEMENT PROJECTS

FIGURE 5-1

PACE
An Engineering Services Company

11255 Kirkland Way, Suite 300
Kirkland, WA 98033
p. 425.827.2014 | f.425.827.5043

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CHAPTER 6
OPERATION AND MAINTENANCE PROGRAM

6.1 INTRODUCTION

Chapter 6 provides an overview of the Town's stormwater Operation and Maintenance Program (O&M), equipment activities, and costs. Drainage facility maintenance is one of the most essential components of an effective Stormwater Management Program. Stormwater facilities require regular inspection, cleaning, and repair to ensure they are functioning as intended in order to provide the required flow control, water quality treatment, detention, and conveyance. An effective O&M Program aims to protect public health and safety, maintain drainage system integrity and function, reduce infrastructure repair and life cycle costs, enhance water quality, and achieve future regulatory compliance.

Both roadway and non-roadway areas contribute excess stormwater runoff, sediment, and pollutants to the Town's stormwater drainage system. Providing regular maintenance is one of the best, most cost-effective ways to maximize the storm system's capacity. It is this optimization that allows the Town to reduce flooding and property damage, as well as control and remove sediments and other contaminants from the system, thus preventing contamination of local receiving waters.

6.1.1 Core O&M Goals

The goals of the Town's stormwater Operation and Maintenance Program are to:

- Maintain the proper function of the Town's stormwater facilities in order to realize their full design capacity.
- Interact and have a positive exchange with the community by conducting effective and responsive maintenance activities.
- Effectively respond to public drainage complaints by performing small works projects or minor improvements using individual contractor or purchase orders and identifying and recommending larger projects for capital design, funding, and construction.
- Reduce particulate and pollutant loading into the conveyance system.
- Establish a plan that outlines how the Town's O&M Program can become more proactive in conducting its annual maintenance program and anticipating future maintenance, and facility repair/replacement needs.

6.1.2 Stormwater System Mapping

An accurate stormwater inventory, developed in a GIS geodatabase, is a key development and implementation tool for an effective O&M Program. As part of this stormwater plan, a geodatabase has been created, as has an up-to-date GIS stormwater system map.

The O&M Program geodatabase needs to be regularly updated and expanded in order to ensure it is always complete and accurate. This is the type of stormwater investment that will always pay off. It is also an invaluable staffing and budget management tool, as the inventory and mapping network can be routinely used to plan the sequencing of O&M activities; create purchase orders for the contractors; and support annual staffing, and budget requests. The uses of an up to date stormwater facility inventory and mapping system are numerous and may include the following:

- Asset management
- Recordkeeping
- Support to the annual budget processes
- Quick response to citizen and Town Council requests
- When under a Permit, an up-to-date map of stormwater facilities supports compliance by providing the information needed for the development of an annual report to Ecology

6.2 YARROW POINT STORMWATER PROGRAM O&M PLAN/PROGRAM

The Town will develop and implement an Operations and Maintenance (O&M) Program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations.

PACE suggest the following maintenance standards, cofound in the 2019 Ecology Manual Volume V Chapter 4 as a guide.

6.2.1 Maintenance Standards

1. The Town Public Works Department should determine if maintenance is required upon inspection. An inspection program should be developed to schedule inspections and record the findings from said inspections.
2. Unless there are circumstances beyond the Town's control, when an inspection identifies an exceedance of the maintenance standard, maintenance will be performed:
   - Within six months for typical maintenance.
   - Within nine months for maintenance requiring re-vegetation.
   - Within two years for maintenance that requires capital construction of greater than $25,000.

Circumstances beyond the Town's control include denial or delay of access by property owners, denial or delay of necessary permit approvals, and unexpected reallocations of funding to perform emergency work. For each exceedance of the required timeframe, the Town should document the circumstances and how they were beyond their control.

6.2.2 General Inspections

If applicable the Town Public Works staff should perform annual inspections of all Town-owned and operated stormwater treatment and flow control facilities and take appropriate maintenance actions in accordance with the Ecology Manual. An inspection program is being developed to schedule inspections and record the findings from said inspections.

6.2.3 Post-Storm Inspections

The Town should perform spot checks of potentially damaged facilities after major storm events (i.e. outfalls). If spot checks indicate widespread damage/maintenance needs, all associated facilities should be inspected. Repairs and maintenance actions should be taken immediately upon inspection as required.

6.2.4 Catch Basins and Inlet Inspections

Inspection of all catch basins and inlets owned or operated by the Town should occur annually. Catch basins should be cleaned if the inspection indicates cleaning is needed to comply with maintenance standards established in the most recent version of the Stormwater Management Manual for Western Washington.

6.2.5 Reduction of Stormwater Impacts:

The Town Stormwater O&M Program should establish practices from the Ecology Manual to reduce stormwater impacts associated with runoff from streets, parking lots, and private roads resulting from the following maintenance activities:

- Pipe cleaning
- Cleaning of culverts that convey stormwater in ditch systems
- Ditch maintenance
- Street cleaning
- Road repair and resurfacing, including pavement grinding
- Snow and ice control, and
- Utility installation

6.2.6 Policies and Procedures

The Town's Stormwater O&M Program should use established policies and best management practices from the Stormwater Management Manual for Western Washington to reduce pollutants in discharges resulting from the following activities

- Application of fertilizer, pesticides, and herbicides, including the development of nutrient management and integrated pest management plans
- Sediment and erosion control

- Landscape maintenance and vegetation disposal
- Trash management
- Building exterior cleaning and maintenance

6.2.7 Training

A training program should be developed for employees and consultants of the Town whose construction, operations, or maintenance job functions may impact stormwater quality. The training program should address the importance of protecting water quality, operation and maintenance standards, inspection procedures, selecting appropriate BMPs, ways to perform their job activities to prevent or minimize impacts to water quality, and procedures for reporting water quality concerns, including potential illicit discharges. Follow-up training should be provided as needed to address changes in procedures, techniques, or requirements. Any and all training should be documented

6.2.8 Special Facility Requirements

A Stormwater Pollution Prevention Plan (SWPPP) for all facilities owned or operated by the Town (i.e. Town Hall) should be developed and implemented.

6.3 CURRENT 6-YEAR CLEAN/CAMERA PROGRAM

The Town currently performs a “Clean/Camera” program in order to inspect and clean the Town’s stormwater system. The system is divided into six sectors and each sector is videotaped using robotic video equipment. If these videos show the system is not performing optimally such as sediment accumulation present or root intrusion, maintenance is performed. This ensures that every element of the Town-owned and operated system is inspected and maintained at least every six years. The annual budget for this program is $30,000 and PACE feels that it is in the best interest of the Town to continue this program.

6.4 PRIVATE FLOW CONTROL FACILITY MAINTENANCE

There are many parcels throughout the Town that utilize private flow control facilities. Typically when a property was developed with a private flow control facility, a maintenance covenant was recorded with King County. However many property owners may not even know that the facility even exists or that they are responsible for the maintenance of the facility. The Town should research these facilities and create a GIS database of all private flow control facilities. This would aid in the maintenance of these facilities and protect water quality through the Town as well as Lake Washington.

CHAPTER 7
FINANCIAL STRATEGIES

7.1 INTRODUCTION

Most municipal agencies have historically funded their stormwater program activities through the general fund, roads program, or water/sewer utilities. With increasing regulations however, agencies have discovered that their stormwater program, like the water and wastewater programs, needs its own reliable and dedicated source of revenue for successful implementation. As such, many agencies have developed a stormwater utility to provide a permanent base level of funding. Some agencies are also charging specific development review fees to increase their stormwater revenue, or imposing system development charges to help defray the cost of new drainage infrastructure.

The more mature utility-based stormwater programs often have adequate annual revenues and fiscal standing to take advantage of long-term capital improvement project (CIP) financing options, including bonding for capital needs, loans for special projects, and partnering for cost sharing with other agencies and/or developers. Occasionally, opportunities arise that allow an agency to take advantage of additional outside funding sources including loans and grants. These revenue sources may augment annual stormwater revenues, but are generally inadequate as a primary source of funding for an entire stormwater program.

7.2 CURRENT TOWN FUNDING ALTERNATIVES

The Town of Yarrow Point utilizes not only general fund monies and development review fees, but grants from the King County Flood Control Sub-Regional Opportunity Fund and revenues generated by its construction vehicle fee and stormwater utility to fund stormwater capital improvement projects and the stormwater management program. Project costs in excess of these revenues have been successfully funded through low interest loans.

7.2.1 Development Review Fees

Government agencies have the legal authority to assess fees for the services they provide. As such, Yarrow Point does not subsidize development review and construction/ maintenance from the general fund, but rather employs outside consultants for zoning, building, and site development permit reviews and inspections. Costs related to these services are easily tracked as part of each consultant's monthly invoice and ultimately paid for by the applicant.

7.2.2 Low Interest Loans

Since 2008 the Town of Yarrow Point has successfully received two (2) separate low interest loans (1-5%) from local banks to construct projects identified in their stormwater

management plan. The loans were typically allocated for a 10-year term (2008-2018 and 2018-2028) and payments are made every six months.

7.2.3 King County Flood Control Grants

The King County Flood Control District (KCFCD) was created by King County in April 2007. In a subsequent resolution, its Board of Supervisors authorized a property tax levy of ten cents per one thousand dollars of assessed valuation to fund the flood districts budget and work program. The Board of Supervisors earmarked 10% of these revenues for a Sub-Regional Opportunity Fund (SROF). The SROF was made available to jurisdictions throughout the KCFCD on a pro-rata basis and can be used for projects that fit within the KCFCD's statutory authorization as provided for in Chapter 86.15 RCW. Eligible activities include, but may not be limited to, flood control, stormwater improvements, and watershed management (ie. habitat conservation). Fund applications are due annually in October for the following year and are not competitive. The Town of Yarrow Point has received roughly $10,000 - $13,000 per year in grants from this program since 2010.

In 2018 the KCFCD administered an annual Flood Control Grant program in addition to the SROF. The program targets small to medium local flood reduction projects where the control of stormwater will have a direct benefit in reducing flooding. Unlike the SROF, Flood Control Grant applications are competitive. The Town of Yarrow Point received a $40,000 grant from this project in 2019 to replace every catch basin grate in the Town with high flow vaned grates and install new rims on aging infrastructure in Basin H (4441 91st Ave NE).

Funds received from the KCFCD are not guaranteed and actual amounts vary from year to year. As such it is important the Town of Yarrow Point budget reflects this uncertainty and completion of future stormwater projects do not lead to a shortfall in project funds.

7.2.4 Construction Vehicle Fee

The Town of Yarrow Point established a Construction Vehicle Fee, also known as a Heavy Truck Fee, on November 9, 2010. Yarrow Point Municipal Code (YPMC) Chapter 12.32 and Ordinance No. 620, generally state the following:

1. All applicants for the following town permits shall pay a construction vehicle fee equal to one percent (1%) of the value of the proposed project to offset and repair the damage done to town streets by the vehicles transporting materials associated with that project:
    a. Demolition permits.
    b. Building permits for which the Town Engineer has determined, based on the permit application materials, that fill, gravel, concrete, asphalt, lumber or other similar bulk material will be transported to or from the site.
    c. Site development permits.
2. This fee shall be waived for any applicant who can document to the Town Engineer's satisfaction that the materials associated with the applicant's project that would

otherwise necessitate construction vehicle trips on the town streets will be transported into and out of the town via barge or other method not requiring use of the town streets.

On average, the Town collects roughly $100,000/ year in construction vehicle fees. Revenues generated by this fee however, **may not** be used directly for stormwater capital improvement projects. YPMC 12.32.010 states the fees are to be used "to offset and repair the damage done to town streets by vehicles transporting materials." For this reason, stormwater projects are typically scheduled one year ahead of roadway restoration projects (ie. grind and overlays) for the same street(s).

7.2.5 Stormwater Utility

The Town of Yarrow Point formed a stormwater utility (Utility) on November 8, 2011, after several months of study. Yarrow Point Municipal Code (YPMC) Chapter 13.12 and Ordinance No. 630, document creation of the Utility and the associated Stormwater Utility Fund. Stormwater utility fees are collected to recover costs for providing service to Town properties in accordance with the cost of improving, operating, and maintaining the Town's stormwater system (YPMC 13.12.020). The Utility is overseen by a Utility Advisory Committee which is ultimately responsible for providing policy recommendations to the Town Council concerning establishment of utility rates, the collection of funds, and the purpose for which those funds shall be used (YPMC 13.12.040).

In an effort to establish equity, the UAC determined the Utility fee should be a flat fee per parcel, regardless of how much impervious surface existed on a single lot or whether or not that lot was in a private basin. The chosen method had several advantages most notable of which was ease of implementation and maintenance. In 2011, the UAC studied data from surrounding jurisdictions prior to recommending a fee of $13.10/ lot/ month ($157.20/ lot/ year). The committee reconvened in 2018 to review the fee and decided to make no changes.

The Town generates roughly $64,000/year as part of the stormwater utility. King County however, collects the fee under an interagency agreement as part of their semi-annual property tax bill and this reduces the amount available for Town stormwater projects by roughly $1,400/ year; leaving approximately $62,600/ year which can be used for:

- Utility planning and administration;
- Development of regulations;
- Construction and repair of facilities;
- System maintenance;
- Provision of storm and surface water management equipment and services; and
- Redemption of bonds used to finance stormwater system improvements.

The Town's stormwater utility is by far the most reliable and successful financial mechanism for stormwater management. As such, PACE recommends the UAC reconvenes in the

summer of 2020 to evaluate the current stormwater utility fee versus the prioritized capital improvement projects included in Chapter 5. If an increase to the utility fee is recommended it can be presented to the Town Council in the fall of 2020, and relayed to King County for inclusion in the 2021 property tax bills by the annual November deadline.

7.2.6 Coordination with Other Agencies

The Town of Yarrow Point often looks for opportunities to collaborate with neighboring jurisdictions and utility purveyors to: (a) promote efficiency and save money; (b) obtain fair and reasonable solutions to problems; and (c) promote consistency of standards and practices. In regards to stormwater, such efforts have included:

- 2009 – Upsizing 500LF of stormwater along NE 47th Street while simultaneously undergrounding overhead power, phone, and cable lines (Puget Sound Energy/ Comcast/CenturyLink);
- 2014 – Installing catch basins and additional pipe along NE 33rd Street while simultaneously undergrounding overhead power, phone, and cable lines (Puget Sound Energy/ Comcast/ CenturyLink);
- 2015 –Grind, overlay, and re-stripe 92nd Ave NE (WSDOT);
- 2016 – Installing 50LF of 24-inch diameter pipe in Basin G at the intersection of NE 42nd and 92nd Ave NE while simultaneously undergrounding overhead power, phone, and cable lines (Puget Sound Energy/ Comcast/ CenturyLink);
- 2019 – Coordinate with City of Bellevue to relocate water meters and a fire hydrant along 95th Ave NE (3800-4000 block) in preparation for a stormwater project; and
- 2020/2021 – Upsizing 600 LF of stormwater along NE 42nd Street including collaboration with the City of Bellevue for water main upgrades and Puget Sound Energy, Comcast, and CenturyLink to underground existing overhead power, phone, and cable lines.

Interagency agreements allow smaller jurisdictions like Yarrow Point to obtain competitive pricing for system improvements and general maintenance activities. In addition they often reduce the overall cost for design, bidding, and other project management activities and provide the least disruption to the surrounding neighborhood. As such, PACE highly recommends Yarrow Point town staff establishes and maintains a contact list (ie. names, emails, phone numbers, job descriptions, past partnering projects, etc.) for neighboring jurisdictions, King County, local conservation groups, and other state agencies and then coordinates with them yearly to determine if partnering opportunities are available. In an effort to get started, PACE has provided a potential list of agencies below.

Neighboring Jurisdictions (Public Works and Maintenance)

- Town of Beaux Arts Village
- City of Bellevue

- City of Clyde Hill
- City of Kirkland
- City of Medina
- Town of Hunts Point

King County (KC)

- KC – Stormwater Utility Billing Contact
- KC – Road Services Division
- KC – Flood Control District
- KC – Conservation District

Local Conservation Districts

- Wetherill Nature Preserve
- WRIA 8

Washington State Entities

- Washington State Department of Transportation (WSDOT)
- WA Transportation Improvement Board
- Department of Fish and Wildlife
- Army Corp of Engineers
- Department of Ecology

7.3 POTENTIAL FUNDING ALTERNATIVES

Agencies often find it takes more than one source of revenue to adequately improve, maintain, and manage a stormwater system. For instance, some alternatives are limited by the amount of revenue they can generate or their projected duration, while others are bound by the types of projects or services they can legally provide. Ultimately it is the preference of agency staff, as supported by elected officials and the general public that determines which alternatives are utilized. This section provides four (4) additional funding alternatives traditionally used by municipalities for stormwater capital improvement projects, annual maintenance, and on-going stormwater management programs.

7.3.1 Fee-in-Lieu

The Town's Stormwater Drainage Guidelines currently require every redevelopment activity that creates a net increase in impervious area greater than 750 square feet to provide an on-site private detention system. Some of these projects however, only need to detain increased flows because the future buildout capacity of the public stormwater drainage

system which receives their runoff has been deemed inadequate to handle the 25-year peak flows for that basin. For this reason the Town of Yarrow Point began evaluating a Fee-in-Lieu of Stormwater Detention in the summer of 2017. If adopted, this funding alternative would generally apply the funds required to install private on-site detention systems to public infrastructure. The concept is beneficial not only to the Town, but also to the developer in that it eliminates the need for a detailed stormwater detention design, shortens the overall permit review time, reduces the cost and time for construction, and most importantly eliminates the need for future maintenance and inspection.

The original concept states the developer may pay a fee-in-lieu-of constructing the stormwater detention facility required by the Yarrow Point Municipal Code, Chapter 20 when authorized by the Town Engineer. In an effort to be equitable, the fee is based on the total proposed impervious area. Fees collected were to be held by the Town's stormwater utility and spent on stormwater management projects within the same basin as the development. On average if the Town sees five new homes per year which require a detention facility and each of these projects propose to install 5,000 square feet or more of impervious surface, this funding alternative could add an additional $75,000/year (5 * $15,000) to the Town's Stormwater Utility.

