

Attachment F

Section 4(f) Concurrence Letters

This page intentionally left blank.

Eric Friedli
June 2, 2017
Page 1



June 2, 2017

Eric Friedli
Director of Parks, Recreation and Cultural Services
City of Shoreline
Parks, Recreation and Cultural Services Department
17500 Midvale Ave N
Shoreline, WA 98133-4905

**RE: Lynnwood Link Extension –
Ronald Bog Park Mitigation Project Concurrence and
Section 4(f) Exception Concurrence**

Dear Mr. Friedli:

As part of Sound Transit's plan to mitigate wetland impacts from the Lynnwood Link Extension, Sound Transit proposes to develop a compensatory mitigation site at Ronald Bog Park in the City of Shoreline (referred to in this letter as the "Ronald Bog Park Mitigation Project"). Historic records indicate that this area was part of a larger bog that was subsequently mined for peat and then partially filled in with construction debris. Elements of the Ronald Bog Park Mitigation Project will include reestablishing approximately one acre of wetlands and establishing a functional wetland buffer around the new wetlands. The City agrees to protect the mitigation site in perpetuity via some type of site protection instrument to be determined by the City (e.g. Native Growth Protection Area designation, restrictive covenant, or conservation easement) consistent with Federal regulatory requirements for permittee responsible compensatory mitigation.

Sound Transit has worked closely with the City to develop concept-level options for wetland mitigation and associated site improvements to be completed in Ronald Bog Park. The City and Sound Transit presented three conceptual designs to the community at a public meeting on April 13, 2017. Based on feedback received from the public, the City requested that Sound Transit advance design of the "Split Option" concept (see Attachment A). The City has determined that this concept best maintains direct access to the water near the shelter and preserves a portion of the existing lawn area for recreational uses.

As part of its implementation of this concept, Sound Transit plans to reimburse King County (4Culture) for the relocation of its "Kiss" sculpture so that it is not within the protected wetland mitigation area. Based on coordination with the City and 4Culture, it will be relocated to the remaining grassed area north of the pond, closer to the shelter. Sound Transit will also install a new gravel trail from the parking lot to the waterfront and shelter area. The final location of the sculpture and waterfront

Central Puget Sound Regional Transit Authority • Union Station
401 S. Jackson St., Seattle, WA 98104-2826 • Reception: (206) 398-5000 • FAX: (206) 398-5499
www.soundtransit.org

CHAIR

Dave Somers
Snohomish County Executive

VICE CHAIRS

John Marchione
Redmond Mayor

Marilyn Strickland
Tacoma Mayor

BOARD MEMBERS

Nancy Backus
Auburn Mayor

Claudia Balducci
King County Councilmember

Fred Butler
Issaquah Mayor

Dow Constantine
King County Executive

Bruce Dammeier
Pierce County Executive

Dave Earling
Edmonds Mayor

Rob Johnson
Seattle Councilmember

Kent Keel
University Place Mayor Pro Tem

Joe McDermott
King County Council Chair

Roger Millar
*Washington State Secretary
of Transportation*

Mary Moss
Lakewood Councilmember

Ed Murray
Seattle Mayor

Paul Roberts
Everett Councilmember

Dave Upthegrove
King County Councilmember

Peter von Reichbauer
King County Councilmember

CHIEF EXECUTIVE OFFICER

Peter M. Rogoff

Eric Friedli
June 2, 2017
Page 2

access trail will be determined during final design and will reflect ongoing input from the City as well as 4Culture. In the northeastern portion of the park, Sound Transit also plans to improve a portion of the existing trail network in the arboretum area. These trails will provide additional recreational opportunities for the public. To enhance educational opportunities related to the mitigation site, Sound Transit will develop up to three interpretive signs.

The City has determined that the Ronald Bog Park Mitigation Project meets the goals and action initiatives in the City’s Plan for Parks, Recreation, and Cultural Services, as it preserves and restores natural resources and expands opportunities to connect with nature by improving and constructing trails (Goal 1; Policy 1.1; and Action Initiatives 2, 6, and 7). The City has also determined that it does not conflict with the Forward Thrust deed requirements on the property.

Ronald Bog Park is a Section 4(f) resource, pursuant to federal regulations (23 CFR 774). Section 4(f) of the U.S Department of Transportation Act of 1966 is a federal law which protects certain parks, recreation areas, historic and cultural areas, and wildlife and waterfowl refuges, and it applies to significant publically-owned parks and recreation areas that are open to the public. As a Section 4(f) resource and pursuant to the exceptions set forth in 23 CFR 774.13(g)(1) and (2), in order for Sound Transit to implement the planned improvements, the City of Shoreline must concur that the above-described improvements are:

- (1) associated with a transportation mitigation project; and
- (2) “solely for the purpose of preserving or enhancing an activity, feature, or attribute that qualifies the property for Section 4(f) protection.”

If you agree, we respectfully request that you execute this letter for the City to confirm your concurrence. Your signature also confirms your concurrence with Sound Transit’s plan to implement the Ronald Bog Park Mitigation Project for wetland mitigation purposes to satisfy local, state, and federal regulatory requirements.

If you have any questions about the mitigation site, please contact Karin Ertl at (206) 398-5360. For questions regarding the 4(f) exception, please contact Steve Kennedy at (206) 398-5302. Thank you for your assistance.

Sincerely,

Karin Ertl, Senior Environmental Planner
Office of Environmental Affairs and Sustainability

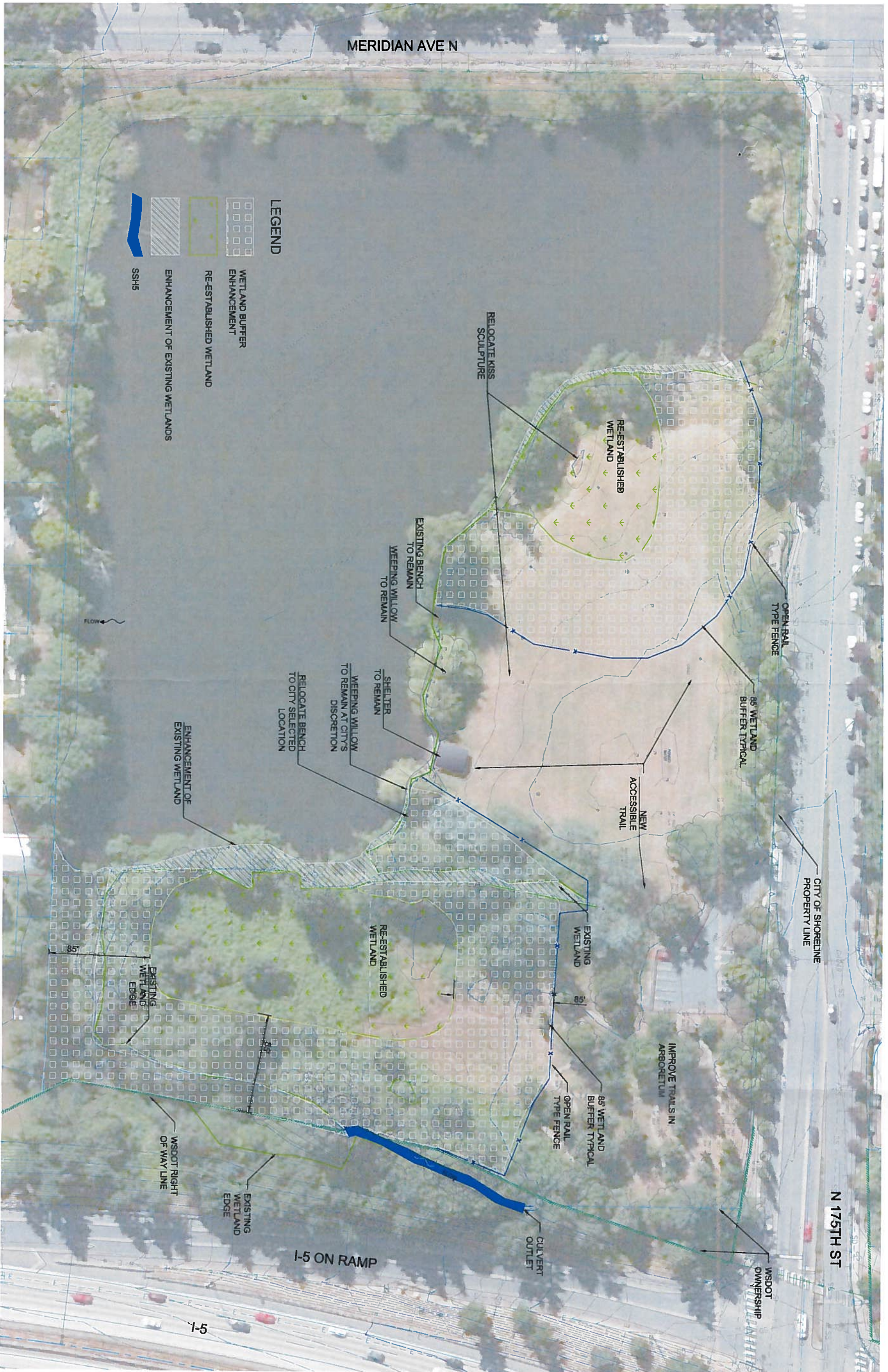
Concurring: Eric Friedli
Director of Parks, Recreation and Cultural Services

6/3/17
Date

Attachment A: Ronald Bog Wetland Mitigation Draft Concept – Split Option

cc: Juniper Nammi, City of Shoreline
John Evans, Sound Transit
Steve Kennedy, Sound Transit

ATTACHMENT A



PRELIMINARY, NOT FOR CONSTRUCTION





January 10, 2018

Lynn Sordel, Director of Parks & Recreation
Paul Kraus, Authorized SEPA Official
City of Lynnwood
19100 44th Ave. W.
Lynnwood, WA 98036

**RE: Lynnwood Link Extension
Scriber Creek Trail - Section 4(f) Exception/Transportation
Mitigation**

Dear Sirs:

As part of the Lynnwood Link Extension, Sound Transit proposes to relocate a portion of the Scriber Creek Trail adjacent to the Lynnwood Transit Center park & ride perimeter roadway (see Figure 1). The trail would be moved to the north and upland of its existing location. The benefits of doing this would be reduced flooding on the trail and increased storage in the Scriber Creek floodplain. The relocation includes excavating a portion of the Scriber Creek Trail and underlying fill material that was placed in the Scriber Creek wetland when the trail was constructed. The excavated area will be replanted with native vegetation to reestablish wetlands and adjacent wetland buffer. Sound Transit also plans to enhance the existing wetland buffer between Scriber Creek and the Lynnwood Transit Center parking lot. Sound Transit is developing this proposal in coordination with the City of Lynnwood, and the agencies have met to discuss planned trail closures required for the construction of the improvements. We will continue to coordinate the installation of temporary detours and the implementation of a public notification plan during construction with the City.

As described in more detail below, the Scriber Creek Trail is considered a Section 4(f) resource under the U.S. Department of Transportation (DOT) Act. Due to this, Sound Transit is seeking the City's concurrence that the trail relocation qualifies as an exception to Section 4(f) rules because the work is part of a larger "transportation / mitigation project" (23 CFR 774.13(g)).

The Scriber Creek Trail generally follows the Scriber Creek corridor in Lynnwood and is a 6-foot wide combination soft surface/asphalt pedestrian trail that provides views of wildlife habitat, creek and associated wetlands. As shown in Figure 2, the trail links Scriber Lake Park, Sprague's Pond Mini Park, Scriber Creek Park, the Interurban Trail and the Lynnwood Transit Center. The portion of the trail immediately adjacent to Scriber Creek occasionally floods during the wet season making it unusable to pedestrians. Additionally, tree roots under the path create an uneven walking surface. Relocating the path to higher ground will improve these conditions, providing a benefit to trail users.

CHAIR

Dave Somers
Snohomish County Executive

VICE CHAIRS

John Marchione
Redmond Mayor

Marilyn Strickland
Tacoma Mayor

BOARD MEMBERS

Nancy Backus
Auburn Mayor

Claudia Balducci
King County Councilmember

Tim Burgess
Seattle Mayor

Fred Butler
Issaquah Mayor

Dow Constantine
King County Executive

Bruce Dammeler
Pierce County Executive

Dave Earling
Edmonds Mayor

Rob Johnson
Seattle Councilmember

Kent Keel
University Place Mayor Pro Tem

Joe McDermott
King County Council Chair

Roger Miller
*Washington State Secretary
of Transportation*

Mary Moss
Lakewood Councilmember

Paul Roberts
Everett Councilmember

Dave Uptegrove
King County Councilmember

Peter von Reichbauer
King County Councilmember

CHIEF EXECUTIVE OFFICER

Peter M. Rogoff

Section 4(f) Review and Concurrence Request

As previously stated, Scriber Creek Trail is a Section 4(f) resource, pursuant to federal regulations (23 CFR 774). Section 4(f) of the U.S. DOT Act of 1966 is a federal law that protects certain parks, recreation areas, historic and cultural areas, and wildlife and waterfowl refuges. This law includes an exception for transportation enhancement projects and mitigation activities on parkland. The conditions that must be satisfied in order for activities to qualify as an enhancement transportation project (23 CFR 774.113(g)) are listed below in bold with a description of the project's consistency with them following:

Transportation enhancements projects and mitigation activities, where:

1. **The use of the Section 4(f) properties is solely for the purpose of preserving or enhancing an activity, feature or attribute that qualifies the property for Section 4(f) protection.** The proposed work will preserve and enhance the Scriber Creek Trail. It will enhance the natural setting through the wetland and wetland buffer creation adjacent to the trail, which is part of Sound Transit's plan to mitigate wetland and wetland buffer impacts in the Scriber Creek sub-basin. Additionally, relocating the trail to higher ground will prevent flooding during the wet season, increasing pedestrian usability.
2. **The official(s) with jurisdiction over the Section 4(f) resource agrees in writing.**

Federal regulations stipulate the officials with jurisdiction over the Section 4(f) resource must document their agreement with an exception/ transportation enhancement finding (23 CFR 774.13(g)) for the proposed relocation of Scriber Creek Trail. We respectfully request that you provide your signature on this letter to confirm your concurrence.

If you have any questions, please contact Steve Kennedy, Sound Transit, by phone at (206) 398-5302 or by email at steven.kennedy@soundtransit.org. Thank you for your assistance.

Sincerely,



Steve Kennedy, Senior Environmental Planner
Office of Environmental Affairs and Sustainability



Concurring:
Lynn Sordel
Director of Parks and Recreation

1/16/18
Date



Concurring:
Paul Kraus
Authorized SEPA Official

1/16/18
Date

cc: Erik Finley, Project Manager Sound Transit

Figure 1: Scriber Creek Trail Relocation / Wetland Mitigation Plan

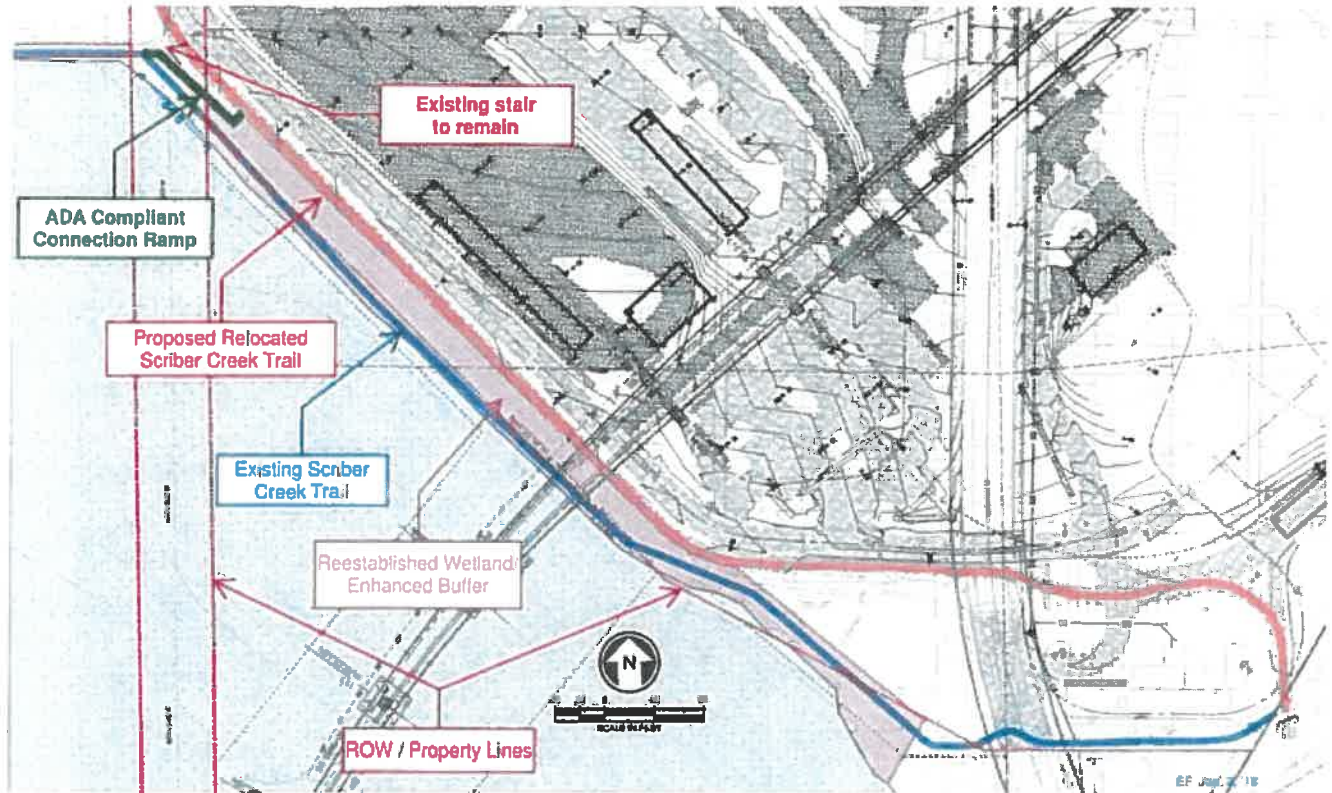


Figure 2: Vicinity Map



 **SCRIBER CREEK TRAIL**
1.5 Miles Scriber Lake Park to Park & Ride



December 15, 2017

Jeff Betz
Director of Recreation and Parks
City of Mountlake Terrace
Recreation and Parks Department
5303 228th Street SW
Mountlake Terrace, WA 98133-4905

**RE: Lynnwood Link Extension
Veterans Memorial Park - Section 4(f) Temporary Occupancy**

Dear Mr. Betz:

As part of the final design phase for the Lynnwood Link Extension (LLE), Sound Transit, has identified a pedestrian path, as set forth in Figure 2, from the project site of the Mountlake Terrace Transit Center (MLT) Station (the existing Community Transit, Park and Ride/Transit Center) into Veterans Memorial Park to maintain an existing trail connection between those locations. This path connects the City Center, a residential and business district, and surrounding neighborhoods with Community Transit Park and Ride (Figure 1: Vicinity Map). As described in more detail below, the park is considered a Section 4(f) resource under the U.S. Department of Transportation Act. Due to this, Sound Transit is seeking the City's concurrence that the trail connection work qualifies as a temporary occupancy under Section 4(f).

Work in the Veterans Memorial Park will temporarily disturb parkland that is approximately 2,445 (163 feet long and 15 feet wide). The construction duration is about 54 months. The actual trail reconstruction will be a short duration, but the trail connection from Veteran's Park through the existing park and ride lot will be blocked while the contractor stages for construction. The trail connection through the parking lot will not be available for public use until the contractor de-mobilizes near the end of construction. After construction, Sound Transit will restore all impacted areas to their original or better condition. Sound Transit would financially compensate the city for the temporary use of land as determined by an independent appraisal. Please see Figure 2 for the Pedestrian Path Design and Figure 3 for the temporary construction easement.

