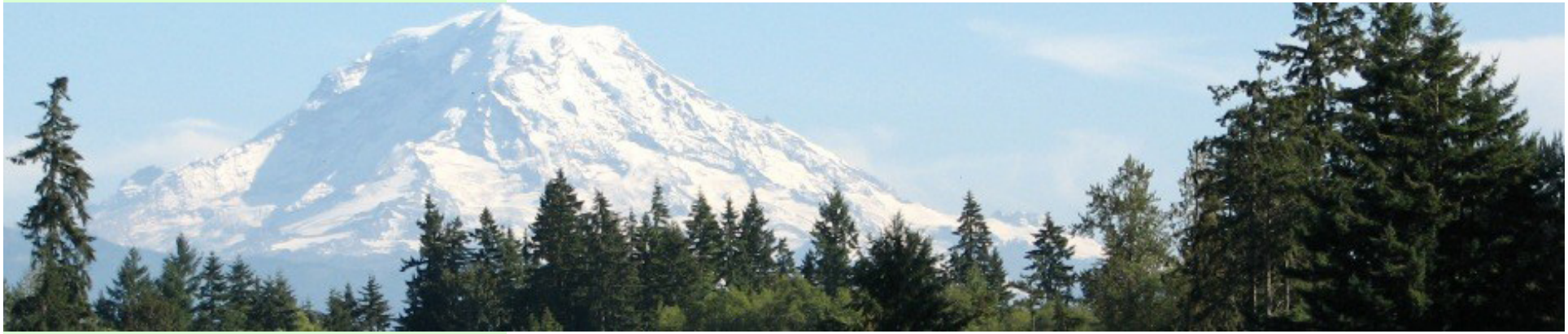
Preliminary Design Report

CHAMBERS CREEK CANYON TRAIL

February 27, 2017



City of University Place
City of Lakewood
Pierce County
Washington

University Place WASHINGTON

City of Lakewood WA 1996

Pierce County Parks and Recreation

BergerABAM

Bruce Dees & Associates

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Acknowledgments 1

Project Scope and Introduction 2

Original Trail Alignment 4

Design Criteria 7

Mapping Methods and Fieldwork 8

Trail Alignment Revisions
- Summary....12
- Reroute #1 13
- Reroute #2 14
- Reroute #3 15
- Potential Reroute #4 17

Final Trail Alignment 18

Bridges
- Summary....38
- Bridge #1....40
- Bridge #2....44
- Bridge #3....48
- Bridge #4....49
- Other Bridges & Crossings....50

Trailheads
- Summary 52
- Kobayashi Park 54
- Chambers Creek Road 55
- Phillips Road....56
- Zircon Drive SW....57
- Tiffany Park, 91st Ave CT SW 58
- 86th Ave West 59
- Chambers Creek Road West 61

Typical Cross Sections / Details 62

Cost Estimate
- Summary 64

Phasing Plan
- Summary....66
- Phased Cost Estimate 69

Appendix
- Permit Matrix....71
- Impact Summary 72
- Bridge Matrix 73
- Bridge Survey Controls....74
- Meeting Minutes 76

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

The Chambers Creek Canyon Trail preliminary design included high level participation from representatives of the City of University Place, the City of Lakewood, and Pierce County.

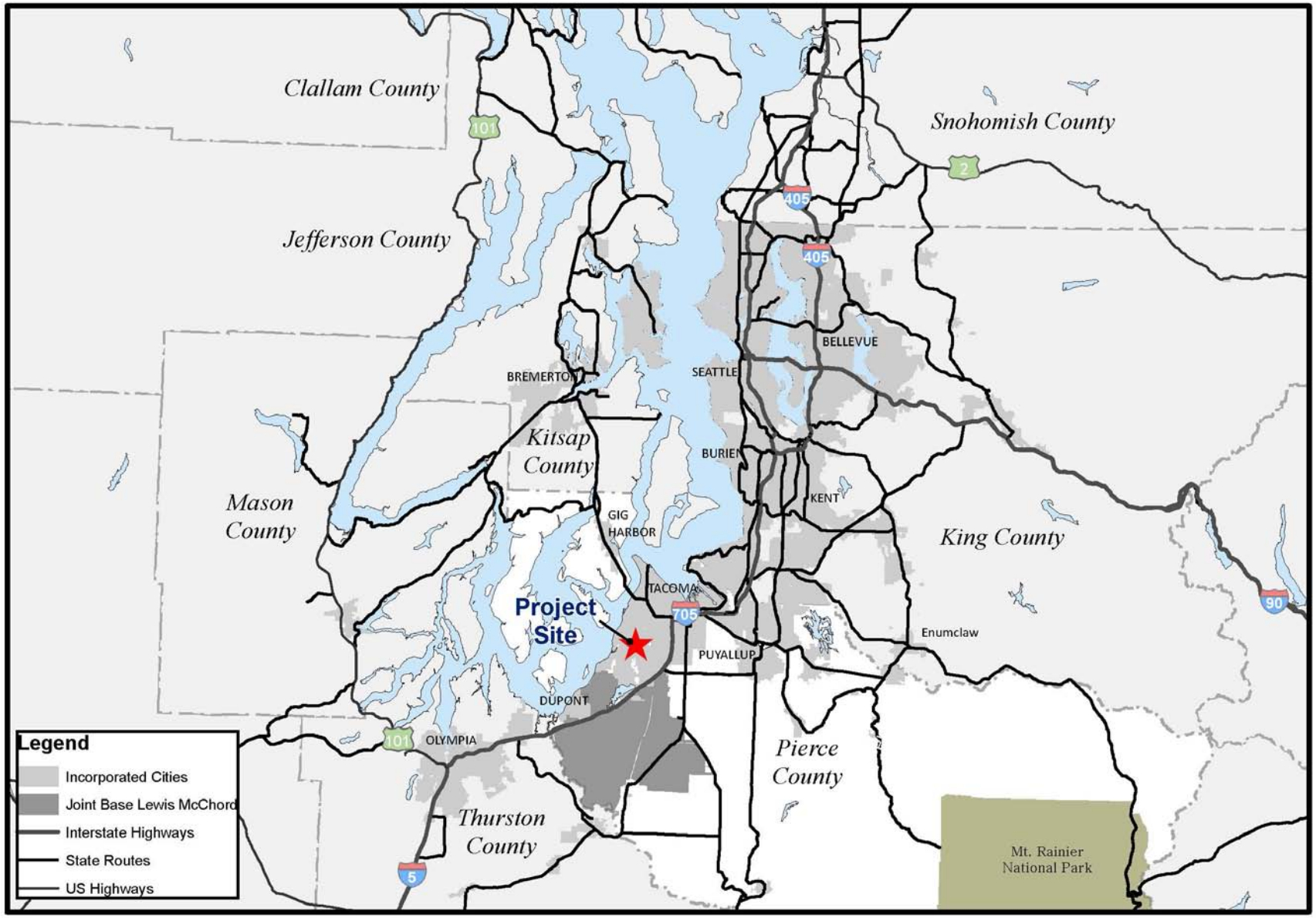
City and County Representatives

City of University Place	David Swindale, Director of Planning and Development Services Gary Cooper, Director of Public Works, Parks and Recreation
City of Lakewood	Mary Dodsworth, Parks, Recreation and Community Services Director
Pierce County	Joseph Coppo, Senior Parks & Recreation Planner Jessica Stone, Natural Lands Steward

Consultants

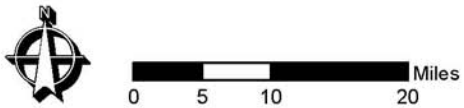
Bruce Dees & Associates	Bruce Dees, Principal-in-Charge Rachel Lingard, Landscape Architect / Project Manager
Berger ABAM	Myles Parrish, Project Engineer Dan Roscoe, Senior Environmental Scientist

PROJECT SCOPE AND INTRODUCTION



CHAMBERS CREEK CANYON REGIONAL LOCATION MAP

10/19/16



Pierce County
Parks and Recreation Services

PROJECT SCOPE AND INTRODUCTION

Executive Summary

Chambers Creek Canyon is a deeply incised, forested stream corridor between the Cities of Lakewood and University Place in the South Puget Sound region. Consisting of 204 acres along a 2.5-mile section of Chambers Creek, the site engulfs trail users in a forested canopy of mature Douglas-fir, western hemlock, and western red cedar. With its thick native understory and the sound of Chambers Creek flowing through the canyon, it creates a unique backcountry experience in the middle of a dense urban setting.

Pierce County, which manages the property as part of the 935-acre Chambers Creek Regional Park, is partnering with the cities of Lakewood and University Place to develop a final trail alignment through the canyon. The entities retained Bruce Dees & Associates and Berger ABAM as consultants to assist with this planning effort. This trail network will provide safe pedestrian access between the two cities for over 100,000 people who live within walking and biking distance.

Needs for the Project

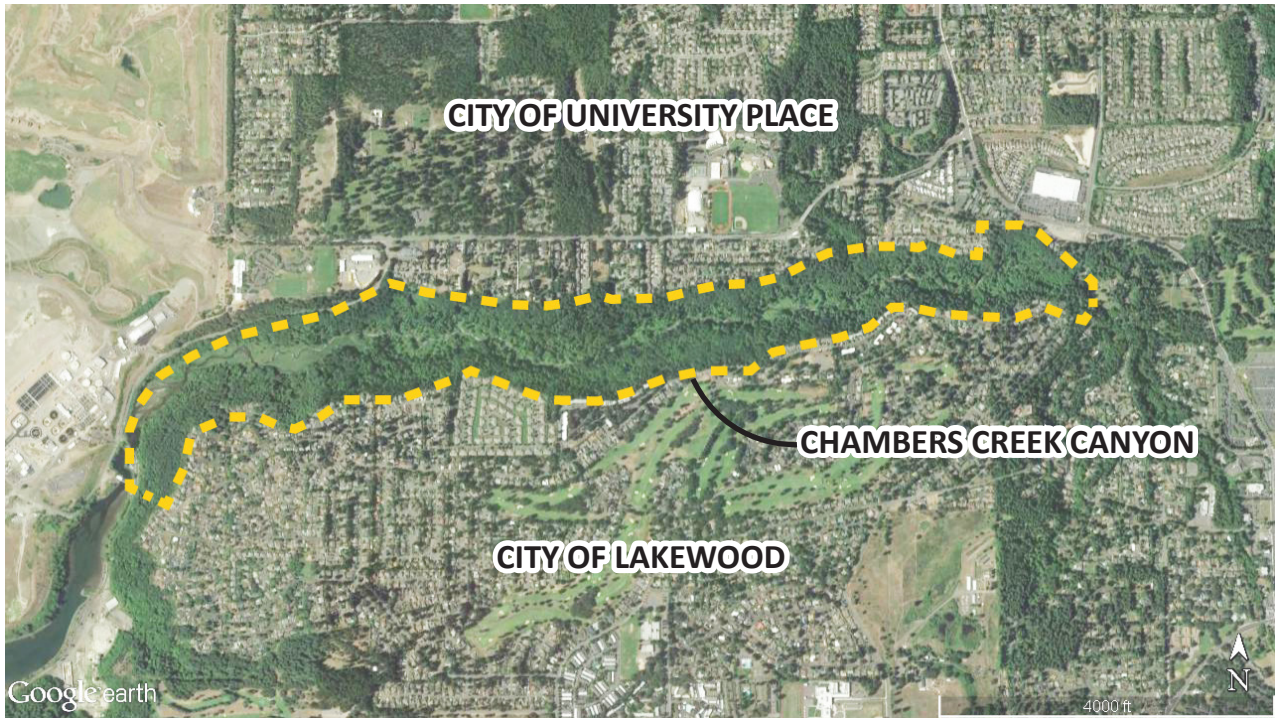
The lack of clearly defined trails within the canyon has resulted in hundreds of volunteer paths. These informal trails threaten the integrity and stability of the steep canyon slopes as well as the health of wildlife habitat. A clearly defined and feasible trail alignment providing safe access for users while simultaneously protecting and preserving sensitive areas within the canyon was needed before any future improvements to the trail network could commence.

Current Work

The consultant team worked closely with the city and county representatives to develop a final trail alignment for Chambers Creek Canyon including trail surfacing recommendations and preliminary bridge, boardwalk, and trailhead designs and locations.

Future Work

Future work will include taking the preliminary design through to implementation. Additional studies, mapping, detailing, and permitting will be required before final and accurate documents can be produced for bidding and construction.



GOOGLE EARTH AERIAL, CHAMBERS CREEK CANYON

CHAMBERS CREEK

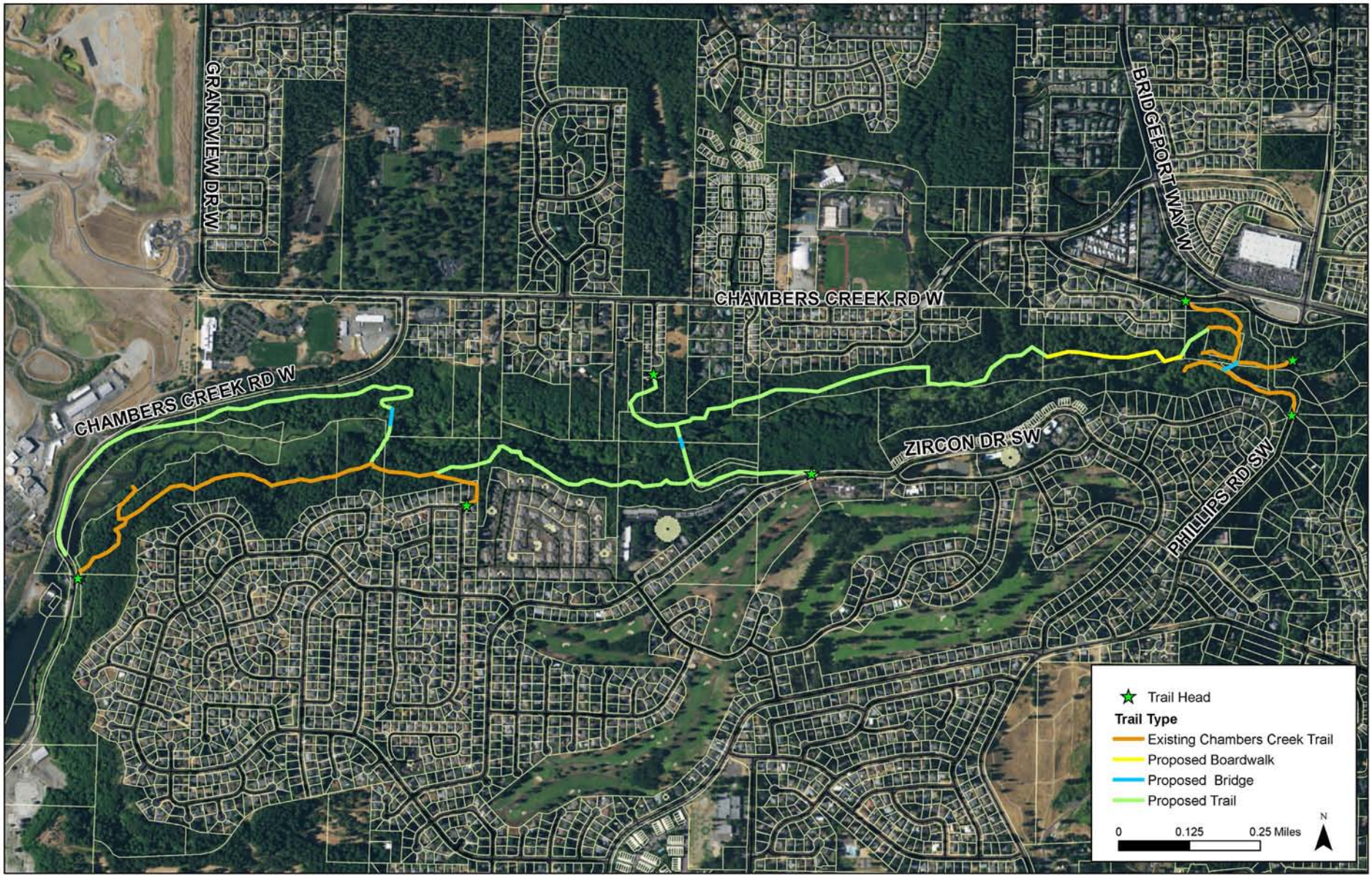
EXISTING CHAMBERS CREEK TRAIL

ORIGINAL TRAIL ALIGNMENT

Summary

Prior to the retention of the consultants, the cities and county worked together to produce a preliminary feasibility alignment for the trail network. This alignment was collected by geographic positioning systems (GPS) and mapped using geographic information system (GIS) methods. This information was provided to the consultant team at the beginning of the planning effort. The team used this preliminary alignment as a starting point for their field work. Recommendations for deviations from this original alignment were presented to the city and county representatives prior to adoption of the final trail alignment (see page 18) described in this report.

ORIGINAL TRAIL ALIGNMENT



ORIGINAL TRAIL FEASIBILITY MAP
The above map was produced by the City of University Place & the City of Lakewood.

THIS PAGE INTENTIONALLY LEFT BLANK

Trail Aesthetics

The character of the new trail will be soft surfaced (wood chips in dry areas or gravel in wet areas) to match existing sections of developed trail in the canyon. The trails and boardwalks will be 6 feet wide, providing enough space to allow two people to walk abreast. Structures such as bridges and boardwalks will be minimally visually intrusive and will blend with the natural character of the site.

Access

Access to the majority of the trail network will be limited to pedestrian use, except for Bridge #1 located west of Kobayashi Park. This bridge will be accessible to small service vehicles as needed. This bridge will also provide ADA access to the creek from Kobayashi Park. Several trailheads along the canyon will provide direct trail access for the surrounding communities (see pg. 52).

Habitat Protection

Chambers Creek Canyon contains pristine wetland and wildlife habitat. The new trail alignment will reduce the impact on these sensitive areas by avoiding them wherever possible. Where crossing sensitive areas is unavoidable, less impacting structures such as clear span bridges and boardwalks will be used to minimize disturbance.

Development Costs

The final trail alignment will reduce the project development costs by incorporating routes that avoid challenging site conditions such as steep cross slopes, wetlands, and other sensitive areas. Avoiding unnecessary wetland and creek crossings will reduce the permit requirements and associated costs of development for elements such as boardwalks and bridges.

CHARACTER OF EXISTING SOFT SURFACE TRAIL

SENSITIVE AREA - WETLANDS

CHALLENGING CONDITIONS - STEEP SLOPES

MAPPING METHODS AND FIELD WORK

Background

Chambers Creek flows through the bottom of the canyon at the project's eastern limit of Kobayashi Park to Puget Sound. There are two primary tributaries to the creek within the project area: Leach Creek and Peach Creek. Chambers Creek exhibits some bank armoring (riprap) through Kobayashi Park before transitioning to natural banks. The floodplain associated with Chambers Creek is fairly broad, but does narrow in places where the canyon slopes abut the creek. Riverine wetlands are common within the valley bottom and are strongly associated with the water elevations in the creek at different times of the year. Wetland vegetation includes reed canary grass (*Phalaris arundinacea*), which dominates in several locations. A mixed forest dominates the canyon and provides shading and riparian habitat. Overstory vegetation consists of Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterphylla*), and bigleaf maples (*Acer macrophylum*).

Mapping Methods

The consultants prepared a base map for the project by collecting available geographic information system (GIS) data from various public sources. The base map consisted of the following data sources.

- Pierce County – 2010 Light Detection and Ranging (LIDAR) derived topography, county wetland inventory, roads, parcels
- Federal Emergency Management Agency (FEMA) – preliminary floodplains
- Washington Department of Natural Resources – watercourses
- University Place and Lakewood provided the original trail alignment that was collected by geographic positioning systems (GPS) during the trail concept development. The base maps were intended to provide a context for the final trail alignment and for use in evaluating the potential route refinements.

Trail Layout & Field Work

Chambers Creek Canyon is a unique area characterized by steep slopes, forested terrain, and a creek running through the base of the valley. The trail alignment is constrained primarily by the slopes and sensitive resources including: wetlands, Chambers Creek, wetland and creek buffers, and adjacent neighborhoods.

The original trail alignment was verified through a field review effort that spanned several site visits. The consultant team walked the length of Chambers Creek Canyon following the previous GPS alignment that was provided by the cities and county. The site conditions were reviewed with respect to existing trail conditions, vegetation communities, slopes, and Chambers Creek, among others.

The field review documented existing conditions for the trail alignment, which are summarized as follows.

University Place Trail

The University Place portion of the trail (Station 7100 to 14500, see pages 27 through 33) is located on the north side of the canyon, from Kobayashi Park to the point where it crosses Chambers Creek into Lakewood. The trail in this location is largely undeveloped outside of Kobayashi Park. Previous logging of the canyon left logging roads, which were evident during field review and could be useful for locating the trail. The trail traverses the northern slopes of the canyon from east to west. Access to the Chambers Road East Trailhead and Phillips Road Trailhead are provided at stations 13700 and 13900, respectively. Access to Philips Road will be provided by a new bridge (Bridge # 1) constructed over Chambers Creek.

In general, the University Place Trail faces several challenges in its construction: steep slopes, wetland seeps, and riverine wetlands. The trail traverses steep canyon slopes leaving Kobayashi Park to the west. The design team believes a portion of the trail could be a cantilevered boardwalk, as the slope's angle and saturation likely prevent traditional trail construction techniques.

CHAMBERS CREEK & FORESTED RIPARIAN FLOODPLAIN

BRIDGE #1 LOCATION

MAPPING METHODS AND FIELDWORK

VIEW UP THE SLOPE ON UNIVERSITY PLACE SIDE OF THE CREEK

Once the trail crosses the slope requiring a cantilever boardwalk, it drops down to Chambers Creek and is envisioned to be an elevated boardwalk through riverine wetlands. The boardwalk will formalize several user-defined trails along the creek.

At Station 11500, the trail leaves the floodplain and climbs the northern canyon slope. The trail traverses the slopes to the west and crosses multiple wetland seeps. These crossings are envisioned to be elevated trail crossings to minimize wetland impacts. Crossing could be either small boardwalk-type sections or large rock fill that would allow drainage to flow unimpeded. Openings in the forest offer views of the canyon and Chambers Creek along this section of trail.

Peach Creek (Station 10800) would be crossed by a small timber bridge that spans the channel banks. The trail could take advantage of previous logging roads between Stations 8300 and 9000 to minimize construction impacts.

At Station 7300, the trail splits into the 86th Avenue West Trailhead access to the north and the continuation of the trail to Lakewood to the south. The bridge to Lakewood (Bridge # 2) is envisioned to be a suspension bridge in order to span the creek. At this location (Stations 7000 to 7100), the canyon slopes run steeply down to the creek and leave little room for construction of a traditional trail bridge. Natural benches on either side of the creek afford the opportunity to construct abutments for a suspension bridge.

TYPICAL SLOPE WETLAND CROSSING

VIEW OF CHAMBERS CREEK FROM UNIVERSITY PLACE TRAIL

MAPPING METHODS AND FIELD WORK

Lakewood Trail

The Lakewood portion of the trail (Stations 0 to 7100) is located on the south side of the canyon. Similar to the University Place side, this trail traverses the canyon slopes west to the Chambers Road West Trailhead. From Bridge #2, the trail follows old logging roads to the Zircon Drive Trailhead access at Station 6400.

A new trail would then be constructed from Station 6400 to 3800 by formalizing several informal user trails in this section. At Station 3800, the new trail merges into the existing trail system in Lakewood. Access to the Tiffany Park 91st Ave CT SW Trailhead is located at Station 3850. Portions of the existing trail need minor improvements such as resurfacing (Stations 0 to 3800).

At Station 3200, a viewpoint access trail will be improved to provide views of Chambers Creek. This viewpoint is also the site of a potential bridge (Bridge #3) that could be constructed in the future and could establish a lower canyon loop trail. Several user-defined spur trails that access Chambers Creek may be restored as part of the trail project. Measures may also be introduced to restrict access to some of these spur trails.

OLD LOGGING ROAD ACCESS TO ZIRCON DRIVE TRAILHEAD

EXISTING CONDITION OF A SEGMENT OF LAKEWOOD TRAIL

WETLAND SEEP CROSSING TRAIL AT STATION 2200

CHAMBERS CREEK OBSERVATION POINT AT BRIDGE #3

TRAIL ALIGNMENT REVISIONS

Summary

The consultant team considered several factors for potential reroutes when reviewing the trail location in the field.

1. Can impacts to critical areas (i.e., wetlands) be avoided or minimized by rerouting the trail?

2. Can traditional trail construction be accomplished by rerouting the trail?

3. Can the trail alignment take advantage of natural openings to minimize vegetation removal?

The field review of the original trail alignment resulted in three trail reroutes. A fourth reroute option was identified, but not incorporated into the final trail alignment because it would involve moving the trail close to private property. It is included in this report as an option.

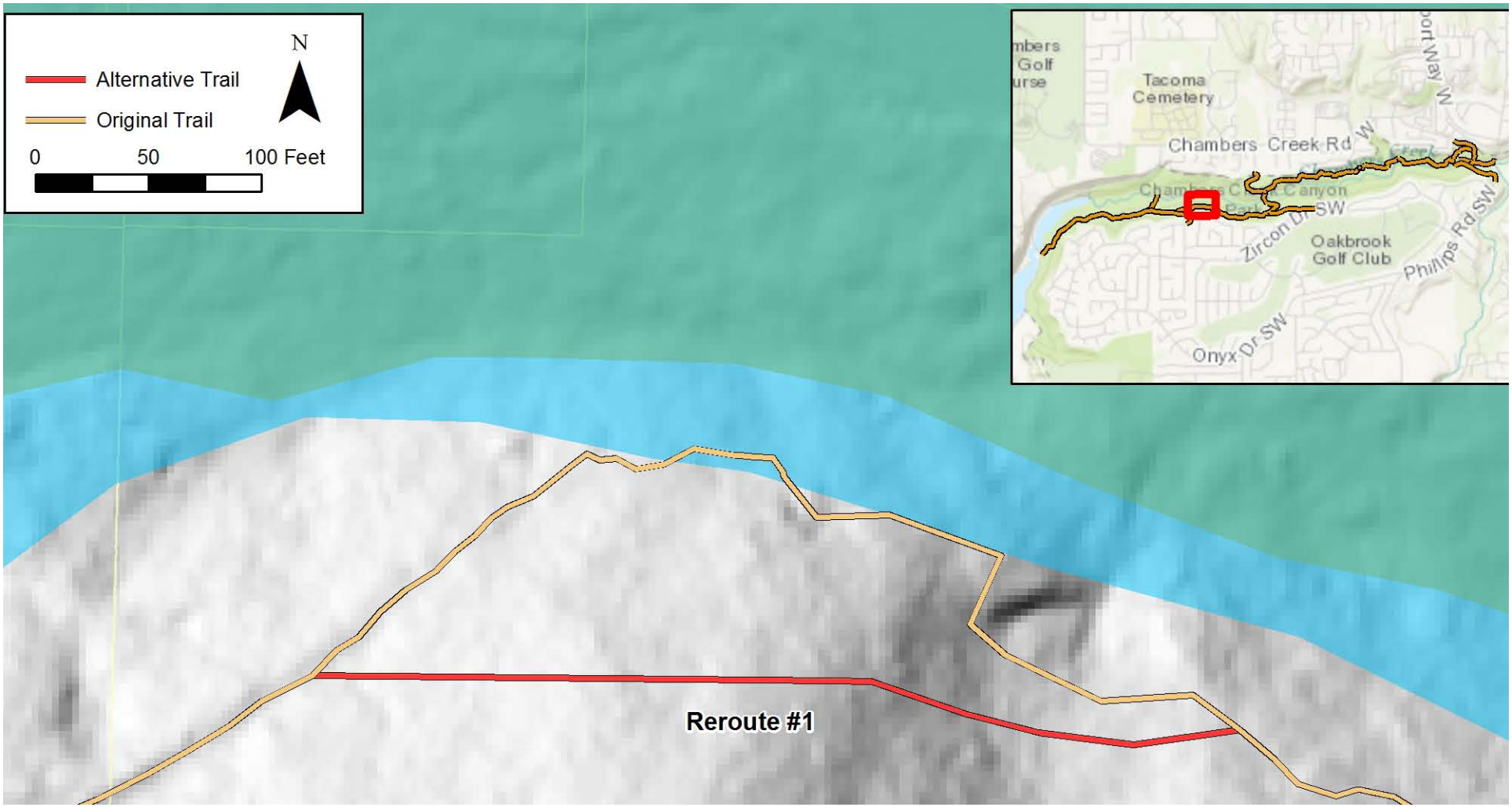
USER-CREATED STEPS ON STEEP SLOPES (REROUTE #2)

USER-CREATED STEPS ON STEEP SLOPES (REROUTE #1)

TOP OF STEEP SECTION (REROUTE #3)

Reroute #1

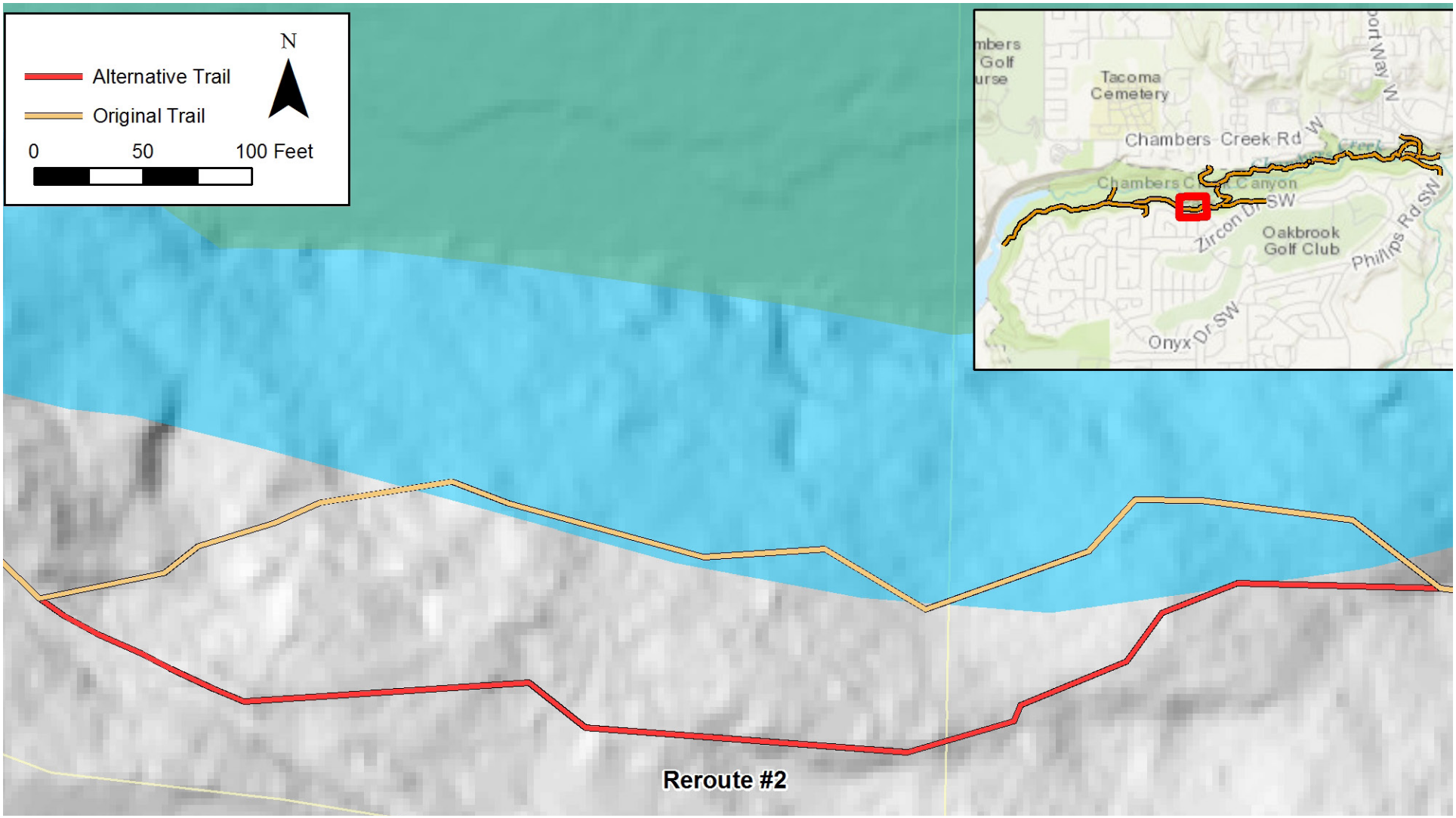
The original trail location traversed the slopes following informal user trails. While the original trail concept works, field review suggested that construction of traditional trail (cut/fill) may not be feasible on several of the cross slopes. User-created steps and rope ladders were observed on this alignment, suggesting that steep slopes are a concern to existing users. Extended cuts and slope stabilization may be required to construct the trail in this alignment. A reroute was identified further upslope (south) of the original trail. The reroute takes advantage of gentler cross slopes and minimizes the amount of cut/fill needed to construct the trail. Existing openings in the forest were connected to minimize tree removal on the reroute.



