TABLE OF CONTENTS

APPENDICES

VICINITY MAP

I. ENGINEER'S DECLARATION

I, Mark Buehrer, a Professional Engineer registered in the State of Washington as a Civil Engineer, do hereby declare that the Stormwater Management Report titled "Stormwater Management Report: PT Preservation Alliance - San Juan Discovery", dated December 22, 2021, was prepared by me, or under my supervision, and that said report was prepared in accordance with generally accepted engineering practices. I hereby affirm that, to the best of my knowledge, information and belief, subject report was prepared in full compliance with the City of Port Townsend Standards and all Technical Standards adopted thereunder.

Respectfully,

Mark Buehrer, PE

2020 ENGINEERING

II. INTRODUCTION & PROJECT DISCRIPTION

This report discusses the proposed concepts for stormwater management for the PT Preservation Alliance Planned Unit Development (PUD) located at San Juan and Discovery Roads in Port Townsend, Washington. The intent of the proposed stormwater management is to mitigate the effects upon the project site's surrounding environment due to the changes of the development's existing stormwater runoff patterns resulting from the construction of the proposed site improvements.

The proposed Low Impact Development (LID) stormwater management design concepts are intended to allow the final PUD to meet the City of Port Townsend drainage requirements which are based on the 2005 Department of Ecology's *Stormwater Management Manual for Western Washington* (DOE Manual).

Each new lot within the development shall mitigate stormwater to meet the requirements of the currently adopted DOE Manual at the time of final design. The proposed design guidelines detailed in this report meet the DOE requirements at the time of writing.

III. PRE-DEVELOPMENT CONDITIONS

Topography

The site topography is divided into an upper and lower region which are separated by a ridge. The ridge slopes roughly 15-20%, while the upper and lower regions slope more gently at about 5%. Total grade change across the site is about 65 feet. The site generally slopes to the northeast.

Land Cover

The majority of the land is currently covered by pasture. Sparse trees and existing houses with parking are present in some areas. A small amount of impervious surfaces exist around two houses within the development limits. A dirt road runs across the southwest corner of the site. An Existing Surface Coverage Map is shown in Exhibit 1 in Appendix A.

Soils

According to the Geology Hazard Assessment by Stratum Group dated February 21, 2016 (see Appendix C), the underlain site soils consist of glacial till and glacial marine drift, which consists mostly of gravelly sandy loam with silt. Topsoil is expected to be thin, which is consistent with surrounding areas.

During Stratum Group's site investigation, no evidence of surface water flow was detected, which indicates that soils are well-draining. The NRCS Web Soil Survey map (see Appendix C) also indicates that the site's soils are well-draining with typical infiltration rates ranging from about 6 in/hr to 20 in/hr within

the soils' most limiting layer. A modified proctor test was performed on March 23, 2019. Average infiltration rate in the field was 109 in/hr (no safety factor). This substantiated infiltration is feasible on the site. More field test information can be found in Appendix E.

A full geotechnical study and report will be conducted and prepared prior to the final site design phase to confirm the project site's soils characteristics related to the LID stormwater design.

Onsite Drainage Description

Stormwater throughout the surface of the site disperses towards the northeast, down-grade towards the low end of the site (near the corner of San Juan Ave and Discovery Road). When there is a sufficient amount of stormwater to flow overland, runoff is intercepted by a drainage swale along the east side of the site, and ultimately drains into an existing grass swale at the site's northeast corner. In extreme storm events, the swale may overflow into the adjacent right-of-way and be conveyed to Hastings Pond east of the site.

Contributing Offsite Areas

Offsite areas do not contribute stormwater run-on to the site due to the site's elevated perimeter and the surrounding right-of-way systems that intercept storm flow.

IV. POST-DEVELOPMENT CONDITIONS

The proposed developments include sub-dividing the project site into 46 residential, commercial and public use lots. The lots are proposed to be developed with a wide variety of buildings, including mixed-use commercial units, townhomes, cottages, and houses. A network of roads, open community spaces, and other associated infrastructure and utilities are proposed to serve the sub-division lots. The PUD Drawing Set providing the proposed site plan and site details are provided in Appendix B.

Roughly 40% of the development will be hard surface, mostly consisting of roads and building roofs. All roadway, driveways, sidewalks and foot paths are proposed to be permeable surfaces. The only impervious surfaces anticipated are building roofs; the remaining surfaces will consist of landscaping or permeable hard surfaces.

The project proposes LID stormwater mitigation strategies. All developed lots will feature individual LID stormwater management facilities that are proposed to infiltrate stormwater onsite. All public road surfaces and footpaths will be designed to infiltrate all received stormwater. The developed site will continue to generally slope towards the northeast. The site's Stormwater Site Plan Concept is shown in Exhibit 2 in Appendix A.