Veterans Memorial Park is a Section 4(f) resource, pursuant to federal regulations (23 CFR 774). Section 4(f) of the U.S Department of Transportation (DOT) Act of 1966 is a federal law that protects parks, recreation areas, historic and cultural areas, and wildlife and waterfowl refuges. This law exempts temporary occupancies of parkland that are so minimal as to not constitute a use. The conditions that must be satisfied in

CHAIR

Dave Somers
Snohomish County Executive

VICE CHAIRS

John Marchione
Redmond Mayor

Marilyn Strickland
Tacoma Mayor

BOARD MEMBERS

Nancy Backus
Auburn Mayor

Claudia Balducci
King County Councilmember

Tim Burgess
Seattle Mayor

Fred Butler
Issaquah Mayor

Dow Constantine
King County Executive

Bruce Dammeier
Pierce County Executive

Dave Earling
Edmonds Mayor

Rob Johnson
Seattle Councilmember

Kent Keel
University Place Mayor Pro Tem

Joe McDermott
King County Council Chair

Roger Millar
*Washington State Secretary
of Transportation*

Mary Moss
Lakewood Councilmember

Paul Roberts
Everett Councilmember

Dave Upthegrove
King County Councilmember

Peter von Reichbauer
King County Councilmember

CHIEF EXECUTIVE OFFICER

Peter M. Rogoff

order for activities to qualify as a temporary occupancy (23 CFR 774.113(d)) are listed below in bold followed by a description of the project's consistency with them:

- **The duration of the use must be less than the time needed for construction of the project, and there should be no change in the ownership of the land.** The construction duration is about 54 months, which is much less than the construction duration for the LLE. Current ownership is the City of Mountlake Terrace and shall remain unchanged.
- **Both the nature and magnitude of the changes to the Section 4(f) property must be minimal.** A trail from the park already exists, connecting the Mountlake Terrace Transit Center (Community Transit Park and Ride) with City Center and surrounding neighborhoods. The scope of this work maintains this trail connection.
- **There must be no anticipated permanent adverse physical impacts, nor interference with the protected activities, features, or attributes of the property on either a temporary or permanent basis.** No permanent adverse physical impacts or interference with the protected activities features, or attributes of the park will occur.
- **The land being use must be fully restored.** Sound Transit will fully restore the impacted area, as identified in Figure 3, to its original condition or better.

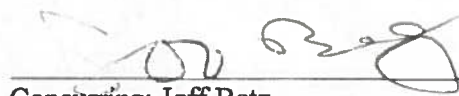
Federal regulations stipulate the officials with jurisdiction over the Section 4(f) resource must document their agreement with a temporary occupancy finding (23 CFR 774.13(d) (5)) based on the conditions above. We respectfully request that you provide your signature on this letter to confirm your concurrence that the scope of work to maintain the existing connection between the Mountlake Terrace Transit Center and the Veteran's Memorial Park qualifies as temporary occupancy,

If you have any questions, please contact Steve Kennedy, Sound Transit, by phone at (206) 398-5302 or by email at steven.kennedy@soundtransit.org. Thank you for your assistance.

Sincerely,

 12/18/17

Steve Kennedy, Senior Environmental Planner
Office of Environmental Affairs and Sustainability



Concurring: Jeff Betz
Director of Recreation and Parks

12-18-17
Date

cc: Erik Finley, Project Manager Sound Transit
Scott Hugill, City Manager City of Mountlake Terrace

Figure 1: Vicinity Map



Figure 2: Pedestrian Path Design

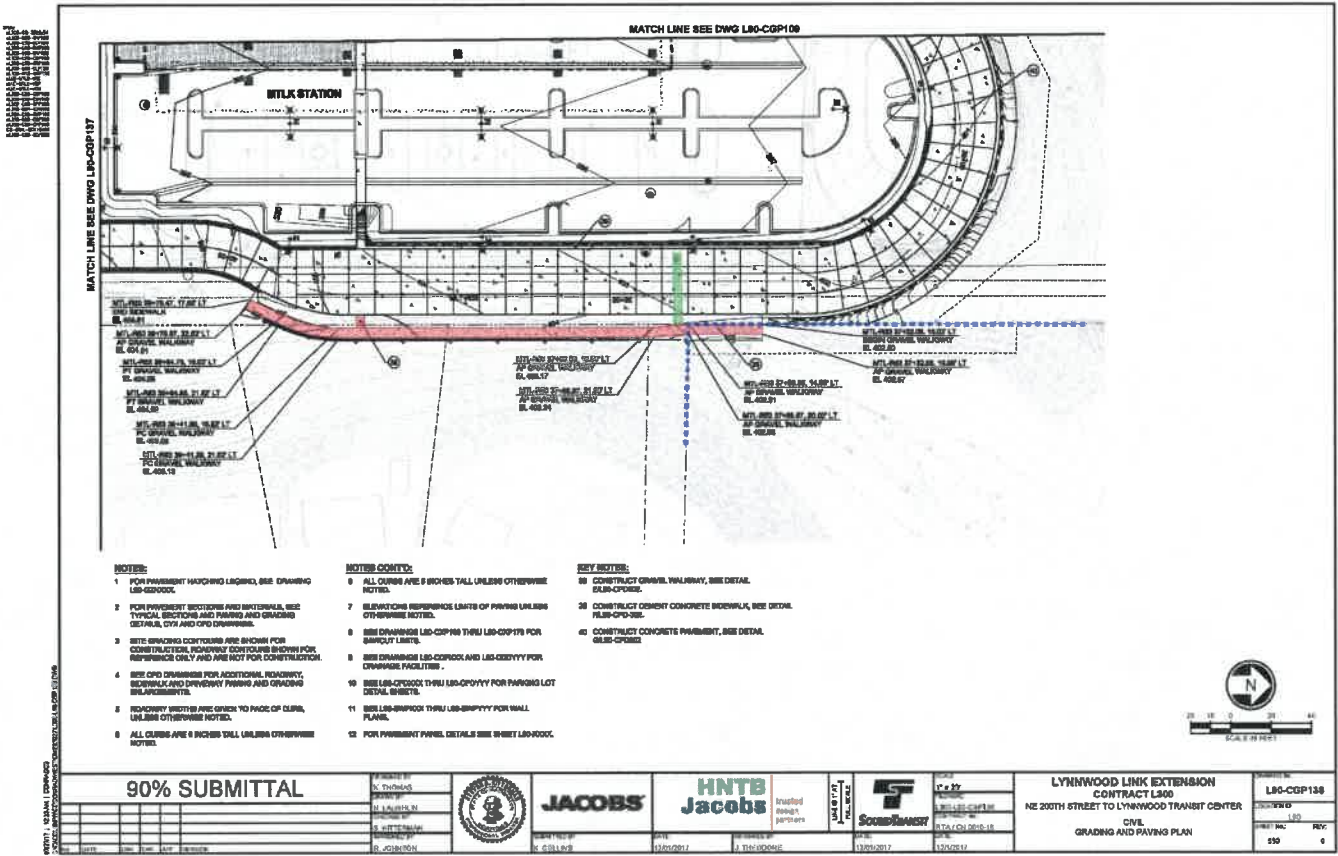
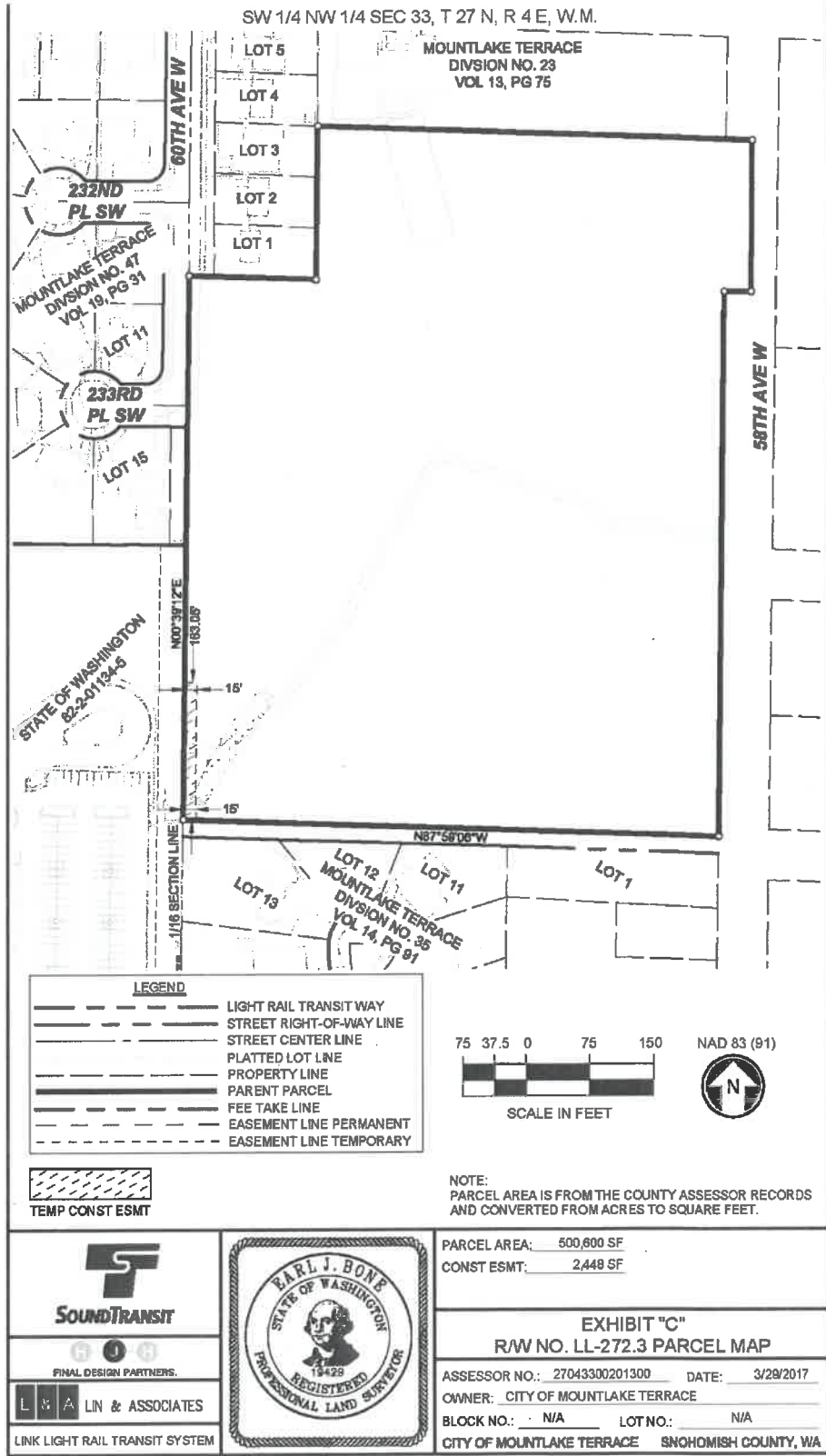


Figure 2 depicts area of trail impact on the park only. The description of the trail, including width and surface type, is yet to be finalized.

Figure 3: Temporary Construction Easement





March 8, 2018

Eric Friedli
Parks, Recreation, and Cultural Services Director
City of Shoreline
17500 Midvale Ave N
Shoreline, WA 98133

Subject: Ridgecrest Park

Dear Eric:

As part of the final design phase for the Lynnwood Link Extension (LLE), Sound Transit, in consultation with the City of Shoreline, has changed the mitigation approach to address project impacts to Ridgecrest Park. As you know, Ridgecrest Park is a Section 4(f) resource under the U.S. Department of Transportation Act. Due to this, the Federal Transit Administration (FTA) requests confirmation from the City about this change.

As the Official with Jurisdiction, the City of Shoreline has proposed two different parcels as mitigation for the impacts on Ridgecrest Park, and is therefore in concurrence with the overall mitigation approach for this impact. The two parcels are listed in Exhibit A, along with a map indicating the alternate replacement parcels. In addition to these two parcels, the City and Sound Transit have agreed to the following revised mitigation elements for all the proposed impacts to the park:

- Construction of a replacement parking lot (paved with 20 stalls) and ADA access to the park to be located on the proposed replacement properties to be completed within 1.5 years of the start of early construction work and completed consistent with applicable City standards for drainage, landscaping, and frontage improvements;
- Maintenance of public access to the the park throughout the construction of the LLE Project and use of the City right-of-way on NE 161st street for temporary public parking until the replacement parking lot is completed, as approximately illustrated in the attached Exhibit B illustrating draft construction areas and potential temporary parking; and
- Replacement of impacted infrastructure within the park such as the park sign, drinking fountain, and irrigation system.

A neighborhood meeting presentation regarding the proposed impacts to the park and this revised approach to mitigation was held May 9, 2017, to meet the outreach requirement in the FTA Record of Decision. This public meeting and the revised proposal is consistent with and fulfills the LLE's Record of Decision,

CHAIR

Dave Somers
Snohomish County Executive

VICE CHAIRS

Ron Lucas
Steilacoom Mayor

John Marchione
Redmond Mayor

BOARD MEMBERS

Nancy Backus
Auburn Mayor

David Baker
Kenmore Mayor

Claudia Balducci
King County Councilmember

Dow Constantine
King County Executive

Bruce Dammeler
Pierce County Executive

Jenny Durkan
Seattle Mayor

Dave Earling
Edmonds Mayor

Rob Johnson
Seattle Councilmember

Kent Keel
University Place Mayor

Joe McDermott
King County Council Chair

Roger Millar
*Washington State Secretary
of Transportation*

Paul Roberts
*Everett Council President/
Mayor Pro Tem*

Dave Upthegrove
King County Councilmember

Peter von Reichbauer
King County Councilmember

Victoria Woodards
Tacoma Mayor

CHIEF EXECUTIVE OFFICER

Peter M. Rogoff

Table B-1 Mitigation Plan, Section 4.17, which states “transfer replacement property at the south end of the park, or other property as agreed to with the City...and the design process will include outreach in the adjacent neighborhood...” Furthermore, the proposal is consistent with the July 25, 2014 FTA/City of Shoreline concurrence letter, as “other property as agreed to with the City.”

Sincerely,

John Evans
Development Manager



Sound Transit

3/8/18
Date

Eric Friedli
Parks, Recreation, and Cultural Services Director



City of Shoreline Concurrence

3/8/18
Date

Exhibit A – Alternate Park Replacement Parcels

LL-180.1	2111600040	PYPER J BRUCE+TERESA K	114 NE 161ST ST	Shoreline
LL-180.2	2111600035	PEW DAVID A+KAITLYN A	122 NE 161ST ST	Shoreline

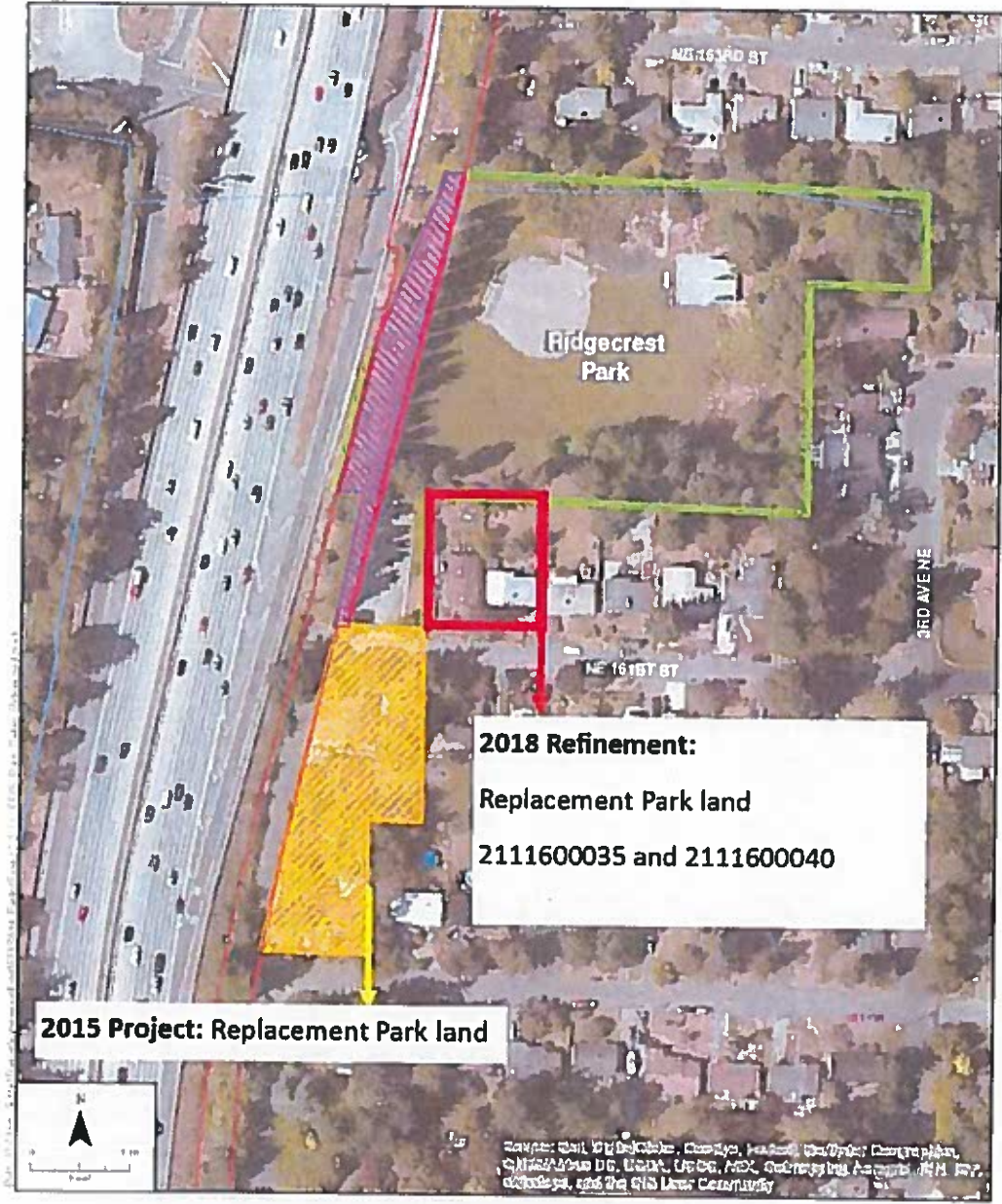


Exhibit B - Draft Temporary Construction Area and Parking Plan



New Ronald Sewer

Approximate fence Limits

Maintain ped path through parking lot

Demo houses and construct replacement lot in Guideway Package



Gate/Trucks In/Out

LEGEND

-  = House to be demolished
-  = Sewer Line
-  = Fence
-  = Pedestrian Path
-  = Temp On-Street Parking Spot (9 ft x 18 ft) - 20 each
-  = Work area/laydown/access

POTENTIAL TIMELINE

- Q1 2019 - Begin Sewer work and house demo. Parking Lot will be out of use to construct the sewer.
- Q3 2019 - NTP of Guideway Package which will include the replacement parking lot.
- Q4 2019 - Q1 2020 - Construct replacement parking lot
- Q2 - Open new Parking Lot

Exhibit B - Draft Temporary Construction Area and Parking Plan





March 8th, 2018

Eric Friedli
Director of Parks, Recreation and Cultural Services
City of Shoreline
Parks, Recreation and Cultural Services Department
17500 Midvale Ave N
Shoreline, WA 98133-4905

Subject: Lynnwood Link Extension, Twin Ponds Utility Relocation – Section 4(f)
Temporary Occupancy

Dear Mr. Friedli:

As part of the final design phase for the Lynnwood Link Extension (LLE), Sound Transit, in consultation with Seattle City Light (SCL), has identified utility improvements along Northeast 155th Street which has temporary access impacts to Twin Ponds Park. As described in more detail below, the park is considered a Section 4(f) resource under the U.S. Department of Transportation Act. Due to this, Sound Transit is seeking concurrence from the City of Shoreline, that the work qualifies as a temporary occupancy under Section 4(f) because the duration is short compared to the overall project schedule, the nature and magnitude is minimal, no permanent adverse physical impacts with the protected features of the park are anticipated, and the land will be fully restored. Assessment of Section 4(f) use determination is provided below.

Proposed Scope of Work

To accommodate construction of the light rail guideway and overhead catenary system, Sound Transit is proposing to relocate existing SCL electrical overhead lines above I-5 by undergrounding the electrical lines within the roadway of NE 155th Street that passes beneath I-5 and on the north side of the Park. As part of the underground work, Sound Transit will install duct banks and vaults beneath the sidewalk and amenity zone, which is the vegetated buffer between the curb and sidewalk. Sound Transit will daylight the undergrounded electrical lines onto overhead poles.

