Point Defiance Bypass Project

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Point Defiance Greenfield Alternative Technical Memorandum

March 2011

Washington State
Department of Transportation

Executive Summary

Purpose of the Technical Memorandum

The intent of a technical memorandum is to capture the reasons why an alternative should or should not be carried forward for analysis in a project's environmental documentation.

The purpose of this technical memorandum is to:

- Evaluate the Greenfield Alternative's practicality and feasibility from a technical, economic, and environmental standpoint under the Federal Rail Administration's (FRA) National Environmental Protection Act (NEPA) regulations; and
- Determine whether the Greenfield Alternative will be carried forward for further evaluation in the Point Defiance Bypass Project (the project) Environmental Assessment.

WSDOT staff, which consists of a multi-discipline team assigned to the production of the project, has attempted to give as thorough of an analysis as required to achieve an impartial review. The projected or predicted impacts of this alternative have been measured against the baseline (the existing facility and surroundings, assuming the project is not built). This technical memorandum summarizes WSDOT's review and is based upon information located in the WSDOT State Rail and Marine/ American Recovery and Reinvestment Act (ARRA) Cascades High Speed Program Office.

Point Defiance Bypass: Purpose and Need

The purpose of the project is to provide more frequent high-speed intercity passenger rail service between Tacoma and Nisqually. This project addresses the deficiencies in the existing rail alignment around Point Defiance. The project needs are to enhance rail service frequency, reliability, efficiency, and to improve safety. The existing alignment is near capacity and is therefore unable to accommodate additional high-speed intercity passenger rail service without substantial improvements. In addition, the existing alignment has physical and operational constraints that adversely affect both passenger and freight train scheduling and reliability.

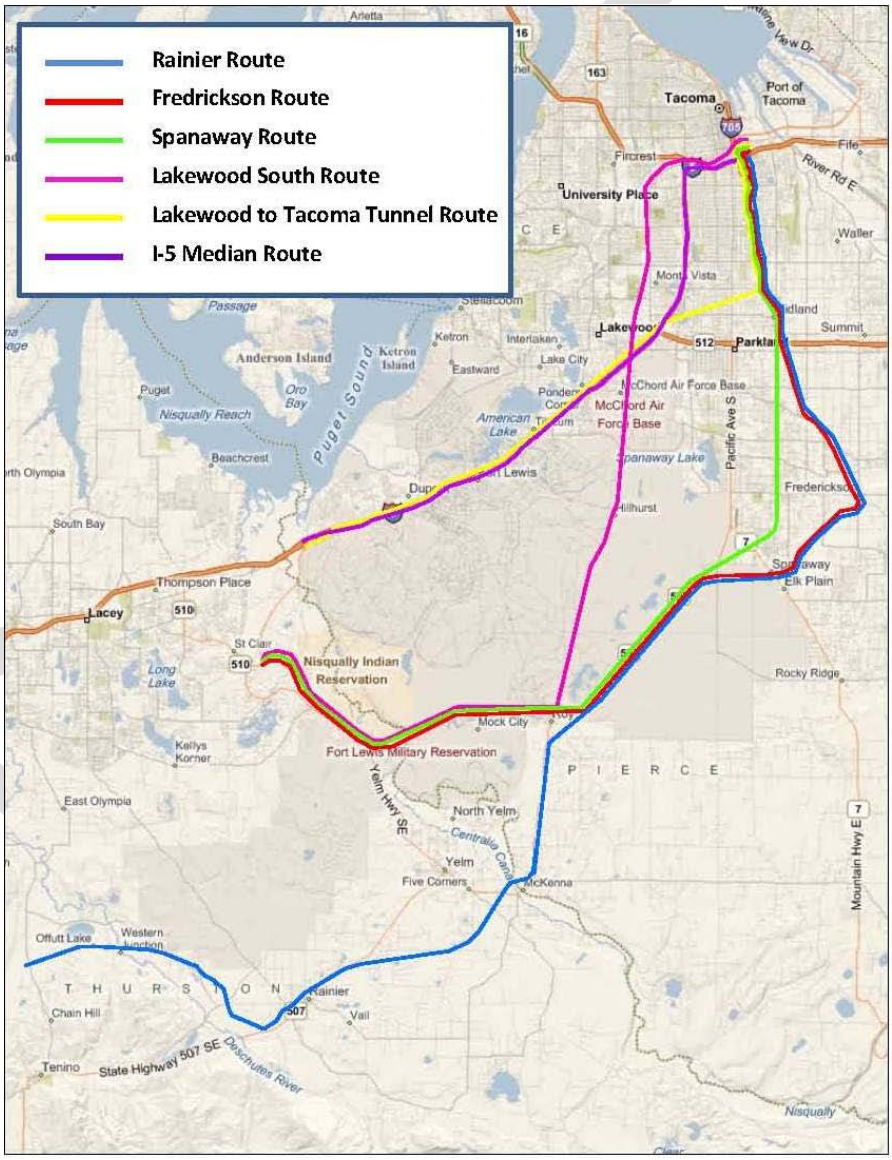
Specific elements of the project needs include:

- Enhanced frequency: Increase Amtrak *Cascades* round-trips from four to six by 2015 in order to meet projected service demands.
- Improved reliability: Improve reliability by reducing or eliminating passenger rail service interruptions caused by natural factors (e.g., landslides) or operational limitations (e.g., drawbridge closures).
- Enhanced efficiency: Enhance the efficient movement of people by reducing the amount of time passenger and freight trains spend yielding to other freight movements.

- Improved safety: At-grade crossings will be constructed with improved safety features including wayside horns, median barriers, pre-signals, and traffic signal improvements.

Description of Project Alternatives

Six variations of the Greenfield Alternative were analyzed and are shown on the below figure.



Greenfield Alternative - Lakewood South Route

The Greenfield Alternative – Lakewood South route would construct a new alignment and reconstruct an existing route. This alternative leaves the BNSF main northeast of the Olympia/Lacey station, travels east on a new alignment to just north of Roy, then turns north and follows the existing BNSF route to Lakewood and continues on the baseline route to the Freighthouse Square vicinity.

