



BLUELINE

City Heights Phase 3

Cle Elum, Washington

Date: January 19, 2023

Storm Drainage Report

Prepared for
City Heights Holdings, LLC
405 NW Gilman Blvd, Suite 102
Issaquah, WA 98027

Blueline Job No. 19-349
Prepared by: Faith Mingus, EIT
Reviewed by: Dené Kuzaro, PE
Approved by: Brett Pudists, PE



1/19/23

TABLE OF CONTENTS

SECTION 1 PROJECT OVERVIEW1

1.1 Site information1

1.2 Executive Summary2

SECTION 2 PRE-DEVELOPED CONDITIONS4

2.1 Upstream.....4

SECTION 3 DEVELOPED CONDITIONS.....6

3.1 Crystal Creek 4 (Pond B7-B)6

3.2 Upstream.....6

SECTION 4 OFF SITE ANALYSIS8

4.1 Upstream Conditions9

4.2 Existing Drainage System9

SECTION 5 CORE ELEMENTS.....10

SECTION 6 PERMANENT STORMWATER CONTROL PLAN11

6.1 Existing Hydrology.....11

6.2 Developed Hydrology.....11

6.3 Design parameters13

6.4 LID BMP Implementation.....13

6.5 Conveyance System Design.....14

SECTION 7 SWPPP17

SECTION 8 SPECIAL REPORTS AND STUDIES18

SECTION 9 OTHER PERMITS19

SECTION 10 OPERATION AND MAINTENANCE.....20



Section 1 Project Overview

Project Name:	City Heights
Project Parcels:	956732/956733*, Phase 3 * Per assessor, parcels are coupled and must be sold together.
Project Engineer:	The Blueline Group Brett Pudists, PE (425) 250-7247
Project Applicant:	City Heights Holdings, LLC Barbara Rodgers (425) 923-9610
Project Development Area:	2.14 acres - Phase 3
Number of Lots:	19

1.1 SITE INFORMATION

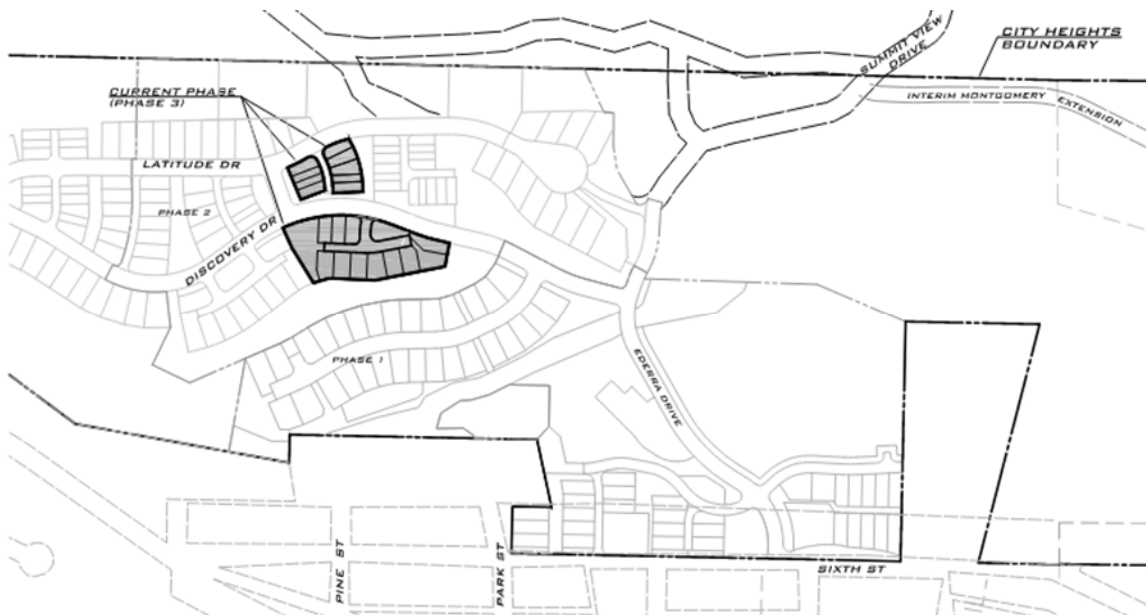
SITE INFORMATION	
Project location	City of Cle Elum
Zoning	Planned Mixed Use Development (PMU)
Climate Region (Figure 4.3.1 of 2004 SWMMEW)	Region I (East Slope Cascades)
Average Annual Precipitation (Figure 4.3.1 of 2004 SWMMEW)	25 in/yr
P2year,24hour (Figure 4.3.3 of 2004 SWMMEW)*	2 in
P10year,24hour (Figure 4.3.4 of 2004 SWMMEW)*	3.25 in
P25year,24hour (Figure 4.3.5 of 2004 SWMMEW)*	3.5 in
P100year,24hour (Figure 4.3.7 of 2004 SWMMEW)*	4.75 in
Type of Soil per Geotech report	Underlain by forest duff or topsoil, silty sand with gravel, & gravel with sand and varying amounts of silt.
Design Infiltration Rate per Geotech report	N/A, deemed infeasible

*Precipitation depth adjusted for rain-on-snow and snowmelt considerations, refer to Section 6.3 of this report for adjusted precipitation depths.



1.2 EXECUTIVE SUMMARY

This Storm Drainage Report is for the construction of City Heights Phase 3 a Planned Mixed Use (PMU) development. The Phase 3 boundary is consistent with Tracts A, R and T shown on the pending Phase 2 Final Plat map on file with the city. The full buildout conditions for Pond B7-B referred to in this report (includes areas associated with future phases and Phase 3) were analyzed in *City Heights Phase 2 Storm Drainage Report Section 6*. Generally, the property is located within the NE $\frac{1}{4}$ of Section 27, Township 20 N, Range 15 East, W.M. See vicinity map below.