Specific work activities:

- Replace two existing utility poles
- One new utility pole
- One underground vault
- Two underground junction boxes

CHAIR
Dave Somers
Snohomish County Executive

VICE CHAIRS
Ron Lucas
Steilacoom Mayor

John Marchione
Redmond Mayor

BOARD MEMBERS
Nancy Backus
Auburn Mayor

David Baker
Kenmore Mayor

Claudia Balducci
King County Councilmember

Dow Constantine
King County Executive

Bruce Dammeyer
Pierce County Executive

Jenny Durkan
Seattle Mayor

Dave Earling
Edmonds Mayor

Rob Johnson
Seattle Councilmember

Kent Keel
University Place Mayor

Joe McDermott
King County Council Chair

Roger Millar
Washington State Secretary of Transportation

Paul Roberts
Everett Council President/ Mayor Pro Tem

Dave Uptegrove
King County Councilmember

Peter von Reichbauer
King County Councilmember

Victoria Woodards
Tacoma Mayor

CHIEF EXECUTIVE OFFICER
Peter M. Rogoff

- Underground duct bank
- Temporary staging in parking lot located at corner of NE 155th St and 1st Ave NE
- Replace the existing park fence on the north side of the parking lot
- Repair parking lot to current conditions: replace existing parking curbs removed/damaged, repair damaged portions of parking lot surface, and restripe parking stall lines
- Repair sidewalk to current conditions or build to new city standards and update parking lot, as agreed to with the City

Work limits within the park are shown in Exhibit A.

Potential Impacts and Mitigation

Temporary impacts on the park includes construction activities to install the vaults/banks, rebuild the sidewalk, and install poles. The construction activities within the park will take up to six months. Permanent changes are associated with providing underground and overhead easements to SCL to access and maintain power lines and vaults. The details of these impacts and associated mitigation actions are listed below in the Impacts and Mitigation Table 1.

Sound Transit will restore all impacted areas to their original condition and may, if agreed upon with the City, update the sidewalk to current standards for pedestrian access improvements resulting in a widened sidewalk and reduced parking lot footprint. If SCL determines overhead utilities cannot be relocated to the amenity zone, SCL will need a permanent overhead easement for aerial power maintenance for overhead lines overhanging the park and a permanent easement within the park for maintenance and access to the poles and vaults/duct banks. A summary of impacts and mitigation measures is shown in Table 1:

Table 1: Impacts and Mitigation

Impact	Mitigation
<p>Temporary</p> <ul style="list-style-type: none"> • 13 parking spaces unavailable during construction for 6 months. • Parking lot surface damaged during construction. • Removed landscape and fence surrounding parking lot. • Sections of sidewalk removed for placement of vaults/duct banks • Intermittent NE 155th St sidewalk closure. 	<p>Temporary</p> <ul style="list-style-type: none"> • Provide temporary parking for park users at near-by properties. • Restore area damaged by construction to existing conditions, including fence, landscaping, and parking pavement. • Reconstruct sidewalk to match existing or updated to current city standards. • Provide detour for pedestrians. • Provide maintenance of traffic plan • Provide financial compensation for temporary use of land as determined by an independent appraisal. • Provide construction fencing.
<p>Permanent – Only if SCL determines overhead utilities cannot be relocated to the amenity zone</p> <ul style="list-style-type: none"> • Overhead utility lines overhanging north edge of the park and new SCL permanent overhead easement on park property for aerial utilities and maintenance access. 	<p>Permanent – Only if SCL determines overhead utilities cannot be relocated to the amenity zone</p> <ul style="list-style-type: none"> • Provide financial compensation, as determined by independent appraisal, for necessary permanent utility and maintenance access easement(s) within

<ul style="list-style-type: none"> • Utility pole installation located in park and new SCL permanent underground easement on park property for maintenance access. • Underground duct banks/vaults located within sidewalk and small section of park and new SCL permanent underground easement for duct banks/vaults and maintenance access. 	<p>the park property for overland utilities, poles, or underground banks/vaults.</p> <ul style="list-style-type: none"> • Execution of SCL's airspace maintenance easement • Execution of SCL's below-ground maintenance easement
---	---

Section 4(f) Assessment and Concurrence

Twin Ponds Park is a Section 4(f) resource, pursuant to federal regulations (23 CFR 774). Section 4(f) of the U.S Department of Transportation (DOT) Act of 1966 is a federal law that protects parks, recreation areas, historic and cultural areas, and wildlife and waterfowl refuges. A transportation project, such as the LLE, cannot be approved under Section 4(f) if it requires the use of Section 4(f) resource, unless it determined that there is no "feasible and prudent alternative" to use of the property; and that the action includes "all possible planning: to minimize harm to the property resulting from such use. The regulations also exempts temporary occupancies of land that are so minimal as to not constitute a use. Below is an assessment of how the proposed utility work complies with Section 4(f).

4(f) Use Assessment

As defined, the "use" of a Section 4(f) property occurs when land is permanently incorporated into a transportation project. In other words, the transportation agency directly purchases the property (fee simple acquisition), and the property sustains a permanent impact—typically, changing from Section 4(f) property to a transportation facility. Such a "use" also includes easements if the ultimate owner is a transportation agency and use is for transportation related purposes.

If, in consultation and agreed to with the City, the sidewalk is updated to current city standards, a portion of the park parking lot would be changed for sidewalk use. With this change, the city will continue to own all park and right of way properties. Sound Transit is not directly purchasing any part of the parking lot for transportation purposes. The changes associated with the proposed overhead and underground easements needed by SCL are also not directly acquired by Sound Transit for transportation purposes. Given that the park property is not being directly purchased for transportation uses by Sound Transit, there is no Section 4(f) use associated with the proposed utility work.

4(f) Temporary Occupancy

This section evaluates how the proposed utility work qualifies as a temporary occupancy, under Section 4(f) (23 CFR 774.113(d)). The required temporary occupancy conditions are listed below in bold, which are followed by how the utility work satisfies each condition.

- **The duration of the use must be less than the time needed for construction of the project, and there should be no change in the ownership of the land.** The duration of use will be approximately six months for construction, much less than the construction duration for the LLE. SCC and the private telecommunications companies will require permanent easements for future maintenance, but there will be no change in ownership of the land.

- **Both the nature and magnitude of the changes to the Section 4(f) property must be minimal.** Changes to the park will be minimal and will consist of a temporary closure of parking spaces, an overhead easement for utility lines overhanging the edge of the park's northern parking lot, and a new vault and a duct bank underneath the parking lot.
- **There must be no anticipated permanent adverse physical impacts, nor interference with the protected activities, features, or attributes of the property on either a temporary or permanent basis.** The work will affect the park's parking lot, on a temporary basis. The parking lot is not a feature or attribute that qualify the park for protection under Section 4(f). The park's southern parking lot will remain unaffected and Sound Transit will provide replacement parking for the parking spaces that are closed. No permanent adverse physical impacts or interference with the protected activities, features, or attributes of the park will occur.
- **The land being used must be fully restored.** Sound Transit will fully restore the impacted area.
- **There must be documented agreement of the official(s) with jurisdiction over the Section 4(f) resource regarding the above conditions.** This concurrence letter constitutes the documented agreement.


If you agree that the scope of work does not qualify as a use under Section 4(f) and furthermore, the work qualifies as temporary occupancy, we respectfully request that you provide your signature on this letter to confirm your concurrence.

If you have any questions, please contact Steve Kennedy, Sound Transit, by phone at (206) 398-5302 or by email at steven.kennedy@soundtransit.org. Thank you for your assistance.

Sincerely,



Steve Kennedy, Senior Environmental Planner
Office of Environmental Affairs and Sustainability



Concurring: Eric Friedli
City of Shoreline, Director of Parks, Recreation and Cultural Services

Date 3/8/18

cc: Juniper Nammi, City of Shoreline
Jon Evans, Sound Transit

Exhibit A:



- Park boundary
- Proposed construction limits
- LLE Project alignment

This page intentionally left blank.

Attachment G

Shoreline South/145th St. Station Refinements (2017)

This page intentionally left blank.

From: [Drais, Daniel \(FTA\)](#)
To: [Kennedy, Steven](#)
Cc: [Witmer, John \(FTA\)](#)
Subject: reeval of LLE, 145th street station
Date: Friday, January 6, 2017 3:28:13 PM

Dear Steve:

The Federal Transit Administration (FTA) has received NEPA Re-evaluation materials submitted on December 14, 2016 related to Sound Transit's Lynnwood Link project refinements at the 145th Street Station area, including a Matrix of Impact Changes Based on the 2016 Design Refinements for the 145th St. Station, a traffic analysis/technical memo, a noise technical memo, and a graphic of the relocated station layout.

We understand that the project refinements would shift the station footprint about 400 feet to the north, with some associated street reconfigurations/realignments. This would eliminate the need to move the northbound I-5 on-ramp at 145th Street.

The changes would improve transit operations and LOS. They would not cause traffic-related construction impacts, and by not relocating the northbound I-5 on-ramp, the changes would result in fewer temporary ramp closures during construction.

The shifted station would acquire seven more properties than the 169 parcels anticipated in the ROD-approved project; this is a relatively minor increase. Sound Transit would provide appropriate compensation and relocation assistance to the affected residents, several of whom have asked to be relocated anyway in light of the impending LRT construction. All of the affected parcels have single-family homes on them.

The shift of the station would not change the project's Area of Potential Effects under Section 106. During the NEPA/Section 106 process, FTA previously determined that the houses that would be removed are ineligible for the National Register, and the SHPO concurred.

The relocated station's light-rail noise would affect different receivers, but not materially change the nature or extent of the impacts. There would be some new noise impacts from bus and auto traffic using the reconfigured surface streets and relocated station entrance, but Sound Transit would eliminate them with a noise wall. Sound Transit would provide sound insulation, if needed, for ten homes that would likely have residual impacts despite the wall.

The refinements would increase the amount of impervious surface by about 1.35 acres (to 2.34 acres). Sound Transit would size the detention facilities to accommodate and treat added impervious surface, resulting in no adverse effects.

The relocated station would remove 12 more trees and would visually affect different residences than the original station, but it would not change the nature or intensity of the impacts. Sound Transit would mitigate visual impacts as described in the ROD/FEIS.

Based on the information provided, **FTA finds that the refinements do not materially change the nature or the extent of the impacts previously disclosed in the Final EIS and ROD. No additional NEPA review is required.** This action applies only to the project as described in the above-referenced materials. Any changes to the proposed action from that described in the materials that would result in a significant environmental impact, or the disclosure of any new information or circumstances relevant to environmental concerns and bearing on the proposed action or its impacts which could result in significant environmental impacts not disclosed in the provided documentation, may require re-evaluation of this project's categorical exclusion.

Thank you for consulting with FTA about the project refinements. As always, please do not hesitate to contact me if you have any questions.

Sincerely,

Dan

From: Kennedy, Steven [<mailto:steven.kennedy@soundtransit.org>]
Sent: Wednesday, December 14, 2016 4:02 PM
To: Drais, Daniel (FTA)
Cc: Witmer, John (FTA); Irish, James
Subject: Lynnwood Link 145th St. Station Relocation Environmental Analysis

Dan: Attached are the final materials included for the environmental analysis associated with moving the Lynnwood Link 145th St. Station about 400 feet to the north. We had been waiting on a few final tweaks to the technical memos. As documented in the attached matrix table of changed impacts, no new significant impacts from relocation of the station are anticipated.

The attached materials include the following:

- 1) Matrix of Impact Changes based on the 2016 Design Refinements for the 145th St. Station
- 2) Transportation Technical Memo
- 3) Noise Technical Memo
- 4) Graphic of Relocated Station Layout

I believe FTA is considering approval of a NEPA Reevaluation for these project changes, in part to cover the new property acquisitions. The attached materials are intended to provide the back-up for your determination. Let me know if you have questions. We could discuss this at our Environmental Coordination meeting tomorrow. Thanks. ---Steve

Steven S. Kennedy, AICP

Senior Environmental Planner

Sound Transit

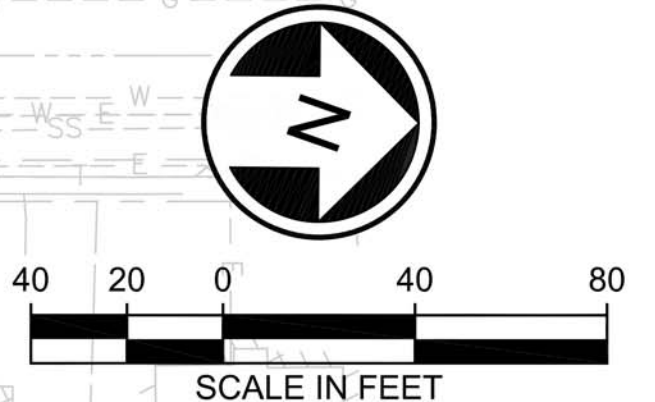
Planning, Environmental, and Project Development (PEPD)

401 S. Jackson St.
Seattle, WA 98177
(206) 398-5302 (direct)
(206) 903-7499 (fax)
steven.kennedy@soundtransit.org

Xrefs:
 xl200-GB-TB22x34
 xl200-L85-CDP100
 xl200-L85-CJP100
 xl200-L85-CRP100
 xl200-L85-KAP100
 xl200-L85-SEP100
 xl200-L85-SWP100
 xl200-N13-CRP100
 xl200-N13-LPP100
 xl200-L85-LPP100
 xl200-P13-APP300
 xllE-SHLN-VBP
 xllE-SHLN-VRX
 xllE-SHLN-VVC
 xl200-N13-APP100
 xl200-P13-APP100
 xl200-N13-APP200
 JDC-PRELM_20-SCALE
 xl200-L85-SZP100
 xl200-N13-LSP100

NEWS_L300 added

100716 | 10:54 AM | MOV:IR
 P:\2016 PROJECTS\2016-23 LYNNWOOD LINK\GRAPHICS\AUTOCAD\EXHIBITS\OPEN HOUSE GRAPHICS\L200-L85-LPP219.DWG



IN-PROGRESS 60%

DESIGNED BY:
J. YONG
 DRAWN BY:
M. OVIIR
 CHECKED BY:
 APPROVED BY:
Approver



DATE:
 REVIEWED BY:
J. THEODORE



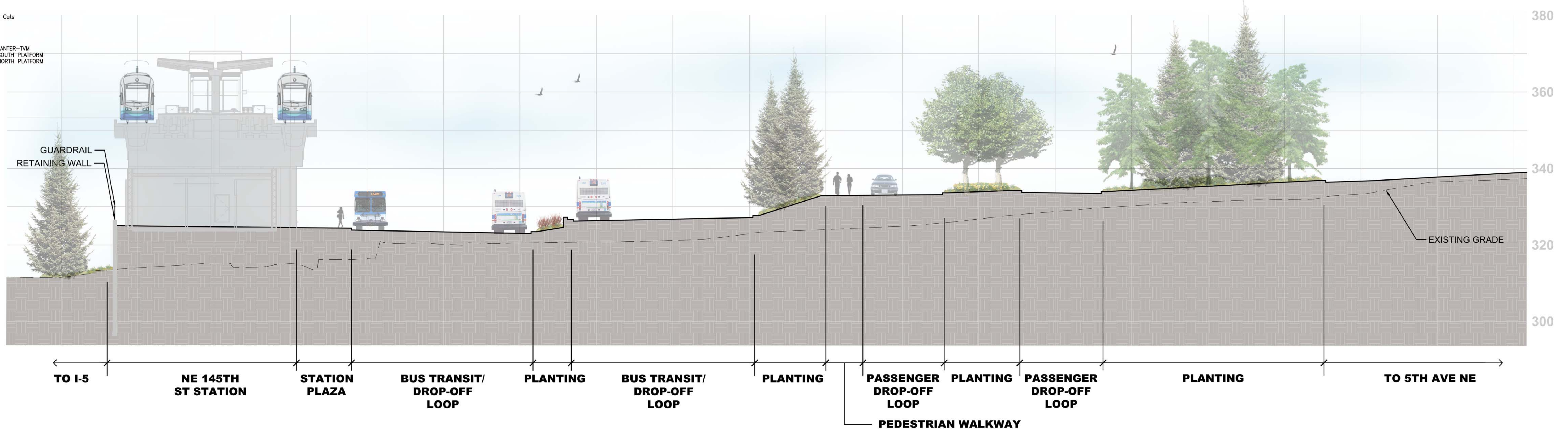
SCALE:
1"=50'
 FILENAME:
L200-L85-LPP219
 CONTRACT No.:
RTA / CN 0079-15
 DATE:
9/30/2016

**LYNNWOOD LINK EXTENSION
 CONTRACT L200**
 NORTHGATE STATION TO NE 200TH STREET
 NE 145TH ST STATION - LANDSCAPE
 SITE PLAN

DRAWING No.:
L85-LPP219
 LOCATION ID:
N13
 SHEET No.:
17
 REV:
0

No.	DATE	DSN	CHK	APP	REVISION

Xrefs:
 xl200-GB-TB22x34
 145th and 185th Station
 Section-Section145-1
 Section-Section145-3
 Section-Section145-4
 xl200-L85-LPP100
 wl200-N15-SECTION-THROUGH PLANTER-TVM
 wl200-N15-SECTION-THROUGH SOUTH PLATFORM
 wl200-N15-SECTION-THROUGH NORTH PLATFORM

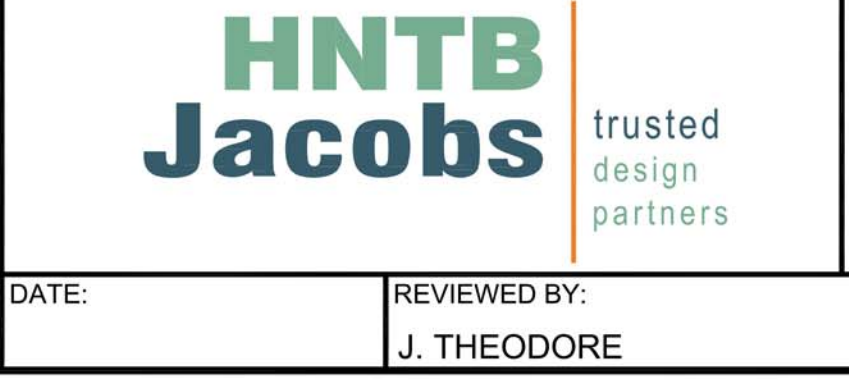
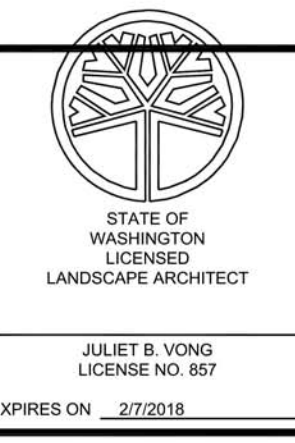


STATION AND PASSENGER DROP OFF SECTION (A)
 SCALE: 3/4" = 10'

10/07/16 | 12:29 PM | MOV/IR
 P:\2016 PROJECTS\2016-23 LYNNWOOD LINK\GRAPHICS\AUTOCAD\EXHIBITS\OPEN HOUSE GRAPHICS\L200-L85-LPD001.DWG

IN-PROGRESS 60%

DESIGNED BY:
J. YONG
 DRAWN BY:
M. OVIIR
 CHECKED BY:
Checker
 APPROVED BY:
Approver



LINE IS 1" AT FULL SCALE



SCALE:
AS SHOWN
 FILENAME:
L200-L85-LPD001
 CONTRACT No.:
RTA / CN 0079-15
 DATE:
9/30/2016

**LYNNWOOD LINK EXTENSION
 CONTRACT L200**
 NORTHGATE STATION TO NE 200TH STREET
 NE 145TH ST STATION - LANDSCAPE
 SITE SECTIONS