TRAIL ALIGNMENT REVISIONS

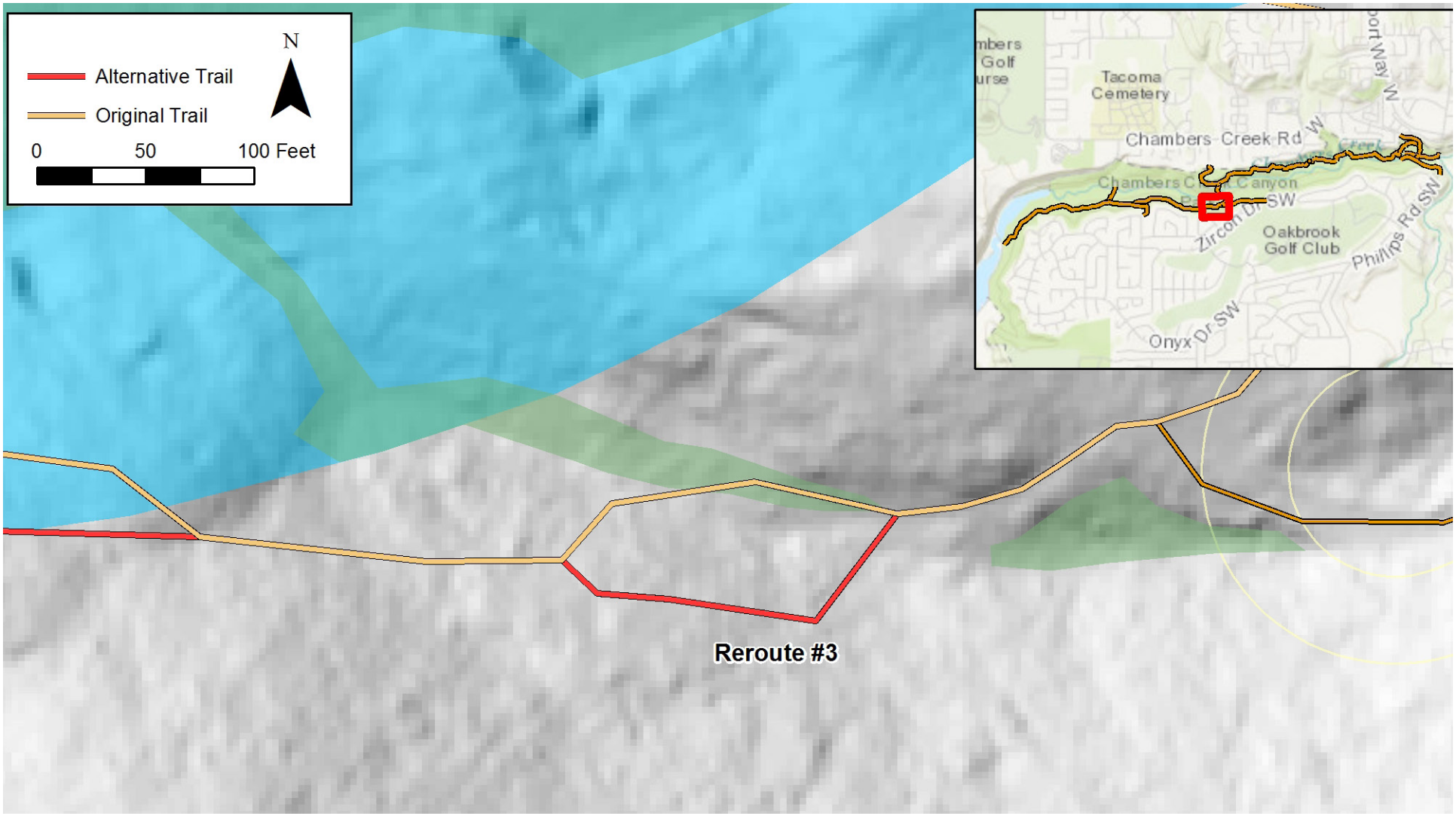
Reroute #2

The original trail alignment in this location traversed steep cross slopes similar to Reroute #1. The original trail rounded a steep knob near the east end, which could be a challenge to construct. The reroute takes advantage of a natural bench in the topography and minimizes the amount of cut/fill needed to construct the trail.



Reroute #3

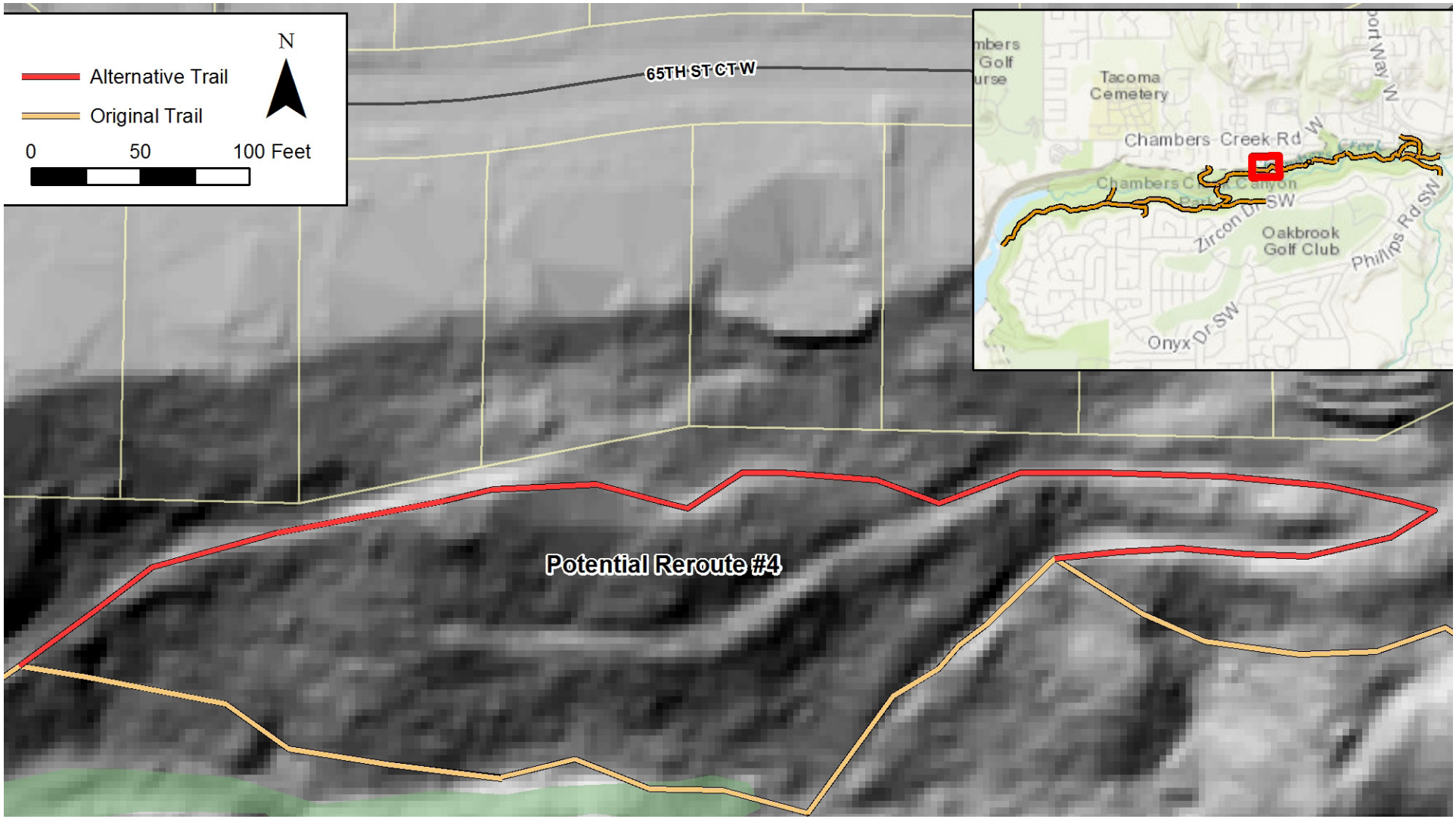
The original trail alignment dropped down the slope, cut under a very steep cross slope, and through a wetland before picking up an old logging road near the access to Bridge #2. The reroute moves the trail south and above the steep section to avoid impacts to the wetland at the toe of the slope.



THIS PAGE INTENTIONALLY LEFT BLANK

Potential Reroute #4

The original trail in this location followed old logging roads that were evident during field review. A portion of the logging roads have developed wetlands where groundwater now forms seeps and flows down the road. Slight changes in the alignment upslope (north) of the wetland or use of an elevated boardwalk may be possible, but would require additional permitting and constructability review. A possible reroute exists in this location to utilize other logging roads with no wetlands, but it would move the trail closer to private property at the top of the canyon. Further discussions between the partners and community stakeholders would be needed if this reroute is selected in the future.



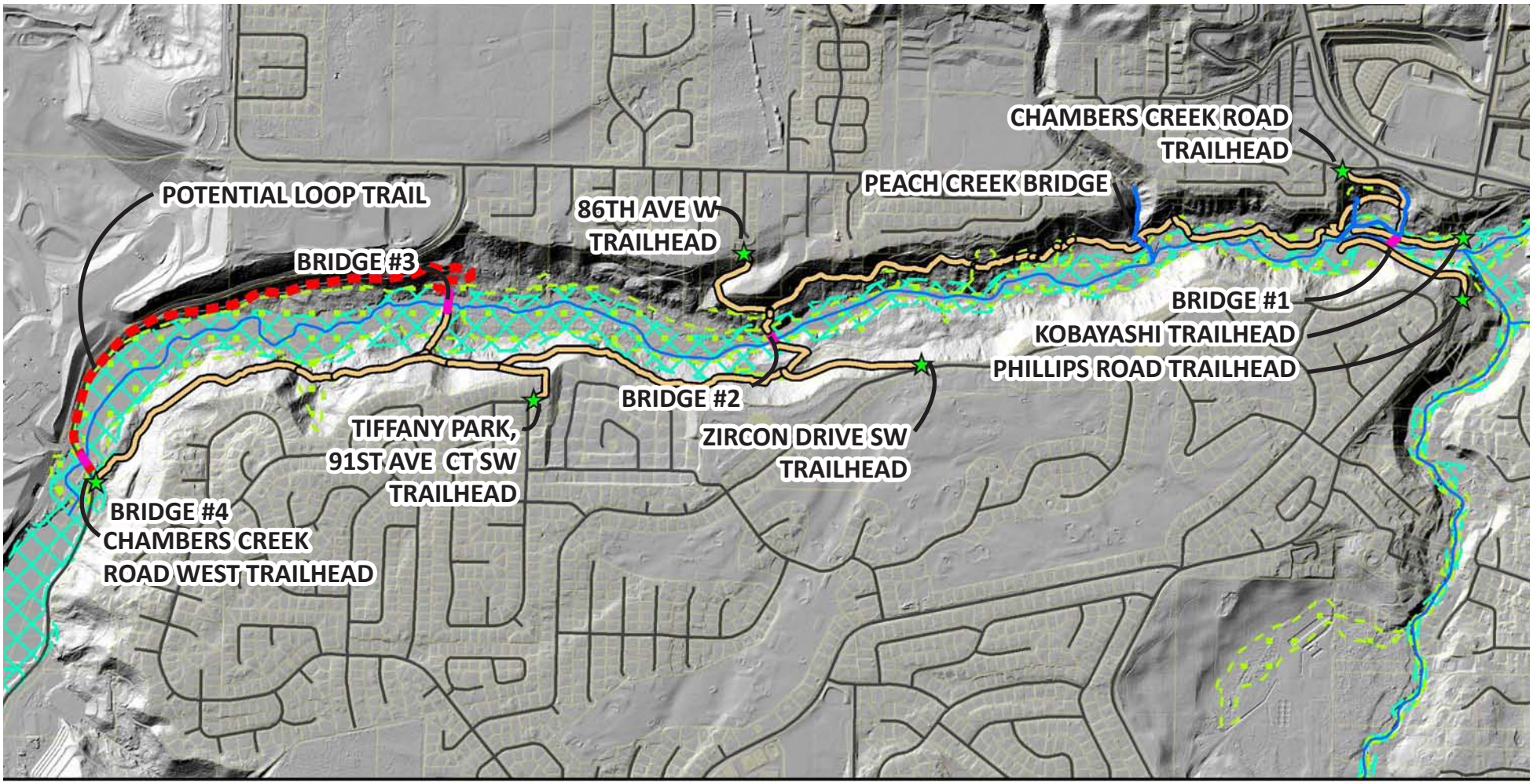
FINAL TRAIL ALIGNMENT

Summary

Following the field review and discussions with the City, three trail reroutes were incorporated into the final trail alignment. Several other refinements of the trail were also made that resulted from the data and field review. These included slight changes to better align the trail with the LIDAR topography or locations where improved GPS signals resulted in a slightly different location. Once the trail alignment was finalized, a main trail running the length of the canyon from Kobayashi Park to the Chambers Creek Road West Trailhead was established. Stationing was added to aid in identifying trail segments and provide reference points along the main trail that are referenced in the previous trail descriptions.

Potential Loop Trail

Although not incorporated in this scope of work, an additional segment of trail could be developed on the University Place side of the creek connecting Bridges #3 and #4. This segment would create a loop trail, which is typically desirable to surrounding communities (see map to the right). The alignment shown is the original GPS route developed by the partners.



Chambers Creek Canyon Trail System

- Road
- Stream
- Wetland
- 100-year Floodplain
- Parcel Boundary
- Canyon Creek Trail System
- Bridge
- Potential Loop Trail

Proposed Feature

- Trailhead

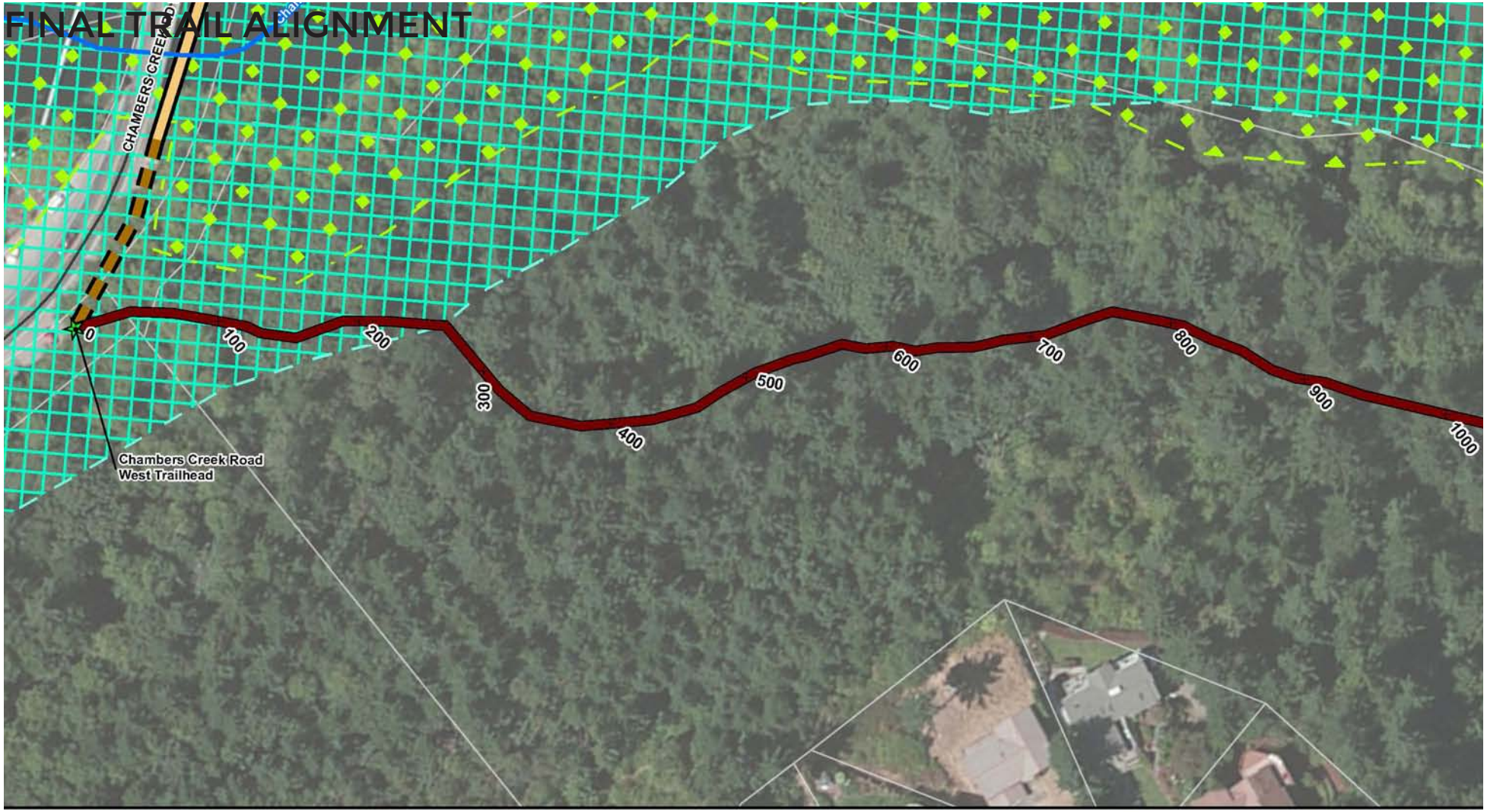
Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County

0 500 1,000 2,000 Feet

1 inch = 1,250 feet

N

FINAL TRAIL ALIGNMENT



Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

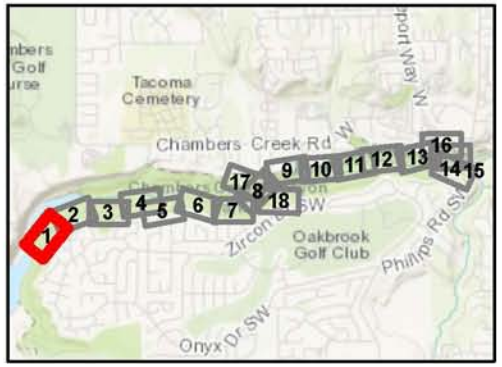
Proposed Trail

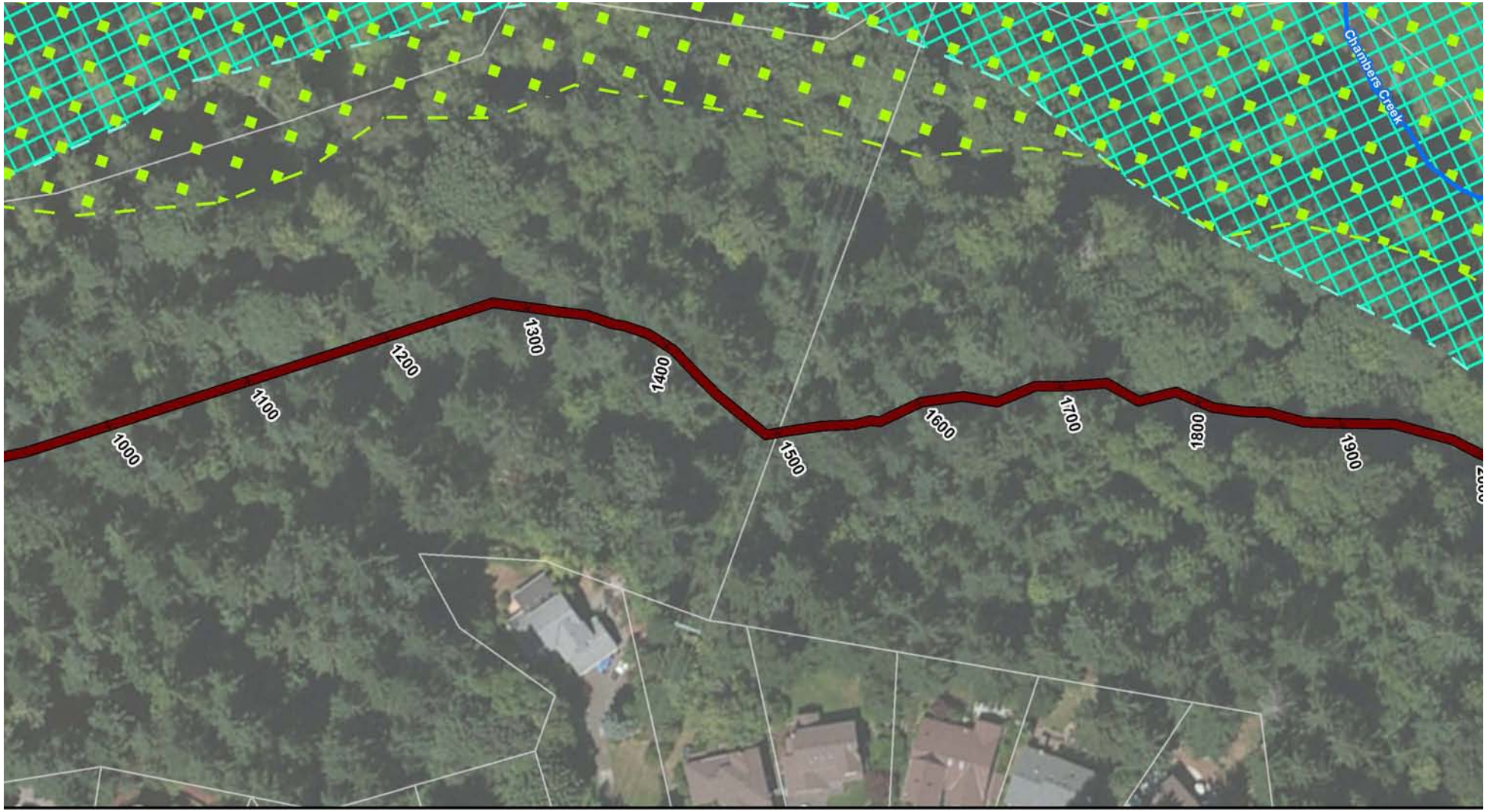
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 1 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

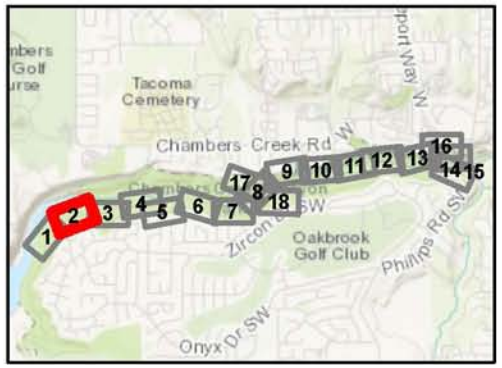
Proposed Trail

- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

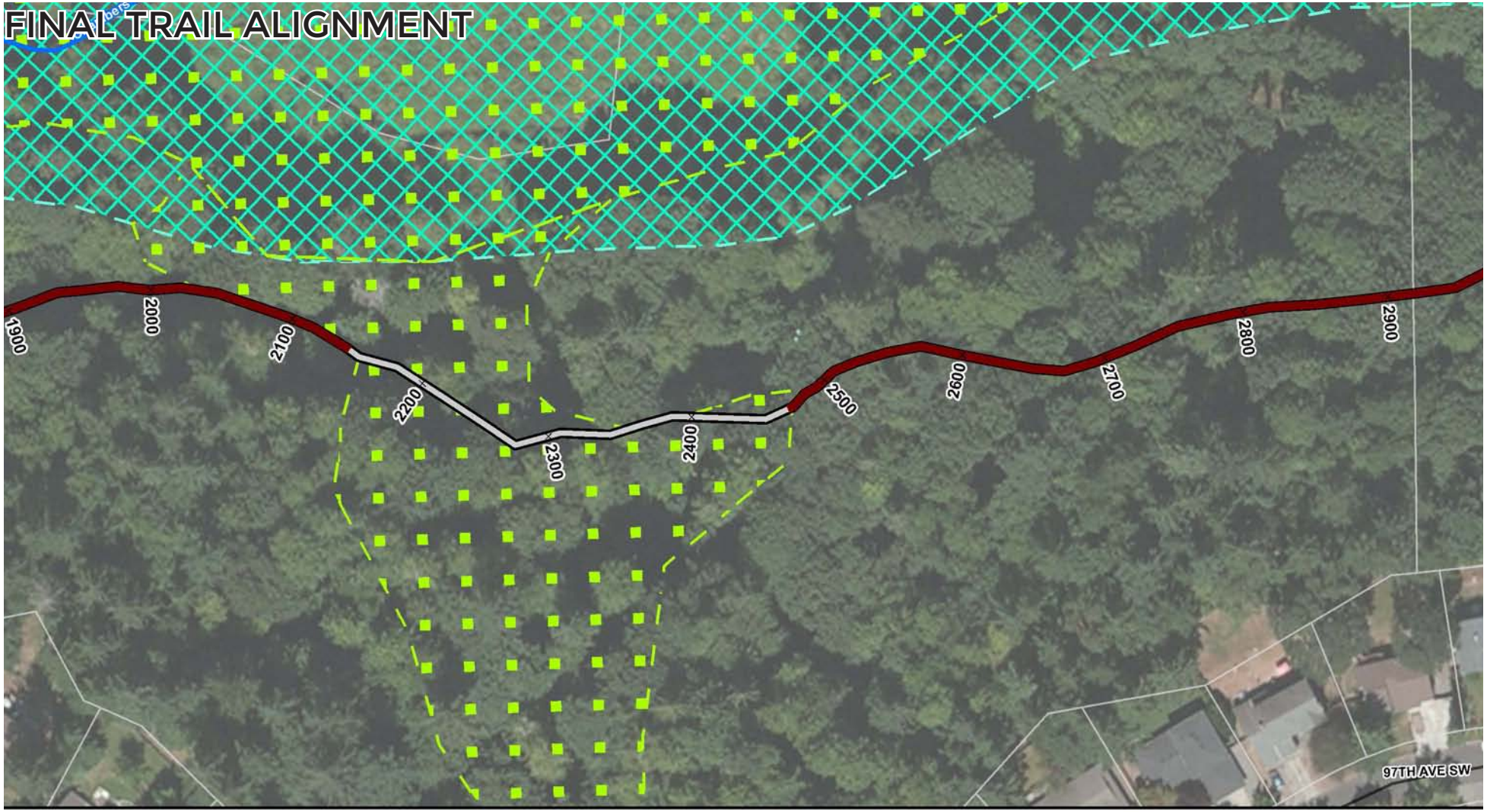
Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 2 of 18

0 50 100 200 Feet

1 inch = 100 feet



FINAL TRAIL ALIGNMENT



Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

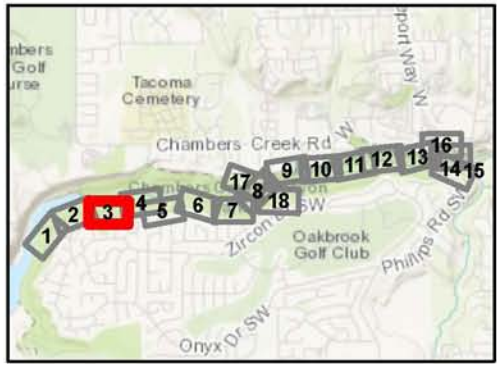
Proposed Trail

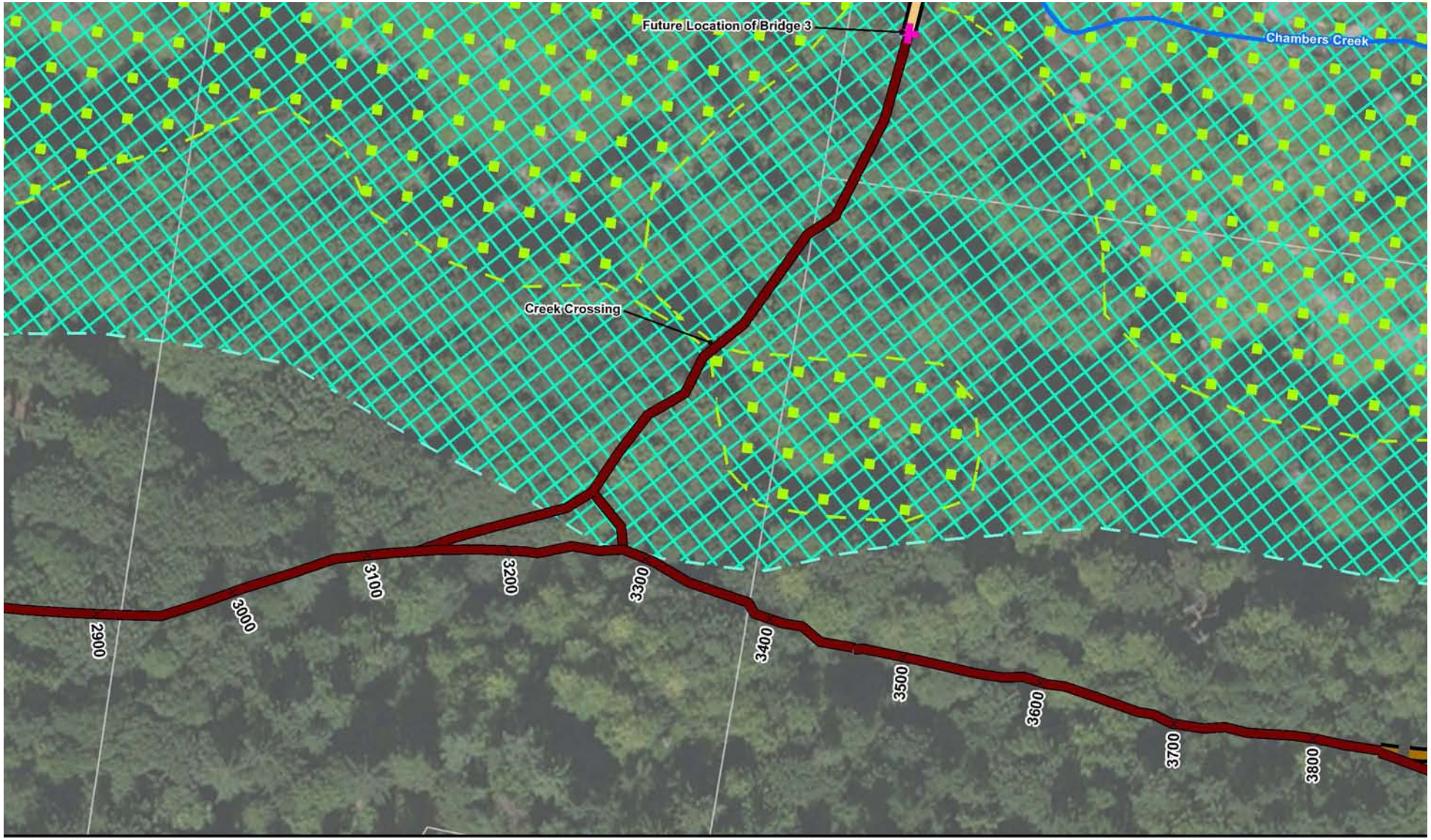
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 3 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

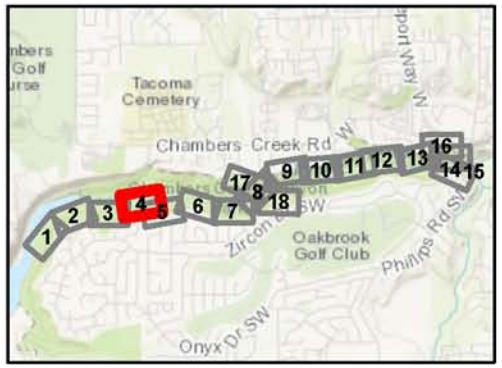
Proposed Trail

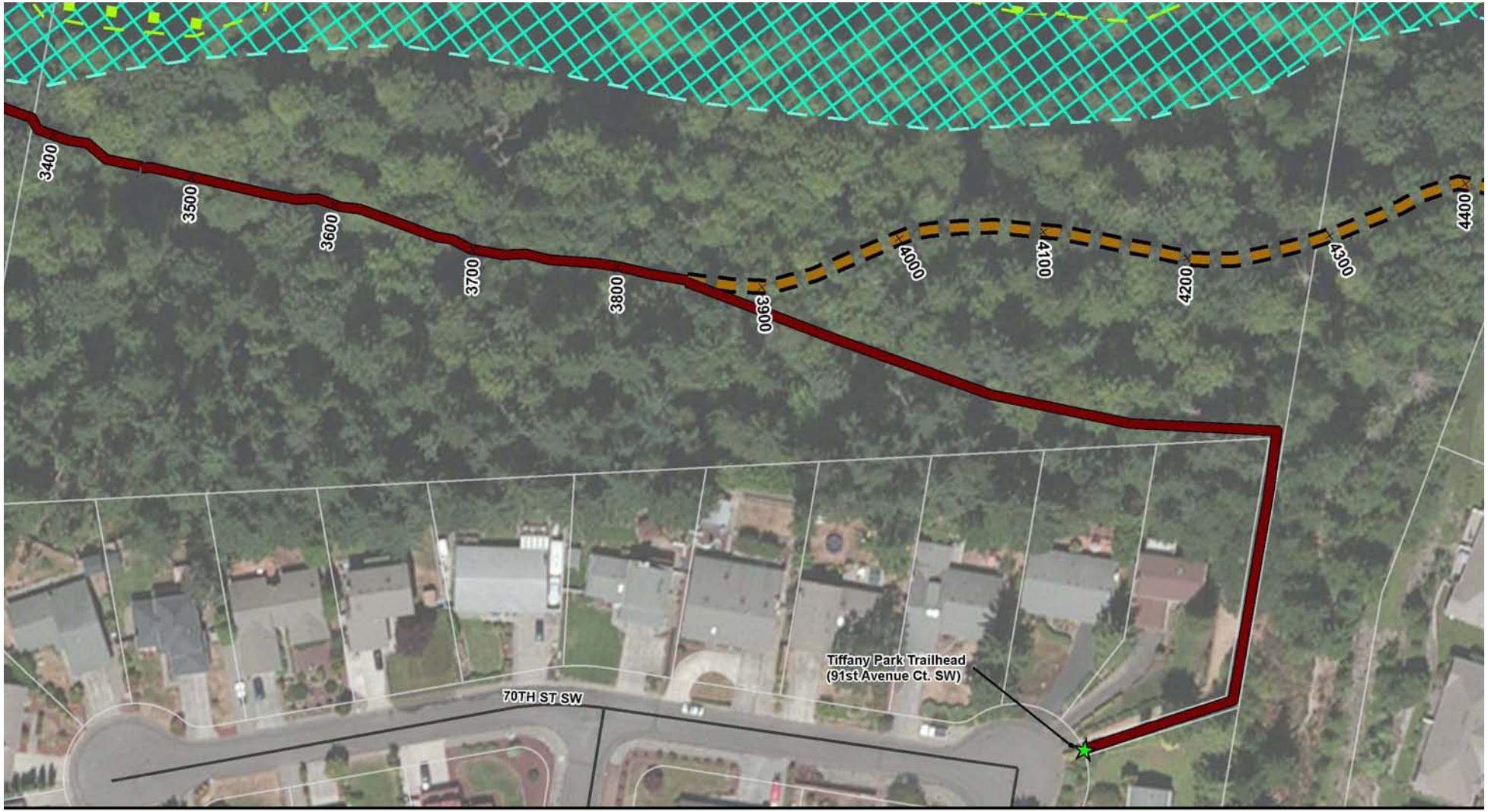
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 4 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