Greenfield Alternative - Spanaway Route

The Greenfield Alternative – Spanaway route would construct a new alignment and reconstruct an existing route. This alternative leaves the BNSF main northeast of the Olympia/Lacey station, travels east on a new alignment to just north of Roy, then turns northeast and follows the existing Tacoma Rail Mount Division route to just south of the junction of State Highway 507 and State Highway 7. The alignment then travels north on a new alignment through the Spanaway/Brookdale area to a point where the Tacoma Rail Mount Division line passes over State Highway 512 where it rejoins the existing rail line to the Freighthouse Square vicinity.

Greenfield Alternative - Fredrickson Route

The Greenfield Alternative – Fredrickson route would construct a new alignment and reconstruct an existing route. This alternative leaves the BNSF main northeast of the Olympia/Lacey station, travels east on a new alignment to just north of Roy, then turns northeast and follows the existing Tacoma Rail Mount Division route over State Highway 507 and on to Fredrickson. The existing alignment then turns and follows the existing Tacoma Rail Mount Division route north – northwest to the Freighthouse Square vicinity.

Greenfield Alternative - Rainier Route

The Greenfield Alternative – Rainier route would reconstruct an existing route. This alternative leaves the BNSF main near Offutt Lake (south of Olympia/Lacey station) and follows the existing Tacoma Rail Mount Division route through Rainier, McKenna, and Roy paralleling State Highway 507, over State Highway 507, and on to Fredrickson. The existing alignment then turns and follows the existing Tacoma Rail Mount Division route north – northwest to the Freighthouse Square vicinity.

Greenfield Alternative – Lakewood to Tacoma Tunnel Route

The Greenfield Alternative – Lakewood to Tacoma tunnel route would construct a new alignment through a new tunnel and reconstruct an existing route. This alternative follows the Pt. Defiance Bypass route from Nisqually to Lakewood, then leaves the BNSF main near Lakewood, travels northeast on a new alignment through a 39' diameter, approximate 4 mile long tunnel to north of Midland, then turns north and follows the existing Tacoma Rail Mount Division route north – northwest to the Freighthouse Square vicinity.

I-5 Median Route

The I-5 median route would construct a new alignment in the median of I-5 between Tacoma and Nisqually. The route would be approximately 18 miles. The existing median width varies between 13' and 300'. The majority of the median varies between 20' to 40'. There is a two mile section in the vicinity of the I-5/41st Division Dr. S. interchange that is approximately 60' wide. There is also a 2.5 mile section at the most southern end of the route that varies between 55' and 300'. An approximate 60' median would be required to construct the new alignment.

Conclusion

Greenfield Alternative Routes that Meet the Project Purpose and Need, Yet Have Significant Technical, Economic, and/or Environmental Barriers

Although the **Lakewood South route** and **Spanaway route** can meet the project purpose and need, they introduce the following challenges and obstacles:

- Acquisition of a significant amount of right of way including residential properties, commercial properties, the Nisqually Indian Reservation, the Joint Base Lewis McChord (JBLM), cities, and others.
- Feasibility of acquiring right of way through JBLM is unknown.
- 1 mile long bridge required over the Nisqually River Valley
- Potential impacts to water quality and watersheds
- Significant impacts to socioeconomic resources

The **Lakewood to Tacoma tunnel route** can also meet the project purpose and need. However, this route introduces the following challenges and obstacles:

- Construction of a 4 mile long tunnel includes risks such as the suitability of the soil, the condition of the structures and buildings above the proposed tunnel alignment, acquiring the right of way needed, and the significant costs. These are only a small portion of the risks included with a tunnel of this size.
- Potential impacts to water quality and watersheds
- Significant impacts to socioeconomic resources

Between 0.8 acre (Tacoma tunnel route) and 6.6 acres (Spanaway route) of wetlands may be impacted by the Greenfield Alternative. Assuming that all the wetlands rated as a Category I *(i.e., highest-functioning wetlands)*, the mitigation cost could range from approximately $0.6 million[1] to $10.2 million.[2,3,4,5] Permits from multiple jurisdictions would likely take a year or longer to acquire.

[1] The lower cost scenario at a 3:1 creation/restoration ratio
[2] Creation/restoration ratios are determined by the US Army Corps of Engineers if a Section 404 Individual Permit is issued
[3] These totals do not include real estate acquisition costs
[4] These costs do not include the area required for the buffer
[5] The higher cost scenario at a 6:1 creation/restoration ratio

The Greenfield Alternative is within the Central Pierce County sole source aquifer,[6] the Pierce County critical aquifer recharge area,[7] and is in proximity to wellhead protection areas.[8] Federal funds may not be spent unless a project avoids any violation of federal or state drinking water regulations.

Several publicly owned parks would be impacted; and prehistoric and historic archaeological sites/resources that may be eligible for the National Register of Historic Places (NRHP) would potentially be impacted. These resources are protected under Section 4(f), 49 U.S.C. 303, of the Department of Transportation Act. Section 4(f) resources cannot be impacted if a feasible and prudent alternative exists that would avoid Section 4(f) resources.

Greenfield Alternative Routes that Do Not Meet the Project Purpose and Need

The **Fredrickson route** and the **Rainier route** are not viable options since they do not decrease travel times; therefore, not meeting the project purpose and need. The **Rainier route** also requires relocating the Lacey station, which is not consistent with Amtrak's performance objectives for the larger Pacific Northwest rail corridor.

The **I-5 median route** is not a viable option due to the limited median width throughout the majority of the route. Due to the limited amount of space, this alternative was not investigated any further.

Recommendation

Staff's recommendation is that the Greenfield Alternative be **considered and eliminated** from further consideration.

WSDOT staff considers this alternative both impractical and unfeasible from a technical, economic, and environmental standpoint, and will describe it as such in the project Environmental Assessment (EA). Because of the Greenfield Alternative's technical and environmental constraints and its high cost, WSDOT does not intend to study this alternative in detail within the project's EA, unless new information becomes available that would change these findings.

The Greenfield Alternative has more potentially significant impacts than the bypass alternative, while the bypass alternative has fewer potentially significant impacts, and better fulfills the project's purpose and need. Project characteristics evaluated under the *Engineering and Feasibility* and *Environmental Impacts* sections of this technical memorandum present the reasons for recommending the elimination of this alternative.