DRAWING No.:
L85-LPD001
 LOCATION ID:
N13
 SHEET No.: 33 REV: 0

No.	DATE	DSN	CHK	APP	REVISION

Impact Category	Impacts as Initially Disclosed (Preferred Alternative Station location in 2015 Final EIS and Preliminary Engineering)	Impacts of relocating Station to the north (final design refinements)	Net Change in Impacts
<p>Transportation Impacts</p>	<p>Northbound I-5 on-ramp intersection on 5th Avenue NE would operate at LOS E in AM peak and LOS B in PM peak.</p> <p>The existing two-way stop controlled west leg of the NE 148th Street/ 5th Avenue NE intersection would operate at LOS C in AM peak and LOS D in PM peak.</p> <p>Relocation of the NB I-5 on-ramp would result in temporary overnight and weekend closures of the ramp during construction.</p> <p>68-stall METRO park and ride lot would be replaced by a new multi-story parking garage for 500 vehicles.</p> <p>Traffic delays and street/lane closures would occur near construction staging areas.</p>	<p>Northbound I-5 on-ramp intersection on 5th Avenue NE would operate at an improved level (LOS A) in both AM and PM Peak Hours</p> <p>Traffic operations along 5th Avenue NE and the NB I-5 on-ramp intersection would operate better due to proposed signalization.</p> <p>Station driveway at the west leg of the new signalized and realigned NE 148th Street/ 5th Avenue NE intersection would operate at LOS C.</p> <p>Relocation of I-5 on-ramp is not required resulting in fewer temporary closures during construction.</p> <p>Impacts to parking would be same as in EIS.</p> <p>No new impacts to I-5 during construction. Haul routes are the same.</p> <p>Would eliminate existing NE 148th St cul-de-sac. NE 148th at 5th Ave. NE would be realigned</p>	<p>Overall improvement in transit operations and LOS, with mitigation.</p> <p>No change in the net increase in the number of park-and-ride spaces.</p> <p>No changes to traffic-related construction impacts.</p> <p>Without having to relocate northbound I-5 on-ramps, there would be fewer temporary closures of the ramp during construction.</p>

Lynnwood Link – NE 145th St Station Relocation – 2016 Design Refinements- Impact Assessment- December 14, 2016

Impact Category	Impacts as Initially Disclosed (Preferred Alternative Station location in 2015 Final EIS and Preliminary Engineering)	Impacts of relocating Station to the north (final design refinements)	Net Change in Impacts
<p>Acquisitions, Displacements and Relocations</p>	<p>6 single family homes would be acquired for the 145th Station under the Preferred Alternative.</p> <p>Limited access restrictions or acquisitions would potentially be required for 11 single family homes due to relocation of northbound I-5 on-ramp.</p> <p>The FEIS Preferred Alternative would require 169 property acquisitions for the entire Lynnwood Link project, displacing 129 residential units. The range for all FEIS alternatives was from 127 to 182 property acquisitions, and from 107 to 208 residential units displaced.</p>	<p>7 new property acquisitions, all single-family homes, are needed in order to relocate the NE 145th Station facilities to the north. This would bring the total for the project to 176 properties, including 136 residential units.</p> <p>No limited access restrictions or acquisitions would be required since northbound I-5 on-ramp would not be relocated.</p>	<p>Compared to the FEIS Preferred Alternative, 7 additional property acquisitions will increase the total number of acquisitions by 4%; and increase the number of residential unit displacements by 5%.</p> <p>No limited access restrictions or acquisitions would be required.</p>
<p>Land Use, Economics, Social, Community Facilities and Neighborhoods</p>	<p>No adverse impacts to land use; economics; social; community facilities; and neighborhoods. The light rail station would be consistent with long-range plans and future anticipated zoning changes in the vicinity of the NE 145th Station.</p>	<p>On 9/26/16, the City of Shoreline adopted zoning changes around the NE 145th Station in the 145th Street Substation Subarea Plan Final EIS (July 2016).</p>	<p>The light rail station would be consistent with the City of Shoreline’s adopted zoning changes. The September 2016 adoption of the 145th Street Station Subarea Plan Zoning Map does not reflect the proposed northerly relocation of the light rail station. The relocation would place the light rail station in the Mixed Use Residential, 70’ height (MUR-70)</p>

Impact Category	Impacts as Initially Disclosed (Preferred Alternative Station location in 2015 Final EIS and Preliminary Engineering)	Impacts of relocating Station to the north (final design refinements)	Net Change in Impacts
			zone; and thus would reduce the total acreage of the MUR-70 zone available for development.
<p>Visual and Aesthetic Resources</p>	<p>Visual impacts in vicinity of NE 145th Street (medium and high), I-5 (medium), and residential (medium-high), depending on mitigation.</p> <p>For areas identified as having high visual impacts, mitigation could include landscaping or visual treatments to retaining wall and other structures, as practical, based on available land, safety, and maintenance and operational needs.</p>	<p>Approximately 12 additional trees and seven houses would be removed.</p>	<p>Additional tree removal could cause added visual impacts, although unlikely given that the number of additional trees would be minor. Moving the station 400 feet to the north could result in different residences being potentially affected, including homes on 149th now being directly adjacent to the station. A noise and visual wall on the north edge of the station would mitigate this impact (see noise section).</p> <p>Other mitigation for high impacts, as stated in the FEIS, would be the same.</p>
<p>Air Quality and Greenhouse Gases</p>	<p>No adverse effects identified.</p>	<p>King County Metro and Sound Transit post EIS programmatic increase of buses servicing the station resulted in the layover buses needing to recirculate (make double or triple loops out onto the street and back into the station).</p>	<p>No adverse impacts to air quality</p> <p>Air quality likely slightly improved by reducing emissions through avoidance of re-circulating buses.</p>

Impact Category	Impacts as Initially Disclosed (Preferred Alternative Station location in 2015 Final EIS and Preliminary Engineering)	Impacts of relocating Station to the north (final design refinements)	Net Change in Impacts
		The larger bus loop configuration in the revised layout with on-site layover spaces eliminated re-circulation of buses.	
Noise and Vibration	<p>The NE 145th St station was projected to have moderate noise impacts on 18 single-family residential properties. A proposed noise barrier on the elevated guideway would mitigate the light rail noise.</p> <p>No vibration impacts requiring mitigation were identified.</p>	<p>Relocating the station to the north would result in 7 moderate and 2 severe impacts, without mitigation, due to light rail train operation noise, according to FTA criteria. A noise barrier of 4 foot height above top of rail would mitigate all light rail noise impacts, similar to initial design.</p> <p>Relocating the station to the north results in 17 moderate residential noise impacts, without mitigation, due to buses and vehicle operation: 7 on NE 149th along the north edge of the site, 5 on the east side of 5th Ave. north of NE 148th, and 5 on the east side of 5th Ave. south of NE 148th. The latter are directly exposed to the revised P&R entrance.</p> <p>Mitigation for impacts from the park and ride bus and vehicular</p>	<p>Due to park and ride bus and vehicular noise impacts, a 10 foot high noise wall would be needed on the north edge of the site to mitigate the impacts to properties on NE 149th St. Residual impacts to residences along 5th Avenue would require residential sound insulation improvements.</p> <p>With mitigation, there would be no impacts, same as for the initially disclosed project design.</p>

Impact Category	Impacts as Initially Disclosed (Preferred Alternative Station location in 2015 Final EIS and Preliminary Engineering)	Impacts of relocating Station to the north (final design refinements)	Net Change in Impacts
		<p>traffic would include a 10 foot high wall constructed on the north edge of the site (adjacent to the backyards of properties on NE 149th). Residual impacts to 10 residences along 5th Ave. NE opposite the entrance to the Park and Ride could be eliminated with residential sound insulation improvements.</p> <p>No vibration impacts requiring mitigation were identified.</p> <p>The larger bus loop configuration with on-site layover spaces eliminated re-circulation of buses.</p>	
Ecosystem Resources	<p>Permanent loss of wetland WSH-1 (approx. 2600 SF) located at the south end of the NE 145th Station site.</p>	<p>Wetland can be avoided and there would be no permanent loss of function of wetland WSH-1.</p> <p>Since the FEIS, coordination with the Corps of Engineers and ECOLOGY has resulted in a determination that WSH-1 is not a jurisdictional wetland.</p>	<p>No impact to wetland.</p> <p>No mitigation would be required, even if affected.</p>

Lynnwood Link – NE 145th St Station Relocation – 2016 Design Refinements- Impact Assessment- December 14, 2016

Impact Category	Impacts as Initially Disclosed (Preferred Alternative Station location in 2015 Final EIS and Preliminary Engineering)	Impacts of relocating Station to the north (final design refinements)	Net Change in Impacts
Water Resources	No adverse effects (with implementation of BMPs and regulatory requirements including treatment and detention facilities).	Larger bus loop and layover spaces and a larger plaza space.	Impervious surface would be approximately 1.35 acres more than the initial design (initial design for the 145 th Street station was 0.99 acres and new design is 2.34 acres). Detention facilities would be sized to accommodate and treat added impervious surface, resulting in no adverse effects.
Energy	No adverse effects identified.	No new impacts identified.	No change in impacts.
Geology and Soils	No impacts anticipated, with appropriate design of this segment.	No new impacts identified.	No change in impacts.
Hazardous Materials	No documented release sites or potential release sites were identified near the NE 145th Station area.	No new impacts identified.	No change in impacts.
Electromagnetic Fields	No adverse health effects identified with operation of light rail.	No new impacts identified.	No change in impacts.
Public Services, Safety and Security			

Lynnwood Link – NE 145th St Station Relocation – 2016 Design Refinements- Impact Assessment- December 14, 2016

Impact Category	Impacts as Initially Disclosed (Preferred Alternative Station location in 2015 Final EIS and Preliminary Engineering)	Impacts of relocating Station to the north (final design refinements)	Net Change in Impacts
	The constrained site layout yielded undesirable pedestrian and vehicular conflicts with buses.	A high quality transfer and reduced pedestrian and vehicular conflicts with buses is achieved with the expanded site layout.	Improved high quality transfer and user experience.
Utilities	No adverse effects identified, with appropriate design. Temporary impacts during construction.	No new impacts identified. Relocating the station to the north and leaving the existing I-5 on ramp where it is currently, reduced impacts to the sanitary sewer	Reduced impacts to the sanitary sewer
Cultural, Archaeological and Historic Resources	Low potential for encountering archaeological resources. No adverse effects to historic or cultural resources were identified.	No new impacts identified. The 7 new residential property acquisitions are located within the Area of Potential Effect (APE) for the EIS and all were determined to not be eligible for the National Register of Historic Places (NRHP).	No change in impacts
Parks and Recreational Resources	No adverse effects identified in this segment of Lynnwood Link.	No new impacts identified.	No change in impacts.

MEMORANDUM

Lynnwood Link Extension | Northgate Station to Lynnwood Transit Center

NE 145th St Station Relocation – FTA Noise Impact Analysis

Date: December 14, 2016

To: Steve Kennedy, Shankar Rajaram

From: Thom Bergen

CC: Jim Schettler, Jeff Schutt, Sam Burch, Jerry Dorn

Re: FTA noise impact analysis of relocated NE 145th St. Station

At the request of Sound Transit, a noise impact analysis related to the proposed relocation of the NE 145th Street Station has been completed. The analysis addressed operational noise sources including light rail vehicles, and bus and automobile traffic in the adjacent park & ride facility. The calculations were taken directly from the FTA *Noise and Vibration Impact Assessment* manual (May 2006) detailed analysis described in Chapter 6. A plan layout of the relocated station is shown in Figure 1. Reference levels for trains and buses were determined by direct measurement.

This memorandum addresses the modeling assumptions, noise impact assessment results, and preliminary mitigation recommendations. The results showed 7 moderate impacts and 2 severe impacts between NE 145th St and NE 149th St due to light rail operations. The FEIS indicated 18 moderate noise impacts in the vicinity of the previous station location, mostly along 5th Ave NE, but that was based on a train speed of 55 mph. In reality, trains will be stationary while in the station, or accelerating/decelerating while leaving/entering so that the train speed is below 55 mph in the vicinity of the station. The train speed is also limited to 40 mph in the curve just south of the station.

Noise measurements and observations were recently made at a local Park & Ride served by King County Metro (KCM) and Sound Transit Express buses. Two-axle diesel buses, and three-axle articulated diesel hybrid buses were observed. It was noted that buses shut off completely while in layover, and idle for between 30 and 120 seconds (75 second average idle time) while loading and unloading passengers. The directly measured noise levels for buses idling and moving through the park and ride were substantially lower than the reference noise levels for buses cited in the FTA manual. Park & ride noise calculations were based on the directly measured noise produced by existing transit vehicles, rather than on the reference levels published in the FTA guidance manual.

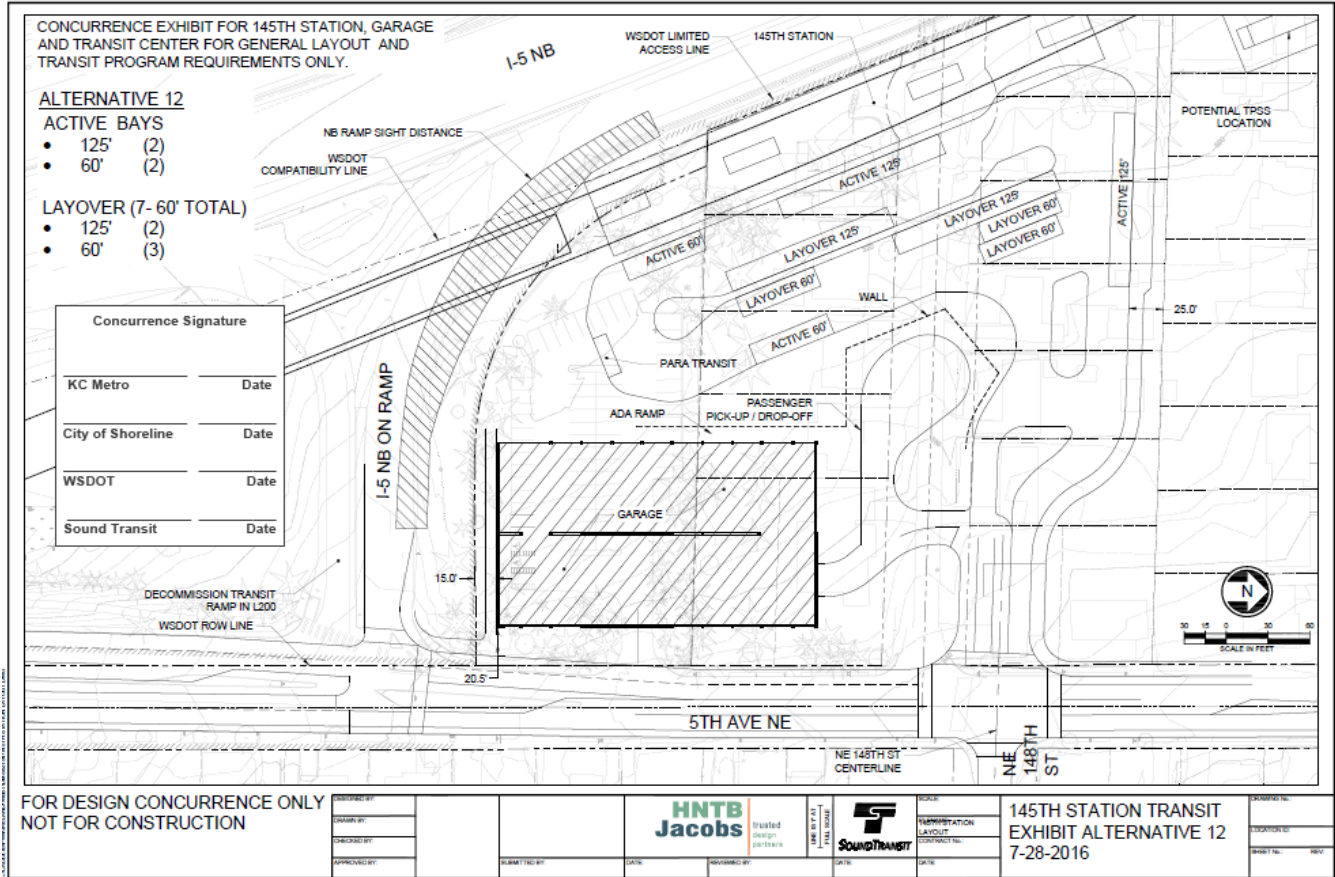


Figure 1 Layout of relocated NE 145th Street Station

ASSUMPTIONS

The basic assumptions for FTA noise analyses of the LRV and Park & Ride are listed below. Both analyses assume that the existing highway noise wall running along I-5 and the on-ramp will be replaced in kind to its current configuration or relocated and redesigned to provide equivalent highway noise mitigation.

Light Rail noise analysis assumptions:

- All receptors in land use category 2 (residential)
- Existing noise levels based on measurements taken during Preliminary Engineering phase
- ST 2035 ridership model with 4 car trains on 4 minute headways during peak service (full 24-hour train schedule shown in Table 1)
- Assume flat ground source/receiver relationship from Figure 6-5 in FTA manual
- Ground type soft
- NB Near track distance calculated from point on receptor building setback relative to track centerline
- SB track distance at NB distance plus 15.75 ft

- Speed Profile assumes maximum speed of 55 mph, 3mph/sec acceleration/deceleration, and 40 mph speed limit in curve south of station
- 35%-65% gaps in first row receivers (5th Ave NE) for second row receivers along 6th Ave NE
- Receiver location and elevation from GIS data provided by City of Shoreline
- Standard FTA source and receiver heights, source 1 ft above top of rail (T/R) and receiver 5 ft above ground
- Noise wall heights defined relative to T/R
- Guideway noise wall 6.5 ft from near track (NB) centerline
- Noise wall type 2; absorptive noise wall within 10 ft of track centerline per Sound Transit standard specification for elevated guideway noise walls

Park & Ride noise analysis assumptions:

- Directly measured diesel bus reference noise levels: SEL of 74 dBA for moving buses, 83 dBA for idling, 74 dBA for cars at 50 feet
- 15 mph bus and car speed in park & ride (P&R)
- Bus and car volume provided by H|J traffic team and bus schedule from KCM
- 15.7 bus/hr daytime, 5.9 bus/hr night average, included both entering and leaving site
- 324 car/hr at peak times, 50 cars/hr assumed at night
- Peak volume of 18 buses during 6 to 7 am hour
- Distance from bus/car source calculated from park & ride entrance for 5th Ave NE receptors
- Distance from bus/car source calculated from center of bus lanes for NE 149th St receptors
- Assume 35ft from bus source to north edge of Park & Ride site (current property line)
- Standard FTA source and receiver heights, 3ft for moving bus, 8 ft for idling bus, and 5ft at receiver
- Building shielding on 2nd row <35% gaps between 1st row buildings for NE 149th St. receptors
- Buses shut down completely during layover (no idling)
- Buses idle for an average period of 75 seconds for passenger loading and unloading
- Buses idle for an average period of 30 seconds at P&R exit
- Buses and cars modeled only while moving or idling within the P&R site; vehicles occupying public streets are considered exempt and excluded from the noise model

Table 1 Sound Transit 2035 Link Train Schedule Used in LRV Noise Analyses

Period	Headway (min)	# hours/Period	# Trains/Period	Consists
0:00 - 1:00	7.5	1	8	4
1:00 - 2:00				
2:00 - 3:00				
3:00 - 4:00				
4:00 - 5:00				
5:00 - 6:00	7.5	1	8	4
6:00 - 7:00	4	1	15	4
7:00 - 8:00	4	1	15	4
8:00 - 8:30	4	0.5	7.5	4
8:30 - 9:00	5	0.5	6	4
9:00 - 10:00	5	1	12	4
10:00 - 11:00	5	1	12	4
11:00 - 12:00	5	1	12	4
12:00 - 13:00	5	1	12	4
13:00 - 14:00	5	1	12	4
14:00 - 15:00	5	1	12	4
15:00 - 16:00	4	1	15	4
16:00 - 17:00	4	1	15	4
17:00 - 18:00	4	1	15	4
18:00 - 18:30	4	0.5	7.5	4
18:30 - 19:00	5	0.5	6	4
19:00 - 20:00	5	1	12	4
20:00 - 21:00	5	1	12	4
21:00 - 22:00	5	1	12	4
22:00 - 23:00	7.5	1	8	4
23:00 - 0:00	7.5	1	8	4

NOISE MODEL APPROACH

For the 145th Station noise analysis, 56 residential receptors were included in the noise model. Forty-one of these receptors lie between 5th Ave NE and 6th Ave NE, north of NE 145th Street and on the east side of the station. The remaining 15 receptors are located on both sides of NE 149th Street north of the station. The homes on either side of NE 148th Street will presumably be displaced and were therefore excluded from the model.