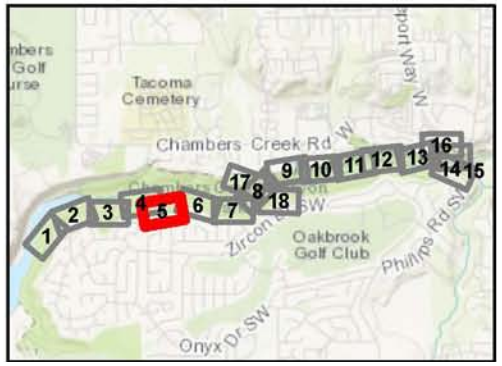
Proposed Trail

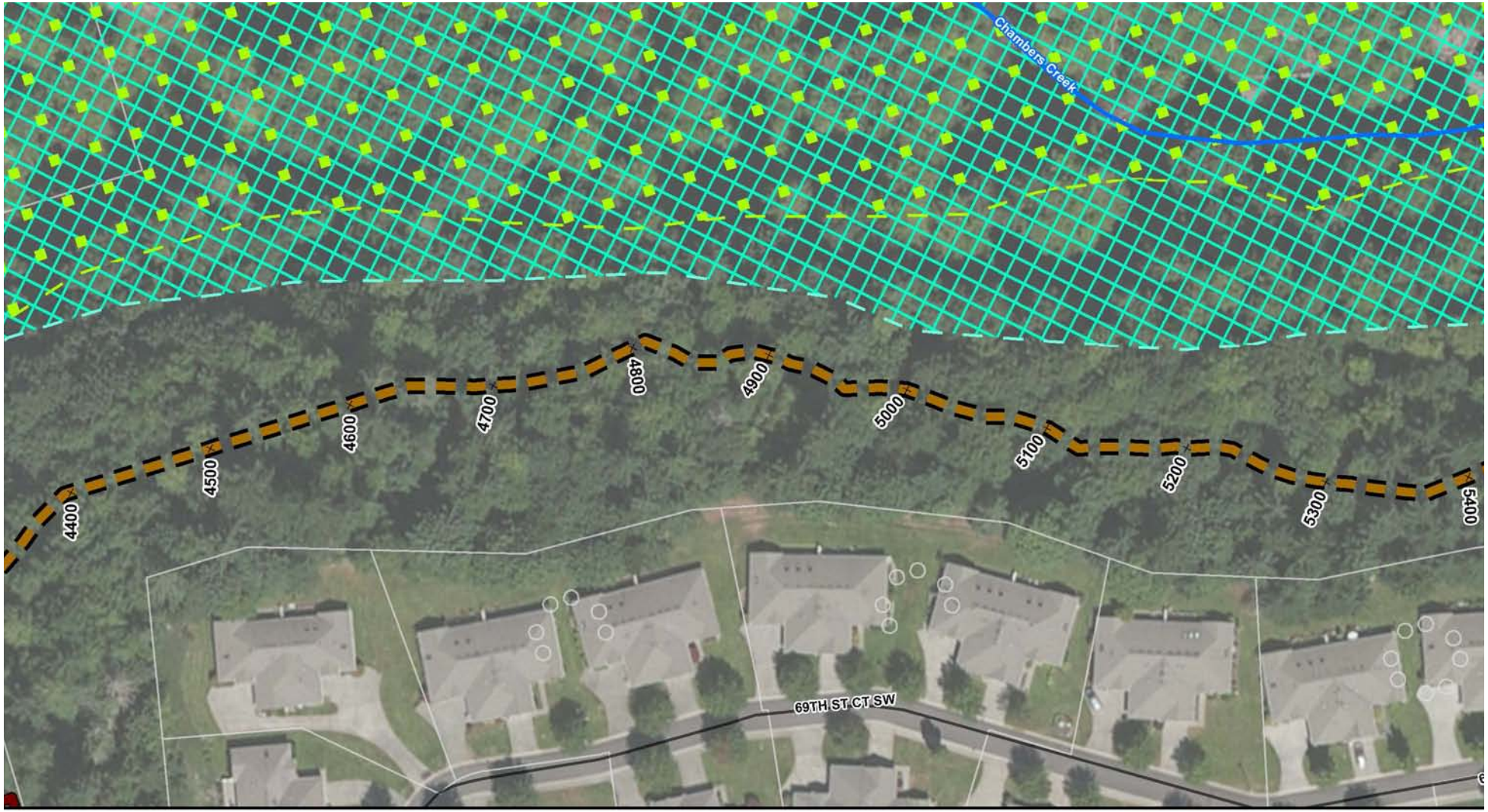
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 5 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

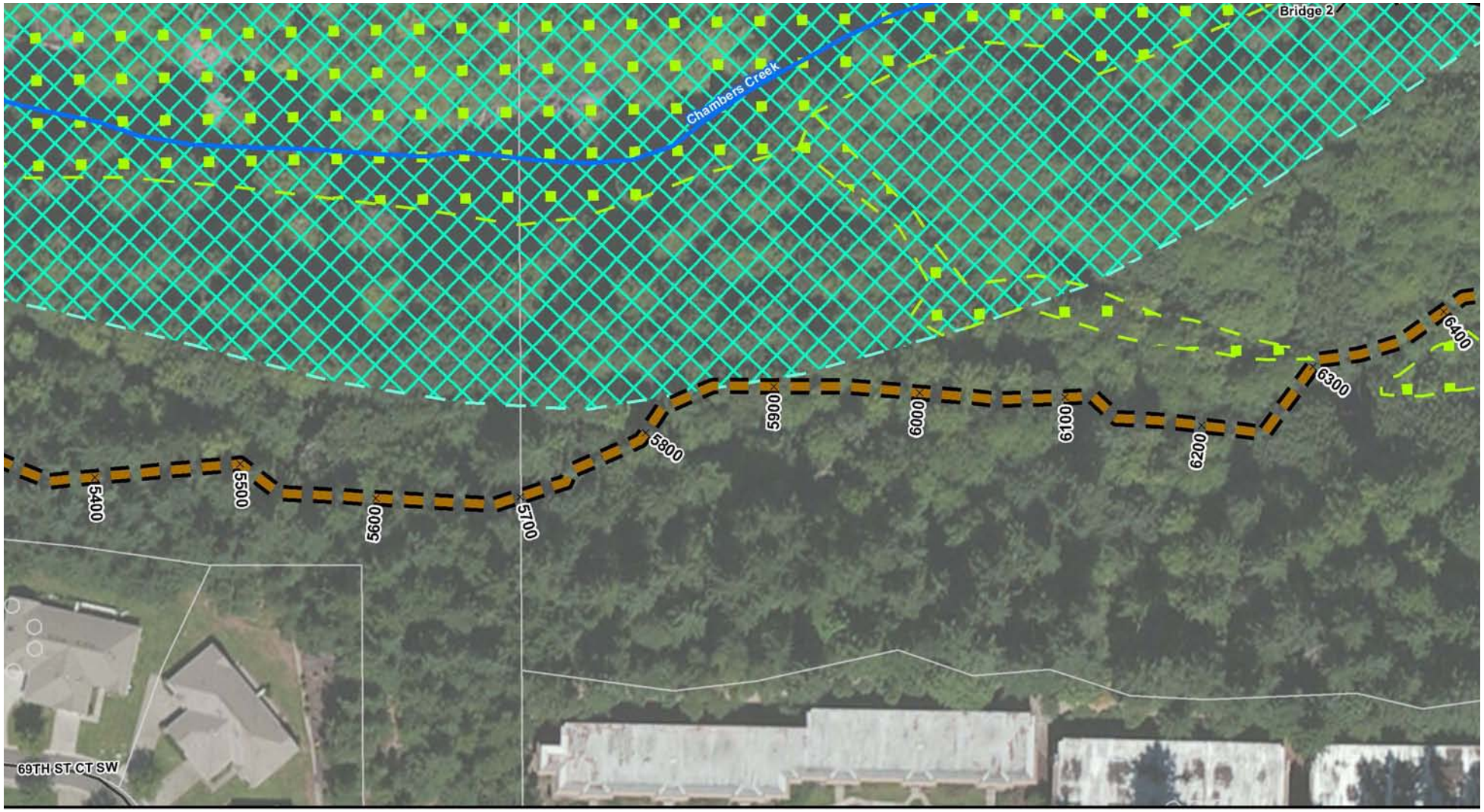
Proposed Trail

- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 6 of 18

0 50 100 200 Feet

1 inch = 100 feet



Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

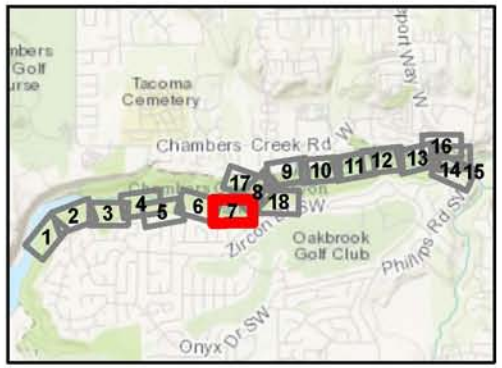
Proposed Trail

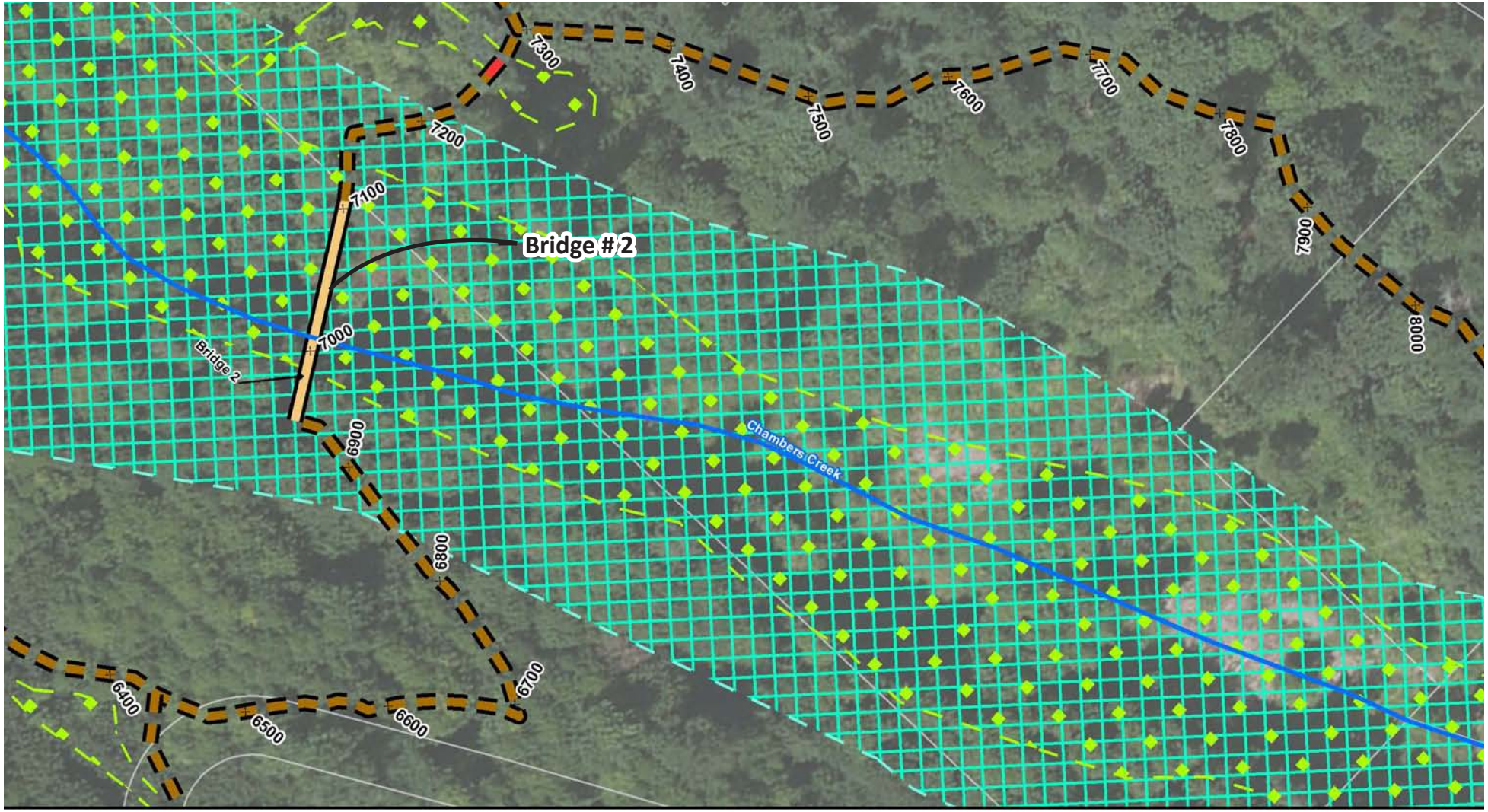
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 7 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

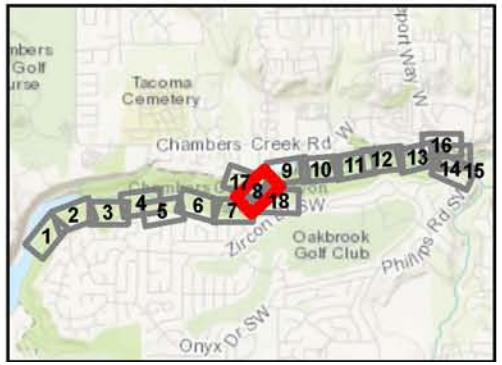
Proposed Trail

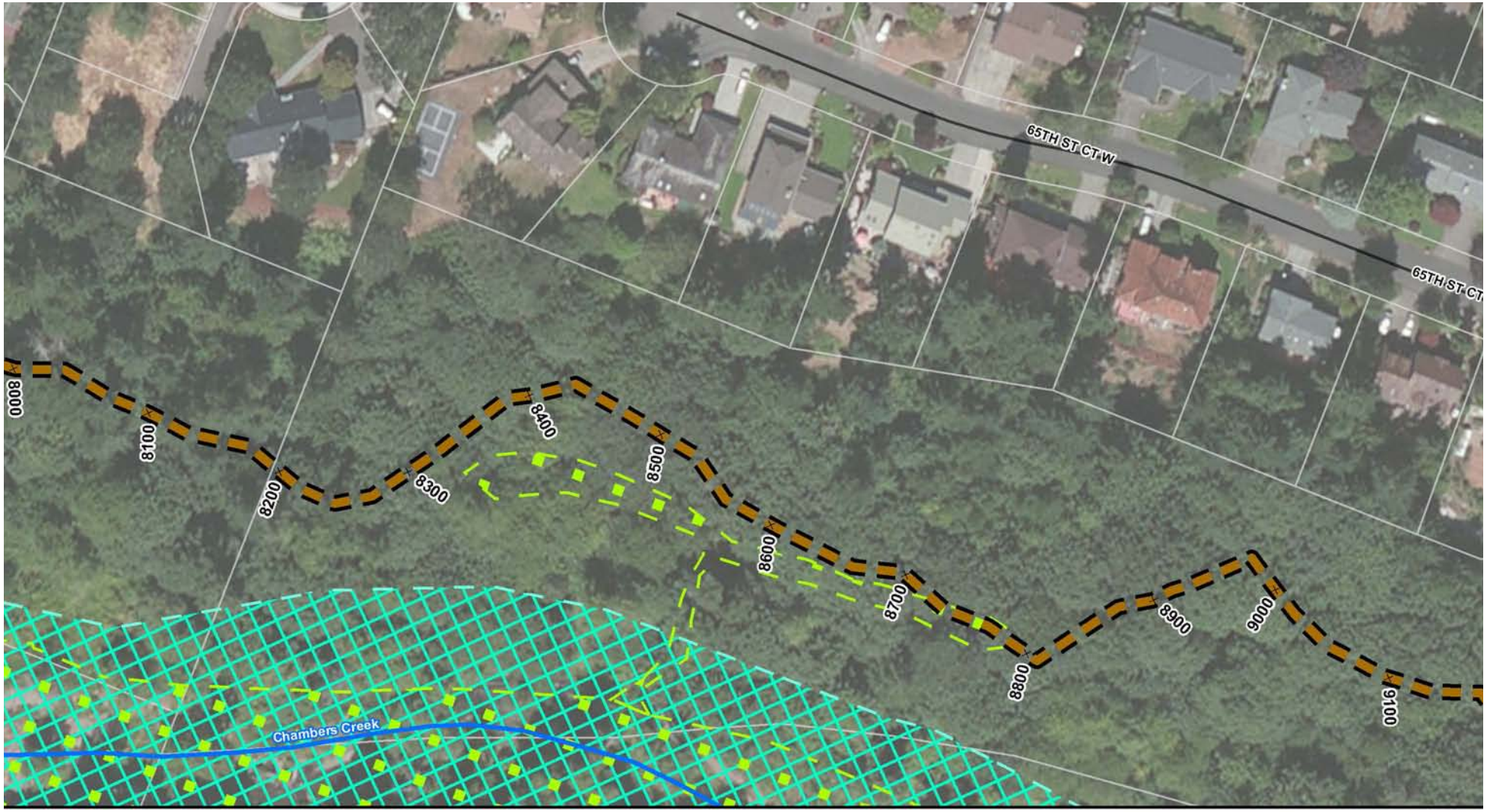
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 8 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

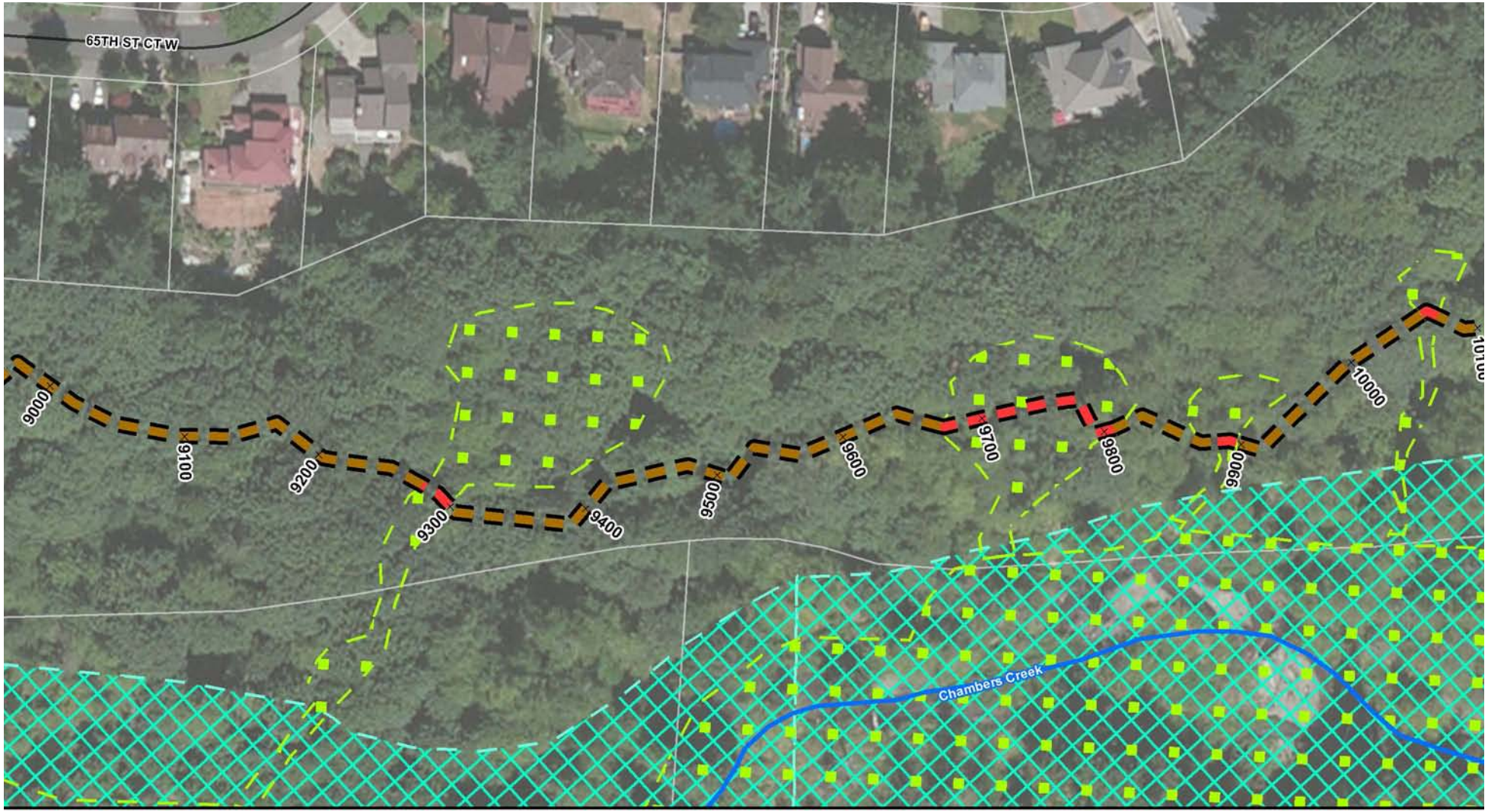
Proposed Trail

- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 9 of 18

0 50 100 200 Feet

1 inch = 100 feet



Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

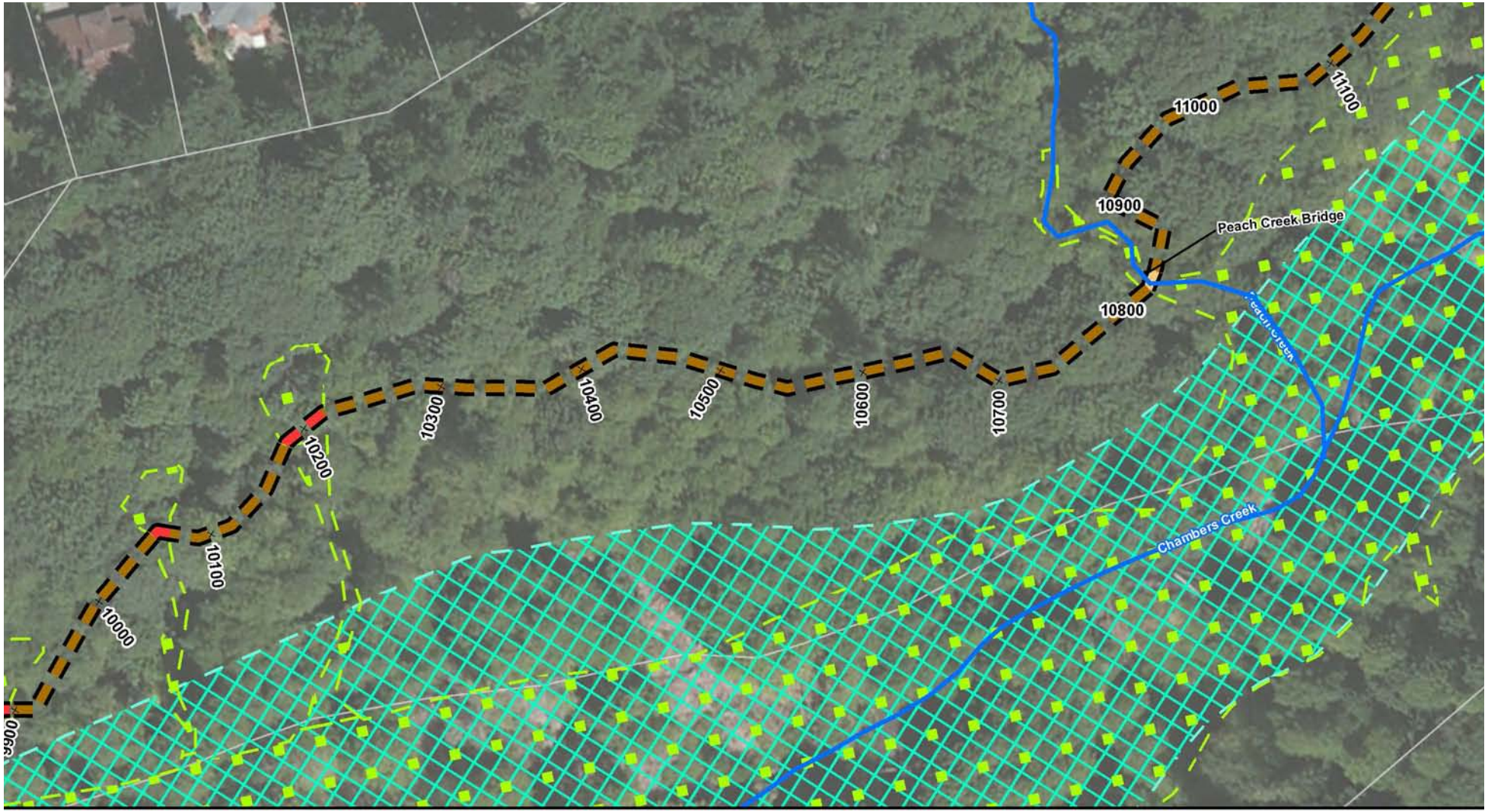
Proposed Trail

- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 10 of 18

0 50 100 200 Feet

1 inch = 100 feet



Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

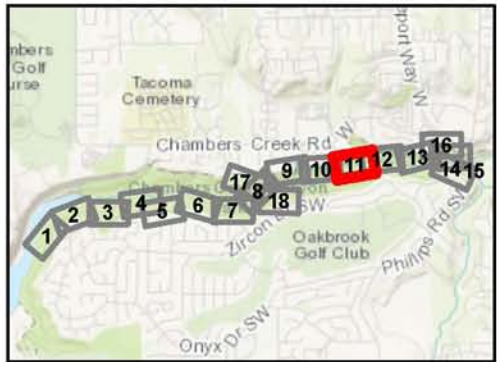
Proposed Trail

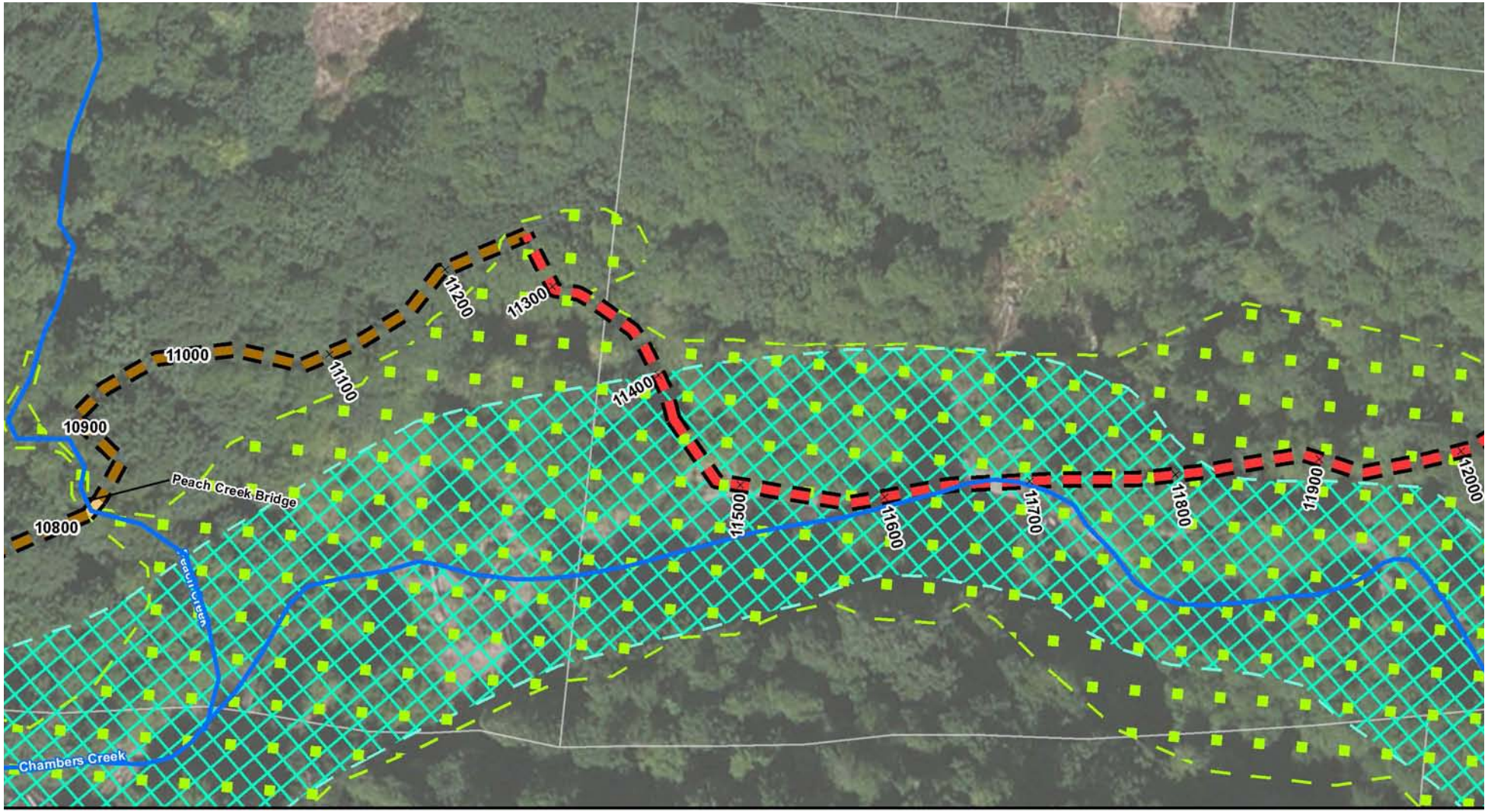
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 11 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

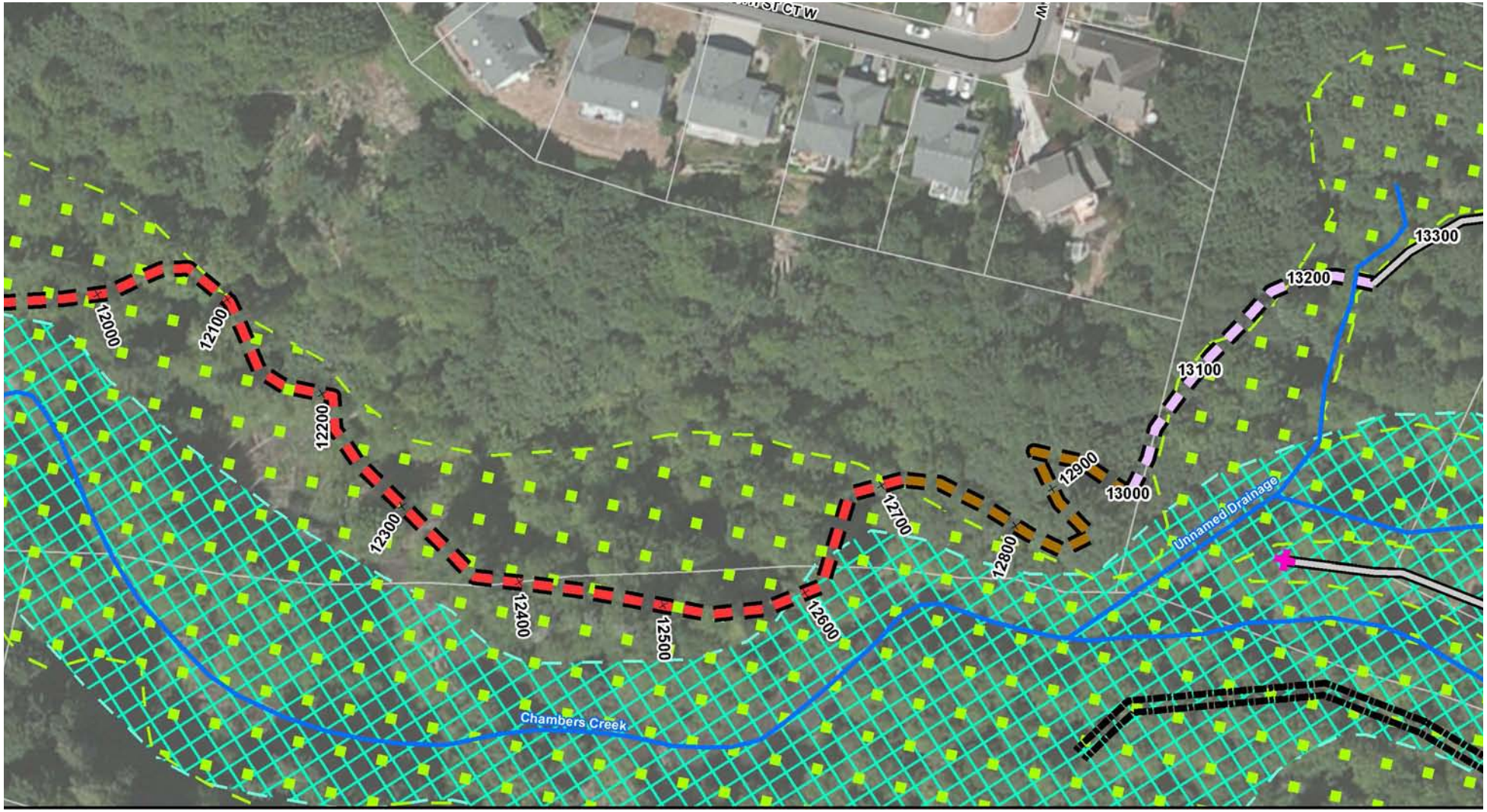
Proposed Trail

- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 12 of 18

0 50 100 200 Feet

1 inch = 100 feet



Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

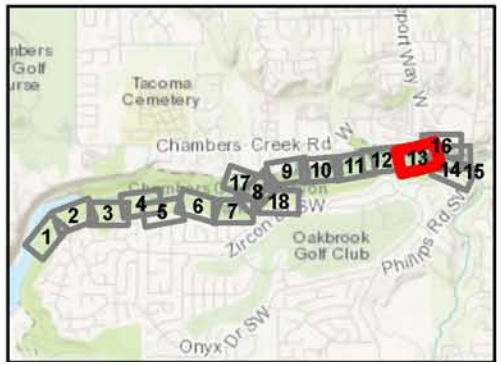
Proposed Trail

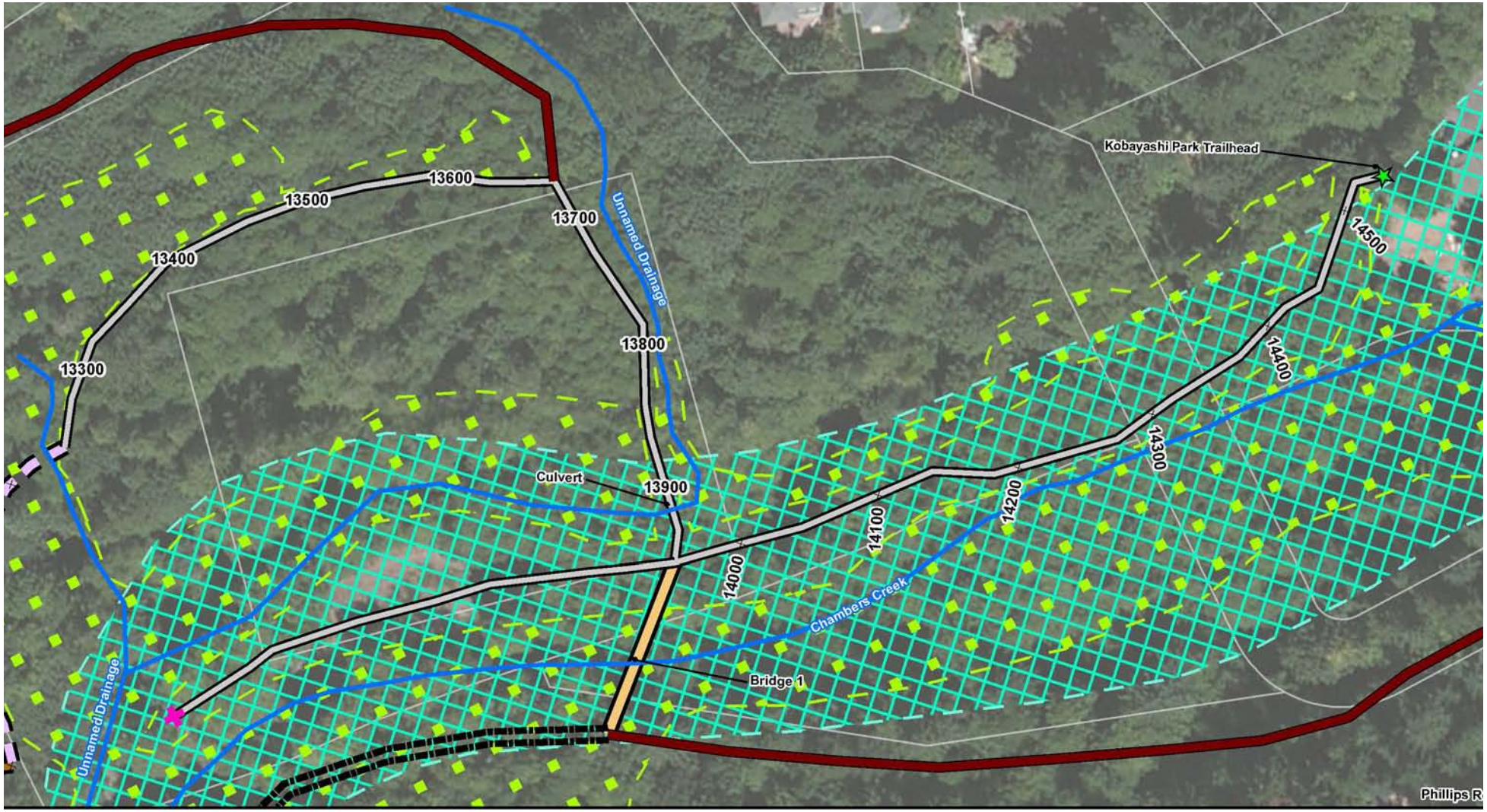
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 13 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