[6] Designated by the US Environmental Protection Agency
[7] Designated by a city or county under the Growth Management Act
[8] Group A systems (Washington State Department of Health) serving 15 or more residential connections, or 25 or more people per day for 60 days or more per year

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Introduction

Purpose of the Technical Memorandum

The intent of a technical memorandum is to capture the reasons why an alternative should or should not be carried forward for analysis in a project's environmental documentation.

The Federal Rail Administration's (FRA) National Environmental Protection Act (NEPA) regulations state that the process of considering environmental impacts "should begin by identifying all reasonable alternatives to the proposed action, including 'no action' and including mitigation measures not incorporated into the design of the proposed action." The Council on Environmental Quality describes "reasonable" alternatives as:

> Reasonable alternatives include those that are practical or feasible from the technical or economic standpoint and using common sense rather than simply desirable from the standpoint of the applicant.
>
> *"Forty Most Asked Questions Concerning CEQ's NEPA Regulations"*

NEPA regulations go on to state "It is entirely proper that the number of alternatives being considered should decrease as the environmental consideration process proceeds and as analysis reveals that certain alternatives would in fact be unreasonable." For alternatives eliminated from further study, a project's environmental documentation must "briefly discuss the reasons for their having been eliminated" [Council on Environmental Quality Regulations, Sec. 1502.14(a)]. Accordingly, this technical memorandum will be appended to the Point Defiance Bypass Project's (the project) Environmental Assessment (EA) and become a part of the permanent project record.

The purpose of this technical memorandum is to:

- Evaluate the Greenfield Alternative's practicality and feasibility from a technical, economic, and environmental standpoint under NEPA regulations; and
- Determine whether the Greenfield Alternative will be carried forward for further evaluation in the project EA.

WSDOT staff, which consists of a multi-discipline team assigned to the production of this project, has attempted to give as thorough of an analysis as required to achieve an impartial review. The projected or predicted impacts of this alternative have been measured against the baseline (the existing facility and surroundings, assuming the project is not built). The following information summarizes this review and is based upon information located in the WSDOT State Rail and Marine/American Recovery and Reinvestment Act (ARRA) Cascades High Speed Program Office.

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The purpose of the project is to provide more frequent high-speed intercity passenger rail service between Tacoma and Nisqually. This project addresses the deficiencies in the existing rail alignment around Point Defiance. The project needs are to enhance rail service frequency, reliability, efficiency, and to improve safety. The existing alignment is near capacity and is therefore unable to accommodate additional high-speed intercity passenger rail service without substantial improvements. In addition, the existing alignment has physical and operational constraints that adversely affect both passenger and freight train scheduling and reliability.

Specific elements of the project needs include:

- Enhanced frequency: Increase Amtrak *Cascades* round-trips from four to six by 2015 in order to meet projected service demands.
- Enhanced efficiency: Enhance the efficient movement of people by reducing the amount of time passenger and freight trains spend yielding to other freight movements.
- Improved reliability: Improve reliability by reducing or eliminating passenger rail service interruptions caused by natural factors (e.g., landslides) or operational limitations (e.g., drawbridge closures).
- Improved safety: Construction of at-grade crossings with improved safety features including wayside horns, median barriers, pre-signals, and traffic signal improvements.

Description of Greenfield Alternative

During the project's October 2010 Technical Advisory Group (TAG) meeting, the TAG brainstormed a rough alignment (the Greenfield Alternative). Based on suggestions by TAG members following the meeting and additional research, WSDOT staff developed several variations of the rough alignment for analysis in this technical memorandum. The following six routes were analyzed as part of the Greenfield Alternative. See Appendix B for the location of the routes.

<u>Greenfield Alternative - Lakewood South Route</u>

The Greenfield Alternative – Lakewood South route would construct a new alignment and reconstruct an existing route. This alternative leaves the BNSF main northeast of the Olympia/Lacey station, travels east on a new alignment to just north of Roy, then turns north and follows the existing BNSF route to Lakewood and continues on the baseline route to the Freighthouse Square vicinity.

The route is approximately 29 miles with 10 miles of track on a new alignment and 10 miles of reconstruction of the existing alignment. The overall route would be single track with a 4 mile long segment of double track required between Roy and Lakewood. The 10 miles of reconstruction includes subballast, ballast, concrete ties, and

continuously welded rail. Two existing curves slightly over 2 degrees totally about 0.4 mile would need to be realigned to 2 degrees or less. Two public at-grade crossings between Roy and Lakewood would be upgraded with new flashing lights and gates.

Included with the improvements would be new track, new connections to the BNSF main, rebuilding track, centralized traffic control, grade crossings, Nisqually River Valley bridge, and other miscellaneous items.

This alternative would require right of way acquisition and residential relocations.

Greenfield Alternative - Spanaway Route

The Greenfield Alternative – Spanaway route would construct a new alignment and reconstruct an existing route. This alternative leaves the BNSF main northeast of the Olympia/Lacey station, travels east on a new alignment to just north of Roy, then turns northeast and follows the existing Tacoma Rail Mount Division route to just south of the junction of State Highway 507 and State Highway 7. The alignment then travels north on a new alignment through the Spanaway/Brookdale area to a point where the Tacoma Rail Mount Division line passes over State Highway 512 where it rejoins the existing rail line to the Freighthouse Square vicinity.

The route is approximately 30 miles with 19 miles of track on a new alignment and 11 miles of reconstruction of the existing alignment. The overall route would be single track with a 4 mile long segment of double track required somewhere in the vicinity of the new segment through the Spanaway/Brookdale area. The 11 miles of reconstruction includes subballast, ballast, concrete ties, and continuously welded rail. Ten existing curves, as sharp as 6 degrees, and totaling about 1.7 miles would need to be realigned to 2 degrees or less. Twenty-four (24) public at-grade crossings would be upgraded with new flashing lights and gates.

Included with the improvements would be new track, new connections to the BNSF main, rebuilding track, centralized traffic control, grade crossings, Nisqually River Valley bridge, and other miscellaneous items.