PACE agrees the concept of a Fee-In-Lieu-Of Stormwater Detention is a viable funding alternative and in fact, it has been used successfully in other jurisdictions (ie. Mercer Island). We recommend Town staff reevaluates this option in the summer of 2020Development Review Fees

Cities and counties have the legal authority and the option to assess charges for the services they provide. Many municipal services, including development review and construction/maintenance inspections can be 100-percent fee supported. It is usually in the agency's best long-term interest not to subsidize these types of services from the Town's general fund. Instead, fees should be based on the actual costs.

For those agencies that do charge development review fees, many do not track separate review processes and are not able to transfer any portion of the review fees back to the stormwater program. To assist in the tracking of these internal labor costs, some municipalities charge a separate drainage review fee that can be directly related to stormwater services provided, particularly when local guidelines require the submittal of separate drainage plans or reports as part of the development application.

7.3.2 Grants

The State of Washington operates grant programs which are available to all towns, cities, and counties, including;:

- Department of Ecology's State Water Pollution Control Revolving Fund – Planning Projects, Pre-Construction Projects
- Department of Ecology's Centennial Clean Water Fund (CCWF) – Planning Projects, Pre-Construction Projects

- Public Works Trust Fund – Design and Construction Projects
- Community Economic Revitalization Board – Construction Program

Although highly competitive, the aforementioned grants can be a good source of funding for planning/ pre-design activities, habitat enhancement, stormwater CIP construction, and/or water quality projects.

NOTE: The Town of Yarrow Point is not eligible for the Department of Ecology grant program as it is currently exempt from the Phase II NPDES permit requirements (see Chapter 4).

7.3.3 State Low-Interest Loans

The State's Public Works Trust Fund, State Revolving Fund (SRF), and the Centennial Clean Water Fund (CCWF) each contain low interest loan programs (1-5%) for drainage and flood control-related projects. These loans are a good opportunity for small communities which have established a stable source of annual revenues by way of an existing stormwater utility. Most loans are available for planning and/or construction and depending on the economy, may be a good funding source for some of the Town's smaller capital improvement projects.

7.3.4 Revenue Bonds

Revenue bonds can contribute substantial annual income to a stormwater program and prevent fluctuating monthly charges which may occur using a pay-as-you-go approach, but the Town should carefully consider the cost/benefit ratio of this funding alternative. Bonding is dependent upon the Town's general financial health including most notably the stability of its stormwater utility (Utility). For instance, to qualify for the use of bonding it is important the Utility maintains a reasonable operating reserve fund in order to demonstrate solvency and obtain an adequate bond rating. Likewise, annual utility rates must be high enough to allow revenue bonds to be issued for capital projects and bonds are normally limited to previously designed and permitted projects. There is also typically an annual payment to service the bond debt (~10% of the bonded amount) and bonding may require public input and approval beyond the Town Council level. If the Town wishes to further evaluate this option, PACE recommends arranging an information session with a local bonding company, similar to the approach taken in 2010 (prior to formation of the Town's stormwater utility) with Foster Pepper, PLLC.

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APPENDIX A
STORMWATER CALCULATIONS

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BASIN A

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MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201610006
Project Simulation Performed on: 06/20/2019 8:45 AM
Report Generation Date: 06/20/2019 8:47 AM

Input File Name: BASIN A.fld
Project Name: Yarrow Point
Analysis Title: Basin A
Comments:

——————————————— PRECIPITATION INPUT ———————————————

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	16.530	16.530
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	16.530	16.530

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Forest	16.530
Subbasin Total	16.530

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Grass	6.380
Impervious	10.150
Subbasin Total	16.530

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	2850.251
Total:	2850.251

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	779.704
Total:	779.704

Total Predevelopment Recharge is Greater than Post Developed

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 18.040 ac-ft/year, Post Developed: 4.935 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.352	2-Year	4.331
5-Year	0.574	5-Year	5.539
10-Year	0.774	10-Year	6.939
25-Year	0.981	25-Year	9.339
50-Year	1.252	50-Year	11.166
100-Year	1.356	100-Year	13.901
200-Year	2.111	200-Year	13.970

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	559.5%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2257.7%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	89.1%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	559.5%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

BASIN B

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MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201610006
Project Simulation Performed on: 06/05/2020 11:11 AM
Report Generation Date: 06/05/2020 11:12 AM

Input File Name: BASIN B - reduced.fld
Project Name: Yarrow Point
Analysis Title: Basin B
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

		Predeveloped	Post Developed
Total Subbasin Area (acres)	2.820	2.820	
Area of Links that Include Precip/Evap (acres)	0.000	0.000	
Total (acres)	2.820	2.820	

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Forest	2.820
Subbasin Total	2.820

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Grass	0.980
Impervious	1.840
Subbasin Total	2.820

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

**********Groundwater Recharge Summary **********
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	486.250
Total:	486.250

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	119.766
Total:	119.766

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)

Predeveloped: 3.078 ac-ft/year, Post Developed: 0.758 ac-ft/year

*************Water Quality Facility Data ****************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ****************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	6.009E-02	2-Year	0.771
5-Year	9.794E-02	5-Year	0.977
10-Year	0.132	10-Year	1.224
25-Year	0.167	25-Year	1.655
50-Year	0.214	50-Year	1.941
100-Year	0.231	100-Year	2.425
200-Year	0.360	200-Year	2.437

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	571.6%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2364.7%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	85.2%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	571.6%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

BASIN C

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MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201610006
Project Simulation Performed on: 03/31/2020 2:42 PM
Report Generation Date: 03/31/2020 2:43 PM

Input File Name: BASIN C.fld
Project Name: Yarrow Point
Analysis Title: Basin C
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post
Developed		
Total Subbasin Area (acres)	7.720	7.720
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	7.720	7.720

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Forest	7.720
Subbasin Total	7.720

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Grass	2.850
Impervious	4.870
Subbasin Total	7.720

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	1331.151
Total:	1331.151

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	348.300
Total:	348.300

Total Predevelopment Recharge is Greater than Post Developed

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 8.425 ac-ft/year, Post Developed: 2.204 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.165	2-Year	2.064
5-Year	0.268	5-Year	2.625
10-Year	0.361	10-Year	3.282
25-Year	0.458	25-Year	4.435
50-Year	0.585	50-Year	5.258
100-Year	0.633	100-Year	6.567
200-Year	0.986	200-Year	6.586

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	564.8%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2305.7%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	87.4%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	564.8%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

BASIN D

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MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201610006
Project Simulation Performed on: 03/31/2020 3:08 PM
Report Generation Date: 03/31/2020 3:09 PM

Input File Name: BASIN D.fld
Project Name: Yarrow Point
Analysis Title: Basin D
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	10.270	10.270
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	10.270	10.270

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Forest	10.270
Subbasin Total	10.270

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Grass	3.630
Impervious	6.640
Subbasin Total	10.270

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	1770.845
Total:	1770.845

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	443.625
Total:	443.625

Total Predevelopment Recharge is Greater than Post Developed

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 11.208 ac-ft/year, Post Developed: 2.808 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.219	2-Year	2.789
5-Year	0.357	5-Year	3.539
10-Year	0.481	10-Year	4.440
25-Year	0.609	25-Year	5.991
50-Year	0.778	50-Year	7.049
100-Year	0.843	100-Year	8.807
200-Year	1.312	200-Year	8.845

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	569.8%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2348.7%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	85.8%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	569.8%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

BASIN E

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MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201610006
Project Simulation Performed on: 06/04/2020 1:52 PM
Report Generation Date: 06/04/2020 1:53 PM

Input File Name: BASIN E.fld
Project Name: Yarrow Point
Analysis Title: Basin E
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post
Developed		
Total Subbasin Area (acres)	7.080	7.080
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	7.080	7.080

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Forest	7.080
Subbasin Total	7.080

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Grass	2.590
Impervious	4.490
Subbasin Total	7.080

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	1220.797
Total:	1220.797

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	316.526
Total:	316.526

Total Predevelopment Recharge is Greater than Post Developed

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 7.727 ac-ft/year, Post Developed: 2.003 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.151	2-Year	1.900
5-Year	0.246	5-Year	2.414
10-Year	0.331	10-Year	3.019
25-Year	0.420	25-Year	4.081
50-Year	0.536	50-Year	4.830
100-Year	0.581	100-Year	6.034
200-Year	0.904	200-Year	6.052

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	565.8%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2314.6%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	87.1%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	565.8%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

BASIN F

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MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201610006
Project Simulation Performed on: 06/04/2020 5:45 PM
Report Generation Date: 06/04/2020 5:45 PM

Input File Name: BASIN F.fld
Project Name: Yarrow Point
Analysis Title: Basin F
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	6.230	6.230
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	6.230	6.230

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Forest	6.230
Subbasin Total	6.230

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Grass	2.230
Impervious	4.000
Subbasin Total	6.230

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	1074.232
Total:	1074.232

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	272.530
Total:	272.530

Total Predevelopment Recharge is Greater than Post Developed

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 6.799 ac-ft/year, Post Developed: 1.725 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.133	2-Year	1.684
5-Year	0.216	5-Year	2.138
10-Year	0.292	10-Year	2.680
25-Year	0.370	25-Year	3.619
50-Year	0.472	50-Year	4.267
100-Year	0.511	100-Year	5.330
200-Year	0.796	200-Year	5.351

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	568.3%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2336.5%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	86.3%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	568.3%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

BASIN G

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MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201610006
Project Simulation Performed on: 06/04/2020 5:49 PM
Report Generation Date: 06/04/2020 5:49 PM

Input File Name: 2020-06-05_BASIN G.fld
Project Name: Yarrow Point
Analysis Title: Basin G
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	37.760	37.760
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	37.760	37.760

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Forest	37.760
Subbasin Total	37.760

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Grass	12.790
Impervious	24.970
Subbasin Total	37.760

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	6510.917
Total:	6510.917

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	1563.074
Total:	1563.074

Total Predevelopment Recharge is Greater than Post Developed

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 41.208 ac-ft/year, Post Developed: 9.893 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.805	2-Year	10.442
5-Year	1.311	5-Year	13.186
10-Year	1.767	10-Year	16.466
25-Year	2.240	25-Year	22.343
50-Year	2.859	50-Year	26.103
100-Year	3.098	100-Year	32.618
200-Year	4.823	200-Year	32.810

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	574.4%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2389.3%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	84.3%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	574.4%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

BASIN H

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MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201610006
Project Simulation Performed on: 06/04/2020 1:58 PM
Report Generation Date: 06/04/2020 1:58 PM

Input File Name: BASIN H.fld
Project Name: Yarrow Point
Analysis Title: Basin H
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	5.880	5.880
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	5.880	5.880

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Forest	5.880
Subbasin Total	5.880

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Grass	2.030
Impervious	3.850
Subbasin Total	5.880

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	1013.882
Total:	1013.882

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	248.088
Total:	248.088

Total Predevelopment Recharge is Greater than Post Developed

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 6.417 ac-ft/year, Post Developed: 1.570 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.125	2-Year	1.613
5-Year	0.204	5-Year	2.041
10-Year	0.275	10-Year	2.555
25-Year	0.349	25-Year	3.458
50-Year	0.445	50-Year	4.052
100-Year	0.482	100-Year	5.063
200-Year	0.751	200-Year	5.089

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	572.4%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2371.2%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	85.0%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	572.4%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

BASIN J

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MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201610006
Project Simulation Performed on: 06/04/2020 2:01 PM
Report Generation Date: 06/04/2020 2:01 PM

Input File Name: BASIN J.fld
Project Name: Yarrow Point
Analysis Title: Basin J
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	39.620	39.620
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	39.620	39.620

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Forest	39.620
Subbasin Total	39.620

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
Till Grass	13.130
Impervious	26.490
Subbasin Total	39.620

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	6831.635
Total:	6831.635

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	1604.626
Total:	1604.626

Total Predevelopment Recharge is Greater than Post Developed

Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 43.238 ac-ft/year, Post Developed: 10.156 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.844	2-Year	11.057
5-Year	1.376	5-Year	13.954
10-Year	1.854	10-Year	17.348
25-Year	2.351	25-Year	23.607
50-Year	3.000	50-Year	27.486
100-Year	3.251	100-Year	34.348
200-Year	5.060	200-Year	34.577

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	576.6%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2408.8%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	83.5%	FAIL
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	576.6%	FAIL

LID DURATION DESIGN CRITERIA: FAIL

EXISTING CONDITIONS

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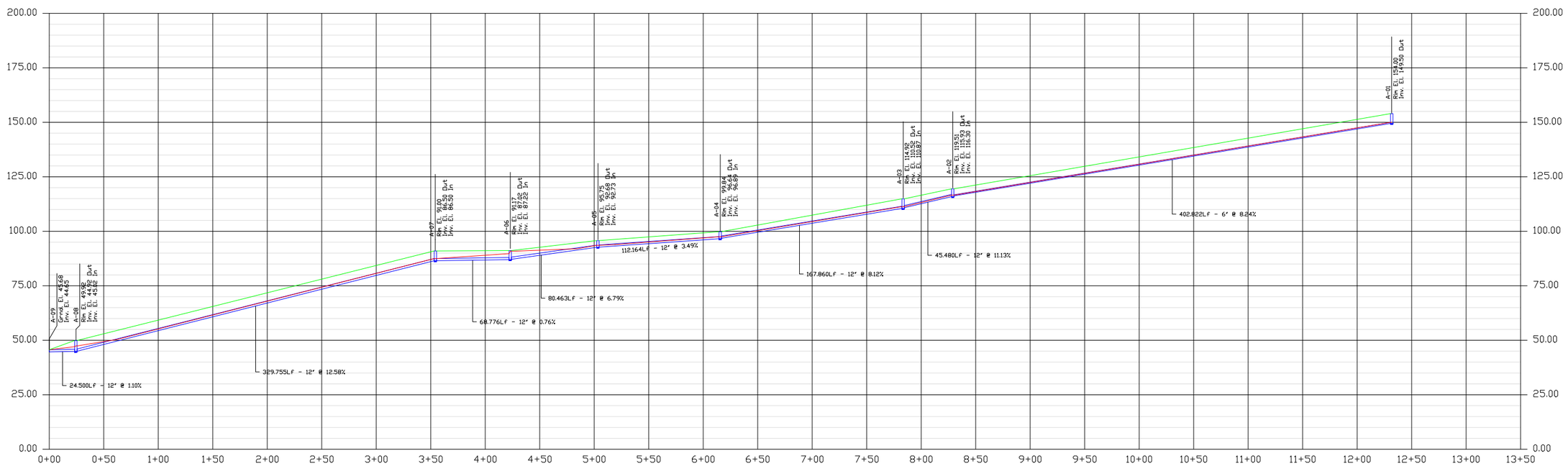

EXISTING CONDITIONS

JOHN RUSSELL POREA
STATE OF WASHINGTON
50442
REGISTERED
PROFESSIONAL ENGINEER

DESIGNED CN					
DRAWN CN					
CHECKED JF					
	SYM	REVISION	DATE	BY	APP'D

PACE
An Engineering Services Company

11255 Kirkland Way, Suite 300
Kirkland, WA 98033
p. 425.827.2014 | f. 425.827.5043
Civil | Structural | Planning | Survey
www. paceengrs.com

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DATE 05/28/2020

SCALE 1"=50'(H);1"=25'(V)

TOWN OF YARROW POINT

PROFILE A 25-YEAR STORM

PACE PROJECT NO. 19357

DWG NAME: P19357_PROF A

SHEET 1 OF 34

FILE NAME: P:\19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF A.DWG
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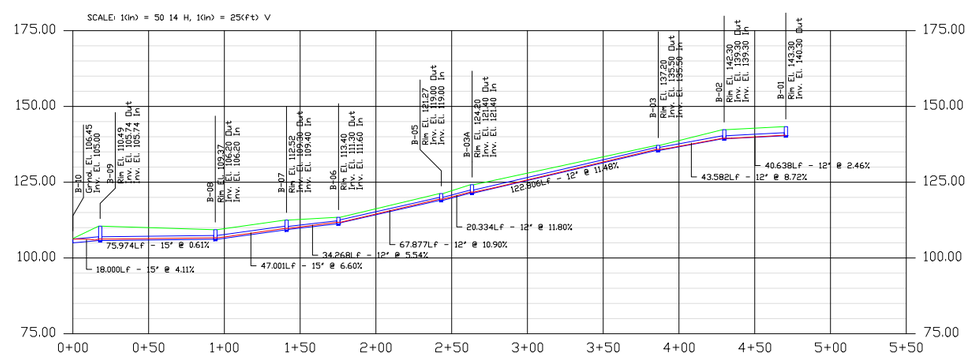
USER NAME: CHRISTIAN NICHOLS
XREF FILES: X19357_BASE.dwg X19357 EX PROF A.dwg



EXISTING CONDITIONS

DESIGNED CN					
DRAWN CN					
CHECKED JF					
	SYM	REVISION	DATE	BY	APP'D

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11255 Kirkland Way, Suite 300
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VERIFY SCALE
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0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DATE **05/28/2020**
SCALE **1"=50'(H);1"=25'(V)**