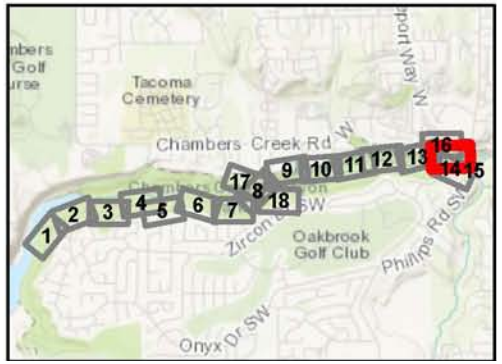
Proposed Trail

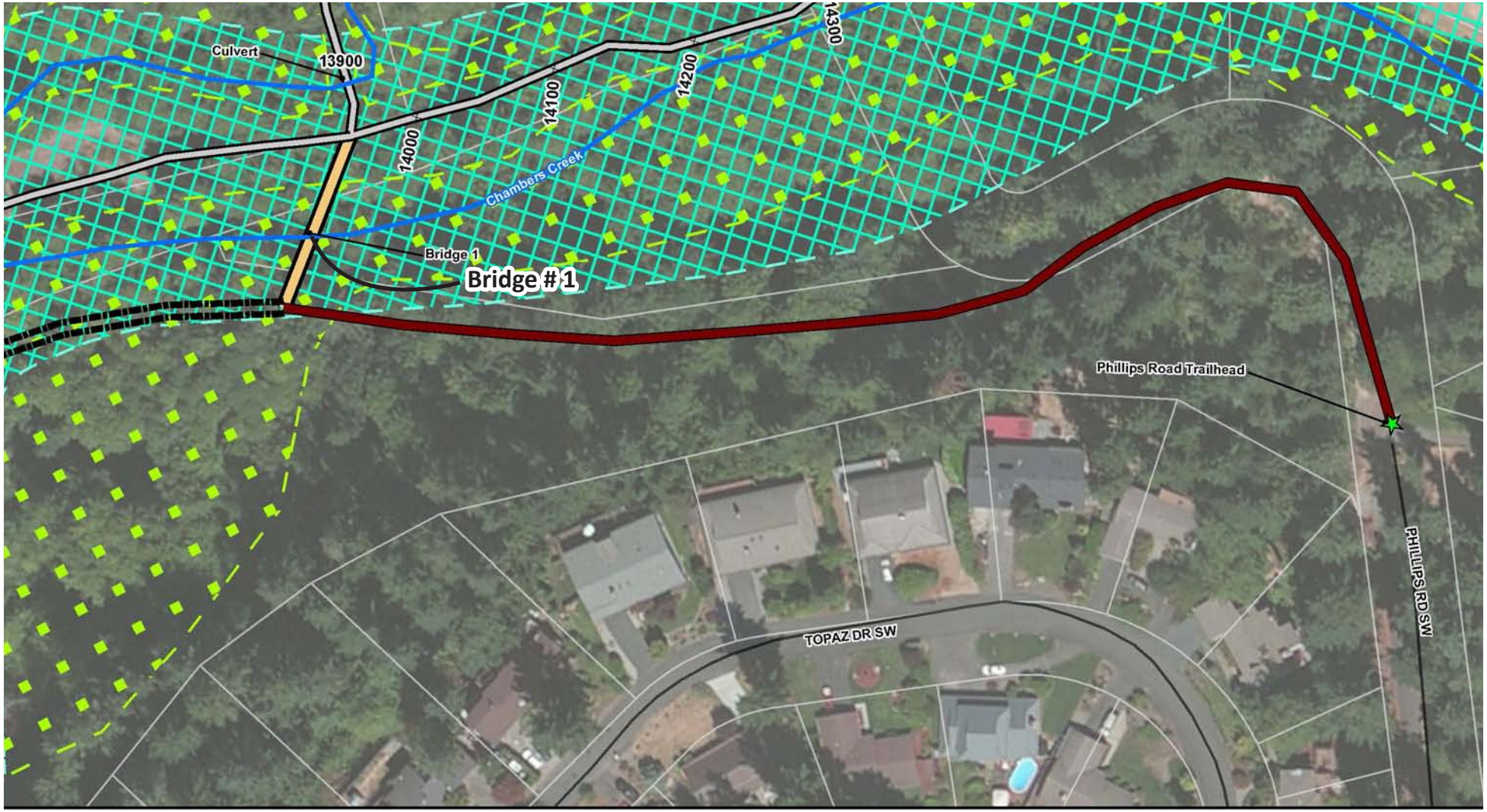
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 14 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

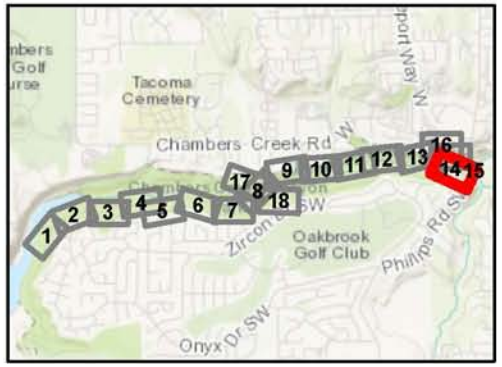
Proposed Trail

- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 15 of 18

0 50 100 200 Feet

1 inch = 100 feet



Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

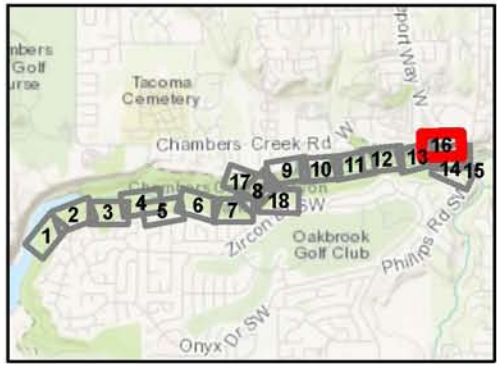
Proposed Trail

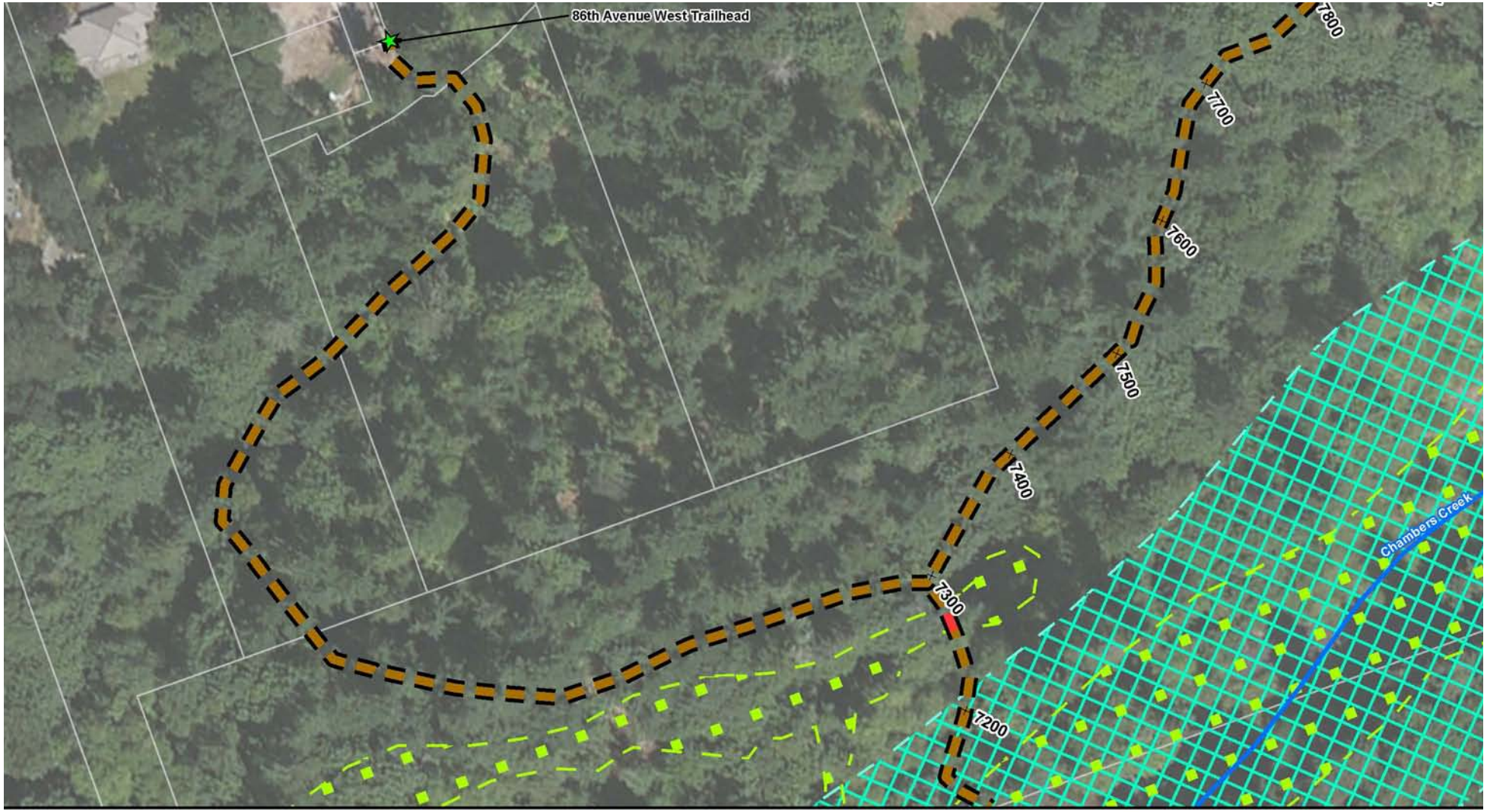
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 16 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

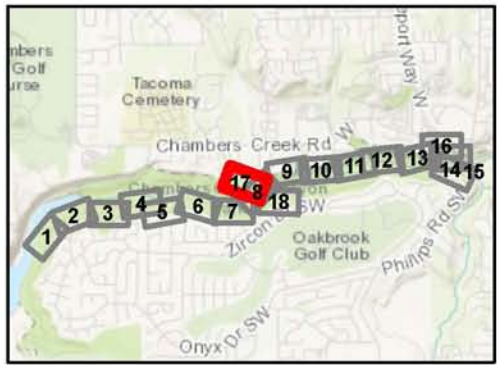
Proposed Trail

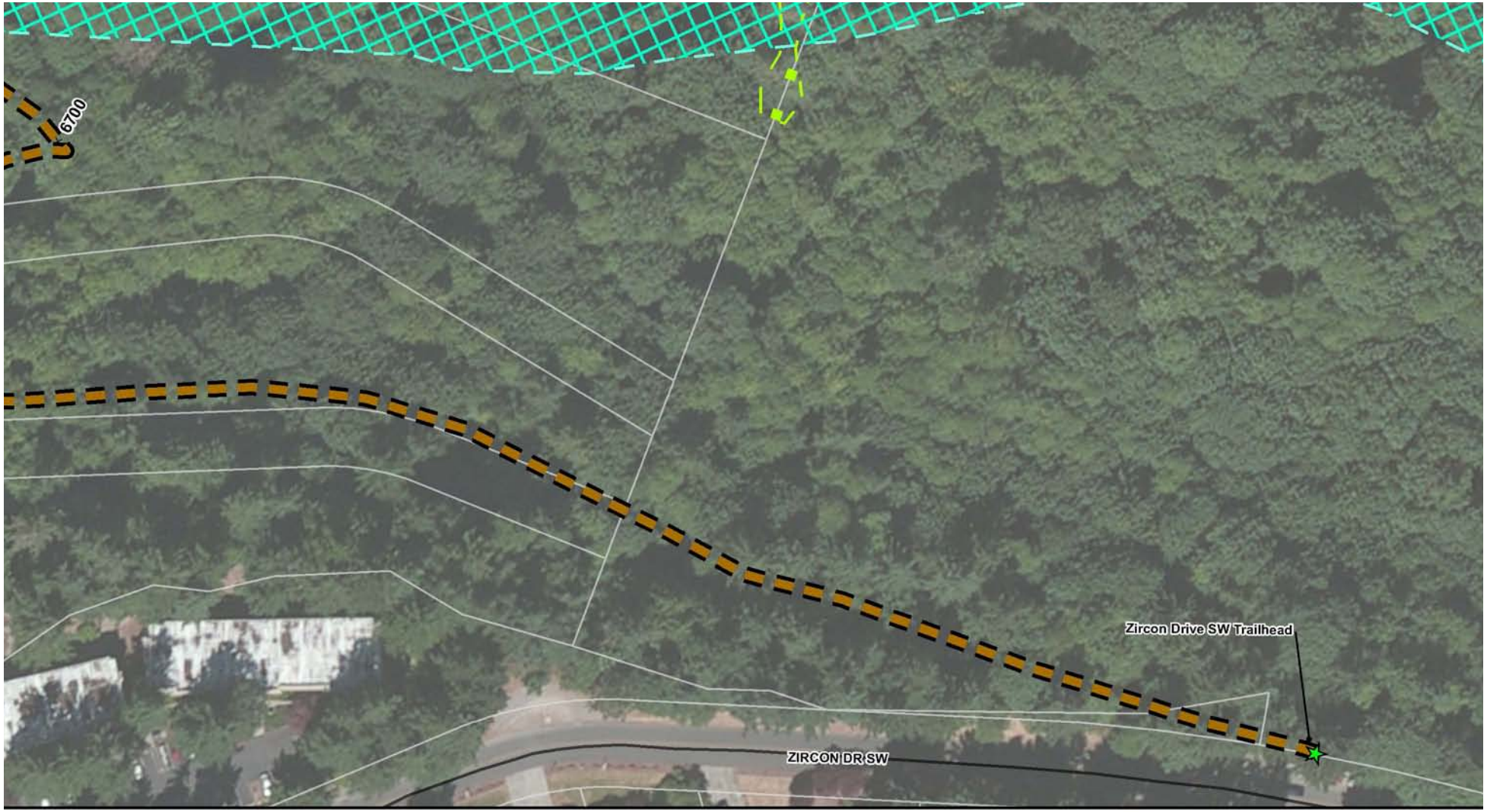
- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 17 of 18

0 50 100 200 Feet

1 inch = 100 feet





Chambers Creek Canyon Trail Final Alignment

× Station

Proposed Feature

- Observation Point
- Trailhead
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Existing Trail

- Gravel Surface
- To be Restored
- Wood Fiber Surface

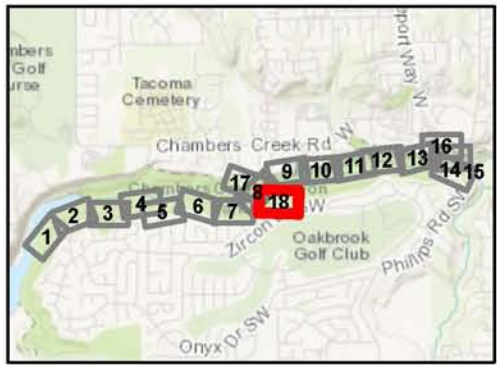
Proposed Trail

- Bridge
- Boardwalk
- Cantilevered Boardwalk
- Wood Fiber Surface

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,
Sheet 18 of 18

0 50 100 200 Feet

1 inch = 100 feet



BRIDGES

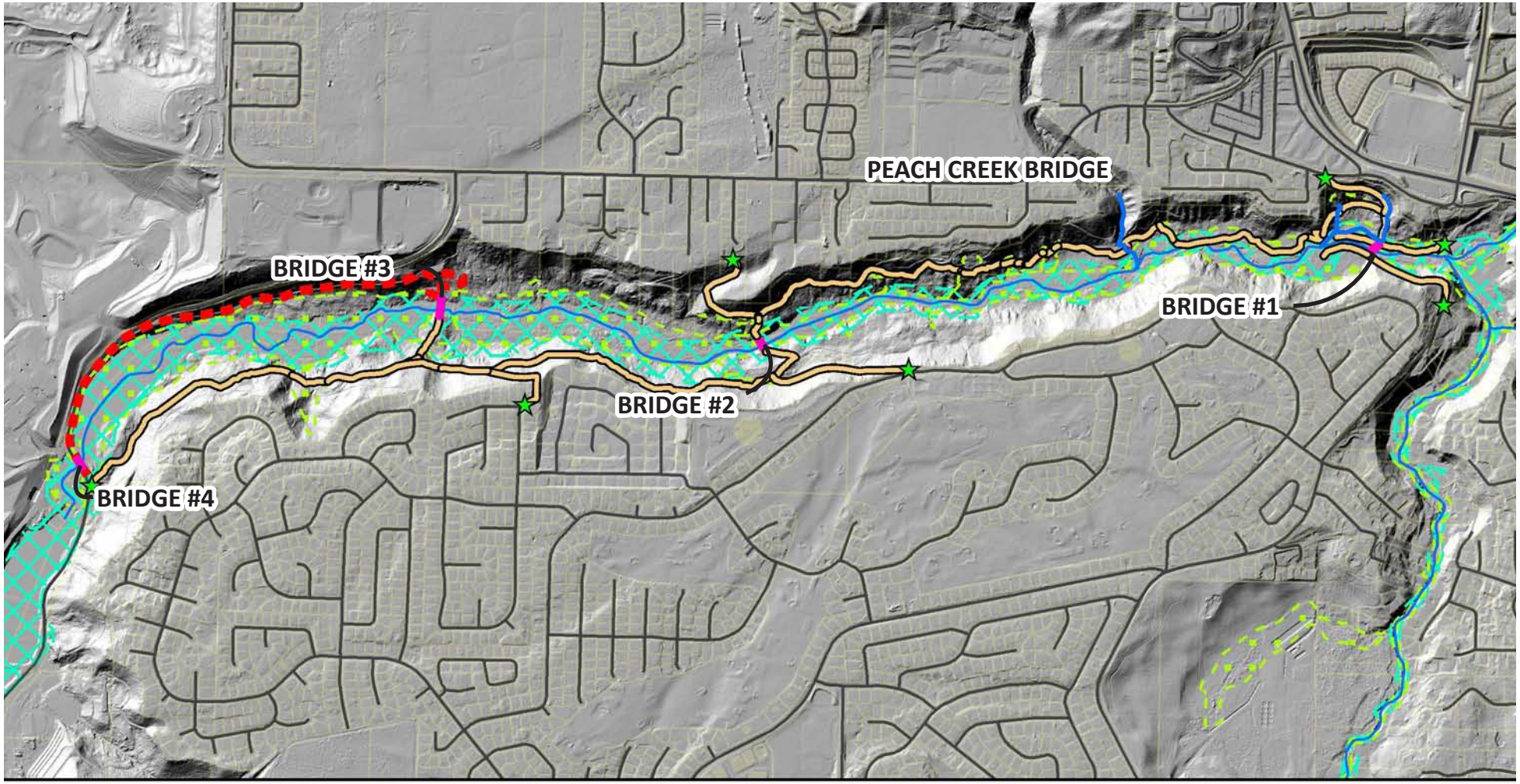
Summary

Multiple bridges over Chambers Creek will be required in order to complete the planned trail system and connect the existing and proposed trails and trailheads. Functionally, the bridges connect the trails and trailheads on the Lakewood side with trails and trailheads on the University Place side.

In selecting the trail bridge types, layouts, aesthetics, and materials for this preliminary planning phase, consideration was given to the guidelines discussed in the team meetings. During the meetings, the need was expressed for the bridge designs to be appropriate to their urban wilderness setting and to consider the demands of the more than 100,000 local community users that will have relatively easy access. With this, the bridges must be durable and constructed of low-maintenance materials to ensure a long and economical design life. It was also voiced that bridges should express a structurally substantial aesthetic, not detract from the surrounding nature, and provide for a safe crossing with striking creek views.

Other parameters for the bridge designs included the need to allow the occasional crossing of light utility vehicles, such as a gator or ATV, for trail maintenance and emergency response activities. Design code requirements considered shall also be appropriate to the urban setting, including considerations such as full pedestrian live loads, maximum 4-inch openings in the railings, and Americans with Disabilities Act (ADA) requirements where feasible.

Bridge designs presented in this preliminary planning report including calculations, sketches, structural member sizes, cost estimates, and descriptions are limited to a planning stage level of detail. The preliminary bridge designs and cost estimates are based on best professional judgment and observed conditions during fieldwork, including geotechnical and hydraulic assumptions. Proposed bridge locations were selected using judgment to allow for some bank erosion, but hydraulics studies, geotechnical engineering, and potential soil borings are recommended for final design. Formal evaluations and full engineering designs are expected to occur in a future project phase and may result in changes to the locations and/or designs. Discussion of specific proposed bridge locations and requirements follow.



Chambers Creek Canyon Trail System

- Road
- Stream
- Wetland
- 100-year Floodplain
- Parcel Boundary

Proposed Feature

- Trailhead
- Canyon Creek Trail System
- Bridge
- Potential Loop Trail

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,

0 500 1,000 2,000 Feet

1 inch = 1,250 feet

N

BRIDGES - BRIDGE #1

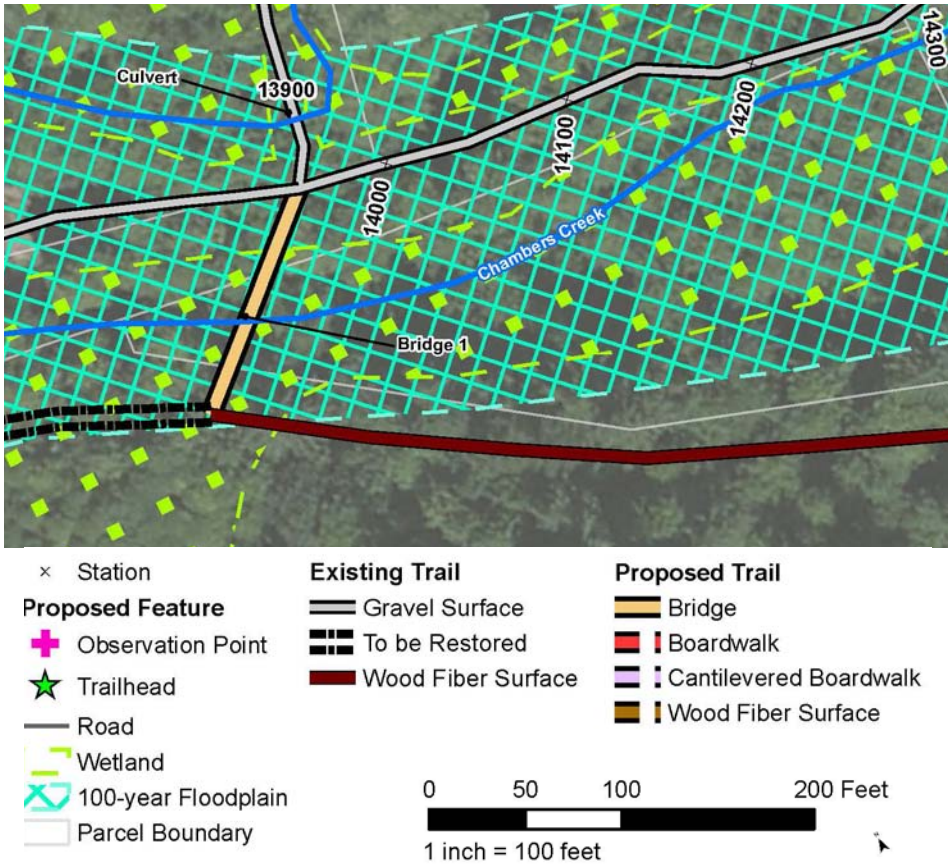
Bridge #1

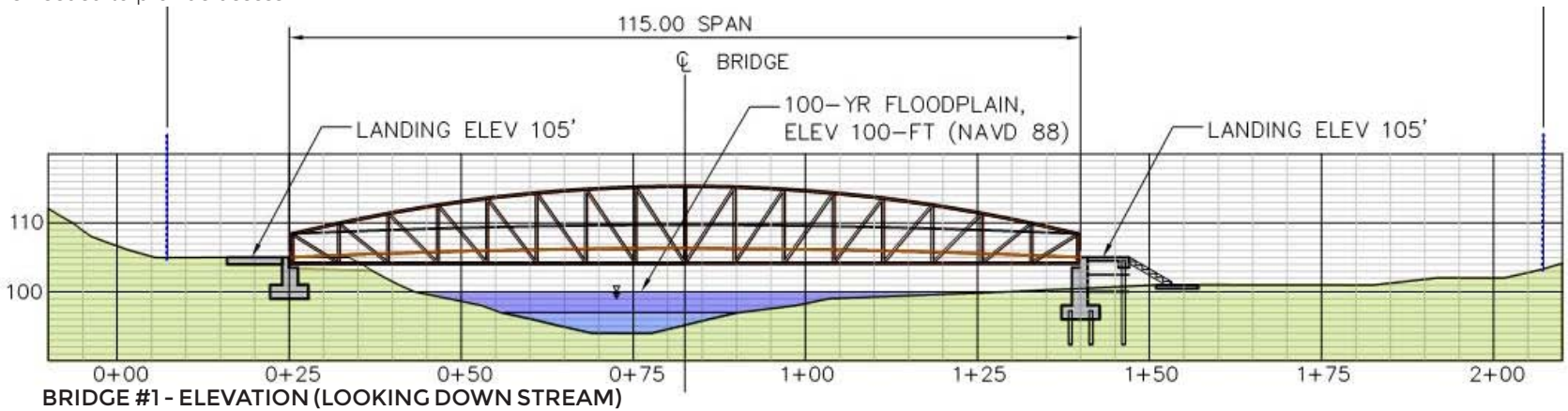
Bridge #1 is the farthest upstream and is located near Kobayashi Park. Per phasing discussions in team meetings, Bridge #1 is anticipated to be first bridge built, and to this end, Pierce County is currently pursuing a funding grant. This bridge will provide a direct connection between the Phillips Road SW Trailhead and the Kobayashi Park Trailhead. The selected location is in close proximity to the location shown in the original trail plans and was confirmed as the preferred location in project team meetings and field visits.

Of significant consideration in setting the location of this bridge was its relationship to Chambers Creek. Keeping the bridge out of the anticipated hydraulic impact envelope of the creek significantly reduces project risks including structural costs, environmental permitting risks, and the risks of the bridge being washed out during a flood event. Bridge #1 is within Zone AE of the FIRM (Flood Insurance Rate Map), meaning specific Base Flood Elevations have been officially determined for this area. The proposed crossing location is in close proximity to both a mapped flood elevation line and a mapped cross section. The value of the mapped 100-year flood (1 percent Annual Chance Flood) elevation line closest to the proposed crossing is given as EL 100 feet.

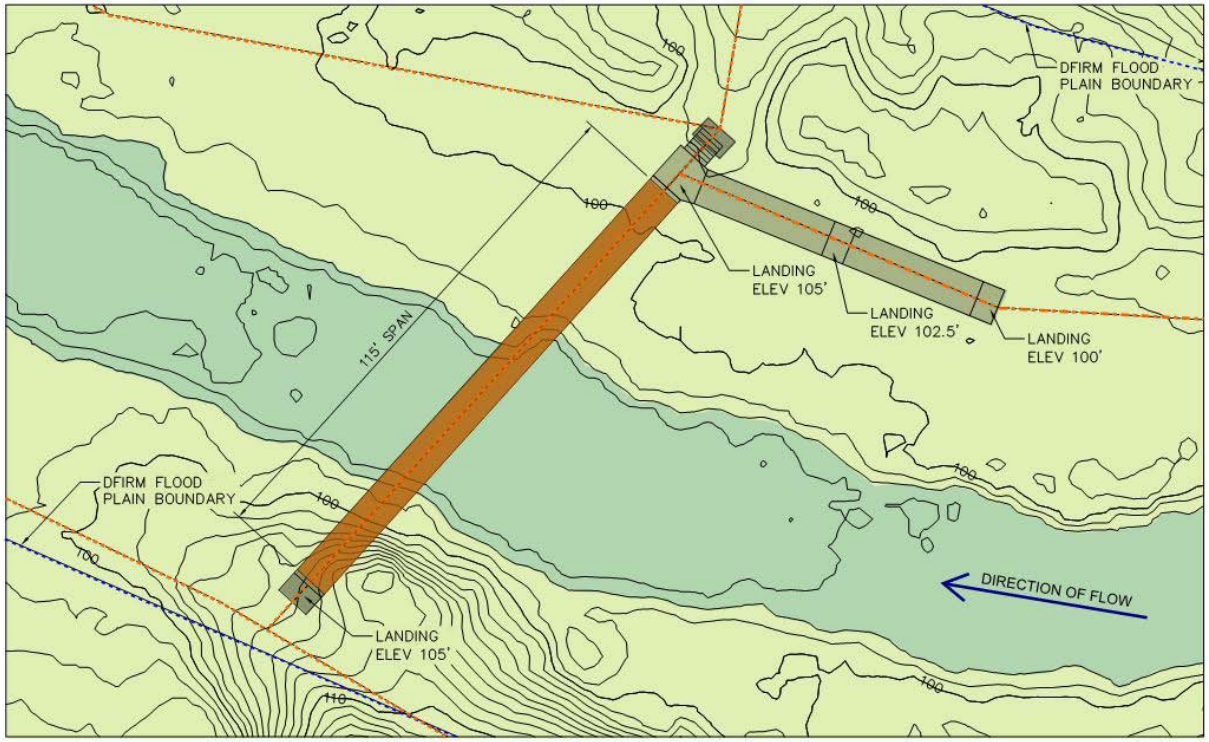
However, at the proposed Bridge #1 crossing location, the FIRM Flood Plain Boundaries do not appear to correlate well with the 2010 LIDAR - based contours. During fieldwork, it was generally observed that the 2010 LIDAR surface matched well with both visual and handheld GPS observations of the terrain. It is theorized that the surface data used to develop the FIRM floodplain boundaries was not as refined as the 2010 LIDAR, leading to plan floodplain boundaries that do not make physical sense with the observed terrain. However, the FIRM Base Flood Elevations generally do seem to correlate with the 2010 LIDAR and make physical sense with the observed terrain.

Therefore, considering the FIRM Base Flood Elevations, the bridge was vertically located to maintain a minimum 3-foot clearance between the bottom of the lowest bridge member and the 100-year flood elevation. On the north bank, the elevation of the landing was set by adding the 3-foot clearance to the Base Flood Elevation of EL 100 feet and then to the anticipated structural height to the top bridge deck. The resulting landing elevation (approximately EL 105 feet) is above the existing terrain, and therefore ramps and stairs are needed to provide access.