The LRV was modeled first using standard FTA methodology to determine light rail impacts and mitigation (height of guideway noise wall). Then, the mitigated light rail noise exposure was combined with projected park & ride vehicle noise to determine total noise exposure in the vicinity of the station for determination of FTA impacts in terms of the L_{dn}. In addition, the predicted peak hour (6-7 am) Park & Ride noise level (hourly L_{eq}) at each receptor was compared with the Washington Administrative Code (WAC) 173-60-040 criteria, presented in Table 2.

Table 2 Washington State Administrative Code (WAC) Noise Control Regulation

EDNA Source of Noise	EDNA Receiver of Noise (Maximum Allowable Sound Level in dBA ^a)		
	Residential	Commercial	Industrial
Residential	55	57	60
Commercial	57	60	65
Industrial	60	65	70

Notes:

^a Between 10:00 pm and 7:00 am, the levels given above are reduced by 10 dBA for residential receiving property.

The WAC establishes maximum permissible noise levels based on the Environmental Designation for Noise Abatement (EDNA) and includes a 10 dBA penalty for noise produced at night (10 p.m. to 7 a.m.) at residential receptors (Class A). Treating the Park & Ride as a commercial zone (Class B), the maximum permissible nighttime noise level at the receiving residential properties is 47 dBA L_{eq} (hour). This classification (WAC 173-60-030.1.b.iii (motor vehicle services) is the same as that stated in Section 5.8 of the Noise and Vibration Technical Report published as part of the FEIS.

SUMMARY OF RESULTS

The projected day-night average noise levels due to LRV operations for the selected receptors are listed in Table 3. Results show that 7 moderate impacts and 2 severe impacts are predicted without mitigation. All but two of the 18 moderate impacts predicted in the FEIS are eliminated by this analysis, but 7 new impacts are predicted. Guideway noise walls were included in the model and it was determined that an absorptive noise wall of 4 foot height above top of rail would be sufficient to eliminate LRV noise impacts. A list of project noise levels with mitigation is provided in Table 4. The light rail impacts without mitigation are shown graphically in Figure 2.

An FTA analysis of cars and buses moving and idling in the Park & Ride based on the directly measured reference noise levels produced by current vehicles resulted in no noise impacts in terms of the L_{dn}. A site plan

showing approximate noise source locations for moving and fixed sources is presented in Figure 3. The analysis was repeated based on the peak hour bus volume of 18 in the 6 to 7 a.m. hour which was used to calculate an hourly L_{eq} . A summary of project noise levels associated with buses and vehicles moving through the Park & Ride is shown graphically in Figure 3 and listed in Table 4. This model predicts 17 WAC impacts associated with the Park & Ride.

NOISE MITIGATION

As stated above, a guideway noise wall 4 feet height above top of rail will be needed to eliminate LRV noise impacts. For the Park & Ride noise sources, a noise wall 10 feet in height above the ground level and positioned along the north edge of the site will be required to eliminate the WAC nighttime noise impacts at the seven receptors along NE 149th Street. This wall would be approximately 500 feet in length. Projected noise levels with this wall in place are presented in Table 5.

However, residual WAC noise impacts would remain at ten receptors on 5th Ave NE opposite the entrance to the Park & Ride. Since most of these receptors have driveways on 5th Ave, a noise wall will not be effective because it would have to be segmented to accommodate the driveways. These impacts could be eliminated with residential sound insulation improvements, and would be evaluated on an individual basis. Supplemental interior and exterior noise measurements should be performed at these receptors to verify the potential for noise impact from the Park & Ride, and to evaluate the sound transmission loss of the existing buildings. It is expected that the hourly noise levels produced by buses may be lower than the existing ambient noise produced by the traffic on I-5.

Applying Sound Transit's Noise Mitigation Policy (2004) criteria for Residential Sound Insulation, "implement residential sound insulation as a noise mitigation measure when justified by the scope of an identified impact that cannot be reduced or eliminated through source control or other operational measures. Residential sound insulation shall be used only when the use of source or path treatments, such as noise barriers is ineffective, unreasonable, and/or infeasible".

In addition, "Unless otherwise required, sound insulation will use the Housing and Urban Development (HUD) interior 45 dBA Ldn as the reference value for interior noise level reduction of light rail impacts and WSDOT's 51 dBA peak hour L_{eq} criteria as the reference value for traffic noise impacts. For those locations where both light rail and traffic noise impacts are identified, the interior noise levels will meet whichever criterion achieves the greatest level of noise reduction".

GROUND VIBRATION IMPACTS

No new vibration or groundborne noise impacts are expected resulting from the relocation of the NE 145th Street station. No impacts in this area were indicated in the FEIS and the guideway support columns will be at equal or greater distances from the nearest residences relative to the Preliminary Engineering design. In general, vibration impacts would not be expected in this area since the guideway is elevated (less efficient vibration transmission relative to at-grade track), and due to reduced train speeds near the station.

Vibration levels at the receptors at the west end of NE 149th Street were recalculated using the train force density levels (FDL) and vibration propagation characteristics (transfer mobility) at that location previously reported in the FEIS. Maximum 1/3 octave band vibration velocity level of 69 VdB was calculated at 321 NE 149th Street, and 67 VdB at 314 NE 149th Street. Both levels occurred in the 63 Hz frequency band and are below the FTA impact criteria of 72 VdB confirming that no impact is predicted. All other receptors included in this study are at greater distances from the nearest guideway columns such that vibration levels produced by passing trains would be lower than those calculated at the west end of the street.

Table 3 FTA noise impact summary for revised NE 145th Station without mitigation

LLE 145th St Station Park & Ride						
LRV noise only, No mitigation						
Address	Tax Parcel	Existing Noise Level (dBA)	Ldn Projected Project Noise Level (dBA)	Criteria and Impacts		
				None	Moderate	Severe
357 Ne 149th St	2004100090	67	58	> 63		> 67
351 Ne 149th St	2004100085	67	60	> 63		> 67
345 Ne 149th St	2004100080	67	62	> 63		> 67
339 Ne 149th St	2004100075	67	63	> 63	Yes	> 67
333 Ne 149th St	2004100065	68	65	> 63	Yes	> 68
327 Ne 149th St	2004100060	69	68	> 64	Yes	> 69
321 Ne 149th St	2004100055	70	72	> 65		> 69
332 Ne 149th St	2004100040	70	70	> 65		> 69
338 Ne 149th St	2004100035	70	67	> 65	Yes	> 69
344 Ne 149th St	2004100030	68	65	> 63	Yes	> 68
350 Ne 149th St	2004100025	68	63	> 63	Yes	> 68
356 Ne 149th St	2004100020	67	61	> 63		> 67
344 NE 149th St	2004100015	68	60	> 63		> 68
350 NE 149th St	2004100010	68	59	> 63		> 68
356 NE 149th St	2004100005	68	58	> 63		> 68
14802 5th Ave Ne	7568700355	65	56	> 61		> 66
14808 5th Ave Ne	7568700360	65	56	> 61		> 66
14812 5th Ave Ne	7568700365	64	56	> 61		> 65
14818 5th Ave Ne	7568700370	64	56	> 61		> 65
14902 5th Ave Ne	7568700375	63	56	> 60		> 65
14910 5th Ave Ne	7568700380	63	57	> 60		> 65
14916 5th Ave Ne	7568700385	62	56	> 59		> 64
14922 5th Ave Ne	7568700390	62	56	> 59		> 64
14845 6th Ave NE	7568700315	62	53	> 59		> 64
14841 6th Ave NE	7568700320	62	53	> 59		> 64
14833 6th Ave NE	7568700325	62	53	> 59		> 64
14827 6th Ave NE	7568700330	62	52	> 59		> 64
14819 6th Ave NE	7568700335	62	53	> 59		> 64
14815 6th Ave NE	7568700340	62	52	> 59		> 64
14809 6th Ave NE	7568700345	62	52	> 59		> 64
14803 6th Ave NE	7568700346	62	53	> 59		> 64
14578 5th Ave Ne	7568700836	65	58	> 61		> 66
14574 5th Ave Ne	7568700835	66	59	> 62		> 67
14570 5th Ave Ne	7568700830	68	59	> 63		> 68
14560 5th Ave Ne	7568700825	72	60	> 66		> 71
14556 5th Ave Ne	7568700820	73	61	> 66		> 71
14552 5th Ave Ne	7568700815	73	61	> 66		> 71
14544 5th Ave Ne	7568700810	73	62	> 66		> 71
14540 5th Ave Ne	7568700805	73	63	> 66		> 71
14532 5th Ave Ne	7568700800	73	63	> 66		> 71
14526 5th Ave Ne	7568700795	73	63	> 66		> 71
14518 5th Ave Ne	7568700790	73	65	> 66		> 71
14512 5th Ave Ne	7568700785	74	66	> 66	Yes	> 72
516 Ne 145th St	7568700770	73	63	> 66		> 71
522 Ne 145th St	7568700765	72	59	> 66		> 71
14579 6th Ave Ne	7568700705	60	53	> 58		> 63
515 Ne 148th St	7568700710	62	54	> 59		> 64
14567 6th Ave Ne	7568700715	60	54	> 58		> 63
14565 6th Ave Ne	7568700720	61	54	> 59		> 64
14555 6th Ave Ne	7568700725	62	55	> 59		> 64
14549 6th Ave Ne	7568700730	63	56	> 60		> 65
14541 6th Ave Ne	7568700734	63	56	> 60		> 65
14535 6th Ave Ne	7568700740	64	56	> 61		> 65
14525 6th Ave Ne	7568700745	65	57	> 61		> 66
14521 6th Ave Ne	7568700755	66	58	> 62		> 67
14515 6th Ave Ne	7568700760	69	58	> 64		> 69
			Totals	47	7	2

Table 4 FTA noise impact summary for revised NE 145th Station with 4 ft guideway noise wall

LLE 145th St Station Park & Ride						
LRV only w/ 4ft guideway barrier						
Address	Tax Parcel	Existing Noise Level (dBA)	Ldn Projected Project Noise Level (dBA)	Criteria and Impacts		
				None	Moderate	Severe
357 Ne 149th St	2004100090	67	52	> 63	> 67	
351 Ne 149th St	2004100085	67	54	> 63	> 67	
345 Ne 149th St	2004100080	67	56	> 63	> 67	
339 Ne 149th St	2004100075	67	57	> 63	> 67	
333 Ne 149th St	2004100065	68	58	> 63	> 68	
327 Ne 149th St	2004100060	69	59	> 64	> 69	
321 Ne 149th St	2004100055	70	60	> 65	> 69	
332 Ne 149th St	2004100040	70	59	> 65	> 69	
338 Ne 149th St	2004100035	70	59	> 65	> 69	
344 Ne 149th St	2004100030	68	58	> 63	> 68	
350 Ne 149th St	2004100025	68	57	> 63	> 68	
356 Ne 149th St	2004100020	67	55	> 63	> 67	
344 NE 149th St	2004100015	68	54	> 63	> 68	
350 NE 149th St	2004100010	68	52	> 63	> 68	
356 NE 149th St	2004100005	68	51	> 63	> 68	
14802 5th Ave Ne	7568700355	65	50	> 61	> 66	
14808 5th Ave Ne	7568700360	65	50	> 61	> 66	
14812 5th Ave Ne	7568700365	64	50	> 61	> 65	
14818 5th Ave Ne	7568700370	64	50	> 61	> 65	
14902 5th Ave Ne	7568700375	63	50	> 60	> 65	
14910 5th Ave Ne	7568700380	63	51	> 60	> 65	
14916 5th Ave Ne	7568700385	62	51	> 59	> 64	
14922 5th Ave Ne	7568700390	62	51	> 59	> 64	
14845 6th Ave NE	7568700315	62	47	> 59	> 64	
14841 6th Ave NE	7568700320	62	47	> 59	> 64	
14833 6th Ave NE	7568700325	62	47	> 59	> 64	
14827 6th Ave NE	7568700330	62	47	> 59	> 64	
14819 6th Ave NE	7568700335	62	47	> 59	> 64	
14815 6th Ave NE	7568700340	62	47	> 59	> 64	
14809 6th Ave NE	7568700345	62	46	> 59	> 64	
14803 6th Ave NE	7568700346	62	46	> 59	> 64	
14578 5th Ave Ne	7568700836	65	53	> 61	> 66	
14574 5th Ave Ne	7568700835	66	54	> 62	> 67	
14570 5th Ave Ne	7568700830	68	54	> 63	> 68	
14560 5th Ave Ne	7568700825	72	55	> 66	> 71	
14556 5th Ave Ne	7568700820	73	56	> 66	> 71	
14552 5th Ave Ne	7568700815	73	56	> 66	> 71	
14544 5th Ave Ne	7568700810	73	57	> 66	> 71	
14540 5th Ave Ne	7568700805	73	57	> 66	> 71	
14532 5th Ave Ne	7568700800	73	57	> 66	> 71	
14526 5th Ave Ne	7568700795	73	57	> 66	> 71	
14518 5th Ave Ne	7568700790	73	57	> 66	> 71	
14512 5th Ave Ne	7568700785	74	57	> 66	> 72	
516 Ne 145th St	7568700770	73	56	> 66	> 71	
522 Ne 145th St	7568700765	72	53	> 66	> 71	
14579 6th Ave Ne	7568700705	60	47	> 58	> 63	
515 Ne 148th St	7568700710	62	48	> 59	> 64	
14567 6th Ave Ne	7568700715	60	48	> 58	> 63	
14565 6th Ave Ne	7568700720	61	49	> 59	> 64	
14555 6th Ave Ne	7568700725	62	51	> 59	> 64	
14549 6th Ave Ne	7568700730	63	51	> 60	> 65	
14541 6th Ave Ne	7568700734	63	51	> 60	> 65	
14535 6th Ave Ne	7568700740	64	51	> 61	> 65	
14525 6th Ave Ne	7568700745	65	53	> 61	> 66	
14521 6th Ave Ne	7568700755	66	53	> 62	> 67	
14515 6th Ave Ne	7568700760	69	53	> 64	> 69	
			Totals	56	0	0

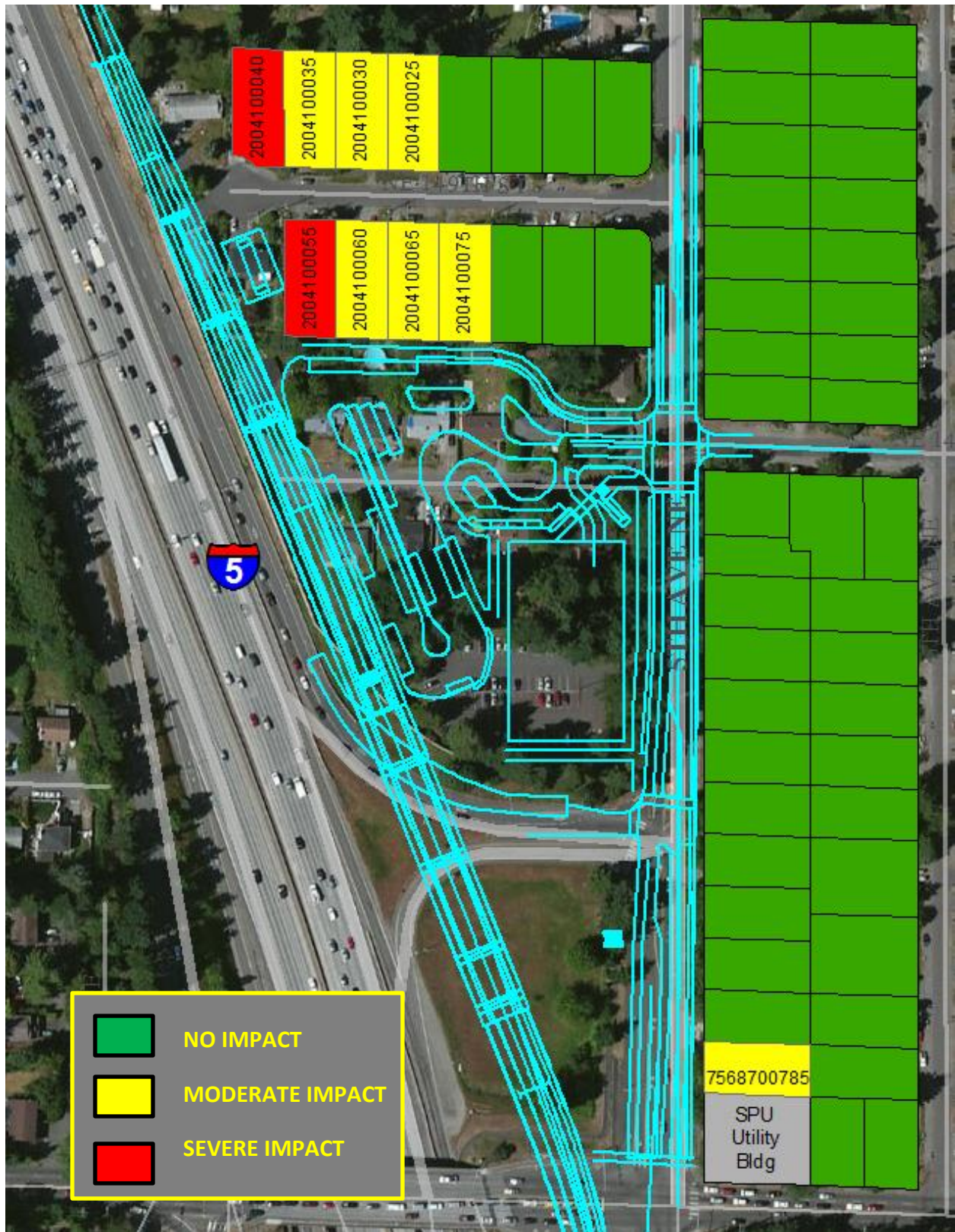


Figure 2 Projected noise impacts at NE 145th Station due to LRV operations – no mitigation

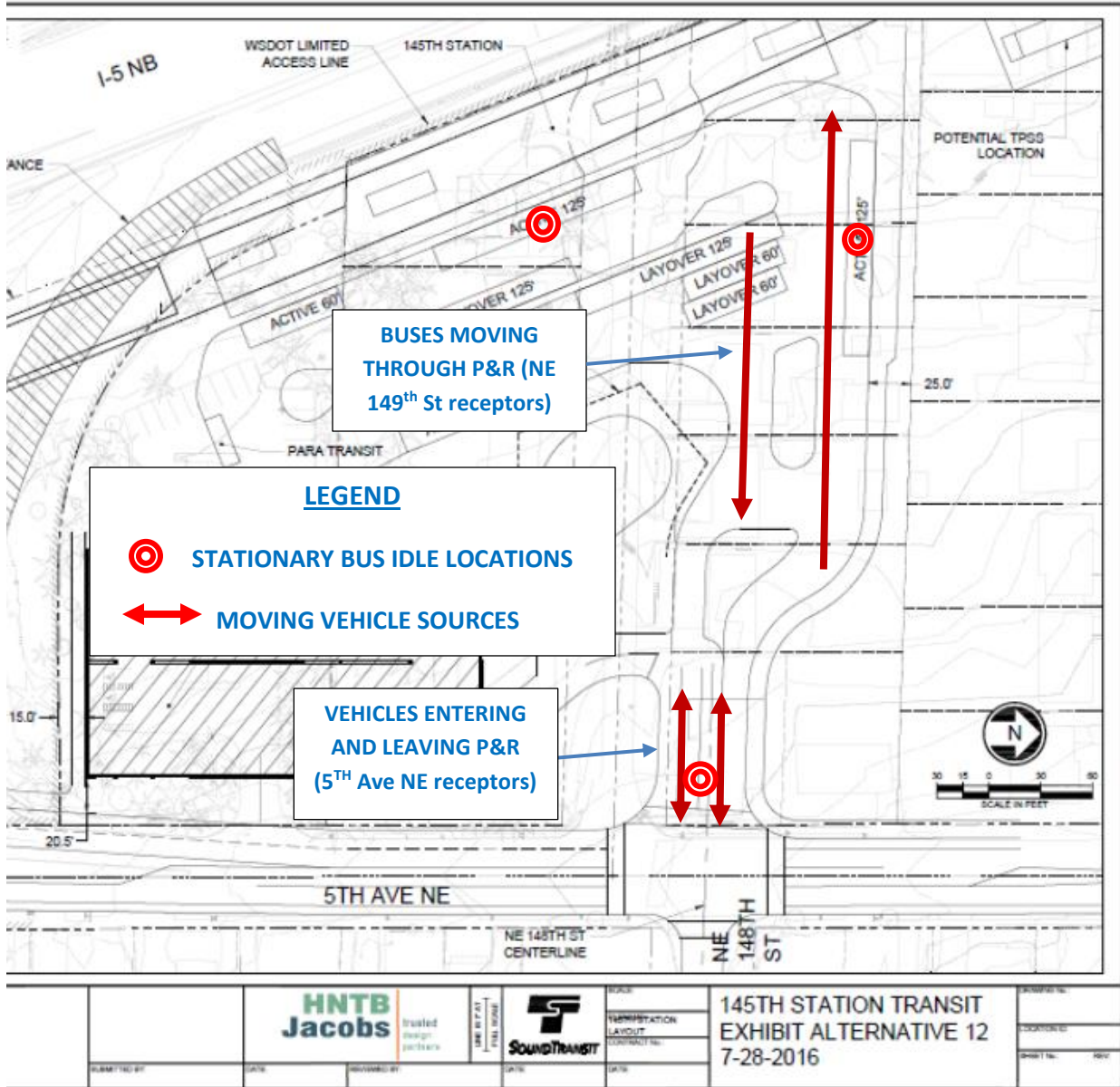


Figure 3 NE 145th Station Park & Ride site showing approximate locations of fixed and moving noise sources used in prediction model