Vicinity Map, Not to Scale

The overall City Heights project is approximately 358 acres; however, this report will limit discussion to Phase 3, tributary to Pond B7-B, which is approximately 2.14 acres. The basin associated with pond B7-B and Phase 3 will be referred to as Crystal Creek 4 (Pond B7-B) throughout the report. This portion of the City Heights project is mostly forested and consists of existing bike trails and gravel roads. Phase 3 is contained entirely within the Phase 2 boundary and does not contain critical areas or steep slopes. The site is underlain by forest duff or topsoil, silty sand with gravel, & gravel with sand and varying amounts of silt. Please refer to the report prepared by Terra Associates, Inc. dated June 9, 2020. The site contains flat areas and slopes up to 65%.

In the pre-developed condition of Phase 3, upstream flows of Tract R, and Tract T will be collected and directed south to Pond B7-B via the storm system to be installed in Phase 2. Any flow that is onsite of Phase 3, Tract R and Tract T will sheet flow southeast and outfall to the storm system within Discovery Dr (formerly Phase 2 Road B), tributary to Pond B7-B. Flows onsite of Tract A will sheet flow south before being intercepted by the storm system proposed to be installed within Phase 1, tributary to Pond B7-B. Please refer to the Existing Conditions Exhibit included at the end of Section 2 and the Downstream Drainage Exhibit referencing the existing conditions of Crystal Creek 4 included in *City Heights Phase 2 Storm Drainage Report Section 3* for existing information related to Phase 3.



In the proposed condition, Phase 3 will consist of approximately 19 lots, proposed roads, and open space tracts. Refer to the Developed Conditions Exhibit included at the end of Section 2.

The project has been designed using the vested guidelines and requirements established in the 2004 Department of Ecology (DOE) Stormwater Management Manual for Eastern Washington (SWMMEW) and the City Heights Annexation and Development Agreement (DA), dated November 8, 2011.

The project will implement flow control BMPs per Chapter 6 of the 2004 SWMMEW. Per Section 4.2.7 of the 2004 SWMMEW, including rain-on-snow and snowmelt design, is optional guidance for detention and water quality design. However, rain-on-snow and snowmelt design requirements are applied for this project. For more information, refer to Section 6 of this report. Per the Geotechnical report provided by Terra Associates, Inc. dated June 9, 2020, infiltration is infeasible.

A detention pond (Pond B7-B) is proposed as a flow control facility for the site per BMP F6.10 to match the developed peak flows with existing peak flows for 50% of the 2-year storm event and the full 25-year storm event. Additionally, per the DA, while the manual stipulates that the design needs to assume a 25-year flood event, the City has requested, and the Ridge Entities have agreed, to design the stormwater system for City Heights assuming a 100-year flood event, thereby increasing the capacity of the system beyond what is required by current regulations. The project will not be required to remedy any already existing deficiencies in the existing system. Refer to *City Heights Phase 2 Storm Drainage Report* Section 6 for Pond B7-B analysis.

The project proposes more than 5,000 SF of pollutant-generating impervious surfaces (PGIS), is not a high-use site, and does not discharge to a wetland or phosphorous sensitive receiving waters. Per Section 2.2.5 of the 2004 SWMMEW, basic water quality treatment is required.



Section 2 Pre-Developed Conditions

The City Heights project is located in Cle Elum, Washington. The Site generally consists of topographic conditions ranging from nearly flat/gently sloping to relatively steeply sloped ground with multiple topographic drainage features. Per the Geotechnical Engineering Report prepared by Terra Associates, Inc. dated June 9, 2020, onsite soils consist of forest duff and topsoil, silty sand with gravel, & gravel with sand and varying amounts of silt. See Geotechnical Report submitted under separate cover for more information.

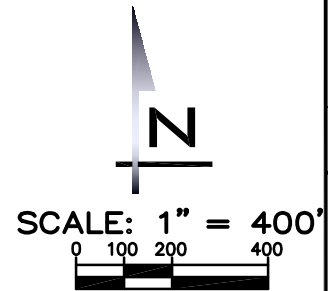
The majority of the site is a forested, undeveloped land surrounded by anticipated Phase 1 and Phase 2. The full buildout surrounding Phase 3 is assumed to be 87 residential lots with associated utilities, stormwater detention and water quality facilities, access roadways and supporting utilities/infrastructure. Phase 3 is included under Crystal Creek 4 Basin. Refer to *City Heights Phase 2 Storm Drainage Report* Section 3 for existing information related to Phase 3

2.1 UPSTREAM

In the pre-developed condition of Phase 3, upstream flows of Tract R, and Tract T will be collected and directed south to Pond B7-B via the storm system to be installed in Phase 2. Similarly, to Tract R, and Tract T, Tract A's upstream flow will be intercepted and directed to Pond B7-B via Discovery Dr (formerly Phase 2 Road B) storm system, to be installed in Phase 2.