BRIDGE #1 - ELEVATION (LOOKING DOWN STREAM)

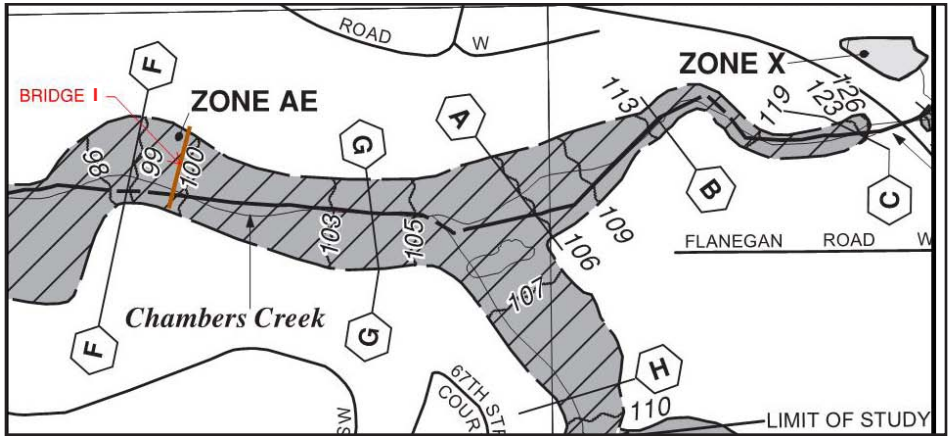


BRIDGE #1 - SITE PLAN

As directed during team meetings, ADA requirements and access for emergency vehicles were considered in the preliminary layout and design of the ramps. On the south bank, the landing location and plan alignment were selected to match the north bank landing elevation while simultaneously minimizing earthwork. By matching the landing elevations, a consistent 3-foot clearance is maintained, bridge and foundation design and construction is simplified, and differential loads on the foundation are minimized.

In plan, the layout for Bridge #1 resulted in a 115-foot clear span. The abutments were located outside of the 100-foot contours (2010 LIDAR based), and therefore theoretically outside of the high water mark limits of the 100-year Base Flood Elevation (EL 100 feet). Furthermore, the abutments were shifted an additional 10 to 15 feet away from the bank in consideration of the potential for creek channel migration. The creek currently takes a turn in this area, with a greater hydraulic energy demand anticipated along the south bank. However, there is riprap already in place along the south bank that is assumed to potentially provide some reduction in the rate of channel migration. It is recommended that prior to final design, the level of protection provided by the riprap should be evaluated through a hydraulic study. The riprap was likely placed to protect a vehicular bridge that previously existed just downstream from the proposed Bridge #1 location. Based on remnants of the abutments, the span appears to have been much shorter than the proposed 115 feet for Bridge #1 and likely did not provide for a 3-foot clearance above the floodplain. It is probable that the bridge was washed out or damaged during past flooding.

EXAMPLE OF PREFABRICATED TRUSS BRIDGE - CAPSTONE STYLE



BRIDGE #1 FIRM FLOOD PLAIN MAP

BRIDGES - BRIDGE #1

With this proposed layout, the abutments are still within the official FIRM floodplain boundary. However, where the official FIRM floodplain boundary does not appear to make physical sense with the observed terrain, it is suggested that at a future stage, the FEMA floodplain be analyzed with real-world survey data and that a FEMA LOMA (Letter of Map Amendment) be performed for the bridge site. The desired outcome of this exercise is regulatory agency approval that the bridge abutments in this layout are realistically located outside of the 100-year floodplain.

If, however, the official floodplain boundaries are maintained and not challenged, and the proposed abutments are judged to be inside of the floodplain, either the clear span would need to be increased to over 200 feet, or the bridge and abutments would have to be designed to withstand the anticipated hydraulic loads and to consider scour. In this scenario, it is also likely that a detailed hydraulic study would be required either in order to establish a no-rise effect or to otherwise determine appropriate mitigation measures.

Increasing the clear span to over 200 feet in order to keep the abutments outside of the current floodplain would greatly increase project costs, complicate construction at this limited access, environmentally sensitive site, and significantly impact the path of travel and flow through this trail section.

In consideration of the desired bridge performance parameters, all-weather steel was selected as the primary structural material for its low-maintenance costs. Wood deck was selected for the low initial cost and ease of replacement for damaged, worn, or vandalized planks. Additionally, both the wood deck and all-weather steel meet the desired aesthetics of simple, natural-appearing materials.

A prefabricated steel truss bridge is the recommended bridge type for this site. Attributes that fit the site and performance requirements include durability and simplification of design, fabrication, and construction. With fabrication of the bridge occurring primarily off site, construction impacts to the site are minimized.

For a timber bridge in this wet, shaded environment, it is anticipated that the relative structural lifespan would be less than with a steel truss. It is also anticipated that the timber bridge would require additional on-site construction time and labor costs as well as an increase in regular maintenance demands. The anticipated 115-foot clear span pushes limits of simple timber bridges and would require a more complicated design.

For the preliminary cost estimates, prefabricated steel truss manufacturers were consulted. In this preliminary report, a CONTECH Capstone truss-style bridge is depicted as a representation of the anticipated bridge style. In team meetings, an aesthetic preference was expressed for the arched top-chord steel truss style. In particular, this Capstone style was selected because it works well with the required span and allows for a limited approach depth and low-abutment backwall for improved hydraulic efficiency. In other words, this style allows for a low structural depth below deck level, which keeps the required landing elevation lower for a given overwater clearance requirement. For the north bank landing, this helps to minimize the required ramp and stair lengths.

For the bridge abutments and foundations at the south bank, a standard cast-in-place concrete spread footing foundation was selected. This left bank is higher than the north bank and is protected to some extent by the existing riprap. For the north bank abutment, a composite system of spread footing with pin piles was selected. The north bank abutment projects higher above the adjacent grade than the south bank and is closer to the floodplain elevation. If the creek channel migrates during a flooding event and scours the abutment, the pin piles would still maintain vertical capacity and reduce the risk of the bridge washing out.

The ramps up to the north landing were laid out in compliance with ADA standards where the slope was limited to 1:12 with a maximum 30- inch rise between landings. Total vertical rise between existing terrain (2010 LIDAR) and the anticipated landing elevation is estimated at approximately 5 feet. The ramp construction was assumed to be partially embedded, rock filled gabion baskets with an asphalt trail surface and full length railings. Stair framing will use weathering steel with prefabricated risers.

For Bridge #1, the current site access is limited to primitive trails coming from both the Kobayashi Park side and from the Phillips Road side of the bridge crossing, limiting access for heavy equipment. Both sides were historically used as service roads, but significant improvements may be required to allow for safe access of heavy equipment including cranes, ready-mix concrete trucks, excavators, etc. From the Phillips Road side, the average grade of the unimproved trail is approximately 12 percent. Additionally, to access the Bridge #1 location from the Kobayashi Park side would require a temporary stream crossing (see photo, bottom right). To pick and set the full span, crane use at the bridge location would likely require significant tree removal.

To minimize required site improvements and overall impacts to the site, the contractor may elect to use smaller equipment specifically suited to trail construction. With additional splices in the bridge and use of alternate rigging and shoring methods to launch and set the bridge, there is potential to avoid the need for a large crane. However, these alternative construction methods may potentially require temporary creek crossings or in-water shoring. Overall, these alternative construction methods may minimize the impacts to the site by reducing the required site improvements and subsequent impacts associated with the use of large construction equipment. At this preliminary planning stage, to avoid limiting the best possible means and methods of construction, it is therefore recommended that the potential need for limited, temporary, in-water work platforms be noted in the permitting applications.

BRIDGES - BRIDGE #1

BRIDGE #1 LOOKING FROM NORTH BANK TO SOUTH LANDING

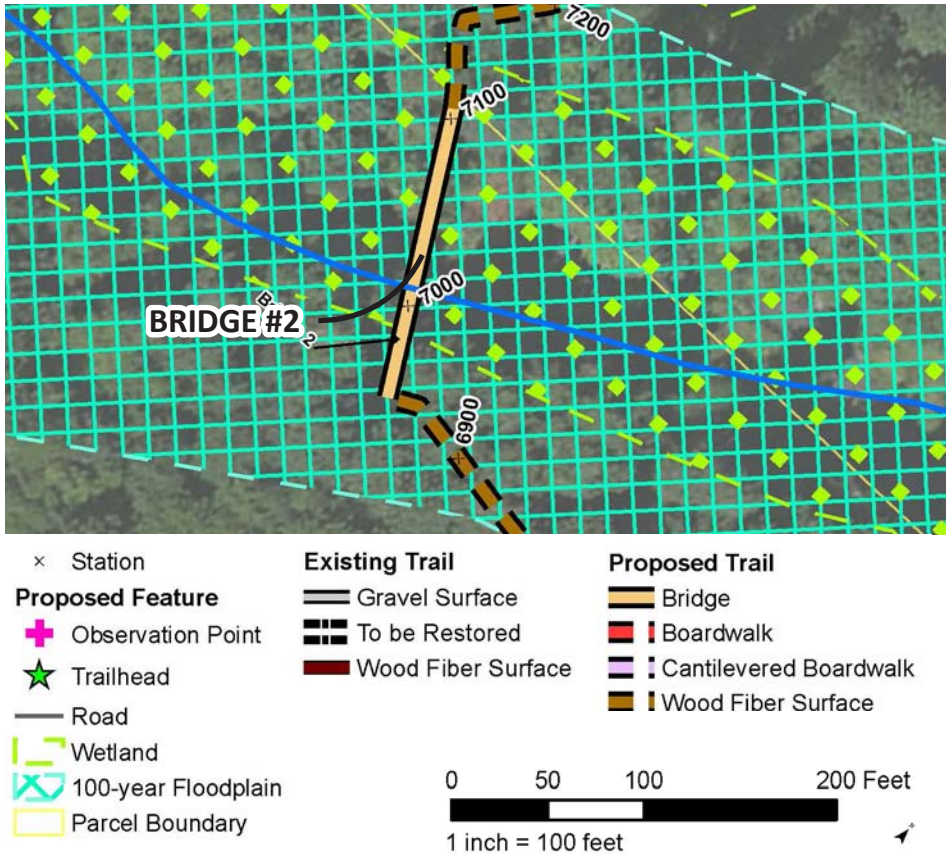
STREAM CROSSING REQUIRED TO ACCESS BRIDGE #1 SITE

BRIDGES - BRIDGE #2

Bridge #2

Bridge #2 is the second farthest upstream and is located nearest to the proposed 86th Avenue West Trailhead. It provides a critical link in the trail system between the planned trail on the University Place side of the canyon and the planned trail on the Lakewood side of the canyon. Per phasing discussions in team meetings, Bridge #2 is anticipated to be the second priority bridge to be built. The selected location is in close proximity to the location shown in the original trail plans and was confirmed as the preferred location during field visits and in project team meetings.

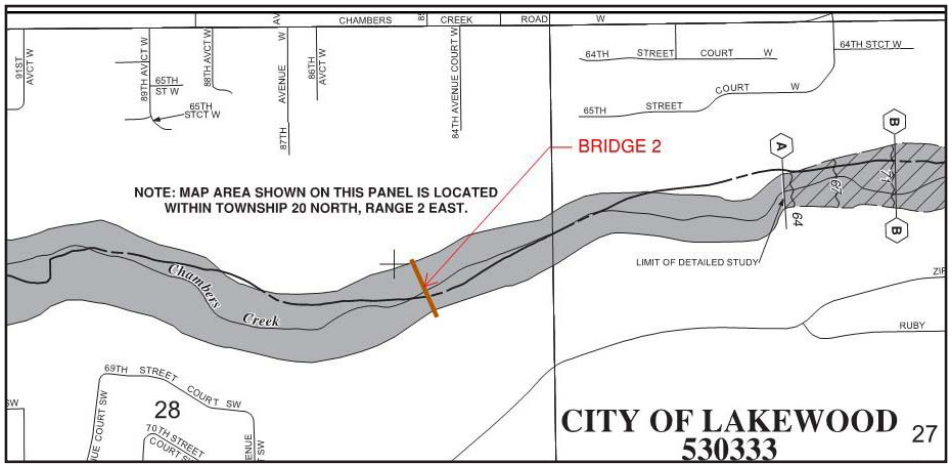
Similar to Bridge #1, of significant consideration in setting Bridge #2's location was its relationship to Chambers Creek. Keeping the bridge out of the anticipated hydraulic impact envelope of the creek significantly reduces project risks, including structural costs, environmental permitting risks, and the risks of the bridge being washed out during a flood event. Bridge #2 is within Zone A of the FIRM (Flood Insurance Rate Map), meaning specific Base Flood Elevations have not been officially determined for this area. Only the FIRM floodplain Boundaries are provided in the official maps. However, a section of the terrain was developed along the centerline of the proposed bridge alignment, based on the 2010 LIDAR surface.



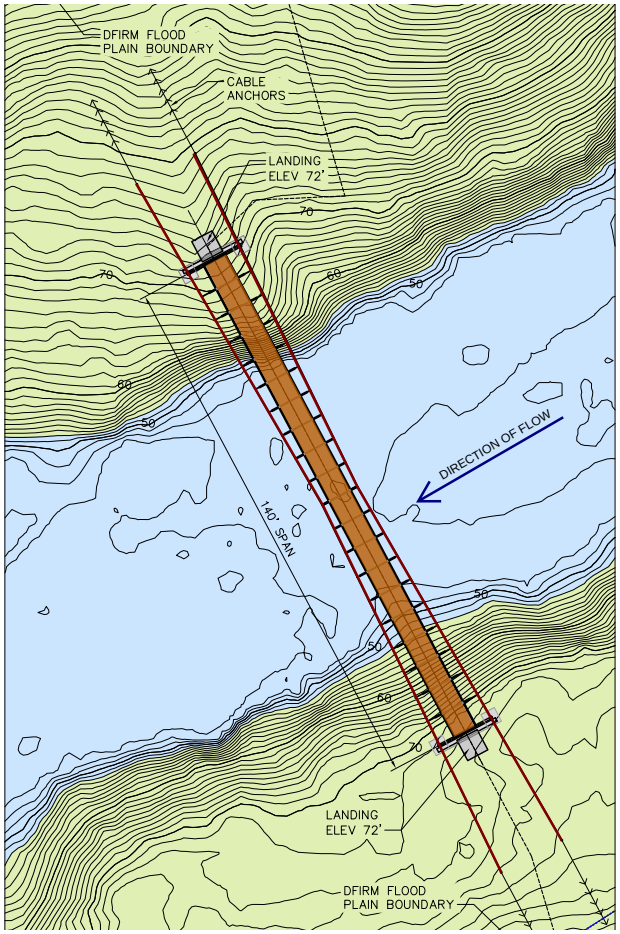
The embankments in this section of the creek are much steeper and the top of the embankments are higher relative to the location of Bridge #1. Based on the nearest upstream Zone AE FIRM Cross Sections and corresponding Base Flood Elevation of EL 64 feet, a bridge in this location spanning from the top of embankment on one side to the top of the other is anticipated to provide more than the required 3-foot clearance above the flood water level.

However, similar to the proposed Bridge #1 crossing location, the FIRM Flood Plain Boundaries do not appear to correlate well with the 2010 LIDAR based contours.

BRIDGE #2 LOOKING UPSTREAM AT BRIDGE CROSSING



BRIDGE #2 FIRM FLOOD PLAIN MAP



BRIDGE #2 -SITE PLAN

During fieldwork, it was generally observed that the 2010 LIDAR surface matched well with both visual and handheld GPS observations of the terrain. It is theorized that the surface data used to develop the FIRM floodplain boundaries was not as refined as the 2010 LIDAR, leading to plan floodplain boundaries that do not make physical sense with the observed terrain.

In plan, the layout for Bridge #2 resulted in a 140-foot clear span. The landing and abutment locations were selected to balance the simultaneous desire to minimize the span length, to provide a relatively flat, manageable approach, and to minimize earthwork. Additionally, based on professional judgment, the abutments were shifted farther from the banks in consideration of the potential for river channel migration. It is recommended that prior to final design, the potential for river channel migration and the relative location of the abutments be evaluated through geotechnical and hydraulic studies.

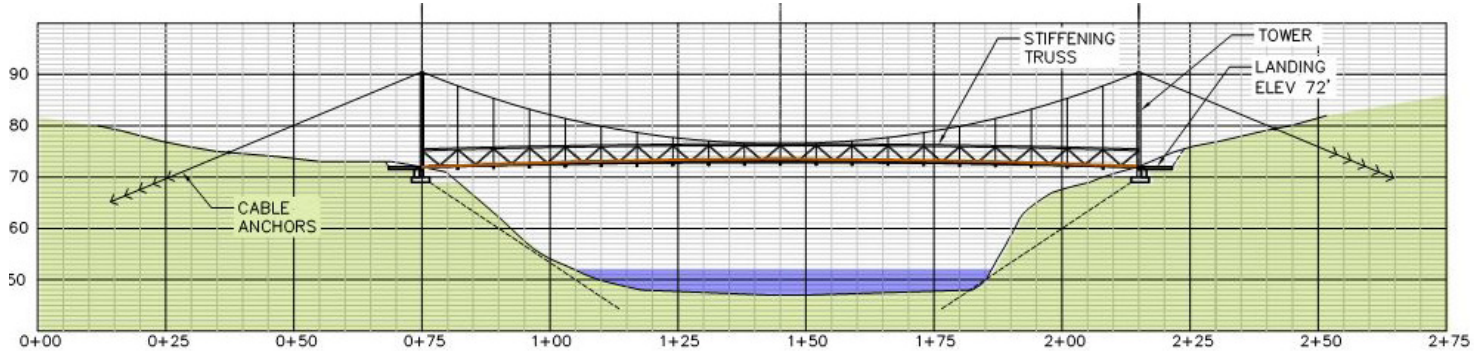
By matching the landing elevations for both sides, a consistent floodwater clearance is maintained, bridge and foundation design and construction is simplified, and differential loads on the foundation are minimized. The terrain of the trail sections taken to get to the Bridge #2 location prohibit feasible ADA access, so ADA compliant approach ramps were not considered.

With this proposed layout, the abutments are still within the official FIRM floodplain boundary. However, where the official FIRM floodplain boundary does not appear to make physical sense with the observed terrain, it is suggested that at a future stage, the FEMA floodplain be analyzed with real world survey data and a FEMA LOMA (Letter of Map Amendment) be performed for this bridge site. The desired outcome of this exercise is regulatory agency buyoff that the bridge abutments in this layout are realistically located outside of the 100-year floodplain.

If, however the official floodplain boundaries are maintained and not challenged, and the proposed abutments are judged to be inside of the floodplain, either the clear span would need to be increased to over 260 feet or the bridge and abutments would have to be designed to withstand the anticipated hydraulic loads and to consider scour. In this scenario, it is also likely that a detailed hydraulic study would be required either in order to establish a no-rise effect or to otherwise determine appropriate mitigation measures.

Increasing the clear span to over 260 feet in order to keep the abutments outside of the current floodplain would greatly increase project costs and complicate construction at this limited-access, environmentally sensitive site.
In consideration of the desired bridge performance parameters, all-weather steel was selected as the primary structural material for its low maintenance costs. Wood deck was selected for the low initial cost and ease of replacement for damaged, worn, or vandalized planks.

Additionally, both the wood deck and all weather steel meet the desired aesthetics of simple, natural appearing materials.



BRIDGE #2 ELEVATION (LOOKING DOWNSTREAM)

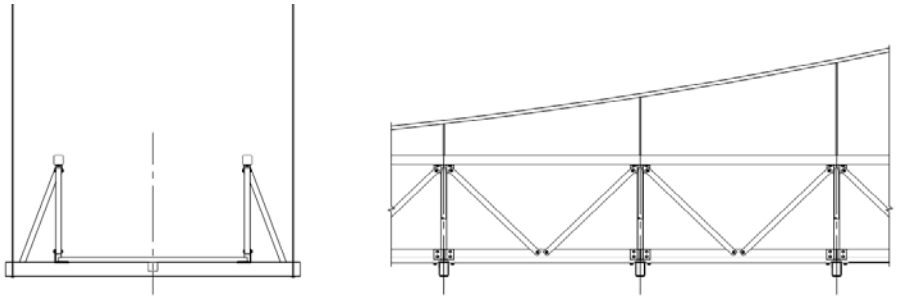
BRIDGES - BRIDGE #2

Given that the remote site is inaccessible to heavy equipment, a suspension bridge with steel truss stiffening members is the recommended bridge type for this site. Attributes that fit the site and performance requirements include durability and simplification of construction for remote sites. The preliminary design developed and presented in this report allows for a significant portion of fabrication of the bridge components to occur off site, minimizing construction impacts.

For the suspension bridge cost estimates, a preliminary design and analysis was used to determine member sizes. Professional judgment and a variety of estimating tools and guidelines were referenced to estimate the cost. Factors considered in the estimate included material quantities, anticipated equipment, labor, project scale, and limited site access.

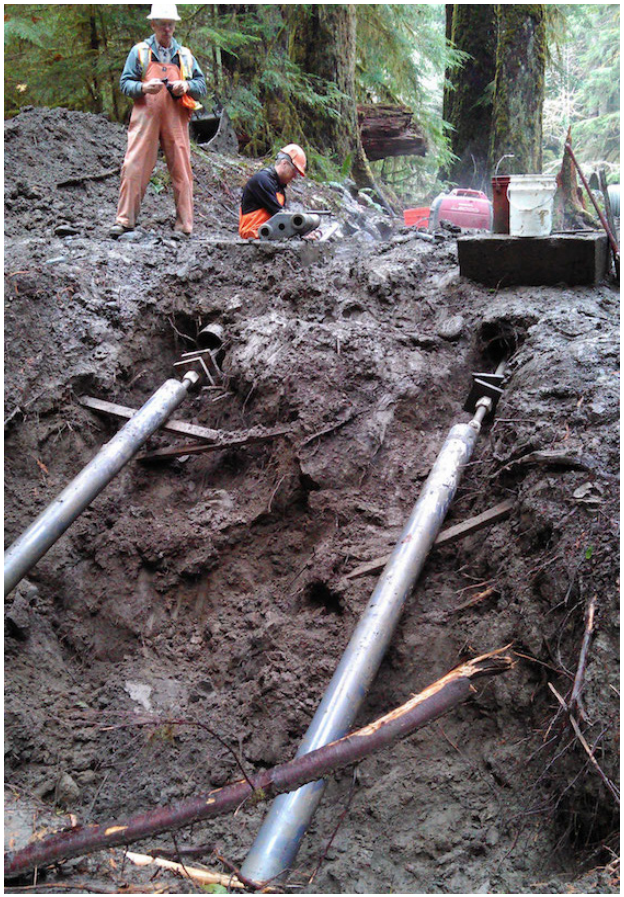
For the bridge abutments and foundations, a standard cast-in-place concrete spread footing foundation was selected for the towers. For the cable anchors, given the constraints to site access for mass concrete, the traditional concrete deadman anchor was not considered. For anchorage, a system of helical anchors or drilled and grouted soil anchors was considered. For formal design, geotechnical consultation and possibly soil borings will be required.

A prefabricated steel truss was also considered for this site. However, given the remote nature of the site, several additional splices would be required, and temporary in-water shoring and work bridges would be required to erect and launch the bridge. Alternately, depending upon costs, a helicopter could be considered for the erection and setting of the bridge.



BRIDGE #2 REPRESENTATIVE SECTION - SUSPENSION

BRIDGE #2 REPRESENTATIVE SUSPENSION BRIDGE STYLE



BRIDGE #2 REPRESENTATIVE SUSPENSION BRIDGE MAIN CABLE ANCHORAGE

For the prefabricated steel truss cost estimate, bridge manufacturers were consulted. In this preliminary report, a CONTECH Connector truss-style bridge is depicted as a representation of the bridge style. Given the limited site access and need for multiple splices, this linear truss style would simplify fabrication and field construction. Decking and railing would be installed in the field. The lightweight and efficient bridge style would make transport to the site easier and increases the potential for the use of a helicopter to set the bridge to be an economical solution. With the bridge layout providing more than adequate clearance over floodwater, the structural depth below deck elevation is not as critical as it was for Bridge #1.

A timber bridge was not considered for this site because the anticipated 140-foot clear span is beyond the practical limits of simple timber bridges, would require a more complicated design, and be difficult to construct in this remote location. In addition, for a timber bridge in this wet, shaded environment, it is anticipated that the relative structural lifespan would be less than that of a steel suspension bridge or a steel truss.

For Bridge #2, the current site access is limited to steep, narrow, and primitive trail with uneven grade coming from the 86th Avenue West Trailhead. This trail will be improved to a 6 foot width during trail construction, but grading will be uneven and will exceed 12 percent in some limited sections.

Coming from the Zircon Drive SW Trailhead, the majority of the trail was historically used as service roads with an average grade of approximately 12 percent, but significant improvements may be required to allow for safe access of heavy equipment including cranes, ready-mix concrete trucks, excavators, etc. For the last couple hundred feet to the planned bridge landing location, there is no pre-existing service road and the grade is uneven and exceeds 12 percent in some limited sections.

Access for a crane to pick and set the full span is not feasible at this location. The contractor will need to use smaller equipment and construction methods specifically suited to trail construction. With additional splices in the bridge and limited equipment access, rigging and shoring methods will be required to launch and set the bridge. These construction methods will require in-water shoring and possibly a temporary creek crossing. At this preliminary planning stage, to avoid limiting the best possible means and methods of construction, it is therefore recommended that the potential need for limited, temporary, in-water work platforms be noted in the permitting applications.

BRIDGE #2 REPRESENTATIVE SUSPENSION BRIDGE STYLE

BRIDGE #2 PREFABRICATED TRUSS HELICOPTER TRANSPORT

BRIDGE #2 -PREFABRICATED TRUSS REPRESENTATION - CONNECTOR STYLE

BRIDGES - BRIDGE #3 & #4

Bridge #3

Bridge #3 is the third farthest upstream and is located nearest to the proposed Tiffany Park Trailhead. It provides a future link in the trail system between the planned trail on the Lakewood side of the canyon and a potential loop trail along an abandoned logging road on the University Place side that would connect back to Bridge #4 and the Chambers Creek Road West Trailhead. This potential loop trail was not incorporated into this planning phase and, per phasing discussions in team meetings, Bridge #3 is only considered as part of the long term plan. The selected location is in close proximity to the location shown in the original trail plans and was confirmed as the preferred location during field visits and in project team meetings.

The site conditions for Bridge #3 were very similar to the Bridge #2 site, and therefore the same considerations were taken into account in determining the recommended bridge layout. However, for Bridge #3, following this same process resulted in a longer clear span of 161 feet.

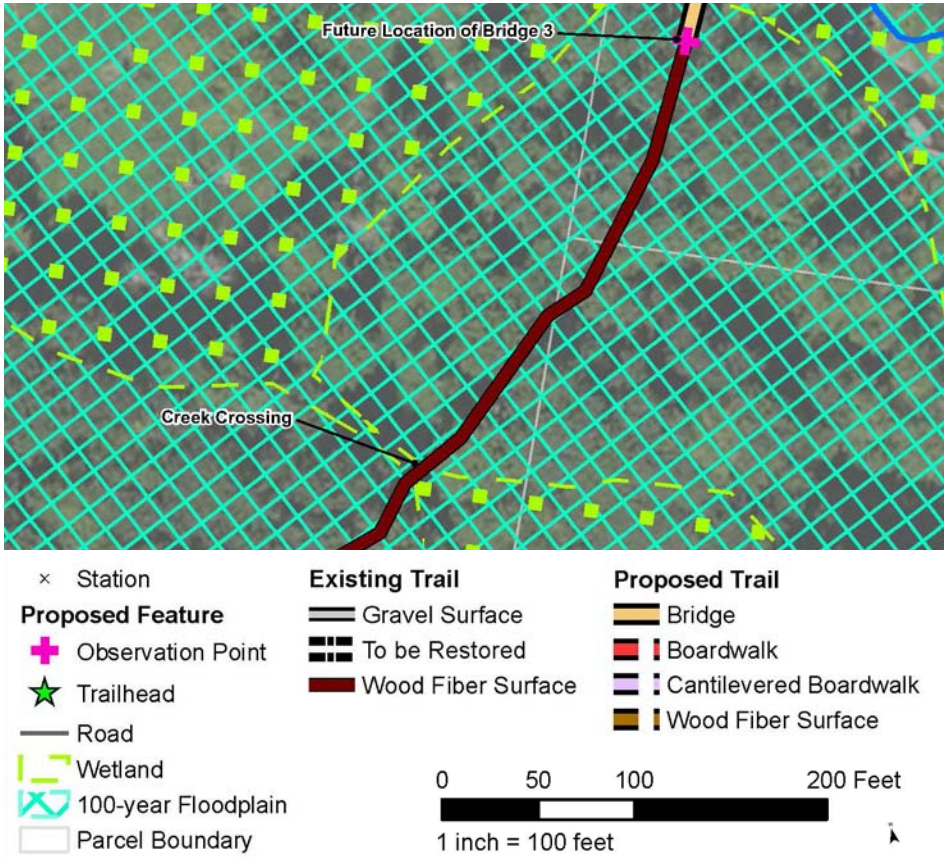
Under current conditions, construction access to the Bridge #3 site is viewed as somewhat more restrictive to heavy equipment than for the Bridge #2 site. However, bridge types similar to those recommended for Bridge #2 are recommended and considered to be constructible.

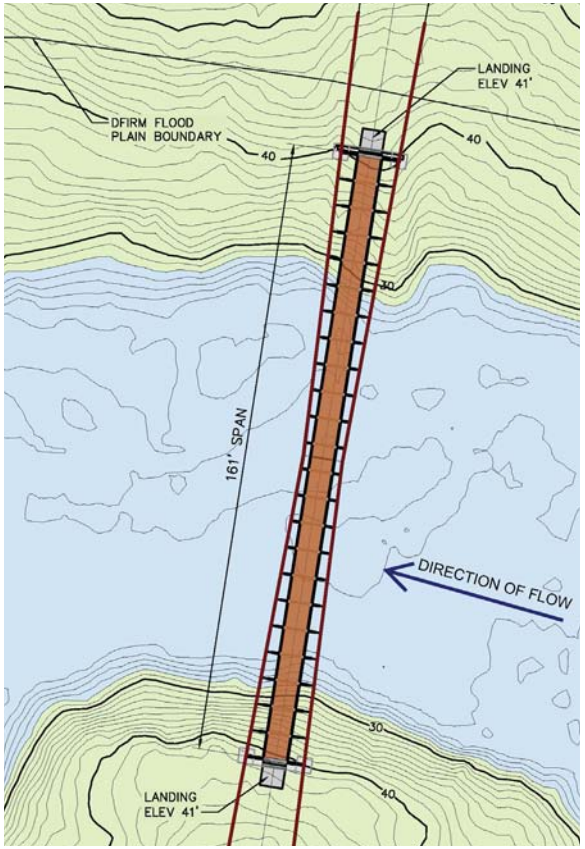
For the suspension bridge cost-estimates, a preliminary design and analysis was used to determine member sizes. Professional judgment and a variety of estimating tools and guidelines were referenced to estimate the cost. Factors considered in the estimate included material quantities, anticipated equipment, labor, project scale, and limited site access.

For the bridge abutments and foundations, a standard cast-in-place concrete spread footing foundation was selected for the towers. For the cable anchors, given the constraints to site access for mass concrete, the traditional concrete deadman anchor was not considered. For anchorage, a system of helical anchors or drilled and grouted soil anchors was considered. For formal design, geotechnical consultation and possibly soil borings will be required.

A prefabricated steel truss was also considered for this site. However, given the remote nature of the site, several additional splices would be required, and temporary in-water shoring and work bridges would be required to erect and launch the bridge. Alternately, dependent upon costs, a helicopter could be considered for the erection and setting of this bridge.

EXISTING CONDITION AT BRIDGE #3





BRIDGE #3 - PLAN VIEW

BRIDGE #4 - EXISTING CONDITION

Bridge #4

Bridge #4 is the farthest downstream and is located nearest to the Chambers Creek Road West Trailhead. As originally considered, the bridge would provide a pedestrian crossing over the existing Chambers Creek Road West vehicular bridge. This would provide a connection between the Chambers Creek Road West Trailhead on the Lakewood side and the proposed potential loop trail along an abandoned logging road on the University Place side. The bridge could also provide a link between the Chambers Creek Canyon Trail system and the Chambers Creek Properties trail system.

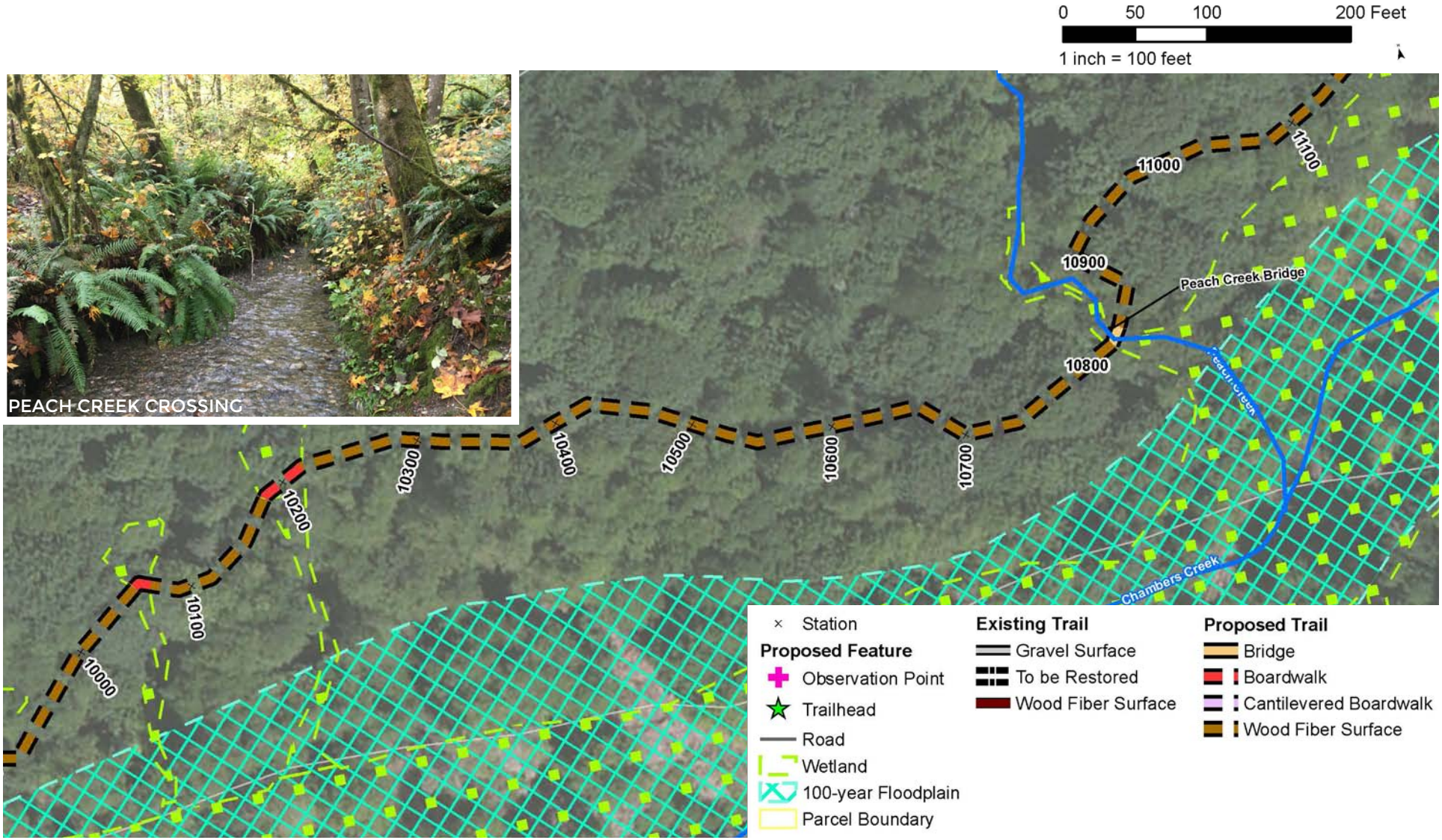
Options of widening the existing bridge and construction of an independent pedestrian bridge running parallel to the existing bridge were initially discussed. However, per discussions in team meetings, plans are in the works to potentially remove the dam immediately downstream, which would likely result in a full replacement of the existing bridge. Considering these potential future projects, it was determined that significant investigation of Bridge #4 would be removed from the scope of this planning study.