V. STORMWATER MANAGEMENT DESIGN CRITERIA

The hydrologic analysis for this project utilizes the following information and tools:

Development Code: City of Port Townsend, Municipal Code

Design Manuals: *Stormwater Management Manual for Western Washington*, 2005
Low Impact Development (Technical Guidance Manual for Puget Sound), 2012

Final LID stormwater management design for each property will need to be completed on a case-by-case basis once the design of the buildings and site features are determined. Properties will require two different levels of stormwater management based on design land coverage types. Typically, properties with less than 5,000-square-feet of impervious surface will be required to comply with Minimum Requirements 1-5 of the DOE Manual. Projects with greater than 5,000-square-feet will need to comply with Minimum Requirements 1-9 of the DOE Manual. The LID stormwater strategies to address these requirements are in the following sections of this report.

1. Preparation of Stormwater Site Plans
2. Construction Stormwater Pollution Prevention
3. Source Control of Pollution
4. Preservation of Natural Drainage Systems and Outfalls
5. Onsite Stormwater Management
6. Runoff Treatment
7. Flow Control
8. Wetlands Protection
9. Operation and Maintenance

VI. STORMWATER DRAINAGE MINIMUM REQUIREMENTS

1. MR #1 - Preparation of Stormwater Site Plans

The project's stormwater site concepts have been prepared by 2020 ENGINEERING based on this report. Sheets 8.0 – 8.3 of the Planned Use Development (PUD) set show the concept stormwater site plans for typical lot and road conditions (see Appendix B). Final design of the project's stormwater site plan will be based on the concepts presented in the PUD set.

2. MR #2 - Construction Stormwater Pollution Prevention

A Stormwater Pollution Prevention Plan (SWPPP) will be provided with the final Stormwater Management Report submittal. As appropriate, the SWPPP measures will identified on the final civil plans and/or specifications prepared.

The Best Management Practices (BMP's) and methodologies used during construction shall follow the guidelines presented in the SWPPP. All proposed stormwater pollution prevention measures shall be put in place during any site clearing, grading or construction of site improvements.

3. MR #3 - Source Control of Pollution

The following recommendations shall be implemented to minimize the likelihood of discharging pollutants into offsite drainage systems.

- *Fertilizers, Herbicides and Pesticides*: Occupants and contractors shall be encouraged to store these items indoors or under roofs, to apply them only during dry (non-precipitation) periods and at doses not exceeding the manufacturer's recommendations, and to dispose of them at properly approved disposal sites.
- *Automobile Fluids, Paint and other Chemicals*: Occupants and contractors are encouraged to store these items indoors or under roofs, and to dispose of them at properly approved disposal sites.

Any spillage of chemicals or other hazardous materials shall be immediately reported to the City of Port Townsend and the Washington State Department of Ecology.

4. MR #4 - Preservation of Natural Drainage Systems & Outfalls

Stormwater in the site's existing condition collects and infiltrates onsite and within a grass swale at the northeast corner of the site. During large storms, overflow may get collected in the adjacent ROW stormwater system which is part of the larger city stormwater network that outfalls to Hasting's Pond. The proposed stormwater system should infiltrate all stormwater onsite, but if an overflow is needed during future design, it will connect to the same city storm network and outfall to Hasting's Pond.

5. MR #5 - Onsite Stormwater Management

The DOE Manual requires various approaches to Onsite Stormwater Management depending on project Minimum Requirements. BMPs to be used for stormwater management are selected using a list approach. Other criteria such as the LID Performance Standard may also be necessary for certain properties.

The project discharges to the Hastings Pond wetland, so Onsite Stormwater Management will be required. The project will need to consider BMPs from List #2 in the DOE Manual.

The PUD stormwater management concept primarily incorporates infiltration via permeable pavements, bioretention and infiltration galleries. For residential lots, downspouts will connect into bioretention (raingardens) for full infiltration. For commercial lots, downspouts will connect infiltration trenches. For public right-of-way (ROW), stormwater will infiltrate through the proposed pervious concrete surfaces and underlying soils. All of these BMPs are intended to take advantage of the infiltrative soils on site.

The design team has determined pervious concrete is the best option for right-of-way streets because it allows the design to eliminate catch basins, pipes, and bioretention. With pervious concrete streets, stormwater will be fully infiltrated and treated for water quality as it passes down through the pavement section. Occasional street-cleaning will be required to maintain the pervious pavement (typical street cleaners that brush and vacuum can be used). The application of pervious concrete streets reduces the overall ROW maintenance by eliminating the maintenance requirements for large bioretention areas and it preserves more area for landscape and community spaces.