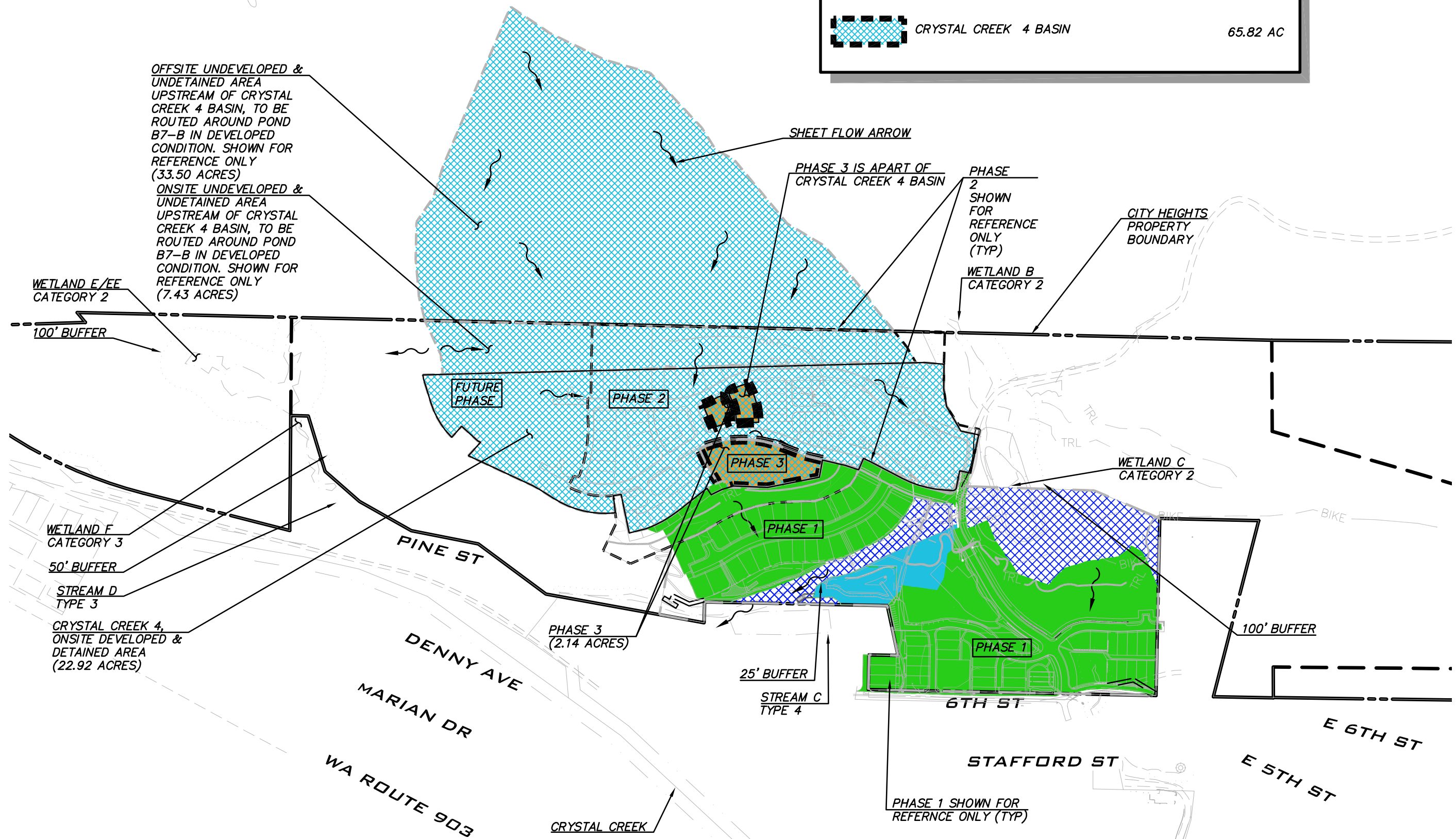


PREDEVELOPED CONDITIONS EXHIBIT



LEGEND

CRYSTAL CREEK 4 BASIN 65.82 AC



OFFSITE UNDEVELOPED & UNDETAINED AREA UPSTREAM OF CRYSTAL CREEK 4 BASIN, TO BE ROUTED AROUND POND B7-B IN DEVELOPED CONDITION. SHOWN FOR REFERENCE ONLY (33.50 ACRES)

ONSITE UNDEVELOPED & UNDETAINED AREA UPSTREAM OF CRYSTAL CREEK 4 BASIN, TO BE ROUTED AROUND POND B7-B IN DEVELOPED CONDITION. SHOWN FOR REFERENCE ONLY (7.43 ACRES)

WETLAND E/EE CATEGORY 2

100' BUFFER

WETLAND F CATEGORY 3

50' BUFFER

STREAM D TYPE 3

CRYSTAL CREEK 4, ONSITE DEVELOPED & DETAINED AREA (22.92 ACRES)

WA ROUTE 903

CRYSTAL CREEK

25' BUFFER

STREAM C TYPE 4

PHASE 3 (2.14 ACRES)

PHASE 1 SHOWN FOR REFERENCE ONLY (TYP)

WETLAND C CATEGORY 2

CITY HEIGHTS PROPERTY BOUNDARY

PHASE 2 SHOWN FOR REFERENCE ONLY (TYP) WETLAND B CATEGORY 2

PHASE 3 IS APART OF CRYSTAL CREEK 4 BASIN

SHEET FLOW ARROW

PREDEVELOPED CONDITIONS EXHIBIT
 CITY HEIGHTS - PH 2 (PODS B4, B5 & B6)
 PRELIMINARY DRAINAGE REPORT
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SCALE	AS NOTED
PROJECT MANAGER	BRETT PUDISTS, PE
DESIGNED BY	CHRIS WISCOMB
DRAWN BY	MICHELLE ROBERGE, PE
PLOT DATE	January 19, 2023

JOB NUMBER:
19-349

FIGURE:
EC

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Section 3 Developed Conditions

The proposed Phase 3 project includes the creation of 19 lots (10 single family, 9 townhomes) with associated utilities, proposed roads, open space tracts, and supporting utilities/infrastructure. Water quality and flow control improvements are described in Section 6 of this report. Drainage analysis associated with these permits will be addressed in further detail in separate drainage reports.

3.1 CRYSTAL CREEK 4 (POND B7-B)

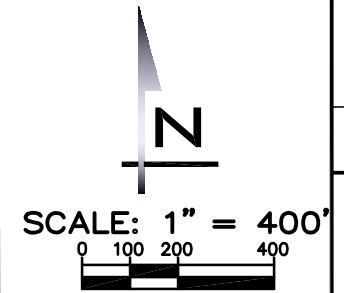
Crystal Creek 4 is the portion of the development tributary to Stream C. A detention pond (Pond B7-B) is proposed to serve the full buildout of Crystal Creek 4 and is assumed to be approximately 106 residential lots, including that of Phase 3. Refer to *City Heights Phase 2 Storm Drainage Report* Section 3 and Section 6 for analysis, conveyance, and sizing for Pond B7-B.