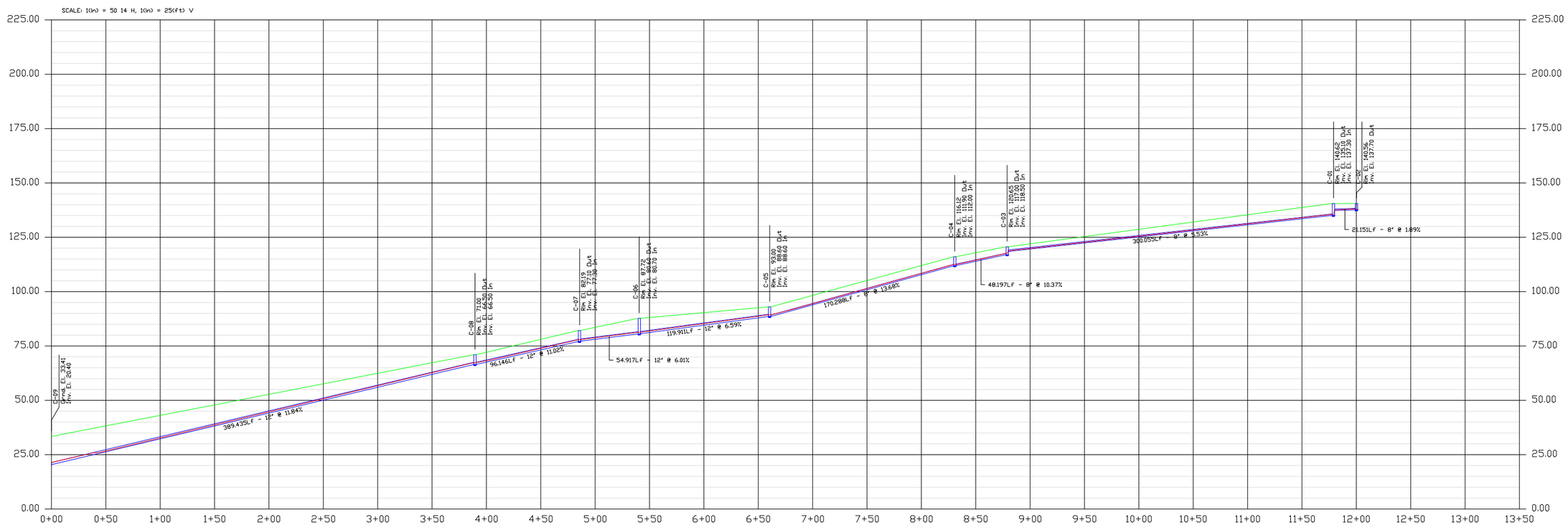
TOWN OF YARROW POINT

PROFILE B 25-YEAR STORM

PACE PROJECT NO. **19357**
DWG NAME: P19357_PROF B
SHEET 2 OF 34

JOHN RUSSELL FORDA
STATE OF WASHINGTON
50442
REGISTERED
PROFESSIONAL ENGINEER

FILE NAME: P:\19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF B.DWG
SAVE TIME: 5/28/2020 3:09:09 PM PLOT TIME: 5/28/2020 3:33 PM
USER NAME: CHRISTIAN NICHOLS
XREF FILES: X19357_BOR.dwg X19357 EX PROF B 25YR.dwg



EXISTING CONDITIONS

JOHN RUSSELL JORDAN
STATE OF WASHINGTON
50442
REGISTERED
PROFESSIONAL ENGINEER

FILE NAME: P:\19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF C.DWG
SAVE TIME: 5/28/2020 5:09:30 PM PLOT TIME: 5/28/2020 5:53 PM
USER NAME: CHRISTIAN NICHOLS
XREF FILES: X19357_BASE.dwg X19357 EX PROF C 25YR.dwg

DESIGNED	CN
DRAWN	CN
CHECKED	JF

SYM	REVISION	DATE	BY	APP'D

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An Engineering Services Company

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VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DATE 05/28/2020

SCALE 1"=50'(H);1"=25'(V)

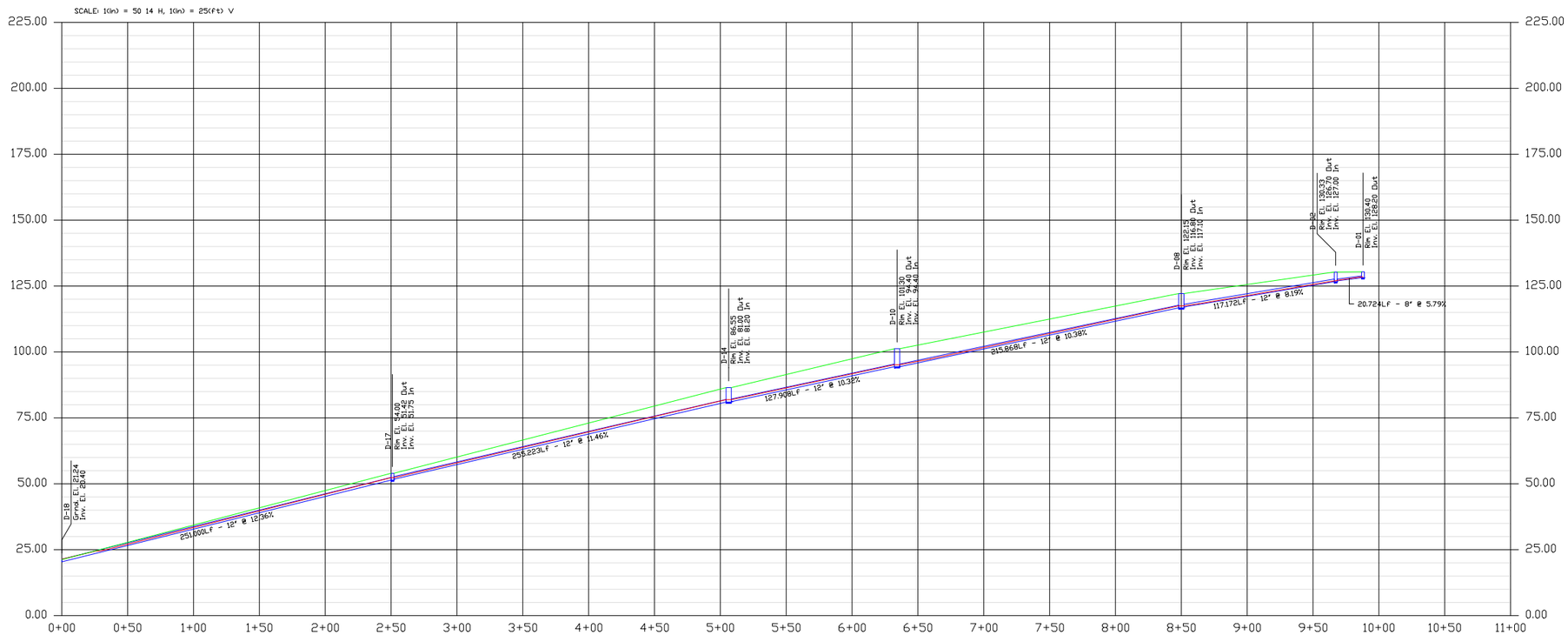
TOWN OF YARROW POINT

PROFILE C 25-YEAR STORM

PACE PROJECT NO. 19357

DWG NAME: P19357_PROF C

SHEET 3 OF 34



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TOWN OF YARROW POINT

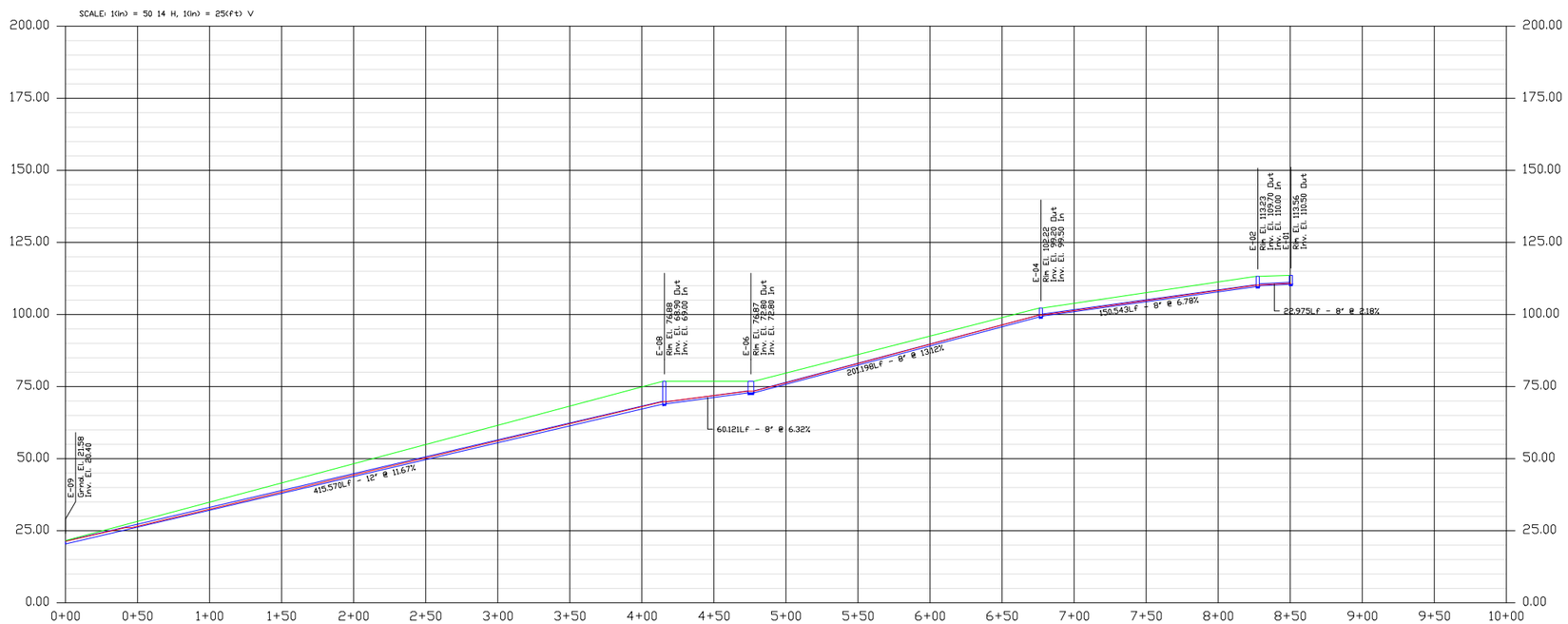
PROFILE D 25-YEAR STORM

JOHN RUSSELL HORSEN
STATE OF WASHINGTON
50442
REGISTERED
PROFESSIONAL ENGINEER

PACE PROJECT NO.
19357

DWG NAME: P19357_PROF D

SHEET 4 OF 34



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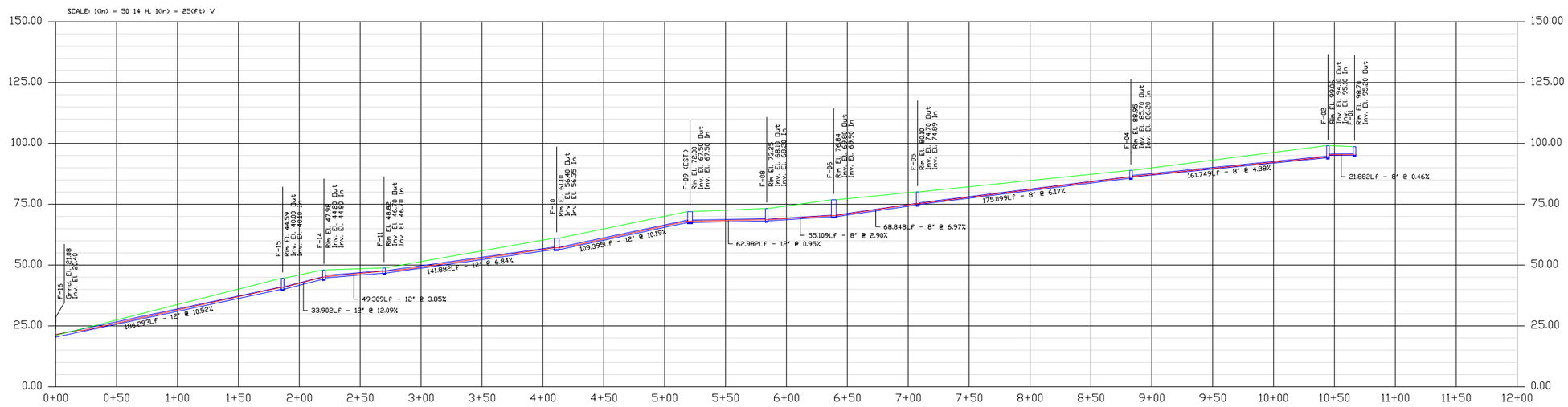
TOWN OF YARROW POINT

PROFILE E 25-YEAR STORM

JOHN RUSSELL LORDEN
STATE OF WASHINGTON
50442
REGISTERED
PROFESSIONAL ENGINEER

PACE PROJECT NO. 19357
DWG NAME: P19357_PROF E
SHEET 5 OF 34



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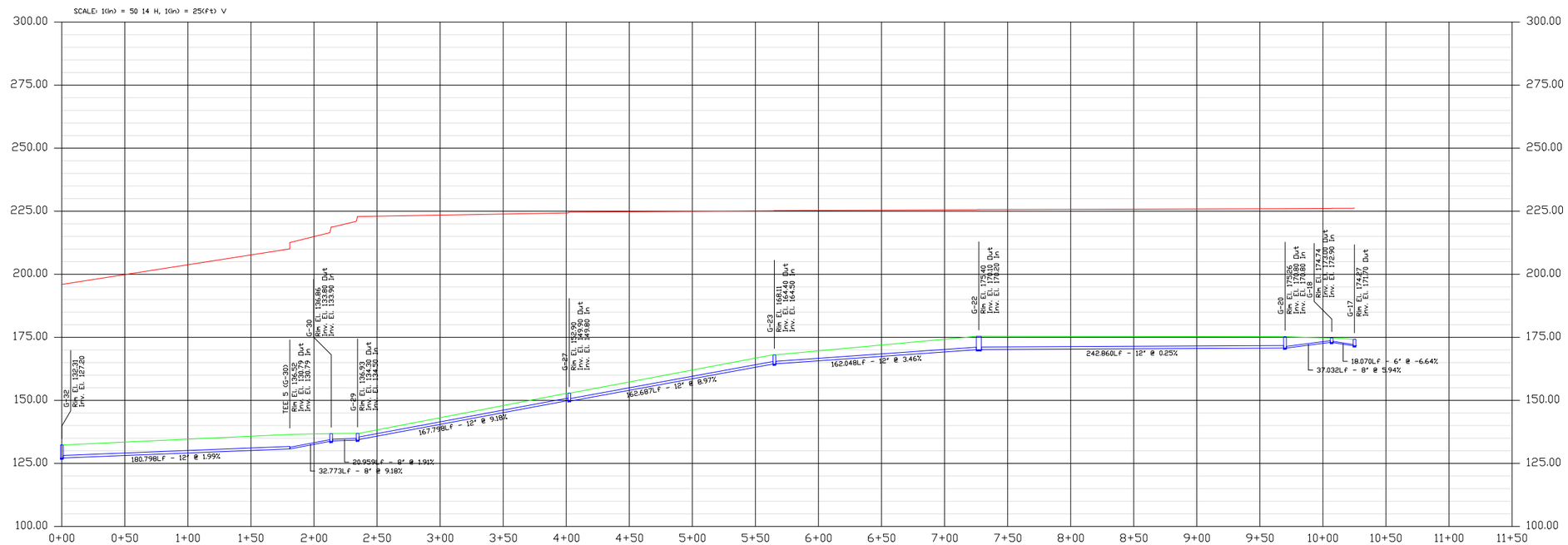
TOWN OF YARROW POINT

PROFILE F 25-YEAR STORM

PACE PROJECT NO. 19357
DWG NAME: P19357_PROF F
SHEET 6 OF 34



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TOWN OF YARROW POINT

PROFILE G 25-YEAR STORM

PACE PROJECT NO.
19357

DWG NAME: P19357_PROF G

SHEET 7 OF 34

FILE NAME: P:\P19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF G.DWG
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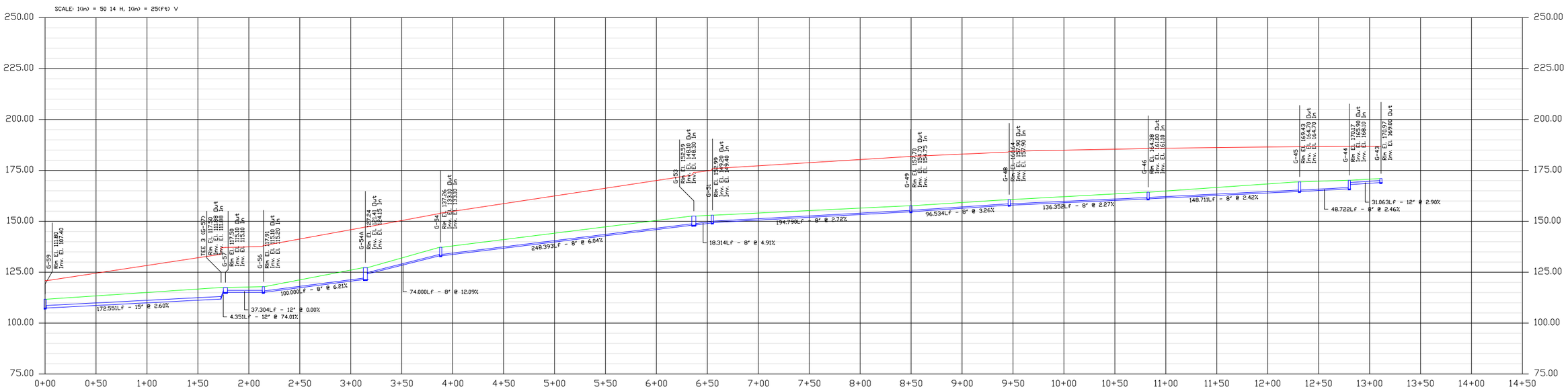