This alternative would require right of way acquisition, residential relocations, and commercial relocation.

Greenfield Alternative - Fredrickson Route

The Greenfield Alternative – Fredrickson route would construct a new alignment and reconstruct an existing route. This alternative leaves the BNSF main northeast of the Olympia/Lacey station, travels east on a new alignment to just north of Roy, then turns northeast and follows the existing Tacoma Rail Mount Division route over State Highway 507 and on to Fredrickson. The existing alignment then turns and follows the existing Tacoma Rail Mount Division route north – northwest to the Freighthouse Square vicinity.

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The route is approximately 32.5 miles with 10.5 miles of track on a new alignment and 22 miles of reconstruction of the existing alignment. The overall route would be single track with a 4 mile long segment of double track required somewhere between Fredrickson and State Highway 512. The 10.5 miles of reconstruction includes subballast, ballast, concrete ties, and continuously welded rail. Fifteen (15) existing curves, as sharp as 6 degrees, and totaling about 2.9 miles would need to be realigned to 2 degrees or less. Thirty-three (33) public at-grade crossings would be upgraded with new flashing lights and gates.

Included with the improvements would be new track, new connections to the BNSF main, rebuilding track, centralized traffic control, grade crossings, Nisqually River Valley bridge, and other miscellaneous items.

This alternative would require right of way acquisition and residential relocations.

Greenfield Alternative - Rainier Route

The Greenfield Alternative – Rainier route would reconstruct an existing route. This alternative leaves the BNSF main near Offutt Lake (south of Olympia/Lacey station), which is not consistent with Amtrak's service objectives for the rail corridor. This alternative then follows the existing Tacoma Rail Mount Division route through Rainier, McKenna, and Roy paralleling State Highway 507, over State Highway 507, and on to Fredrickson. The existing alignment then turns and follows the existing Tacoma Rail Mount Division route north – northwest to the Freighthouse Square vicinity.

The route is approximately 44 miles. The overall route would be single track with a 4 mile long segment of double track required somewhere between Fredrickson and State Highway 512 and another 4 mile long segment between Rainier and Yelm. The reconstruction includes subballast, ballast, concrete ties, and continuously welded rail. Fifteen (15) existing curves, as sharp as 6 degrees, and totaling about 2.9 miles would need to be realigned to 2 degrees or less. Forty-six (46) public at-grade crossings would be upgraded with new flashing lights and gates.

Included with the improvements would be new track, rebuilding track, centralized traffic control, grade crossings, and other miscellaneous items.

Greenfield Alternative – Lakewood to Tacoma Tunnel Route

The Greenfield Alternative – Lakewood to Tacoma tunnel route would construct a new alignment through a new tunnel and reconstruct an existing route. This alternative follows the Pt. Defiance bypass route from Nisqually to Lakewood, then leaves the BNSF main near Lakewood, travels northeast on a new alignment through a 39' diameter, approximate 4-mile long tunnel to north of Midland, then turns north and follows the existing Tacoma Rail Mount Division route north – northwest to the Freighthouse Square vicinity.

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The route is approximately 32.5 miles with 4.1 miles of track on a new alignment and 28.4 miles of reconstruction of the existing alignment. The overall route would be single track with a 4 mile long segment of double track required through the tunnel. The reconstruction includes subballast, ballast, concrete ties, and continuously welded rail. Ten existing curves, as sharp as 6 degrees, and totaling about 1.7 miles would need to be realigned to 2 degrees or less. Twenty-four (24) public at-grade crossings would be upgraded with new flashing lights and gates.

Included with the improvements would be new track, new connections to the BNSF main, rebuilding track, centralized traffic control, grade crossings, new tunnel, and other miscellaneous items.

This alternative would require right of way acquisition, residential relocations, and commercial relocations.

<u>I-5 Median Route</u>

The I-5 median route would construct a new alignment in the median of I-5 between Tacoma and Nisqually. The route would be approximately 18 miles. The existing median width varies between 13' and 300'. The majority of the median varies between 20' to 40'. There is a two mile section in the vicinity of the I-5/41st Division Dr. S. interchange that is approximately 60' wide. There is also a 2.5 mile section at the most southern end of the route that varies between 55' and 300'. An approximate 60' median would be required to construct the new alignment. Due to the limited amount of space, this alternative was not analyzed any further than looking at the existing median widths.

Relationship between Bypass Route and Greenfield Alternatives

The bypass route is located inland in Pierce County, and extends roughly 28 miles from Freighthouse Square vicinity in Tacoma, through Lakewood and to Centennial Station in Olympia/Lacey, where it connects with the BNSF main line (see Figure 1). See Appendix A for a comparison of the Greenfield Alternative routes and the Point Defiance Bypass route. Below is a summary of major differences between the bypass route and Greenfield Alternatives:

1) The length of the routes:
    a. Lakewood South Route – approximately 29 miles (1 mile longer than the bypass route).
    b. Spanaway Route – approximately 30 miles (2 miles longer than the bypass route).
    c. Fredrickson Route – approximately 32.5 miles (4.5 miles longer than the bypass route).
    d. Rainier Route – approximately 44 miles (16 miles longer than the bypass route).
    e. Lakewood to Tacoma Tunnel Route – approximately 32.5 miles (4.5 miles longer than the bypass route).

2) The bypass route will decrease travel time when compared to the baseline. The travel time impact for the Greenfield Alternative routes are as follows:
    a. Lakewood South Route – would decrease travel time.
    b. Spanaway Route – would decrease travel time.
    c. Fredrickson Route – would increase travel time; therefore, not meeting purpose and need.
    d. Rainier Route – would increase travel time, therefore, not meeting the purpose and need.
    e. Lakewood to Tacoma Tunnel Route – would decrease travel time.
3) With the exception of the Rainier Route, the Greenfield Alternative creates new alignments. The bypass route upgrades an existing line for passenger train use.
4) With the exception of the Rainier Route, the Greenfield Alternative would require purchasing a significant amount of right of way (between 12-200 acres). Because the bypass route is in an existing track corridor, the right of way in general already exists.