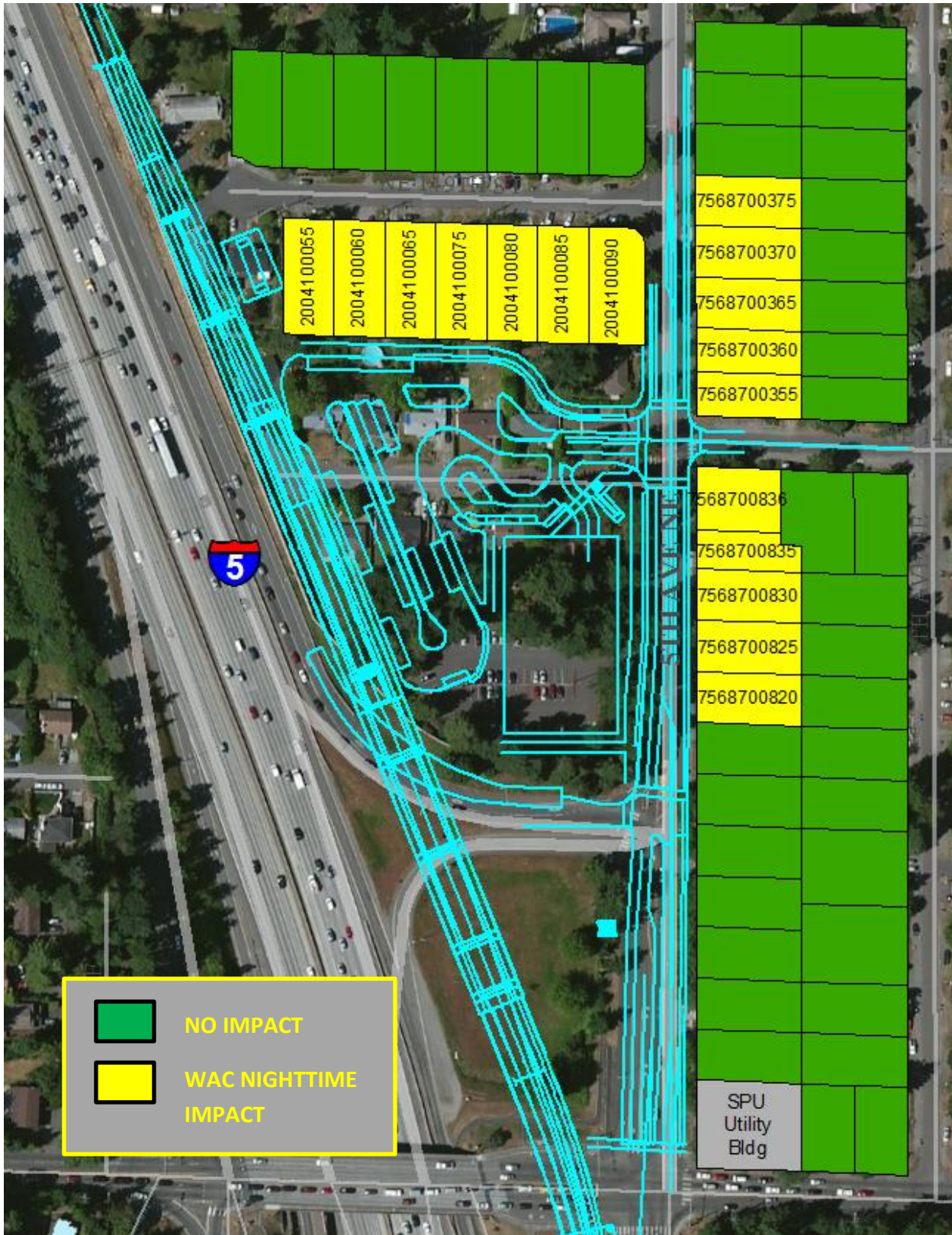


Figure 4 Projected noise impacts at NE 145th Station due to LRV operations and Park & Ride –

Table 5 WAC noise impact assessment for the Park & Ride facility at the revised 145th Station without mitigation

LLE 145th St Station Park & Ride						
w/ 4ft guideway noise barrier, NO park & ride noise walls, WIA recorded SELs						
Address	Tax Parcel	Distance to nearest source (ft)	Leq Impact Criteria (dBA)	Leq Projected Project Noise Level (dBA)	Impacts	
					None	Exceeds
357 Ne 149th St	2004100090	100	47	51		Yes
351 Ne 149th St	2004100085	100	47	51		Yes
345 Ne 149th St	2004100080	100	47	51		Yes
339 Ne 149th St	2004100075	100	47	51		Yes
333 Ne 149th St	2004100065	100	47	51		Yes
327 Ne 149th St	2004100060	100	47	51		Yes
321 Ne 149th St	2004100055	100	47	51		Yes
332 Ne 149th St	2004100040	250	47	44		
338 Ne 149th St	2004100035	250	47	44		
344 Ne 149th St	2004100030	250	47	44		
350 Ne 149th St	2004100025	250	47	44		
356 Ne 149th St	2004100020	250	47	44		
344 NE 149th St	2004100015	250	47	44		
350 NE 149th St	2004100010	250	47	44		
356 NE 149th St	2004100005	250	47	44		
14802 5th Ave Ne	7568700355	135	47	50		Yes
14808 5th Ave Ne	7568700360	173	47	49		Yes
14812 5th Ave Ne	7568700365	526	47	48		Yes
14818 5th Ave Ne	7568700370	242	47	48		Yes
14902 5th Ave Ne	7568700375	292	47	47		Yes
14910 5th Ave Ne	7568700380	336	47	46		
14916 5th Ave Ne	7568700385	398	47	46		
14922 5th Ave Ne	7568700390	449	47	45		
14845 6th Ave NE	7568700315	498	47	42		
14841 6th Ave NE	7568700320	450	47	42		
14833 6th Ave NE	7568700325	404	47	43		
14827 6th Ave NE	7568700330	359	47	43		
14819 6th Ave NE	7568700335	315	47	44		
14815 6th Ave NE	7568700340	238	47	45		
14809 6th Ave NE	7568700345	267	47	45		
14803 6th Ave NE	7568700346	250	47	45		
14578 5th Ave Ne	7568700836	122	47	51		Yes
14574 5th Ave Ne	7568700835	148	47	50		Yes
14570 5th Ave Ne	7568700830	148	47	50		Yes
14560 5th Ave Ne	7568700825	242	47	48		Yes
14556 5th Ave Ne	7568700820	290	47	47		Yes
14552 5th Ave Ne	7568700815	353	47	46		
14544 5th Ave Ne	7568700810	404	47	46		
14540 5th Ave Ne	7568700805	466	47	45		
14532 5th Ave Ne	7568700800	530	47	45		
14526 5th Ave Ne	7568700795	591	47	44		
14518 5th Ave Ne	7568700790	639	47	44		
14512 5th Ave Ne	7568700785	703	47	43		
516 Ne 145th St	7568700770	821	47	40		
522 Ne 145th St	7568700765	841	47	40		
14579 6th Ave Ne	7568700705	273	47	45		
515 Ne 148th St	7568700710	245	47	45		
14567 6th Ave Ne	7568700715	304	47	44		
14565 6th Ave Ne	7568700720	337	47	44		
14555 6th Ave Ne	7568700725	369	47	43		
14549 6th Ave Ne	7568700730	422	47	43		
14541 6th Ave Ne	7568700734	470	47	42		
14535 6th Ave Ne	7568700740	543	47	42		
14525 6th Ave Ne	7568700745	618	47	41		
14521 6th Ave Ne	7568700755	696	47	40		
14515 6th Ave Ne	7568700760	748	47	40		
				Totals	39	17

Table 6 WAC noise impact assessment for the Park & Ride facility at the revised 145th Station with noise wall along north edge of site

LLE 145th St Station Park & Ride							
w/ 4ft guideway noise barrier, 11ft park & ride noise wall, WIA recorded SELs							
Address	Tax Parcel	Distance to nearest source (ft)	Park & Ride Wall Height (ft)	Leq Impact Criteria (dBA)	Leq Projected Project Noise Level (dBA)	Impacts	
						None	Exceed
357 Ne 149th St	2004100090	100	10	47	45		
351 Ne 149th St	2004100085	100	10	47	45		
345 Ne 149th St	2004100080	100	10	47	45		
339 Ne 149th St	2004100075	100	10	47	45		
333 Ne 149th St	2004100065	100	10	47	45		
327 Ne 149th St	2004100060	100	10	47	45		
321 Ne 149th St	2004100055	100	10	47	45		
332 Ne 149th St	2004100040	250	10	47	44		
338 Ne 149th St	2004100035	250	10	47	44		
344 Ne 149th St	2004100030	250	10	47	44		
350 Ne 149th St	2004100025	250	10	47	44		
356 Ne 149th St	2004100020	250	10	47	44		
344 NE 149th St	2004100015	250	10	47	44		
350 NE 149th St	2004100010	250	10	47	44		
356 NE 149th St	2004100005	250	10	47	44		
14802 5th Ave Ne	7568700355	135		47	50		Yes
14808 5th Ave Ne	7568700360	173		47	49		Yes
14812 5th Ave Ne	7568700365	526		47	48		Yes
14818 5th Ave Ne	7568700370	242		47	48		Yes
14902 5th Ave Ne	7568700375	292		47	47		Yes
14910 5th Ave Ne	7568700380	336		47	46		
14916 5th Ave Ne	7568700385	398		47	46		
14922 5th Ave Ne	7568700390	449		47	45		
14845 6th Ave NE	7568700315	498		47	42		
14841 6th Ave NE	7568700320	450		47	42		
14833 6th Ave NE	7568700325	404		47	43		
14827 6th Ave NE	7568700330	359		47	43		
14819 6th Ave NE	7568700335	315		47	44		
14815 6th Ave NE	7568700340	238		47	45		
14809 6th Ave NE	7568700345	267		47	45		
14803 6th Ave NE	7568700346	250		47	45		
14578 5th Ave Ne	7568700836	122		47	51		Yes
14574 5th Ave Ne	7568700835	148		47	50		Yes
14570 5th Ave Ne	7568700830	148		47	50		Yes
14560 5th Ave Ne	7568700825	242		47	48		Yes
14556 5th Ave Ne	7568700820	290		47	47		Yes
14552 5th Ave Ne	7568700815	353		47	46		
14544 5th Ave Ne	7568700810	404		47	46		
14540 5th Ave Ne	7568700805	466		47	45		
14532 5th Ave Ne	7568700800	530		47	45		
14526 5th Ave Ne	7568700795	591		47	44		
14518 5th Ave Ne	7568700790	639		47	44		
14512 5th Ave Ne	7568700785	703		47	43		
516 Ne 145th St	7568700770	821		47	40		
522 Ne 145th St	7568700765	841		47	40		
14579 6th Ave Ne	7568700705	273		47	45		
515 Ne 148th St	7568700710	245		47	45		
14567 6th Ave Ne	7568700715	304		47	44		
14565 6th Ave Ne	7568700720	337		47	44		
14555 6th Ave Ne	7568700725	369		47	43		
14549 6th Ave Ne	7568700730	422		47	43		
14541 6th Ave Ne	7568700734	470		47	42		
14535 6th Ave Ne	7568700740	543		47	42		
14525 6th Ave Ne	7568700745	618		47	41		
14521 6th Ave Ne	7568700755	696		47	40		
14515 6th Ave Ne	7568700760	748		47	40		
					Totals	46	10

MEMORANDUM

Lynnwood Link Extension | Northgate Station to Lynnwood Transit Center

NE 145th Street Station – 5th Avenue NE Traffic Analysis

Date: November 11, 2016

To: Steven Kennedy – Sound Transit

From: C.J. Grove / Bill James – H|J

cc: Jeff Schutt – H|J, Mike Coward – H|J, Jon Jordan – ST, John Evans - ST

Re: 5th Avenue NE Traffic Analysis (NE 145th Street Station Vicinity)

Contract L200 will construct a light rail station and bus transit center with a 500 stall parking garage on the east side of I-5, north of NE 145th Street. 5th Avenue NE will be modified to accommodate transit, pedestrian, bicycle, and general purpose traffic access to the station area and the garage.

The final design configuration of the intersections along 5th Avenue NE (see Figure 1) includes a single station access connection to 5th Avenue NE at NE 148th Street. The west leg of NE 148th Street will be realigned to the north in order to create a four-leg intersection with the east leg of NE 148th Street, eliminating the existing offset-T intersection.

The on-ramp to northbound I-5 from 5th Avenue NE will not need to be relocated with the final design light rail station configuration, as it was in the preliminary engineering (PE) design configuration and evaluated in the Lynnwood Link Extension Environmental Impact Statement (EIS).

This memorandum compares traffic operations between the final design station configuration and the PE design configuration. The PE design of the intersections along 5th Avenue NE included an unsignalized entrance-only driveway on 5th Avenue NE north of NE 145th Street, a signalized relocated I-5 northbound on-ramp / station exit-only driveway on 5th Avenue NE, and the existing offset-T intersection at NE 148th Street / 5th Avenue NE (see Figure 2).

The Synchro 9 software was used in the preparation of design year (2035) intersection level-of-service (LOS) and delay estimates. The 2035 No-Build Synchro network prepared for the FEIS was used as the basis for this analysis.

Level of service categories for signalized and unsignalized intersections were determined in accordance with the 2010 *Highway Capacity Manual*. For unsignalized intersections, delay and LOS are reported for the poorest movement. The vehicle delay associated with level-of-service is shown in Table 1.

Table 1: Intersection Level-of-Service Criteria

Level of Service	Control Delay* (seconds per vehicle)	
	Signalized	Unsignalized
A	≤10	0 to 10
B	>10 to 20	>10 to 15
C	>20 to 35	>15 to 25
D	>35 to 55	>25 to 35
E	>55 to 80	>35 to 50
F	>80	>50

Source: Transportation Research Board. Highway Capacity Manual 2010. Exhibit 18-4 and Exhibit 19-1.

* Control delay is time spent slowing, stopping, moving up in a queue, and accelerating back to desired speed.

Intersection delay and LOS values for the 2035 AM and PM peak hours are shown in Table 2. The four intersections included in this analysis are: NE 145th Street / 5th Avenue NE, Station Entrance-Only Driveway / 5th Avenue NE (PE design only), I-5 northbound on-ramp / 5th Avenue NE, and NE 148th Street / 5th Avenue NE.

Table 2: Comparison of Final Design and PE Design Level of Service

Intersection	2035 AM Peak Hour		2035 PM Peak Hour	
	Intersection Delay (sec/veh) / Level of Service (LOS)		Intersection Delay (sec/veh) / Level of Service (LOS)	
	Final Design	PE Design	Final Design	PE Design
NE 145th Street / 5th Avenue NE ²	56 / E	56 / E	69 / E	69 / E
Station Enter-Only / 5th Avenue NE	--	12 / B ¹	--	8 / A ¹
NB I-5 On-Ramp / 5th Avenue NE ²	9 / A	80 / E	10 / A	19 / B
NE 148th Street / 5th Avenue NE	21 / C ²	21 / C ¹	28 / C ²	32 / D ¹

Notes:

- 1) Unsignalized intersection control – 5th Avenue NE does not stop
- 2) Signalized intersection control

The configuration of the NE 145th Street / 5th Avenue NE intersection is the same in PE design and final design. This intersection would operate at LOS E in the AM and PM peak hours.

The station entrance-only intersection operated at LOS A or B in the PE design.

The northbound I-5 on-ramp intersection on 5th Avenue NE would operate at an improved level of service with elimination of the station exit-only driveway. This intersection would operate at LOS A in the final design configuration, compared to LOS E in the AM peak and LOS B in the PM peak with the PE design configuration. This intersection operates as a through-T with traffic signal control in the final design configuration, with northbound through traffic only stopping for the east-west pedestrian crossing.

Traffic operations along 5th Avenue NE at the northbound I-5 on-ramp intersection would benefit from signalization. With the existing unsignalized traffic control, queues of northbound left-turning vehicles would extend up to 800 feet and would spill back through the NE 145th Street intersection. With traffic signal control, northbound queue lengths of 210 feet or less would not interfere with traffic operation on NE 145th Street, as

documented for 2035 Baseline and Build Option 2 conditions in the project’s SR 523 (NE 145th Street) Interchange Justification Report.

The west leg of the NE 148th Street / 5th Avenue NE intersection becomes the station driveway in the final design configuration and a traffic signal is added at this intersection. This intersection would operate at LOS C in the final design configuration. In the PE design configuration, the existing two-way stop control (east/west stop control) would remain and the intersection would operate at LOS C in the AM peak and LOS D in the PM peak.

Traffic operations at the northbound I-5 on-ramp intersection would be improved in the final design configuration and operations at the other intersections along 5th Avenue NE would be similar between the final design and PE design configurations.