The existing bridge is listed as Bridge Number 29202A in the WSDOT bridge inventory, with the year built listed as 1946. This bridge is listed as jointly owned by Pierce County and the City of University Place. Per the inventory report, the bridge is listed as 22 foot wide (curb-to-curb) with a 65 foot length and a maximum span length of 16 feet. The bridge is considered to be functionally obsolete, but a timeline for replacement is not known and would likely be tied to the potential dam removal project. When the bridge is replaced, increasing the bridge width and modifying the alignment and lane configuration to accommodate a pedestrian crossing is recommended.

OTHER BRIDGES & CROSSINGS

Peach Creek

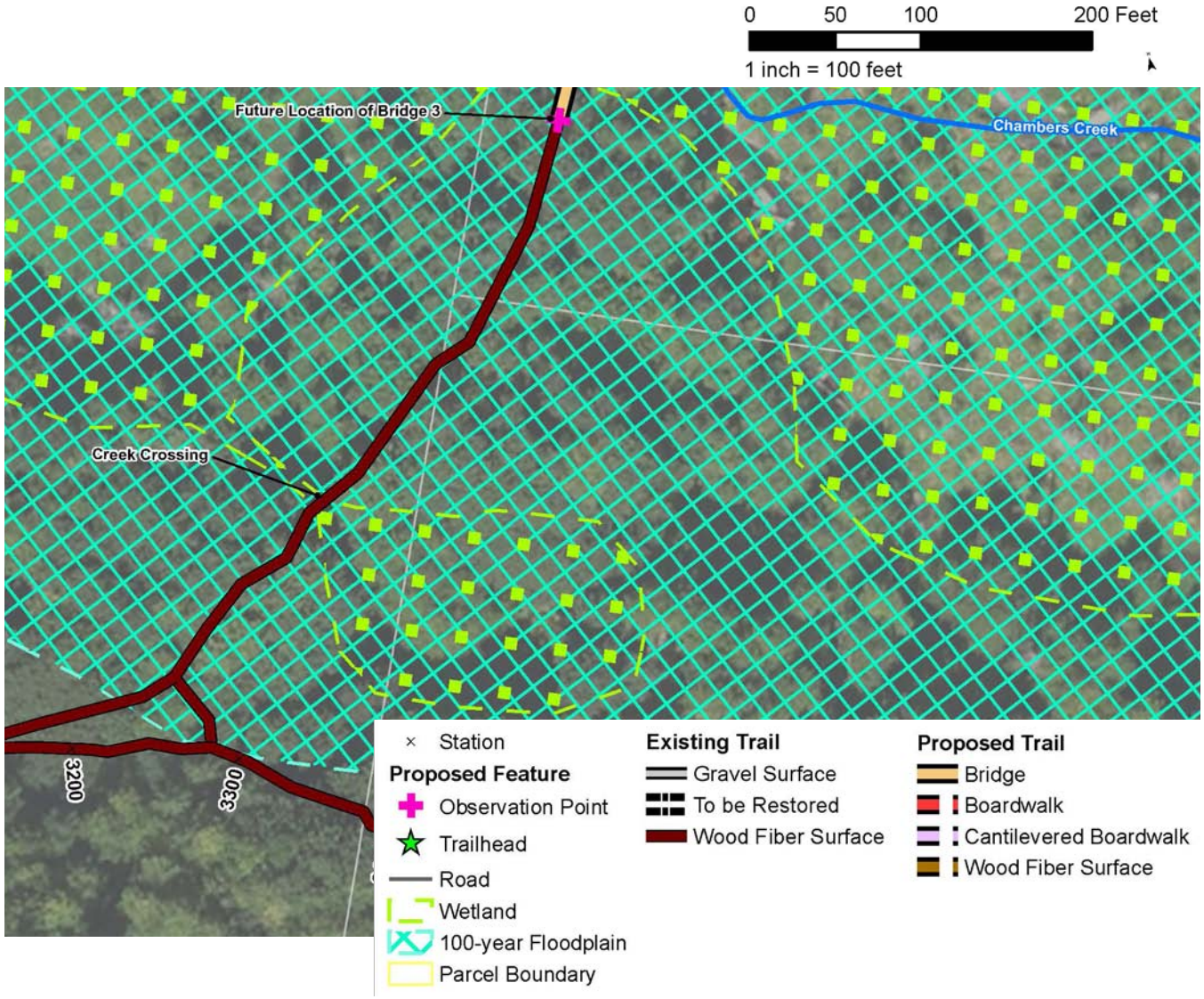
Peach Creek (Station 10800) would be crossed by a small timber bridge that spans the channel banks. The trail could take advantage of previous logging roads between Stations 8300 and 9000 to minimize construction impacts.



Wetland Crossing Near Bridge #3 Observation Point

A small length of wetland will need to be crossed to reach the Observation Point at the future location of Bridge #3. This could be accomplished through the implementation of a culvert or an elevated boardwalk.

EXISTING CONDITION AT CROSSING



TRAILHEADS

Summary

Preliminary designs were developed for the trailheads along the canyon as a part of this work, however additional mapping and studies will need to be conducted at a future time to determine the exact configuration of each. The improvements at each trailhead are intended to improve user experience and safety.

Kobayashi Park Trailhead

This existing access point onto the trail may be improved by adding a new informational kiosk, as well as a trash can and dog waste station. No new parking is shown for this trailhead as parking is currently available at Kobayashi Park.

PHILLIPS ROAD TRAILHEAD

Phillips Road Trailhead

The improvements at the Phillips Road Trailhead may be done in two phases. Phase 1 might include the improvement of the existing shoulder parking that is available along the eastern side of the road. Phase 2 improvements could include a new paved parking lot, split rail fencing, traffic control bollards, a secure access gate, as well as an informational kiosk, trash can, and dog waste station.

Zircon Drive SW Trailhead

Perpendicular parking is currently available on the gravel shoulder at the Zircon Drive SW Trailhead, however this could be modified to parallel stalls to improve traffic safety. Proposed improvements may include resurfacing for 20 parallel spaces. Split rail fencing could be used to help demarcate the trailhead, and traffic control bollards could be used to protect the informational kiosk, trash can, and dog waste station from vehicles.

Chambers Creek Road Trailhead

Angled parking stalls could be provided on the south side of Chambers Creek Road. Some earthwork would be required to remove an existing berm to accommodate these improvements. Other improvements might include split rail fencing along the edge of the parking, traffic control bollards, as well as an informational kiosk, trash can, and dog waste station. Overflow parking would be available on the north side of the road, however these improvements are not included in the cost estimate (see page 65).

Tiffany Park, 91st Ave CT SW Trailhead

This existing trailhead may be improved by incorporating a new informational kiosk, trash can, and dog waste station. No new parking is being incorporated at this location. It is assumed that this trailhead would be primarily accessed by local foot traffic.

86th Ave West Trailhead

This trailhead would be accessed by local foot traffic only, and as such does not include any new parking. The improvements might include split rail fencing, an informational kiosk, trash can, and dog waste station.

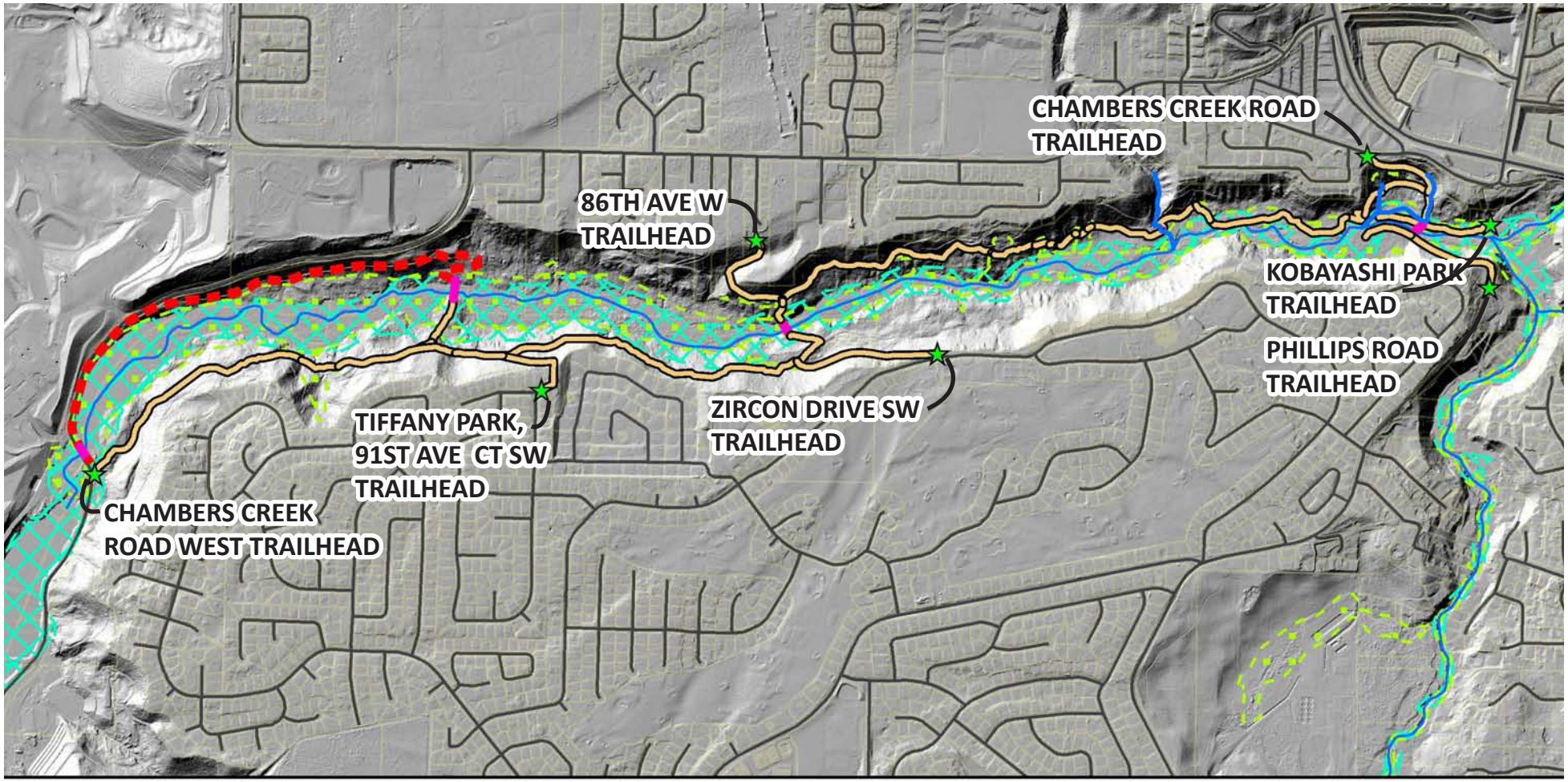
Chambers Creek Road West Trailhead

This trailhead, along with an informational kiosk, bollards, and trash can are existing. Improvements may include updating the kiosk to match the Chambers Creek Properties signage plan as well as the other trailheads for Chambers Creek Trail. The existing shoulder parking could be paved, and wet conditions just off of the shoulder could be protected from further impact by incorporating a split rail fence along the edge of the parking area. Overflow parking is available on the west side of the road, but improvements for this area are not included in the cost estimate (see page 65).