Many different design variations could be analyzed. The substantial cumulative impacts of pioneering any new alignment through partially undisturbed lands and through heavily developed lands cannot be avoided. A new route could adversely affect resources protected under Section 4(f) to a much greater magnitude than do other reasonable and prudent alternatives.

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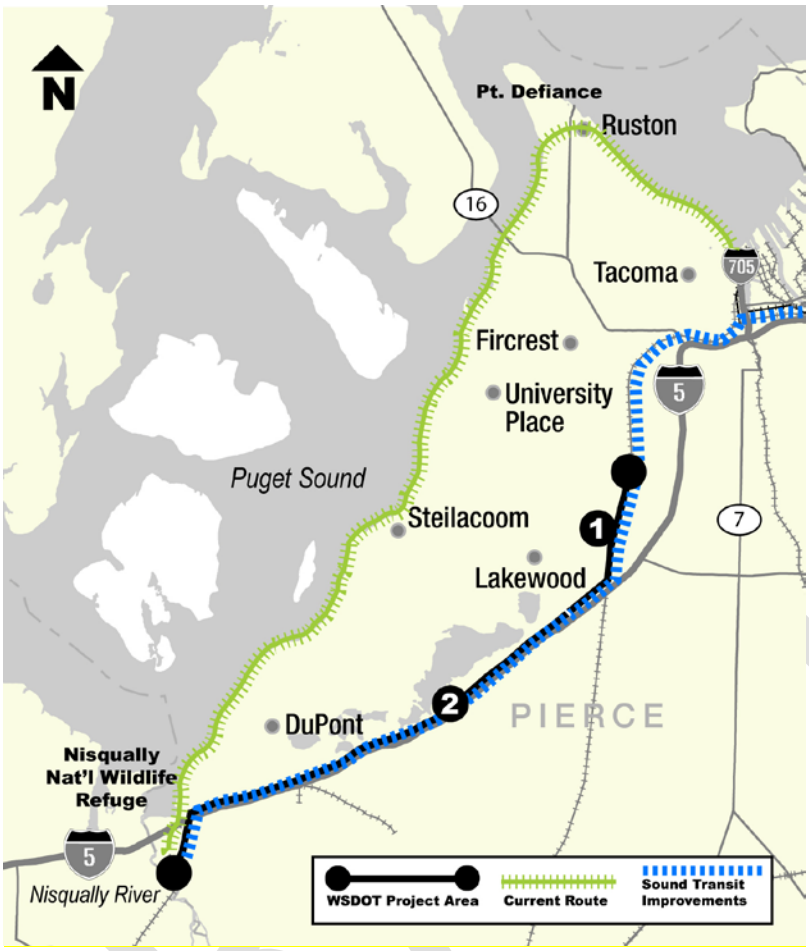

Figure 1

Engineering and Feasibility

The Greenfield Alternative concept was considered for the following reasons: 1) efficiency and 2) frequency.

Efficiency

Three of the six Greenfield Alternative routes (the Lakewood South route, Spanaway route, and Lakewood to Tacoma tunnel route) analyzed would result in a schedule reduction when compared to the baseline, while two of the six Greenfield Alternative routes (the Fredrickson route and the Rainier route) would result in a schedule increase. With the new alignment, re-construction of the existing track, and realignment of the curves associated with these three routes, the alignment would be able to accommodate 79 mph passenger train speeds.

Frequency

The construction of any of the Greenfield Alternative routes would accommodate two additional daily Amtrak *Cascades* round-trips.

Geometrics

For this conceptual estimate, the ground was assumed to be fairly flat. Therefore, it was assumed that the embankment and/or excavation required would be minimal. The required footprint for each route was assumed to be 50' each side of the track centerline along the entire route.

Structures

The Lakewood South route, Spanaway route, and Fredrickson route would require a structure across the Nisqually River Valley. The structure would be approximately 1 mile long and 50' wide.

The Lakewood to Tacoma tunnel route would require a tunnel approximately 4.1 miles with a diameter of 39'. The tunnel would be a two-track tunnel with walkways on each side. Boring a new tunnel of this size underneath a neighborhood presents many risks. Some of the potential risks include the suitability of the soil, the condition of the structures and buildings above the proposed tunnel alignment, acquiring the right of way needed, and substantial cost. These are only a small portion of the risks included with this alternative.

Right Of Way

Right of way purchase would be required for four of the Greenfield Alternative routes – Lakewood South Route, Spanaway Route, Fredrickson Route, and Lakewood to Tacoma Tunnel Route. The acreage required is as follows:

- Lakewood South Route – approximately 118 acres including approximately 15 acres of residential area, Nisqually Indian Reservation, and Joint Base Lewis McCord (JBLM). The new alignment between the Olympia/Lacey Station and Roy is near the impact zone on JBLM.
- Spanaway Route – approximately 217 acres including approximately 88 acres of densely populated residential area, Nisqually Indian Reservation, and (JBLM). The new alignment between the Olympia/Lacey Station and Roy is near the impact zone on the JBLM.
- Fredrickson Route – approximately 118 acres including approximately 15 acres of residential area, Nisqually Indian Reservation, and JBLM. The new alignment between the Olympia/Lacey Station and Roy is near the impact zone on the JBLM.
- Lakewood to Tacoma Tunnel Route – approximately 12 acres of densely populated residential and commercial property would need to be purchased.

As part of the Greenfield Alternative, right of way would be needed from select federal agencies including the JBLM and the Nisqually Indian Tribe. Substantial time would be needed for compliance with applicable statutes and regulations specific to the agency or the tribe before right of way would be granted. Depending on the agency or tribe, special documentation may be required and the right of way may be acquired as an easement rather than in fee.

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Conclusion

The Lakewood South Route, Spanaway Route, and the Lakewood to Tacoma Tunnel Route are attractive because they result in schedule reductions.

The Lakewood South Route and Spanaway Route have major disadvantages. The cost of each route is high due to the construction of a new alignment, rebuilding existing alignments, a mile long bridge, and other various items. The disadvantages also include significant federal, state, and private right of way purchases.