Figure 1 – Proposed 5th Avenue NE Final Design Configuration

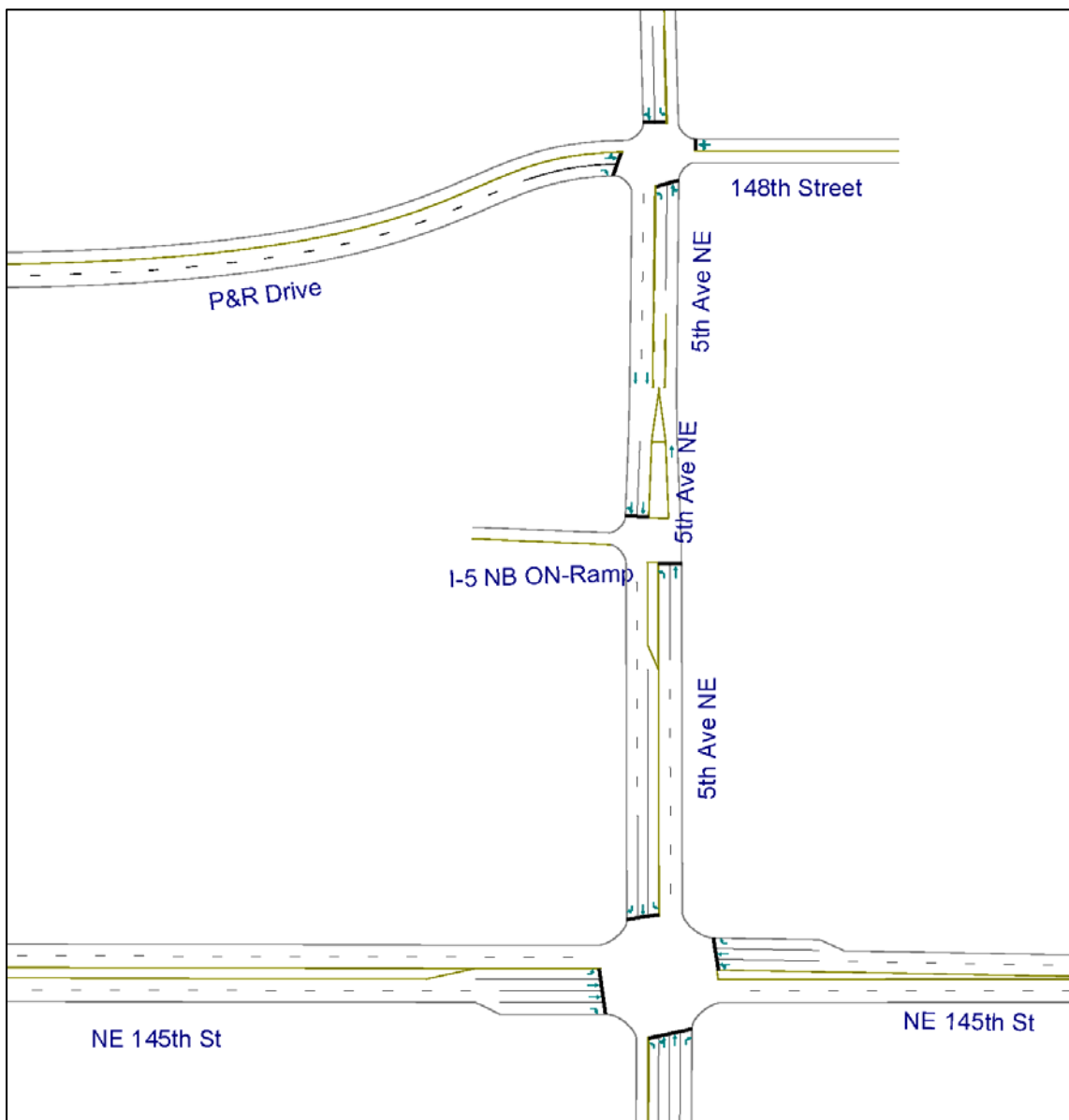
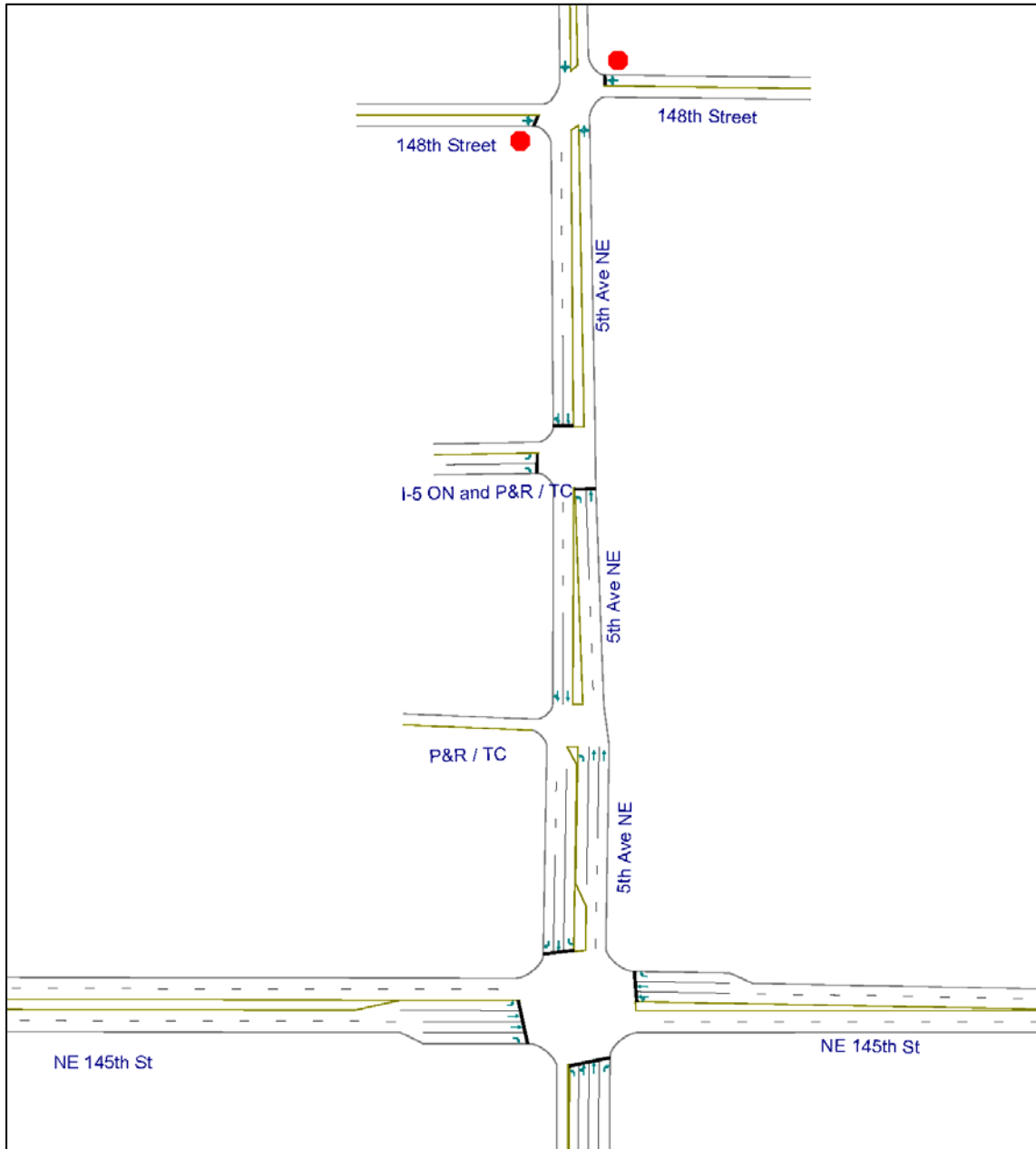


Figure 2 – 5th Avenue NE Preliminary Engineering Design Configuration



2035 AM - P&R Shifted North to 148th St
 2: 5th Ave NE & P&R Drive/148th Street

9/27/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗		↕		↖	↖		↖	↖	
Traffic Volume (vph)	20	5	75	5	5	5	160	255	5	5	700	85
Future Volume (vph)	20	5	75	5	5	5	160	255	5	5	700	85
Satd. Flow (prot)	0	1790	1583	0	1750	0	1734	1820	0	1787	1846	0
Flt Permitted		0.784			0.922		0.098			0.591		
Satd. Flow (perm)	0	1460	1583	0	1640	0	179	1820	0	1112	1846	0
Satd. Flow (RTOR)					5			2				13
Peak Hour Factor	0.80	0.80	0.80	0.95	0.95	0.95	0.80	0.95	0.95	0.95	0.95	0.80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	31	94	0	15	0	200	273	0	5	843	0
Turn Type	Perm	NA	Perm	Perm	NA		D.P+P	NA		D.P+P	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4		4	4			6			2		
Total Split (s)	21.0	21.0	21.0	21.0	21.0		14.0	50.0		9.0	45.0	
Total Lost Time (s)		5.0	5.0		5.0		5.0	5.0		5.0	5.0	
Act Effect Green (s)		12.5	12.5		12.5		54.7	58.9		58.7	45.7	
Actuated g/C Ratio		0.16	0.16		0.16		0.68	0.74		0.73	0.57	
v/c Ratio		0.14	0.38		0.06		0.67	0.20		0.01	0.80	
Control Delay		28.3	33.4		22.1		25.9	2.8		4.4	23.4	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		28.3	33.4		22.1		25.9	2.8		4.4	23.4	
LOS		C	C		C		C	A		A	C	
Approach Delay		32.1			22.1			12.6			23.2	
Approach LOS		C			C			B			C	

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 56 (70%), Referenced to phase 2:NBSB and 6:NBSB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.80
 Intersection Signal Delay: 20.5
 Intersection LOS: C
 Intersection Capacity Utilization 68.6%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 2: 5th Ave NE & P&R Drive/148th Street



2035 AM - P&R Shifted North to 148th St
 525: 5th Ave NE & I-5 NB On-Ramp

9/27/2016



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	Ø4	Ø5
Lane Configurations			↙	↑	↑↑			
Traffic Volume (vph)	0	0	640	420	735	45		
Future Volume (vph)	0	0	640	420	735	45		
Satd. Flow (prot)	0	0	1752	1632	3527	0		
Flt Permitted			0.229					
Satd. Flow (perm)	0	0	422	1632	3527	0		
Satd. Flow (RTOR)					9			
Confl. Peds. (#/hr)			18			18		
Confl. Bikes (#/hr)		1						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95		
Heavy Vehicles (%)	100%	100%	2%	2%	2%	2%		
Bus Blockages (#/hr)	4	4	0	0	0	0		
Parking (#/hr)				3				
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	0	674	442	821	0		
Turn Type			pm+pt	NA	NA			
Protected Phases			4 5	2	6		4	5
Permitted Phases			2					
Total Split (s)				50.0	35.0		30.0	15.0
Total Lost Time (s)				5.0	5.0			
Act Effect Green (s)			77.0	51.5	36.5			
Actuated g/C Ratio			0.96	0.64	0.46			
v/c Ratio			0.68	0.42	0.51			
Control Delay			9.4	9.7	6.6			
Queue Delay			1.6	0.8	0.0			
Total Delay			11.0	10.5	6.6			
LOS			B	B	A			
Approach Delay				10.8	6.6			
Approach LOS				B	A			

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 68 (85%), Referenced to phase 6:SBT, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.68
 Intersection Signal Delay: 9.0
 Intersection LOS: A
 Intersection Capacity Utilization 64.8%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 525: 5th Ave NE & I-5 NB On-Ramp



2035 AM - P&R Shifted North to 148th St
 530: 5th Ave NE & NE 145th St

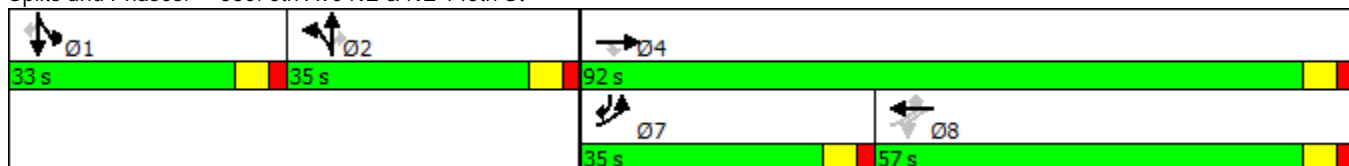
9/27/2016

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	405	635	75	5	840	325	360	330	410	80	235	420
Future Volume (vph)	405	635	75	5	840	325	360	330	410	80	235	420
Satd. Flow (prot)	1728	3575	1599	0	3490	1561	1466	3152	1544	1728	1819	1546
Flt Permitted	0.108				0.951		0.950	0.986		0.950		
Satd. Flow (perm)	196	3575	1544	0	3319	1518	1464	3150	1479	1705	1819	1526
Satd. Flow (RTOR)			61			121			303			61
Confl. Peds. (#/hr)	7		4	4		7	1		11	11		1
Confl. Bikes (#/hr)						1			4			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Shared Lane Traffic (%)							38%					
Lane Group Flow (vph)	426	668	79	0	889	342	235	491	432	84	247	442
Turn Type	D.P+P	NA	Perm	Perm	NA	Perm	Split	NA	Perm	Split	NA	pm+ov
Protected Phases	7	4			8		2	2		1	1	7
Permitted Phases	8		4	8		8			2			1
Total Split (s)	35.0	92.0	92.0	57.0	57.0	57.0	35.0	35.0	35.0	33.0	33.0	35.0
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	75.9	82.0	82.0		46.8	46.8	27.9	27.9	27.9	24.2	24.2	53.4
Actuated g/C Ratio	0.50	0.54	0.54		0.31	0.31	0.18	0.18	0.18	0.16	0.16	0.35
v/c Ratio	1.09	0.35	0.09		0.87	0.62	0.88	0.85	0.83	0.31	0.86	0.76
Control Delay	113.6	20.9	6.2		60.6	34.1	91.9	75.5	33.1	61.1	89.6	30.7
Queue Delay	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.2
Total Delay	113.6	20.9	6.2		60.6	34.1	91.9	75.5	33.1	61.1	93.3	30.9
LOS	F	C	A		E	C	F	E	C	E	F	C
Approach Delay		53.6			53.3			63.0			54.1	
Approach LOS		D			D			E			D	

Intersection Summary

Cycle Length: 160
 Actuated Cycle Length: 152.2
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 1.09
 Intersection Signal Delay: 56.1
 Intersection LOS: E
 Intersection Capacity Utilization 92.3%
 ICU Level of Service F
 Analysis Period (min) 15

Splits and Phases: 530: 5th Ave NE & NE 145th St



2035 PM - P&R Shifted to 148th Street
 1: 5th Ave NE & P&R Drive/148th Street

9/27/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗		↔		↖	↗		↖	↗	
Traffic Volume (vph)	100	5	140	10	5	5	80	810	0	10	205	20
Future Volume (vph)	100	5	140	10	5	5	80	810	0	10	205	20
Satd. Flow (prot)	0	1521	1346	0	1694	0	1734	1825	0	1787	1801	0
Flt Permitted		0.721			0.870		0.575			0.208		
Satd. Flow (perm)	0	1010	913	0	1322	0	893	1825	0	391	1801	0
Satd. Flow (RTOR)					5							7
Confl. Peds. (#/hr)	30		145	145		30	55		70	70		55
Confl. Bikes (#/hr)									15			15
Peak Hour Factor	0.80	0.80	0.80	0.95	0.95	0.95	0.80	0.95	0.95	0.95	0.95	0.80
Heavy Vehicles (%)	20%	2%	20%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	131	175	0	21	0	100	853	0	11	241	0
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4		4	4			2			6		
Total Split (s)	46.0	46.0	46.0	46.0	46.0		9.0	85.0		9.0	85.0	
Total Lost Time (s)		5.0	5.0		5.0		5.0	5.0		5.0	5.0	
Act Effct Green (s)		31.3	31.3		31.3		96.7	95.1		93.7	89.7	
Actuated g/C Ratio		0.22	0.22		0.22		0.69	0.68		0.67	0.64	
v/c Ratio		0.58	0.86		0.07		0.16	0.69		0.04	0.21	
Control Delay		57.4	86.0		32.0		5.7	14.4		8.7	11.9	
Queue Delay		0.0	0.0		0.0		0.0	4.6		0.0	0.0	
Total Delay		57.4	86.0		32.0		5.7	19.0		8.7	11.9	
LOS		E	F		C		A	B		A	B	
Approach Delay		73.8			32.0			17.6			11.8	
Approach LOS		E			C			B			B	

Intersection Summary

Cycle Length: 140
 Actuated Cycle Length: 140
 Offset: 0 (0%), Referenced to phase 2:NBTL, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 28.0
 Intersection LOS: C
 Intersection Capacity Utilization 71.8%
 ICU Level of Service C
 Analysis Period (min) 15

Splits and Phases: 1: 5th Ave NE & P&R Drive/148th Street



2035 PM - P&R Shifted to 148th Street
 530: 5th Ave NE & NE 145th St

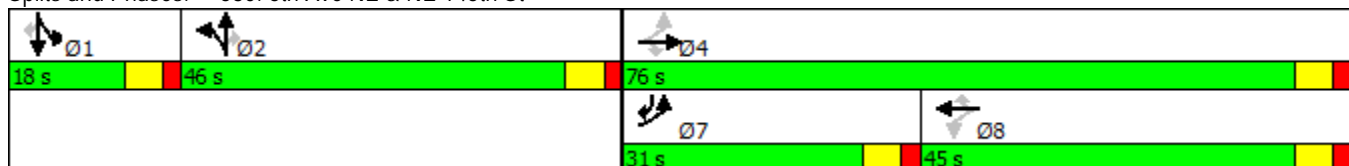
9/27/2016

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	485	810	145	5	755	395	380	670	575	80	100	165
Future Volume (vph)	485	810	145	5	755	395	380	670	575	80	100	165
Satd. Flow (prot)	1762	3646	1631	0	3490	1561	1495	3250	1575	1695	1784	1516
Flt Permitted	0.104				0.949		0.950	0.997		0.950		
Satd. Flow (perm)	193	3646	1553	0	3312	1522	1495	3250	1555	1695	1784	1516
Satd. Flow (RTOR)			88			176			140			98
Confl. Peds. (#/hr)	7		9	9		7						
Confl. Bikes (#/hr)									1			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	1%	1%	1%	4%	4%	4%
Shared Lane Traffic (%)							11%					
Lane Group Flow (vph)	511	853	153	0	800	416	356	749	605	84	105	174
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	Split	NA	Perm	Split	NA	pm+ov
Protected Phases	7	4			8		2	2		1	1	7
Permitted Phases	4		4	8		8			2			1
Total Split (s)	31.0	76.0	76.0	45.0	45.0	45.0	46.0	46.0	46.0	18.0	18.0	31.0
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	68.6	68.6	68.6		37.6	37.6	40.0	40.0	40.0	11.2	11.2	36.3
Actuated g/C Ratio	0.50	0.50	0.50		0.27	0.27	0.29	0.29	0.29	0.08	0.08	0.26
v/c Ratio	1.34	0.47	0.19		0.89	0.77	0.82	0.79	1.10	0.61	0.72	0.37
Control Delay	204.9	23.8	8.9		60.9	36.5	62.7	52.9	103.5	80.6	89.3	11.5
Queue Delay	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	204.9	23.8	8.9		60.9	36.5	62.7	52.9	103.5	80.6	89.3	11.5
LOS	F	C	A		E	D	E	D	F	F	F	B
Approach Delay		83.3			52.6			72.8			50.0	
Approach LOS		F			D			E			D	

















Intersection Summary

Cycle Length: 140
 Actuated Cycle Length: 137.9
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 1.34
 Intersection Signal Delay: 69.3
 Intersection Capacity Utilization 93.4%
 Analysis Period (min) 15
 Intersection LOS: E
 ICU Level of Service F

Splits and Phases: 530: 5th Ave NE & NE 145th St



2035 AM - PE Design
2: 5th Ave NE & 148th Street

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	0	5	5	0	5	5	270	5	5	780	5
Future Volume (Veh/h)	5	0	5	5	0	5	5	270	5	5	780	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			4%			-2%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	0	5	5	0	5	5	284	5	5	821	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								301				
pX, platoon unblocked	0.97	0.97		0.97	0.97	0.97					0.97	
vC, conflicting volume	1135	1132	824	1135	1132	286	826				289	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1125	1123	824	1125	1123	254	826				257	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	97	100	99	97	100	99	99				100	
cM capacity (veh/h)	175	198	373	174	198	764	805				1274	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	10	10	294	831								
Volume Left	5	5	5	5								
Volume Right	5	5	5	5								
cSH	238	283	805	1274								
Volume to Capacity	0.04	0.04	0.01	0.00								
Queue Length 95th (ft)	3	3	0	0								
Control Delay (s)	20.8	18.2	0.2	0.1								
Lane LOS	C	C	A	A								
Approach Delay (s)	20.8	18.2	0.2	0.1								
Approach LOS	C	C										
Intersection Summary												
Average Delay			0.5									
Intersection Capacity Utilization			54.0%		ICU Level of Service					A		
Analysis Period (min)			15									

2035 AM - PE Design
 520: 5th Ave NE & I-5 ON and P&R / TC

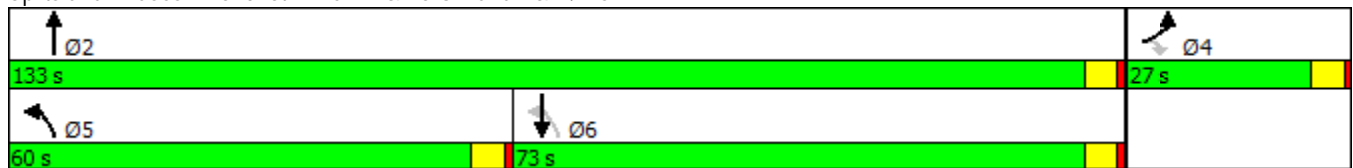


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	20	75	640	260	745	45
Future Volume (vph)	20	75	640	260	745	45
Satd. Flow (prot)	1719	1538	1752	1783	1798	0
Flt Permitted	0.950		0.059			
Satd. Flow (perm)	1719	1538	109	1783	1798	0
Satd. Flow (RTOR)		79			2	
Confl. Peds. (#/hr)			12			12
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	2%	2%	2%	2%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	21	79	674	274	831	0
Turn Type	Prot	Perm	D.P+P	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4	6			
Total Split (s)	27.0	27.0	60.0	133.0	73.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	
Act Effect Green (s)	15.7	15.7	123.3	128.3	68.2	
Actuated g/C Ratio	0.10	0.10	0.80	0.83	0.44	
v/c Ratio	0.12	0.35	1.00	0.18	1.04	
Control Delay	62.6	16.1	77.1	3.4	85.1	
Queue Delay	0.0	0.0	34.9	0.0	0.0	
Total Delay	62.6	16.1	112.0	3.4	85.1	
LOS	E	B	F	A	F	
Approach Delay	25.9			80.6	85.1	
Approach LOS	C			F	F	