3.2 UPSTREAM

In the developed condition of Phase 3, upstream flows will remain the same as that in the pre-developed condition. Refer to section 2 of this report.

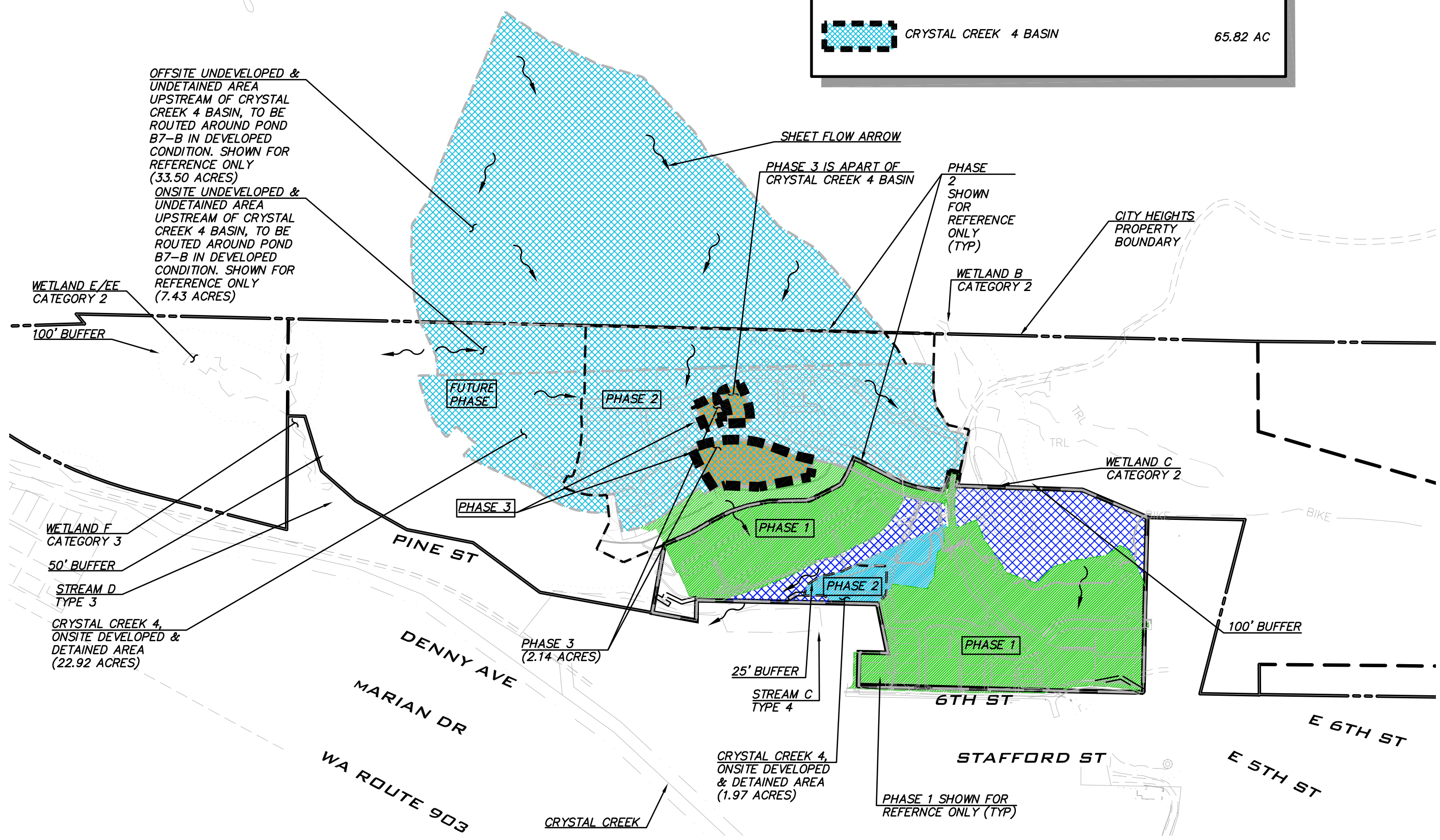


DEVELOPED CONDITIONS EXHIBIT



LEGEND

CRYSTAL CREEK 4 BASIN 65.82 AC



OFFSITE UNDEVELOPED & UNDETAINED AREA UPSTREAM OF CRYSTAL CREEK 4 BASIN, TO BE ROUTED AROUND POND B7-B IN DEVELOPED CONDITION. SHOWN FOR REFERENCE ONLY (33.50 ACRES)

ONSITE UNDEVELOPED & UNDETAINED AREA UPSTREAM OF CRYSTAL CREEK 4 BASIN, TO BE ROUTED AROUND POND B7-B IN DEVELOPED CONDITION. SHOWN FOR REFERENCE ONLY (7.43 ACRES)

WETLAND E/EE CATEGORY 2

100' BUFFER

WETLAND F CATEGORY 3

50' BUFFER

STREAM D TYPE 3

CRYSTAL CREEK 4, ONSITE DEVELOPED & DETAINED AREA (22.92 ACRES)

WA ROUTE 903

CRYSTAL CREEK 4, ONSITE DEVELOPED & DETAINED AREA (1.97 ACRES)

PHASE 1 SHOWN FOR REFERENCE ONLY (TYP)

DEVELOPED CONDITIONS EXHIBIT
CITY HEIGHTS - PH 3
PRELIMINARY DRAINAGE REPORT

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SCALE	AS NOTED
PROJECT MANAGER	BRETT PUDISTS, PE
DESIGNED BY	FAITH MINGUS
DRAWN BY	FAITH MINGUS
PLOT DATE	January 19, 2023