The Lakewood to Tacoma Tunnel Route also has major disadvantages. The cost of this route is high due to the construction of an approximate 4 mile long tunnel, rebuilding existing alignments, and other miscellaneous items. Without further analysis, it is unknown at this time whether this alternative would even be feasible due to soil conditions and other factors.

The Fredrickson Route and the Rainier Route are not viable options since they both increase travel times; therefore, not meeting the purpose and need.

The I-5 median route is not a viable option due to the limited median width throughout the majority of the route. A limited median would require the rail line to either be elevated on structures, or submerged in a tunnel, both of which result in substantially increased cost and risk. Due to the limited amount of space, this alternative was not analyzed any further than looking at the existing median widths.

Environmental Impacts

This portion of the technical memo describes the Greenfield Alternative's likely impacts to the built and natural environmental.

Resources

Air Quality

The Greenfield Alternative is within an air quality attainment area for ozone and carbon monoxide, and in proximity to an attainment area for particulates.

During construction, dust particles would be released as a result of construction vehicles, equipment and wind erosion over exposed earth surfaces. Fugitive dust releases generally constitute the largest source of PM_{10} during construction. Most of the dust particles would settle out immediately adjacent to the construction areas while a small fraction would contribute to the area's PM_{10} level. Air quality impacts caused by construction equipment emissions are short term and occur only when construction

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activities are taking place. Construction emissions would be minimized, and impacts would be less significant with mitigation measures.

Hazardous Materials

Several hazardous material sites are located within 500 feet of all the Greenfield Alternative routes. Additional studies would be necessary to assure that these routes could avoid these sites or to determine if any new sites exist. If any sites were located within an expanded right-of-way, WSDOT would likely be required to remediate the site(s).

Noise/Vibration

Noise: The Greenfield Alternative routes range in length from approximately 30-44 miles. Noise sensitive receptors within 500 feet of the routes include publicly owned parks, schools, and homes. All receptor sites located along the proposed routes would be subject to possible noise impacts.

Noise impacts could be reduced by initiating traffic management measures, acquiring land to serve as buffer zones, realigning the rail route, insulating public use or nonprofit institutional structures (not residential or commercial buildings), or constructing noise barriers.

Vibration: According to the *Noise and Vibration Discipline Study* (revised 03/08) developed for the Point Defiance Bypass project "Because the existing train traffic in the corridor is infrequent, the vibration associated with the proposed project has been evaluated as a new source of vibration and not as an existing vibration source that will occur more frequently. In accordance with the *FRA General Assessment* procedures, it is not necessary to estimate existing vibration levels for a *General Vibration Assessment*. However, based on general projection curves, it is unlikely that vibration from existing train traffic is perceptible inside buildings that are up to approximately 60 feet from the tracks." This assessment should apply to the Greenfield Alternative routes as well.

Hydrology/Water Quality

The new alignments of the Fredrickson, Lakewood South, and Spanaway Routes will cross several waterbodies, including the Nisqually River, Muck Creek, and Lacamas Creek. Additionally, the Spanaway Route will cross the North Fork Clover Creek, which is on the Washington State Department of Ecology's 303(d) listed waterbodies for fecal coliform.

The Fredrickson, Lakewood South, and Spanaway Routes will require a mile-long, 50-foot wide structure to cross the Nalley Valley, including the Nisqually River. However, the quantity of cut and fill is unknown since the details of these routes were not done to the level that they could be quantified.

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All six routes are within the Central Pierce County sole source aquifer,[9] the Pierce County critical aquifer recharge area,[10] and are in proximity to wellhead protection areas.[11] WSDOT will need to work with the appropriate entities regarding appropriate protective and mitigation measures. Federal funds may not be expended unless a project is designed to avoid any violation of federal or state drinking water regulations.

It is unknown if the Greenfield Alternative would have a substantial impact on water quality or water resources at this time. Further study would be necessary to determine the extent of these impacts.

Ecosystems

Fish, Wildlife, Vegetation

Property would need to be acquired as right-of-way for the Greenfield Alternative, some of which is developed. Some of this acreage is likely to be wildlife habitat, which would have a direct impact on wildlife.

Route	Total ROW Acres	Residential Acres Sub-Total
Fredrickson	118	15
Lakewood South	118	15
Rainier	0	0
Spanaway	217	88
Tacoma Tunnel	12	12

The US Fish and Wildlife Service (USFWS) has listed the following species in Pierce County: bull trout (including designated critical habitat), Canada lynx, gray wolf, grizzly bear, marbled murrelet (including designated critical habitat), and northern spotted owl (including designated critical habitat). Additionally, there are eight candidate species, and 26 species of concern. Further study would be necessary to determine the impacts to fish, wildlife, and vegetation.

Endangered Species Act (ESA)

Unavoidable impacts to listed threatened species could occur if the Greenfield Alternative routes are constructed, and a Biological Assessment will be required to determine this alternative's impact on those species and their habitats. The timeframe for formal consultation under Section 7 of the ESA, for larger projects in the Puget Sound area, generally exceeds one year and may take up to two years to complete.

[9] Designated by the US Environmental Protection Agency
[10] Designated by a city or county under the Growth Management Act
[11] Group A systems (Washington State Department of Health) serving 15 or more residential connections, or 25 or more people per day for 60 days or more per year

Mitigating for potential impacts to threatened or endangered species' habitat would require the creation or restoration of equivalent habitat near the project. The regulatory requirements and costs of such mitigation would depend on the final alternative alignment and the result of consultation with the regulatory agencies.

Wetlands

The preliminary design information available at the time of this analysis suggests that wetlands may be impacted by the Greenfield Alternative. Further study would be necessary to determine the actual impacts to wetlands. Wetland impacts must be mitigated in accordance with federal, state, and local regulations.

Route	Total Wetlands Impacted	Total Acres Impacted
Fredrickson	19	6.7
Lakewood South	14	5.2
Tacoma Tunnel	3	0.8
Rainier	21	5.9
Spanaway	18	6.6

Wetland impacts would be reduced to the greatest practicable extent by designing and implementing minimization and mitigation measures. However, for unavoidable impacts, the cost to mitigate is highly variable depending on the rating of the impacted wetlands *(Categories I-IV)*, the type of mitigation implemented *(preservation, enhancement, and/or creation)*, and the price of real estate. Construction costs and the cost to subsequently monitor the mitigation site(s) *(up to 10 years or more)* are somewhat more stable, and therefore can be predicted with a higher level of confidence.

Assuming all the wetlands identified during this analysis rated as a Category I *(i.e., highest-functioning wetlands)*, the following two cost scenarios[12] were developed:

1. The *lower cost* scenario, which would require a 3:1 creation/restoration ratio[13] per Class I acre impacted and include a 150-foot buffer.
2. The *higher cost* scenario, which would require a 6:1 creation/restoration ratio[11] per Class I acre impacted and include a 300-foot buffer.

Based on the above requirements, the following acreages and associated costs would be needed for each route:

Route	3:1 Ratio	Cost[14,15,16]	6:1 Ratio	Cost[3,4,5]

[12] Based on 2006 guidance, and input from Geoff Gray, SCR Biologist, on September 9, 2010.
[13] Creation/restoration ratios are determined by the US Army Corps of Engineers if a Section 404 Individual Permit is issued.
[14] A total of $256,784/acre. This total was inflated by 15% from the 2006 guidance of $223,290/acre. The cost has been rounded to the nearest $100,000 for the purposes of this analysis.
[15] This total does not include real estate acquisition costs.
[16] This cost does not include the area required for the buffer.

Fredrickson	20.1 acres	$5.2M	40.2 acres	$10.3M
Lakewood South	15.6 acres	$4.0M	31.2 acres	$8.0M
Tacoma Tunnel	2.4 acres	$0.6M	4.8 acres	$1.2M
Rainier	17.7 acres	$4.5M	35.4 acres	$9.1M
Spanaway	19.8 acres	$5.1M	39.6 acres	$10.2M

These cost scenarios only address the cost of constructing the wetlands; they do not address the costs of finding and purchasing the real estate for these sites.

These estimates would be refined only after accurately identifying wetland boundaries and assessing their functions and values, which would be accomplished by delineating and rating each wetland. It is also possible that additional wetlands would be discovered during the fieldwork, which would increase mitigation costs.

Approvals would be required from the following agencies:

- **US Army Corps of Engineers** – Section 404, which includes determining the Least Environmentally Damaging Practicable Alternative (LEDPA); Section 10
- **WA State Department of Ecology** – Section 401; Coastal Zone Management Consistency Certification
- **WA State Department of Fish and Wildlife** – Hydraulic Project Approval
- **Local jurisdictions** – Shorelines; Floodplain Development; Critical Area Ordinances

Because of the many jurisdictions involved, acquiring the necessary approvals could take a year or longer.

Human Communities

Socioeconomic/Environmental Justice

The Greenfield Alternative could potentially impact private residences, private businesses, JBLM, and the Nisqually Indian Reservation. The 2009 poverty guideline for a family of four is $22,050; within the study area, the median income is above the poverty guideline.

Route	Average Median Income	Minority Population
Fredrickson	$50,374	30%
Lakewood South	$39,875	36%
Tacoma Tunnel	$46,810	40%
Rainier	$51,510	25%
Spanaway	$51,811	33%

Further study is necessary in order to determine whether minority or low-income populations would be disproportionately affected.

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Private residences and businesses would be displaced by the Greenfield Alternative. Any individuals or businesses that would be displaced as a result of implementing this alignment would be provided with relocation assistance under the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 USC 4601).

Recreation/Section 4(f) and Section 6(f)

The Greenfield Alternative as currently designed would impact several publicly owned parks, which are Section 4(f) resources. Impacts could include increased noise levels, displacement and/or change in access.

Section 4(f), 49 U.S.C. 303, of the Department of Transportation Act states that the Federal Railroad Administration will not approve the use of land from a significant publicly owned park, recreation area, or wildlife and waterfowl refuge, or a prehistoric/historic site that is on or eligible for the National Register of Historic Places (NRHP), unless a determination is made that:

1) There is no feasible and prudent alternative to the use of land from the property; and
2) The proposed action includes all possible planning to minimize harm to the property resulting from such use.

Supporting information demonstrates that there is a feasible and prudent alternative that would avoid these Section 4(f) resources. Because another alternative exists that does not impact Section 4(f) resources, the Greenfield Alternative should be considered and rejected.

Historic/Cultural

Preliminary research indicates that the Greenfield Alternative would potentially impact the following recorded prehistoric and historic archaeological sites/resources:

- Fredrickson Route: 24 sites
- Lakewood South Route: 25 sites
- Tacoma Tunnel Route: 1 site
- Rainier Route: 19 sites
- Spanaway Route: 25 sites

Some of these sites/resources could be eligible for listing on the NRHP and could trigger a Section 4(f) analysis. Section 4(f) of the Department of Transportation Act requires an analysis to show that there is no prudent and feasible alternative to using such a resource and that all possible mitigation is planned. Historic/cultural sites and resources and their potential importance would require extensive study and consultation with agencies with jurisdiction and affected Indian tribes, and could play a major role in developing or modifying this alternative. Excavations for data recovery and historic research would likely be needed for some of these sites/resources.

Section 106 of the National Historic Preservation Act would require any such impact to properties on or eligible for the NRHP to complete a 4(f) Evaluation. This process is discussed in the preceding *Recreation/Section 4(f) and Section 6(f)* sub-section.

Conclusion

Because the Greenfield Alternative would build new rail alignment, it creates more impacts than would either improving the Point Defiance Bypass (the proposed action) or the no action alternative.

- Section 4(f) resources such as several publicly owned parks;
- Wildlife habitat that supports threatened species;
- Private residences, private businesses, a portion of JBLM, and the Nisqually Indian Reservation;
- Up to approximately 10.9 acres of wetlands;
- Up to 25 cultural/historic resources; and
- Possible disproportionate adverse effects to minority populations.

See Appendix A for a summary of the environmental impacts.