Preliminary sizes for stormwater infiltration facilities are shown on the drawings.

6. MR #6 - Runoff Treatment

All ROW streets and lots with greater than 5,000 SF of pollution generating impervious surface will require water quality treatment. The bioretention facilities located on smaller lots (less than 5,000 sf of pollution-generating impervious surface) are used for Onsite Stormwater Management and will provide additional water quality treatment.

The most typical scenario where water quality treatment will be required is for roadways and parking areas. Permeable pavement is proposed to provide water quality treatment as water infiltrates through the soil layer. Future soil studies of organic content will be performed to determine if the native soil is sufficient for water quality treatment, otherwise it can be amended with a small amount of compost.

Oil Control is required for projects that are considered as "high-use sites". It is unlikely properties in this development will be considered "high-use sites", however, each lot will need to be assessed during its final design.

7. MR #7 - Flow Control

The project will be required to match pre-developed conditions from 50% of the 2-year peak flow to 100% of the 50-year peak flow. The project is aiming to achieve full infiltration of all stormwater (effectively meeting the requirement above). Details of the site's infiltration plan are described in Section VII of this report.

If an emergency overflow from the proposed infiltration facilities is needed, it will connect to the municipal stormwater system northeast of the site. An evaluation of the downstream conveyance system's flow capacity will be provided during final design of the development's ROW street system.

8. MR #8 - Wetlands Protection

There are no Wetlands on this site. The site's stormwater overflow will eventually discharge into Hasting's Pond. The final stormwater design will meet the code requirements to protect discharges into wetlands.

9. MR #9 - Operations & Maintenance

Operation and Maintenance will be prepared during final design and submitted with the Project's final Stormwater Report.

VII. STORMWATER MANAGEMENT SYSTEM DESIGN

The PT Preservation Alliance's LID stormwater system consists of a combination of private property and ROW drainage facilities. 100% of stormwater from each property and ROW shall be infiltrated onsite.

For preliminary design, the bioretention facilities, infiltration galleries, and permeable pavement are conservatively assumed to have an underlying long-term infiltration rate of 1.5 in/hr. *[Note the long-term infiltration rate is assumed based on a 4x safety factor on the 6 in/hr infiltration rate shown in the NRCS Soil Survey (see Appendix C). More recent Modified Proctor field tests have substantiated this number (See Appendix E). Site-specific soil characteristics will be evaluated during final design, and presented in the final Storm Report.]*

Bioretention Facilities and Infiltration Galleries

Preliminary bioretention modeling was performed using Western Washing Hydrology Model 2012 (WWHM12). The minimum bioretention or infiltration gallery bottom area needed to infiltrate 100% of contributing stormwater was calculated for various impervious areas. Table 1 below was developed to be used as a guide for determining sizes during final design for each individual lot. Supporting calculations are provided in Appendix D.

Table 1: Bioretention and Infiltration Gallery Facility Sizing Requirements

Impervious Area (sf)	500	1000	1500	2000	2500	3000	4000	5000	6000	7000	8000
Minimum Bottom Area (sf)	25	55	85	120	150	175	240	310	480	460	560

Pervious Concrete Pavement

Preliminary modeling of the pervious concrete pavement was performed using Western Washing Hydrology Model 2012 (WWHM12). The minimum depth of chipped rock base was determined to be 2 inches to hold stormwater as it infiltrates into the ground. Supporting calculations are provided in Appendix D.

VIII. STORMWATER MANAGEMENT SYSTEM PHASING

The PT Preservation Alliance's stormwater system will be built in phases to manage stormwater as various portions of the development are built-out. The development will be broken down into two main phases, adhering to the upper and lower portions of the site. See Sheet 13.0 in the PUD plan set for phasing diagrams.