Intersection Summary

Cycle Length: 160	
Actuated Cycle Length: 154	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 79.7	Intersection LOS: E
Intersection Capacity Utilization 95.8%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 520: 5th Ave NE & I-5 ON and P&R / TC



2035 AM - PE Design
 525: 5th Ave NE & P&R / TC



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	160	900	735	85
Future Volume (Veh/h)	0	0	160	900	735	85
Sign Control	Stop			Free	Free	
Grade	0%			2%	-2%	
Peak Hour Factor	0.95	0.95	0.80	0.95	0.95	0.80
Hourly flow rate (vph)	0	0	200	947	774	106
Pedestrians	18					
Lane Width (ft)	0.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (ft)				298	301	
pX, platoon unblocked						
vC, conflicting volume	1718	458	898			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1718	458	898			
tC, single (s)	8.8	8.9	4.1			
tC, 2 stage (s)						
tF (s)	4.5	4.3	2.2			
p0 queue free %	100	100	73			
cM capacity (veh/h)	21	350	752			
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	
Volume Total	200	474	474	516	364	
Volume Left	200	0	0	0	0	
Volume Right	0	0	0	0	106	
cSH	752	1700	1700	1700	1700	
Volume to Capacity	0.27	0.28	0.28	0.30	0.21	
Queue Length 95th (ft)	27	0	0	0	0	
Control Delay (s)	11.5	0.0	0.0	0.0	0.0	
Lane LOS	B					
Approach Delay (s)	2.0			0.0		
Approach LOS						
Intersection Summary						
Average Delay	1.1					
Intersection Capacity Utilization	38.7%			ICU Level of Service	A	
Analysis Period (min)	15					

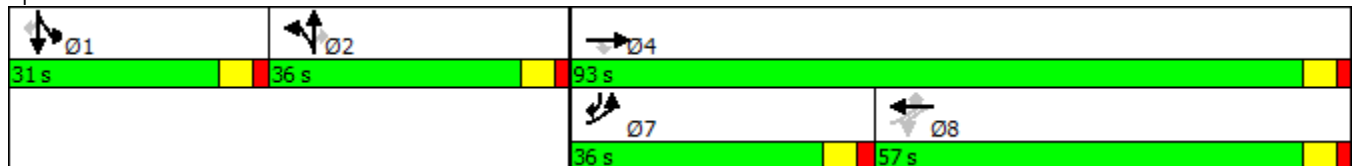
2035 AM - PE Design
 530: 5th Ave NE & NE 145th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	405	635	75	5	840	325	360	330	410	80	235	420
Future Volume (vph)	405	635	75	5	840	325	360	330	410	80	235	420
Satd. Flow (prot)	1728	3575	1599	0	3490	1561	1466	3152	1544	1728	1819	1546
Flt Permitted	0.107				0.951		0.950	0.986		0.950		
Satd. Flow (perm)	195	3575	1544	0	3319	1518	1464	3150	1479	1705	1819	1526
Satd. Flow (RTOR)			61			121			293			61
Confl. Peds. (#/hr)	7		4	4		7	1		11	11		1
Confl. Bikes (#/hr)						1			4			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Shared Lane Traffic (%)							38%					
Lane Group Flow (vph)	426	668	79	0	889	342	235	491	432	84	247	442
Turn Type	D.P+P	NA	Perm	Perm	NA	Perm	Split	NA	Perm	Split	NA	pm+ov
Protected Phases	7	4			8		2	2		1	1	7
Permitted Phases	8		4	8		8			2			1
Total Split (s)	36.0	93.0	93.0	57.0	57.0	57.0	36.0	36.0	36.0	31.0	31.0	36.0
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	77.2	83.3	83.3		47.1	47.1	28.7	28.7	28.7	23.5	23.5	53.7
Actuated g/C Ratio	0.50	0.54	0.54		0.31	0.31	0.19	0.19	0.19	0.15	0.15	0.35
v/c Ratio	1.07	0.34	0.09		0.88	0.62	0.86	0.84	0.84	0.32	0.89	0.77
Control Delay	107.3	20.6	6.0		61.3	34.4	89.5	74.1	34.8	62.9	95.6	31.7
Queue Delay	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	107.3	20.6	6.0		61.3	34.4	89.5	74.1	34.8	62.9	95.6	31.7
LOS	F	C	A		E	C	F	E	C	E	F	C
Approach Delay		51.1			53.8			62.6			55.5	
Approach LOS		D			D			E			E	

Intersection Summary

Cycle Length: 160
 Actuated Cycle Length: 153.6
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 1.07
 Intersection Signal Delay: 55.7
 Intersection LOS: E
 Intersection Capacity Utilization 92.3%
 ICU Level of Service F
 Analysis Period (min) 15

Splits and Phases: 530: 5th Ave NE & NE 145th St



2035 PM - PE Design
1: 5th Ave NE & 148th Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	5	0	5	10	0	5	5	905	0	10	220	5
Future Volume (Veh/h)	5	0	5	10	0	5	5	905	0	10	220	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			4%			-2%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	0	5	11	0	5	5	953	0	11	232	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								390				
pX, platoon unblocked	0.61	0.61		0.61	0.61	0.61				0.61		
vC, conflicting volume	1224	1220	234	1224	1222	953	237			953		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1047	1039	234	1047	1043	600	237			600		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	100	99	91	100	98	100			98		
cM capacity (veh/h)	121	137	805	122	136	304	1330			594		
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	10	16	958	248								
Volume Left	5	11	5	11								
Volume Right	5	5	0	5								
cSH	211	151	1330	594								
Volume to Capacity	0.05	0.11	0.00	0.02								
Queue Length 95th (ft)	4	9	0	1								
Control Delay (s)	22.9	31.7	0.1	0.7								
Lane LOS	C	D	A	A								
Approach Delay (s)	22.9	31.7	0.1	0.7								
Approach LOS	C	D										
Intersection Summary												
Average Delay			0.8									
Intersection Capacity Utilization			59.4%		ICU Level of Service					B		
Analysis Period (min)			15									

2035 PM - PE Design
 520: 5th Ave NE & I-5 ON and P&R / TC

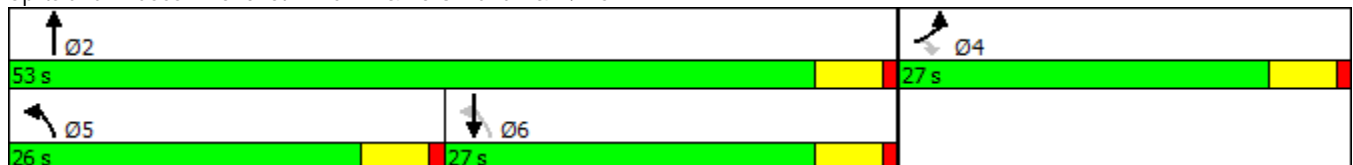


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	100	140	660	810	225	10
Future Volume (vph)	100	140	660	810	225	10
Satd. Flow (prot)	1685	1508	1752	1783	3431	0
Flt Permitted	0.950		0.598			
Satd. Flow (perm)	1685	1508	1103	1783	3431	0
Satd. Flow (RTOR)		147			6	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Shared Lane Traffic (%)						
Lane Group Flow (vph)	105	147	695	853	248	0
Turn Type	Prot	Perm	D.P+P	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4	6			
Total Split (s)	27.0	27.0	26.0	53.0	27.0	
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	
Act Effect Green (s)	12.8	12.8	33.1	38.4	12.8	
Actuated g/C Ratio	0.21	0.21	0.54	0.62	0.21	
v/c Ratio	0.30	0.34	0.86	0.77	0.35	
Control Delay	24.3	7.0	23.8	15.8	22.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	24.3	7.0	23.8	15.8	22.4	
LOS	C	A	C	B	C	
Approach Delay	14.2			19.4	22.4	
Approach LOS	B			B	C	

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 61.8
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 19.1
 Intersection Capacity Utilization 61.4%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service B

Splits and Phases: 520: 5th Ave NE & I-5 ON and P&R / TC



2035 PM - PE Design
 525: 5th Ave NE & P&R / TC



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	80	1470	345	20
Future Volume (Veh/h)	0	0	80	1470	345	20
Sign Control	Stop			Free	Free	
Grade	4%			2%	-2%	
Peak Hour Factor	0.95	0.95	0.80	0.95	0.95	0.80
Hourly flow rate (vph)	0	0	100	1547	363	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)				299	299	
pX, platoon unblocked	0.82	0.96	0.96			
vC, conflicting volume	1349	194	388			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	787	81	283			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	92			
cM capacity (veh/h)	249	925	1227			
Direction, Lane #	NB 1	NB 2	NB 3	SB 1	SB 2	
Volume Total	100	774	774	242	146	
Volume Left	100	0	0	0	0	
Volume Right	0	0	0	0	25	
cSH	1227	1700	1700	1700	1700	
Volume to Capacity	0.08	0.46	0.46	0.14	0.09	
Queue Length 95th (ft)	7	0	0	0	0	
Control Delay (s)	8.2	0.0	0.0	0.0	0.0	
Lane LOS	A					
Approach Delay (s)	0.5			0.0		
Approach LOS						
Intersection Summary						
Average Delay	0.4					
Intersection Capacity Utilization	44.0%			ICU Level of Service	A	
Analysis Period (min)	15					

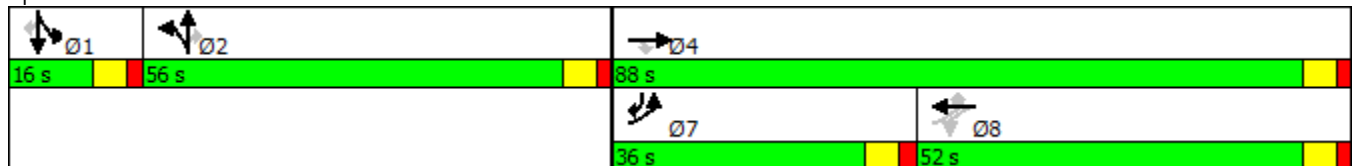
2035 PM - PE Design
 530: 5th Ave NE & NE 145th St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	485	810	145	5	755	395	380	670	575	80	100	165
Future Volume (vph)	485	810	145	5	755	395	380	670	575	80	100	165
Satd. Flow (prot)	1762	3646	1631	0	3490	1561	1495	3250	1575	1695	1784	1516
Flt Permitted	0.118				0.949		0.950	0.997		0.950		
Satd. Flow (perm)	219	3646	1546	0	3311	1519	1495	3250	1555	1695	1784	1516
Satd. Flow (RTOR)			79			156			123			
Confl. Peds. (#/hr)	7		9	9		7						
Confl. Bikes (#/hr)									1			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	1%	1%	1%	4%	4%	4%
Shared Lane Traffic (%)							11%					
Lane Group Flow (vph)	511	853	153	0	800	416	356	749	605	84	105	174
Turn Type	D.P+P	NA	Perm	Perm	NA	Perm	Split	NA	Perm	Split	NA	pm+ov
Protected Phases	7	4			8		2	2		1	1	7
Permitted Phases	8		4	8		8			2			1
Total Split (s)	36.0	88.0	88.0	52.0	52.0	52.0	56.0	56.0	56.0	16.0	16.0	36.0
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	73.5	79.5	79.5		43.5	43.5	50.0	50.0	50.0	10.0	10.0	40.0
Actuated g/C Ratio	0.47	0.50	0.50		0.28	0.28	0.32	0.32	0.32	0.06	0.06	0.25
v/c Ratio	1.29	0.46	0.19		0.88	0.78	0.75	0.73	1.05	0.79	0.93	0.37
Control Delay	187.0	26.2	10.5		66.1	43.5	60.0	52.9	91.2	115.1	139.4	10.7
Queue Delay	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	187.0	26.2	10.5		66.1	43.5	60.0	52.9	91.2	115.1	139.4	10.7
LOS	F	C	B		E	D	E	D	F	F	F	B
Approach Delay		78.8			58.4			68.0			72.1	
Approach LOS		E			E			E			E	

Intersection Summary

Cycle Length: 160
 Actuated Cycle Length: 157.5
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 1.29
 Intersection Signal Delay: 69.3
 Intersection Capacity Utilization 93.4%
 Analysis Period (min) 15
 Intersection LOS: E
 ICU Level of Service F

Splits and Phases: 530: 5th Ave NE & NE 145th St



Attachment H

Cross Section of Alignment Shift at I-5 Crossing

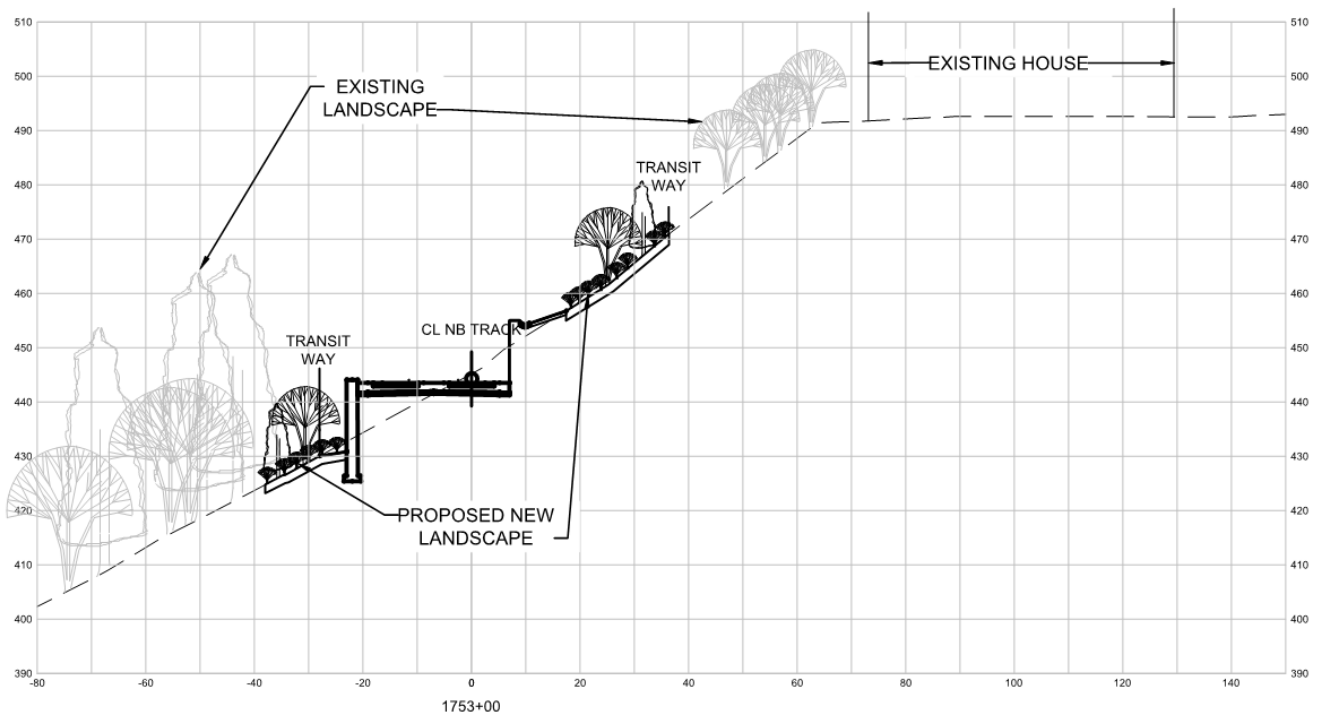
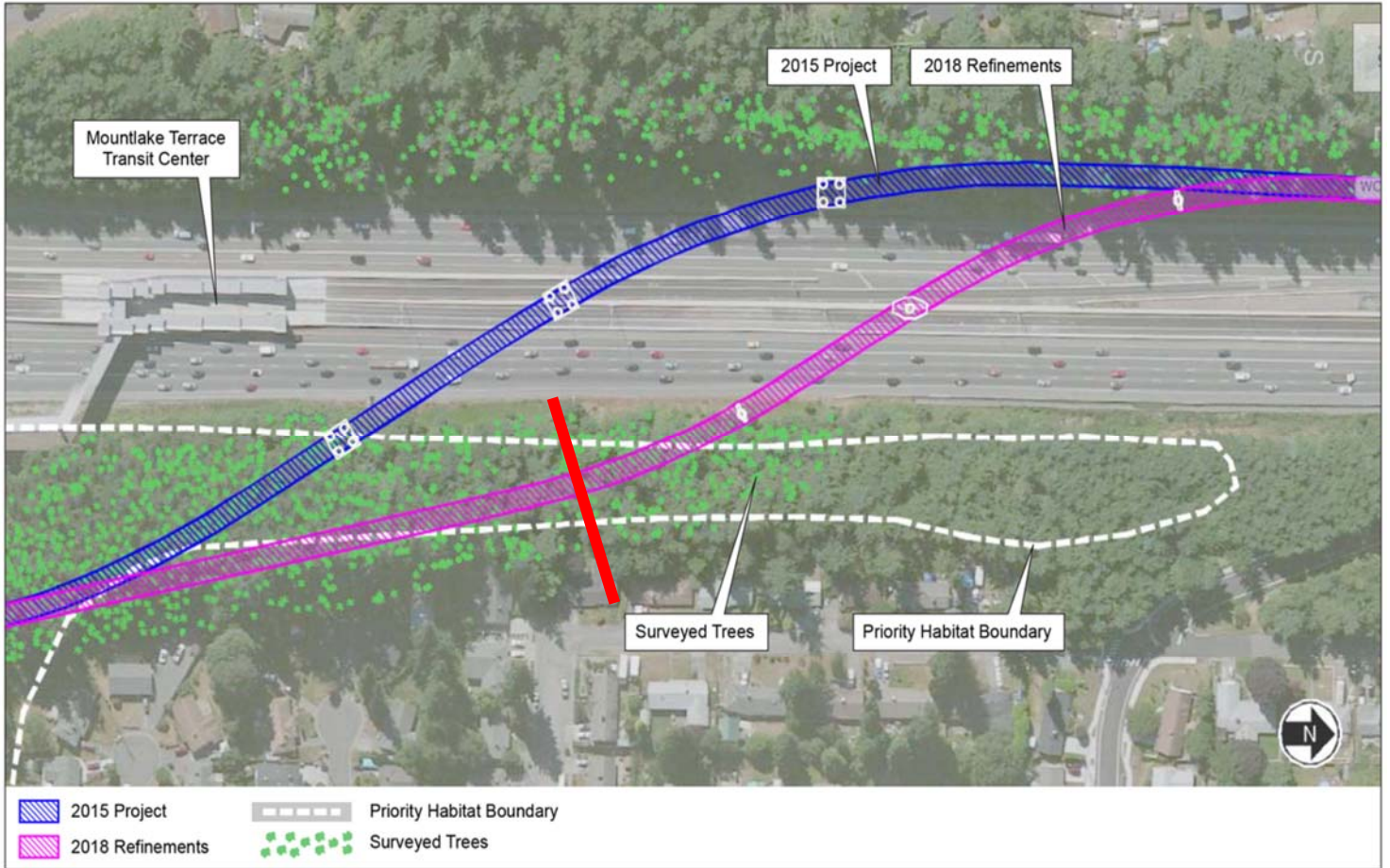


This page intentionally left blank.

Attachment H:

Cross section of 2018 Refinement : Alignment Shift of I-5 Crossing

Below are two figures: 1) the shift of alignment and location of the cut and 2) an illustration of the cross section.



This page intentionally left blank.