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TOWN OF YARROW POINT

PROFILE G-2 25-YEAR STORM

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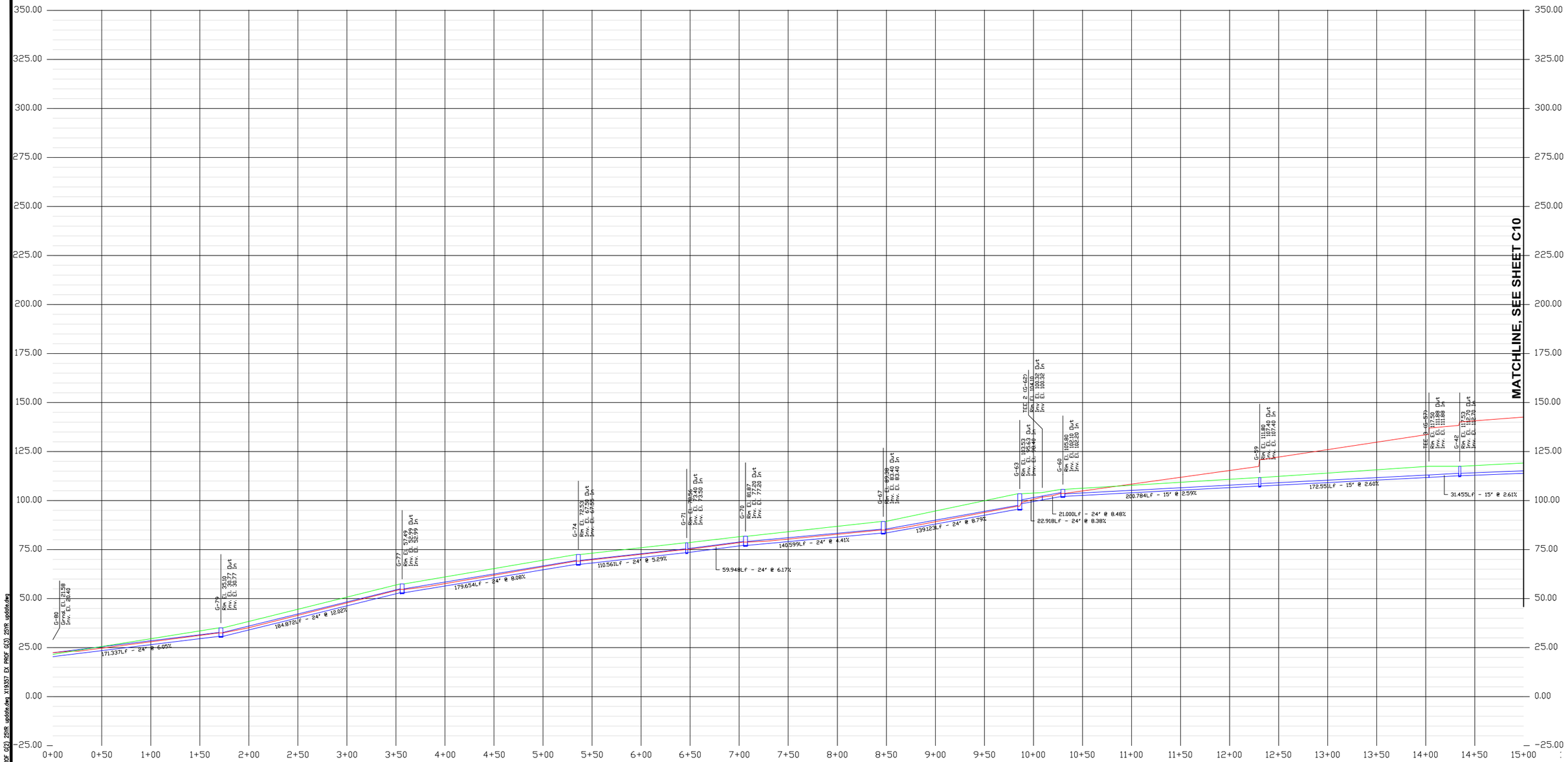
DWG NAME:P19357_PROF G
SHEET 8 OF 34



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TOWN OF YARROW POINT

PROFILE G-3 25-YEAR STORM

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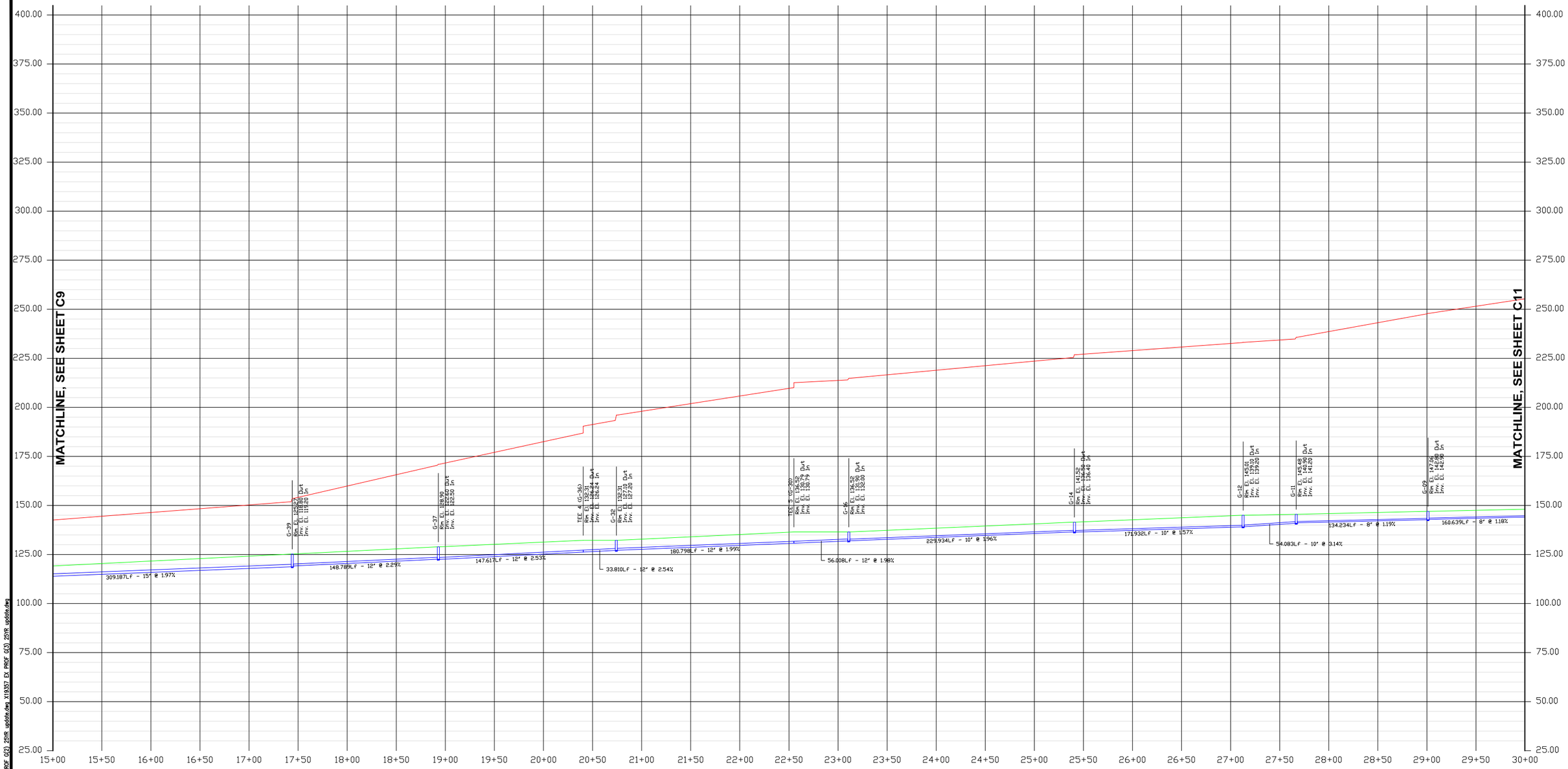
DWG NAME:P19357_PROF G
SHEET 9 OF 34



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TOWN OF YARROW POINT

PROFILE G-4 25-YEAR STORM

PACE PROJECT NO.
19357

DWG NAME:P19357_PROF G

SHEET 10 OF 34

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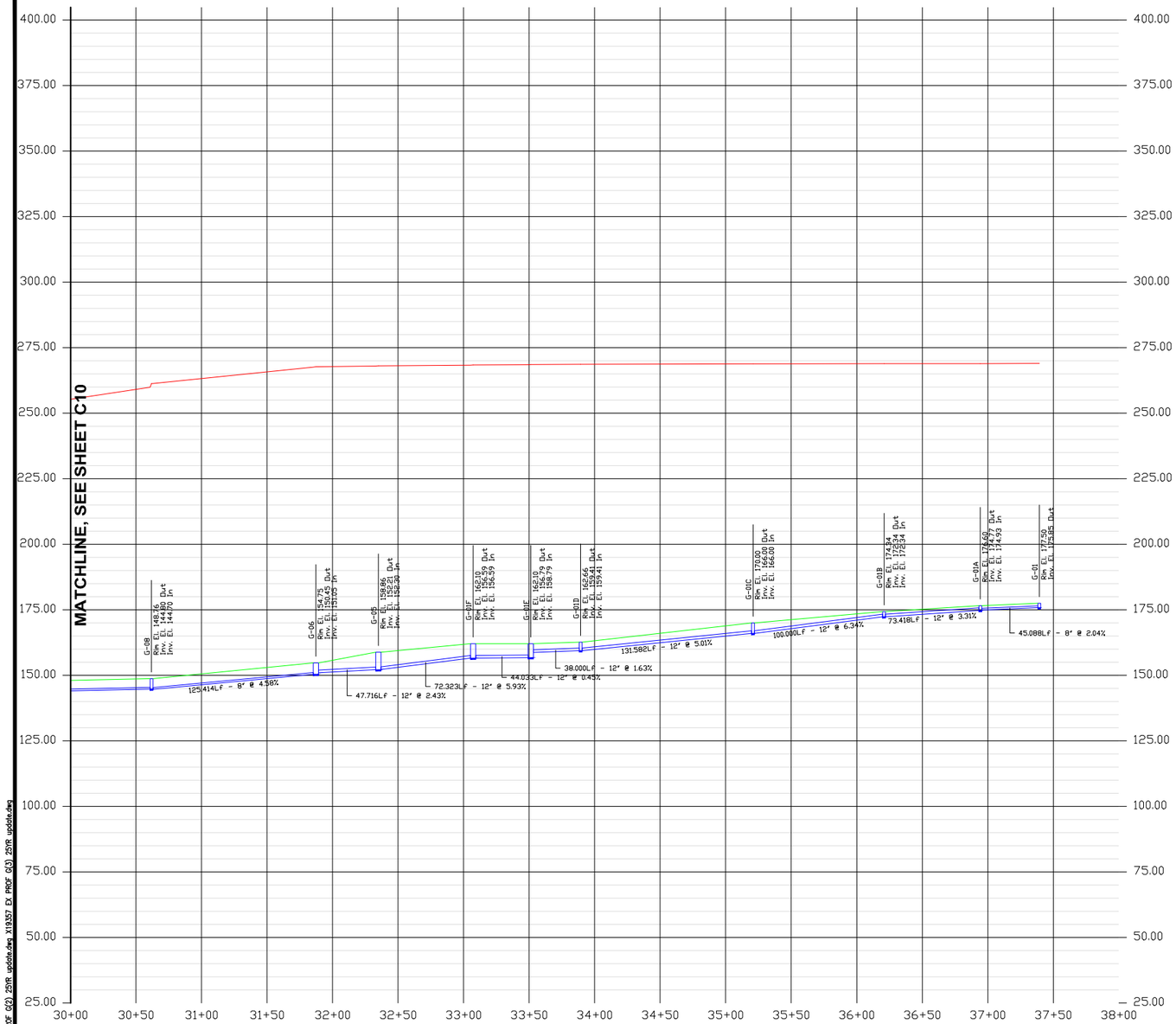

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TOWN OF YARROW POINT

PROFILE G-5 25-YEAR STORM

PACE PROJECT NO. 19357

DWG NAME: P19357_PROF G

SHEET 11 OF 34

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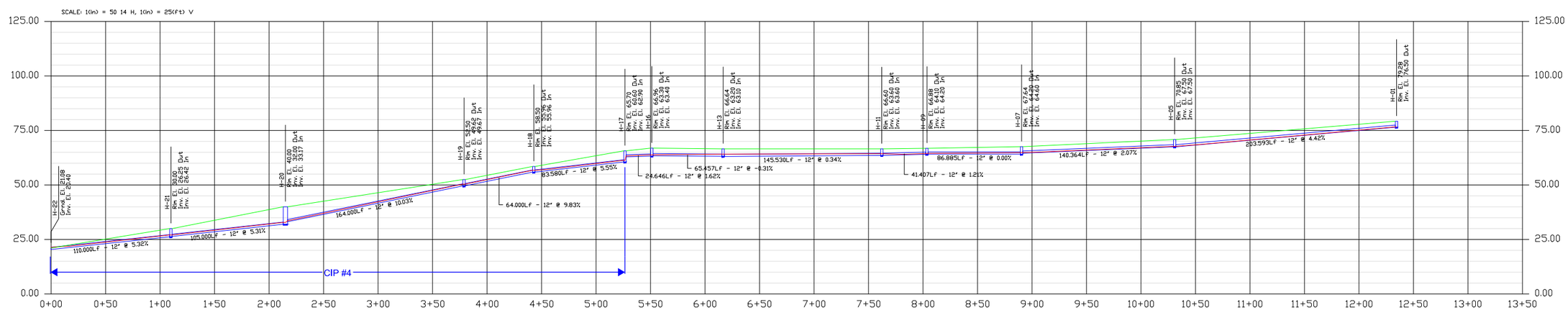

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TOWN OF YARROW POINT

PROFILE H 25-YEAR STORM

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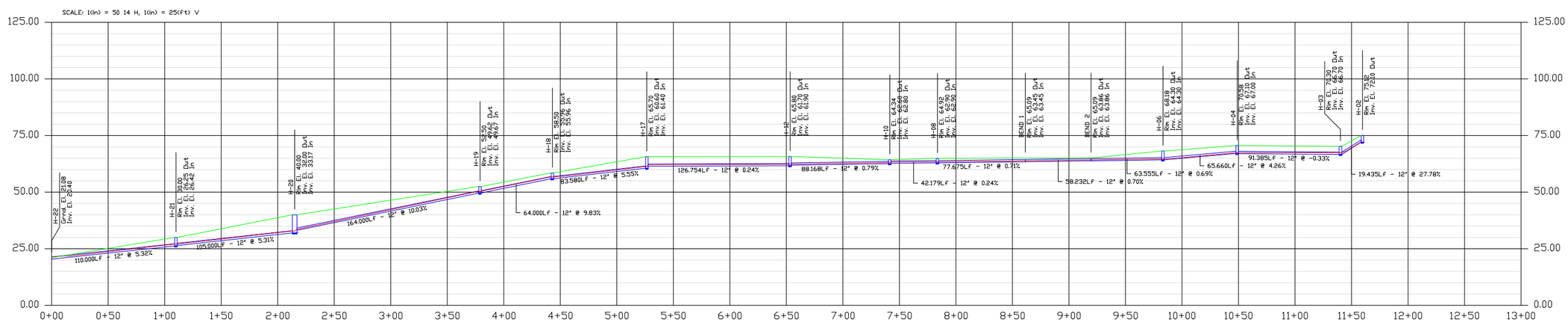
DWG NAME: P19357_PROF H
SHEET 12 OF 34



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TOWN OF YARROW POINT

PROFILE H-2 25-YEAR STORM

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PACE PROJECT NO. 19357
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SHEET 13 OF 34

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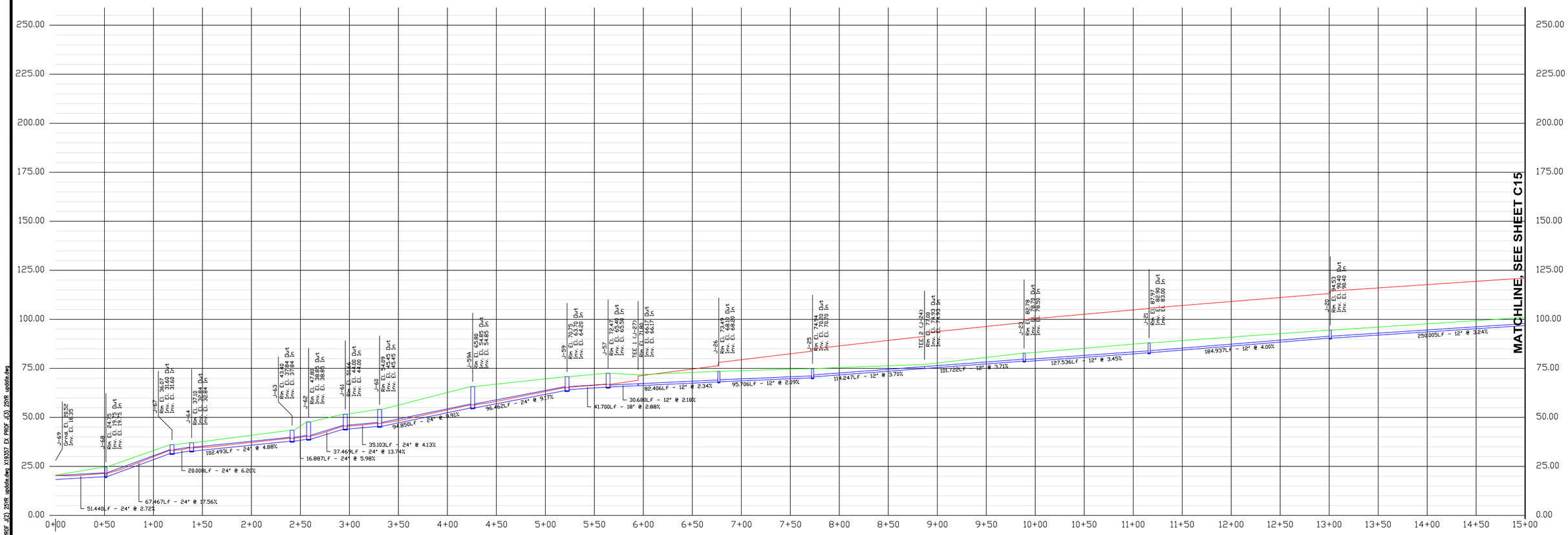