Technical Memo Summary

In summary, the Greenfield Alternative includes three routes (Lakewood South Route, Spanaway Route, Lakewood to Tacoma Tunnel Route) that would meet the project purpose and need. Although they meet the purpose and need, there are many challenges and obstacles including the following:

- Lakewood South Route, Spanaway Route
    - Construction of an approximately one mile long bridge over the Nisqually River Valley
    - Acquisition of a significant amount of right of way from many different owners including residential, commercial, Nisqually Indian Reservation, JBLM, cities, and other federal, state, and private entities
    - The new alignment between the Olympia/Lacey Station and Roy is near the impact zone on JBLM
    - Potential impacts to endangered species
    - Potential significant impacts to socioeconomic resources.
- Lakewood to Tacoma Tunnel Route
    - Construction of an approximately four mile long tunnel including the high cost and associated risks
    - Potential impacts to endangered species
    - Potential impacts to socioeconomic resources

Between 0.8 acre (Tacoma tunnel route) and 6.6 acres (Spanaway route) of wetlands may be impacted by the Greenfield Alternative. Assuming that all the wetlands rated as a Category I *(i.e., highest-functioning wetlands)*, the mitigation cost could range from

approximately $0.6 million[17] to $10.2 million.[18] Permits from multiple jurisdictions would likely take a year or longer to acquire.

The Greenfield Alternative is within the Central Pierce County sole source aquifer, the Pierce County critical aquifer recharge area, and is in proximity to wellhead protection areas. Federal funds may not be spent unless a project avoids any violation of federal or state drinking water regulations.

Staff Recommendation

Staff's recommendation is that the Greenfield Alternative be **considered and eliminated from further consideration**.

WSDOT staff considers this alternative both impractical and unfeasible from a technical, economic, and environmental standpoint, and will describe it as such in the project Environmental Assessment (EA). Because of the Greenfield Alternative's technical and environmental constraints and its high cost, WSDOT does not intend to study this alternative in detail within the project's EA, unless new information becomes available that would change these findings.

The Greenfield Alternative has more potentially significant impacts than the bypass alternative, while the bypass alternative has fewer potentially significant impacts and better fulfills the project's purpose and need. Project characteristics evaluated under the *Engineering and Feasibility* and *Environmental Impacts* sections of this technical memorandum present the reasons for recommending the elimination of this alternative.

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[17] The lower cost scenario at a 3:1 creation/restoration ratio
[18] The higher cost scenario at a 6:1 creation/restoration ratio

Appendix A – Comparison of Greenfield Alternative to Point Defiance Project

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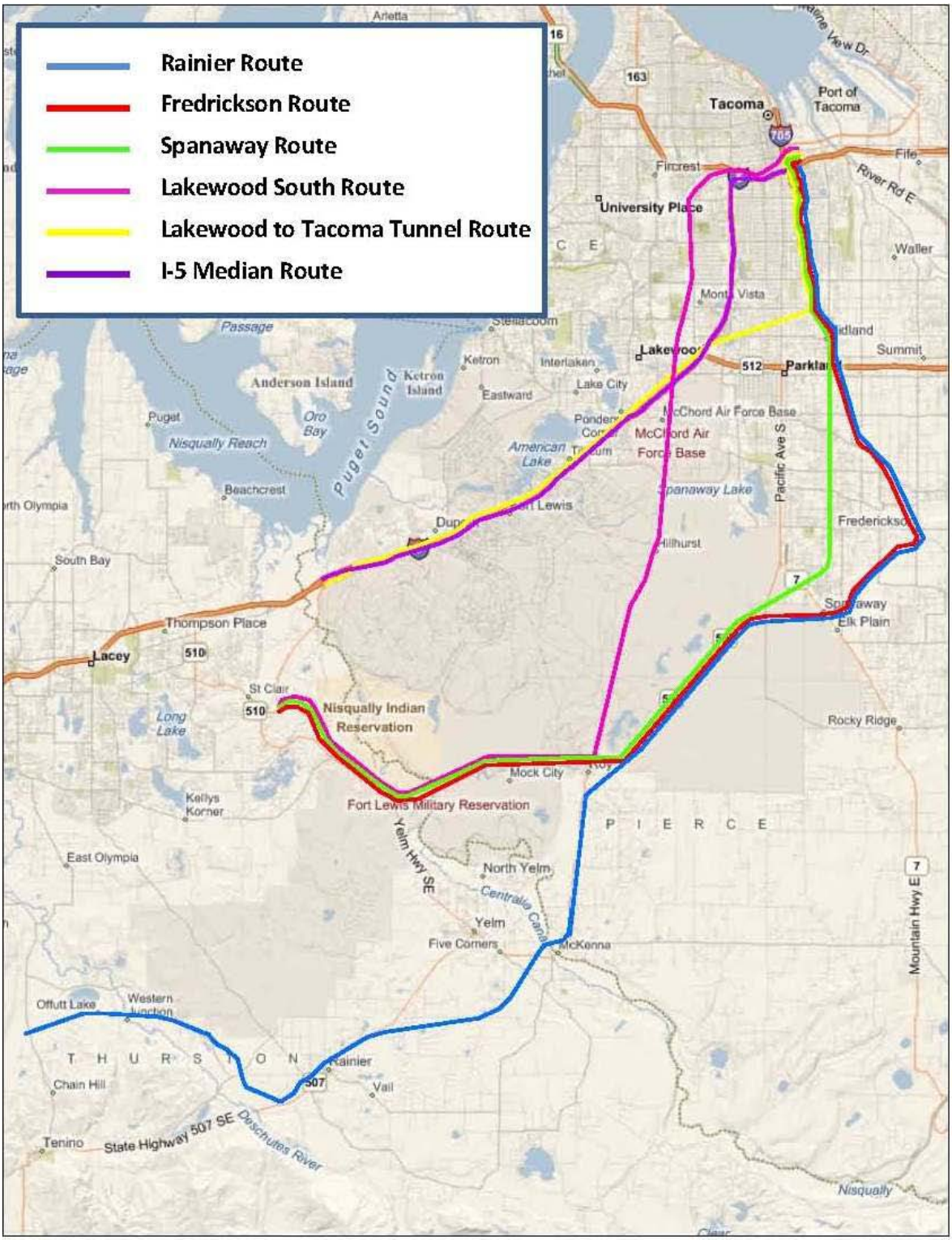
Appendix B – Route Locations