JOB NUMBER:
19-349

FIGURE:
DC

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Section 4 Off Site Analysis

This project is for Phase 3, a part of Pond B7-B Basin of the City Heights development. However, the full buildout condition of Pond B7-B Basin was analyzed in *City Heights Phase 2 Storm Drainage Report* Section 6. As part of the EIS process, an offsite analysis for the entire City Heights development was prepared by Encompass Engineering & Surveying. An additional offsite analysis prepared by Barghausen Consulting Engineers, Inc. addresses the downstream system for the City Heights development. Refer to excerpts from the *Grading, Drainage and Utilities Engineering Report* that was prepared by Encompass Engineering & Surveying, dated March 24, 2010 and the *Downstream Drainage Analysis* prepared by Barghausen Consulting Engineers, Inc., dated February 25, 2011 refer to *City Heights Phase 2 Storm Drainage Report* Section 4. A supplemental field investigation was conducted by Blueline on April 24, 2020 to confirm the findings in these reports refer to *City Heights Phase 2 Storm Drainage Report* Section 4.

The following is a summary of the findings from the information used in preparing this report for Phase 3. Refer to the *Geotechnical Engineering Report and Geologic Hazard Assessment* prepared by Terra Associates, Inc. dated June 9, 2020, *Wetlands and Wildlife Habitat Report* prepared by Sewall Wetland Consulting, Inc. dated October 26, 2009, and *Impacts Analysis* prepared by Sewall Wetland Consulting, Inc. dated May 21, 2021 submitted under separate cover.

- The site is located within the Upper Yakima Watershed (DOE Mapping).
- Site is underlain by forest duff or topsoil, silty sand with gravel, & gravel with sand and varying amounts of silt. See Geotechnical Report submitted under separate cover.
- The site contains one drainage basin that ultimately drains to the Yakima River (see downstream Exhibit at end of this section). October 26, 2009. (Refer to report submitted under separate cover for Sewall Map Figure 3.4-2).
- The site is not located within a floodplain (FEMA Flood Maps).
- The site is mapped within a critical aquifer recharge area with moderate risk of contamination (City of Cle Elum).
- The site contains slopes up to 65% in the waste rock pile area per geologic hazard assessment, Section 4.2 of Geotechnical Report by Terra Associates, Inc. See Geotechnical Report submitted under separate cover.
- For Erosion Hazard Area, refer to Section 4.6 and 4.7 of Geotechnical Report by Terra Associates, Inc. See Geotechnical Report submitted under separate cover.
- For geologic hazard assessment, refer to Section 4.3 of Geotechnical Report by Terra Associates, Inc. See Geotechnical Report submitted under separate cover. Shallow slope failures observed along Summit View Road.
- For Seismic Assessment refer to Section 4.1.4 of Geotechnical Report by Terra Associates, Inc. See Geotechnical Report submitted under separate cover.
- For Liquefaction Assessment refer to Section 4.1.3 of Geotechnical Report by Terra Associates, Inc. See Geotechnical Report submitted under separate cover. The potential for liquefaction is low.
- Sedimentation accumulation in the conveyance system downstream was observed during the supplemental field investigation conducted by Blueline on April 24, 2020. Per the DA, the project will not be required to remedy any already existing deficiencies in the existing system. Sediment removal is likely to occur as part of regular City maintenance.



4.1 UPSTREAM CONDITIONS

In the pre-developed condition of Phase 3, upstream flows of Tract R, and Tract T will be collected and directed south to Pond B7-B via the storm system to be installed in Phase 2. Similarly, to Tract R, and Tract T, Tract A's upstream flow will be intercepted and directed to Pond B7-B via Discovery Dr (formerly Phase 2 Road B) storm system, to be installed in Phase 2. In the developed condition of Phase 3, upstream flows will remain the same as that in the pre-developed condition.

4.2 EXISTING DRAINAGE SYSTEM

This project is for Phase 3, of the City Heights development. The full buildout condition of Pond B7-B Basin was analyzed was analyzed in *City Heights Phase 2 Storm Drainage Report* Section 6. As part of the EIS process, an offsite analysis for the entire City Heights development was prepared by Encompass Engineering & Surveying. An additional offsite analysis prepared by Barghausen Consulting Engineers, Inc. addresses the downstream system for the City Heights development. Refer to excerpts from the *Grading, Drainage and Utilities Engineering Report* that was prepared by Encompass Engineering & Surveying, dated March 24, 2010 and the *Downstream Drainage Analysis* prepared by Barghausen Consulting Engineers, Inc., dated February 25, 2011 refer to *City Heights Phase 2 Storm Drainage Report* Section 4. A supplemental field investigation was conducted by Blueline to confirm the findings in these reports. Refer to *City Heights Phase 2 Storm Drainage Report* Section 4.2 for Blueline's findings and Downstream Analysis.



Section 5 Core Elements

Compliance with Core Elements 1 through 8, per Section 2.2 of the 2004 SWMMEW, are listed below.

Core Element #1: Preparation of a Stormwater Site Plan:

Clearing, Grading and Infrastructure plans under separate cover and Storm Drainage Report herein have been prepared for the subject property.

Core Element #2: Construction Stormwater Pollution Prevention Plan (SWPPP):

The project will include temporary measures (silt fence, construction entrance) as well as permanent measures (seeding, landscaping) for control of stormwater during construction to be designed at the final engineering permit phase. See Section 7 for more information.

Core Element #3: Source Control of Pollution:

The site is mostly residential and is, therefore, anticipated to have minimal opportunities for pollution. The community will have an HOA which is encouraged to share educational information to future residents regarding water quality and to promote voluntary use of BMP's.

Core Element #4: Preservation of Natural Drainage Systems:

The site consists of one drainage basin that drains to an on-site stream (Stream C), tributary to Crystal Creek. In the proposed condition Crystal Creek 4 will enter a proposed conveyance system which will be routed to a tightline conveyance system, a biofiltration swale and a detention pond (Pond B7-B) prior to outletting into a dispersion trench upstream of Stream C.