CHAMBERS CREEK ROAD TRAILHEAD

ZIRCON DRIVE SW TRAILHEAD

CHAMBERS CREEK ROAD WEST TRAILHEAD



Chambers Creek Canyon Trail System

- Road
- Stream
- Wetland
- 100-year Floodplain
- Parcel Boundary

Proposed Feature

- Trailhead
- Canyon Creek Trail System
- Bridge
- Potential Loop Trail

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,

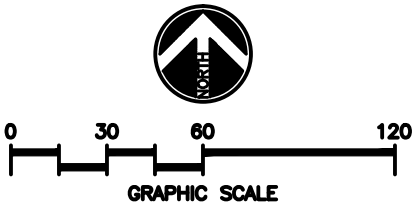
0 500 1,000 2,000 Feet

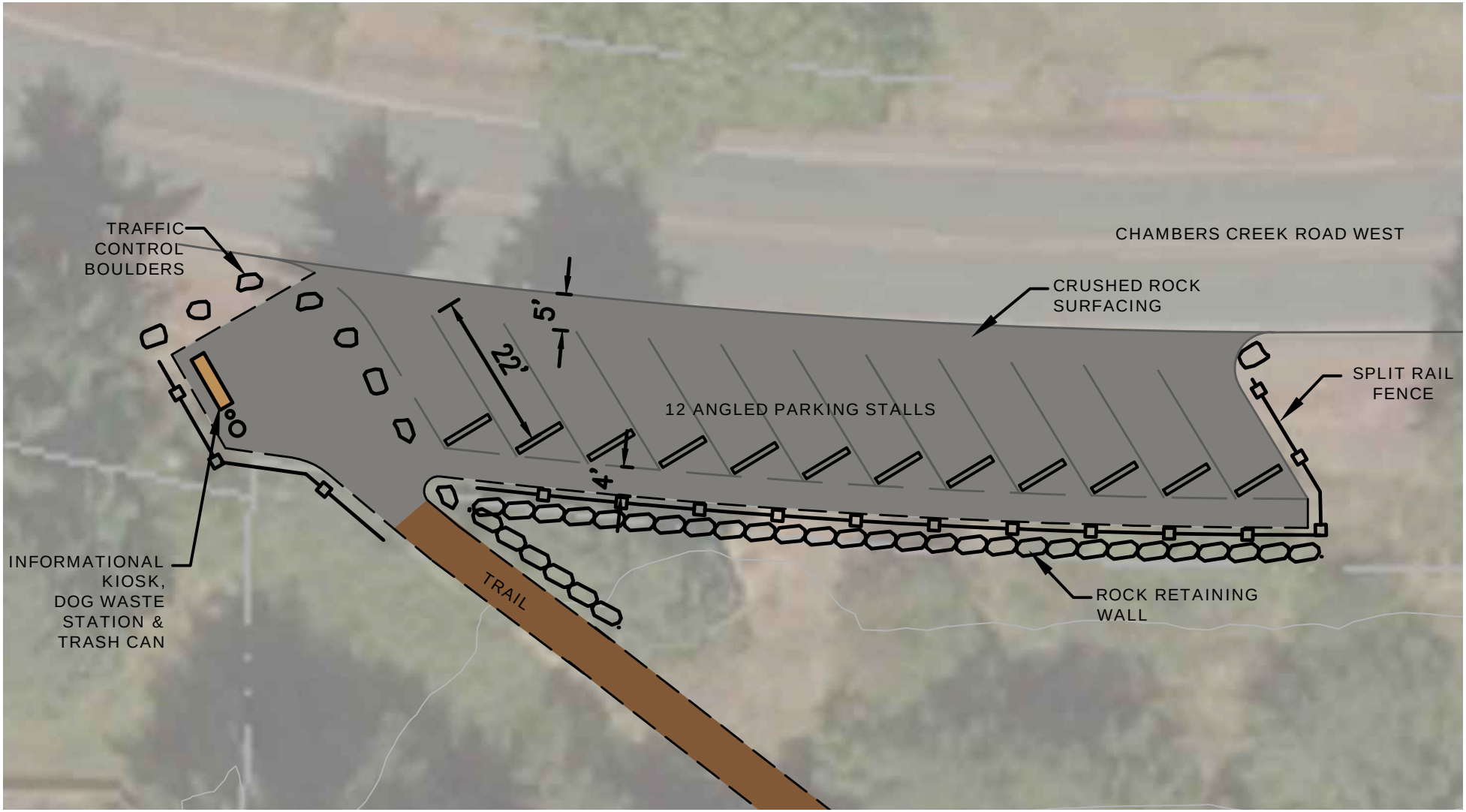
1 inch = 1,250 feet

N

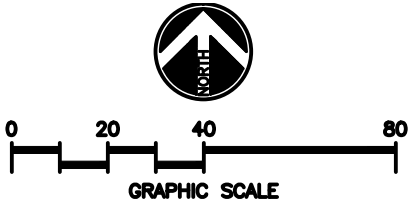
TRAILHEADS

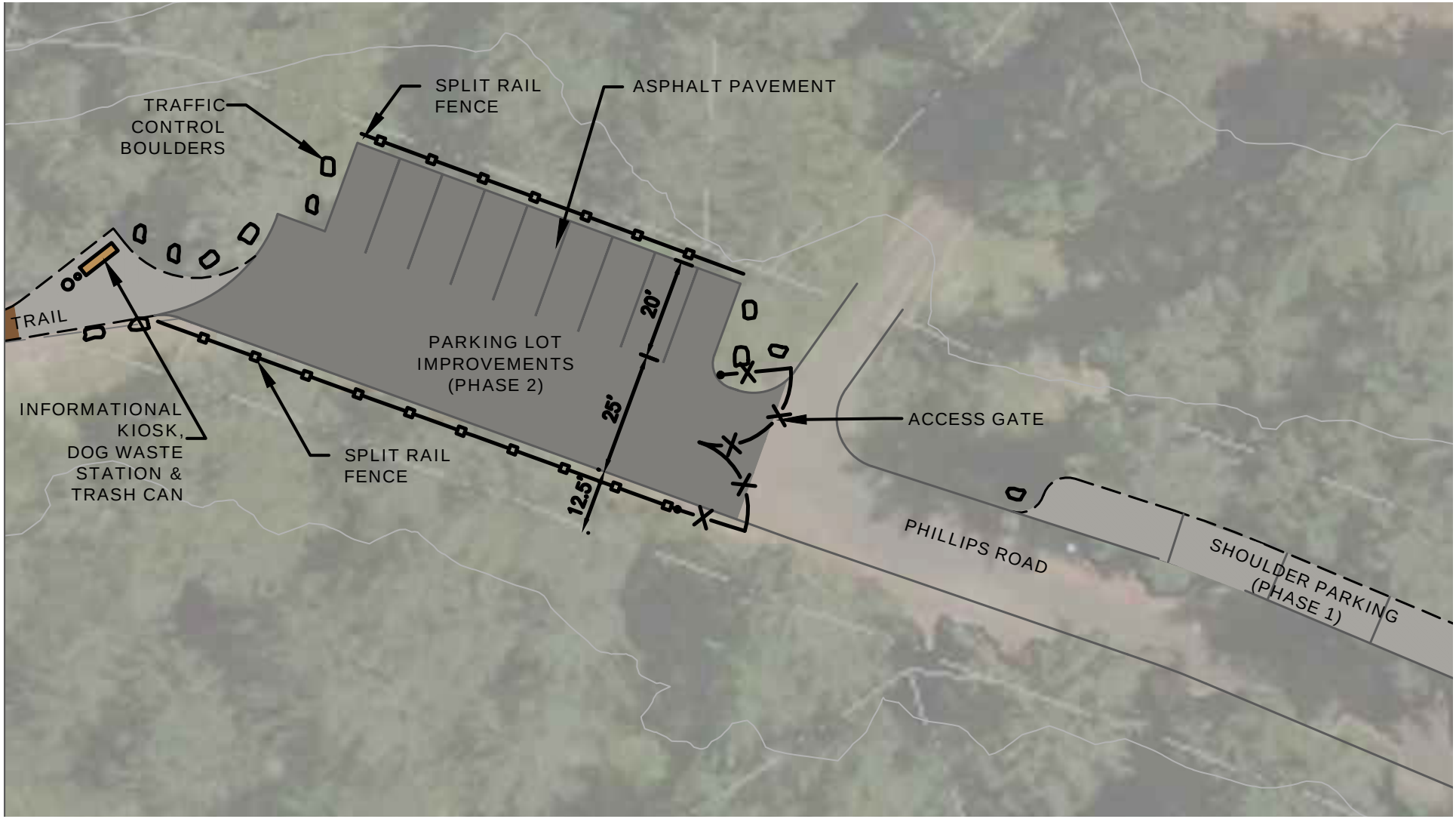
Kobayashi Park Trailhead Plan



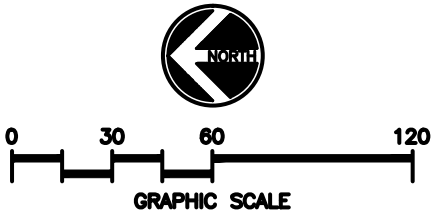


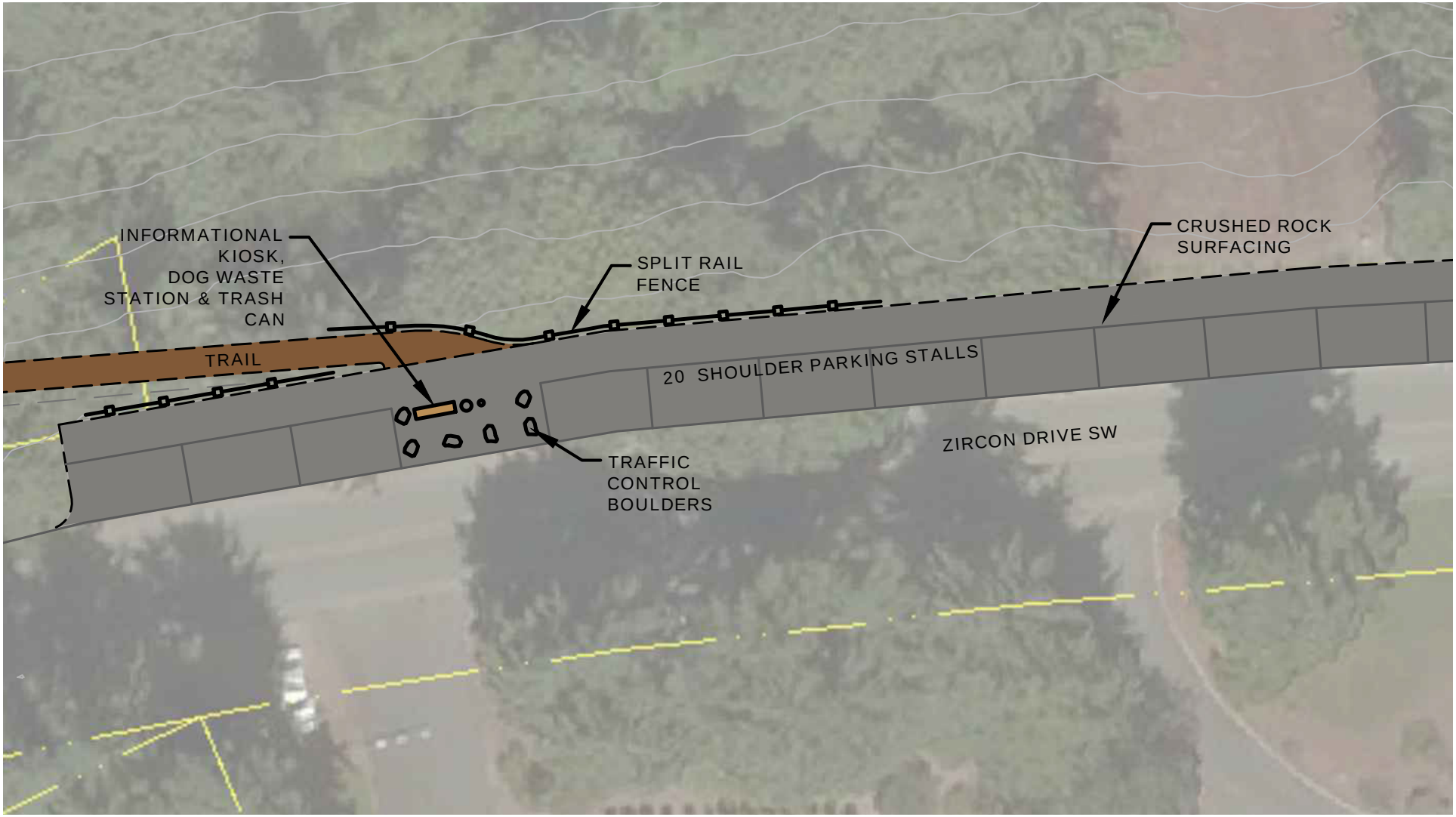
Chambers Creek Road Trailhead Plan



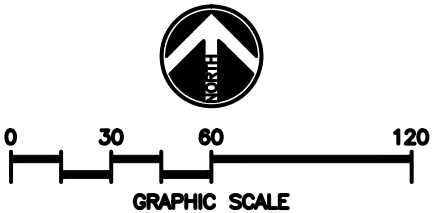


Phillips Road Trailhead Plan

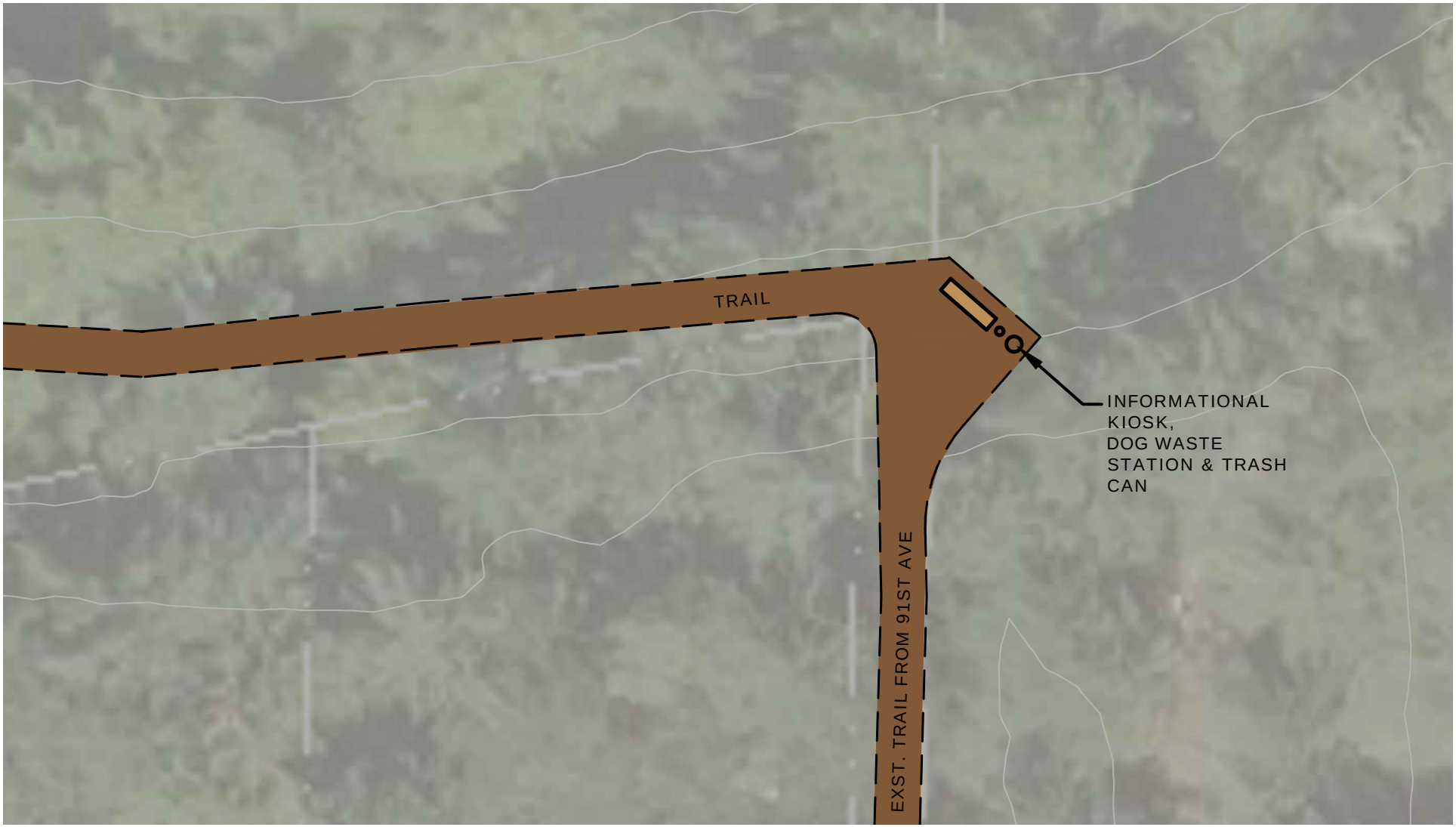




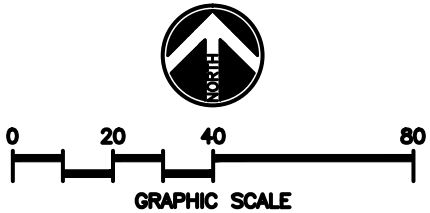
Zircon Drive SW Trailhead Plan

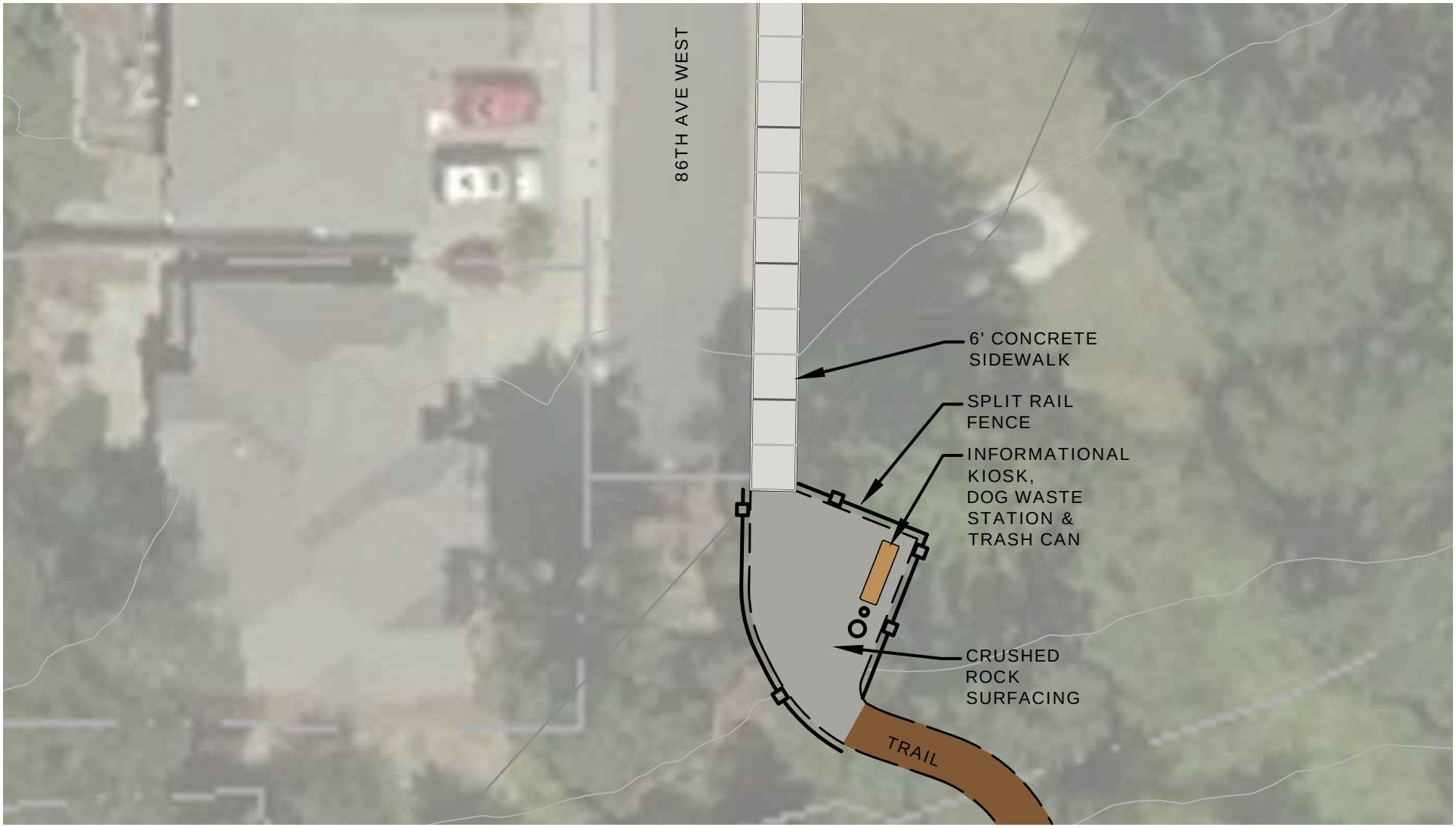


TRAILHEADS

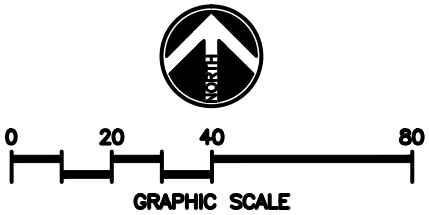


Tiffany Park, 91st Ave CT SW Trailhead Plan

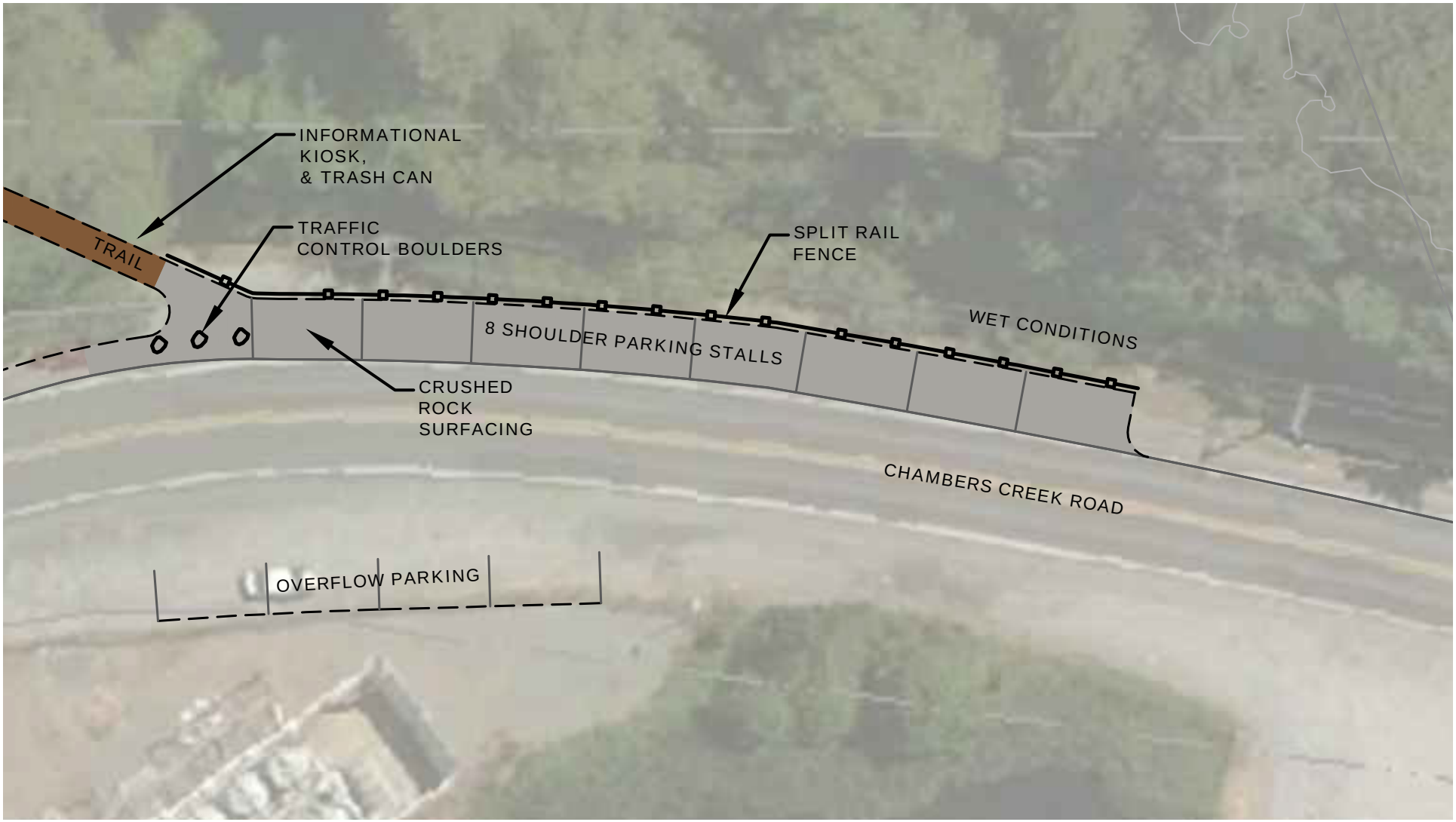




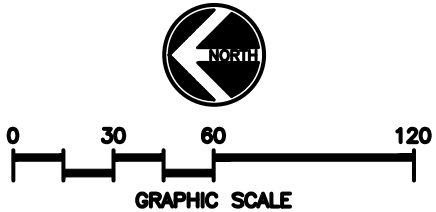
86th Ave West Trailhead Plan



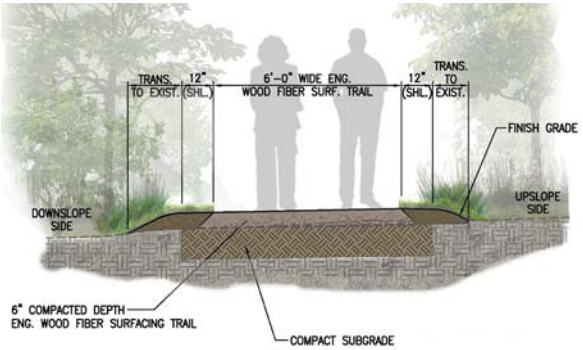
THIS PAGE INTENTIONALLY LEFT BLANK



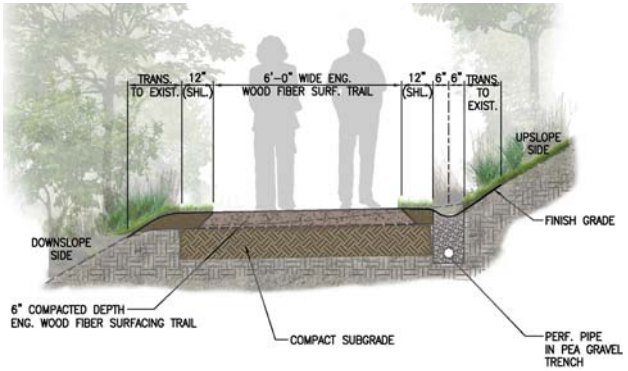
Chambers Creek Road West Trailhead Plan



TYPICAL CROSS SECTIONS / DETAILS



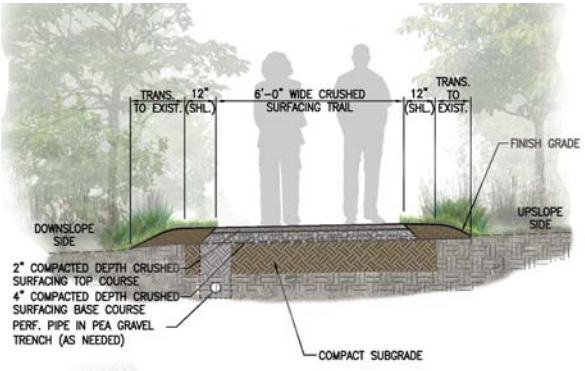
WOOD FIBER SURFACING - IN DRY AREAS



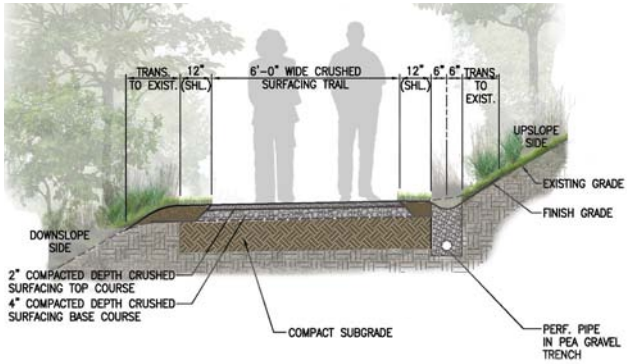
WOOD FIBER SURFACING - AT BENCH

Description

These two cross sections illustrate a typical wood fiber surfacing trail condition in either dry areas or at a bench. At locations where the trail is benched, a perforated pipe in a pea gravel trench may be incorporated on the uphill side of the trail as needed to control water and prevent trail washouts.



CRUSHED ROCK SURFACING - IN WET AREAS

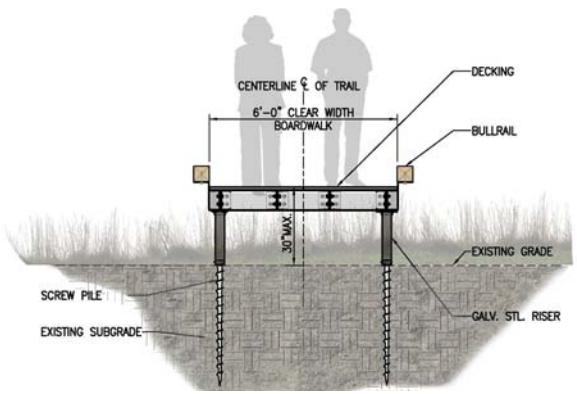


CRUSHED ROCK SURFACING - AT BENCH

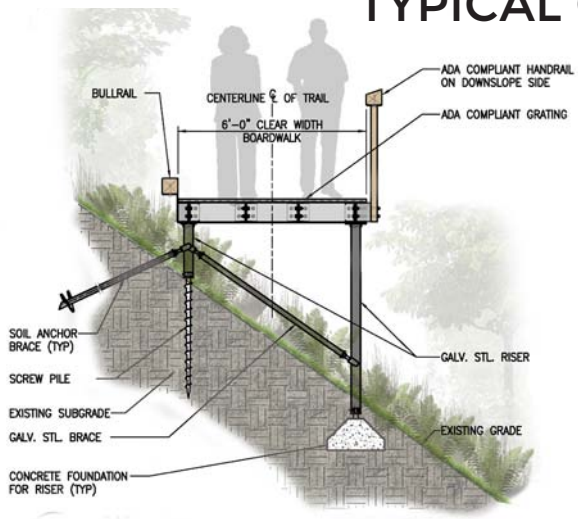
Description

These two cross sections illustrate a typical crushed rock surfacing trail condition in either wet areas or at a bench. A perforated pipe in a pea gravel trench may be incorporated as needed to control water and prevent trail washouts.

TYPICAL CROSS SECTIONS / DETAILS

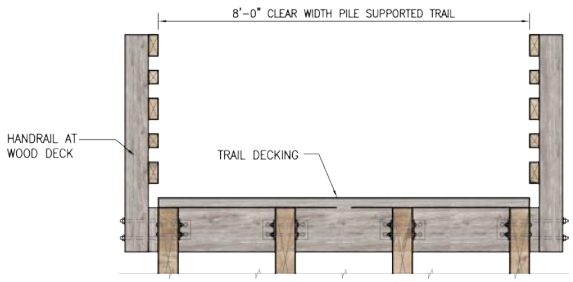


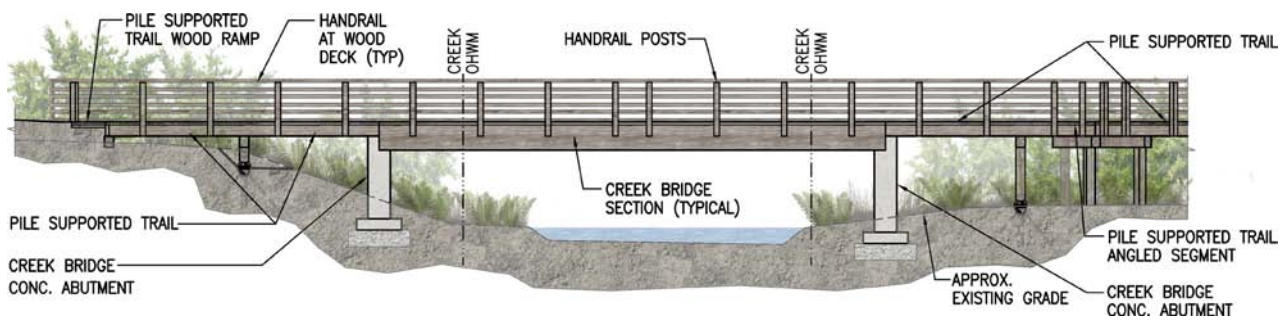
BOARDWALK WITH WOOD DECKING - AT GRADE



CANTILEVERED BOARDWALK WITH GRATING AT SLOPE

Description
These two cross sections illustrate a typical boardwalk condition in either wetland or sloped locations. The systems will be able to be constructed without the use of heavy equipment and with only minimal and temporary disturbances to the wetland and sensitive hillside. Solid decking should be used in the wetland as opposed to grating to prevent reed canary grass from growing up through the boardwalk.





SMALL BRIDGE, PEACH CREEK

Description
This detail shows an example of a bridge that could be used at the Peach Creek crossing or other locations where smaller bridges will be required. The bridge could be supported by pinned foundations or concrete abutments, as necessary.

COST ESTIMATE

Summary

Estimated costs for the bridges, trails, boardwalks, and trailheads are based on 2016 construction prices and will need to be adjusted annually to account for rates of inflation. Estimated costs for the design, construction contingency, engineering, inspection, testing, administration, and sales tax are incorporated. Precise quantities of the various construction items cannot be determined until final design for construction is completed; therefore, the contingency covers unknowns inherent at this preliminary plan stage. Sales tax (which is included in the cost) could change over time. City administration fees must be added to this estimate.

Chambers Creek Canyon Trail
City of University Place, WA
Estimate of Probable Construction Cost - **Preliminary Design - BRIDGES**
January 11, 2017

Item Description	Qty	Unit	Unit Price	Amount
• Bridge #1[1]	1	LS	$292,000.00	$292,000.00
			BRIDGE #1 SUB-TOTAL	$292,000.00
• Bridge #2[1]	1	LS	$263,000.00	$263,000.00
			BRIDGE #2 SUB-TOTAL	$263,000.00
• Bridge #3[1]	1	LS	$305,000.00	$305,000.00
			BRIDGE #3 SUB-TOTAL	$305,000.00
• Peach Creek Bridge[1]	1	LS	$28,000.00	$28,000.00
			BRIDGE #4 SUB-TOTAL	$28,000.00
• Bridge #4 (Not Included)				Not Included
			BRIDGE #4 SUB-TOTAL	$0.00
			BRIDGE TOTAL	$888,000.00

Notes:
[1] Costs include a 20% Construction Contingency and AE costs.

Bruce Dees Associates Page 1 of 1 117-04-01

Chambers Creek Canyon Trail
City of University Place, WA
Estimate of Probable Construction Cost - **Preliminary Design - TRAILS & BOARDWALKS**
December 13, 2016

Item Description	Qty	Unit	Unit Price	Amount
TRAIL SURFACING				
• Restored Trail	400	LF	$7.00	$2,800.00
			Restored SUB-TOTAL	$2,800.00
• 6' Engineered Wood Fiber w/ Drain (EWFD)[3] *Subtract $12 per LF if no drainage is needed.	20,500	LF	$37.00	$758,500.00
			EWFD SUB-TOTAL	$758,500.00
• 6' Crushed Surfacing Trail w/ Drain (CSTD)[3] *Subtract $12 per LF if no drainage is needed.	2,200	LF	$42.00	$92,400.00
			CSTD SUB-TOTAL	$92,400.00
• 6' Wide Boardwalk w/ Wood Decking (BWD)[3]	1,720	LF	$490.00	$842,800.00
			BWD SUB-TOTAL	$842,800.00
• 6' Wide Boardwalk w/ Grating at Slope (BGS)[3]	250	LF	$590.00	$147,500.00
			BGS SUB-TOTAL	$147,500.00
			TRAIL SUB - TOTAL	$1,844,000.00
			TRAIL TOTAL	$1,844,000.00

Notes:
[1] Assumes strippings will be spread on-site.
[2] Assumes spoils will be spread on-site.
[3] Trail Surfacing estimates include clearing, grubbing, trail materials and sub base, and seeding of shoulders (if applicable).
[4] Estimate includes 20% Construction Contingency (10% estimate contingency, 10% mobilization) & 20% for design fees, taxe

Bruce Dees Associates Page 1 of 1 117-04-01

Chambers Creek Canyon Trail
City of University Place, WA
Estimate of Probable Construction Cost - **Preliminary Design** - **TRAILHEADS**
January 11, 2017

KOBAYASHI PARK TRAILHEAD
- clearing and grubbing
- grading (assume 1')
- wood chips
- seeding
- informational kiosk
- trash can

KOBAYASHI SUB-TOTAL $ 14,000

CHAMBERS CREEK ROAD TRAILHEAD
- clearing and grubbing
- grading (assume 1')
- seeding
- informational kiosk
- dog waste station
- trash can
- split rail fence
- traffic control boulders
- rock retaining wall
- surfacing
- wheel stops

CHAMBERS CREEK ROAD SUB-TOTAL $ 77,000

PHILLIPS ROAD SW TRAILHEAD

PHASE 1 - SHOULDER PARKING
- clearing and grubbing
- grading (assume 1')
- seeding
- crushed rock surfacing

PHILLIPS ROAD PHASE 1 SUB-TOTAL $ 4,000

PHASE 2 - PARKING LOT
- clearing and grubbing
- grading (assume 1')
- seeding
- informational kiosk
- access gate
- dog waste station
- trash can
- split rail fence
- traffic control boulders
- crushed rock surfacing
- stormwater infrastructure
- surfacing

PHILLIPS ROAD PHASE 2 SUB-TOTAL $ 117,000

TRAILHEAD TOTAL $ 406,000

Notes:
1 Assumes strippings will be spread on-site.
2 Assumes spoils will be spread on-site.
3 Construction Contingency includes 10% estimate contingency, 10% mobilization, 40% soft costs.

Chambers Creek Canyon Trail
City of University Place, WA
Estimate of Probable Construction Cost - **Preliminary Design** - **TRAILHEADS**
January 11, 2017

ZIRCON DRIVE SW TRAILHEAD
- clearing and grubbing
- grading (assume 1')
- seeding
- surfacing
- dog waste station
- informational kiosk
- trash can
- split rail fence
- traffic control boulders

ZIRCON DRIVE SW SUB-TOTAL $ 123,000

TIFFANY PARK / 91ST AVE COURT SW TRAILHEAD
- clearing and grubbing
- grading (assume 1')
- wood chips
- dog waste station
- seeding
- informational kiosk
- trash can

TIFFANY PARK/91ST AVE COURT SW SUB-TOTAL $ 14,000

86TH AVE WEST TRAILHEAD
- clearing and grubbing
- grading (assume 1')
- seeding
- informational kiosk
- dog waste station
- trash can
- split rail fence
- crushed rock surfacing
- concrete walk

86TH AVE WEST SUB-TOTAL $ 22,000

CHAMBERS CREEK ROAD WEST TRAILHEAD
- clearing and grubbing
- grading (assume 1')
- dog waste station
- seeding
- traffic control boulders
- split rail fence
- surfacing

CHAMBERS CREEK ROAD WEST SUB-TOTAL $ 35,000

TRAILHEAD TOTAL $ 406,000

PROJECT GRAND TOTAL: $3,138,000

PHASING PLAN

SUMMARY

A phasing plan was developed based upon probable costs, ease of permitting, and construction as well as alignment with probable grant funding.

Phase 1

Phase 1 may include segments of trail on both the Lakewood and University Place sides of the creek, as well as construction of Bridge #1, the Chambers Creek Road Trailhead, and the Kobayashi Park Trailhead. Shoulder parking improvements at the Phillips Road Trailhead may also be a part of this phase.

Phase 2

Phase 2 may include segments of trail on the Lakewood side of the creek, as well as construction of the Zircon Drive SW Trailhead, Tiffany Park 91st Ave CT SW Trailhead, and the Chambers Creek Road West Trailhead. The parking lot at the Phillips Road Trailhead may also be a part of this phase.

Phase 3

Phase 3 may include segments of trail on the University Place side of the creek, as well as the 86th Ave West Trailhead. It may also include the Peach Creek Bridge.

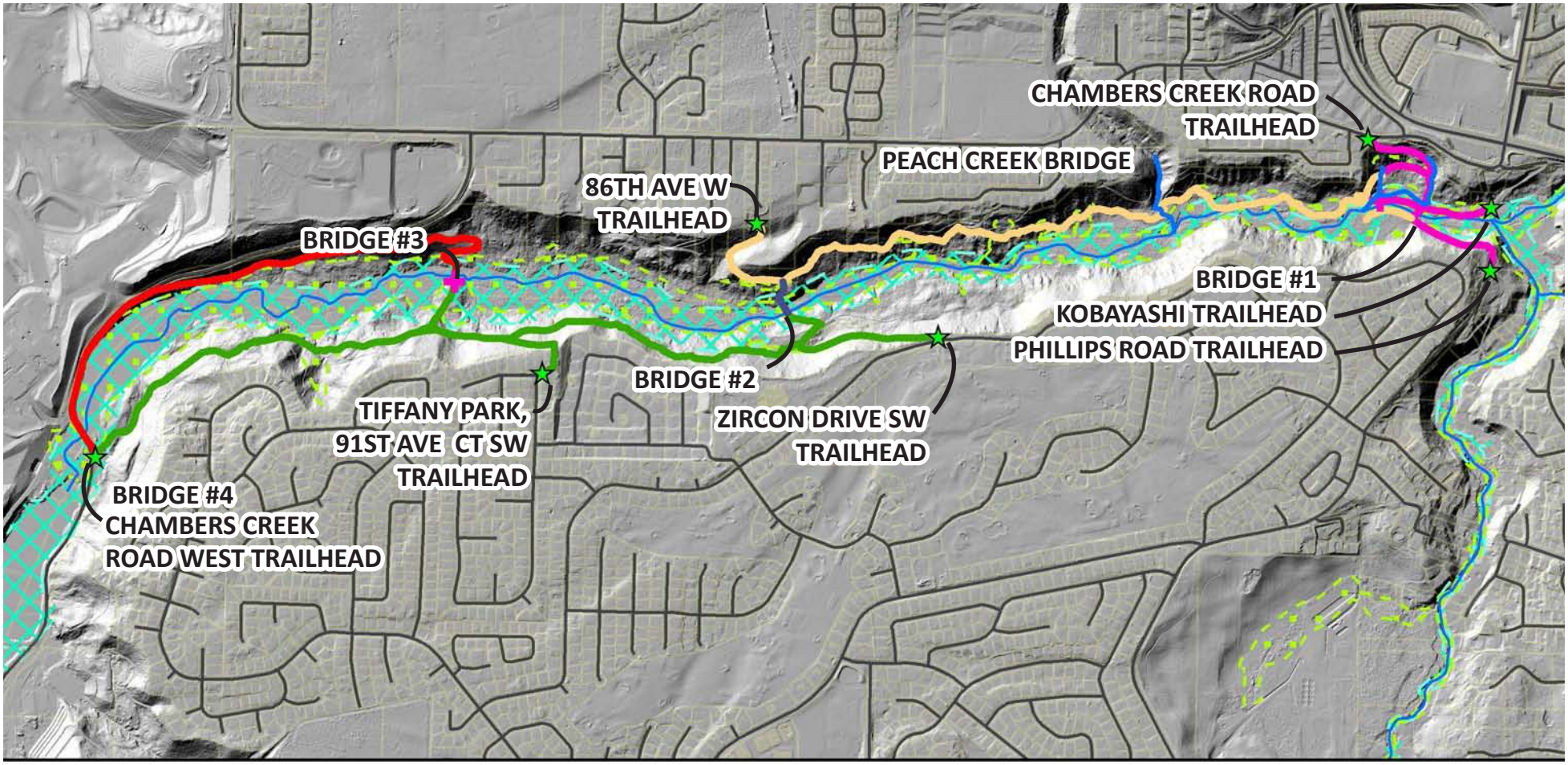
Phase 4

Phase 4 could consist of the construction of Bridge #2.

Phase 5

Phase 5 may include the construction of Bridge #3 and the loop trail on the University Place side of the creek.

PHASING PLAN



Chambers Creek Canyon Trail Construction Phasing

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County

Proposed Feature
- Observation Point
- Trailhead
- Stream
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

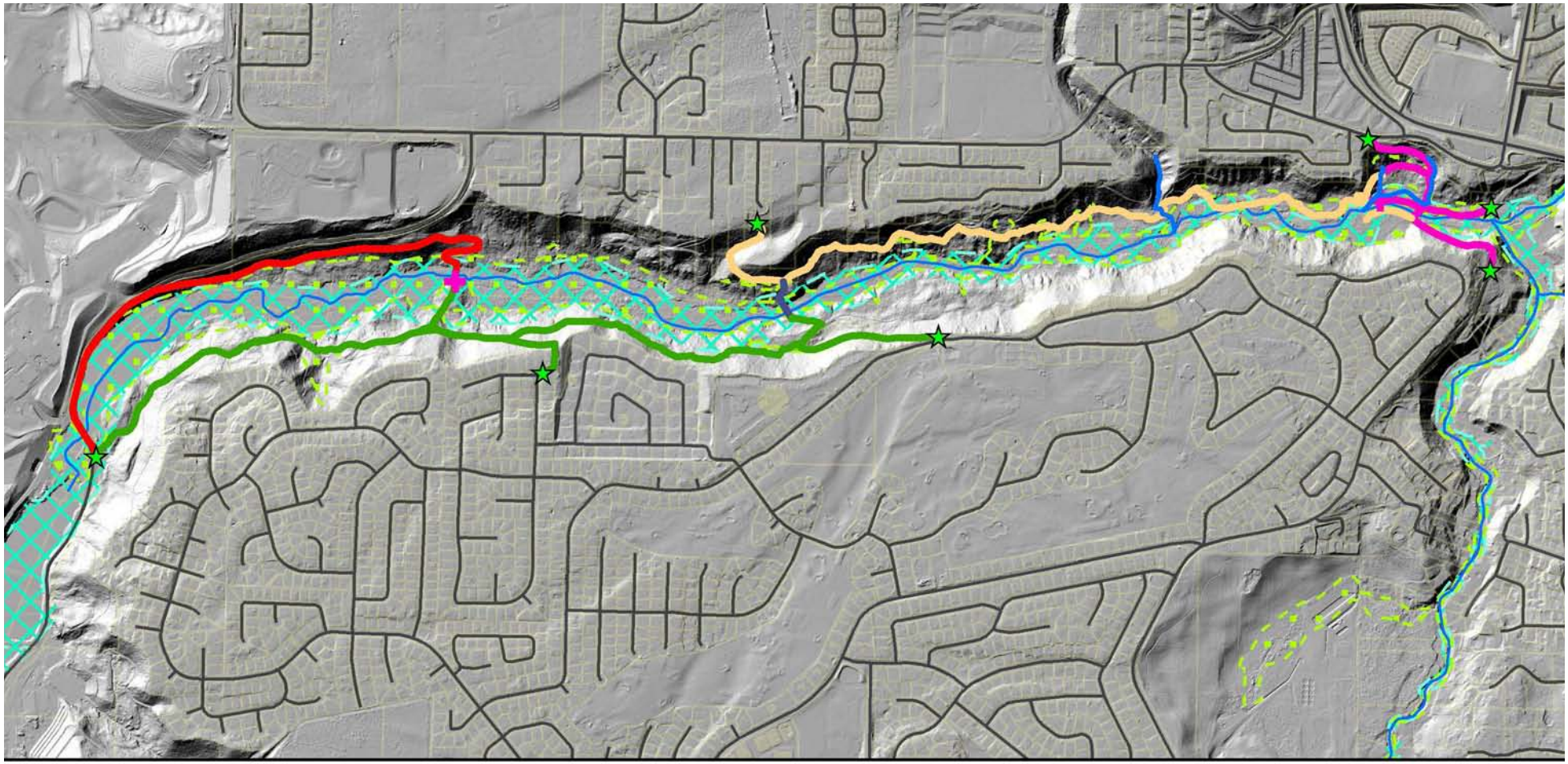
Construction Phase
- 1
- 2
- 3
- 4
- 5

0 500 1,000 2,000 Feet

1 inch = 1,250 feet

N

PHASING PLAN



Chambers Creek Canyon Trail Construction Phasing

Proposed Feature
- Observation Point
- Trailhead
- Stream
- Road
- Wetland
- 100-year Floodplain
- Parcel Boundary

Construction Phase
- 1
- 2
- 3
- 4
- 5

Date: January 2017
Data Sources:
Pierce County Wetland Inventory, Pierce County Transportation, Pierce County Assessor Parcels 2014, FEMA Preliminary DFRIM mapping for Pierce County,

0 500 1,000 2,000 Feet

1 inch = 1,250 feet

N

Phased Cost Estimate

Chambers Creek Canyon Trail
City of University Place, WA
Phased Cost Estimate - **Preliminary Design**
January 13, 2017

ITEM		TOTAL
PHASE 1		
Bridge #1	$	292,000
Bridge #1 Sub-Total	**$**	**292,000**
Trails		
• Wood Fiber Trail (1,600 LF)		$59,200.00
• Crushed Surface Trail (1,700 LF)		$71,400.00
Trail Sub-Total	**$**	**130,600**
Trailheads		
• Kobayashi Trailhead	$	14,000
• Chambers Creek Road Trailhead	$	77,000
• Phillips Road Trailhead (Shoulder Parking Improvements)	$	4,000
Trailhead Sub-Total	**$**	**95,000**
PHASE 1 GRAND TOTAL	**$**	**517,600**
PHASE 2		
Trails		
• Wood Fiber Trail (9,100 LF)		$336,700.00
• Crushed Surface Trail (350 LF)		$14,700.00
Trail Sub-Total	**$**	**351,400**
Trailheads		
• Zircon Drive SW Trailhead	$	123,000
• Tiffany Park / 91st Ave CT SW Trailhead	$	14,000
• Phillips Road Trailhead (Parking Lot Improvements)	$	117,000
• Chambers Creek Road West Trailhead	$	35,000
Trailhead Sub-Total	**$**	**289,000**
PHASE 2 GRAND TOTAL	**$**	**640,400**

Bruce Dees & Associates 1 of 2 Phasing

Chambers Creek Canyon Trail
City of University Place, WA
Phased Cost Estimate - **Preliminary Design**
January 13, 2017

ITEM		TOTAL
PHASE 3		
Peach Creek Bridge		$28,000.00
Peach Creek Bridge Sub-Total		**$28,000.00**
Trails		
• Restored Trail (400 LF)		$2,800.00
• Wood Fiber Trail (5,000 LF)		$185,000.00
• Boardwalk W/ Wood Decking (1,700 LF)		$833,000.00
• Boardwalk W/ Grating at Slope (250 LF)		$147,500.00
Trail Sub-Total		**$1,168,300.00**
Trailheads		
• 86th Ave West Trailhead	$	22,000
Trailhead Sub-Total	**$**	**22,000**
PHASE 3 GRAND TOTAL	**$**	**1,218,300**
PHASE 4		
Bridge #2		$263,000.00
Bridge #2 Sub-Total		**$263,000.00**
Trails		
• Wood Fiber Trail (200 LF)		$7,400.00
• Boardwalk W/ Wood Decking (20 LF)		$9,800.00
Trail Sub-Total		**$17,200.00**
PHASE 4 GRAND TOTAL		**$280,200.00**
PHASE 5		
Bridge #3		$305,000.00
Bridge #2 Sub-Total	**$**	**305,000**
Trails		
• Wood Fiber Trail (4,600 LF)		$170,200.00
• Crushed Surface Trail (150 LF)		$6,300.00
Trail Sub-Total	**$**	**176,500**
PHASE 5 GRAND TOTAL	**$**	**481,500**
CHAMBERS CREEK CANYON GRAND TOTAL	$	3,138,000

NOT INCLUDED
• Bridge #4

Bruce Dees & Associates 2 of 2 Phasing

APPENDIX

Permit Matrix

Impact Summary

Bridge Matrix

Bridge Survey Controls

Meeting Minutes

Meeting 1 - Kickoff Meeting - October 3, 2016
Meeting 2 - Final Trail Location Meeting - October 26, 2016
Meeting 3 - Bridge/Trailhead Design Meeting - November 22, 2016
Meeting 4 - Draft Preliminary Design Report Meeting - December 14, 2016
Meeting 5 - Final Plan Presentation - January 18, 2017

PERMIT MATRIX

Summary

It is our understanding that the partner agencies have agreed to use the City of University Place's local regulations to satisfy permit requirements for all three jurisdictions. Permits may be phased depending on if and/or when the project is funded for construction. Based on our current understanding of the project and site conditions, applicable permits are likely to include the following:

Permit	Project Implications
Federal	
U.S. Army Corp of Engineers (USACE) Clean Water Act Section 404 – discharges to wetlands	The trail project includes work within jurisdictional wetlands (both slope and riverine systems) that will require review and approval from the USACE. This includes placement of the boardwalk in wetlands and trail construction or improvements through wetlands.
State	
Washington Department of Fish and Wildlife (WDFW) Hydraulic Project Approval (HPA)	Working within and over waters of the state (Chambers Creek and Peach Creek, as well as connected wetlands) are subject to the Hydraulic Code. An HPA will need to be obtained from WDFW for the bridges and trail work within wetlands.
Washington Department of Ecology (Ecology) Clean Water Act Section 401 Certification (water quality standards)	As part of the USACE review, Ecology may need to certify that the project meets state water quality standards.
Local	
City of University Place State Environmental Policy Act (SEPA) approval	As lead agency, the City will need to complete a review of the project under SEPA in order to proceed with local and state permitting. We assume that a detailed SEPA checklist will be prepared for review and result in a mitigated determination of non-significance (MDNS).
City of University Place Critical Areas	The proposed trail crosses several critical areas and their applicable buffers and is subject to critical area review. These includes streams, wetlands, steep slopes, and fish and wildlife habitats.
City of University Place Shorelines	The proposed trail is located with the 200-foot regulatory buffer of the shoreline management plan for Chambers Creek. A shoreline substantial development permit will be required for all project activities proposed within the SMP.
City of University Place Site Development Permit	Construction of the trail will require a clear and grade permit.
City of University Place Tree Removal Permit	Construction of the trail will require tree removal and permit from the City.
City of University Place Building Permit	Construction of the trail bridges will require a building permit.

IMPACT SUMMARY

Summary

The proposed trail would be constructed through wetlands and their associated buffers, as well as several bridge crossings over creeks. Formal wetland delineations and ratings have not occurred, therefore impacts are assessed based on professional judgment and conditions observed during field reviews.