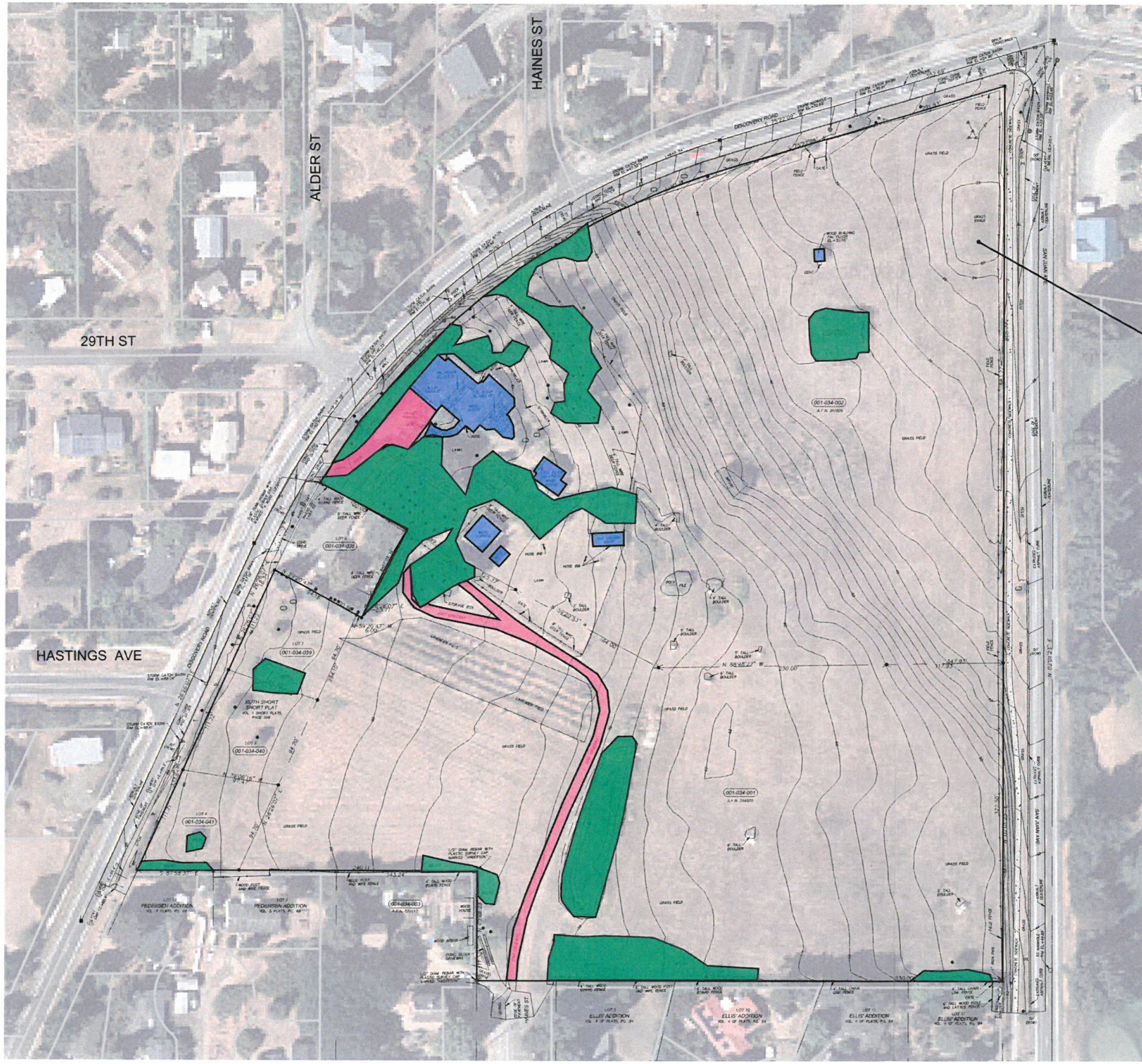
Phase 1

The first phase is in the upper portion of the site and consists mostly of ROW and house build-out. All lots and roadways are proposed to fully infiltrate stormwater on site.

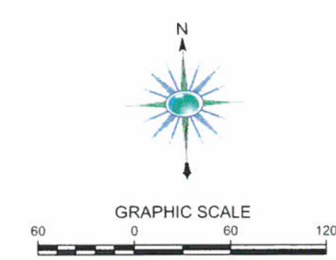
Phase 2

The second phase is in the lower portion of the site and consists mostly of ROW, commercial and public use areas. All lots and roadways are proposed to fully infiltrate stormwater on site.

APPENDIX A – STORMWATER EXHIBITS



Hatch Color	Surface Coverage	Impervious	Pollution-Generating	Area	
				sf	*ac*
(green)	Brush	No	No	50,733	1.16
(pink)	Driveway	Yes	Yes	9,068	0.21
(blue)	Roof/Sidewalk	Yes	No	7,125	0.16
NO HATCH	Pasture	No	No	472,595	10.85
	Total Site	**3.0%**	**1.7%**	**539,521**	**12.39**



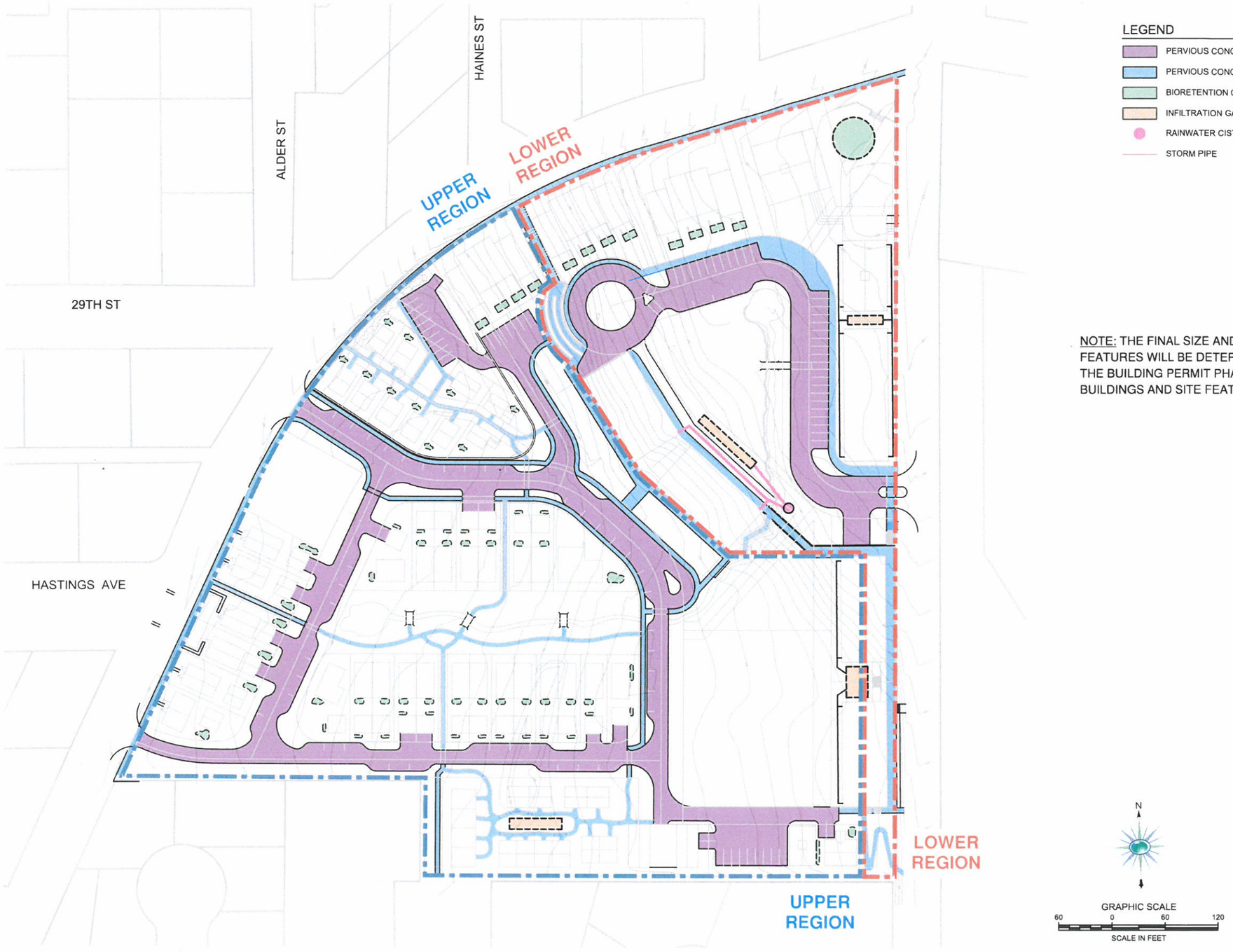
DECEMBER 22, 2021

2020 ENGINEERING

PT PRESERVATION ALLIANCE
SAN JUAN DISCOVERY

EXHIBIT 1

EXISTING SURFACE COVERAGE MAP



LEGEND

- PERVIOUS CONCRETE ROAD
- PERVIOUS CONCRETE SIDEWALK/TRAIL
- BIORETENTION CELL
- INFILTRATION GALLERY
- RAINWATER CISTERN W/ PUMP
- STORM PIPE

NOTE: THE FINAL SIZE AND LOCATIONS OF THE LID FEATURES WILL BE DETERMINED FOR EACH LOT DURING THE BUILDING PERMIT PHASE ONCE THE DESIGN OF THE BUILDINGS AND SITE FEATURES ARE DETERMINED.

N

GRAPHIC SCALE
60 0 60 120
SCALE IN FEET

DECEMBER 22, 2021

2020 ENGINEERING

PT PRESERVATION ALLIANCE
SAN JUAN DISCOVERY

EXHIBIT 2

STORMWATER SITE PLAN CONCEPT