The proposed project will preserve the natural drainage system. See Section 4 of *City Heights Phase 2 Storm Drainage Report* provided by Blueline for the downstream analysis.

Core Element #5: Runoff Treatment:

The project proposes more than 5,000 SF of PGIS, is not a high-use site, and does not discharge to a wetland or phosphorous sensitive receiving waters. Per Section 2.2.5 of the 2004 SWMMEW, basic water quality treatment is required.

Core Element #6: Flow Control:

The project will implement flow control BMPs per Chapter 6 of the 2004 SWMMEW. A detention pond (Pond B7-B) is proposed per BMP F6.10 to meet the allowable developed peak flows and not exceed the pre-developed rates for the following storm events: 50% of the 2-year storm event, 25-year storm event, and 100-year storm event (per DA).

Core Element #7: Operation and Maintenance:

An Operation and Maintenance Manual is provided.

Core Element #8: Local Requirements:

The project has been designed using the guidelines and requirements established in the 2004 SWMMEW and the City Heights Annexation and Development Agreement (DA), dated November 8, 2011. The DA contains references to local requirements and vesting.



Section 6 Permanent Stormwater Control Plan

6.1 EXISTING HYDROLOGY

The existing site is of Phase 3, of the City Heights development is undeveloped and mostly forested, with existing gravel roads and bike trails within the premises. An area breakdown of the existing conditions is summarized below. However, the full buildout condition for Pond B7-B Basin were analyzed and modeled in *City Heights Phase 2 Storm Drainage Report Section 6*. Within the full buildout condition the entirety of Pods B2-B6 were analyzed, Phase 3 are included in this area.

TRIBUTARY TO CRYSTAL CREEK 4

EXISTING CONDITIONS

Pervious (CN=73)

Forest	2.11	ac
TOTAL PERVIOUS (SOIL GROUP C)	2.11	ac

Impervious (CN=89)

Gravel Roads	0.03	ac
TOTAL IMPERVIOUS	0.03	ac
TOTAL EXISTING CONDITIONS	2.14	ac

6.2 DEVELOPED HYDROLOGY

The proposed Phase 3 project includes the creation of 19 lots (10 single family, 9 townhomes). However, the full buildout condition for Pond B7-B Basin (Pods B2-B6) were analyzed for the entirety of of Pods B2-B6. Refer to *City Heights Phase 2 Storm Drainage Report*.

Onsite storm drain infrastructure will collect and convey drainage for the site. Please refer to Engineering plans for more information on the proposed storm drain improvements. The areas used to run the drainage model associated with the developed basins conditions are summarized *City Heights Phase 2 Storm Drainage Report*.

The assumed percent impervious for each type of area is listed in the area tables below. Lot area coverage is based on anticipated house and garage footprints. This is conservative as it is anticipated that roof drains will not be directly connected to the conveyance system. The portion of the developed basin located on single-family lots is assumed to contain 50% impervious coverage. Townhome lots contain between 60% and 70% impervious coverage and modeled as 70% impervious coverage. Lot coverage assumptions are consistent with the *City Heights Phase 2 Storm Drainage Report*.



TRIBUTARY TO CRYSTAL CREEK 4 (Pond B7-B)

DEVELOPED CONDITIONS

Impervious (CN=98)

Lots 50% <i>impervious: Phase 3 lots (10-19)</i>	0.45	ac
Lots 70% <i>impervious: Phase 3 lots (1-9)</i>	0.37	ac
32' ROW (98% <i>impervious</i>)	0.17	ac
24' ROW (98% <i>impervious</i>)	0.05	ac
TOTAL IMPERVIOUS	1.04	ac

Pervious (CN=74)

Lots 50% <i>pervious: Phase 3 lots (10-19)</i>	0.45	ac
Lots 30% <i>pervious: Phase 3 lots (1-9)</i>	0.16	ac
32' ROW (2% <i>pervious</i>)	0.00	ac
24' ROW (2% <i>impervious</i>)	0.00	ac
Open Space Tracts (100% <i>pervious</i>)*	0.49	ac
TOTAL PERVIOUS (SOIL GROUP C)	1.10	ac
TOTAL DEVELOPED CONDITIONS	2.14	ac

*Pervious areas (other than forest) are modeled as 50% Pasture CN=74 and 50% Forest CN=73 in anticipation that forested areas will remain where feasible to preserve the natural feel of the development.



6.3 DESIGN PARAMETERS

This project is for Phase 3, part of the City Heights development. However, the full buildout condition for Pond B7-B Basin (Pods B2-B6) with water quality design, flow control, and pond performance has been analyzed in *City Heights Phase 2 Storm Drainage Report* Section 6.

6.4 LID BMP IMPLEMENTATION

LID BMPs will be implemented for the project to the maximum extent feasible per the 2004 SWMMEW recommendations. Per the Geotechnical Engineering Report prepared by Terra Associates, infiltration as a primary means of stormwater flow control and management will not be feasible. Amended soils will be applied to landscaped areas on the site. Additionally, native vegetation in critical area tracts will be preserved as well as in many of the proposed open space tracts.



6.5 CONVEYANCE SYSTEM DESIGN

Per the City Heights Annexation and Development Agreement, dated November 8, 2011 the storm drain conveyance system will be designed to convey the 100-year storm. The conveyance system is designed with sufficient capacity to convey and contain the 100-yr peak flow and no overtopping.

The Rational Method is most appropriate for sizing new conveyance systems that drain smaller, quickly responding tributary areas (i.e., less than 10 acres) where very short, intense storms tend to generate the highest peak flows. For conveyance sizing and analysis tributary to Pond B7-B, in Phase 3 the Rational Method is most accurate and will be used for conveyance system sizing.