Critical Area	Trail Length (feet)	Trail Area[1] (square feet)
Wetland	3,040	18,240
Wetland Buffer	15,485	92,910

[1] Trail width is assumed to be 6 feet

BRIDGE MATRIX

	Bridge Type	Bridge Clear Span (ft)	Bridge Width (ft.)	Superstructure Material	Bridge Deck	Foundation Components	Ramp Length (ft)	Bridge Cost	Ramp-Stair Cost	Constr. Cost	A&E Cost	Contingency 20%	Total Constr. Cost
Bridge 1 (option A)	Prefab. Truss - Capstone	115	8	Weathering Steel	DF (2x10)	Spread Ftg w/ Pin Piles, Gabian Baskets for Ramps	65	$ 203,000	$ 40,000	$ 243,000	$ 23,000	$ 49,000	$ 292,000
Bridge 1 (option B)	Prefab. Truss - Connector	115	8	Weathering Steel	DF (2x10)	Spread Ftg w/ Pin Piles, Gabian Baskets for Ramps	65	$ 191,000	$ 40,000	$ 231,000	$ 23,000	$ 47,000	$ 278,000
Bridge 2 (option A)	Suspension	140	6	Weathering Steel	DF (2x10)	Spread Ftg for Tower, Helical Anchors	-	$ 182,000	$ -	$ 182,000	$ 37,000	$ 44,000	$ 263,000
Bridge 2 (option B)	Prefab. Truss - Connector	140	6	Weathering Steel	DF (2x10)	Spread Ftg	-	$ 268,000	$ -	$ 268,000	$ 19,000	$ 58,000	$ 345,000
Bridge 3 (option A)	Suspension	161	6	Weathering Steel	DF (2x10)	Spread Ftg for Tower, Helical Anchors	-	$ 211,000	$ -	$ 211,000	$ 43,000	$ 51,000	$ 305,000
Bridge 3 (option **B**)	Prefab. Truss - Connector	161	6	Weathering Steel	DF (2x10)	Spread Ftg	-	$ 307,000	$ -	$ 307,000	$ 21,000	$ 66,000	$ 394,000

Summary

Bridge Type: Prefabricated steel truss bridge superstructures are assumed to be engineered, designed, fabricated, and delivered to the site by the manufacturer, per the project specifications. Suspension bridge superstructures are assumed to be custom engineered and then fabricated and constructed by the contractor, per the project plans and specifications.

Bridge Clear Span: Bridge span is taken from back-of-pavement seat to back-o-pavement seat. Bridge location and span determinations were based on profesional judgement and observed conditions during field work. Formal evaluation, full engineering design, and permitting requirements may result in changes to the bridge locations and spans.

Bridge Width: Assumed clear path width across the bridge.

Superstructure Material: Primary structural members were assumed to be fabricated using weathering steel, such as ASTM A588 and A242, that develop a protective oxide film on the metal surface. Materials used for bolted connections, cables, hangers, railings, and other miscellaneous components will vary. Bridge designs are at planning level and structural member materials and sizes will vary with final design.

Bridge Deck: Bridge deck was assumed to be 2" x10" (nominal) Douglas Fir Deck.

Foundation Components: Foundation design was based on engineering judgement and field observations. Final designs will require evaluation by a geotechnical engineer and may require soil borings. Foundation components including spread footings, abutments, and landings are assumed to be constructed using reinforced concrete. For Bridge #1, the abutment on north bank of creek was assumed to be supported by pin piles in consideration of potential creek migration risks. Foundations for the ramps at Bridge # 1 were assumed to be constructed using a gabian basket system. Anchors for the suspension bridge main cables were assumed to be a helical ground anchors systems.

Ramp Length: The ramp for Bridge #1 was assumed to rise from existing grade with a maximum 1:12 slope for a total rise of 5-ft. A 5-ft intermediate landing was included per ADA requirements.

Construction Costs: Construction costs include the bridge and ramp, where applicable. Estimates are preliminary and include materials, labor, and equipment for the contractor. Mobilization costs of 15% of the construction costs were assumed and are included in the estimates.

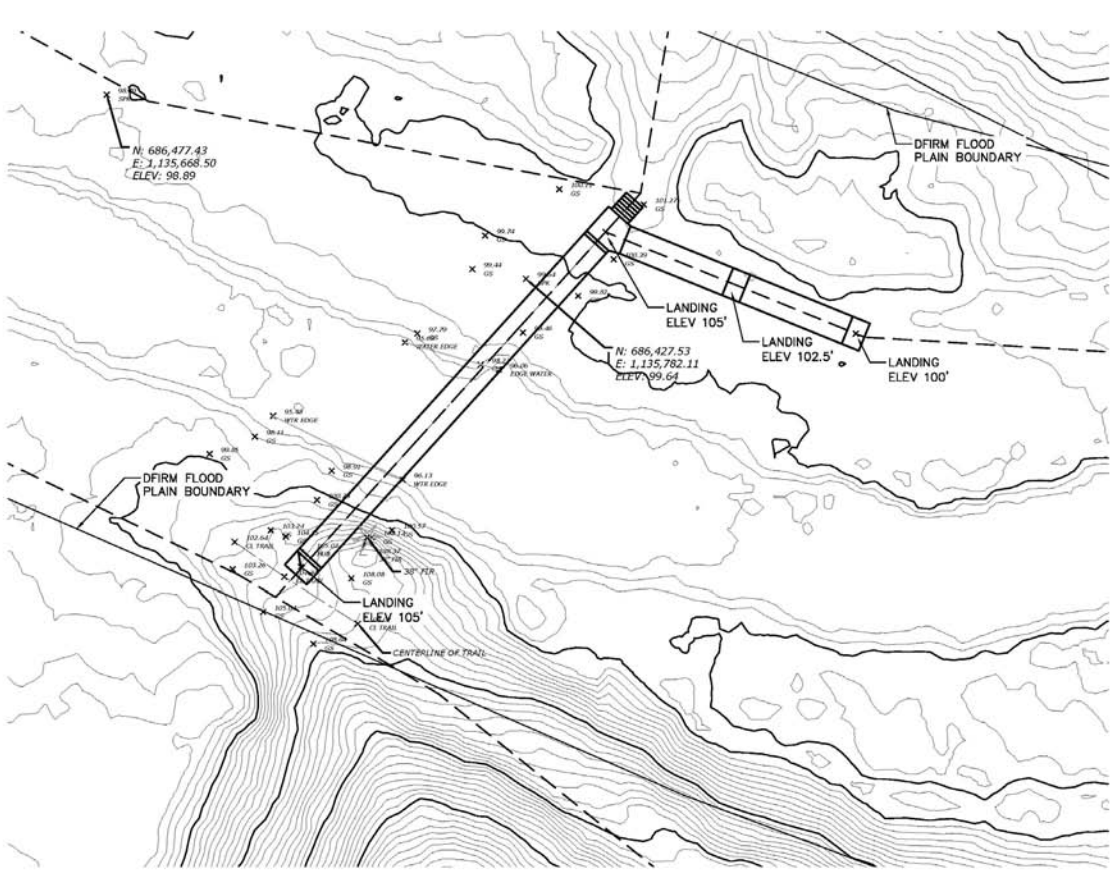
A&E Cost: A&E Costs were estimated at 20% of construction costs, except for with the pre-engineered superstructure of the prefabricated steel truss bridges, where the A&E costs were estimated as 5% of the construction costs for that component. Estimated costs are subject to increase where unanticipated conditions require extensive hydrologic studies, geotechnical exploration, or environmental investigations in order to complete final design.

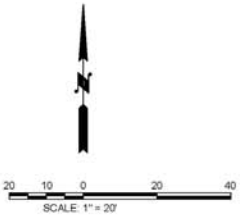
Contingency: Considering that the estimates were based on a planning level of design, a contingency cost of 20% of the construction cost was added.

Total Construction Cost: The Total Construction Cost includes the summation of the Construction Cost, A&E Cost, and the Contingency 20% columns.

BRIDGE SURVEY CONTROLS

BRIDGE #1 STAKING EXHIBIT





SURVEY DATA

VERTICAL DATUM
NAVD 88

BASED ON GPS RESOLUTION USING THE WSRN NETWORK AT A PK SET ON THE EAST SIDE OF THE FRED MEYER BUILDING LOCATED AT 6049 BRIDGEPORT WAY W, UNIVERSITY PLACE, WA 98467
DATE: JANUARY 12TH, 2017
ELEVATION=218.105

BASIS OF BEARINGS
STATE PLANE COORDINATES

GPS POINT #8:
PK SET ON THE EAST SIDE OF THE FRED MEYER BUILDING LOCATED AT 6049 BRIDGEPORT WAY W
N: 687,472.56
E: 1,136,597.53

GPS POINT #7:
PK SET ON THE SOUTH SIDE OF BRIDGEPORT WAY W AT THE INTERSECTION OF 67TH AVE W
N: 686,649.17
E: 1,136,305.05

BEARING: N 29°11'47" E

Summary

Control was set for both Bridge #1 and Bridge #2, with horizontal values based upon State Plane Coordinates (NAD 83/91), and vertical based upon NAVD 88. Control consists of three inter-visible rebar and control caps at each of the two locations. Coordinate values are provided at ground. See attached maps for additional survey data and coordinates of control stakes.

The coordinate values were calculated for the ends of Bridge #1, and stakes were set at the center of each landing. Ground shots were taken throughout the landing areas of Bridge #1, including a shot near the floodplain edge on each side.

Additionally, data was tied to the stream gauge "USGS 12091500 Chambers Creek BL Leach Creek Near Steilacoom, WA" near Bridge #1. The stream gage water level of 3.0 feet corresponds to the surveyed elevation of 99.82 feet.

BEYLER CONSULTING

CONTACT
phone: 253-301-4157
fax: 253-336-3950
beylerconsulting.com

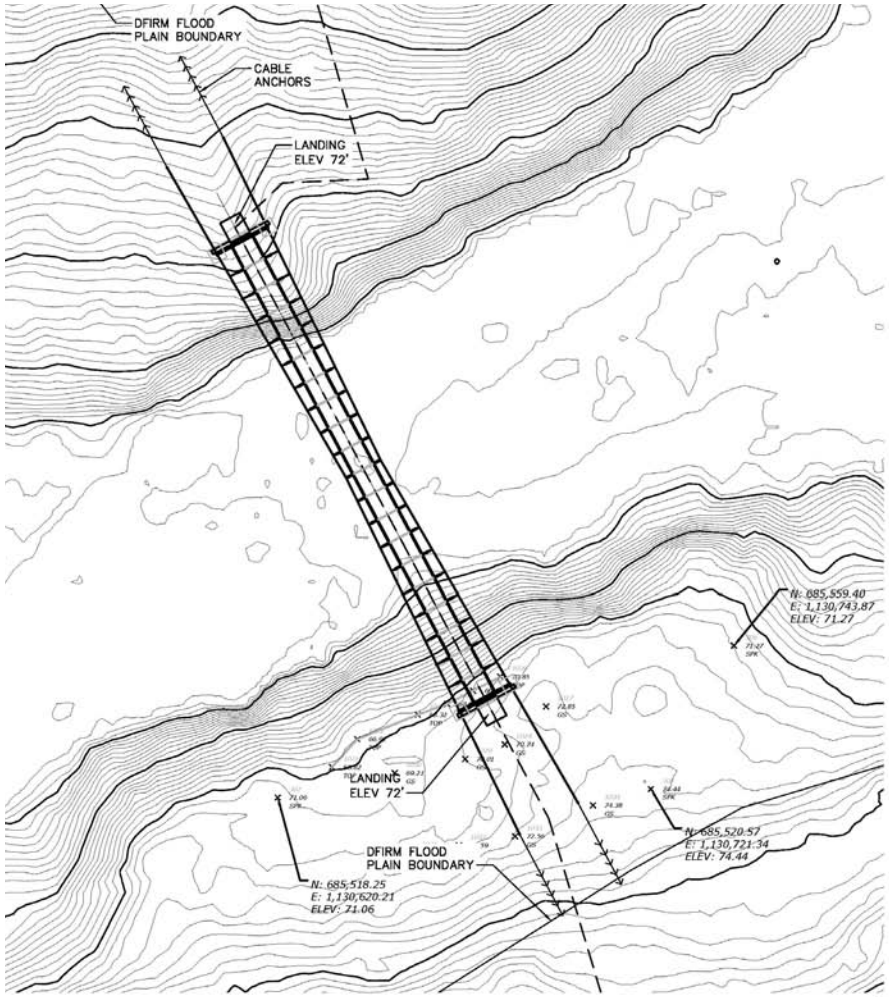
OFFICE
7602 Bridgeport Way W; 3D
Lakewood, WA 98499

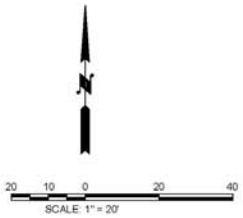
SURVEY FOR: **CHAMBERS CREEK**
SITE #1
STAKING EXHIBIT

DRWN. BY:	DATE:	JOB #:
PJJ	2/1/2017	16-400
CHKD. BY: MTW	SCALE:	SHEET: OF

BRIDGE SURVEY CONTROLS

BRIDGE #2 STAKING EXHIBIT





SURVEY DATA

VERTICAL DATUM
NAVD 88

BASED ON GPS OBSERVATION USING OPUS RESOLUTION
FILE: log1229q.tps OP1484080661845
DATE:DECEMBER 29, 2016
BENCHMARK: SET MAG NAIL ON WEST SIDE OF THE ENTRANCE TO THE GOLF CART SHOP AT OAKBROOK GOLF CLUB.
ELEVATION=232.52

BASIS OF BEARINGS
STATE PLANE COORDINATES

GPS POINT #201:
SET MAG NAIL ON WEST SIDE OF THE ENTRANCE TO THE GOLF CART SHOP AT OAKBROOK GOLF CLUB.
N: 685,320.70
E: 1,131,877.21

GPS POINT #200:
SCRIBED "X" ON SE CORNER OF POWER VAULT LOCATED ON THE WEST SIDE OF HOUSE #8214 ZIRCON DR SW
N: 685,232.00
E: 1,131,369.79

BEARING: N 80°05'06" E

BEYLER CONSULTING

CONTACT
phone: 253-301-4157
fax: 253-336-3950
beylerconsulting.com

OFFICE
7602 Bridgeport Way W; 3D
Lakewood, WA 98499

SURVEY FOR: **CHAMBERS CREEK**
SITE #2
STAKING EXHIBIT

DRWN. BY:	DATE:	JOB #:
PJJ	2/8/17	16-400
CHKD. BY: MTW	SCALE:	SHEET: OF

MEETING MINUTES

MEETING 1

University Place – Chambers Creek Canyon Trail
Master Plan
Kickoff Meeting #1
October 3, 2016

Bruce Dees & Associates
Job No. 83-09-01

PRESENT (P)

University Place Parks
David Swindale – City of University Place
Gary Cooper – City of University Place
Jessica Stone – Pierce County
Mary Dodsworth – City of Lakewood

Consultants
(P) Bruce Dees, Bruce Dees & Associates
(P) Rachel Lingard, Bruce Dees & Associates
(P) Dan Roscoe, Berger ABAM
(P) Myles Parrish, Berger ABAM

PURPOSE

The purpose of this meeting was to kick off the project and confirm the trail route and characteristics. The design team also presented some initial findings from field work that was completed. The approach to the Preliminary Design Report was also discussed.

Trail Characteristics

- The County Master Plan calls for soft surface and narrow trails
- Casual walking/Nature trail
  - The path should be wide enough for two people to walk abreast wherever possible.
- Paved sections
  - Paved areas would be limited to ADA access to strategic lookout points.
  - The trail should be considered soft surface at this preliminary stage. Hard surfaces may be incorporated in the future.
- Gravel v. bark trail
  - A bark trail would necessitate more excavation than a gravel trail.
    - Jessica emphasized that the depth of excavation should be minimized to limit disturbance.
  - Gravel should be considered in wetter areas to reduce mud
    - Wet areas should also be under drained.
- Trail coming down from Philips Road is almost good as is in its current condition.

Boardwalks:

- Boardwalks could be used in wet areas.
  - Jessica recommends we avoid the open grates for the surfacing of the boardwalks in areas where reed canary grass is prevalent
    - Concerned that they grass will grow up through the grating.

Trailheads

- End of Philips Road could be a trailhead
  - Place to Park? Yes
  - Paved ADA compliant? – possibly
    - Switch backs
    - Viewpoint for ADA without going all the way down

Bridge Characteristics

- Clear span bridges are desirable.
  - Would like consistency of style between bridges
    - Use of similar materials
  - Like the metal truss look
    - Easy to paint if tagged
  - wood decking is liked
  - Bridges will have more use since this is an urban area
    - Should be heavy duty
    - Will be used regularly
    - Needs to be safe and kid friendly
    - Railings to have 4" openings max

Alignment Concerns

The current alignment shows the trail going around a "nose" just south of bridge 1, however after visiting the location the consultant team recommended changing the alignment to go up and over the nose to avoid the steep conditions found in that location.

- The trail above the "nose" could be accomplished with a pin pile supported boardwalk system
  - Minimizes cut into the hillside
  - Minimizes erosion issues
- The trail should be benched into the hillside wherever possible,
  - The pin pile boardwalk should only be used where absolutely necessary.
    - Boardwalk would be limited to extreme conditions, like up and over the "nose".

Bike Connection

The group was asked if having a bike connection from Phillips Road to Chambers Creek Road was desired. Below is a summary of their comments.

- Mary:
  - Not seeing the bike connection
    - Too steep
  - The consensus was that the trail should not be designed for bike access.

Bridge Location Existing Conditions

Bridge 1 (nearest Kobayashi Park)

- First priority bridge
  - RCO grant currently being pursued.
  - 150k available in grant funding
- FEMA maps, reasonably conformed
- Chambers Creek mapped for base flood elevations
- This is not the historic location of the bridge
  - Originally 25 yards down stream
- Min. clear span 55' from bank to bank, but still within floodplain
  - Still want bridge elevated to allow debris to pass beneath
  - Pulling bridge back from banks is ideal to allow for erosion to occur
  - Ramps are preferred over stairs

- Ramps allow for ADA and service vehicle access (gators with trailers)
- Ramps make more sense from a maintenance perspective.
- Both stairs and ramp are susceptible to damage during flooding.

- Any pier or structure you put within the flood plain will require you to take out volume elsewhere – Zero Rise
- Truss option for Installation:
  - Could get 40' sections that bolt together on site.
    - Cost effective
- Can get bridge out of floodplain except for abutments
  - Would put the entrance to trail up a little higher
- Would pile supported bridge structure require the same displaced volume?
  - David will check
- Bridge abutment will not go to creek edge
- Bridge construction will impact buffer
  - will need to do mitigation
- Slope is moving, lots of seeps
- Existing culvert in this area

Bridge 2

- Wetland seeps through hillside
- Outside of FEMA mapping
- Site was selected by Gary's crew years ago
  - Because of high banks
  - Narrow channel is 48'
    - Need to clear span to stay out of OHW
  - Could look at other locations for this bridge, but this location did seem to make sense because it is fairly narrow.
- 270' span to get out of FEMA floodplain
  - Hunch that it will actually be narrower
- 175' selected span
  - Off nose/bluff and onto south bluff
- County wetland line is generous
  - Official delineation would actually determine this
- Will need appropriate mitigation since this whole project will be in some kind of buffer
- Suspension bridge is an option here
  - Not many other options other than a suspension bridge in this location
    - Cost anywhere between 250-500k
  - 175' span in a remote location would make it difficult to bring in a truss bridge without a helicopter
  - Railings could be changed to match other bridges
- Any glacial till we can tie into?
  - We don't know on the soil
  - That would be a next step thing after this contract

West Most Bridge (near dam)

- Near sewer treatment facility
  - Existing bridge is dual owned
    - No serious plans to upgrade
    - Some discussion to remove dam, which would mean the bridge would have to be replaced
      - Nothing in the near future
      - This would be the lowest priority bridge to update
- If trail were to connect to Chambers Creek properties and trails, it would have to cross the street
  - Would need safe crossing location and flashing crosswalk
    - Crossing south of bridge
    - Then pedestrian bridge and dam
- If bridge is located at the road, it should be made wider for pedestrian path.
  - Pre-fab bridge?
- A pedestrian bridge could go where the dam is now

RCO Grant

- RCO funding
  - Recreational trails program
- Grant is for the bridge closest to Kobayashi Park (Bridge 1)
- Grant graphic will need to show how the bridge connects people from Lakewood to University Place.
- Estimate of probable construction for the bridge only, not including the trails leading to it.

NEXT MEETING

The next meeting is scheduled for October 26 at 2:00 p.m.

These are the minutes as we understand them. If there are any additions or questions, please contact Bruce Dees & Associates immediately.

MEETING MINUTES

MEETING 2

University Place – Chambers Creek Canyon Trail
Master Plan
Meeting #2 – Final Trail Location
October 26, 2016

Bruce Dees & Associates
Job No. 83-09-01

PRESENT (P)

University Place Parks
(P) David Swindale – City of University Place
(P) Gary Cooper – City of University Place
(P) Jessica Stone – Pierce County
(P) Mary Dodsworth – City of Lakewood
(P) Joseph Coppo – Pierce County

Consultants
( ) Bruce Dees, Bruce Dees & Associates
(P) Rachel Lingard, Bruce Dees & Associates
(P) Dan Roscoe, Berger ABAM
(P) Myles Parrish, Berger ABAM

PURPOSE
The purpose of this meeting was to review the findings from fieldwork on the trail and determine a final trail alignment.

GENERAL DISCUSSION
Dan led the meeting by virtually walking the group along the trail, sharing findings and photos, and pointing out where revisions to the original alignment are proposed. Below is a summary of the items discussed.

- The city is not married to their original route.
  - Fine with rerouting based upon field work.
- County's wetland map has been refined by Dan based upon his field work, but it is not a formal delineation.
- User trails information that has been collected could be included in mitigation plans.

Fourth Bridge (westernmost -leave out of narrative)
- Should not be included as a part of this work.
- That bridge will be linked to the trail when the dam goes away.

LAKEWOOD TRAIL SEGMENT (SOUTH SIDE OF CREEK)
- LW side route has been established.
  - Mostly redefining and widening
- The trail up to Bridge #2 is fairly well established.
  - Well-defined user paths along general alignment.
  - Less natural resource constraints along this side.
    - Wetland seeps are present
- Lakewood existing trails are how new trails on UP side will look.
- The client is ok with the trail being a more forested experience, except where the boardwalk goes through the wetland on the UP side.
  - Incorporate lookouts to the creek
- Users are widening the existing trails where there are soggy or muddy conditions.
  - Better drainage will reduce/prevent this issue.
- Some areas along the trail lend themselves to steps due to steep grades.
- 3rd bridge and trail along logging road on the north side of the creek will be a future phase

  - Show an overlook at this point for this phase.
- Existing easement between houses to get people to the trail system (westernmost neighborhood access point).
  - The other two access points do not have easements.
    - A conversation needs to happen with neighbors to determine the treatment of these areas.
  - Maybe don't create a formal easement at these locations – provide some kind of barrier if they don't want the trail.
  - The cities are planning on developing them, leave as user trails or block off.
- New Routes of Trail:
  - LW side: driven by cross slopes and wetland line.
  - Reroutes to minimize impact on wetlands and topography and constructability.
  - Stability of soils is still unknown at this point, needs to be addressed.
  - Trail would be field fit around existing trees.
    - Limited clearing and grubbing, understory is primarily sword fern.
  - If trails are rerouted, try and obscure old trail at ends to deter people continuing to use them.
    - Obscure for 50' or so.
- User trails formalized into actual trails.
- Connection trail up to golf course at Zircon Dr. could be developed as a partnership with golf course.
  - Should develop this; include this connection in our work.

UNIVERSITY PLACE TRAIL SEGMENT (NORTH SIDE OF CREEK)
- This section needs a finer tooth comb in a future phase.
- More challenging from a permitting standpoint.
- More natural resource concerns.
  - drainages
  - seeps
    - more than LW side
    - Going up and around the seeps brings you closer to private property and gets steeper.
      - Potential reroute #1 on UP side brings trail closer to property lines
      - Maybe split rail fence along trail to hinder people accessing private property.
  - wetlands
    - Boardwalk sections
- Bridge #2 could be a suspension bridge.
- Neighborhood access just north of #2 is pretty well established.
  - No available parking in this area, fire turnaround only.
  - Cul-de-sac posted "No Parking".
  - At best, this is a walking connection – no parking provision.
- Trail construction west of boardwalk could use existing logging roads or be benched into hillside.

MEETING 2 CONT.

- This section of trail at UP will be a hybrid of gravel trail, wood fiber and boardwalk (across seeps).
- Trail leading up to Philips Road should be shown as improved trail.
- Trail on south side of creek at Bridge #1 and leading west doesn't need to be developed.
  - Should discourage people from using
    - could be mitigation area

Peach Creek

- Might need a bridge.
  - 8-10'
  - timber possibly
- Downstream the creek narrows, which is where we have shown our alignment.
- Peach Creek west to Bridge #2 will be the most challenging section of this trail.

Boardwalk in Wetland

- User trails all though this area.
- Wouldn't be straight boardwalk since there are some drier areas that could be a gravel or wood fiber section.
- User trail goes over gravel bar.
  - Wouldn't need a boardwalk in these areas.
  - Unsure where OHW is in this area, could get flooded out if a formal trail was here.
    - Leave gravel bar and define edge with rocks only.
- The boardwalk segment of trail through the wetland is the portion of the trail that will give people the opportunity to be closer to the creek. Other parts of the trail will be more forested.
  - Generally trail should be further away from creek with lookouts, except in the wetland boardwalk area.
    - Minimized environmental impacts

DETAILS

- Regular wood chips instead of engineered wood fiber.
- Expectation for maintenance?
  - If we use pipe?
  - BDA will look into that.
- Bridge #2 and #3 will be suspension bridges most likely.
  - Suspension bridges aren't as expensive as originally thought.
  - Could we do suspension for all bridges to have consistency?
  - Bridge #3 will be done in a future phase.

Trailhead Design

- Signage
- No parking lots

NEXT MEETING

The next meeting is scheduled for November 22, 2016.

These are the minutes as we understand them. If there are any additions or questions, please contact Bruce Dees & Associates immediately.

MEETING MINUTES

MEETING 3

University Place – Chambers Creek Canyon Trail
Master Plan
Meeting #3 – Bridge & Trailhead Design
November 22, 2016

Bruce Dees & Associates
Job No. 83-09-01

PRESENT (P)

University Place Parks
(P) David Swindale – City of University Place
(P) Gary Cooper – City of University Place
( ) Jessica Stone – Pierce County
(P) Mary Dodsworth – City of Lakewood
(P) Joseph Coppo – Pierce County

Consultants
(P) Bruce Dees, Bruce Dees & Associates
(P) Rachel Lingard, Bruce Dees & Associates
( ) Dan Roscoe, Berger ABAM
(P) Myles Parrish, Berger ABAM

PURPOSE

The purpose of this meeting was to review Bridge and Trailhead designs and cost estimates.

BRIDGE GENERAL DISCUSSION

- Discrepancy in maps v. narrative on flood map.
  - Real floodplain is likely narrower than what is shown.
  - Updated floodplain maps go into effect next year.
  - Need to submit a FEMA LOMA (letter of map amendment) to get the mapping adjusted.
    - FEMA approves this.
- Being outside the mapped floodplain changes footing requirements and permits.
- What do we need to set the floodplain?
  - Survey
    - City is ok focusing efforts on bridges 1 & 2. Bridges 3 & 4 will be in a future phase.
      - Collect more survey data on Bridge 1 & 2.
  - Permitting of bridges is outside current scope of work.

BRIDGE #1

- Re-align ramp to accommodate gator access.
  - 8' width
- Joseph: could you tilt the bridge?
  - Yes, within ADA requirements.
- Constructability
  - 10-12% grade from Phillips Road
    - Some spots get a little steeper.
    - Need some regrading and widening to gain access from that side.
      - More likely to come from Kobayashi for construction.
        - Temporary construction bridge over Kobayashi lawn
    - Use of a crane is questionable because of trees
      - Could use smaller cranes, smaller sections, fly wire attached to trees, midpoint scaffolding.
- Remain open when describing method of construction for permits since it is unknown at this point.
- Could bring in two 60' sections, could make smaller splices if needed.
  - Maybe down to 3 pieces

- Pouring concrete for footings will be a challenge due to limited access.
  - Could use pre-cast pieces that are bolted together.
- **Bridge Style**
  - A suspension bridge was ruled as less fitting than a prefabricated bridge.
  - Prefabricated Capstone (arched), or a Continental Truss (straight)
    - Capstone style should be used for bridge 1.

BRIDGE #2

- Might have to add some rip rap along bank to prevent erosion or increase the span of the bridge to allow for anticipated erosion. Rip rap is unlikely to be allowed environmentally and would be prohibitive to install.
- Floodplain mapping is off in this area too.
- Suspension
  - Construction approach from Zircon Drive would involve some road improvement and regrading work.
    - is an existing logging road.
- Prefabricated Option
  - Can do it
  - Capstone is too heavy for this remote location, difficult to install.
  - Continental truss would be possible.
- Bridge is likely 10 years out on construction.
- Helicopter installation is an option, but would add approximately 12-20k to the cost.

PHASE BRIDGES 1 & 2

- Will not be built at the same time.
- Could not use the same engineering for both because of installation and time differences.

BRIDGE #3

- A suspension or a truss bridge are options, although #3 is no longer included as a part of this work.

COST ESTIMATE

- Need engineering number for suspension bridge cost.
- Break out abutments and anchors.
- Bridge #1
  - Capstone bridge.
- Bridge #2
  - Need to know what suspension engineered costs would be so a decision can be made between suspension and prefabricated.
- Bridge #4
  - No looking into this for this work.
- Other Bridges
  - Peach Creek
    - $2000/LF

MEETING 3 CONT.

TRAILHEADS

- General comments:
  - All parking lots need to be asphalt. No gravel parking lots.
- Phillips Road
  - Neighbors are concerned about a parking lot here – look at parking along the ROW as phase 1, with a parking lot being phase 2.
- Chambers Lane West
  - Change name to Chambers Creek Road Trailhead
  - A survey will need to be done to determine what trees will be impacted.
  - Possible overflow parking on the north side of the road.
- Cameo Drive
  - Remove from our work.
- Chambers Creek West
  - Show parking on the west side of the road.
- 69th St. Ct SW
  - Remove as a trail head.

Interpretive Signage

- A sign standard for the Chambers Creek Properties is currently being developed.
  - Joseph will share with the team.

NEXT MEETING

The next meeting is scheduled for December 14th, 2016.

These are the minutes as we understand them. If there are any additions or questions, please contact Bruce Dees & Associates immediately.

MEETING MINUTES

MEETING 4

University Place – Chambers Creek Canyon Trail
Master Plan
Meeting #4 – Draft Preliminary Report Review
December 14, 2016

Bruce Dees & Associates
Job No. 83-09-01

PRESENT (P)

University Place Parks
(P) David Swindale – City of University Place
(P) Gary Cooper – City of University Place
(P) Jessica Stone – Pierce County
(P) Mary Dodsworth – City of Lakewood
(P) Joseph Coppo – Pierce County

Consultants
(P) Bruce Dees, Bruce Dees & Associates
(P) Rachel Lingard, Bruce Dees & Associates
(P) Dan Roscoe, Berger ABAM
(P) Myles Parrish, Berger ABAM

PURPOSE
The purpose of this meeting was to review the draft of the Preliminary Report.

GENERAL DISCUSSION
- Include names of all participants on cover
  - City of Lakewood
  - Pierce County
  - City of University Place
- Update Pierce County Logo with latest provided by Joseph
- Joseph Coppo needs answers to highlighted items for JARPA by January 6th, 2017.

BRIDGE COST MATRIX
- Simplify matrix.
  - Combine columns if possible and round numbers
    - Combine columns for superstructure and substructure costs.

SIGNAGE & KIOSKS
- Sign standards for Chambers Creek Park are being developed.
  - A partnership sign could be developed in the future between the cities and county for this project.

PERMITS
- Mary will follow up on a MOU (memorandum of understanding) between the cities and county for permitting this project.
  - Cities will need to coordinate their permitting to prevent requiring duplicate permits

PHASING PLAN
- Permitting relates to the Phasing
  - Several permits will have expiration dates
  - Nationwide, permits are reviewed on a 5-year cycle
- Improve readability and colors for the phasing plan
- Time Frame for Phases
  - Approximately 2018 for UP side of trail
  - Lakewood side could be done through volunteer work primarily
    - Show sections of trail suitable for volunteer work on design report map.

University Place: Chambers Creek Canyon Trail — December 14, 2016
Meeting #4 – Draft Preliminary Report Review — 1 of 2

- Call out bridge locations on the Phasing map
- Add the Lower Loop Segment on to the Phasing Plan as a future trail
- Set up a meeting to present the final report to the city councils.
  - Second week of March, 2017? Final date TBD.

ACTION ITEMS
- GIS file to clients

NEXT MEETING

The next meeting is scheduled for January 18th, 2017.

These are the minutes as we understand them. If there are any additions or questions, please contact Bruce Dees & Associates immediately.

University Place: Chambers Creek Canyon Trail — December 14, 2016
Meeting #4 – Draft Preliminary Report Review — 2 of 2

MEETING 5

University Place – Chambers Creek Canyon Trail
Master Plan
Meeting #5 – Final Plan Presentation
January 18, 2017

Bruce Dees & Associates
Job No. 83-09-01

PRESENT (P)

University Place Parks
(P) David Swindale – City of University Place
(P) Gary Cooper – City of University Place
(P) Jessica Stone – Pierce County
(P) Mary Dodsworth – City of Lakewood
(P) Joseph Coppo – Pierce County

Consultants
( ) Bruce Dees, Bruce Dees & Associates
(P) Rachel Lingard, Bruce Dees & Associates
(P) Dan Roscoe, Berger ABAM
(P) Myles Parrish, Berger ABAM

PURPOSE
The purpose of this meeting was to present the final plan report and phased cost estimate.

DISCUSSION
The final draft report was presented by Rachel including the phased cost estimate. The following were discussed topics:

- It was requested that the Kobayashi Trailhead graphic show the existing parking at the park.
- The cities would like all of the images used in the final report to be provided for their use in presentations.
  - BDA will provide this as a part of the final package.
- Survey control information for bridges will be added to the appendix.

ACTION ITEMS
- Each member of the committee is to review the final draft report and provide comments to Rachel for inclusion in the final report.

NEXT MEETING

This was the final project meeting.

These are the minutes as we understand them. If there are any additions or questions, please contact Bruce Dees & Associates immediately.

University Place: Chambers Creek Canyon Trail
Meeting #5 – Final Plan Presentation
1 of 1
January 18, 2017