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TOWN OF YARROW POINT

PROFILE J 25-YEAR STORM

PACE PROJECT NO. 19357
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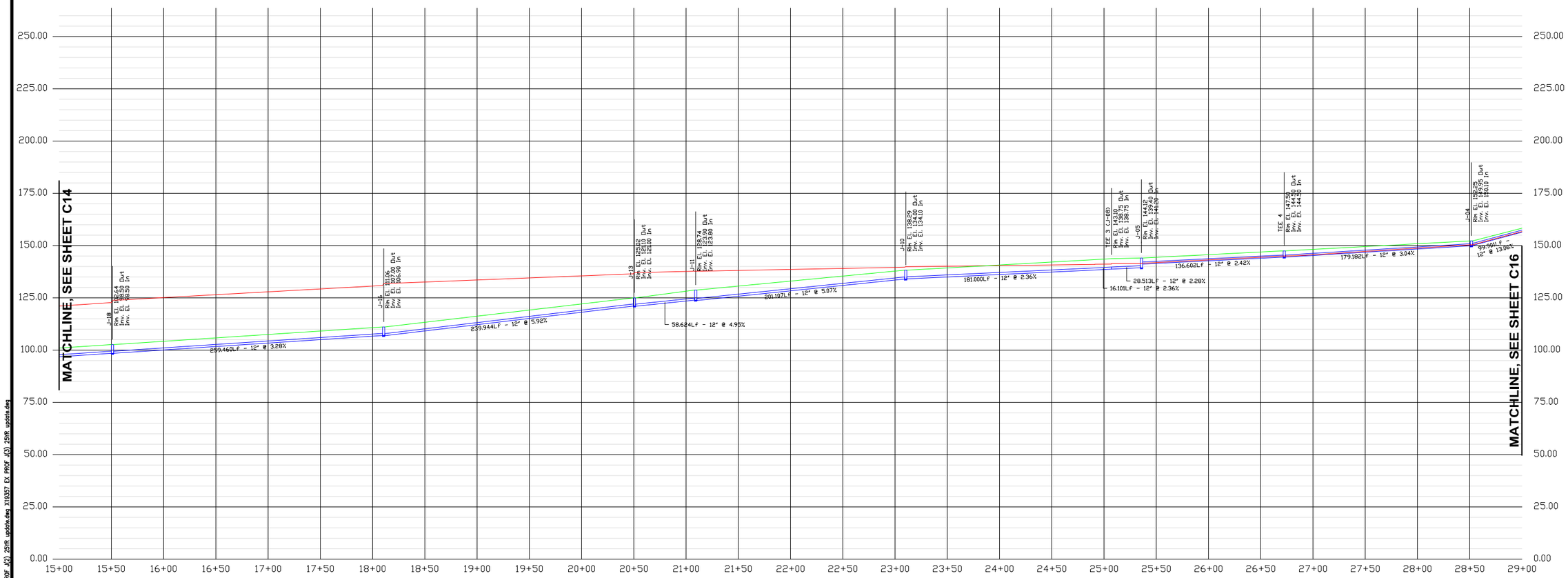

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TOWN OF YARROW POINT

PROFILE J-2 25-YEAR STORM

PACE PROJECT NO. 19357

DWG NAME: P19357_PROF J

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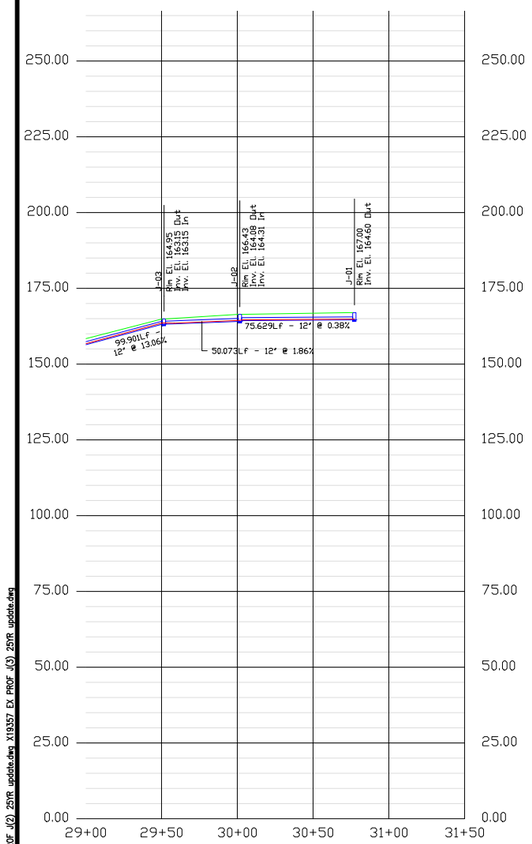

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TOWN OF YARROW POINT

PROFILE J-3 25-YEAR STORM

PACE PROJECT NO. 19357
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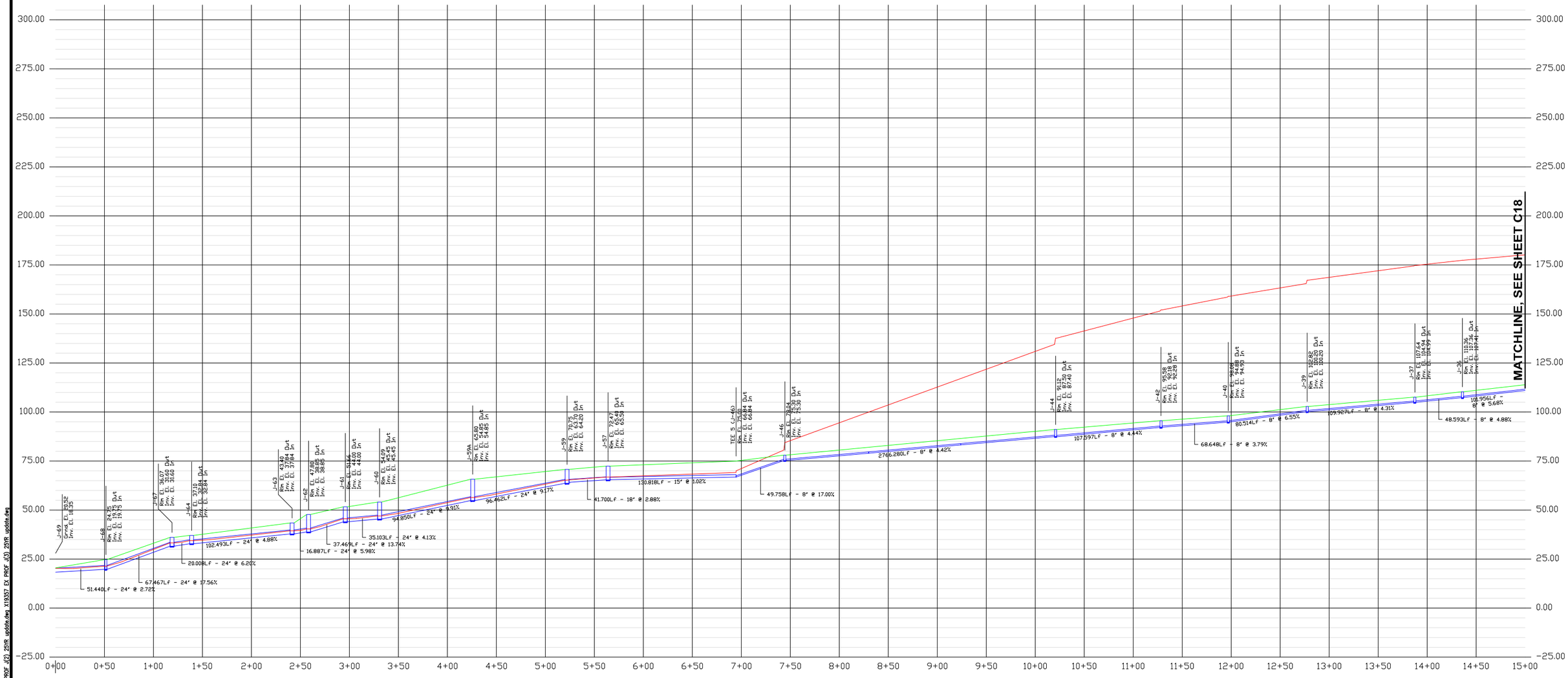

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TOWN OF YARROW POINT

PROFILE J-4 25-YEAR STORM

PACE PROJECT NO. 19357

DWG NAME: P19357_PROF J

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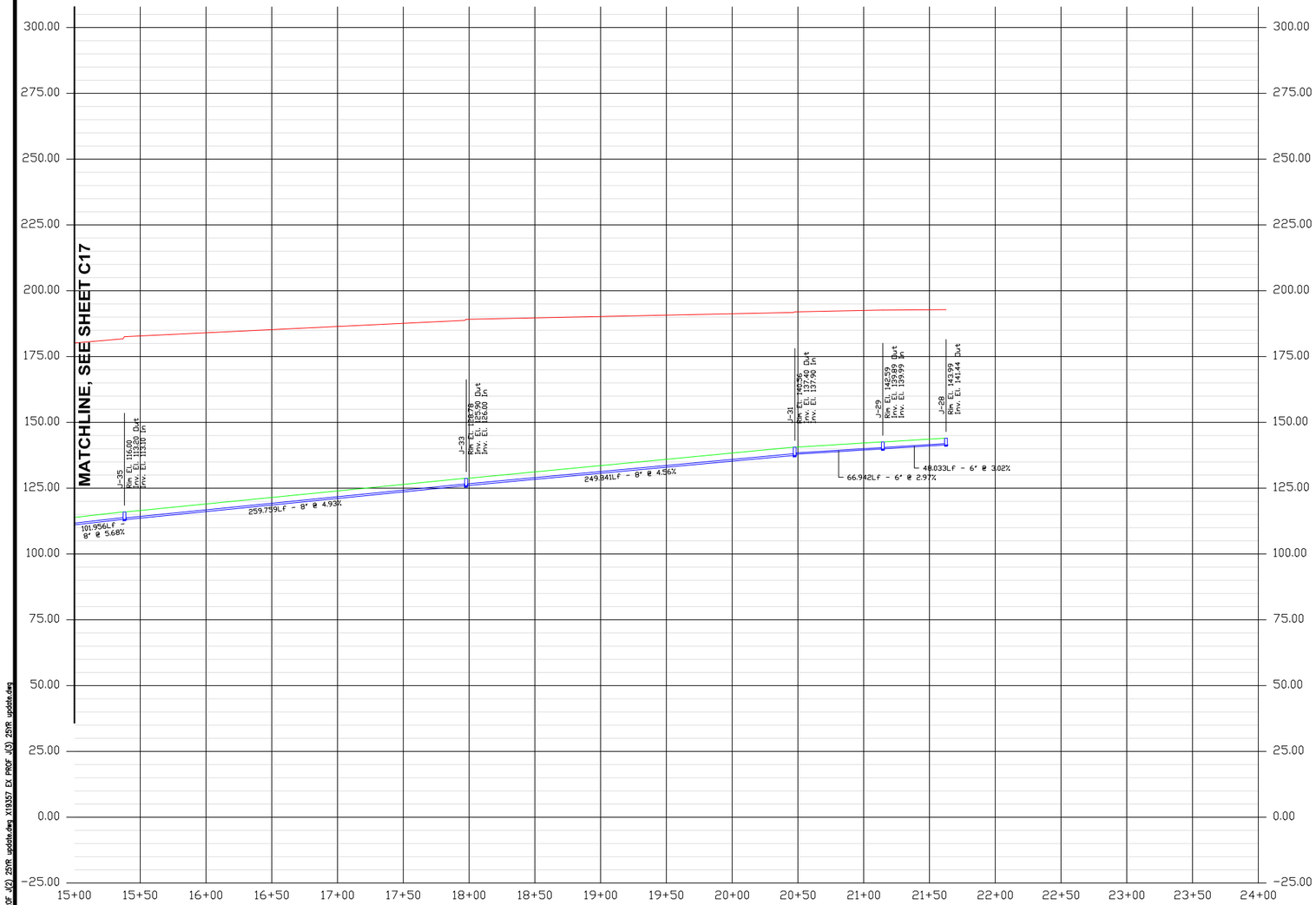

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DATE 05/28/2020

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TOWN OF YARROW POINT

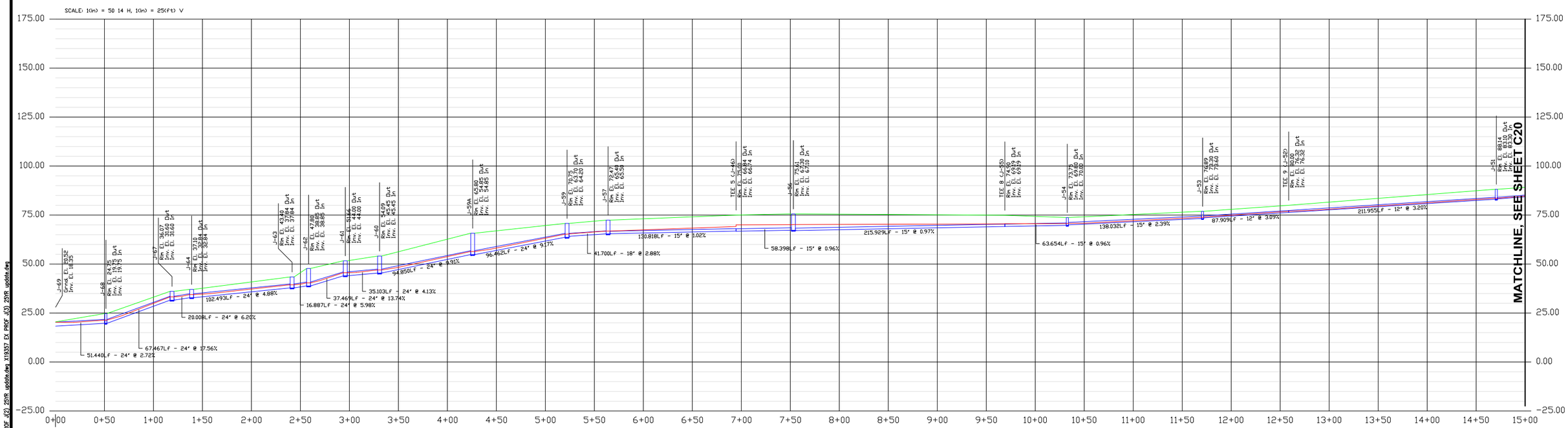
PROFILE J-5 25-YEAR STORM

JOHN RUSSELL FORD
STATE OF WASHINGTON
50442
REGISTERED
PROFESSIONAL ENGINEER

PACE PROJECT NO. 19357

DWG NAME:P19357_PROF J

SHEET 18 OF 34



EXISTING CONDITIONS

JOHN RUSSELL JORDAN
STATE OF WASHINGTON
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PROFESSIONAL ENGINEER

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DRAWN CN					
CHECKED JF					
	SYM	REVISION	DATE	BY	APP'D

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TOWN OF YARROW POINT

PROFILE J-6 25-YEAR STORM

PACE PROJECT NO. 19357

DWG NAME: P19357_PROF J

SHEET 19 OF 34

FILE NAME: P:\19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF J.DWG
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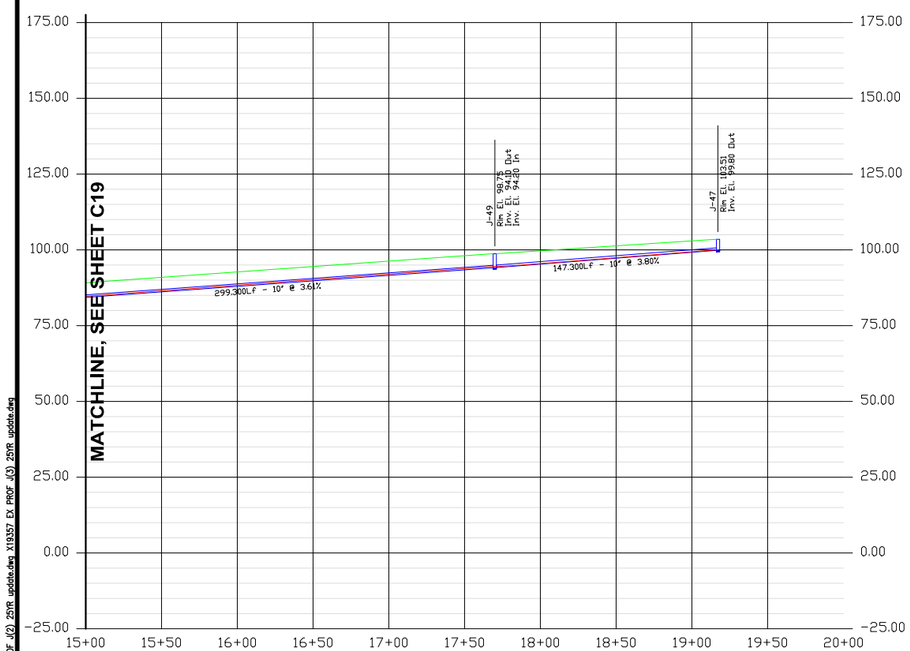

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TOWN OF YARROW POINT

PROFILE J-7 25-YEAR STORM

JOHN RUSSELL FOIDA
STATE OF WASHINGTON
50442
05/31/2020
PROFESSIONAL ENGINEER

PACE PROJECT NO.
19357
DWG NAME:P19357_PROF J
SHEET 20 OF 34

FILE NAME: P:\P19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF J.DWG
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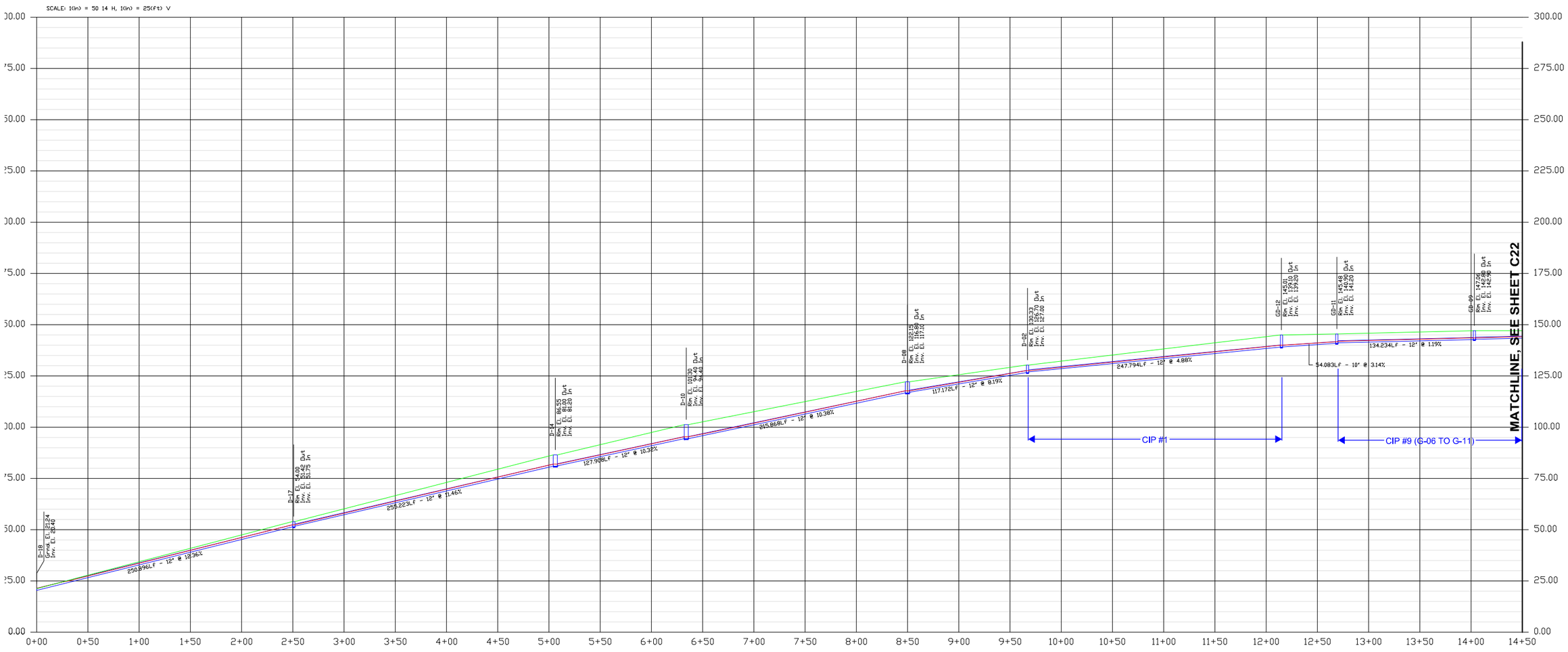

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STATE OF WASHINGTON
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REGISTERED PROFESSIONAL ENGINEER

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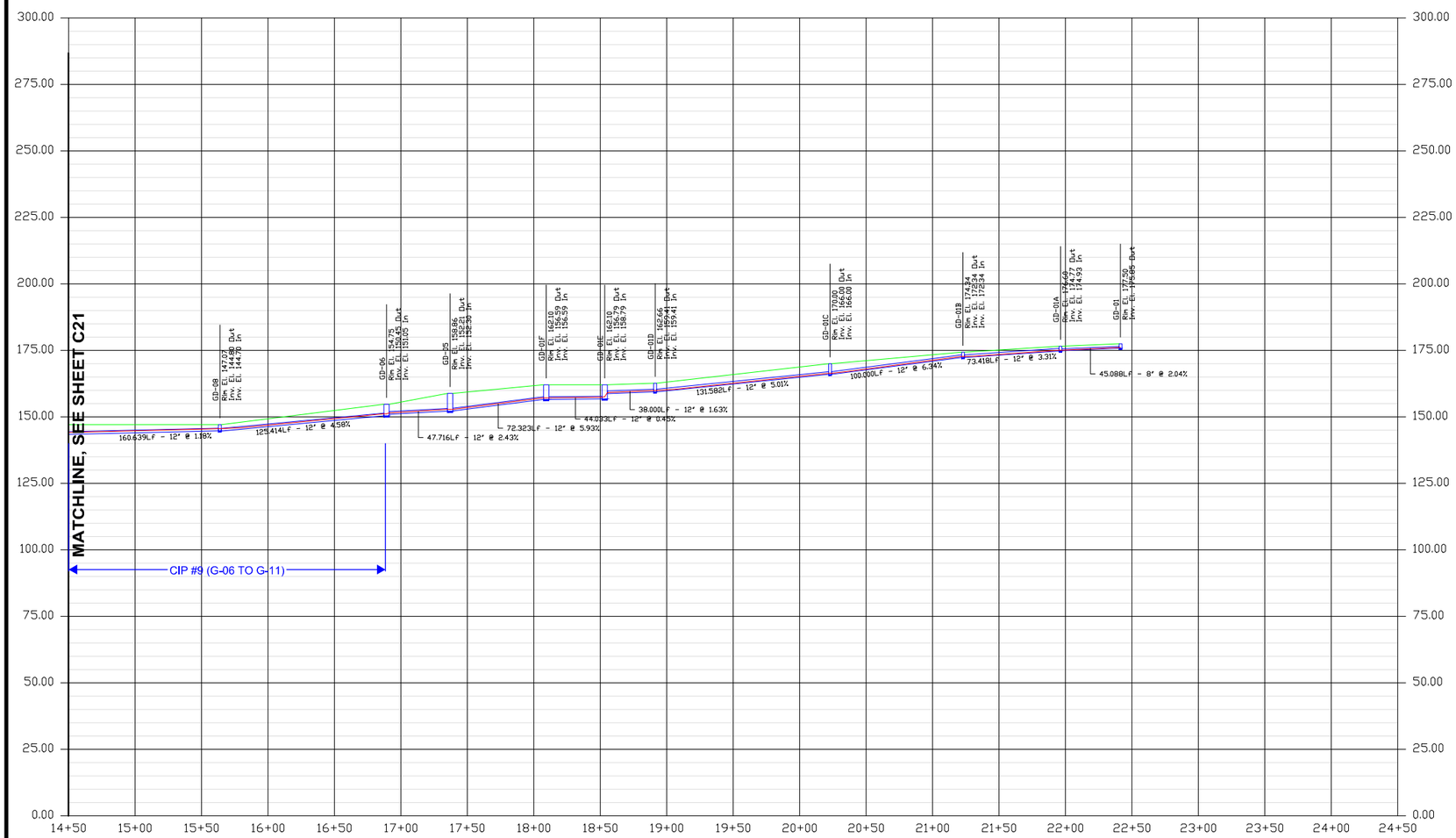
TOWN OF YARROW POINT

PROFILE D WITH DIVERTED FLOW

PACE PROJECT NO. 19357
DWG NAME: P19357_PROF D FIX
SHEET 21 OF 34



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TOWN OF YARROW POINT

PROFILE D-2 WITH DIVERTED FLOW

PACE PROJECT NO. 19357
DWG NAME: P19357_PROF D FIX
SHEET 22 OF 34

FILE NAME: P:\19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF D FIX.DWG
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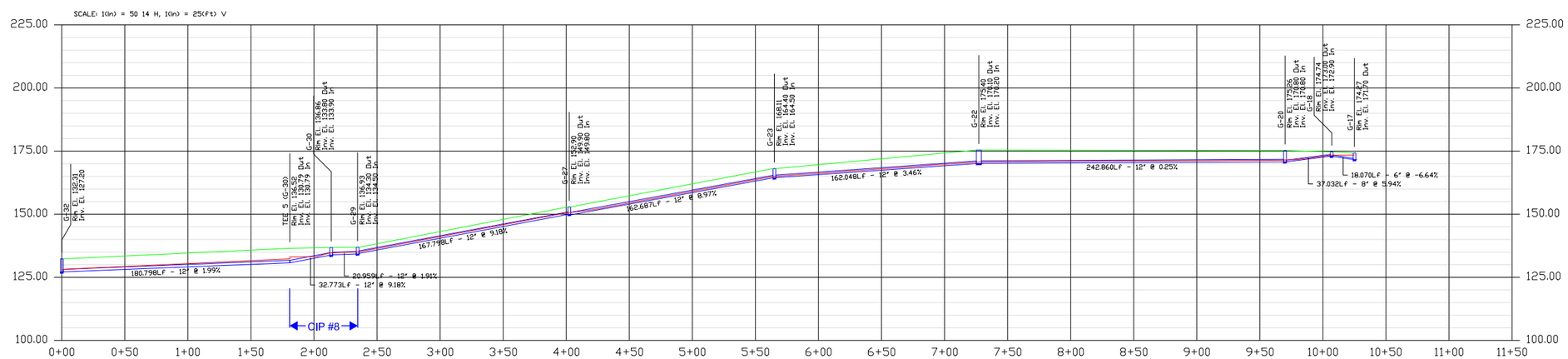

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TOWN OF YARROW POINT

PROFILE G WITH SPOT FIXES

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PACE PROJECT NO. 19357
DWG NAME: P19357_PROF G FIX
SHEET 24 OF 34

FILE NAME: P:\P19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF G FIXLDWG
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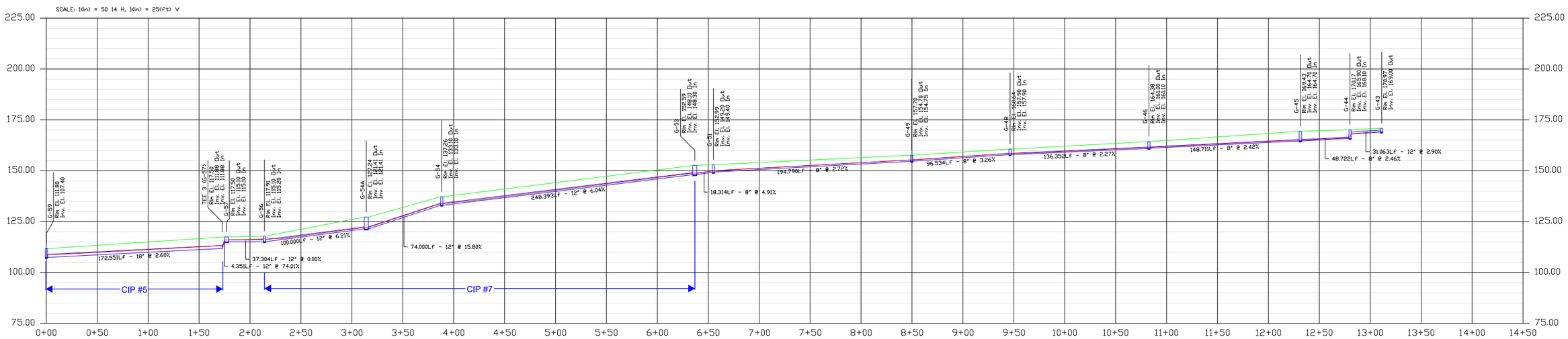

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TOWN OF YARROW POINT

PROFILE G-2 WITH SPOT FIXES

PACE PROJECT NO. 19357

DWG NAME: P19357_PROF G FIX

SHEET 25 OF 34

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FILE NAME: P:\P19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF G FIX.DWG
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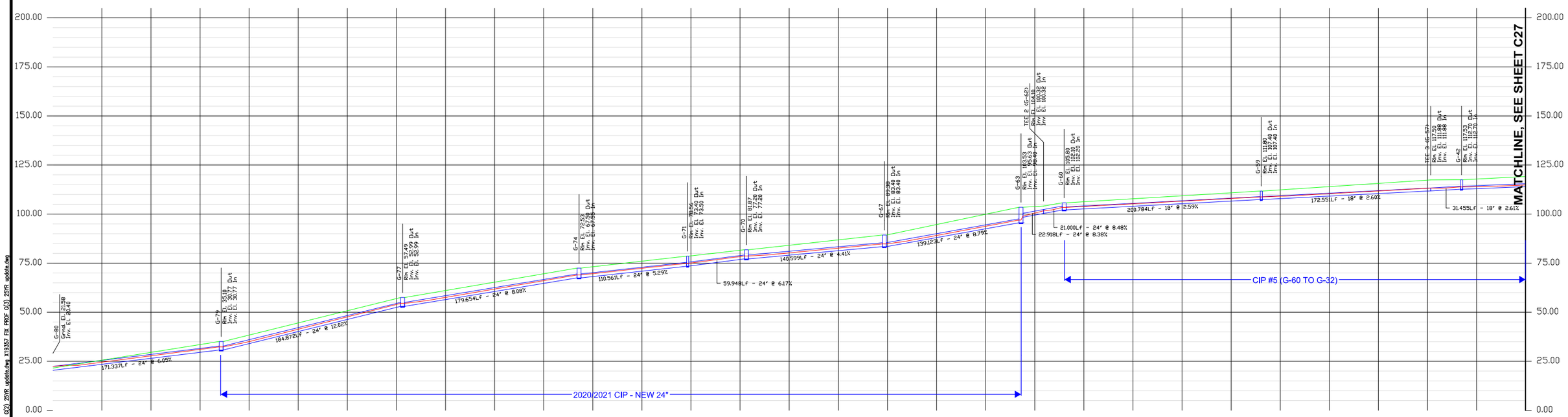

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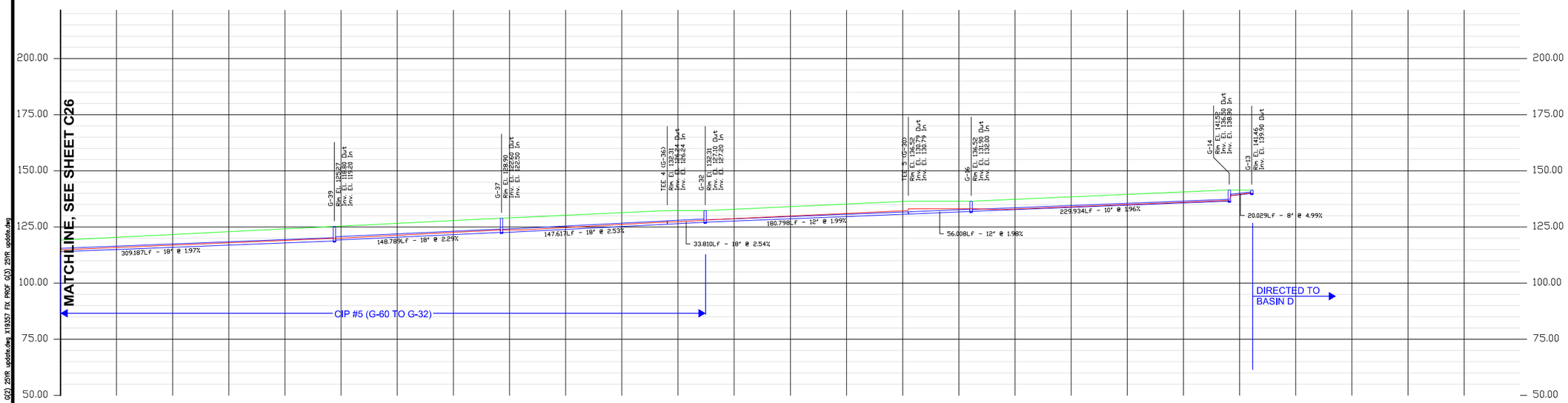
TOWN OF YARROW POINT

PROFILE G-3 WITH SPOT FIXES

PACE PROJECT NO. 19357

DWG NAME: P19357_PROF G FIX

SHEET 26 OF 34



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TOWN OF YARROW POINT

PROFILE G-4 WITH SPOT FIXES

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PACE PROJECT NO. 19357
DWG NAME: P19357_PROF G FIX
SHEET 27 OF 34

FILE NAME: P:\P19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF G FIXLDWG
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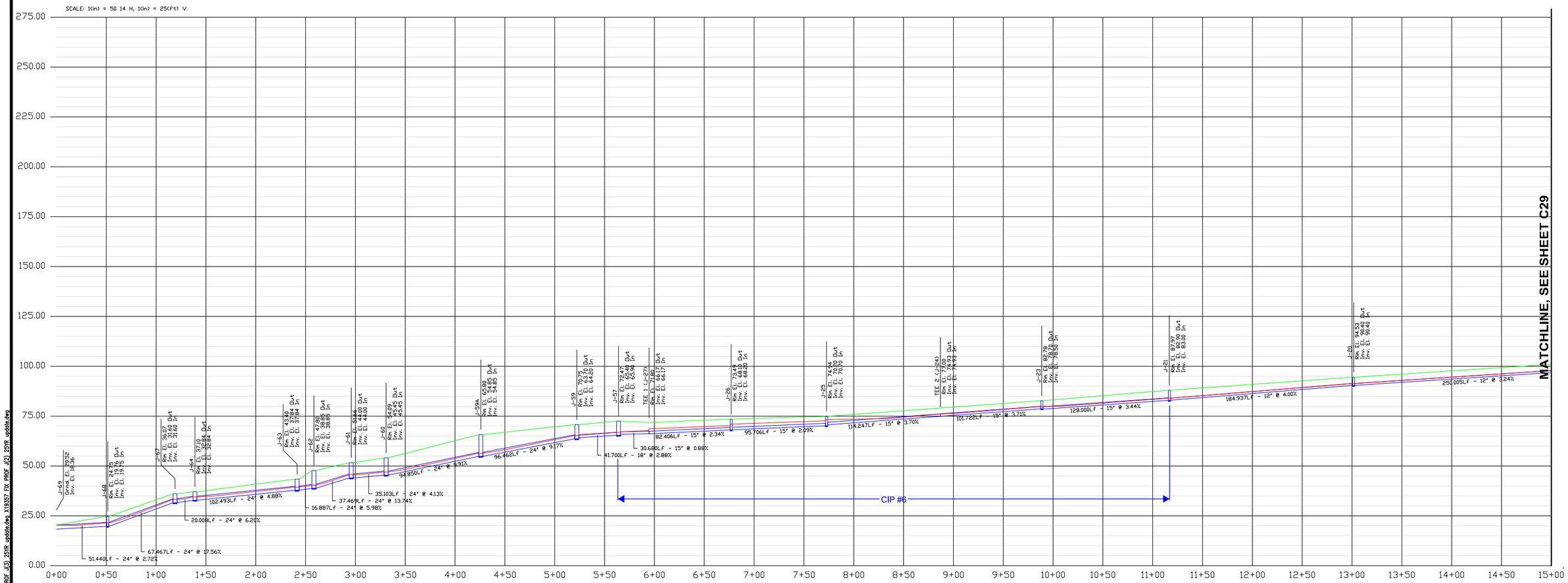

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FILE NAME: P:\P19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF J FIX.DWG
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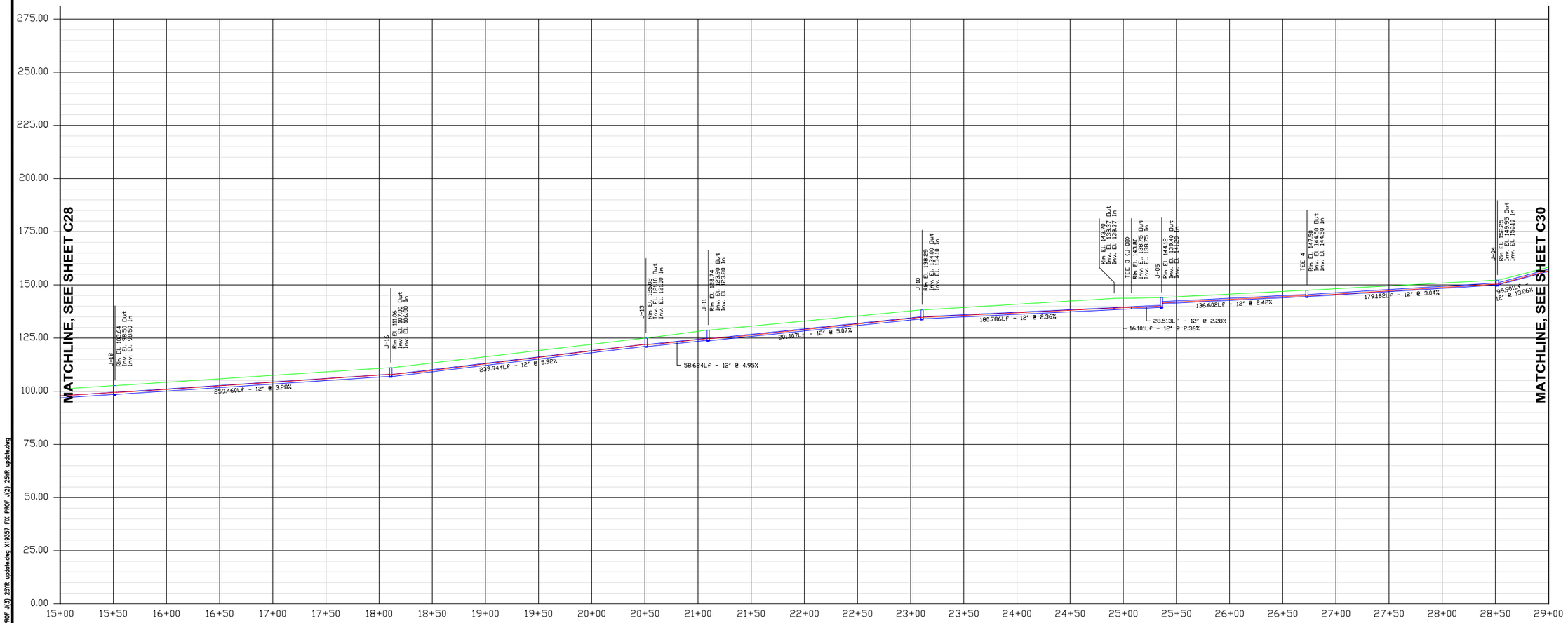
TOWN OF YARROW POINT

PROFILE J WITH SPOT FIXES

PACE PROJECT NO. 19357
DWG NAME:P19357_PROF J FIX
SHEET 28 OF 34



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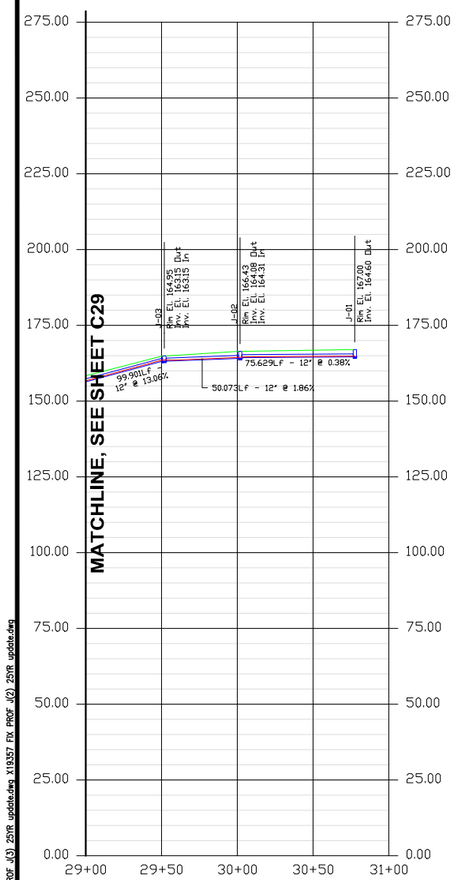
TOWN OF YARROW POINT

PROFILE J-1 WITH SPOT FIXES

PACE PROJECT NO. 19357
DWG NAME: P19357_PROF J FIX
SHEET 29 OF 34



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TOWN OF YARROW POINT

PROFILE J-3 WITH SPOT FIXES

PACE PROJECT NO. 19357

DWG NAME:P19357_PROF J FIX

SHEET 30 OF 34

FILE NAME: P:\P19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF J FIX.DWG
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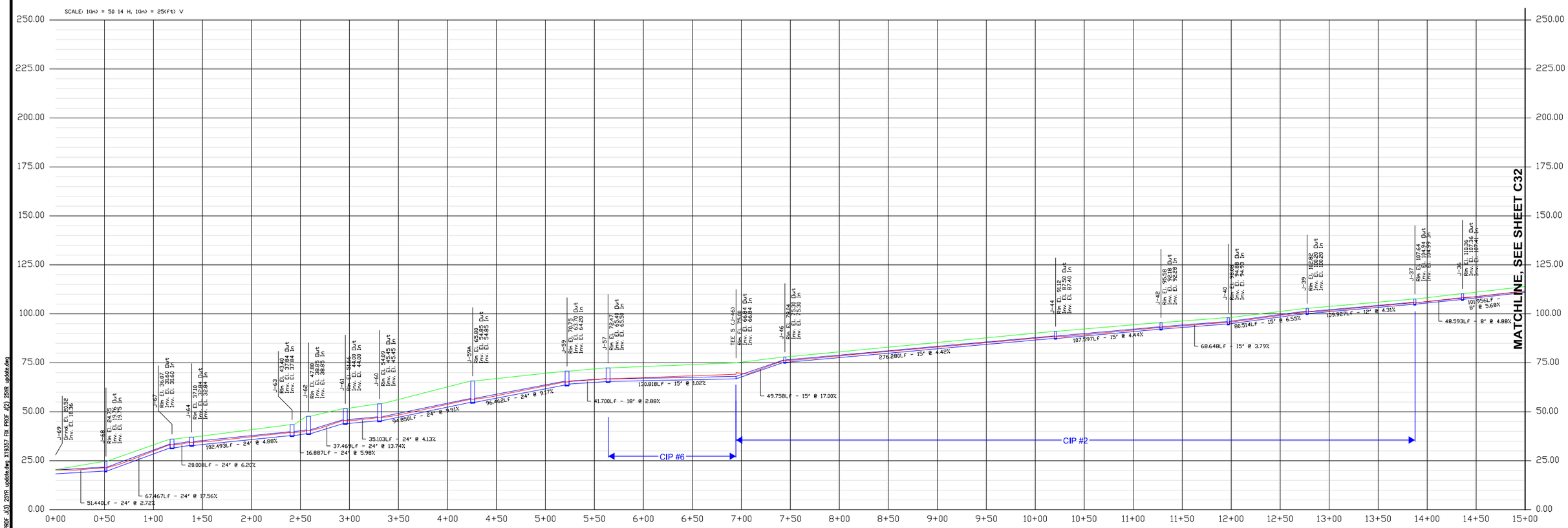

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TOWN OF YARROW POINT

PROFILE J-4 WITH SPOT FIXES

JOHN RUSSELL FORBA
STATE OF WASHINGTON
50442
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PROFESSIONAL ENGINEER

PACE PROJECT NO. 19357

DWG NAME:P19357_PROF J FIX

SHEET 31 OF 34

FILE NAME: P:\P19\19357 TOWN OF YARROW POINT\040 ENGINEERING\SHEETS\P19357_PROF J FIX.DWG
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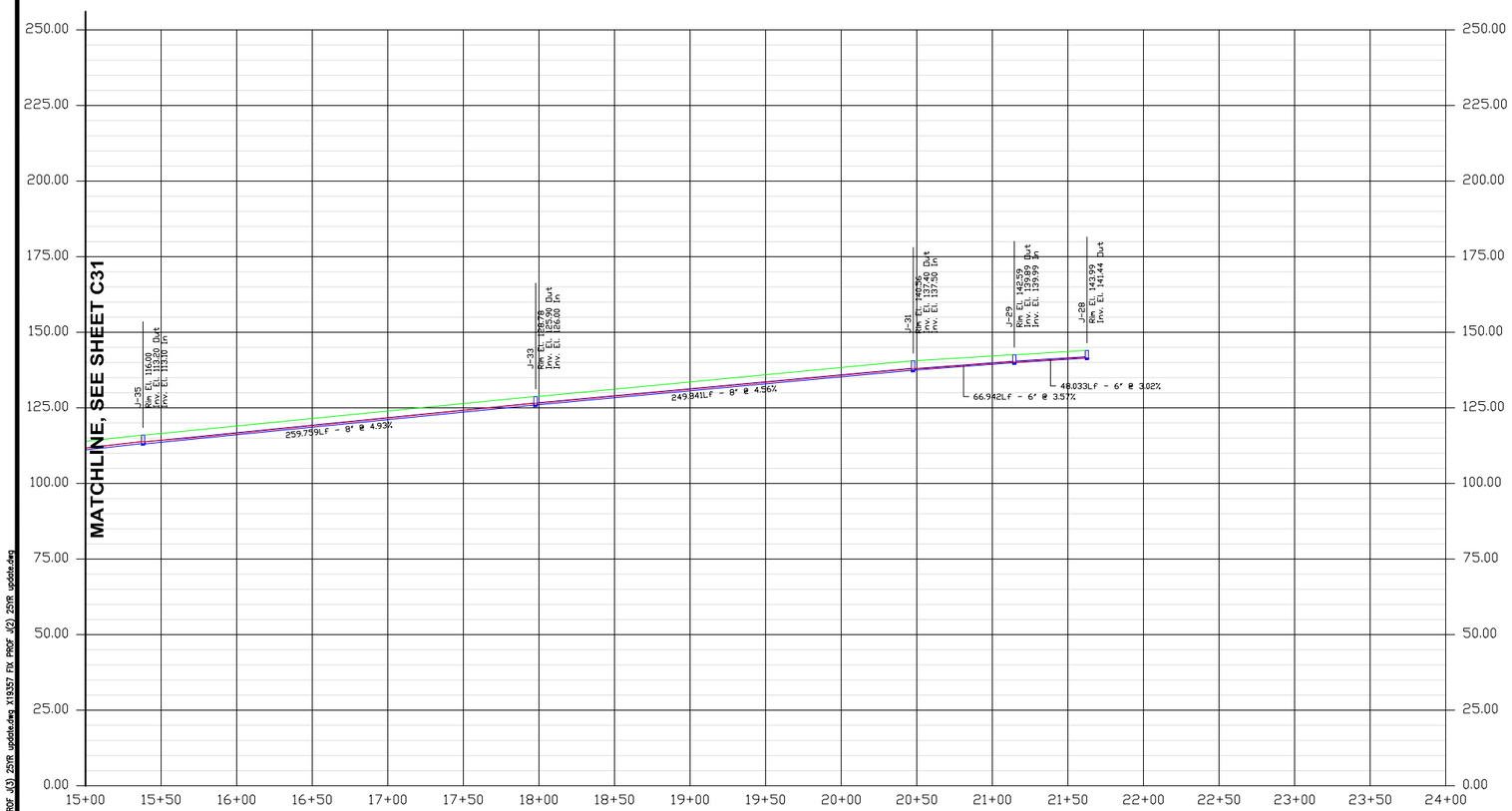

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STATE OF WASHINGTON
50442
09/21/2020
PROFESSIONAL ENGINEER

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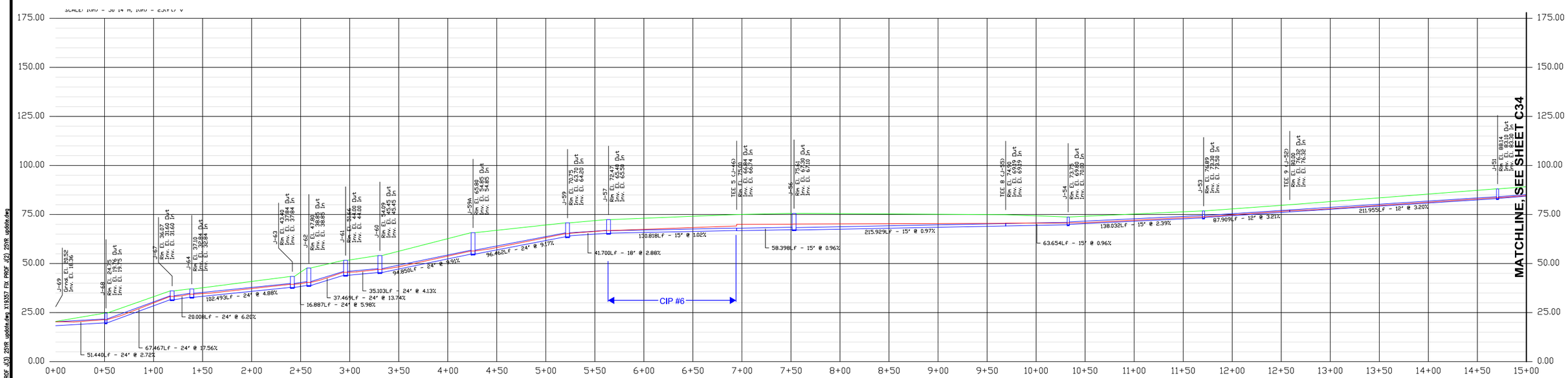
TOWN OF YARROW POINT

PROFILE J-5 WITH SPOT FIXES

PACE PROJECT NO.
19357

DWG NAME: P19357_PROF J FIX

SHEET 32 OF 34



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TOWN OF YARROW POINT

PROFILE J-6 WITH SPOT FIXES

PACE PROJECT NO. 19357
DWG NAME: P19357_PROF J FIX
SHEET 33 OF 34

FILE NAME: P:\P19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF J FIX.DWG
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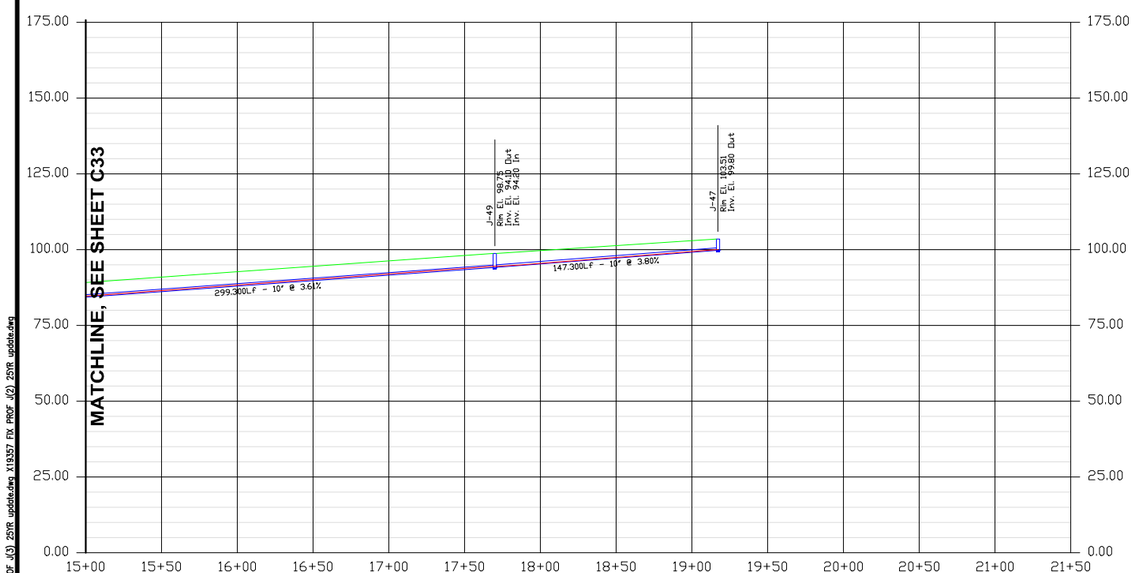

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STATE OF WASHINGTON
50442
REGISTERED
PROFESSIONAL ENGINEER

FILE NAME: P:\19\19357 TOWN OF YARROW POINT\CAD\ENGINEERING\SHEETS\P19357_PROF J FIXLDWG
SAVE TIME: 5/29/2020 9:14:57 AM PLOT TIME: 5/29/2020 9:17 AM
USER NAME: CHRISTIAN NICHOLS
XREF FILES: X19357_BDR.dwg X19357 FIX PROF J(1) 25YR update.dwg X19357 FIX PROF J(2) 25YR update.dwg X19357 FIX PROF J(3) 25YR update.dwg X19357 FIX PROF J(4) 25YR update.dwg

DESIGNED CN					
DRAWN CN					
CHECKED JF					
	SYM	REVISION	DATE	BY	APP'D

PACE
An Engineering Services Company

11255 Kirkland Way, Suite 300
Kirkland, WA 98033
p. 425.827.2014 | f. 425.827.5043
Civil | Structural | Planning | Survey
www.paceengrs.com

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DATE 05/28/2020
SCALE 1"=50'(H);1"=25'(V)

TOWN OF YARROW POINT

PROFILE J-7 WITH SPOT FIXES

PACE PROJECT NO. 19357
DWG NAME: P19357_PROF J FIX
SHEET 34 OF 34

APPENDIX B
CAPITAL IMPROVEMENT PROJECTS COST ESTIMATES

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Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #1
92nd Ave NE b/w Points Dr NE & NE 36th St
"Divert G-5 through G-12 to Basin D" - Connect G-12 to D-2 w/ 12" SD, and Replace 6 Structures in Basin D"

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 1,000.00	$ 1,000.00
2	Temporary Traffic Control	1	LS	$ 18,000.00	$ 18,000.00
3	Mobilization	1	LS	$ 12,000.00	$ 12,000.00
4	Remove and Dispose of Existing Asphalt	52	SY	$ 50.00	$ 2,600.00
5	Remove and Dispose of Existing Concrete	30	SY	$ 100.00	$ 3,000.00
	Remove and Dispose of Existing Stormwater Structure	6	EA	$ 1,000.00	$ 6,000.00
6	Plug Existing Drainage Pipe	2	EA	$ 500.00	$ 1,000.00
7	Shoring or Extra Excavation Class B	1	LS	$ 500.00	$ 500.00
8	HMA CL 1/2" PG-64-22*	20	Ton	$ 180.00	$ 3,600.00
9	Concrete Roadway	30	SY	$ 250.00	$ 7,500.00
	Catch Basin, Type I	6	EA	$ 1,800.00	$ 10,800.00
10	Storm Sewer Pipe, 12" Diameter	250	LF	$ 100.00	$ 25,000.00
11	Connection to Existing Drainage Structure/Pipe	16	EA	$ 500.00	$ 8,000.00
12	Bank Run Gravel for Pipe Zone Backfill *	235	Ton	$ 30.00	$ 7,050.00
13	Outfall Upgrades	1	LS	$ 20,000.00	$ 20,000.00
14	Cement Concrete Sidewalk/Driveway	5	SY	$ 45.00	$ 225.00
15	Roadside/Property Restoration	1	LS	$ 3,500.00	$ 3,500.00
16	Erosion Control and Water Pollution Control	1	LS	$ 2,000.00	$ 2,000.00
				Subtotal	$ 131,775.00
				Design Engineering (15%)	$ 19,766.25
				Construction Engineering (10%)	$ 13,177.50
				Contingency (15%)	$ 19,766.25
				Total	**$ 184,485.00**

Notes:
8" PVC inlets into D-2 from East, PVC pipe direction/length unknown (conflict w/ proposed 12" pipe)

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #2
94th Ave NE b/w 92nd Ave NE & NE 40th St
"Upsize between J-37 and J-46 plus pipe downstream of J-46" -Replace 8" w/ 15", install type 1s at bends & intersections

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 1,000.00	$ 1,000.00
2	Temporary Traffic Control	1	LS	$ 10,000.00	$ 10,000.00
3	Mobilization	1	LS	$ 19,000.00	$ 19,000.00
4	Remove and Dispose of Existing Asphalt	227	SY	$ 50.00	$ 11,350.00
5	Removal and Disposal of Existing Storm Sewer Pipe	690	LF	$ 40.00	$ 27,600.00
6	HMA CL 1/2" PG-64-22*	55	Ton	$ 180.00	$ 9,900.00
7	Storm Sewer Pipe, 15" Diameter	690	LF	$ 125.00	$ 86,250.00
8	Catch Basin, Type 1	8	EA	$ 1,800.00	$ 14,400.00
9	Catch Basin, Type 2	1	EA	$ 4,500.00	$ 4,500.00
10	Connection to Existing Drainage Structure/Pipe	6	EA	$ 500.00	$ 3,000.00
11	Bank Run Gravel for Pipe Zone Backfill	600	Ton	$ 30.00	$ 18,000.00
12	Roadside/Property Restoration	1	LS	$ 1,000.00	$ 1,000.00
13	Erosion Control and Water Pollution Control	1	LS	$ 1,000.00	$ 1,000.00
				Subtotal	$ 207,000.00
				Design Engineering (15%)	$ 31,050.00
				Construction Engineering (10%)	$ 20,700.00
				Contingency (15%)	$ 31,050.00
				Total	**$ 289,800.00**

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #3
Basin H
"Install 400 LF of Asphalt Thickened Edge between H-3 and H-10, Redirect Runoff to East Side of 91st Ave. NE"

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 1,000.00	$ 1,000.00
2	Temporary Traffic Control	1	LS	$ 10,000.00	$ 10,000.00
3	Mobilization	1	LS	$ 8,000.00	$ 8,000.00
4	Asphalt Thickened Edge	400	LF	$ 70.00	$ 28,000.00
5	Storm Sewer Pipe, 8" Diameter	100	LF	$ 90.00	$ 9,000.00
6	Catch Basin, Type 1	5	EA	$ 1,800.00	$ 9,000.00
7	Connection to Existing Drainage Structure/Pipe	1	EA	$ 500.00	$ 500.00
8	Roadside/Property Restoration	1	LS	$ 20,000.00	$ 20,000.00
9	Erosion Control and Water Pollution Control	1	LS	$ 1,000.00	$ 1,000.00
				Subtotal	$ 86,500.00
				Design Engineering (15%)	$ 12,975.00
				Construction Engineering (10%)	$ 8,650.00
				Contingency (15%)	$ 12,975.00
				Total	**$ 121,100.00**

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #4
Private Basin-Basin H Outfall west of 91st PL NE
"Replace existing pipe between H-17 and H-22 "

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 1,000.00	$ 1,000.00
2	Temporary Traffic Control	1	LS	$ 10,000.00	$ 10,000.00
3	Mobilization	1	LS	$ 13,000.00	$ 13,000.00
4	Remove and Dispose of Existing Asphalt	40	SY	$ 50.00	$ 2,000.00
5	Removal and Disposal of Existing Storm Sewer Pipe	535	LF	$ 40.00	$ 21,400.00
6	HMA CL 1/2" PG-64-22*	10	Ton	$ 180.00	$ 1,800.00
7	Storm Sewer Pipe, 12" Diameter	535	LF	$ 100.00	$ 53,500.00
8	Catch Basin, Type 1	4	EA	$ 1,800.00	$ 7,200.00
9	Connection to Existing Drainage Structure/Pipe	1	EA	$ 500.00	$ 500.00
10	Bank Run Gravel for Pipe Zone Backfill *	465	Ton	$ 30.00	$ 13,950.00
11	Roadside/Property Restoration	1	LS	$ 20,000.00	$ 20,000.00
12	Erosion Control and Water Pollution Control	1	LS	$ 1,000.00	$ 1,000.00
				Subtotal	$ 145,350.00
				Sales Tax - 10.0%	$ 14,535.00
				Design Engineering (15%)	$ 23,982.75
				Construction Engineering (10%)	$ 15,988.50
				Contingency (15%)	$ 23,982.75
				Total	**$ 223,839.00**

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #5
92nd Ave NE b/w NE 40th Pl & NE 41st St
"Upsize pipe between G-32and G-60. -Replace 18" w/ new 18", and install new type 2 CB"

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 3,000.00	$ 3,000.00
2	Temporary Traffic Control	1	LS	$ 25,000.00	$ 25,000.00
3	Mobilization	1	LS	$ 30,000.00	$ 30,000.00
4	Remove and Dispose of Existing Asphalt	425	SY	$ 50.00	$ 21,250.00
5	Remove and Dispose of Existing Gravel Shoulder	95	SY	$ 25.00	$ 2,375.00
6	Removal and Disposal of Existing Storm Sewer Pipe	1,050	LF	$ 40.00	$ 42,000.00
7	Removal and Disposal of Existing Storm Sewer Structure	1	EA	$ 1,000.00	$ 1,000.00
8	Shoring or Extra Excavation Class B	1	LS	$ 3,000.00	$ 3,000.00
9	HMA CL 1/2" PG-64-22*	90	Ton	$ 180.00	$ 16,200.00
10	Shoulder Gravel Surfacing (CSTC)	12	Ton	$ 30.00	$ 360.00
11	Storm Sewer Pipe, 18" Diameter	1050	LF	$ 120.00	$ 126,000.00
12	Catch Basin, Type 1	6	EA	$ 1,800.00	$ 10,800.00
13	Catch Basin, Type 2	3	EA	$ 4,500.00	$ 13,500.00
14	Connection to Existing Drainage Structure/Pipe	8	EA	$ 500.00	$ 4,000.00
15	Bank Run Gravel for Pipe Zone Backfill	1000	Ton	$ 30.00	$ 30,000.00
16	Roadside/Property Restoration	1	LS	$ 3,000.00	$ 3,000.00
17	Erosion Control and Water Pollution Control	1	LS	$ 3,000.00	$ 3,000.00
				Subtotal	$ 334,485.00
				Design Engineering (15%)	$ 50,172.75
				Construction Engineering (10%)	$ 33,448.50
				Contingency (15%)	$ 50,172.75
				Total	**$ 468,279.00**

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #6
95th Ave NE b/w NE 42nd Pl and NE 47th St
"Upsize between J-21 and J-57" - Replace 12" SD w/ 15"

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 1,000.00	$ 1,000.00
2	Temporary Traffic Control	1	LS	$ 4,000.00	$ 4,000.00
3	Mobilization	1	LS	$ 12,000.00	$ 12,000.00
4	Remove and Dispose of Existing Asphalt	90	SY	$ 50.00	$ 4,500.00
5	Removal and Disposal of Existing Storm Sewer Pipe	550	LF	$ 40.00	$ 22,000.00
6	Shoring or Extra Excavation Class B	1	LS	$ 5,000.00	$ 5,000.00
7	HMA CL 1/2" PG-64-22*	25	Ton	$ 180.00	$ 4,500.00
8	Storm Sewer Pipe, 15" Diameter	550	LF	$ 110.00	$ 60,500.00
9	Catch Basin, Type 1	1	EA	$ 1,800.00	$ 1,800.00
10	Connection to Existing Drainage Structure/Pipe	5	EA	$ 500.00	$ 2,500.00
11	Bank Run Gravel for Pipe Zone Backfill	360	Ton	$ 30.00	$ 10,800.00
12	Roadside/Property Restoration	1	LS	$ 2,500.00	$ 2,500.00
13	Erosion Control and Water Pollution Control	1	LS	$ 1,000.00	$ 1,000.00
				Subtotal	$ 132,100.00
				Design Engineering (15%)	$ 19,815.00
				Construction Engineering (10%)	$ 13,210.00
				Contingency (15%)	$ 19,815.00
				Total	**$ 184,940.00**

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #7
NE 40th St b/w 92nd Ave NE & 94th Ave NE
"Upsize between G-53 and G-56." - Replace exst. 8" SD w/ 12" SD and install Type 2 CB

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 1,000.00	$ 1,000.00
2	Temporary Traffic Control	1	LS	$ 10,000.00	$ 10,000.00
3	Mobilization	1	LS	$ 11,000.00	$ 11,000.00
4	Remove and Dispose of Existing Asphalt	142	SY	$ 50.00	$ 7,100.00
5	Removal and Disposal of Existing Storm Sewer Pipe	425	LF	$ 40.00	$ 17,000.00
6	Shoring or Extra Excavation Class B	1	LS	$ 1,000.00	$ 1,000.00
7	HMA CL 1/2" PG-64-22*	31	Ton	$ 180.00	$ 5,580.00
8	Storm Sewer Pipe, 12" Diameter	425	LF	$ 100.00	$ 42,500.00
9	Catch Basin, Type 1	2	EA	$ 1,800.00	$ 3,600.00
10	Catch Basin, Type 2	1	EA	$ 4,500.00	$ 4,500.00
11	Connection to Existing Drainage Structure/Pipe	4	EA	$ 500.00	$ 2,000.00
12	Bank Run Gravel for Pipe Zone Backfill	360	Ton	$ 30.00	$ 10,800.00
13	Roadside/Property Restoration	1	LS	$ 2,500.00	$ 2,500.00
14	Erosion Control and Water Pollution Control	1	LS	$ 1,000.00	$ 1,000.00
				Subtotal	$ 119,580.00
				Design Engineering (15%)	$ 17,937.00
				Construction Engineering (10%)	$ 11,958.00
				Contingency (15%)	$ 17,937.00
				Total	**$ 167,412.00**

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #8
Intersection of 92nd Ave NE & NE 37th Pl
"Upsize downstream of G-29 and G-30."

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 1,000.00	$ 1,000.00
2	Temporary Traffic Control	1	LS	$ 3,000.00	$ 3,000.00
3	Mobilization	1	LS	$ 2,000.00	$ 2,000.00
4	Remove and Dispose of Existing Asphalt	17	SY	$ 60.00	$ 1,020.00
5	Removal and Disposal of Existing Storm Sewer Pipe	50	LF	$ 50.00	$ 2,500.00
6	HMA CL 1/2" PG-64-22*	4	Ton	$ 180.00	$ 720.00
7	Storm Sewer Pipe, 12" Diameter	50	LF	$ 120.00	$ 6,000.00
8	Catch Basin, Type 1	2	EA	$ 1,800.00	$ 3,600.00
9	Connection to Existing Drainage Structure/Pipe	3	EA	$ 750.00	$ 2,250.00
10	Bank Run Gravel for Pipe Zone Backfill *	50	Ton	$ 35.00	$ 1,750.00
11	Erosion Control and Water Pollution Control	1	LS	$ 1,000.00	$ 1,000.00
				Subtotal	$ 24,840.00
				Design Engineering (15%)	$ 3,726.00
				Construction Engineering (10%)	$ 2,484.00
				Contingency (15%)	$ 3,726.00
				Total	**$ 34,776.00**

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #9
Basin G
"Replace 6" pipe that transisitons to 8" pipe midstream between G-6 and G-8 to reduce clogging"

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 3,000.00	$ 3,000.00
2	Temporary Traffic Control	1	LS	$ 10,000.00	$ 10,000.00
3	Mobilization	1	LS	$ 10,000.00	$ 10,000.00
4	Remove and Dispose of Existing Asphalt	80	SY	$ 50.00	$ 4,000.00
5	Removal and Disposal of Existing Storm Sewer Pipe	420	LF	$ 40.00	$ 16,800.00
6	HMA CL 1/2" PG-64-22*	45	Ton	$ 180.00	$ 8,100.00
7	Storm Sewer Pipe, 12" Diameter	420	LF	$ 100.00	$ 42,000.00
8	Catch Basin, Type 1	4	EA	$ 1,800.00	$ 7,200.00
9	Connection to Existing Drainage Structure/Pipe	6	EA	$ 500.00	$ 3,000.00
10	Bank Run Gravel for Pipe Zone Backfill	300	Ton	$ 30.00	$ 9,000.00
11	Erosion Control and Water Pollution Control	1	LS	$ 1,000.00	$ 1,000.00
				Subtotal	$ 114,100.00
				Design Engineering (15%)	$ 17,115.00
				Construction Engineering (10%)	$ 11,410.00
				Contingency (15%)	$ 17,115.00
				Total	**$ 159,740.00**

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates

6/7/2020
CIP #10
Basin G
"180 LF of 8"-12" pipe on NE 38th Street"

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 1,000.00	$ 1,000.00
2	Temporary Traffic Control	1	LS	$ 5,000.00	$ 5,000.00
3	Mobilization	1	LS	$ 5,000.00	$ 5,000.00
4	Remove and Dispose of Existing Asphalt	60	SY	$ 50.00	$ 3,000.00
5	Removal and Disposal of Existing Storm Sewer Pipe	180	LF	$ 40.00	$ 7,200.00
6	HMA CL 1/2" PG-64-22*	20	Ton	$ 180.00	$ 3,600.00
7	Storm Sewer Pipe, 8" Diameter	90	LF	$ 90.00	$ 8,100.00
8	Storm Sewer Pipe, 12" Diameter	90	LF	$ 100.00	$ 9,000.00
	Catch Basin Type 1	2	EA	$ 1,800.00	$ 3,600.00
9	Connection to Existing Drainage Structure/Pipe	3	EA	$ 500.00	$ 1,500.00
10	Bank Run Gravel for Pipe Zone Backfill *	125	Ton	$ 30.00	$ 3,750.00
11	Erosion Control and Water Pollution Control	1	LS	$ 1,000.00	$ 1,000.00
				Subtotal	$ 51,750.00
				Sales Tax - 10.0%	$ 5,175.00
				Design Engineering (15%)	$ 8,538.75
				Construction Engineering (10%)	$ 5,692.50
				Contingency (15%)	$ 8,538.75
				Total	**$ 79,695.00**

Town of Yarrow Point Stormwater Management Plan
CIP Cost Estimates
6/7/2020
CIP #11
Basin G
"Replace Substandard pipes between G-48 and G-49 "

Item	Description	Estimated Quantity	Unit	Unit Cost	Total
1	SPCC Plan	1	LS	$ 500.00	$ 500.00
2	Temporary Traffic Control	1	LS	$ 1,000.00	$ 1,000.00
3	Mobilization	1	LS	$ 1,000.00	$ 1,000.00
4	Remove and Dispose of Existing Asphalt	6	SY	$ 60.00	$ 360.00
5	Removal and Disposal of Existing Storm Sewer Pipe	20	LF	$ 50.00	$ 1,000.00
6	HMA CL 1/2" PG-64-22*	3	Ton	$ 250.00	$ 750.00
7	Storm Sewer Pipe, 8" Diameter	20	LF	$ 120.00	$ 2,400.00
8	Connection to Existing Drainage Structure/Pipe	2	EA	$ 500.00	$ 1,000.00
9	Bank Run Gravel for Pipe Zone Backfill *	16	Ton	$ 40.00	$ 640.00
10	Erosion Control and Water Pollution Control	1	LS	$ 500.00	$ 500.00
				Subtotal	$ 9,150.00
				Design Engineering (15%)	$ 1,372.50
				Construction Engineering (10%)	$ 915.00
				Contingency (15%)	$ 1,372.50
				Total	**$ 12,810.00**