The hydraulic grade line is calculated using a backwater analysis spreadsheet. The spreadsheet performs a standard step backwater analysis on the network based on flows to each pipe, accounting for friction losses, bend losses, and velocity head losses. The steady state energy (Bernoulli) equation is used to calculate the hydraulic grade line at each on-site catch basin from downstream to upstream, beginning with the maximum water surface elevation of the downstream facility as the initial network tailwater elevation.

The tabular summary of the backwater spreadsheet analysis for each tributary area to Pond B7-B for the 100-year event was calculated in *City Heights Phase 2 Storm Drainage Report* Section 6. A conveyance analysis has been created for Phase 3 for the 100-year storm. Refer to the conveyance analysis tables on the following pages.



Pond B7-B – Hydraflow Method, 100-year event

The areas associated with Pond B7-B were analyzed using the Hydraflow Method in the 100-year storm event. Phase 3 areas were analyzed within this model. Refer to *City Heights Phase 2 Storm Drainage Report* Section 6.8 Conveyance System Design, for the full sizing for Pond B7-B. The developed, unmitigated 100-year storm event is 20.03 cfs, the entire flow, 20.03 cfs, is conservatively used for determining the flow tributary to each catch basin.

Hyd. No. 2

POST (Crystal Creek 4)

Hydrograph type	= SCS Runoff	Peak discharge	= 20.03 cfs
Storm frequency	= 100 yrs	Time to peak	= 8.47 hrs
Time interval	= 1 min	Hyd. volume	= 388,438 cuft
Drainage area	= 24.300 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 56.50 min
Total precip.	= 6.09 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(11.740 \times 98) + (6.960 \times 73) + (5.600 \times 74)] / 24.300$

In order to determine the flow tributary to each catch basin, the percent of the total area tributary to the catch basin was determined and then multiplied by the total tributary to the pond. For example, the total flow tributary to Phase 3 – CB 2 is equal to 0.29 acres divided by 21.84 acres multiplied by 20.03 cfs, or 0.27 cfs. The conveyance system tailwater elevation is taken to be the 100-year water surface elevation at the already modeled Phase 2 – CB 2, 2083.76. The conveyance tailwater elevation for Phase 3 – CB 4 was taken from the crown elevation of the outfall pipe of Phase 3, 2098.34. The CB collecting the northern area of Phase 3 (CB 17) was analyzed in Phase 2, refer to *City Heights Phase 2 Storm Drainage Report* Section 6.8 Conveyance System Design.

The Tributary areas to each catch basin are shown in the exhibit below, refer to *Tributary Area Exhibit* for an area breakdown. A conservative assumption is that the impervious areas from each lot will be tightlined from the downspouts into the proposed stormwater drainage system.

As shown on the spreadsheets on the following pages, the headwater elevations remained below the rims during the 100-year storm. Therefore, the system meets the requirements of the City Heights Annexation and Development Agreement, dated November 8, 2011 and is adequately designed.



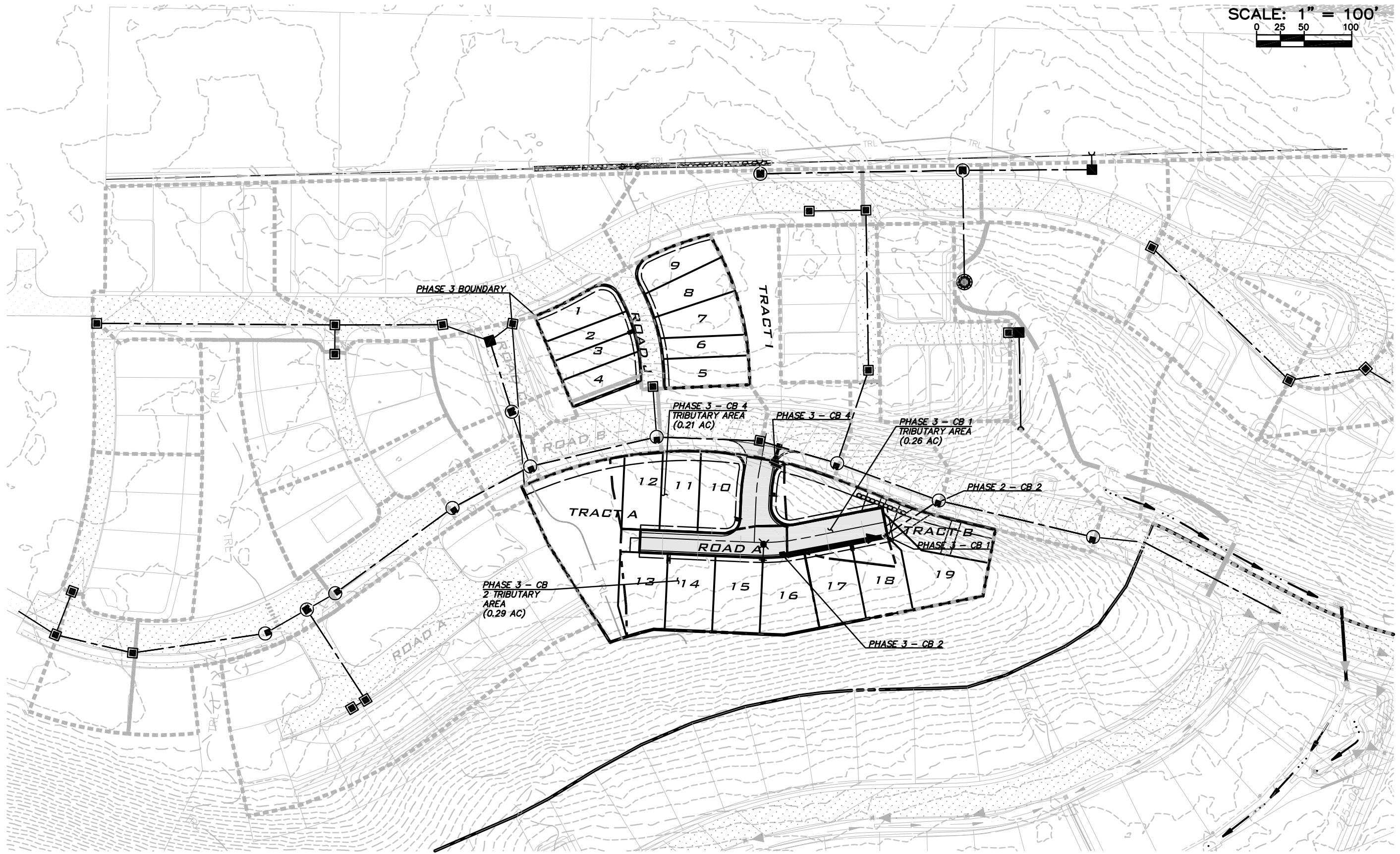
BACKWATER CALCULATIONS

PIPE SEGMENT		Q (CFS)	PIPE LENGTH (FT)	PIPE SIZE (IN)	MANNING'S "n" VALUE	OUTLET ELEVATION (FT)	INLET ELEVATION (FT)	PIPE AREA (SQ FT)	FULL VELOCITY (FT/SEC)	VELOCITY HEAD (FT)	TAILWATER ELEVATION (FT)	FRICTION LOSS (FT)	ENTRANCE	ENTRANCE	EXIT	OUTLET	INLET	APPROACH	BEND	JUNCTION	HEADWATER	RIM	FREEBOARD
FROM CB	TO CB												HGL ELEVATION (FT)	HEAD LOSS (FT)	HEAD LOSS (FT)	CONTROL ELEVATION (FT)	CONTROL ELEVATION (FT)	VELOCITY HEAD (FT)	HEAD LOSS (FT)	HEAD LOSS (FT)	HEADWATER ELEVATION (FT)	RIM ELEVATION (FT)	
Phase 2- CB 2	Phase 3 - CB 1	0.51	67	12	0.011	2080.56	2087.81	0.79	0.65	0.01	2083.76	0.01	2088.81	0.00	0.01	2088.82	2088.81	0.00	0.00	0.00	2088.82	2099.81	10.99
Phase 3 - CB 1	Phase 3 - CB 2	0.27	110	12	0.011	2087.81	2102.89	0.79	0.34	0.00	2088.82	0.00	2103.89	0.00	0.00	2103.89	2103.89	0.00	0.00	0.00	2103.89	2106.85	2.96
Phase 3 - CB 3	Phase 3 - CB 4	0.19	19	12	0.011	2091.80	2098.34	0.79	0.24	0.00	2098.34	0.00	2099.34	0.00	0.00	2099.34	2099.34	0.00	0.00	0.00	2099.34	2102.34	3.00

TRIBUTARY AREA EXHIBIT



SCALE: 1" = 100'
0 25 50 100



TRIBUTARY AREA EXHIBIT CITY HEIGHTS - PH 3

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SCALE	AS NOTED
PROJECT MANAGER	BRETT PUDISTS, PE
DESIGNED BY	FAITH MINGUS
DRAWN BY	FAITH MINGUS
PLOT DATE	January 18, 2023

JOB NUMBER:
19-349

FIGURE:
TA-1

Jan 18, 2023 - 4:07pm - User: faithmingus
E:\Projects\19349\Drawings\Final\WestPh3\Exhibits\2022-12-05_19-349 TA Exhibit - Ph.3.dwg

Section 7 SWPPP

A SWPPP will be submitted under a separate cover prior to construction.



Section 8 Special Reports and Studies

Refer to the *Geotechnical Engineering Report and Geologic Hazard Assessment* prepared by Terra Associates, Inc. dated June 9, 2020, *Wetlands and Wildlife Habitat Report* prepared by Sewall Wetland Consulting, Inc. dated October 26, 2009, and *Impacts Analysis* reports prepared by Sewall Wetland Consulting, Inc. dated March 8, 2022 and March 11, 2022 and the *Geotechnical Plan Review Letter* prepared by Terra Associates, Inc. dated May 23, 2022 included under separate cover.



Section 9 Other Permits

Forest Practices Application (FPA) will be required as part of City Heights Phase 2 (Pods B4, B5 & B6) as will an HPA permit from WDFW. City Heights Phase 3 will be included within this application. Refer to *City Heights Phase 2 Storm Drainage Report Other Permits*.



Section 10 Operation and Maintenance

The main stormwater collection and conveyance system addressing runoff from the proposed lots, tracts and roadways within City Heights and runoff from upstream areas shall be a public system (owned and maintained by City).

The applicant has agreed to own and maintain the following items provided a declaration of covenant for inspection and maintenance of stormwater facilities is provided to the City at final plat.

- Storm drain conveyance systems located in private roads and private alleys provided a downturned elbow or other accepted floatables separator is provided at the last catch basin in the private system discharges flow to the public system.
- Detention and water quality facilities that are located in private tracts as depicted on the Phase 2 plans.

Lot owners will be responsible for maintaining service lines and drains (if used) within their individual property limits. Symptoms of failure are clean-outs or yard drains overflowing. If this happens, the homeowners should remove the structure lid and remove visible debris. If problems persist, the service drain should be flushed or professionally cleaned.

Semi-annual inspections are recommended before and after the wet season (Oct/Nov and April/May) to ensure proper operation of the drainage system. Any detected maintenance problems should be corrected prior to the winter season. Sediment can build up inside control structures and catch basins, blocking or restricting flow to the inlet. To prevent this problem, these structures should be regularly inspected and routinely cleaned.

The following maintenance instructions per the 2004 SWMMEW are included at the end of this section:

No. 5 – Catch Basins

No. 6 – Debris Barriers (e.g., Trash Racks)



No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No Trash or debris located immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) that exceeds 60% of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Contamination and Pollution	See "Wetponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

No. 6 – Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe