Draft Environmental Impact Statement

SOUTH LAKE UNION
Height and Density Alternatives

City of Seattle

February 2011

Prepared by:
City of Seattle
Department of Planning and Development

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

for the

SOUTH LAKE UNION HEIGHT AND DENSITY ALTERNATIVES

City of Seattle
Department of Planning & Development

This Draft Environmental Impact Statement (Draft EIS) considering ***South Lake Union Height & Density*** alternatives has been prepared in compliance with the State Environmental Policy Act (SEPA) of 1971 (Chapter 43.21C, Revised Code of Washington); the SEPA Rules (Chapter 197-11, Washington Administrative Code); and rules adopted by the City of Seattle implementing SEPA – Seattle's Environmental Policies and Procedures Code (Chapter 25.05, Seattle Municipal Code). Preparation of this EIS is the responsibility of the City of Seattle. As Lead Agency, the City is responsible for SEPA compliance and based on the scoping process has directed the areas of research and analysis that were undertaken in preparation of this EIS. This document is not an authorization for an action, nor does it constitute a decision or a recommendation for an action. In its final form – as a Final EIS – it will accompany the *Proposed Action* and will be considered in making final decisions concerning proposed options for ***South Lake Union Height & Density***.

Date of Draft EIS Issuance .... **February 24, 2011**

Dates of Draft EIS Public Meeting: .... **March 28, 2011**

*(Please refer to the City's website (***http://www.seattle.gov/dpd/Planning/South_Lake_Union/Overview/default.asp***) or the Fact Sheet of this EIS.)*

Date Comments are Due on the Draft EIS .... **April 11, 2011**

City of Seattle

Department of Planning & Development
Diane M. Sugimura, Director

February 24, 2011

Dear Affected Agencies, Organizations and Interested Parties:

Enclosed is the Draft Environmental Impact Statement (Draft EIS) for proposed South Lake Union Height & Density Alternatives in the South Lake Union neighborhood.

Three site alternatives representing varying height and density configurations, as well as geographic locations are evaluated in this Draft EIS, together with a No Action Alternative; the site alternatives include:

- Alternative 1 – Greatest potential increase in height and density;
- Alternative 2 – Moderate potential increase in height and density;
- Alternative 3 – Least amount of potential increase in height and density; and
- Alternative 4 – No Action – current zoning.

The public comment period associated with this Draft EIS is: February 24, 2011 through April 11, 2011.

An open house and public hearing regarding the Draft EIS is scheduled for 5:30 PM March 28, 2011. The open house and public hearing will be held at Unity Church, 200 8th Avenue N, Seattle. Additional information concerning the open house and public hearing is provided on the South Lake Union website http://www.seattle.gov/dpd/Planning/South_Lake_Union/Overview/default.asp and the Fact Sheet in this Draft EIS.

Following the Draft EIS comment period, a Final EIS will be prepared that addresses written comments and public testimony received during the Draft EIS public comment period.

Thank you for your interest in the proposed South Lake Union Height and Density Alternatives. We welcome your comments.

Sincerely,

Diane Sugimura dm

Diane Sugimura, Director
City of Seattle Department of Planning and Development

Fact Sheet

Name of Proposal

South Lake Union Height and Density Alternatives

Proponent

City of Seattle

Location

The area represented by this Draft EIS is the South Lake Union neighborhood of downtown Seattle. This is approximately a 340-acre area that is generally bounded by Denny Way on the south, Aurora Avenue N. on the west, Eastlake Avenue E. on the east and Galer Street and E. Nelson Place on the north.

Proposed Alternatives

This Draft EIS considers four alternatives to height and density in the South Lake Union neighborhood. Alternatives 1, 2 and 3 represent a range of potential height increases that could be achieved through incentive zoning and are collectively referred to as action alternatives. Alternative 4 would retain the existing zoning designations with no incentives for height increases and is referred to as the no-action alternative.

- **Alternative 1** – This alternative would allow the greatest increases in height and density relative to the other alternatives. Height and density increases apply both to proposed commercial and residential development. In general, greatest building height would be located along the south boundary of the neighborhood.
- **Alternative 2** – This alternative would allow moderate increases in height and density relative to the three action alternatives. In general, greatest building heights would be located in the southwest portion of the neighborhood.
- **Alternative 3** – This alternative would allow the least amount of height and density increases relative to the three action alternatives. In general, greatest building heights would be allowed in the southwest portion of the neighborhood.
- **Alternative 4** – This alternative would retain existing zoning designations and associated development standards within the neighborhood.

Lead Agency
City of Seattle
Department of Planning and Development

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Final Action
Adoption of code amendments that would provide incentive zoning provisions to allow increased height and density in the South Lake Union neighborhood

Required Approvals and/or Permits
Approval of amendments by the Seattle City Council.

Authors and Principal Contributors to this EIS
This ***South Lake Union Height and Density*** EIS has been prepared under the direction of the City of Seattle Department of Planning and Development. Research and analysis associated with this EIS were provided by the following consulting firms:

- **EA|Blumen** – lead EIS consultant; document preparation; environmental analysis – land use – relationship to plans/policies & regulations, energy (greenhouse gas emissions), housing, and public services
- **NBBJ** – aesthetics, light/glare, shadow, viewshed
- **Fehr & Peers** – transportation, circulation, parking; greenhouse gas emissions
- **Shannon & Wilson** – earth, plants/animals, environmental health
- **ENVIRON International Corp.** – air quality, noise
- **BOLA Architecture & Planning, Inc.** – historic/resources
- **Cultural Resources Consultants** – archaeology
- **Coughlin Porter Lundeen** – utilities
- **RWDI** – wind

Location of Background Data

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Kirkland, WA 98034-6927

Date of Issuance of this Draft EIS

February 24, 2011

Date Draft EIS Comments Are Due

April 11, 2011

Written comments are to be submitted to:

Seattle Department of Planning and Development
Attn: James Holmes
700 Fifth Ave., Suite 1900
P.O. Box 34019
Seattle, WA 98124-4019

or via e-mail: southlakeunioneis@seattle.gov

Date of Draft EIS Open House and Public Hearing

An open house and public hearing regarding this Draft EIS is scheduled for:

- **Date: March 28, 2011**
- **Location – Unity Church, 200 8th Avenue N, Seattle**

This meeting will include the following schedule:

- **5:30 pm – 6:30 pm** – Open House;
- **6:30 pm – 6:35 pm** – Introductions;
- **6:35 pm – 6:50 pm** – Overview of the ***Height and Density EIS*** Alternatives;
- **6:50 pm – 7:00 pm** – Overview of the EIS Process;
- **7:00 pm** – Public Comments Regarding the Draft EIS; and
- Concluding Remarks Following Public Comments.

The purpose of the open house and public hearing is to provide an opportunity for agencies, organizations and individuals to review information concerning the Draft EIS and to present oral comments on the Draft EIS – in addition to submittal of written comments

Availability of this Draft EIS

Copies of this Draft EIS have been distributed to agencies, organizations and individuals noted on the Distribution List (Appendix A). Notice of Availability of the Draft EIS has been provided to organizations and individuals that requested to become parties of record.

The Draft EIS can be reviewed at the following public libraries:

- **Seattle Public Library – Central Library** (1000 Fourth Avenue)
- **Seattle Public Library – Queen Anne Branch** (400 W Garfield Street)
- **Seattle Public Library – Capitol Hill Branch** (425 Harvard Ave. E.)

A limited number of complimentary copies of this Draft EIS are available – while the supply lasts -- either as a CD or hardcopy from the Seattle Department of Planning and Development Public Resource Center, which is located in Suite 2000, 700 Fifth Avenue, in Downtown Seattle. Additional copies may be purchased at the Public Resource Center for the cost of reproduction.

This Draft EIS and the appendices are also available online at: http://www.seattle.gov/dpd/Planning/South_Lake_Union/Overview/default.asp

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CHAPTER 1 ENVIRONMENTAL SUMMARY

This chapter summarizes environmental impacts, mitigation strategies and significant unavoidable adverse impacts for four alternatives to height and density in the South Lake Union Neighborhood that are evaluated in this Environmental Impact Statement (EIS). This summary provides a brief overview of the information considered in this EIS. The reader should consult Chapter 2 for a detailed description of the alternatives and Chapter 3 for more information concerning the affected environment, environmental impacts and mitigation strategies for each element of the environment.

1.1 Proposal

This Draft EIS considers four alternatives to height and density in the South Lake Union neighborhood. Alternatives 1, 2 and 3 represent a range of potential height increases that could be achieved through incentive zoning and are collectively referred to as action alternatives. Alternative 4 would retain the existing zoning designations with no incentives for height increases and is referred to as the no-action alternative.

Among the action alternatives, Alternative 1 would provide the greatest potential for increases in height and density, Alternative 3 the least, and Alternative 2 falls between Alternatives 1 and 3. Alternative 1 would allow for building heights of 240 to 300 feet in much of the neighborhood, with maximum heights of 400 feet between John Street and Denny Way. Alternative 2 would allow for maximum heights of 300 feet in the area between Aurora and Westlake avenues north, with much of the rest of the neighborhood at maximum heights of 160 to 240 feet. Under Alternative 3, the majority of the neighborhood would have maximum building heights of 160 feet to 240 feet. Under Alternatives 2 and 3, existing zoning, with no provision for increased height through zoning incentives, would be retained in the majority of the Cascade neighborhood, with changes limited to areas near the western and southern boundaries in Alternative 2 and along the western boundary in Alternative 3. Similarly, under Alternative 3, the majority of the Fairview neighborhood would also retain existing zoning, with no provision for increased height through incentive zoning.

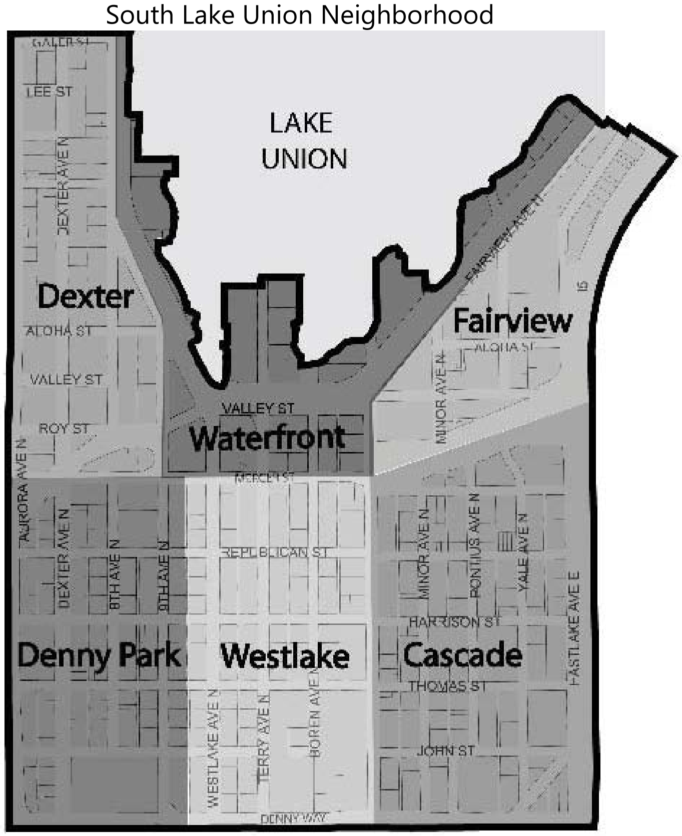
Alternatives 1 and 2 would provide for height and density increases for both commercial and residential development while Alternative 3 is focused primarily on residential development.

1.2 Location

The South Lake Union neighborhood is located in the center of the City of Seattle, immediately north of Downtown, and adjoining the Uptown and Capitol Hill areas to the west and east, respectively. Consisting of about 340 acres, the area is generally bounded on the east by Interstate 5, on the west by Aurora Avenue, on the south by Denny Way and on the north by the Lake Union shoreline.

For planning purposes, the City has identified six neighborhoods in the neighborhood, known as the Dexter, Denny Park, Waterfront, Westlake, Fairview and Cascade neighborhoods. See Figure 1-1.

Figure 1-1
South Lake Union Neighborhood



Source: South Lake Union Urban Center Neighborhood Plan, 2007

1.3 Objectives of the Proposal

The City has identified the following specific objectives of the proposal:

- Advance Comprehensive Plan goals to use limited land resources more efficiently, to pursue a development pattern that is economically sound, and to maximize the efficiency of public investment in infrastructure and services.

- Ensure adequate zoned development capacity for long-term growth consistent with the designation of South Lake Union as one of the City's six urban centers.
- Provide for a more diverse and attractive neighborhood character by providing a mix of housing types, uses, building types and heights.
- Enhance the pedestrian quality at street level by providing amenities, taking into consideration light and air as well as public view corridors and providing for retail activity at key locations.
- Use increases in height and density to achieve other neighborhood plan goals such as increasing the amount of affordable housing, open space, and other public benefits through an incentive zoning program.
- Determine how to best accommodate growth while maintaining a functional transportation system, including street network, transit, and non-motorized modes of travel. Similarly, determine how to accommodate growth while maintaining functional capacity of utility systems, including electrical energy, water, sewer and storm drain systems.

1.4 Alternatives

In order to meet the goals of the Comprehensive Plan, the City is considering adoption of incentive zoning provisions to allow increased height and density in certain areas of the South Lake Union neighborhood. The City has identified four alternatives, each of which describes a different pattern of height and density in the neighborhood. In general, Alternative 1 would provide for the greatest increases in building height and corresponding residential density. Similarly, Alternative 2 provides for height and density increases, but relatively less than Alternative 1. Alternative 3 provides for the least amount of height and density increase relative to the action alternatives. Alternative 4 would retain the existing zoning standards and height limits. **Table 1-1** summarizes the key features of the alternatives.

Table 1-1
Alternatives Overview

Features	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Podium Height	45′ – 85′	30 – 45′	20 – 45′	Not applicable
Incentive Zoning Height Limits	85′ – 400′	85′ – 300′	85′ – 240′	Not applicable
Floor Plate Size	Commercial - 24,000 sf above podium height for commercial Residential - 10,500 sf average/11,500 sf maximum above podium height			Not applicable
Commercial Floor Area Ratio	Base of 4.5 or 5; up to 7 with bonuses			4.5 to 5
Residential Densities	Varies according to building height and podium size. The range of densities at different heights is shown below. Note that not all alternatives include all of the heights listed. 400′ height limit: 720 – 890 units/acre 300′ height limit: 562 – 655 units/acre 240′ height limit: 465 – 535 units/acre 160′ height limit: 327 – 385 units/acre Lower building heights and corresponding densities are assumed for lots fronting Lake Union. See Appendix B for complete methodology.			Not applicable
Minimum Lot Size for Towers	22,000 sf (2 towers/block), 60,000 sf (1 tower/block)			Not applicable

Source: City of Seattle, 2010

A podium is the base of a building that supports a tower.

A floor plate is the horizontal plane of the floor of a building, measured to the inside surface of exterior walls.

Floor area ratio is the ratio of the total square feet of a building to the total square feet of the property on which it is located.

Incentives

An incentive program offers development bonuses, usually in the form of additional height or floor area, for development projects that offer public benefits and amenities. As shown in **Table 1-1**, the three action alternatives include the potential for an FAR bonus and increased height through the provision of public benefits as defined by incentive zoning.

Seattle Municipal Code Section 23.58A establishes conditions and process for development incentives. As described in this Section, buildings less than 85 feet in height may gain increased floor area only through the provision of affordable housing as established by the provisions of

Section 23.58A.014. For buildings greater than 85 feet in height, other City approved bonus options may be used for up to 40% of their increased floor area, as long as at least 60% of the increased floor area is supported by the provision of affordable housing through the process established in Section 23.58A.014.

Although not currently applicable in South Lake Union, future development under any of the action alternatives would be able to seek floor area bonuses consistent with the requirements of Seattle Municipal Code 23.58A. For buildings taller than 85 feet in height, potential public benefits that could be included as a future development incentive, in addition to the affordable housing requirement, will be specifically identified following public comment and City review of Draft EIS findings.

Alternatives 1 – 3 (Action Alternatives)

The following features are common to all of the action alternatives.

- **Shoreline Designations**. No changes to the existing shoreline designations are proposed under any of the alternatives.
- **Permitted Uses**. No change to the permitted uses in the Seattle Mixed zone is proposed under any of the alternatives.
- **Floor Plate Size**. In all alternatives, commercial floor plates are limited to a maximum of 24,000 sf. Residential floor plates are limited to an average of 10,500 sf for the entire tower, with a maximum of 11,500 sf above the podium.
- **Floor Area Ratio**. In all alternatives, the commercial floor area ratio is limited to a base of 4.5 or five, with potential of increasing to a maximum of seven through use of incentives or transfer of development rights (TDR).
- **Tower Location**. In all alternatives, a maximum of one tower per block (equivalent to a minimum 60,000 sf lot size) near Lake Union, but outside of the designated shoreline area, is permitted. In all other areas, a maximum of two towers per block (equivalent to a minimum 22,000 sf lot size) is permitted.
- **Lake Union Seaport Airport**. In all alternatives, building heights in the approach/departure corridor for the Lake Union Seaport Airport would continue to be limited according to Federal Aviation Administration (FAA) requirements.

Key unique features associated with each of the action alternatives are described below:

Alternative 1

Zoning Designations. The underlying Seattle Mixed zoning designation would be retained in all parts of the neighborhood. The existing Industrial Commercial (IC) designation would be rezoned to Seattle Mixed.

Building Heights. Building Heights. Greatest heights are permitted along the southern edge of the neighborhood, between Denny Way and John Street. In this area, residential towers could be 400 feet and commercial towers 240 feet in height.

Lowest heights continue in the east central part of the neighborhood, roughly corresponding to the Cascade neighborhood. In this area, maximum heights of 160 feet for residential towers and 85 feet for commercial uses are established.

In the balance of the neighborhood, maximum heights range between 240 to 300 feet for residential towers. Commercial uses in mixed use buildings are limited to 20 feet along the 8th Avenue corridor, between John and Republican Streets and to 85 feet in the blocks bounded by Mercer, Valley and Roy streets and 9th Avenue. In the remaining areas, commercial height limits vary from 160 feet to 240 feet.

Podium Heights. Podium heights of up to 85 feet are allowed along the Mercer Street corridor. Along the Dexter, Westlake, Fairview and Denny Way corridors, maximum podium height is 65 feet. Podium heights are limited to 45 feet in the balance of the area.

Alternative 2

Zoning Designations. . The underlying Seattle Mixed zoning designation would be retained in all parts of the neighborhood. The existing Industrial Commercial (IC) designation would be rezoned to Seattle Mixed.

Building Heights. Greatest heights are permitted in the southwestern portion of the neighborhood, corresponding to the Denny Park subarea. In this area, residential towers could be 300 feet and commercial towers 160 feet in height. Within this area, height limits are reduced along the 8th Avenue corridor, with commercial development limited to 20 feet and residential to 240 feet in height.

Height limits are lowest in the northern part of the neighborhood. In the blocks bounded by Mercer, Valley and Roy Streets and 9th Avenue North, commercial uses are limited to 85 feet and residential uses to 160 feet in height. Immediately to the east, in the Fairview neighborhood, building heights are limited to 125 feet. In the balance of the neighborhood, maximum height for residential towers is 240 feet and for commercial buildings 160 feet.

Podium Heights. Podium heights are limited to 30 feet along the 8th Avenue corridor and 45 feet in all other parts of the neighborhood.

Alternative 3

Zoning Designations. The underlying Seattle Mixed zoning designation would be retained in all parts of the neighborhood. The existing Industrial Commercial (IC) designation would be rezoned to Seattle Mixed.

Building Heights. Alternative 3 allows building heights up to 240 feet for residential development and 125 feet for commercial uses between Denny Way, John Street, 9th Avenue North and the east side of Fairview Avenue.

Commercial use height limits vary between 65 feet to 85 feet in the rest of the area. In the central part of the neighborhood, residential height limits decrease from 240 feet along John Street to 125 feet in the blocks between Mercer and Valley Streets. West of 9th Avenue and north of Mercer Street (Dexter neighborhood), residential building heights are limited to 240 feet.

Podium Heights. Podium heights are limited to 20 feet along the 8th and 9th Avenue corridors. West and north of this corridor, podium heights are limited to 30 feet. In the remaining area, podium heights are limited to 45 feet.

No Action Alternative

Zoning Designations. The majority of the neighborhood would remain Seattle Mixed at varying heights, ranging from SM-125" along Denny Way, down to SM-40 in the north central part of the neighborhood. The Fairview area would retain the existing Commercial (C2) zoning. The central portion of the neighborhood would remain in an Industrial Commercial (IC) zone.

Shoreline Designations. No changes to the existing shoreline designations are proposed.

Building Heights. In general, height limits are lowest near Lake Union and in the Cascade Subarea, with height limits ranging between 40 and 75 feet in these areas. Greatest heights (up to 125 feet) are permitted along the southern edge of the neighborhood, along Denny Way and John Street. In this area, a maximum of 125 feet is permitted.

Podium Heights. Existing zoning standards do not specifically define podium heights, but do require upper level setbacks in certain areas. To some extent, these upper level setbacks define a podium for the development. In general, the area along Denny Way in the SM-125′ zone requires an upper level setback for any portion of a structure greater than 75 feet in height. Similarly, along portions of Thomas and Harrison Streets, upper level setbacks are required for structures greater than 25 feet (in residential areas) and 45 feet in height.

1.5 Summary of Potential Impacts and Mitigation Strategies

Table 1-2 summarizes the potential environmental impacts for each element of the environment evaluated in Chapter 3.

Table 1-2
Summary of Impacts

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Geology and Soils			
Impacts common to all alternatives			
By itself, this proposal would not directly result in impacts to geology and soils. Future site-specific development proposals under any of the alternatives, however, could result in impacts to geology and soils. Potential impacts that could be associated with future site-specific development under any alternative are briefly listed below. • Native soils unsuitable for construction, particularly artificial fill and soft compressible soils near the waterfront may be removed and replaced with structural fill and/or other suitable material. • Excavation near existing slopes and/or landslides could result in slope instability. • Surface water and groundwater flow will likely be impacted by new construction. • Steep slopes, landslides, and liquefaction have the potential to impact existing development and new construction.			
• Excavation, grading, soil removal, placement of structural fill, and construction of new foundations could have direct impacts on soils and groundwater.	• Similar to Alternative 1, however impacts would be less in areas where building height limits are less, thereby requiring shallower building foundations.	• Similar to Alternative 1, however impacts would be less in areas where building height limits are less, thereby requiring shallower building foundations.	• Impacts under this alternative would be much less than those discussed under Alternative 1 since building height limits would remain as they currently exist.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Air Quality			
Impacts common to all alternatives			
By itself, this proposal would not directly result in impacts to air quality. Future site-specific development proposals under any of the alternatives, however, could result in impacts to air quality. Potential impacts that could be associated with future site-specific development under any alternative are briefly listed below. *Construction* • Construction activities could result in temporary, localized increases in particulate concentrations due to emissions from construction-related sources. • Demolition of existing structures would require removal and disposal of building materials that could possibly contain asbestos and lead based paint. • Emissions from construction equipment, especially from diesel-fueled engines, could result in a temporary degradation of local air quality. • Construction activities, such as paving operations using tar and asphalt, could result in short-term localized odors.			
Operation • Predicted PM peak hour auto trips are expected to be the highest under this alternative. Traffic sources would not cause an increase in ambient CO concentrations at receptors near two of the three intersections studied. Even with CO concentration increases at the Mercer Street/Fairview Avenue intersection, ambient concentrations would remain well below the NAAQS. Because increased traffic resulting from new development near the most congested intersections would not likely cause an impact to air quality, impacts are also unlikely at other less congested intersections. Therefore, Alternative 1 would be unlikely to affect air quality in the South Lake Union study area.	• Traffic generated under this alternative is predicted to be the same as Alternative 1. Therefore, ambient concentrations with Alternative 2 would likely be the same as that under Alternative 1. No impacts to air quality are expected	• Under this alternative, approx. 3,000 fewer vehicular trips would occur than under Alternatives 1 and 2, therefore it is likely that fewer trips would result in less traffic at the most congested intersections. Therefore, CO concentrations would likely be similar to or less than those predicted for Alternatives 1 or 2. No impacts to air quality are expected.	• Under this alternative trips generated would be slightly fewer than under Alternative 3, therefore maximum-predicted CO concentrations in 2031 would be less than the ambient air quality standards, so no impacts to air quality are anticipated.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)

Water Quality

Impacts common to all alternatives

Construction activities associated with new development or redevelopment under any of the alternatives would be accompanied by ground disturbing activities such as clearing and grading. These activities could result in minor erosion and sedimentation that might result in short-term turbidity increases to local receiving waters (Lake Union). In addition to sediment transport, runoff may also carry other contaminants such as fuel or oil, from construction vehicles and machinery used on-site. The risk of these effects would be of short duration (limited to the length of each project construction period) and can largely be minimized or eliminated with the proper use of construction best management practices (BMPs).

Construction Stormwater Runoff

- Construction activities could cause minor erosion, sedimentation that might result in short-term turbidity increases to local receiving waters (Lake Union), as well as possible fuel/oil contamination from construction vehicles.
- Implementation of construction best management practices, and compliance with applicable permit requirements and conditions would help to ensure that any impacts would be temporary and minor.

Urban Stormwater Runoff

- It is expected that the majority of future development within South Lake Union will exceed the Pollution Generating Impervious Surfaces (PGIS) 5,000 sq. ft. threshold, which will require provision of water quality treatment. Smaller redevelopment projects may not reach this threshold, and multiple, independent small-scale developments in an area could create new PGIS areas without any individual project tripping the 5,000 sq. ft. treatment requirement.
- Per city code water quality treatment facilities are designed based on surface area and not on traffic volumes. Under the current stormwater code, increases in density do not require increased stormwater treatment, although increased pollution would likely be generated as a result of increased vehicle traffic to support this level of development.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)

Plants and Animals

Impacts common to all alternatives

By itself, this proposal would not directly result in impacts to plant and animal habitat. Future site-specific development proposals under any of the alternatives, however, could result in impacts to plant and animal habitat. Potential impacts that could be associated with future site-specific development under any alternative are briefly listed below.

- Urban wildlife may be displaced on lots that currently provide urban habitat (such as blackberry thickets, debris piles, and landscaped areas) by future construction/development.
- Development of increased building height could indirectly result in increased bird strikes for migratory birds flying through the study area. However, the net effect on northward migrations of birds would likely be low since downtown buildings would still present the first obstacle to migratory birds.
- Increasing vehicle use in the study area by allowing increased density may contribute to adverse effects on juvenile salmonids associated with poor water quality.
- Potential increases in water quantity associated with increases in the amount of impervious surfaces are not expected to impact fish habitat in Lake Union or downstream waters.
- This alternative is not expected to result in increased predation of juvenile salmonids due to changes in shade or shoreline development.

Environmental Health

Impacts common to all alternatives

The proposal analyzed in this EIS considers the use of incentive zoning to increase height and density in the South Lake Union neighborhood. By itself, this proposal would not directly result in impacts to environmental health. Future site-specific development proposals under any of the alternatives, however, could result in impacts to environmental health. Development activities could include excavation associated with demolition of existing foundations and construction of new foundations. Potential indirect and cumulative impacts for all alternatives associated with property redevelopment include:

- Contaminated soil and/or groundwater may be encountered during excavation when properties in the study area are redeveloped.
- Asbestos Containing Material (ACM) and lead-based paint may be encountered during building demolition when properties in the study area are redeveloped.
- Contamination may be cleaned up as properties are redeveloped, resulting in less contamination in the study area.
- Contaminated materials may be uncovered during property redevelopment, allowing more direct exposure to the public.
- Contamination may be spread as a result of property redevelopment (for example, a new utility corridor could provide a new conduit for contamination to spread through; dewatering activities could pull contaminated groundwater into areas that were initially clean).

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)

Noise

Impacts common to all alternatives

The proposal analyzed in this EIS considers the use of incentive zoning to increase height and density in the South Lake Union subarea. By itself, this proposal would not directly result in noise impacts in the subarea. Future site-specific development proposals under any of the alternatives, however, could result in impacts to noise. Depending on the nature of these site-specific actions, noise impacts could occur to existing, adjacent land uses in. Construction, parking, and mechanical equipment related to new developments have the potential to cause noise impacts to sensitive receivers (e.g., residences, schools, churches, parks, etc.). Larger residential and commercial structures could result in an increase in traffic volumes and traffic-related noise on local streets. Potential impacts that may be associated with future site-specific development under any of the alternatives are discussed below.

Construction

- Noise from demolition and construction activities has the potential to temporarily affect nearby receivers, particularly sensitive uses such as residences.

Operation

- Increased building heights within the flight path for the Lake Union Seaport Airport could result in increased noise impacts to residences and/or offices in upper portions of new buildings from aircraft overflights.
- HVAC/mechanical equipment could result in increased noise impacts to nearby residences and/or commercial buildings.
- Increases in population density and commercial activity could add more traffic to local streets, which would increase noise levels in South Lake Union area.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Energy (GHG)			
Impacts common to all alternatives			
Climate Change • The assumed impacts of climate change would not be anticipated to have a disproportionate impact on the South Lake Union Neighborhood as compared to other sites in Seattle.			
Greenhouse Gas Emissions • Based upon the calculations from the King County SEPA GHG Emissions worksheet, this alternative would generate roughly 23,537,267 $MTCO_2e$ additional GHG emissions over existing conditions during the lifespan of future development.	• Same as Alternative 1.	• Same as Alternative 1.	• Based upon the calculations from the King County SEPA GHG Emissions worksheet, this alternative would generate roughly 16,393,154 $MTCO_2e$ additional GHG emissions over existing conditions during the lifespan of future development.
• Based on the calculations from the SEPA Greenhouse Gas Emissions Inventory Worksheets and the VMT GHG Tool, this alternative would generate roughly 24,160,080 $MTCO_2e$ additional GHG emissions during the lifespan of future development.	• Based on the calculations from the SEPA Greenhouse Gas Emissions Inventory Worksheets and the VMT GHG Tool, this alternative would generate roughly 24,144,150 $MTCO_2e$ additional GHG emissions during the lifespan of future development.	• Based on the calculations from the SEPA Greenhouse Gas Emissions Inventory Worksheets and the VMT GHG Tool, this alternative would generate roughly 22,686,472 $MTCO_2e$ additional GHG emissions during the lifespan of future development.	• Based on the calculations from the SEPA Greenhouse Gas Emissions Inventory Worksheets and the VMT GHG Tool, this alternative would generate roughly 18,063,203 $MTCO_2e$ additional GHG emissions during the lifespan of future development.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Land Use			
Plans, Policies, and Regulations • This section of the EIS contains an analysis of the consistency of each alternative with existing state, regional and local planning policies. The proposed action is generally consistent with adopted City plans, policies and regulations.			
Wind Analysis The addition of significantly taller buildings directly south of Lake Union could generally increase the potential for: • increased height of vertical and leeward wind wake zones and consequently shear layers; • introduction of wake effects extending into Lake Union; • increase in turbulence intensity north of the subarea; and; • change in local wind speed patterns.	• Similar to but less than Alternative 1.	• Similar to but less than Alternative 2.	• Impacts are not anticipated under this alternative since building height limits would remain as they currently exist.
• Under this alternative, the maximum height of buildings is higher than the anticipated elevation of float planes travelling over/through this area. Apart from the risk of physical impact, small aircraft flying through a "canyon" or "corridor" of tall structures can be significantly affected by turbulent, local winds channeling and accelerating between buildings	• Similar to but less than Alternative 1.	• Similar to but less than Alternative 2.	• Impacts are not anticipated under this alternative since building height limits would remain as they currently exist.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Housing			
• Increases in population and employment would result in an associated increase in demand for diverse housing opportunities, and public facilities within the subarea. With capacity for 21,000 units, Alternative 1 provides the greatest housing capacity.	• Similar to but less than Alternative 1. Alternative 2 would have capacity for 19,000 units,	• Similar to but less than Alternative 2. Alternative 3 would have capacity for 15,000 units.	• Similar to but less than Alternative 3. Alternative 4 would have capacity for 11,500 units.
• Increased residential capacity due to incentive zoning under this alternative has the potential to result in an increased number of affordable housing units.	• Same as Alternative 1.	• Same as Alternative 1.	• This impact would not occur relative to development under this alternative; no existing area-wide incentive zoning in place.
• This alternative has the largest development potential, therefore it would have the potential through incentive zoning programs to generate the greatest amount of developer financial contributions for affordable housing for lower wage workers.	• Similar to but less than Alternative 1.	• Similar to but less than Alternative 2.	• This impact would not occur relative to development under this alternative; no existing area-wide incentive zoning in place.
• Alternative 1 may also provide market-driven opportunities for new construction of affordable housing separate from the residential towers.	• Similar to but less than Alternative 1.	• Similar to but less than Alternative 2.	• This impact would not occur relative to development under this alternative; no existing area-wide incentive zoning in place.
• Redevelopment under this alternative has the potential to reduce the existing inventory of affordable housing due to displacement of existing wood frame buildings and older single family residences in the subarea.	• Similar to but less than Alternative 1.	• Similar to but less than Alternative 2.	• This impact would not occur relative to development under this alternative; no existing area-wide incentive zoning in place.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Housing (con't)			
• Under this alternative, height and density increases in the focus areas could result in increased residential development within these corridors.	• Similar to but less than Alternative 1.	• Similar to but less than Alternative 1.	• This impact would not occur relative to development under this alternative; no existing area-wide incentive zoning in place.
Aesthetics			
Area Context • As infill occurs in the South Lake Union Neighborhood, the greatest aesthetic difference resulting from the development under this alternative will be the visual expansion of the Downtown Seattle skyline north to the shores of Lake Union.	• Similar to but less than Alternative 1.	• Similar to but less than Alternative 2.	• This impact would not occur relative to development under this alternative.
Neighborhood Character • As infill occurs in the South Lake Union Neighborhood, the greatest aesthetic difference resulting from the development under this alternative will be the visual expansion of the Downtown Seattle skyline north to the shores of Lake Union.	• Similar to but less than Alternative 1.	• Similar to but less than Alternative 2.	• This impact would not occur relative to development under this alternative.
Height, Bulk and Scale • This alternative proposes a relatively new building typology for the neighborhood, which would feature a high-rise tower positioned atop a bulkier low-rise podium that would potentially fill the site from property line to property line.	• Similar to but less than Alternative 1.	• Similar to but less than Alternative 2.	• This impact would not occur relative to development under this alternative.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Aesthetics (con't)			
• This alternative would generally gradually transition down in height from the south boundary of the neighborhood toward Mercer Street on the north. Building heights increase slightly in the block north of Mercer Street.	• Same as Alternative 1, except that the transition downward in height extends north toward Lake Union, with no increase in proposed building height north of Mercer Street.	• Same as Alternative 1, except that the transition downward in height extends north toward Lake Union, with no increase in proposed building height north of Mercer Street.	• Same as Alternative 1, except that the transition downward in height extends north toward Lake Union, with no increase in proposed building height north of Mercer Street.
• Tower bulk (length and width) and podium bulk are not expected to create significant impacts given the restrictions on floor plate size for the towers and restrictions on podium height.	• Same as Alternative 1.	• Same as Alternative 1.	• This impact would not occur relative to development under this alternative.
Viewshed Designated Viewpoints • New high-rise buildings within the study area would be prominent in these views. However, the Space Needle, Elliott Bay, Seattle Downtown skyline, Bainbridge Island, the Cascade Mountains, and the Olympic Peninsula would still be visible.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to but much less than Alternative 1
Scenic Routes • New high-rise buildings within the study area would frame route corridors and would have the potential to screen/block some existing views of the Space Needle from these routes.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to but much less than Alternative 1.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Aesthetics (con't)			
Shadows • Cumulative shadow impacts would result due to the increased amount of development under this alternative.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to Alternative 1.
• Generally, the infill development on undeveloped or under-developed sites would increase the local shadows on streets and adjacent properties	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to Alternative 1.
• Shadows from this alternative could shade portions of the water area of Lake Union in the winter morning (southeast lake shore) and in the winter afternoon (southwest lake shore) hours.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to Alternative 1.
• Overall, the shadow impacts are not expected to result in significant adverse environmental impacts. The impacts are typical of an urbanizing area changing from lower intensity development to that of more intensive development.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to Alternative 1.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Aesthetics (con't)			
Light and Glare • The increased amount of buildings would increase the cumulative level of artificial illumination in South Lake Union. The new buildings will include towers that may potentially incorporate reflective surfaces that could on occasion create glare impacts. The exposure may extend to adjacent hillsides and the freeway because of the topographic basin location. .	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to Alternative 1, although highrise towers would not be built under this alternative.
• Potential increases in building heights in this area and specular surfaces on buildings could, at times, generate increased light and glare impacts that may affect seaplane approaches to the south.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to Alternative 1, although highrise towers would not be built under this alternative.
• The distant visibility from Capitol Hill and Gas Works Park of artificial illumination of the towers is high because of their currently unobstructed location. Artificial illumination from new towers will be highly visible from those portions of Capitol Hill, Queen Anne Hill and Gas Works Park that currently have unobstructed views toward the study area.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to Alternative 1, although highrise towers would not be built under this alternative.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Historic Resources			
• This alternative allows for the greatest amount of development, which could also result in the greatest amount of development pressure on existing small scale structures that may be eligible for historic designation.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Maintaining the existing zoning in the study area would not change the development pressure on historic resources.
• Differences in character, height, and bulk of new development adjacent to a designated historic structure or a structure that is potentially eligible for historic designation, could negatively impact the historic value of the existing structure.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Not anticipated under this alternative.
Cultural Resources			
Impacts common to all alternatives			
• Because the study area is considered to have a low potential to contain intact archaeological deposits, no significant impacts to archaeological sites are anticipated. No pre-contact archaeological sites have been identified within the study area. One historic-period archaeological site has been recorded within the study area and was previously impacted by sewer line and trail construction. Further development is not anticipated to generate additional impacts to this site.			
Transportation			
Impacts Common to the Action Alternatives			
Study Corridors. Under all three action alternatives, the following study corridors experience significant impacts to traffic operations: • Westlake Avenue N from Valley Street to Harrison Street • Westlake Avenue N from Harrison Street to Denny Way • Mercer Street from Dexter Avenue N to Fairview Avenue N			**Study Corridors.** The following study corridors would operate at LOS E or F, exceeding the City's LOS standard, which constitutes a traffic operations deficiency (note that these facilities will also experience deficient

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Transportation (cont.)			
• Denny Way from Aurora Avenue N to Stewart Street • Boren Avenue from Denny Way to Pine Street • Boren Avenue from Pine Street to University Street • Stewart Street from Eastlake Avenue E to Boren Avenue • Harrison Street from Aurora Avenue N to Eastlake Avenue E • 9th Avenue N from Roy Street to Republican Street In addition to those previously listed, the following study corridors are significantly impacted under Alternatives 1 and 2: • Fremont Bridge • Eastlake Avenue E from Fairview Avenue to Lakeview Blvd E • Dexter Avenue N from Valley Street to Denny Way • E Pine Street from Boren Avenue to Broadway • Howell Street/Eastlake Avenue from Stewart Street to Boren Avenue Poor operations on the study corridors identified above can also be assumed to translate to poor intersection operations (LOS E and F) at key intersections along these corridors, such as Mercer Street/Westlake Avenue N, Mercer Street/Fairview Avenue N, Denny Way/Westlake Avenue N, and Denny Way/Boren Avenue. **Transit.** Transit lines that would operate unacceptably under the action alternatives include: • Route 21 (northbound AM and southbound PM) • Route 28 (northbound AM and southbound PM) • Route 29 in both directions (AM and PM peak hours) • Route 56 (northbound AM and southbound PM) Planned capacity increases for the Seattle Streetcar will keep pace with the future ridership estimates from the City's travel model. Transit frequency is the same as under the No Action Alternatives and would not meet the frequency goals outlined in the Urban Village Transit Network (UVTN). **Bicycle and Pedestrian System.** No pedestrian or bicycle demand/capacity impacts are anticipated under the three action alternatives. While no bicycle or pedestrian demand/capacity impacts are anticipated, there are several adverse impacts to the pedestrian and bicycle system: • The increased heights and densities associated with each of the alternatives will lead to additional traffic demand on area roadways, which could result in longer traffic signal cycle lengths. Longer cycle lengths are associated with increased pedestrian delay, which discourages pedestrian travel. Any increases in pedestrian delay at intersections would be an impact to pedestrian mobility.			operations under the three Action Alternatives): • Street to Westlake Avenue N • Westlake Avenue N from Valley Street to Harrison Street • Westlake Avenue N from Harrison Street to Denny Way • Fairview Avenue N from Eastlake Avenue to Yale Avenue N • Dexter Avenue N from Fremont Bridge to Valley Street • Dexter Avenue N from Valley Street to Denny Way • Mercer Street from Dexter Avenue N to Fairview Avenue N • Denny Way from Aurora Avenue N to Stewart Street • Boren Avenue from Denny Way to Pine Street • Stewart Street from Eastlake Avenue E to Boren Avenue • E Pine Street from Boren Avenue to Broadway • Harrison Street from Aurora Avenue N to Eastlake Avenue N • 9th Avenue N from Roy Street to Republican Street • Howell Street/Eastlake Avenue from Stewart Street to Boren Avenue **Transit.** Two transit routes serving South Lake Union will not operate with acceptable load factors – Route 29 and Route 56. Eight transit lines do

<table>
<tr><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th><th>Alternative 4 (No Action)</th></tr>
<tr><td colspan="4">Transportation (cont.)</td></tr>
<tr><td colspan="3">

- Additional vehicle traffic at the Mercer Street/Dexter Avenue N could increase vehicle-bicycle conflicts at this High Bicycle Accident intersection.

Parking. If current parking demand trends continue, short-term shortages are likely for both on-street and off-street parking, particularly around office uses. The level of impact will vary depending on the intensity of land use. The balance between parking supply, parking cost, and alternative mode use will cause some travelers to change modes. Therefore, the parking impact may not be long-term since travelers will shift to other modes in response to limited parking supply and higher parking cost.

Although Alternatives 1 and 2 would have the most demand, they would also provide more supply based on market trends. Because of the relationship between development intensity, parking supply, and parking demand, all action alternatives are expected to have short-term parking impacts.

Freight. The increase in traffic congestion along the Major Truck Streets is caused by both additional development in South Lake Union and regional traffic. There are also potential localized freight impacts that could occur as the neighborhood develops. Impacts to freight mobility could be caused by lack of loading areas and small curb radii that cannot be navigated by trucks.

Traffic Safety. While it is likely that the total number of vehicle collisions will increase proportionally with the increase in traffic in the South Lake Union area, there is nothing to suggest that the volume-based rate of vehicle-to-vehicle collisions will increase with the implementation of the height and density alternatives.

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not meet the UVTN frequency goal of peak hour -- Routes 16, 25, 28, 29, 66, 15 minute headways during the AM 308, 313, and 316. Since the Height and Density alternatives do not affect transit frequency, these routes will also fail to meet frequency goals under the Action Alternatives.

Pedestrian and Bicycle System.

- Anticipated development will result in a substantial number of pedestrian and bicycle trips within the study area. Pedestrian and bicycle demand/capacity issues not likely, but could lead to consequences such as:
- Additional pedestrian and vehicle travel at major intersections could lead to increased pedestrian delays if the City retimes traffic signals to facilitate vehicle flow.
- Additional vehicle traffic at the Mercer Street/Dexter Avenue N could increase vehicle-bicycle conflicts at this High Bicycle Accident intersection.

Parking. If current parking demand trends continue, there will likely be at least temporary shortages for both on-street and off-street parking, particularly around office uses. The

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Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Transportation (cont.)			
			relationship between parking supply and cost will cause prices to climb as demand approaches or exceeds supply. In turn, this will cause some travelers to switch to modes such as transit, thereby freeing up some parking. **Freight.** Increase in traffic congestion on Mercer Street between Dexter Avenue and Fairview Avenue N will lead to increased difficulty for trucks to maneuver and increased travel times, which could delay trucking operations. This is considered a freight mobility deficiency in the area. With future development there could be localized freight deficiencies related to the lack of loading areas and small curb radii that trucks cannot navigate. The removal of Broad Street between 5th Avenue N/Thomas Street and Mercer Street will leave a gap in the City of Seattle Major Truck Street network. **Traffic Safety**. Increased traffic volumes could lead to the identification of additional High Accident Locations. While there may be more High Accident Locations there is no data available to suggest that a volume-based collision rate (e.g., collisions per million entering vehicles) will increase.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Public Services			
Impacts common to all alternatives			
Fire and Emergency Services • Construction activities associated with potential development under the proposed alternatives could result in an increase in demand for fire services. • The Fire Department would attempt to maintain response times consistent with current performance levels. An additional 1-2 EMS companies could be required over the next 10 years in order to maintain performance levels. However, given that Stations 2 and 25 are two of the busiest stations in the Department, additional EMS companies could be required in SLU even without potential development under this alternative *Police Services* • Potential construction under this alternative could result in an increase in demand for police services. • Potential increases in onsite population and employment associated with development under this alternative would be incremental and would result in associated incremental increases in demand for police services. • Sufficient staffing and facilities exist to accommodate the increased demand for service under this alternative and no additional safety problems are anticipated.			
• Requests for fire department services could result in an increase of approximately 18 percent by 2031.	• Requests for fire department services could result in an increase of approximately 17 percent by 2031.	• Requests for fire department services could result in an increase of approximately 15 percent by 2031.	• Requests for fire department services could result in an increase of approximately 14 percent by 2031.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)
Utilities			
Water System • The increased density and intensity of development under this alternative could result in greater demands on the water supply and distribution system.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to but much less than Alternative 1.
Combined Sewer System • The increased density and intensity of development under this alternative could result in greater demands on the local sewer collection system and on the downstream conveyance and treatment facilities.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to but much less than Alternative 1.
Storm Sewer System • Potential development under any of the alternatives is not expected to result in increased demand on the storm water systems of the neighborhood.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to but much less than Alternative 1.
Electric Power • The increased density and intensity of development under this alternative could result in greater demands on electrical energy.	• Similar to Alternative 1.	• Similar to Alternative 1.	• Similar to but much less than Alternative 1.

Alternative 1	Alternative 2	Alternative 3	Alternative 4 (No Action)

Open Space and Recreation

Impacts common to all alternatives

- Potential increases in height and density associated with this alternative would subsequently result in an increase in population and employment in the SLU Neighborhood, which would result in an associated increase in demand for parks, open space and recreation facilities in the area.
- Based on current parks and recreation distribution guidelines and the estimated 2031 household and employment targets for SLU, the total estimated park and recreation demand under this alternative would be approximately 14.1 acres, which is an increase over the total 2024 estimated demand of 12.78 acres, but still less than the existing 15.7 acres of open space.
- Future residential and employment growth under this alternative would tend to increase the overall use and activity levels of existing parks and recreation facilities in the SLU Neighborhood and site vicinity.
- This alternative could include an incentive program that offers development bonuses for projects (typically an allowance for additional height or floor area). Potential public benefits that could be considered as part of a development incentive program include new park and recreation facilities such as a new center for community, arts, and culture, pocket plazas, and/or children's play areas.

1.6 Mitigation Strategies

Mitigation Strategies

Table 1-3, below summarizes all mitigation strategies listed in the EIS and is organized by element of the environment. As described in the EIS, many of the strategies are intended to address future site-specific development that could occur under any of the alternatives. Other strategies focus on area-wide mitigation that is intended to directly address potential impacts associated with the increased height and density associated with the alternatives.

Geology and Soils

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur with development under any of the alternatives. Site specific measures may include reducing the size of the project, placing limits on project timing and schedule, or requiring additional practices during construction to avoid adverse impacts (SMC 25.05.675(D)). Additional practices might include landscaping, supplemental drainage measures, water quality control, erosion control, and stabilization measures.

Air Quality

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives. These are briefly described below.

Although significant air quality impacts are not anticipated due to construction activities, construction contractors would be required to comply with all relevant federal, state, and local air quality rules. In addition, implementation of best management practices would reduce emissions related to the construction of the developments.

Possible management practices for reducing the potential for air quality impacts during construction address measures for reducing exhaust emissions and fugitive dust. The Washington Associated General Contractors brochure Guide to Handling Fugitive Dust from Construction Projects and the PSCAA suggest a number of methods for controlling dust and reducing the potential exposure of people to emissions from diesel equipment. A list of some of the possible control measures that could be implemented to reduce potential air quality impacts from construction activities include:

- use only equipment and trucks that are maintained in optimal operational condition;
- require all off-road equipment to have emission reduction equipment (e.g., require participation in Puget Sound Region Diesel Solutions, a program designed to reduce air pollution from diesel, by project sponsors and contractors);
- use car-pooling or other trip-reduction strategies for construction workers;
- implement restrictions on construction truck and other vehicle idling (e.g., limit idling to a maximum of 5 minutes);
- spray exposed soil with water or other suppressant to reduce emissions of PM and deposition of particulate matter;
- pave or use gravel on staging areas and roads that would be exposed for long periods;
- cover all trucks transporting materials, wetting materials in trucks, or providing adequate freeboard (space from the top of the material to the top of the truck bed), to reduce PM emissions and deposition during transport;
- provide wheel washers to remove particulate matter that would otherwise be carried off site by vehicles to decrease deposition of particulate matter on area roadways;
- cover dirt, gravel, and debris piles as needed to reduce dust and wind-blown debris; and
- stage construction to minimize overall transportation system congestion and delays to reduce regional emissions of pollutants during construction.

Operation

No impacts have been identified and no mitigation is proposed or necessary.

Water Quality

Although current City Stormwater Code provisions would not require additional mitigation for increased height or density within the study area, increased pollution would likely be generated as a result of increased vehicle traffic to support increased development under any of the alternatives. In addition to requiring water quality treatment in storm water basins and flow control in CSO basins for certain levels of development, the Stormwater Code requires the use of green stormwater infrastructure (GSI) to the maximum extent feasible on all projects. These GSI techniques can provide additional water quality and/or flow control benefits.

Sustainable Drainage Strategies

The alternatives to increase height and density within the study area would not require additional water quality or flow control measures; however, several strategies are provided below that could further mitigate impacts from urban road runoff.

- Water quality treatment best management practices (BMPs) are facilities that remove pollutants by some combination of the following: gravity settling of particulate pollutants, filtration, plant Uptake, biological processes, and/or adsorption. Examples include bio-filtration swales, sand filtration systems, raingardens and stormwater wet ponds.

  Urban settings are challenging to provide water quality facilities since the space needed to provide these systems is typically not readily available. Incorporating the water quality facility into the streetscape design is an option designers can use to ensure roadway runoff is properly treated. Typical examples of integrated water quality BMPs into streetscape design include: roadside raingardens, porous paving, bio-filtration swales, filter strips and ecology embankments.

  Planning of streetscape improvements could consider incorporating water quality design features as noted above to treat runoff prior to discharging to the storm system. The City's Stormwater Code requires use of these and other Green Stormwater Infrastructure (GSI) methods as part of stormwater design.

- As noted, significant portions of the pollution generating surfaces are comprised of public rights-of-way. As such, the development of a regional or neighborhood treatment facility could become an alternative to individual solutions. Redevelopment of the area provides the opportunity for partnering to install regional stormwater treatment facilities. An example of this is the Swale on Yale/Capitol Hill Water Quality Facility which is the project being jointly developed through a public/private partnership with SPU to provide stormwater quality treatment via biofiltration for a large portion of the approximately 500-acre basin draining through the 72-inch storm drain.

Plants and Animals

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives, such as adverse impacts to vegetation, the avian patterns of use in the study area, and fish habitat in Lake Union. Potential impacts will be assessed in future project-level SEPA review associated with any specific development proposal to determine whether adverse impacts are significant. The mitigating measures described below address potential site-specific mitigation that may be associated with future site-specific actions.

When project-specific environmental review occurs in the future for development projects located within the South Lake Union neighborhood, an inventory of all non-native and native trees six inches or greater in diameter (measured 4.5 feet above the ground) would be required for the site-specific proposal. City staff would determine which trees qualify as exceptional and would determine protection requirements at that time. If exceptional trees or trees with a diameter of 2 ft. or greater are located within the site area of a new building, the project would be required to comply with the provisions of the City's code, as described above. In addition, Seattle Municipal Code 23.47A.016 requires landscaping and screening for most commercial developments, which would likely mitigate any vegetation loss in the study area.

City permitting of proposed redevelopment under all alternatives would require completion of the SEPA process, which includes an assessment of project impacts to fish and wildlife. Mitigation requirements could include treatment of project-related stormwater, evaluation of outside lighting, installation of native plant species to reduce potential light impacts, and implementation of a "lights out" program to educate and encourage high-rise building tenants to turn off lights at night, particularly during the fall (southward) avian migration period. The City could also choose to reduce height limits on the three lots discussed above that could shade the juvenile outmigration corridor during spring mornings and evenings under Alternatives 1 and 2.

Environmental Health

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives. Mitigation measures that could be required during future property redevelopment include:

- Further site investigations to determine the potential for contamination to be present on the property.

- Soil and groundwater investigations to evaluate the type, concentration, and extent of contamination, if present.
- Cleanup of contamination sources (e.g. removal of underground storage tanks, excavation of contaminated soil).
- Handling and disposing of contaminated soil and groundwater according to local and state regulations.

Noise

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives. Mitigation measures that could be required during future property redevelopment include:

Construction

Practices which can reduce the extent to which people are affected by construction noise and ensure that construction noise levels stay within the applicable daytime sound level limits include:

- Use properly sized and maintained mufflers, engine intake silencers, engine enclosures, and turn off idle equipment.
- Construction contracts can specify that mufflers be in good working order and that engine enclosures be used on equipment when the engine is the dominant source of noise.
- Stationary equipment should be placed as far away from sensitive receiving locations as possible. Where this is infeasible, or where noise impacts are still significant, portable noise barriers could be placed around the equipment with the opening directed away from the sensitive receiving property. These measures are especially effective for engines used in pumps, compressors, welding machines, and similar equipment that operate continuously and contribute to high, steady background noise levels. In addition to providing about a 10-dBA reduction in equivalent sound levels, the use of portable barriers demonstrates to the public the contractor's commitment to minimizing noise impacts during construction.
- Substitute hydraulic or electric models for impact tools such as jack hammers, rock drills and pavement breakers could also reduce construction and demolition noise. And electric pumps could be specified if pumps are required.

- Although as a safety warning device, back-up alarms are exempt from noise ordinances, these devices emit some of the most annoying sounds from a construction site. One mitigation measure would be to ensure that all equipment required to use backup alarms utilize ambient-sensing alarms that broadcast a warning sound loud enough to be heard over background noise -- but without using a preset, maximum volume. Another alternative would be to use broadband backup alarms instead of typical pure tone alarms. Such devices have been found to be very effective in reducing annoying noise from construction sites. Requiring operators to lift rather than drag materials wherever feasible can also minimize noise from material handling.
- Construction staging areas expected to be in use for more than a few weeks should be placed as far as possible from sensitive receivers, particularly residences. Likewise, in areas where construction would occur within about 200 feet of existing uses (e.g., residences, schools/classrooms, and noise-sensitive businesses), effective noise control measures (possibly outlined in a construction noise management plan) should be employed to minimize the potential for noise impacts. In addition to placing noise-producing equipment as far as possible from homes and businesses, such control could include using quiet equipment and temporary noise barriers to shield sensitive uses, and orienting the work areas to minimize noise transmission to sensitive off-site locations. Although overall construction sound levels would vary with the type of equipment used, common sense distance attenuation should be applied.

Operation

To minimize the potential for noise impacts, HVAC units should be located away from residences – or other sensitive receptors, whenever possible and/or shielded to comply with applicable noise limits. No other specific impacts have been identified and, therefore, no other specific mitigation measures are necessary.

Energy (Greenhouse Gas Emissions)

The following potential mitigation strategies would address potential impacts to climate change, energy use and greenhouse gas emissions from future development in the South Lake Union neighborhood:

- **Natural Drainage and Green Roofs** – Green roofs can provide additional open space, opportunities for urban agriculture, and decreased energy demands by reducing the cooling load for the building. Green Stormwater Infrastructure (GSI) could also be used for flow control and water quality treatment.

- **Tree Protection** – The City of Seattle has aggressive urban forest goals in order to help restore tree cover which has been lost due to development. Trees can provide stormwater management, habitat value, noise buffering, air purification, carbon sequestration, and mitigation of the urban heat island effect. Trees also have a positive effect on property values and neighborhood quality. Protection of existing trees, as feasible, and careful attention to new tree planting could help meet the Seattle Comprehensive Urban Forest Management Plan Goals for multi-family residential and commercial office development by achieving 15-20 percent overall tree canopy within 30 years.
- **Urban Agriculture** – New P-patch Community Gardens and rooftop gardens could be provided or encouraged within the neighborhood for residents to grow food. Balconies, decks, and right-of-way planting strips could also be utilized for individual residents' agriculture needs. A farmer's market could be established for residents to sell locally grown food.
- **Native Plants** – Native plants are adapted to the local climate and do not depend upon irrigation after plant establishment for ultimate survival. Landscaping with native plants, beyond that required by City code, could be planted to reduce water demand and integrate with the local urban ecosystem.
- **District Infrastructure Systems for Energy, Water and Waste** – District Infrastructure Systems aggregate enough service demands to make local neighborhood utility solutions feasible, and may reduce greenhouse gases by utilizing renewable sources of energy and increasing the use of local resources, materials and supplies. District parking solutions and car sharing are designed to reduce vehicle trips. Water reuse and anaerobic digesters may reduce sewer flows. Rainwater capture may reduce stormwater flows. Water reuse and rainwater capture could also reduce potable water demands. District systems for the South Lake Union neighborhood could potentially include energy, potable water, wastewater, and solid waste.
- **Waste Management and Deconstruction** – When existing buildings need to be demolished, there are often opportunities to reduce the amount of waste being sent to the landfill with sustainable waste management strategies. In the Seattle area, standard practice for building construction and demolition results in fairly high recycling rates of over 50 to 60 percent. However,

these rates can be increased by implementing aggressive demolition recycling. Such efforts can require considerable additional effort on the part of the contractor.

- **Building Design** – Green building encompasses energy and water conservation, waste reduction, and good indoor environmental quality. Tools and standards that are used to measure green building performance, such as Built Green, LEED, and the Evergreen Sustainable Development Criteria, could be encouraged or required for development within the South Lake Union neighborhood.

Land Use

Plans, Policies and Regulations

- In order to ensure that buildings do not obstruct the flight path and airspace established by FAR 77, maximum building heights in this area of South Lake Union will be adjusted to ensure that buildings do not penetrate the airspace.
- A vertical safety buffer – below the approach surface – should be considered to ensure adequate separation between the airspace and building rooftops.
- Consideration should be given to limiting the height of rooftop appurtences (e.g., antennae, flag poles, etc.) proximate to the flight path that could penetrate the airspace or the associated safety buffer.
- Consideration should also be given as part of the City's design review process to limiting rooftop specular surfaces that can act as a distraction for pilots.
- Proximate to the flight path, consideration should be given to limiting electrical interference on frequencies used by aircraft.

Wind Analysis

The mitigation measures presented below apply to all action alternatives.

- The area of the tallest height limit should be located near the outer perimeter of the South Lake Union neighborhood most distant from Lake Union. The largest buildings would tend to create the most significant, far reaching shear layers and would need a maximum separation from the lake.
- Reduce overall building massing and height progressively, approaching the lake. The upwind buildings would provide a measure of wind shielding of the downwind buildings. The shorter buildings adjacent to the lake would result in smaller wakes that extend towards the south approach/departure surface.

- The building height and space relationships and their influence on the approach/departure surface winds should be assessed as part of future consideration of building heights in the flight path vicinity. In order to establish a more specific definition of the extent of wakes and other significant wind dominated effects, quantitative wind modeling with a scale model of proposed development in a boundary layer wind tunnel would be required.

Housing

Future population and employment increases in the South Lake Union neighborhood under Alternatives 1-4 would be incremental and would result in associated increases in demand for diverse housing opportunities within the subarea. In order to address the City's goals of providing affordable housing, the following incentives and programs could be implemented in the South Lake Union subarea:

Existing Development Incentives

Multi-Family Property Tax Exemption

Seattle's Multifamily Tax Exemption (MFTE) program allows developers to receive a property tax exemption on the residential portion of a development for a specified number of years in exchange for providing a specified percentage of housing units in rental projects that are affordable for moderate-wage workers during the time the exemption is utilized. The current MFTE program expired on Dec. 31, 2010; however the Seattle City Council is currently reviewing the program for renewal. There may be changes to existing program requirements once the City Council renews the program. It is assumed that the MFTE Program will continue to be available in 39 target areas in Seattle, one of which is the South Lake Union Urban Center.

Incentive Zoning

Incentive zoning is a strategy to both encourage the desired density while ensuring growth contributes to livability and sustainability. The goal of incentive zoning is to link code flexibility, increased density and development potential with public benefits in the form of affordable housing and other amenities valued by communities. By helping to direct growth to areas targeted in the Comprehensive Plan, incentive zoning could also work to preserve the character of many of Seattle's neighborhoods. Incentive zoning is used to offer extra floor area for new development in exchange for community amenities. A baseline height limit or Floor Area Ratio (FAR) limit is created in a given neighborhood or a zone. Developers can then take advantage of additional height or FAR by purchasing TDR and/or acquiring bonus floor area in exchange for providing public benefits, which include low-income housing (defined as affordable to households making less than 80 or 100 percent of Area Median Income depending on tenure) and a long list of on-site public amenities (SMC 23.50.051).

The commercial/industrial bonus provision of Seattle's incentive zoning enables developers to achieve additional floor area ratio (FAR) in exchange for housing and childcare that is affordable to lower-wage workers. The housing and/or childcare can be provided by the developer or a contribution of $18.75 per bonus square foot for housing and $3.25 per bonus square foot for childcare facilities may be made to the City for those purposes. This bonus is currently available in high-rise downtown commercial zones and on a few IC-zoned lots in the South Lake Union Urban Center (SMC 23.50.052).

The residential bonus provision of Seattle's incentive zoning enables residential developers to achieve extra floor area above the base height limit when affordable housing is provided. Developers can build affordable housing as part of their development or, in certain zones, make a contribution of approximately $19 per bonus square foot to the City to fund new affordable housing. The housing is intended to primarily serve Seattle's modest-wage workers. The residential bonus is currently available in midrise and high-rise zones, in certain Downtown zones, and in certain areas of the Dravus neighborhood; this program is not presently available in the South Lake Union subarea.

Transferable Development Rights (TDR)

This option helps Seattle maintain a more variable scale of buildings in the South Lake Union neighborhood by allowing density to be moved from one site to another (SMC 23.50.053). Owners of certified TDR sites — ones with low-income housing, an arts facility, or a designated Landmark building— can sell excess development rights to developers in certain IC zones and use the proceeds for preservation of those priority uses. A TDR program is also in effect in downtown.

Other Strategies Specific to South Lake Union to Achieve Affordable Housing Objectives

Preservation

Structure incentive programs to allow use of TDR to preserve the following older residential buildings (all red brick buildings):

- Grandview Apartments (409 Eastlake East)

- Carolina Court (527 Eastlake North)
- Carlton Apartments (603 Pontius North)
- 502 Minor North
- Carolyn Manor Apartments (1309 Dexter North)
- Jensen Apartments

Employers Promoting Living near Work

Involve employers in identifying strategies to promote living near work.

- Create innovative ways for employers to help develop a "live and work" community.
- Explore ways for South lake Union employers to contribute to housing if employees live in South Lake Union through Transportation Management Plans.

Surplus Sites for Affordable Housing

- Inventory publicly owned property in South Lake Union suitable for development in affordable housing.
- Identify key community properties for particular uses, including affordable housing.

Family Housing

- Encourage affordable family sized homes through employer-developer partnerships and direct City funding.
- Use surplus property to achieve housing objectives not being met through private market, such as family housing.
- Use zoning and design guidelines to encourage ground-related housing in the six block area along 8th Avenue from John to Republican.
- Encourage ground-related housing units with good access to open space around Denny Park and Cascade Park.

Subsidized Housing Resources

- Leverage public funding to preserve existing and create new subsidized housing within South Lake Union.
- Use South Lake Union commercial/industrial bonus payment option funds for new low-income housing in the South Lake Union subarea.

Aesthetics

Height, Bulk and Scale

A number of potential approaches for mitigation are discussed below. See also mitigation recommendations contained in SMC 25.05.675, some of which are incorporated below.

Possible mitigation strategies to reduce the impact of height, bulk and scale that may apply to all alternatives include:

a. Either limit the height of development or create additional zones that transition building heights down more gradually.
b. Implement measures to modify the bulk of development.
c. Modify building façades or envelopes through adjustments in building modulation, finish material, color, architectural detailing or fenestration (including type or percentage of glazing).
d. Reduce, relocate or rearrange of accessory structures.
e. Modify required building setbacks.
f. Relocate buildings on-site.
g. Modify building orientation.
h. Redesign the building profile of a project.
i. Create or modify on-site view corridors.
j. Reduce or modify walls, fences, screening or landscaping.
k. Require or encourage incorporation of open space or through-block pedestrian connections as part of development projects.
l. Develop and adopt design guidelines to specifically address bulk impacts identified with each alternative.

Viewshed

No significant impacts have been identified relative to protected viewpoints as a result of this programmatic analysis and, therefore, no mitigation is necessary.

At such time site-specific development occurs, detailed viewshed analysis should be performed relative to any development that would be within the view corridor between Volunteer Park and the Space Needle.

Shadows

At such time site-specific development occurs, detailed shadow analysis should be performed relative to any development that could affect Denny Park, Cascade Playground or Lake Union Park with attention to times of the year and hours of the day the open space could be affected, the geographical area(s) of the open space affected, anticipated seasonal use of the open space, availability of other open spaces in the area, and the number of people affected.

SMC 25.05.675Q2e authorizes the City to employ measures to mitigate adverse shadow impacts to key open spaces, including:

a. limiting the height of development;
b. limiting the bulk of the development;
c. redesigning the profile of the development;
d. limiting or rearranging walls, fences or plant material;
e. limiting or rearranging accessory structures, i.e., towers, railings, antennae; and
f. relocating the project on the site.

Light and Glare

SMC 25.05.675K2d authorizes the City to employ measures to mitigate adverse light and glare impacts, including the following:

a. "limiting the reflective qualities of surface materials that can be used in the development;
b. limiting the area and intensity of illumination;
c. limiting the location or angle of illumination;
d. limiting the hours of illumination; and
e. Providing landscaping."

Other measures that may be also employed include:

f. install screening, overhangs, or shielding to minimize spillover lighting impacts – particularly near sensitive residential receivers;
g. shield exterior lighting fixtures and directing site security lighting away from nearby residential uses;
h. include pedestrian-scaled and pedestrian-oriented lighting for safety along sidewalks, parking areas, street crossings and building access points;
i. employ timers or motion sensors for lighting to reduce spillover lighting and generally reduce ambient light levels;
j. avoid large expanses of smooth, uniform, reflective building surfaces;
k. incorporate architectural relief and detail, such as exterior sun shades, deep spandrels, mullions or other features of façade articulation, that reduce reflectivity; and
l. as necessary, undertake project-specific solar impact analysis studies to determine the extent of light and/or glare impacts and to identify specific mitigation measures.

Historic Resources

In order to comprehensively assess existing resources and identify historic preservation priorities, potentially undertake a new inventory of historic resources in the South Lake Union neighborhood. Up-to-date information will allow proper assessment of potentially eligible properties. A new survey would address buildings such as 501 Dexter Avenue N, which appears to have architectural significance yet has not been cited in earlier surveys.

If higher-density alternatives (1, 2, or 3) are chosen, funding to the Department of Neighborhoods Historic Preservation Office for preparation of landmark nominations should be considered as mitigation. The work would allow the properties to be taken through the nomination process to clarify the status of potentially significant properties.

The *South Lake Union Urban Center Neighborhood Plan* of September 2007 identifies goals and policies that specifically relate to historic or older buildings in the neighborhood. The plan identifies the following policies, which would be appropriate as mitigation measures for increased height and density allowed in the neighborhood (under Alternatives 1, 2, or 3).

- Establish incentives to encourage preservation, adaptive use, and rehabilitation of historically significant structures in the neighborhood.
- Explore incentives to encourage the adaptive use of older, character-providing buildings in the neighborhood.
- Provide incentives to support property owners who wish to maintain existing buildings.

A zoning capacity and financial feasibility model should be created and analyzed to determine whether an expanded transfer of development rights (TDR) program would be an effective financial incentive and mitigation tool for preservation of local landmark properties in the South Lake Union neighborhood.

A certified arborist should undertake a conditions analysis of the trees in Denny Park, including an assessment of their need for seasonal sunlight from the north. Design standards should be modified accordingly to allow ample light.

Cultural Resources

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the location and nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives.

Mitigation measures could potentially include archaeological monitoring, testing, or data recovery excavations; development of interpretive signs, markers, or exhibits; and/or minimization or avoidance of further impacts through redesign.

Transportation

Bicycle and Pedestrian System

Research has shown that vehicle trip generation and traffic congestion impacts can be reduced if a robust pedestrian system is provided.

Based on a review of the Pedestrian Master Plan, several improvements could be implemented in South Lake Union. Some of the improvements related to Tier 1 Pedestrian mobility issues in the South Lake Union neighborhood include, but are not limited to:

- Complete missing sidewalks along Terry Avenue consistent with the *Terry Avenue Street Design Guidelines*
- Add sidewalk to north side of Denny Way between Stewart Street and Melrose Avenue consistent with the proposed *Denny Way Streetscape Concept Plan*[1]
- Add sidewalk along the east side of Eastlake Avenue from Denny Way to Harrison Street and add a signalized[2] crossing at the Eastlake Avenue/Republican Street intersection
- Close pedestrian system gaps on Roy Street between Fairview Avenue and Minor Avenue and on Valley Street between Minor Avenue and Yale Avenue

The Bicycle Master Plan identifies the following relevant actions in the South Lake Union neighborhood including but not limited to:

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[1] *The Denny Way Streetscape Concept Plan* has not yet been adopted.

[2] To be implemented, a signal must meet warrants and be approved by SDOT.

- Add bikeways along Fairview Avenue from Valley Street to Eastlake Avenue E to connect to facilities provided as part of Mercer East and West projects on Valley and Roy Streets
- Add bikeways along Harrison or Thomas street between Fifth N and Eastlake and along Fairview Avenue between Denny Way and Valley Street
- Improve bicycle access through the Fairview Avenue/Denny Way intersection
- Signalize intersection at Minor Avenue N and Denny Way consistent with the *Denny Way Streetscape Concept Plan*

All Bicycle Master Plan improvements were considered for this analysis. However, before implementation, SDOT would review the projects during the design stage to address any potential concerns, such as safety. Other pedestrian and bicycle network projects include the following:

- Implement the planned Lake to Bay Loop
- Repair facilities in poor condition
- Require that projects which develop above the "base height" implement the mid-block connector concept consistent with the South Lake Union Urban Design Framework
- Provide additional signalized crossings on Thomas Street at the Dexter Avenue, 9th Avenue, and Westlake Avenue N intersections[3]
- Provide additional signalized crossings on John Street at the Dexter Avenue and Westlake Avenue N intersections[4]
- Evaluate opportunity to provide enhanced, marked crossing locations across Westlake Avenue N, between Galer Street and 9th Avenue N[5], and implement improvement as appropriate
- Implement the hill climbs defined in the Urban Design Framework
- Improve street lighting and way finding

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[3] Given the multi-lane nature of these streets, a pedestrian signal or half-signal is necessary to provide a safe crossing. The signal is required because of the adjacent land uses and likely pedestrian desire lines.

[4] To be implemented, a signal must meet warrants and be approved by SDOT..

[5] The frequency of marked crossings is a key component of the pedestrian network. The exact location of each crossing is not known at this time. In the future, the City would evaluate pedestrian desire lines to determine the precise location and treatment for each crossing.

Travel Demand Management and Parking Strategies

Implement best management practices for travel demand management including maximum parking limits and unbundled parking costs for residential and commercial properties. Research by the California Air Pollution Control Officers Association (CAPCOA), which is composed of air quality management districts in that state has shown that implementation of travel demand management programs can substantially reduce vehicle trip generation (see **Appendix E** for details), which, in turn, reduces traffic congestion impacts. Parking maximums would limit the number of parking spaces which can be built with new development. Unbundled parking separates parking costs from total property cost, allowing buyers or tenants to forego buying or leasing parking spaces. These types of potential mitigation measures would tend to reduce the number of work-based commute trips and all types of home-based trips .Shopping-based trips would also decrease, but at a lower level since these types of trips are less sensitive to parking costs and limited supply for short-term use.

The parking-based travel demand management strategies described above could be further supported by implementing the car sharing incentives identified in the Seattle Municipal Code[6] and through the development of a parking management program like the recently deployed e-park system in Downtown Seattle to better utilize private parking resources.

Note that the parking analysis in the previous sections identified potential short-term parking impacts related to an imbalance between supply and demand. Any reductions to the parking supply in the South Lake Union area would exacerbate this short-term impact. However, as described in the previous sections, while reduced supply will create a short-term shortage in parking spaces, over time prices will adjust and some drivers will switch to other modes. This shift to other modes is the primary goal of the potential travel demand management mitigation measures since it will reduce the impacts to traffic congestion and freight mobility.

In addition to the parking management strategies described above, the City of Seattle could also seek to expand the Downtown Growth and Transportation Efficiency Center (GTEC) program to include the South Lake Union area, or institute a separate GTEC for South Lake Union. As

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[6] SMC – 23.54.020.J

described in *Growth and Transportation Efficiency Center Program 2009 Report to the Legislature*, WSDOT describes the GTEC program as an extension of the existing CTR program. The GTEC program engages employers of all sizes in vehicle trip reduction programs through an area-wide approach. GTECs must also include an evaluation of transportation and land use policies to determine the extent to which they complement and support trip reduction goals. The South Lake Union Height and Density land use changes along with the potential mitigation packages conform well to the general goals of the GTEC program.

Transit Service Expansion

Impacts to transit load factors could be reduced and frequencies could increase by providing capital and/or operational support existing and planned transit service between Uptown and Capitol Hill. King County Metro should consider options to increase the frequency and capacity on the impacted routes by running additional busses. A South Lake Union shuttle service connecting destinations along Eastlake, the streetcar line, and the Aurora Rapid Ride line would provide additional transit service opportunities in the area, while supporting the shift to other modes caused by the potential travel demand management mitigation measures.

Additional improvements to the transit network include transit signal priority at the Fairview Avenue N./Denny Way intersection, and a northbound queue jump lane and southbound transit signal priority at the Fairview Avenue N./Harrison Street intersection.

Roadway Capacity Enhancements

Impacts to traffic congestion and freight mobility along the Mercer Street corridor could be reduced by the completion of the Mercer West Corridor Project. The roadway changes include:

- Widen the Mercer Street underpass between Dexter and 5th Avenues N to include three lanes in each direction, left-turn lanes, wider sidewalks, and a bicycle path
- Connect 8th Avenue N between Mercer and Roy Streets
- Consider separating southbound left turn phase at 9th Avenue/Denny Way/Bell Street intersection

Potential Mitigation Measure Implementation

Implementation of the potential mitigation measures described above is anticipated to be achieved through an update of the South Lake Union Voluntary Impact Fee Program and updates to the City Code to support the potential travel demand management/parking mitigation measures.

As the South Lake Union neighborhood builds out, the Seattle Department of Transportation will monitor the transportation system, prioritize projects, and use the fees collected to construct projects, much as the current Voluntary Impact Fee Program is operated.

Projects that develop within the South Lake Union neighborhood may pay the voluntary mitigation fee in order to receive a Master Use Permit. Alternatively, if a project applicant does not wish to pay the voluntary impact fee, project applicants must perform a supplemental environmental analysis to determine transportation impacts and appropriate measures to mitigate project impacts.

Specific Mitigation Measures

This section summarizes each impact along with potential mitigation measures.

Impact 1: Under all three alternatives, there will be significant impacts to study corridor traffic operations.

Potential Mitigation 1: The Roadway Capacity Enhancement mitigation measure, which includes the completion of the Mercer West Corridor Project, will reduce the impact on Mercer Street corridor and improve overall pedestrian and bicycle circulation in the area by implementing a key section of the Lake to Bay Loop.

Since no other roadway capacity expansion projects are planned or considered feasible, many of the remaining impacts can be lessened by implementing the Bicycle and Pedestrian System and Travel Demand Management mitigation measures, as described below.

Based on the output from the Mixed Use Development (MXD) model, the Bicycle and Pedestrian System mitigation measures will reduce vehicle trip generation by approximately 7 percent (for PM peak hour trips, see **Appendix E** for other time periods). The MXD trip generation tool predicts mode share based primarily on land use and demographic information, and does not take additional travel demand management into account. To estimate the reduction in trips prompted by travel demand management programs, research summarized by CAPCOA[7]was

[7]*Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from GHG Mitigation Measures,* CAPCOA, August, 2010.

consulted. According to this research, the travel demand management strategies will reduce vehicle trip generation by 15 percent[8]. Combined, these two measures would reduce overall PM vehicle trip generation by about 21 percent for all three height and density alternatives[9].Additional information regarding these calculations and the CAPCOA research are available in **Appendix E**.

As shown in **Table 1-3**, these trip generation rates would be lower than what is anticipated under the No Action Alternative and the impact on many study roadway segments would be reduced to a less-than-significant level. However, because the change in traffic congestion would affect drivers' behavior, some roadway segments would continue to be impacted, as described in the next section.

The Transit Service Expansion mitigation measure is also recommended. Based on the CAPCOA research, providing capital support that would lead to increased transit frequency would lead to an additional two percent reduction in vehicle trip generation. CAPCOA estimates an additional five percent reduction in vehicle trip generation could be achieved by providing new transit service (e.g., new service between Queen Anne, South Lake Union, and Capitol Hill via Mercer Street; South Lake Union shuttle service connecting the neighborhood with the Streetcar and the Aurora Rapid Ride). However, additional studies would need to be conducted to determine the exact level of ridership on new transit lines.

Any additional transit would also support and enhance the pedestrian, bicycle, and travel demand management mitigation measures described above. However, since the City of Seattle does not generally own and operate the transit service in South Lake Union, there is no guarantee that expanded transit service (beyond what is assumed in the Seattle travel model) will occur. Therefore, this mitigation measure was not assumed when reporting the results with mitigation in **Table 1-4**.

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[8] 15 percent reduction in trip generation assumes that the maximum parking limits reduce parking supply (on a per square foot/dwelling unit basis) by 25 percent compared to the No Action alternative. Unbundled parking is assumed to cost an average of $100 per month per space.

[9] As noted in Appendix E, the combined effects of two trip reduction strategies are not additive since there are diminishing returns when multiple strategies are implemented.

Impact 2: Under all three height and density alternatives, there will be impacts to bicycle and pedestrian mobility.

Potential Mitigation 2: To reduce the significance of this impact, it is recommended that the Bicycle and Pedestrian System mitigation measures be implemented.

Impact 3: Under all three height and density alternatives, freight mobility is significantly impacted.

Potential Mitigation 3: As discussed, the Roadway Capacity Enhancements will not address congestion on Mercer Street between Dexter Avenue and Fairview Avenue N. Therefore it is recommended that the Bicycle and Pedestrian System and Travel Demand Management mitigation measures also be implemented to reduce the automobile trip generation from residents and employees of South Lake Union. These measures will free up more capacity on the Mercer Street corridor for freight traffic.

It is also recommended that the City update the Major Truck Street network to identify a replacement for Broad Street. Further, improvements to major truck streets and arterials expected to carry heavy vehicles on a regular basis will continue to be considered pursuant to the City's adopted Complete Streets policy which guiding principle is to design, operate and maintain Seattle's streets to promote safe and convenient access and travel for all users. For example, the need for wider corner radii to accommodate turning trucks must be balanced with the need to shorten pedestrian crossings and slow regular passenger vehicles. The City will evaluate these trade-offs on a case-by-case basis.

Also, as specific projects seek a Master Use Permit, the City should review the applications to ensure that adequate loading and truck circulation facilities are provided based on the proposed use.

Impact 4: Under all three height and density alternatives, there will be significant impacts to transit in terms of load factors.

Potential Mitigation4: To reduce the significance of this impact, it is recommended that King County Metro increase the frequency and capacity on the impacted routes by running additional busses.

Impact 5: Under all three height and density alternatives, there will be significant short-term impacts to parking. The impacts would be felt by employees who must pay more for parking, and building owners who must maintain active TDM programs to accommodate all the tenants.

Potential Mitigation 5: To reduce the significance of this impact, it is recommended that the Bicycle and Pedestrian System, Travel Demand Management, and Transit Service Expansion mitigation measures be implemented. There is a strong relationship between parking supply, parking cost, and mode share. Although there may be short-term impacts as individual developments are completed (causing parking demand to exceed supply), over the long-term the situation will reach equilibrium as drivers shift to other modes.

The City may have to review its on-street parking policies and consider implementing variable parking pricing to maintain supply. The shift from driving to transit may also require more transit service from King County Metro. The parking maximum limits suggested as mitigation for Impact 1 would also reduce supply and shift travelers to other modes.

Mitigation Results

The potential mitigation measures were taken into account and analysis was repeated on the three height and density rezone alternatives. The Pedestrian and Bicycle System and Travel Demand Management mitigation packages were factored in at the trip generation level. The Roadway Capacity Enhancement mitigation measures were integrated into the travel model. The trip generation results of the mitigated height and density alternatives are summarized in **Table 1-3** (more details may be found in **Appendix E**). The d/c ratios of the three action alternatives with mitigation are shown in **Table 1-4**, along with the No Action Alternative for comparison.

Table 1-3
PM Peak Hour Trip Generation with and without Mitigation

Alternative	No Mitigation			Mitigation		
		Non-auto Trips (mode share %)			Non-auto Trips (mode share %)	
	Auto Trips (mode share %)	Internal, Bicycle & Pedestrian	Transit	Auto Trips (mode share %)	Internal, Bicycle & Pedestrian	Transit
No Action Alternative - Current Zoning (Mitigation Not Applicable)	12,648 (51.4%)	7,279 (26.9%)	6,091 (21.7%)	12,648 (51.4%)	7,279 (26.9%)	5,871 (21.7%)
Alternative 1 - Maximum Increases to Height and Density	15,554 (50.5%)	9,429 (27.8%)	7,371 (21.7%)	12,244 (39.7%)	11,835 (34.9%)	8,606 (25.4%)
Alternative 2 - Mid-Range Increases to Height and Density	15,548 (50.4%)	9,435 (27.8%)	7,371 (21.7%)	12,236 (39.7%)	11,844 (34.9%)	8,606 (25.4%)
Alternative 3 - Moderate Increases to Height and Density	13,605 (50.3%)	8,334 (28.0%)	6,449 (21.7%)	10,715 (39.6%)	10,435 (35.1%)	7,526 (25.3%)

Source: Fehr & Peers, 2010

Note: See Appendix E for details on the mode share calculation. Auto trips include both SOV and HOV trips, so the number reported is not equivalent to person-trips. The Internal, Bicycle & Pedestrian and Transit categories are person-trips.

Table 1-4
Mitigated Action Alternative: Demand-to-Capacity Ratios of Study Corridors

		NO ACTION ALTERNATIVE			ALTERNATIVE 1			ALTERNATIVE 2			ALTERNATIVE 3		
Road	Segment	Volume	Peak Hour/ Direction	d/c Ratio/ LOS	Volume	Peak Hour/ Direction	d/c Ratio/ LOS	Volume	Peak Hour/ Direction	d/c Ratio/ LOS	Volume	Peak Hour/ Direction	d/c Ratio/ LOS
Fremont Bridge	1) N 35th Street to Westlake Avenue N	1,768	PM/N	1.11/F	1,754	PM/N	1.10/F	1,755	PM/N	1.10/F	1,733	PM/N	1.08/F
Westlake Avenue N	2) Fremont Bridge to Valley Street	1,330	PM/N	0.83/D	1,316	PM/N	0.82/D	1,316	PM/N	0.82/D	1,320	PM/N	0.83/D
	3) Valley Street to Harrison Street	1,040	PM/S	0.99/E	988	PM/S	0.94/E	991	PM/S	0.94/E	946	PM/S	0.90/E
	4) Harrison Street to Denny Way	1,061	PM/S	1.01/F	1,029	PM/S	0.98/E	1,030	PM/S	0.98/E	994	PM/S	0.95/E
	5) Denny Way to Stewart Street	624	PM/N	0.69/D	610	PM/N	0.68/D	616	PM/N	0.68/D	598	PM/N	0.66/D
Eastlake Avenue E	6) N 40th Street to E Hamlin Street	1,166	AM/SW	0.61/D	1,130	AM/SW	0.59/D	1,129	PM/NE	0.59/D	1,108	AM/SW	0.58/D
	7) E Hamlin Street to Fairview Avenue N	1,163	AM/S	0.61/D	1,130	AM/S	0.59/D	1,127	AM/S	0.59/D	1,109	AM/S	0.58/D
	8) Fairview Avenue to Lakeview Blvd E	578	AM/N	0.83/D	547	PM/N	0.78/D	544	PM/N	0.78/D	549	PM/S	0.78/D
	9) Lakeview Blvd E to Stewart Street	867	PM/S	0.62/D	849	PM/N	0.61/D	851	PM/N	0.61/D	858	PM/N	0.61/D
Fairview Avenue N.	10) Eastlake Avenue to Yale Avenue N	810	AM/SW	1.16/F	781	AM/SW	1.12/F	766	AM/SW	1.09/F	774	AM/SW	1.11/F
	11) Yale Avenue N to Harrison Street	1,389	PM/N	0.83/D	1,381	PM/N	0.82/D	1,384	PM/N	0.82/D	1,396	PM/N	0.83/D
	12) Harrison Street to Denny Way	1,009	PM/N	0.60/D	1,000	PM/N	0.60/D	1,000	PM/N	0.60/D	985	PM/N	0.59/D
Dexter Avenue N	13) Fremont Bridge to Valley Street	1,132	AM/S	1.18/F	**1,140**	**AM/S**	**1.19/F**	1,134	AM/S	1.18/F	**1,151**	**AM/S**	**1.20/F**
	14) Valley Street to Denny Way	1,787	PM/N	1.28/F	1,737	PM/N	1.24/F	1,734	PM/N	1.24/F	1,709	PM/N	1.22/F
Valley Street	15) Westlake Avenue N to Fairview Avenue N	624	PM/E	0.74/D	636	PM/E	0.76/D	633	PM/E	0.75/D	611	PM/E	0.73/D
Mercer Street	16) Queen Anne Avenue N to 5th Avenue N	1,091	PM/E	0.65/D	1,091	PM/E	0.65/D	1,091	PM/E	0.65/D	1,091	PM/E	0.65/D
	17) 5th Avenue N to Dexter Avenue N	1,445	AM/E	0.86/D	1,980	PM/W	0.79/D	1,983	PM/W	0.79/D	1,970	AM/W	0.78/D
	18) Dexter Avenue N to Fairview Avenue N	2,057	AM/W	0.98/E	2,054	AM/W	0.98/E	**2,072**	**AM/W**	**0.99/E**	2,040	AM/W	0.97/E
Denny Way	19) Broad Street to Aurora Avenue N	1,053	AM/W	0.63/D	1,031	PM/W	0.61/D	1,031	PM/W	0.61/D	1,032	AM/W	0.61/D
	20) Aurora Avenue N toStewart Street	1,607	PM/E	1.53/F	1,591	PM/E	1.52/F	1,586	PM/E	1.51/F	1,573	PM/E	1.50/F
	21) Stewart Street to Broadway E	1,151	AM/W	0.72/D	1,126	AM/W	0.70/D	1,122	PM/W	0.70/D	1,102	AM/W	0.69/D
Broad Street	22) Denny Way to Westlake Avenue N	Segment does not exist under future conditions											
Boren Avenue	23) Denny Way to Pine Street	1,297	AM/NW	1.08/F	1,289	AM/NW	1.07/F	1,282	AM/NW	1.07/F	1,270	AM/NW	1.06/F
	24) Pine Street to University Street	1,068	PM/SE	0.89/D	1,063	PM/SE	0.89/D	1,068	PM/SE	0.89/D	1,051	PM/SE	0.88/D
Stewart Street	25) Eastlake Avenue E to Boren Avenue	2,196	AM/SW	1.05/F	2,194	AM/SW	1.04/F	2,208	AM/SW	1.05/F	2,163	AM/SW	1.03/F
	26) Boren Avenue to 7th Avenue	1,334	AM/SW	0.74/D	1,344	AM/SW	0.75/D	1,347	AM/SW	0.75/D	1,340	AM/SW	0.74/D
	27) 7th Avenue to 3rd Avenue	873	AM/SW	0.73/D	860	AM/SW	0.72/D	862	AM/SW	0.72/D	840	AM/SW	0.70/D
Virginia Street	28) Denny Way to Westlake Avenue N	839	PM/NE	0.70/D	854	PM/NE	0.71/D	851	PM/NE	0.71/D	856	PM/NE	0.71/D
	29) Westlake Avenue N to 3rd Avenue	1,215	PM/NE	0.68/D	1,195	PM/NE	0.66/D	1,203	PM/NE	0.67/D	1,177	PM/NE	0.65/D
E Pine Street	30) Boren Avenue to Broadway	691	PM/W	0.96/E	676	AM/W	0.94/E	689	PM/W	0.96/E	678	AM/W	0.94/E
Lakeview/Belmont/Roy	31) Eastlake Avenue to Broadway E	415	PM/E	0.52/D	415	PM/E	0.52/D	415	PM/E	0.52/D	415	PM/E	0.52/D
Thomas Street	32) Aurora Avenue N to Eastlake Avenue E	429	PM/E	0.60/D	419	PM/E	0.58/D	436	PM/E	0.61/D	390	PM/E	0.54/D
Harrison Street	33) Aurora Avenue N to Eastlake Avenue E	537	PM/E	0.90/E	522	PM/E	0.87/D	515	PM/E	0.86/D	502	PM/E	0.84/D
9th Avenue N	34) Roy Street to Republican Street	698	PM/N	1.00/F	661	PM/N	0.94/E	667	PM/N	0.95/E	648	PM/N	0.93/E
Howell/Eastlake	35) Stewart Street to Boren Avenue	1,113	PM/N	0.93/F	1,099	PM/N	0.92/E	1,093	PM/N	0.91/E	1,095	PM/N	0.91/E

Source: Fehr & Peers, 2010

Note: Bold text signifies a significant impact.

* These study corridors intersect or are adjacent to other study corridors that are expected to operate at LOS F conditions. Actual LOS may be worse because of queuing.

Potential transit mitigation calculations were completed independently of the other potential mitigation measures. **Table 1-5** shows the number of additional busses that would need to run during the peak hour to reduce the load factor to acceptable levels. Details of the calculations may be found in **Appendix E**.

Table 1-5
South Lake Union Peak Hour Transit Mitigation

Route	Termini Locations	No Action Load Factor	Action Load Factor	Peak Hour Ridership	Additional busses required	Mitigated Load Factor
21 NB	Downtown, Arbor Heights	1.17	1.35	520	1	1.18
28 NB	Downtown, Broadview	1.19	1.40	240	1	1.06
29 NB	Downtown, Woodland Park	1.19	1.49	120	1	1.04
29 SB	Downtown, Woodland Park	1.49	1.79	144	1	1.25
56 NB	South Lake Union, West Seattle	1.38	1.53	396	2	1.07

Source: Fehr & Peers, 2010

Public Services

Future population and employment increases associated with potential development in the South Lake Union neighborhood under Alternatives 1-4 would be incremental and would result in associated increases in demand for fire and emergency services and police services in the area. These impacts could be addressed by the following mitigation measures.

1. A portion of the tax revenue generated from potential redevelopment in the neighborhood – including construction sales tax, business and operation tax, property tax and other fees, licenses and permits – would accrue to the City of Seattle and could help offset demand for police and fire services.
2. All new buildings would be constructed in accordance with the 2006 Fire Code which is comprised of the 2006 International Fire

Code with Seattle amendments or the applicable fire code in effect at the time of permit submittal.

3. Design features could be incorporated into potential development in the South Lake Union neighborhood that would help reduce criminal activity and calls for police service, including orienting buildings towards the sidewalk and public spaces, providing connections between buildings, and providing adequate lighting and visibility.

Utilities

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives.

Leadership in Energy and Environmental Design (LEED) provides a framework and ranking system to reduce the impact of development on the environment including the utility infrastructure. By using LEED methods to reduce energy and other resources, projects can reduce the overall effects of new or re-development. Encouraging the use of the LEED or a similar standard score card (such as Built Green) for resource use reduction with some type of development incentives would help to reduce the effects on the utility infrastructure.

Water

1. The use of low or no-flow fixtures and water saving devices in new construction and renovations.
2. Collection and re-use of storm water for non-potable uses (irrigation, toilet flushing, mechanical make up water, etc.) would reduce demand on the public water supply.
3. A replacement or rehabilitation plan for the oldest water mains in this neighborhood should be developed by SPU. Pipes adjacent to re-developed sites could be replaced as part of the related street improvements.

Combined Sewer & Storm Sewers

1. Modern low flow or no-flow plumbing will reduce the per capita waste water volume discharged to the combined sewer pipes and sent to the treatment facility.
2. New development in the area will be required to meet the 2009 City of Seattle Stormwater Code. Stormwater collected on

site will be required to be held on site with Green Stormwater Infrastructure (GSI) methods, or detained before discharge to the city storm system. These measures will reduce the peak rate of water discharged to the combined and storm sewer systems.

3. A replacement or rehabilitation plan for the oldest sewer pipes in this neighborhood should be developed by SPU. Pipes adjacent to re-developed sites could be replaced as part of the related street improvements.
4. Installation of a separated storm sewer system in this area, sized for the approved level of development, would reduce the load of storm water sent to the treatment plant, and nearly eliminate combined sewer over flows in this area. The existing combined sewer system would be retained for use as a sanitary sewer.

Electric Power

1. The installation of photovoltaic and other local generating technologies will reduce the demand on the public generating and distribution facilities.
2. Construction and operation of LEED compliant (or similar ranking system) buildings will reduce the level of increase required in power systems.
3. Reduce the use of power in building heating and cooling with passive systems and modern power saving units.

Open Space and Recreation

Future population and employment increases in the South Lake Union Neighborhood under Alternatives 1-4 would be incremental and would result in associated increases in demand for park and recreation facilities in the area. These impacts could be addressed by the following mitigation measures.

1. A portion of the tax revenues generated from potential future development in the South Lake Union Neighborhood would accrue to the City of Seattle and could help offset demands for park and recreation facilities.
2. Future increases in population and employment in the South Lake Union Neighborhood could be planned for through the City's ongoing capital facilities planning process.
3. New park and recreation facilities could be provided in conjunction with potential future development as part of the development bonus process under Alternatives 1-3.

4. New open space facilities could be provided in the Fairview and Dexter Subareas in conjunction with potential future development.
5. Consider facilities to address the identified gaps in service in the 8th Avenue Corridor and the Fairview Corridor focus areas in conjunction with potential future development.

1.7 Significant Unavoidable Adverse Impacts

There are no significant unavoidable adverse impacts identified for any of the elements of the environment, except transportation. Significant unavoidable adverse impacts associated with transportation are as described below.

Transportation

Even with the proposed mitigation strategies, two study corridors would continue to have unmitigated traffic operations impacts:

- Dexter Avenue N from the Fremont Bridge to Valley Street – Alternatives 1 and 3
- Mercer Street from Dexter Avenue N to Fairview Avenue N – Alternative 2

The above impacts could be mitigated through additional roadway corridor widening. However, as described earlier, the City has no additional roadway widening plans and additional roadway widening would have right-of-way, cost, and environmental consequences. Additionally, roadway widening would tend to induce more vehicle trips in the South Lake Union neighborhood, which could conflict with the transportation goals outlined in the Seattle Comprehensive Plan. Therefore, additional widening is considered infeasible.

In addition to the traffic operations impacts described above, the impacts to transit load factors may remain. Although transit service expansion was identified as a potential mitigation measure, the City of Seattle does not generally own and operate the transit service in South Lake Union. Therefore, expanded transit service cannot be guaranteed by the City and no expansion was assumed in the analysis.

All other impacts were reduced to a less-than-significant level with mitigation.

1.8 Major Issues to be Resolved

The key planning issue facing decision-makers is whether and how to change development regulations and standards for building height, bulk and scale in the South Lake Union neighborhood. Major environmental issues include potential impacts to the transportation system and to the aesthetic/visual character of the neighborhood.

Chapter 2

Description of the Alternatives

CHAPTER 2 DESCRIPTION OF THE ALTERNATIVES

2.1 Introduction

The City of Seattle Comprehensive Plan, *Toward a Sustainable Seattle*, establishes a framework for accommodating future growth in a manner that is sustainable and consistent with community values. The urban village strategy is a key component of the plan. The urban village strategy, as described in the Urban Village element, is a comprehensive approach to planning for future growth in a sustainable manner. The Urban Village element identifies four categories of urban villages, including urban centers, manufacturing/industrial centers, hub urban villages and residential urban villages. Urban centers are identified as the densest neighborhoods in the City, with a diverse mix of uses, housing, and employment. The South Lake Union neighborhood is identified as an urban center.

As an urban center, the Comprehensive Plan establishes that the South Lake Union neighborhood should contain a concentration of housing and employment and provide a regionally significant focus for housing and employment growth. Densities and mix of uses should support walking, transit use and cohesive community development.

Consistent with these goals, the Urban Center Neighborhood Plan for South Lake Union (Neighborhood Plan) establishes goals, policies and strategies supportive of the urban center designation. Strategy 2c specifically addresses the use of increased height and density to achieve Neighborhood Plan goals (see sidebar). Although the Neighborhood Plan notes that there was disagreement about this strategy, it is identified as a high priority, with implementation to start in the near term (defined as within a five-year period).

The City is considering the use of incentive zoning as a strategy to encourage increased density while ensuring growth contributes to livability and sustainability. The goal of incentive zoning is to link code flexibility, increased density and development potential with public benefits valued by the community. The City initiated an Environmental Impact Statement (EIS) process to study the potential impacts of increased height and density in the neighborhood. Over the course of 2008 and 2009, working in partnership with interested citizens and organizations, the City identified three alternative zoning scenarios, each providing a different configuration of height and density in the South Lake Union neighborhood.

Chapter 2 Contents

Urban villages … enable the City to: deliver services more equitably, pursue a development pattern that is environmentally and economically sound, and provide better means of managing growth and change through collaboration with the community…

Toward a Sustainable Seattle, 2004.

Strategy 2c: Use additional height and density as an incentive for projects that implement multiple neighborhood plan policies where the additional height will not negatively affect the surrounding area, flight paths or key public view corridors
South Lake Union Neighborhood Plan, 2007

The City is testing these scenarios, along with a scenario that does not provide for height increases (No Action), through this Draft EIS. Based on the analysis and public comment received during the Draft EIS comment period, the City will determine future actions, if any, associated with code updates to permit increased height and density in the South Lake Union neighborhood.

2.1.1 Overview of the Proposal

This Draft EIS considers four alternatives to height and density in the South Lake Union neighborhood. Alternatives 1, 2 and 3 represent a range of potential height increases that could be achieved through incentive zoning and are collectively referred to as action alternatives. Alternative 4 would retain the existing zoning designations with no incentives for height increases and is referred to as the no-action alternative.

Among the action alternatives, Alternative 1 would provide the greatest potential for increases in height and density, Alternative 3 the least, and Alternative 2 falls between Alternatives 1 and 3. Alternative 1 would allow for building heights of 240 to 300 feet in much of the neighborhood, with maximum heights of 400 feet between John Street and Denny Way. Alternative 2 would allow for maximum heights of 300 feet in the area between Aurora and Westlake avenues north, with much of the rest of the neighborhood at maximum heights of 160 to 240 feet. Under Alternative 3, the majority of the neighborhood would have maximum building heights of 160 feet to 240 feet. Under Alternatives 2 and 3, existing zoning, with no provision for increased height through zoning incentives, would be retained in the majority of the Cascade neighborhood, with changes limited to areas near the western and southern boundaries in Alternative 2 and along the western boundary in Alternative 3. Similarly, under Alternative 3, the majority of the Fairview neighborhood would also retain existing zoning, with no provision for increased height through incentive zoning.

Alternatives 1 and 2 would provide for height and density increases for both commercial and residential development, while Alternative 3 is focused primarily on residential development.

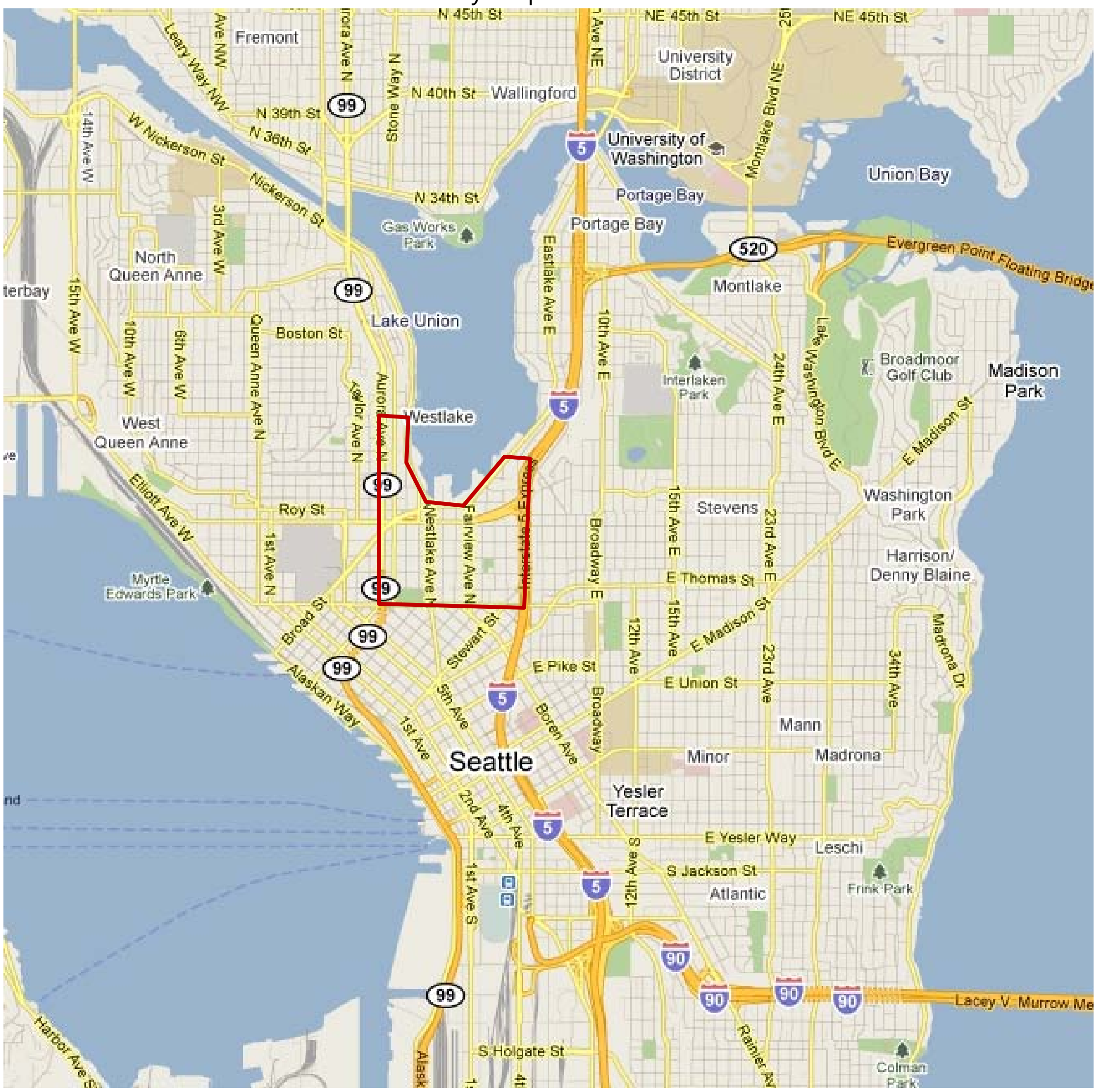
All of the alternatives are described in more detail in Section 2.3 and shown in Figures 2-5 through 2-8.

Study Area

The South Lake Union neighborhood is located in the center of the City of Seattle, located immediately north of the Downtown, and adjoining the Uptown and Capitol Hill areas to the west and east. Consisting of about

340 acres, the area is generally bounded on the east by Interstate 5, on the west by Aurora Avenue, on the south by Denny Way and on the north by the Lake Union shoreline. See **Figure 2-1**.

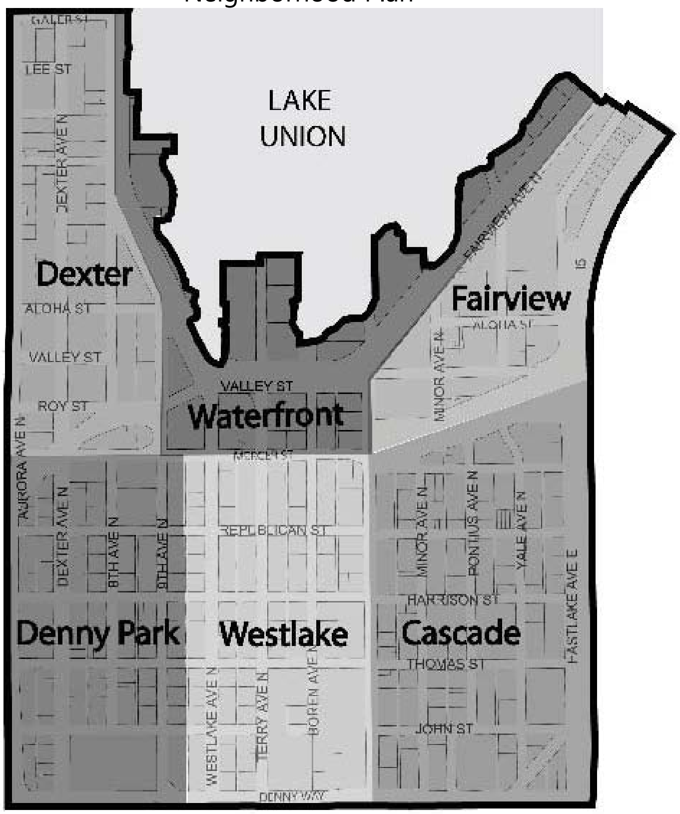
Figure 2-1
Vicinity Map



Source: Google Maps, 2010

For planning purposes, the City has identified six neighborhoods in the neighborhood, known as the Dexter, Denny Park, Waterfront, Westlake, Fairview and Cascade neighborhoods See **Figure 2-2**.

Figure 2-2
Neighborhood Plan



Source: South Lake Union Urban Center Neighborhood Plan, 2007.

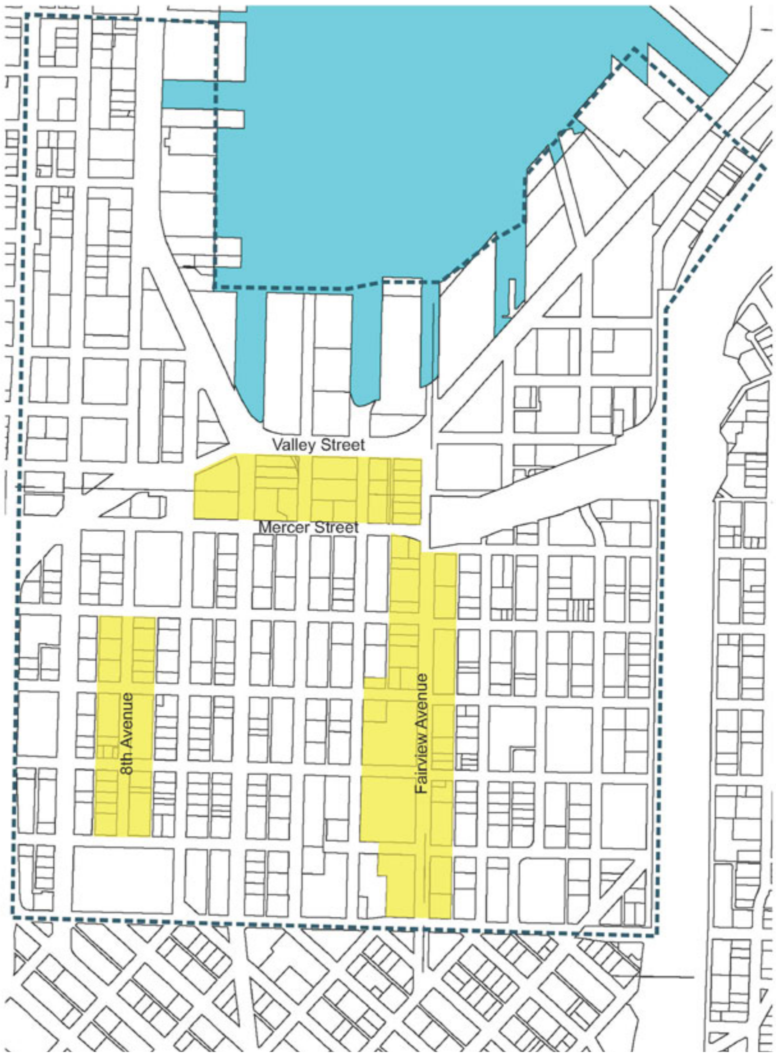
Within the study area boundaries and where appropriate, this EIS will consider in greater detail existing conditions and potential environmental impacts of the alternatives in three focus areas. Due to the area-wide cumulative nature of the analyses, the focus areas are not specifically called out in the transportation, energy (greenhouse gas), and air quality analyses.

Focus areas are shown in **Figure 2-3** and described below:

- 8th Avenue Corridor – Consisting of about 5.9 acres in the Denny Park area, this area is comprised of one-half block east and west of 8th Avenue between Republican and John Streets.
- Fairview Avenue Corridor – About 16.2 acres, generally consisting of one-half block east and west of Fairview Avenue between Mercer Street and Denny Way. This area straddles the boundary between the Westlake and Cascade neighborhoods.
- Valley/Mercer Blocks – Consisting of about 8 acres in the Waterfront area, this area is bounded by Valley Street on the north, Mercer Street on the south, 9th Avenue on the west and Fairview Avenue on the west.

8th Avenue at Harrison Street

Figure 2-3
Focus Areas



Source: EA|Blumen, 2010.

Transportation Network

Due to its central location and proximity to the major regional north/south corridors of Aurora Avenue North and Interstate 5, South Lake Union is heavily affected by regional and local traffic. Major transportation projects in the neighborhood that would result in changes to right-of-way alignment and associated access and configuration of parcels adjacent to the affected rights of way include the Mercer Corridor-East Project and the Bored Tunnel Street Grid Reconnection. Because these projects are either funded or highly likely to be funded, they have been assumed as part of the underlying street network for the neighborhood.

2.1.2 Objectives of the Proposal

The City has identified the following specific objectives of the proposal:

- Advance Comprehensive Plan goals to use limited land resources more efficiently, to pursue a development pattern that is economically sound, and to maximize the efficiency of public investment in infrastructure and services.
- Ensure adequate zoned development capacity for long-term growth consistent with the designation of South Lake Union as one of the City's six urban centers.
- Provide for a more diverse and attractive neighborhood character by providing a mix of housing types, uses, building types and heights.
- Enhance the pedestrian quality at street level by providing amenities, taking into consideration light and air as well as public view corridors and providing for retail activity at key locations.
- Use increases in height and density to achieve other neighborhood plan goals such as increasing the amount of affordable housing, open space, and other public benefits through an incentive zoning program.
- Determine how to best accommodate growth while maintaining a functional transportation system, including street network, transit, and non-motorized modes of travel. Similarly, determine how to accommodate growth while maintaining functional capacity of utility systems, including electrical energy, water, sewer and storm drain systems.

2.2 Planning Context

2.2.2 Seattle Comprehensive Plan

The Seattle Comprehensive Plan, *Toward a Sustainable Seattle*, is a GMA-compliant 20-year plan that provides guidance for how Seattle will accommodate growth in a way that is consistent with the vision of the citizens of the City. As a policy document, the Plan lays out general guidance for future City actions. In many cases, general guidance in the Plan is more specifically addressed in functional plans that focus on a particular aspect of City services, such as parks, transportation or drainage. The City implements the Plan through development and other regulations, primarily found in the City's zoning map and Land Use Code.

The City adopted the current Plan in 1994. It has been updated in major and minor ways in subsequent years. The amendment processes for the Comprehensive Plan are defined under state law:

- Once a year, the City may amend the plan to address specific proposed changes initiated by the City and private parties.
- Every seven years, the City must review and consider amendments to ensure continued compliance with the Growth Management Act, reflect updated population projections and ensure capacity to accommodate projected population for the next 20-year time horizon.

Growth Targets

The Comprehensive Plan contains growth targets that establish how much residential and employment growth is anticipated through 2024 and where it will be located. Recently, King County and its cities have allocated new growth targets that extend the planning horizon to 2031. It is expected that this updated target will be the basis for the City's next 10-year comprehensive plan update, due in 2014. However, the City has not yet adopted those targets into the Comprehensive Plan or allocated portions of those targets to individual urban centers or urban villages.

In order to provide the City with an early opportunity to consider the fit of the alternatives relative to the future comprehensive plan update effort, this EIS assumes a 2031 South Lake Union target that is proportionate to the adopted South Lake Union 2024 target, see **Table 2-1** below. The estimate is for analysis purposes only and does not represent policy intent by the City.

It should be noted that the adopted 2024 growth target for the neighborhood allocated a relatively high share of citywide growth to South Lake Union. Because the current growth target is ambitious, it is unlikely that future planning would increase the proportion of citywide growth that is allocated to South Lake Union. It is more likely that future planning will match the current proportion or reduce it by distributing citywide growth to other areas of the City. Therefore, the EIS estimate of a 2031 growth target that is proportionate to the adopted 2024 target is a conservative assumption.

Table 2-1
City of Seattle Growth Targets[1]

	City		South Lake Union	
	2024	2031	2024	2031[2]
Residences	47,000	70,000	8,000	11,900
Jobs	84,000	115,000	16,000	21,900

Source: City of Seattle, EA|Blumen, 2010

[1] Growth targets for the City in 2024 and 2031 and for South Lake Union in 2024 represent adopted City policy. The growth target shown for South Lake Union in 2031 is an estimate developed for analysis in this EIS and has not been reviewed, recommended or adopted by the City. See Note 2, below.

[2] The City has not yet identified specific 2031 targets for neighborhoods within the City. For this analysis, the estmated 2031 target for South Lake Union was determined by determining the ratio of the 2024 South Lake Union to City targets and applying this ratio to the 2031 citywide target (About 17% of the citywide total for residences and 19% of the citywide total for jobs)..

Development Capacity

Development capacity is a measure of the total amount of new development that could be added in an area. The City of Seattle calculates this measure by comparing existing land uses to what could be built under current or proposed zoning. The difference between the potential and existing development is the capacity for new development. Development capacity estimates are not a prediction that a certain amount of development will occur or when it may occur, but instead a measure of the maximum development that could occur in a given area. Development capacity is expressed in terms of housing units and the number of potential jobs that could be added.

The estimate of development capacity varies according to the amount and type of development that is permitted. Accordingly, the development capacity for South Lake Union has been calculated for each alternative, including No Action (Alternative 4). **Table 2-2**, below summarizes the development capacity for South Lake Union under each alternative. Please see **Appendix B** for complete description of the development capacity methodology used in this analysis.

Table 2-2
Development Capacity

	Employment Capacity[1] (jobs)	Residential[2] (dwelling units)
Alternative 1	31,500	21,000
Alternative 2	30,500	19,000
Alternative 3	23,000	15,000
Alternative 4 (No Action)	20,000	11,500

Source: City of Seattle, 2010

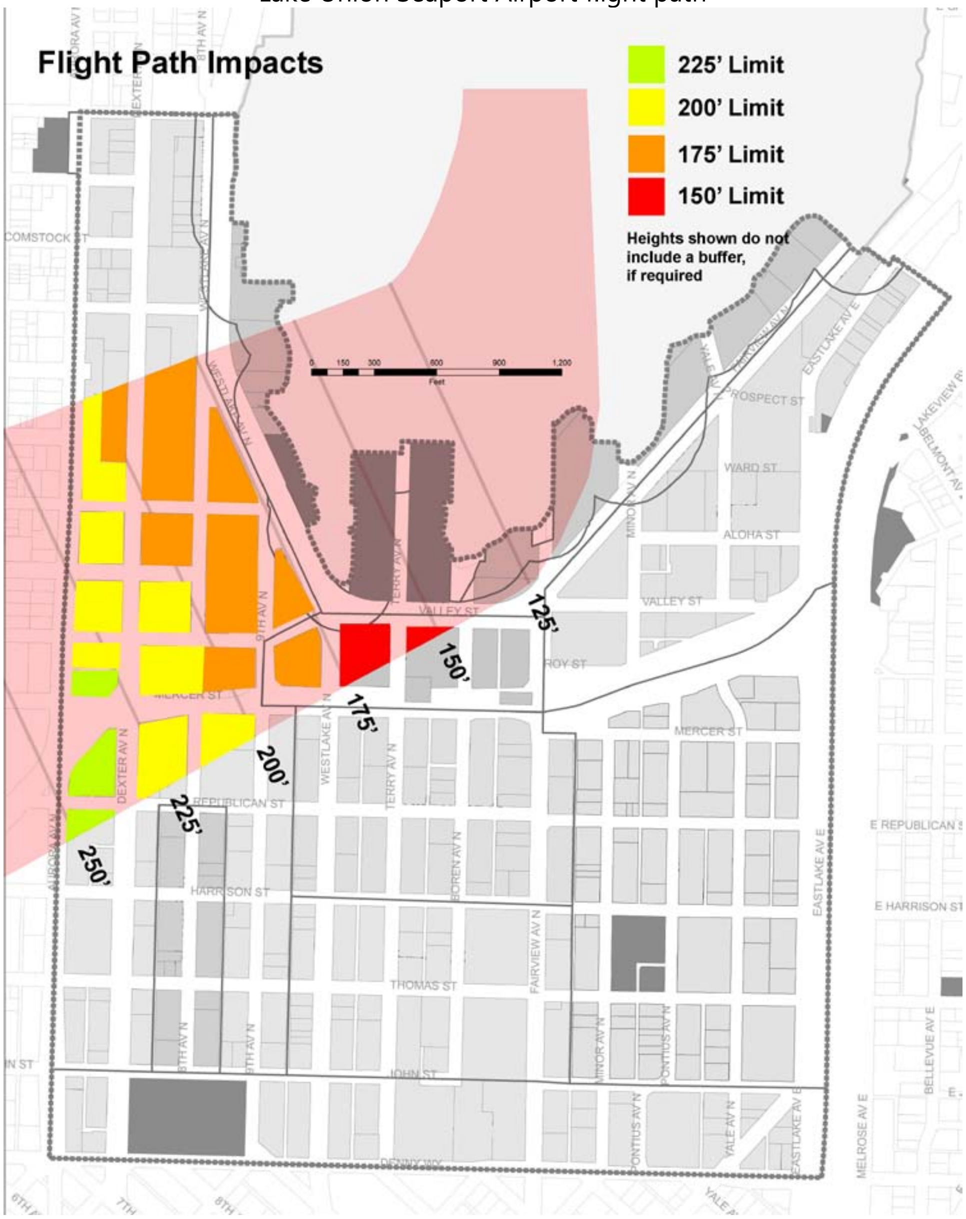
1 Assumes one job/350 square feet of commercial development and 45% of new development will be for commercial use.
2 Assumes recent residential development trends (see Appendix B) and 55% of new development will be for residential use

2.2.3 Lake Union Seaport Airport Flight Path

The Lake Union Seaport Airport is a public airport connecting downtown Seattle with regional destinations. Kenmore Air, the primary airport operating from Lake Union, provides daily service to the San Juan Islands and Canada. During its peak season, extending from late spring until fall, Kenmore Air provides up to 80 daily arrivals and departures from morning until dusk. The area between the south shore of Lake Union and extending over Seattle Center to Puget Sound is a primary flight path. **Figure 2-4** shows the Lake Union Seaport Airport flight path, as prepared by the Washington Department of Transportation, Aviation Division, and assumed in this EIS. This figure shows the flight path elevation as it rises over the South Lake Union neighborhood. Impacts associated with this flight path are discussed in Chapter 3, Land Use (Section 3.8) and Aesthetics (Section 3.10) of this EIS.

Seaplane on Lake Union

Figure 2-4
Lake Union Seaport Airport flight path



Source: WSDOT (Aviation Division), NBBJ, 2010.

2.2.4 South Lake Union Urban Center Neighborhood Plan

In 2004, the City designated South Lake Union as an Urban Center. The City's Comprehensive Plan describes urban centers as the City's densest neighborhoods, providing a diverse mix of uses, housing and employment opportunities. Collectively, the City's six urban centers are intended to accommodate most of the City's targeted future growth. Accordingly, Plan policies focus on these areas to ensure their continued vitality and capacity for growth.

City of Seattle Urban Centers
Northgate
University Community
Uptown
South Lake Union
First Hill/Capitol Hill
Downtown

The South Lake Union Urban Center Neighborhood Plan is a free-standing plan that establishes goals, policies and strategies supportive of the urban center designation. Portions of the Neighborhood Plan have been adopted as part of the Comprehensive Plan.

The Neighborhood Plan describes the future vision for the neighborhood:

The future of South Lake Union will be characterized by:

- *A pervasive human scale ambiance consistent with a vital aesthetically pleasing, safe and energetic neighborhood which embraces a dynamic intermixing of opportunities for working living and playing;*
- *Retention of a significant element of the area's commercial activities, including opportunities for business growth;*
- *A full spectrum of housing opportunities;*
- *Ecologically sound development and lifestyles and promotion of ecologically sound business practices consistent within the regulatory environment;*
- *Ease of transportation for all modes within and through the area;*
- *A variety of open spaces serving the needs of the area and the city, with emphasis on Lake Union, and its continued preservation for a wide range of uses;*
- *A sensitivity to the area's history and historical elements; and*
- *Coordination with plans of adjacent areas.*

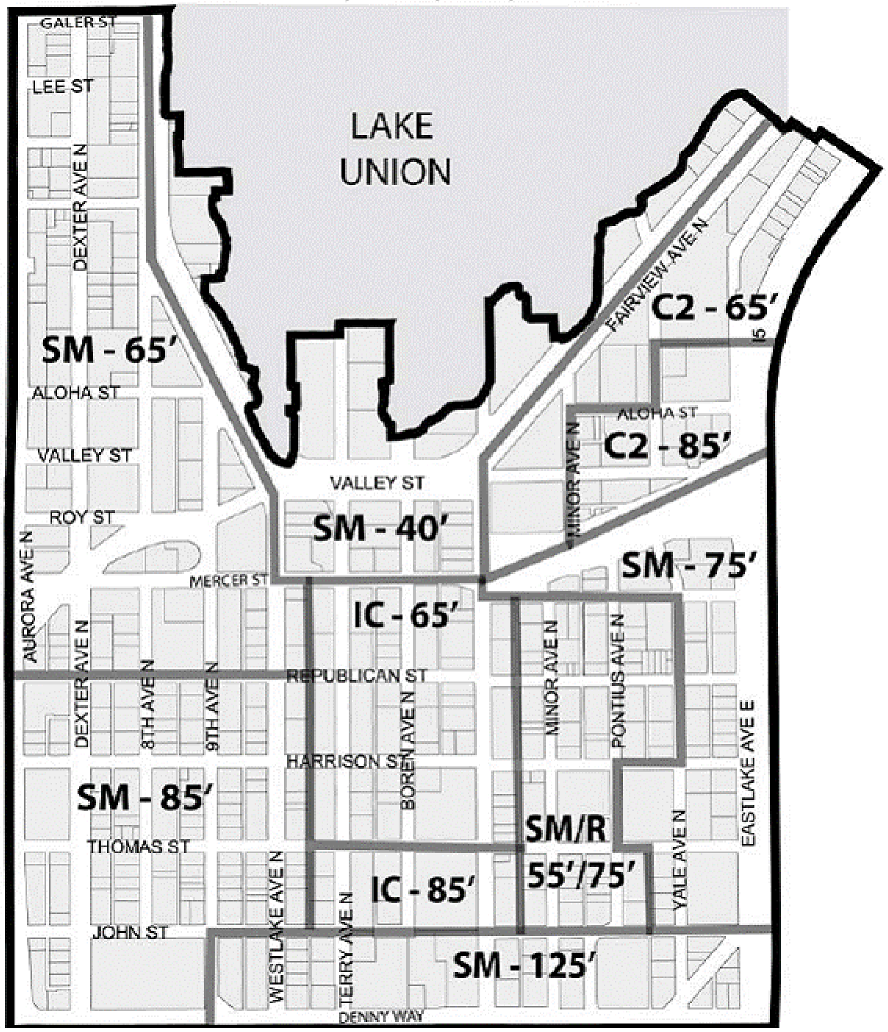
City of Seattle. South Lake Union Neighborhood Plan, 2007.

The Neighborhood Plan contains five chapters: Neighborhood Character, Transportation, Parks and Open Space, Housing and Sustainable Development. In each of these chapters, one or more goals for the neighborhood's future are identified. In order to meet those goals, the plan identifies policies, which provide broad direction for City and neighborhood action, and strategies, which are more specific actions to be implemented over the next twenty years.

2.2.5 Existing Zoning

Figure 2-5 shows the existing zoning designations in the neighborhood. Most of the neighborhood is currently zoned Seattle Mixed (SM) with varying height limits. The SM zone provides for a range of residential and commercial uses to support a pedestrian-oriented mixed-use neighborhood. An Industrial Commercial (IC) designation is located in the central part of the neighborhood. This designation allows for a mix of industrial and commercial uses and prohibits most types of residential development. To the northeast and near Lake Union, property is zoned Commercial 2 (C2), providing for auto-oriented, primarily non-retail commercial uses. Height limits range from 40 feet adjacent to Lake Union to 125 feet along Denny Way.

Figure 2-5
Existing Zoning Designations



Source: South Lake Union Urban Center Neighborhood Plan, 2007

8th Avenue Corridor

This area is currently zoned Seattle Mixed (SM), with a height limit of 85 feet.

Fairview Avenue Corridor

The Fairview Avenue area is zoned Industrial Commercial (IC) between Mercer and John streets. North of Thomas Street, the IC zone has a height limit of 65 feet; while between Thomas and John streets, the height limit is 85 feet. Between John Street and Denny Way, existing zoning is Seattle Mixed (SM), with a height limit of 125 feet.

Valley/Mercer Blocks

This area is currently zoned Seattle Mixed (SM), with a height limit of 40 feet.

Development allowed under existing zoning represents the No Action Alternative in this EIS. Please see Section 2.3.6 for a description of the No Action Alternative.

2.2.4 Urban Design Framework

The Urban Design Framework (UDF) identifies strategies to guide zoning changes, amendments to the South Lake Union Design Guidelines and Right-of-Way Improvement Manual and other implementation actions. The UDF was developed over a multi-year process, beginning in 2008, and included participation from a range of constituents, including planners, urban designers, architects, landscape architects, and neighborhood residents and business owners. The UDF contains recommendations addressing the following elements:

Guiding Principles	Upper-level setbacks
Gateways, hearts and edges	Urban form
Street character	Lakefront
Residential and retail focus areas	Neighborhood connections
Residential open space strategies	Green stormwater infrastructure
Public space network	Incentive zoning priorities
Views	

The UDF will guide the work of the Seattle Department of Planning and Development and other departments within the City. Please see Section 2.3.2 for a discussion of the incentive zoning recommendations contained in the UDF and Chapter 3.8 for additional description of the UDF.

2.2.5 Public Outreach

An extensive public outreach effort was integral to preparation of the South Lake Union Neighborhood Plan. Community members and organizations were involved in shaping the Neighborhood Plan through provision of background information, meeting participation and/or feedback on draft plan recommendations. A summary of major public meetings is provided below, beginning with the most recent.

- Urban Design Framework Public Meeting. Held January 26, 2010, to review and comment on draft South Lake Union Design Framework Principles and Actions
- Public Workshop. Held February 12, 2008 to review and comment on the results of a recent design charrette conducted as part of the South Lake Union Urban Form Study. At the charrette, several scenarios for future development of the South Lake Union

neighborhood were produced. The open house was an opportunity to view the charrette results, offer comments, and learn how these alternative scenarios will be used in the Urban Form Study.

- Urban Form Study Scoping Meeting. Held November 19, 2008 to invite comments on the preliminary EIS scope.
- Kick-Off Meeting. Held January 9, 2008 to kick off the South Lake Union Urban Form Study, leading to recommendations for changes to height and density regulations that will help shape the character of South Lake Union for the next 20-30 years.
- Public Hearing. Held December 10, 2007, public hearing on proposed land use code amendments to the South Lake Union Industrial Commercial Zone.
- Open House. Held on October 29, 2007 as a celebration of the completion of the South Lake Union neighborhood plan.
- Open House. Held June 26, 2007 to discuss the priorities of the South Lake Union Neighborhood Plan recommendations.
- Open House. Held June 12, 2006 to present the updated South Lake Union Neighborhood Plan.
- Public Workshop. Held on April 4, 2006 to discuss key issues in the neighborhood plan update.
- Open House. Held on November 29, 2005 to gather feedback on draft goals and policies for a draft South Lake Union Neighborhood Plan.
- Open House. Held on June 7, 2005. University of Washington Master of Urban Planning students showcased 20 weeks of work on topics such as urban design, housing, sustainability, community identity, streetscapes, historic preservation, and more.

Public involvement continues to be an important element of the planning process. This EIS process includes a public comment period, during which one or more public meetings have been scheduled. During the public comment period, written and verbal comments are invited. All comments will be considered and addressed in the Final EIS. Please see the Fact Sheet at the beginning on this Draft EIS for the dates of the public comment period and public meeting(s).

2.3 Proposed Action and Alternatives

2.3.1 Overview

In order to meet the goals of the Comprehensive Plan, the City is considering adoption of incentive zoning provisions to allow increased height and density in certain areas of the South Lake Union neighborhood. The City has identified four alternatives, each of which describes a different pattern of height and density in the neighborhood. In general, Alternative 1 would provide for the greatest increases in building height and corresponding residential density. Similarly, Alternative 2 provides for height and density increases, but relatively less than Alternative 1. Alternative 3 provides for the least amount of height and density increase relative to the action alternatives. Alternative 4 would retain the existing zoning standards and height limits. **Table 2-3** summarizes the key features of the alternatives.

Table 2-3
Alternatives Overview

Features	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Podium Height	45' – 85'	30 – 45'	20 – 45'	Not applicable
Incentive Zoning Height Limits	85' -- 400'	85' – 300'	85' – 240'	Not applicable
Floor Plate Size	Commercial - 24,000 sf above podium height for commercial Residential - 10,500 sf average/11,500 sf maximum above podium height			Not applicable
Floor Area Ratio Limits	Commercial: Base of 4.5 or 5; up to 7 with bonuses Residential: no FAR limits			4.5 to 5
Residential Densities	Varies according to building height and podium size. The range of densities at different heights is shown below. Note that not all alternatives include all of the heights listed. 400' height limit: 720 – 890 units/acre 300' height limit: 562 – 655 units/acre 240' height limit: 465 – 535 units/acre 160' height limit: 327 – 385 units/acre Lower building heights and corresponding densities are assumed for lots fronting Lake Union. See Appendix B for complete methodology.			Not applicable
Minimum Lot Size for Towers	22,000 sf (2 towers/block), 60,000 sf (1 tower/block)			Not applicable

Source: City of Seattle, 2010

A podium is the base of a building that supports a tower.

A floor plate is the horizontal plane of the floor of a building, measured to the inside surface of exterior walls.

Floor area ratio is the ratio of the total square feet of a building to the total square feet of the property on which it is located.

2.3.2 Incentives

An incentive program offers development bonuses, usually in the form of additional height or floor area, for development projects that offer public benefits and amenities. As shown in **Table 2-2**, the three action alternatives include the potential for an FAR bonus and increased height through the provision of public benefits as defined by incentive zoning.

A bonus is an incentive offered to developers, usually in the form of increased height or floor area, for providing a public benefit, such as affordable housing, energy efficiency, open space and others.

Seattle Municipal Code Section 23.58A establishes conditions and process for development incentives. As described in this Section, buildings less than 85 feet in height may gain increased floor area only through the provision of affordable housing as established by the provisions of Section 23.58A.014. For buildings greater than 85 feet in height, other City approved bonus options may be used for up to 40% of their increased floor area, as long as at least 60% of the increased floor area is supported by the provision of affordable housing through the process established in Section 23.58A.014.

Although not currently applicable in South Lake Union, future development under any of the action alternatives would be able to seek floor area bonuses consistent with the requirements of Seattle Municipal Code 23.58A. For buildings taller than 85 feet in height, potential public benefits that could be included as a future development incentive, in addition to the affordable housing requirement, will be specifically identified following public comment and City review of Draft EIS findings.

The *South Lake Union Urban Design Framework* addresses strategies to support increased density and intensity of development while maintaining the neighborhood character described in the Neighborhood Plan. The document identifies the following list of public amenity priorities that could be incorporated into an incentive program for South Lake Union:

- **Renovation of 100 Dexter.** Convert the Parks office facility into a new center for community, arts, and culture.
- **Public Space and Streetscapes.** Develop pocket plaza, play area, or streetscape improvements consistent with Urban Design Framework. Improvements should focus in pedestrian corridors, such as Thomas, Terry and 8th Avenue. Streetscape improvements could include green stormwater facilities exceeding Stormwater Code requirements.
- **Landmark Preservation.** Use transfer of development rights to landmark buildings based on an updated inventory of South Lake Union.

Transfer of development rights is a zoning tool that allows property owners in areas with constraints to development, such as significant environmental features or historical significance, to sell their development rights to property owners in areas more suitable for development.

- **Housing Preservation.** Use transfer of development rights to protect existing affordable housing, including red brick buildings (Carolina Ct, Grandview, Carlton Apts., 502 Minor N, Carolyn Manor Apts., Brewster, Jensen).
- **Reduced Overwater Coverage.** Use transfer of development rights to encourage removal of overwater buildings along the west shore of Lake Union to provide shoreline habitat and public access trail improvements consistent with Shoreline Master Program.

Source: South Lake Union Urban Design Framework, 2010

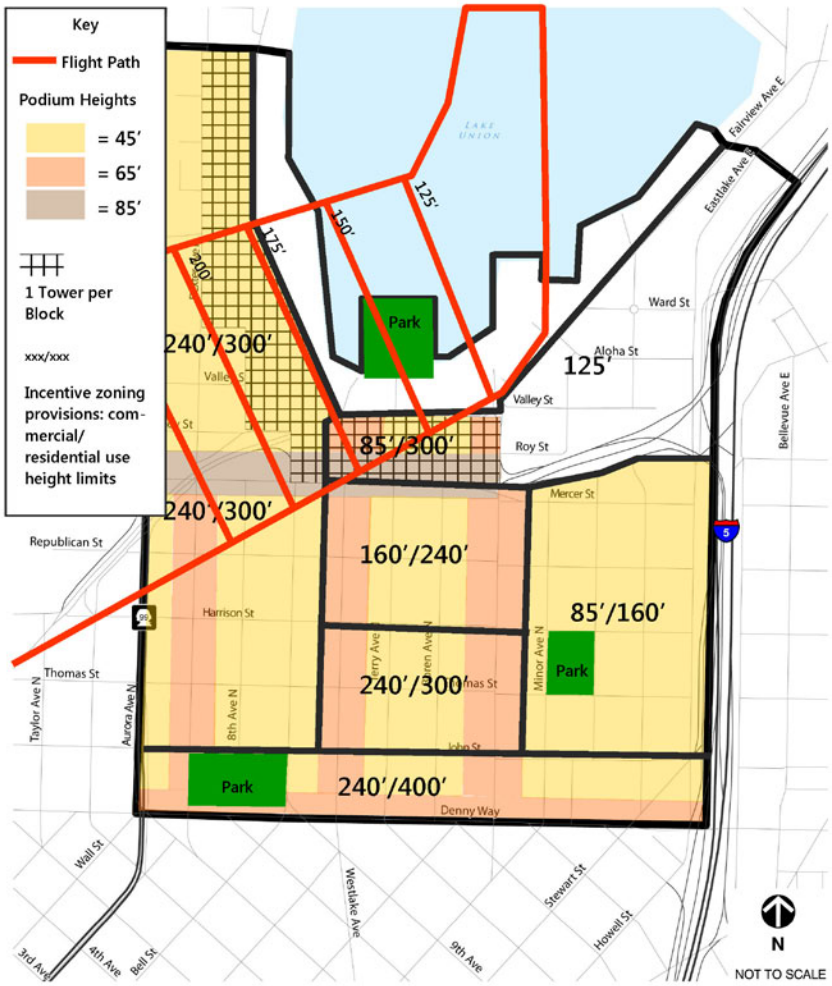
In addition to affordable housing, existing incentive programs in other zones in the City provide bonuses for meeting a specific LEED™ standard, provision or payment in lieu of childcare, provision of public amenities, such as open space, TDR, or some combination of these benefits.

LEED (Leadership in Energy and Environmental Design) is a building certification program focused on environmental and human health, energy efficiency, indoor environmental quality, materials selection, sustainable site development and water savings. Buildings can qualify for four levels of ratings: certified, silver, gold or platinum.

2.3.3 Alternative 1

Alternative 1 would permit the greatest increases in height and density, relative to the other alternatives. Key features of this alternative are described below and shown in **Figure 2-6**.

Figure 2-6
Alternative 1



Source: City of Seattle, 2010

Zoning Designations. The underlying Seattle Mixed zoning designation would be retained in all parts of the neighborhood. The existing Industrial Commercial (IC) designation would be rezoned to Seattle Mixed.

Shoreline Designations. No changes to the existing shoreline designations are proposed under any of the alternatives.

Permitted Uses. The Seattle Mixed zone provides for a wide range of uses to encourage development of the area into a mixed-use neighborhood with a pedestrian orientation or an area that is in transition from traditional manufacturing or commercial uses to one where residential use is also appropriate.

Height and FAR Bonuses. Alternative 1 provides the greatest potential for increased FAR and building height through the use of incentive zoning, relative to the action alternatives. Maximum building heights that could be achieved under incentive zoning provisions would vary throughout the neighborhood, as shown in **Figure 2-6** and described below.

Building Heights. Greatest heights are permitted along the southern edge of the neighborhood, between Denny Way and John Street. In this area, residential towers could be 400 feet and commercial towers 240 feet in height.

Lowest heights continue in the east central part of the neighborhood, roughly corresponding to the Cascade neighborhood. In this area, maximum heights of 160 feet for residential towers and 85 feet for commercial uses are established.

In the balance of the neighborhood, maximum heights range between 240 to 300 feet for residential towers. Commercial uses in mixed use buildings are limited to 20 feet along the 8th Avenue corridor, between John and Republican Streets and to 85 feet in the blocks bounded by Mercer, Valley and Roy streets and 9th Avenue. In the remaining areas, commercial height limits vary from 160 feet to 240 feet.

Lake Union Seaport Flight Path. Regardless of permitted building heights allowed by city zoning provisions, building heights in the approach/departure corridor for the Lake Union Seaport Airport would continue to be limited according to Federal Aviation Administration (FAA) requirements, as shown in **Figure 2-4**.

Podium Heights. Podium heights of up to 85 feet are allowed along the Mercer Street corridor. Along the Dexter, Westlake, Fairview and Denny Way corridors, maximum podium height is 65 feet. Podium heights are limited to 45 feet in the balance of the area.

Floor Area Ratio. Commercial floor area ratio is limited to a base of five, with the potential of increasing to a maximum of seven through use of incentives or TDR.

Floor Plate Size. Commercial floor plates are limited to a maximum of 24,000 sf. Residential floor plates are limited to an average of 10,500 sf for the entire tower, with a maximum of 11,500 sf above the podium.

Density. Density assumptions vary according to building height and podium size. In general, the range of densities assumed in this EIS are as follows:

- 400’ height limit: 720 – 890 units/acre
- 300’ height limit: 562 – 655 units/acre
- 240’ height limit: 465 – 535 units/acre
- 160’ height limit: 327 – 385 units/acre

Lower building heights and corresponding densities are assumed for lots near Lake Union. See **Appendix B** for a complete discussion of the methodology used to estimate residential densities.

Tower Location. Near Lake Union, but outside of the 200’ designated shoreline area, a maximum of one tower per block, (equivalent to a minimum 60,000 sf lot size) is permitted. This area is shown in a crosshatched pattern in **Figure 2-6**. For the balance of the area, a maximum of two towers per block (equivalent to a minimum 22,000 sf lot size) is permitted.

8th Avenue Corridor. This area is zoned SM 20/300, allowing a maximum height of 20 for commercial uses and 300 feet for residential uses. The maximum podium height in this area is 45 feet. Two towers per block area permitted.

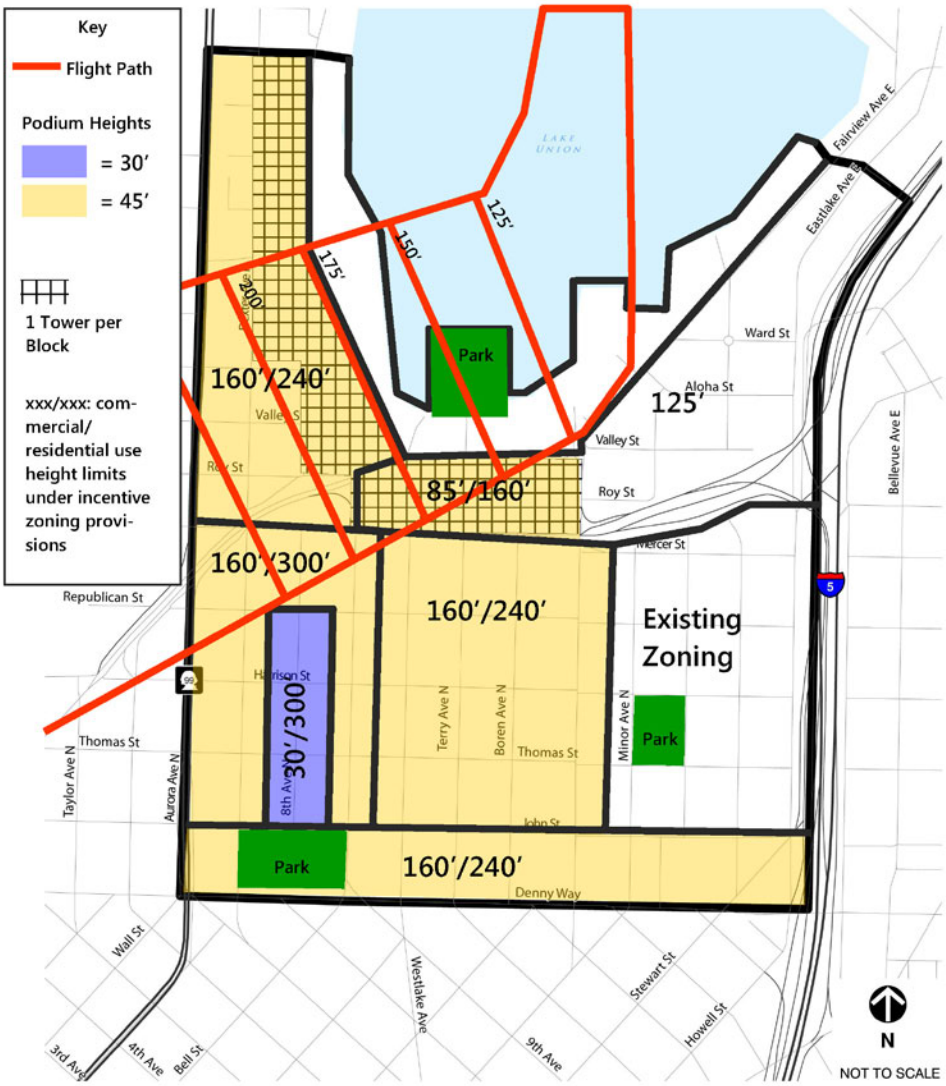
Fairview Avenue Corridor. This area is zoned SM, with varying building heights. In the blocks between Valley and Mercer streets, the height limit is 300’. In the area between Mercer and Harrison streets, height limits are 160 feet for commercial uses and 240 feet for residential uses, increasing to 240 feet for commercial uses and 300 feet for residential uses between Harrison and John streets and to 240 feet for commercial uses and 400 feet for residential uses between John Street and Denny Way. The maximum podium height is 65 feet. Two towers per block are permitted.

Valley/Mercer Blocks. This area is zoned SM 85/300, allowing a maximum building height of 85 feet for commercial uses and 300 feet for residential uses. Permitted podium heights vary between 45 and 85 feet within this area. A maximum of one tower per block is permitted in this area.

2.3.4 Alternative 2

Alternative 2 describes a development scenario that would allow increases in height and density that are generally between that of Alternatives 1 and 3. Key features of this alternative are described below and shown in **Figure 2-7**.

Figure 2-7
Alternative 2



Source: City of Seattle, 2010

Zoning Designations. The underlying Seattle Mixed zoning designation would be retained in all parts of the neighborhood. The existing Industrial Commercial (IC) designation would be rezoned to Seattle Mixed.

Shoreline Designations. No changes to the existing shoreline designations are proposed under any of the alternatives.

Permitted Uses. The Seattle Mixed zone provides for a wide range of uses to encourage development of the area into a mixed-use neighborhood with a pedestrian orientation or an area that is in transition from traditional manufacturing or commercial uses to one where residential use is also appropriate.

Height and FAR Bonuses. Alternative 2 provides for a mid-range of increased FAR and height bonuses through the use of incentive zoning, relative to the action alternatives. No incentives for increased height and FAR would be established in the eastern portion of the neighborhood (portions of the Cascade and Fairview neighborhoods). Maximum building heights that could be achieved under incentive zoning provisions would vary throughout the neighborhood, as shown in **Figure 2-6** and described below.

Building Heights. Greatest heights are permitted in the southwestern portion of the neighborhood, corresponding to the Denny Park subarea. In this area, residential towers could be 300 feet and commercial towers 160 feet in height. Within this area, height limits are reduced along the 8th Avenue corridor, with commercial development limited to 20 feet and residential to 240 feet in height.

Height limits are lowest in the northern part of the neighborhood. In the blocks bounded by Mercer, Valley and Roy Streets and 9th Avenue North, commercial uses are limited to 85 feet and residential uses to 160 feet in height. Immediately to the east, in the Fairview neighborhood, building heights are limited to 125 feet. In the balance of the neighborhood, maximum height for residential towers is 240 feet and for commercial buildings 160 feet.

Lake Union Seaport Flight Path. Regardless of permitted building heights allowed by city zoning provisions, building heights in the approach/departure corridor for the Lake Union Seaport Airport would continue to be limited according to Federal Aviation Administration (FAA) requirements, as shown in **Figure 2-4**.

Podium Heights. Podium heights are limited to 30 feet along the 8th Avenue corridor and 45 feet in all other parts of the neighborhood.

Floor Area Ratio. Same as Alternative 1. Commercial floor area ratio is limited to a base of five, with the potential of going up to a maximum of seven with incentives or TDR.

Density. Density assumptions vary according to building height and podium size. In general, the range of densities assumed in this EIS are as follows:

- 300' height limit: 562 – 655 units/acre
- 240' height limit: 465 – 535 units/acre
- 160' height limit: 327 – 385 units/acre

Lower building heights and corresponding densities are assumed for lots fronting Lake Union. See **Appendix B** for a complete discussion of the methodology used to estimate residential densities.

Floor Plate Size. Same as Alternative 1. Commercial floor plates are limited to a maximum of 24,000 sf. Residential floor plates are limited to an average of 10,500 sf for the entire tower, with a maximum of 11,500 sf above the podium.

Tower Location. Same as Alternative 1. Near Lake Union, but outside of the 200′ designated shoreline area, a maximum of one tower per block, (equivalent to a minimum 60,000 sf lot size) is permitted. This area is shown in a crosshatched pattern in **Figure 2-7**. For the balance of the area, a maximum of two towers per block (equivalent to a minimum 22,000 sf lot size) is permitted.

8th Avenue Corridor. This area is zoned SM 20/240, allowing a maximum height of 20 feet for commercial uses and 240 feet for residential uses. The maximum podium height in this area is 20 feet. Two towers per block area permitted.

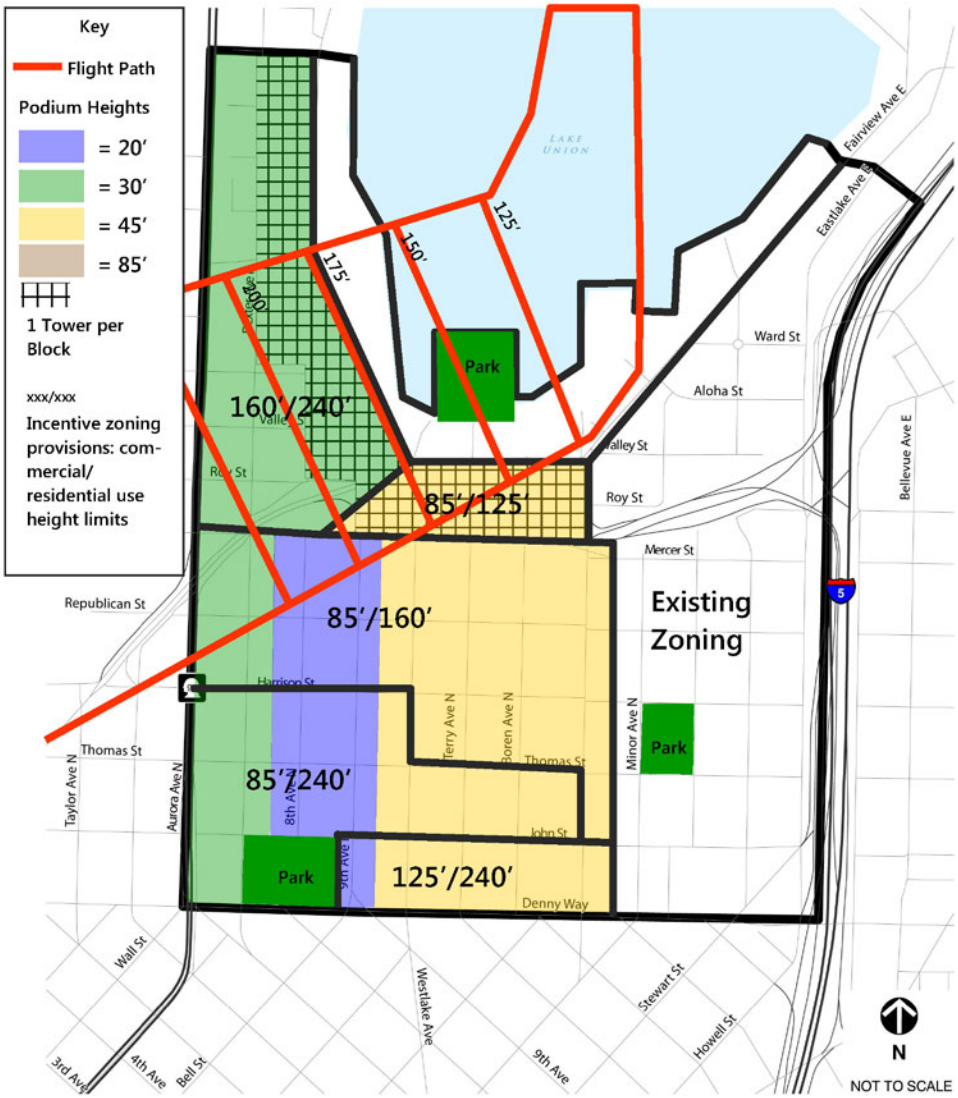
Fairview Avenue Corridor. This area is zoned SM, allowing a maximum building height of 160 feet for commercial uses and 240 feet for residential development. The maximum podium height is 45 feet. Two towers per block are permitted.

Valley/Mercer Blocks. This area is zoned SM 85/300, allowing a maximum building height of 85 feet for commercial uses and 300 feet for residential uses. Permitted podium heights vary between 45 and 85 feet within this area. A maximum of one tower per block is permitted in this area.

2.3.5 Alternative 3

Alternative 3 describes a development scenario that would permit the least amount of increase in height and density, relative to the other action alternatives. Potential height increases are focused on residential development. Key features of this alternative are described below and shown in **Figure 2-8**.

Figure 2-8
Alternative 3



Source: City of Seattle, 2010

Zoning Designations. The underlying Seattle Mixed zoning designation would be retained in all parts of the neighborhood. The existing Industrial Commercial (IC) designation would be rezoned to Seattle Mixed.

Shoreline Designations. No changes to the existing shoreline designations are proposed under any of the alternatives.

Permitted Uses. The Seattle Mixed zone provides for a wide range of uses to encourage development of the area into a mixed-use neighborhood with a pedestrian orientation or an area that is in transition from traditional manufacturing or commercial uses to one where residential use is also appropriate.

Height and FAR Bonuses. Alternative 3 provides the least potential for increased FAR and height bonuses through the use of incentive zoning, relative to the action alternatives. No incentives for increased height and FAR would be established in the eastern portion of the neighborhood (portions of the Cascade and Fairview neighborhoods). Maximum building heights that could be achieved under incentive zoning provisions would vary throughout the neighborhood, as shown in **Figure 2-6** and described below.

Building Heights. Alternative 3 allows building heights up to 240 feet for residential development and 125 feet for commercial uses between Denny Way, John Street, 9th Avenue North and the east side of Fairview Avenue.

Commercial use height limits vary between 65 feet to 85 feet in the rest of the area. In the central part of the neighborhood, residential height limits decrease from 240 feet along John Street to 125 feet in the blocks between Mercer and Valley Streets. West of 9th Avenue and north of Mercer Street (Dexter neighborhood), residential building heights are limited to 240 feet.

Lake Union Seaport Flight Path. Regardless of permitted building heights allowed by city zoning provisions, building heights in the approach/departure corridor for the Lake Union Seaport Airport would continue to be limited according to Federal Aviation Administration (FAA) requirements, as shown in **Figure 2-4**.

Podium Heights. Podium heights are limited to 20 feet along the 8th and 9th Avenue corridors. West and north of this corridor, podium heights are limited to 30 feet. In the remaining area, podium heights are limited to 45 feet.

Floor Area Ratio. Same as Alternatives 1 and 2. Commercial floor area ratio is limited to a base of five with the potential of going up to a maximum of seven with incentives or TDR.

Floor Plate Size. Same as Alternatives 1 and 2. Commercial floor plates are limited to a maximum of 24,000 sf. Residential floor plates are limited to an average of 10,500 sf for the entire tower, with a maximum of 11,500 sf above the podium.

Density. Density assumptions vary according to building height and podium size. In general, the range of densities assumed in this EIS are as follows:

- 240' height limit: 465 – 535 units/acre
- 160' height limit: 327 – 385 units/acre

Lower building heights and corresponding densities are assumed for lots near Lake Union. See **Appendix B** for a complete discussion of the methodology used to estimate residential densities.

Tower Location. Same as Alternatives 1 and 2. Near Lake Union, but outside of the 200' designated shoreline area, a maximum of one tower per block, (equivalent to a minimum 60,000 sf lot size) is permitted. This area is shown in a crosshatched pattern in **Figure 2-8**. For the balance of the area, a maximum of two towers per block (equivalent to a minimum 22,000 sf lot size) is permitted.

8th Avenue Corridor. This area is zoned SM, with increasing height allowed moving south from Republican Street. Between Republic and Harrison streets, building heights are limited to 85 feet for commercial uses and 160 feet for residential uses. South of Harrison, the maximum commercial use limit remains at 85 feet, but the height limit for residential uses increases to 240 feet. The maximum podium height in this area is 20 feet. Two towers per block area permitted.

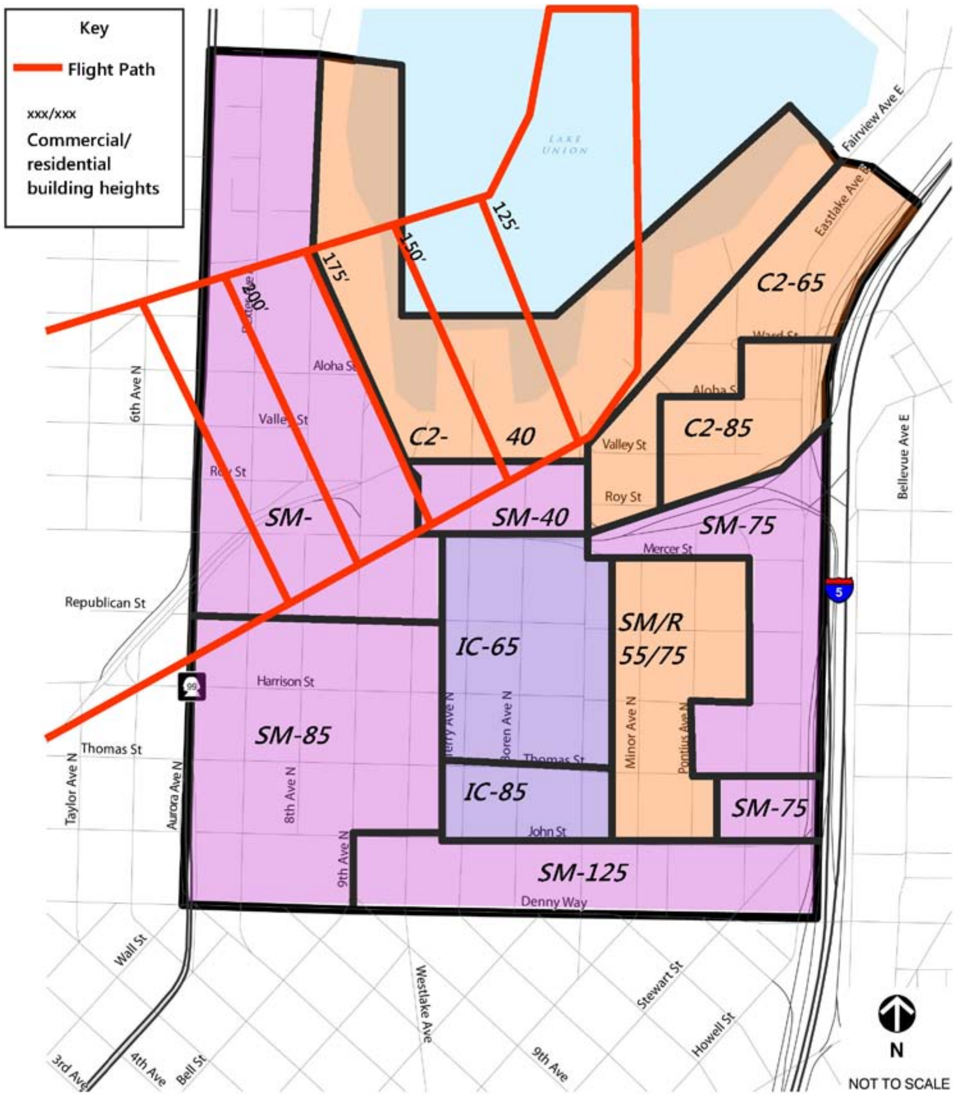
Fairview Avenue Corridor. This area is zoned SM, with increasing heights allowed moving south from Mercer Street. In the area between Mercer and Thomas streets, buildings height limits are 85 feet for commercial uses and 160 feet for residential uses, remaining at 85 feet for commercial uses and increasing 240 feet for residential uses between Thomas and John streets, and to 125 feet for commercial uses and 240 feet for residential uses between John Street and Denny Way. The maximum podium height is 45 feet. Two towers per block are permitted.

Valley/Mercer Blocks. This area is zoned SM, allowing a maximum building height of 85 feet for commercial uses and 125 feet for residential uses. Maximum podium height is 45 feet. A maximum of one tower per block is permitted in this area.

2.3.6 Alternative 4

Alternative 4 retains the existing zoning designations in the neighborhood, with no potential for height increases through incentive zoning provisions. Key features of this alternative are described below and shown in **Figure 2-9**.

Figure 2-9
Alternative 4



Source: City of Seattle, 2010

Zoning Designations. The majority of the neighborhood would remain Seattle Mixed at varying heights, ranging from SM-125" along Denny Way, down to SM-40 in the central Waterfront area, as shown in **Figure 2-8.** The Fairview area would retain the existing Commercial (C2) zoning. The central portion of the neighborhood would remain in an Industrial Commercial (IC) zone.

Shoreline Designations. No changes to the existing shoreline designations are proposed under any of the alternatives.

Permitted Uses. The Seattle Mixed zone provides for a wide range of uses to encourage development of the area into a mixed-use neighborhood with a pedestrian orientation or an area that is in transition from traditional manufacturing or commercial uses to one where residential use is also appropriate.

The C-2 zone provides for an auto-oriented, primarily non-retail commercial area that provides a wide range of commercial activities serving a community, citywide, or regional function, including uses such as manufacturing and warehousing that are less appropriate in more-retail-oriented commercial areas.

The IC zone is intended to promote development of businesses which incorporate a mix of industrial and commercial activities, including light manufacturing and research and development, while accommodating a wide range of other employment activities. Most residential development is not permitted in this zone.

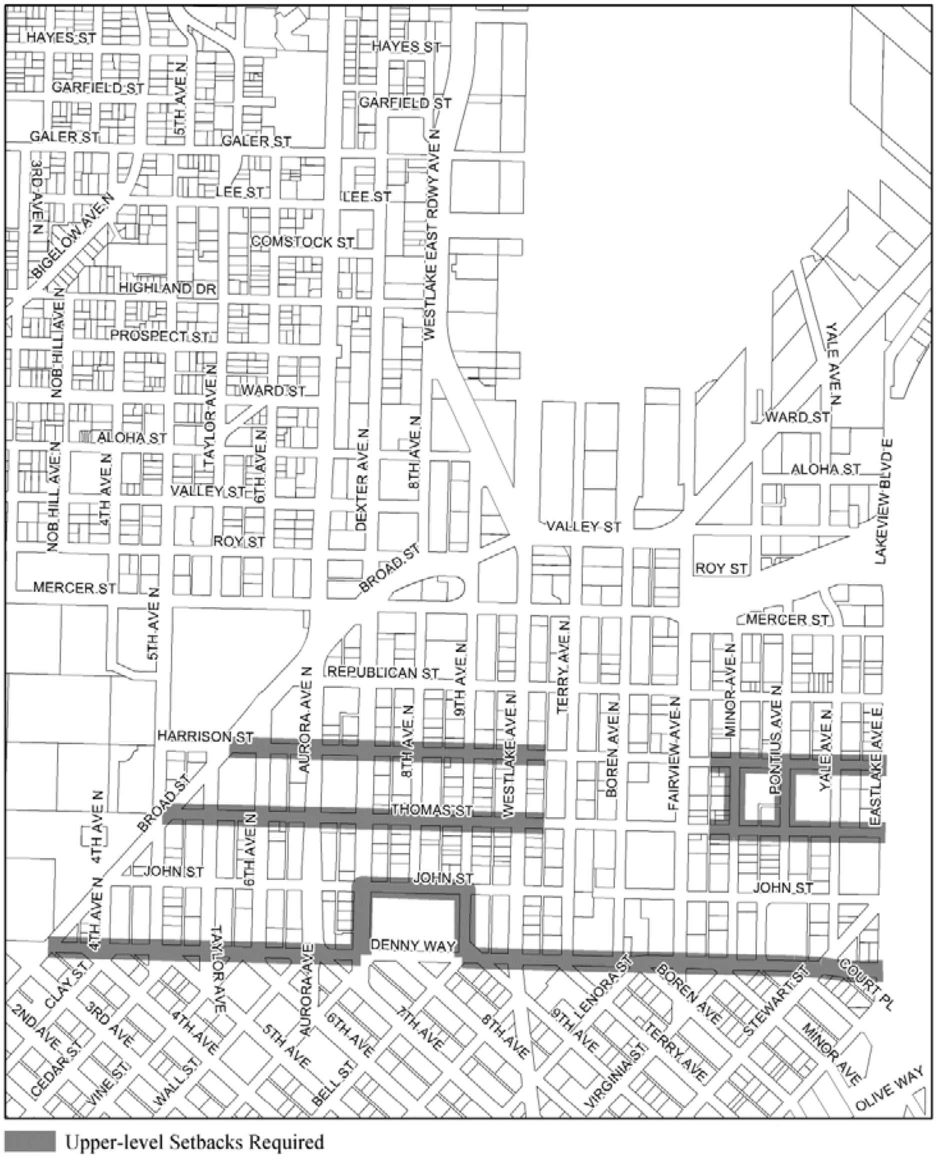
Height and FAR Bonuses. Alternative 4 does not propose any height or FAR bonuses through incentive zoning provisions.

Building Heights. In general, height limits are lowest near Lake Union and in the Cascade subarea, with height limits ranging between 40 and 75 feet in these areas. Greatest heights (up to 125 feet) are permitted along the southern edge of the neighborhood, along Denny Way and John Street. In this area, a maximum of 125 feet is permitted.

Lake Union Seaport Flight Path. Regardless of permitted building heights allowed by city zoning provisions, building heights in the approach/departure corridor for the Lake Union Seaport Airport would continue to be limited according to Federal Aviation Administration (FAA) requirements, as shown in **Figure 2-4**.

Podium Heights. Existing zoning standards do not specifically define podium heights, but do require upper level setbacks in certain areas. To some extent, these upper level setbacks define a podium for the development. In general, the area along Denny Way in the SM-125' zone requires an upper level setback for any portion of a structure greater than 75 feet in height. Similarly, along portions of Thomas and Harrison Streets, upper level setbacks are required for structures greater than 25 feet (in residential areas) and 45 feet in height. See **Figure 2-10** for the location of upper level setback requirements.

Figure 2-10
Upper Level Setback Requirements



Source: City of Seattle Land Use Code, 2010

Floor Area Ratio. In the SM 85 zone, the maximum commercial FAR is 4.5. In the SM-125' zone, the maximum commercial FAR is 5. There are no FAR limits for residential uses and the remaining zoning designations do not establish a maximum FAR standard.

Floor Plate Size. Existing zoning standards do not establish a minimum floor plate size.

Density. Densities are not limited under current zoning, except by existing height and bulk requirements.

Tower Location. Existing zoning standards do not establish a minimum lot size for towers.

8th Avenue Corridor. This area is currently zoned Seattle Mixed (SM), with a height limit of 85 feet.

Fairview Avenue Corridor. The Fairview Avenue area is zoned Industrial Commercial (IC) between Mercer and John streets. North of Thomas Street, the IC zone has a height limit of 65 feet; while between Thomas and John streets, the height limit is 85 feet. Between John Street and Denny Way, existing zoning is Seattle Mixed (SM), with a height limit of 125 feet.

Valley/Mercer Blocks. This area is currently zoned Seattle Mixed (SM), with a height limit of 40 feet.

2.3.7 Alternatives Eliminated from Consideration

The 2008 South Lake Union Urban Form Study resulted in initial alternatives that were described in the 2008 EIS Scoping Notice. These initial alternatives were similar to those currently proposed, but had substantive differences in terms of tower spacing and podium heights. As previously described, the current alternatives were developed as part of the 2009 Design Framework planning process and are intended to address concerns raised by the neighborhood about the initial alternatives. Specific changes made to the initial alternatives that led to the current alternatives include:

<u>All Alternatives</u>

- Residential floor plate size reduced from 12,500 sf below 160′ to an average of 10,500 sf for the entire tower.
- Commercial floor plate size reduced from 35,000 sf to 24,000 sf.
- Commercial floor area ratio changed from unlimited to seven.
- Increase minimum lot size from 18,000 sf to 24,000 sf (2 towers per block); established minimum lot size of 60,000 sf for lots Lakefront lots.
- In most places where height of 400 feet had been proposed, reduced to no greater than 300 feet.

<u>Alternative 1</u>

- Podiums reduced to 45′ in most areas, but higher on wider and more intensely used streets.

<u>Alternative 2</u>

- Maximum height between Valley and Mercer streets reduced from 240 to 160′.
- Commercial height in the area generally between Westlake and Fairview streets reduced from 240 to 160′.
- Residential focus changes from 8th and 9th avenues to only 8th Avenue.

<u>Alternative 3</u>

- Maximum height for commercial buildings between Valley and Mercer streets reduced to from 125′ to 85′.

2.4 Environmental Review

2.4.1 Purpose

The purpose of this EIS is to assist the public and agency decision-makers in considering the potential environmental effects of proposed changes to Zoning Code standards for height and density in the South Lake Union Neighborhood.

2.4.2 Programmatic Review

SEPA requires government officials to consider the environmental consequences of proposed actions, and to consider better or less damaging ways to accomplish the objectives of those proposed actions. They must consider whether the proposed action will have a probable significant adverse environmental impact on the elements of the natural and built environment.

This Draft EIS provides qualitative and quantitative analysis of environmental impacts as appropriate to the general nature of the Proposed Action planning efforts. The adoption of development regulations is classified by SEPA as a non-project (i.e., programmatic) action. A non-project action is defined as an action that is broader than a single site-specific project, and involves decisions on policies, plans, or programs. An EIS for a non-project proposal does not require site-specific analyses; instead, the EIS will discuss impacts and alternatives appropriate to the scope of the non-project proposal and to the level of planning for the proposal. (WAC 197-11-442)

Within the context of programmatic review, and as described in Section 2.1, this EIS will also consider three focus areas in greater detail. This increased level of detail will provide a basis for future environmental review, allowing for a more streamlined review of specific sites within these focus areas. (see **Figure 2-3**).

2.4.3 Phased Review

SEPA encourages the use of phased environmental review to focus on issues that are ready for decision, and to exclude from consideration issues already decided or not yet ready for decision-making [WAC 197-11-060 (5)]. Phased review is appropriate where the sequence of a proposal is from a programmatic document, such as an EIS addressing a comprehensive plan, to other documents that are narrower in scope, such as for a site-specific, project-level analysis. The City of Seattle is using phased review, as authorized by SEPA, in this environmental review. The analysis in this EIS will be used to review the environmental impacts of the proposed height and density changes in the South Lake Union neighborhood.

This analysis will also provide a more specific review of potential development impacts within three focus areas. This analysis will allow for a future phase of SEPA review that may be able to incorporate the analysis in this EIS and streamline future project-level SEPA review.

2.4.4 EIS Scope of Analysis

The City issued a Determination of Significance and Scoping Notice on November 18, 2008. During the scoping comment period, which extended from November 18 to December 18, 2008, interested citizens, agencies, organization and affected tribes were invited to provide comments on the scope of the EIS. Comments received during the comment period raised issues related to specific environmental impacts proposed for study in the EIS, the alternatives proposed for study and the planning process that led to the proposed alternatives.

Subsequently, the City worked with neighborhood stakeholders to develop an Urban Design Framework. This Design Framework was developed in direct response to the concerns raised by stakeholders in their scoping comments and is intended to complement and inform the EIS alternatives, provide direction on potential impact mitigation, as well as serve as a tool to guide implementation of the Neighborhood Plan.

Based on this process, the City revised the EIS alternatives and finalized the scope of the EIS. Environmental topics addressed in this EIS include:

Land Use Plans & Policies	Public Services & Utilities	Environmental Health
Housing	Soils/Geology	Noise
Aesthetics & Urban Design	Water	Plants & Animals
Transportation	Air Quality	Historic & Cultural Resources
Open Space & Recreation	Greenhouse Gas	

2.4.5 Prior Environmental Review

The South Lake Union neighborhood has experienced a significant amount of public and private development in the past several years. The documentation of the SEPA review process for many of these projects is a source of valuable data and have been consulted in preparing this EIS. Whenever used in this EIS, prior documents have been cited as a source of information. Consulted documents include:

Amazon World Headquarters SEPA Review (multiple processes and documents)

Group Health Headquarters/Westlake Terry Building Expanded SEPA Checklist

Fred Hutchison Cancer Research Center EIS,

UW School of Medicine Phase II and III EIS

Museum of History & Industry (MOHAI) Expanded SEPA Checklist

2200 Westlake Avenue/2200 EIS Addendum

2201 Westlake Avenue/ENSO EIS Addendum

Lake Union Park Master Plan EIS

2.5 Benefits and Disadvantages of Delaying the Proposed Action

Delaying adoption of zoning incentives to allow for increased height and density in the South Lake Union neighborhood could reduce the likelihood of public benefits that may be experienced as a result of zoning incentives. Because the existing IC and C2 zones would be retained, residential development would remain focused in the existing SM zone. Delaying the action would also maintain existing height limits. Depending on the perspective of the individual, this may be seen as a benefit or a disadvantage.

Chapter 3

Affected Environment, Significant Impacts, Mitigation Measures and Unavoidable Adverse Impacts

3.1 GEOLOGY AND SOILS

The following discussion of geology and soils in the South Lake Union neighborhood is based readily available secondary sources of information. Primary research, such as soil borings, was not conducted for this analysis. The following sources of information were used to evaluate the geology and soils in the South Lake Union neighborhood:

- City of Seattle environmentally critical areas maps
- King County sensitive areas maps
- The Geologic Map of Seattle (Troost and others, 2005)

Geology and Soils Contents

3.1.1 Affected Environment

Geology and Soils

Regional Geologic Setting

Seattle is located in the central portion of the Puget Sound Basin, an elongated, north-south depression situated between the Olympic Mountains and the Cascade Range. Repeated glaciation (glacial events) of this region strongly influenced the present-day topography, geology, and groundwater conditions. The topography is dominated by a series of north-south ridges and troughs formed by glacial erosion and sediment deposition. Puget Sound, Lake Union, and Lake Washington now occupy some of these troughs.

The sediment distribution in the Puget Sound area is complex as a result of the repeated glaciations. Each glaciation deposited new sediment and partially eroded previous sediment. During the intervening periods when glacial ice was not present, normal stream processes, wave action, and landsliding eroded and reworked some of the glacially derived sediments. The most recent glaciation that covered the central Puget Lowland (termed Vashon) retreated about 13,500 years ago. The weight of the glacial ice resulted in compaction of the glacial and nonglacial soils. As a result, the glacially overriden deposits tend to be very dense or hard.

Glacially overridden deposits are overlain by recessional glacial deposits that accumulated during retreat and wasting of the Vashon ice sheet and by younger (Holocene Epoch) soils that include lacustrine, alluvial, colluvial, peat, landslide, and fill deposits. These deposits are typically very loose to dense or very soft to stiff.

Geology, Soils, and Groundwater in the Study Area

Much of the ground in the South Lake Union neighborhood has been modified by grading or placement of artificial fill. Artificial fill in Seattle is highly variable, and can range from very soft to stiff or very loose to dense, sand, gravel, silty, and/or clay. Fill is mapped across nearly the entire waterfront area north of Mercer Street. South of Mercer Street, fill is mapped along Eastlake Avenue E as far south as John Street, and in isolated pockets between 8th Avenue and Terry Avenue N north of Republican Street.

Native surficial deposits mapped in the South Lake Union neighborhood include overridden Vashon and pre-Vashon glacial and nonglacial deposits, and non-overridden recessional glacial and Holocene deposits (Troost and others, 2005).

Very soft to stiff Holocene and recessional lake deposits (Ql and Qvrl) underlie much of the waterfront area of the South Lake Union neighborhood. These deposits occur along Westlake Avenue N on the west side of Lake Union and along Fairview Avenue N on the east side of the lake. South of Lake Union, the deposits extend as far south as Harrison Street and as far west as the neighborhood edge between Mercer Street and Republican Street.

Loose to dense recessional outwash (Qvr) and ice-contact (Qvi) deposits are mapped across much of the South Lake Union neighborhood south of Mercer Street. Qvi deposits are mapped between Aurora Avenue N and Terry Avenue N south of Republican Street. Qvi and Qvr deposits occur between Boren Avenue N and Yale Avenue N south of Roy Street and north of John Street.

The margins of the South Lake Union neighborhood are generally underlain by glacially overridden deposits, including Vashon till (Qvt) and pre-Vashon glacial and nonglacial deposits (Qpf and Qob). These very dense and/or hard deposits are principally mapped along Eastlake Avenue E and Lakeview Boulevard E, along Dexter Avenue north of Mercer Street, and between Terry Avenue N and Boren Avenue N south of Harrison Street.

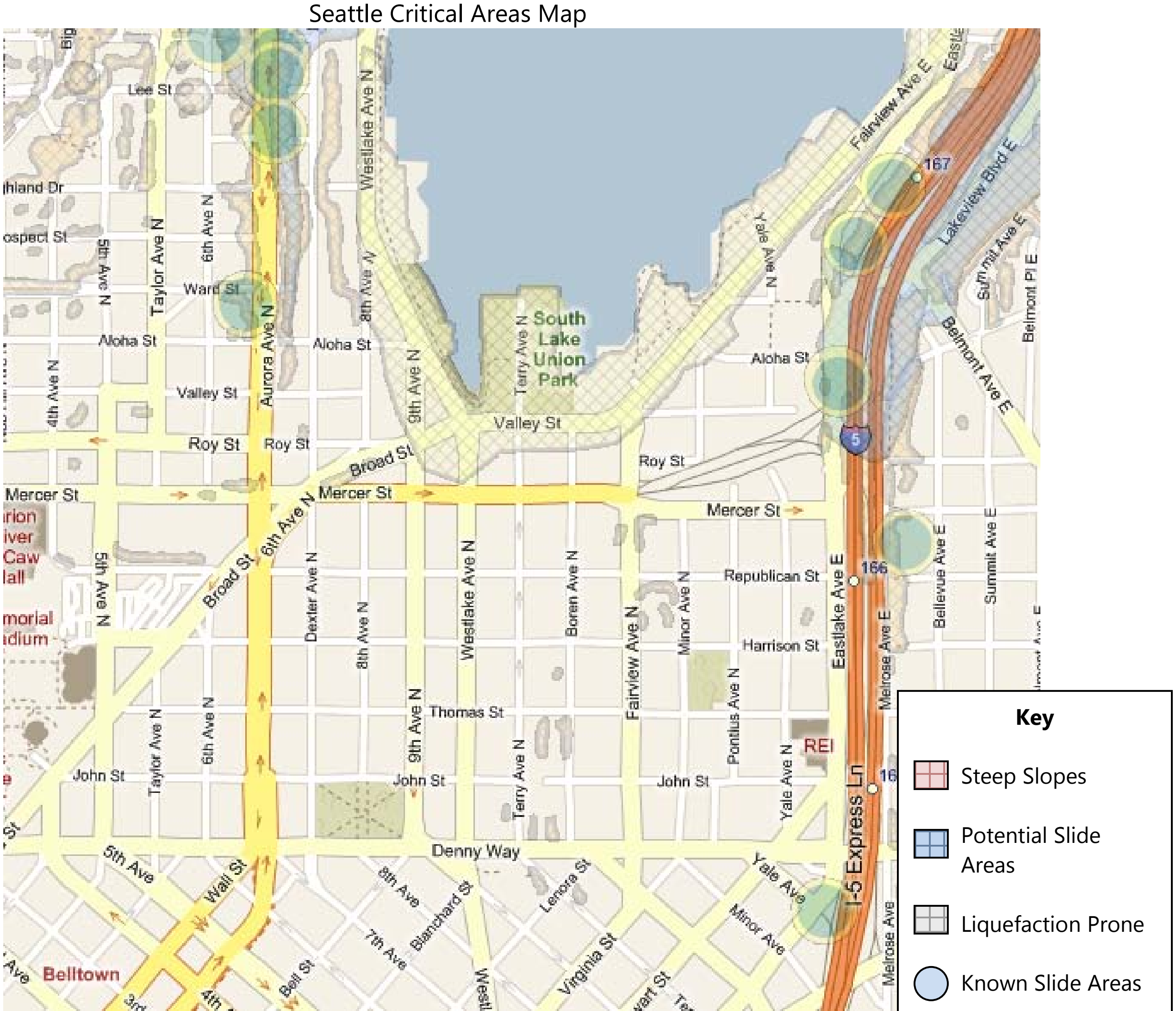
In general, groundwater across the South Lake Union neighborhood is anticipated to be relatively shallow. Groundwater typically ranges from a few feet to approximately 20 feet deep. In general, surface water and groundwater flow is expected to be towards Lake Union. Suitability of soils for development at a specific site will depend not only on the soil characteristics, but also on the type and design of the proposed structure.

In general, soft and loose soils are not considered suitable as a foundation subgrade. However, unsuitable soils can be removed or improved, or a foundation can be lowered so that is founded on denser or harder material. A geotechnical investigation would need to be performed to evaluate subsurface soil conditions, soil suitability, and to provide engineering recommendations during the design process.

Critical Areas

Steep slopes, potential slide areas, and liquefaction-prone areas are mapped within the South Lake Union neighborhood by the City of Seattle (See **Figure 3.1-1**). These critical areas and their approximate locations are discussed in the following sections.

Figure 3.1-1
Seattle Critical Areas Map



Source: City of Seattle, 2010

Steep Slopes

A steep slope is defined in the Seattle Municipal Code (Section 25.09.020) as any slope with an inclination greater than or equal to 40%, and having a height of at least 10 feet. Such slopes are at an increased risk of erosion and landslides. These risks become more acute with steeper and higher slopes.

Steep slopes are distributed sporadically across the South Lake Union neighborhood. They are most concentrated along the east and west margins of Lake Union north of Mercer Street. On the west side of the lake, north-south oriented steep slopes flank the east and west sides of Dexter Avenue N. On the east side of the lake, steep slopes generally follow the west margin of the I-5 corridor, adjacent to the eastern boundary of the study area. South of Mercer Street, isolated steep slopes occur along Fairview Avenue N between Mercer and Harrison Streets, adjacent to Terry Avenue N and Boren Avenue N and south of Harrison Street, and in the vicinity of the intersection of Broad and Mercer Streets.

Steep slope along shoreline

Landslide Hazards

Potential slide areas include areas of historic landslides, areas with topographic or geologic evidence of past sliding, and areas adjacent to or within steep slopes. Risks posed by landslides include injury or death to humans and damage to, or destruction of, structures.

Potential slide areas in the South Lake Union neighborhood are generally associated with the steep slopes on the east and west sides of Lake Union. On the west side of the lake, potential slide areas are mapped on the west side of Dexter Avenue north of Aloha Street, in the northwest corner of the study area. On the east side of the lake, potential slide areas are mapped along the I-5 corridor and Eastlake Avenue E north of Roy Street, near the northeast corner of the study area.

Liquefaction

Liquefaction is the loss of soil strength due to ground shaking. The process is most common in low density sand or silt deposits that are below the water table. Liquefaction can cause significant damage to buildings and infrastructure by causing settlement and slope movement.

Liquefaction-prone areas are mapped near the shore of Lake Union. They generally include the areas between the lake and Dexter Avenue to the west, Mercer Street to the south, and Eastlake Avenue E to the east.

8th Avenue Corridor

Surficial deposits mapped along the 8th Avenue Corridor consist of loose to dense, sandy and gravelly, recessional ice-contact deposits (Qvi). Geologic mapping shows that the 8th Avenue Corridor has been modified by grading along nearly its entire length.

Steep slopes, potential slide areas, and liquefaction prone areas are not currently mapped within the limits of the 8th Avenue Corridor.

Fairview Avenue Corridor

Surficial deposits along the Fairview Avenue Corridor consist principally of loose to dense, sandy and gravelly, recessional outwash and ice-contact deposits (Qvr and Qvi). Soft to stiff, recessional lake (Qvrl) deposits are mapped across the northwest corner of the corridor, west of Fairview Avenue N and north of Republican Street. Very dense and/or hard pre-Vashon deposits (Qpf) are mapped near the southern limit of the Fairview Avenue Corridor south of John Street. Geologic mapping shows that the corridor has been modified by grading along nearly its entire length.

Steep slopes occur in the Fairview Avenue Corridor between Mercer and Harrison Streets. Potential slide areas and liquefaction-prone areas are not currently mapped within the limits of the Fairview Avenue Corridor.

Valley/Mercer Blocks

The Valley/Mercer Blocks are underlain by artificial fill and very soft to stiff, Holocene and recessional lake deposits (Ql and Qvrl).

The Valley/Mercer Blocks are mapped as a liquefaction-prone area. Steep slopes and areas of potential sliding are not currently mapped within the limits of the Valley/Mercer Blocks.

3.1.2 Environmental Impacts

The proposal analyzed in this EIS considers the use of incentive zoning to increase height and density in the South Lake Union neighborhood. By itself, this proposal would not directly result in impacts to geology and soils.

Future site-specific development proposals under any of the alternatives, however, could result in impacts to geology and soils. Potential impacts that could be associated with future site-specific development under any alternative are briefly discussed below.

Impacts Common to All Alternatives

Any future development will likely require excavation, grading, soil removal, placement of structural fill, and construction of new foundations. These activities could have direct impacts on soils and groundwater. The impacts would likely be greater for those alternatives with greater height limits (such as Alternative 1), because deeper foundations would probably be required for construction.

Construction operations may result in changes to native soil conditions because of the need for grading or to remove unsuitable soil and replace it with structural fill. In particular, artificial fill and soft compressible soils near the waterfront (Valley/Mercer Blocks) may need to be excavated and replaced with suitable material.

Excavation operations have the potential to impact areas near construction. Excavation near existing slopes and/or landslides can result in slope instability. Some excavations will require installation of shoring, which may cause ground vibrations depending on the installation method chosen.

Future development is also likely to impact surface water and groundwater flow in the area. Changes in grade and the addition of impervious surfaces would alter surface water flow. Excavation and foundation construction may require temporary or permanent dewatering to lower groundwater levels. Once constructed, foundations or underground structures may alter the natural flow of groundwater by acting as a barrier to groundwater movement.

Steep slopes, landslides, and liquefaction could have the potential to impact future development under any of the alternatives. Steep slopes in the Fairview Avenue Corridor could be destabilized by construction activities. Destabilization could result in increased erosion or landsliding. Liquefaction-prone areas, such as the Valley/Mercer Blocks, might experience settlement and/or increased earth pressures on retaining structures during an earthquake. Impacts associated with development in areas with steep slopes, landslide potential, or liquefaction hazards can be minimized through appropriate design and construction measures.

3.1.3 Mitigation Strategies

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur with development under any of the alternatives. Site specific measures may include reducing the size of the project, placing limits on project timing and schedule, or requiring additional practices during construction to avoid adverse impacts (SMC 25.05.675(D)). Additional practices might include landscaping, supplemental drainage measures, water quality control, erosion control, and stabilization measures.

3.1.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to earth resources are anticipated.

3.2 AIR QUALITY

3.2.1 Affected Environment

Future development associated with any of the alternatives would likely add small-scale commercial pollution-generating activities within the South Lake Union neighborhood. Emissions from motor vehicles associated with future development would comprise the major source of air quality emissions within this study area – compared with any direct emissions related to the potential uses in the study area. Vehicles directly emit, among other things, relatively large quantities of carbon monoxide (CO). The potential for air quality impacts due to vehicles, therefore, is the focus of this air quality analysis.

Regulatory Overview

Ambient Air Quality Standards and Attainment Status

Air quality is generally assessed in terms of whether concentrations of air pollutants are higher or lower than ambient air quality standards that are established to protect human health and welfare. Ambient air quality standards are set for what are referred to as "criteria" pollutants (e.g., CO, and particulate matter). Three agencies have jurisdiction over ambient air quality in the Seattle area: the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and the Puget Sound Clean Air Agency (PSCAA). These agencies establish regulations that govern both the concentrations of pollutants in the ambient air and rates of contaminant emissions from air pollution sources. Although their regulations are similar in stringency, each agency has established its own standards. Unless the state or local jurisdiction has adopted more stringent standards, the EPA standards apply. Applicable local, state, and federal ambient air quality standards for federally designated "criteria" pollutants that may pertain to this review are displayed in **Table 3.2-1**. These standards are intended to protect human health with a margin of safety, including sensitive individuals like the aged, chronically ill, and the very young.

Ecology and PSCAA maintain a network of air quality monitoring stations throughout the Puget Sound area. In general, these stations are located where air quality problems may occur. As such, they are usually in or near urban areas or close to specific large air pollution sources. Other stations that are located in more remote areas provide indications of regional or background air pollution levels. Based on monitoring information for criteria air pollutants that has been collected over a period of years, Ecology and EPA designate regions as being "attainment" or "nonattainment" areas for particular pollutants. Attainment status is, therefore, a measure of whether air quality in a specific area complies with the federal health-based ambient air quality standards for criteria pollutants.

Once a nonattainment area achieves compliance with the National Ambient Air Quality Standards (NAAQSs), that area is considered an air quality "maintenance" area.

Table 3.2-1
Applicable Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Terms of Compliance[1]	Concentration
Inhalable Particulate Matter (PM_{10})		
24-Hour Average ($\mu g/m^3$)	The 3 year average of the 98th percentile of the daily concentrations must not exceed	150 $\mu g/m^3$
Fine Particulate Matter ($PM_{2.5}$)		
Annual Average ($\mu g/m^3$)	The 3-year annual average of daily concentrations must not exceed	15 $\mu g/m^3$
24-Hour Average ($\mu g/m^3$)	The 3-year average of the 98th percentile of daily concentrations must not exceed	35 $\mu g/m^3$
Carbon Monoxide (CO)		
8-Hour Average (ppm)	The 8-hour average must not exceed more than once per year	9 ppm
1-Hour Average (ppm)	The 1-hour average must not exceed more than once per year	35 ppm
Ozone (O_3)		
8-Hour Average (ppm)	The 3-year average of the 4th highest daily maximum 8-hour average must not exceed	0.075 ppm

Source: ENVIRON International Corporation, 2010

Note: $\mu g/m^3$ = micrograms per cubic meter; ppm = parts per million

1 All limits are federal *and* state air quality standards except as noted. All indicated limits represent "primary" air quality standards intended to protect human health.

Air Quality Conformity Review

Special air quality rules pertain in areas that are designated as nonattainment or maintenance for one or more air pollutants. These rules apply to CO sources in the study area by virtue of the region being a CO maintenance area.

Transportation Conformity

The air quality conformity rules pertain to transportation projects and to development projects that include substantial "transportation components" and that have the potential to affect the regional transportation system. Transportation conformity review is triggered when a transportation project or a transportation component of a development project would affect the operation of or require structural changes to either a state-controlled facility (i.e., a highway) or a "regionally significant arterial." While no state-controlled highway would be affected, each of the alternatives would affect traffic flows on City streets in the area – several of which may be considered "regionally significant."

Existing Air Quality Conditions

Carbon Monoxide

Carbon monoxide (CO) is the product of incomplete combustion. It is generated by transportation sources and other fuel-burning activities like residential space heating, especially heating with solid fuels like coal or wood. Carbon monoxide is usually the pollutant that serves as an indicator of transportation source air pollution. This is because it is the pollutant that is emitted in the greatest quantity for which short-term health standards exist. CO is a pollutant whose impact is usually localized and CO concentrations typically diminish within a short distance of roadways. The highest ambient concentrations of CO usually occur near congested roadways and intersections during wintertime periods of air stagnation.

The South Lake Union neighborhood is located within the former Puget Sound region CO nonattainment area (established in 1991).This designated area encompassed a large portion of the Everett-Seattle-Tacoma urban area. Because no monitoring stations had recorded violations of the CO standards in many years, in 1997 EPA re-designated the Central Puget Sound region as attainment for CO. The former nonattainment area remains an air quality maintenance area for CO. However, there have been no measured violations of the standards in many years and the former CO problem is thought to have been resolved.

Ozone

Ozone is a highly reactive form of oxygen created by sunlight-activated chemical transformations of nitrogen oxides and volatile organic compounds (hydrocarbons) in the atmosphere. Ozone problems tend to be regional in nature because the atmospheric chemical reactions that produce ozone occur over a period of time and because during the delay between emission and ozone formation, ozone precursors can be transported far from their sources. Key transportation sources that produce ozone precursors include large marine vessels, locomotives, trucks and other motor vehicles.

In the past, due to violations of the federal ozone standard, the Puget Sound region was designated as nonattainment for ozone based on the 1-hour standard in effect at that time. In 1997, the EPA determined that the Puget Sound ozone nonattainment area had attained the public health-based NAAQS for ozone. At that time EPA re-designated the Puget Sound region as attainment for ozone and approved the associated air quality maintenance plan. In 2005, EPA revoked the 1-hour ozone standard in most areas of the U.S., including the Puget Sound region. This action ended the maintenance status of this region. At the same time, however, EPA adopted a new more stringent 8-hour average ozone standard that has since been made even more stringent. Based on ozone measurements over the last few years, the Puget Sound region seems to again be on the brink of becoming nonattainment for ozone based on measured violations of the current 8-hour average standard (**Table 3.2-1**). As described above, ozone problems are regional in nature and can be transported far from their sources. For these reasons, the potential future nonattainment status for ozone would have no direct implications for any of the South Lake Union alternatives.

Inhalable Particulate Matter – PM_{10} and $PM_{2.5}$

Particulate matter air pollution is generated by industrial activities and operations, fuel combustion sources like marine vessels and residential wood burning, motor vehicle engines and tires, and other sources. Federal, state, and local regulations set limits for particulate concentrations in the air based on the size of the particles and the related potential threat to human health. When first regulated, particle pollution rules were based on concentrations of "total suspended particulate," which included all size fractions. As air sampling technology has improved and the importance of particle size and chemical composition have become more clear, ambient standards have been revised to focus on the size fractions thought to be most dangerous to people. Based on the most recent studies, EPA has redefined the size fractions and set new, more stringent standards for particulate matter based on fine and coarse inhalable particulate matter to focus control efforts on the smaller size fractions.

There are currently health-based ambient air quality standards for PM_{10}, (particles less than or equal to about 10 micrometers [microns] in diameter), as well as for $PM_{2.5}$ (particulate matter less than or equal to 2.5 microns in diameter) (**Table 3.2-1**). The latter size fraction and even smaller (ultra-fine) particles are now considered the most dangerous size fractions of airborne particulate matter because such small particles[1] can be breathed deeply into lungs. In addition, such particles are often associated with toxic substances that are deleterious in their own right that can absorb to the particles and be carried into the respiratory system.

With revocation of the federal annual standard for PM10 in October 2006, the focus of ambient air monitoring and control efforts related to particle air pollution in the Puget Sound region has been almost entirely on fine particulate matter (PM2.5).

Based on particulate matter measurements over the last few years, EPA in 2009 established a PM2.5 nonattainment area in Tacoma.[2] There are no other particulate matter nonattainment areas in the Puget Sound region.

3.2.2 Environmental Impacts

The analysis of potential air quality impacts related to the alternatives focuses on traffic and was based on consideration of ambient concentrations of carbon monoxide (CO) that could occur under worst-case conditions near congested intersections. The analytical process is described below.

Analysis Method

The air quality impact review consisted of a microscale CO "hot-spot" analysis using computer models recommended or required by EPA guidelines and/or air quality rules. The assessment considered air quality due to emissions from the traffic sources in the future year (2031).[3]

The air quality review considered potential air quality impacts in accordance with EPA air quality "hot-spot" modeling guidelines. Based on these guidelines, signalized intersections that would be affected by traffic related to a proposed project are screened for possible quantitative analysis using dispersion modeling (i.e., computerized analysis to estimate air pollutant concentrations due to sources of interest). Such screening is

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1 For comparison, a typical human hair is about 100 microns in diameter.)

2 The proposed nonattainment area is called the Wapato Hills-Puyallup River Valley area. See information and maps at: http://www.ecy.wa.gov/programs/air/Nonattainment/Nonattainment.htm.

3 The hot spot analysis did not include modeling the existing condition because emissions in the South Lake Union neighborhood were already considered in the Mercer Corridor Improvements EIS, 2007.

conducted by reviewing the predicted future signalized intersection peak-hour traffic levels of service (LOS). EPA guidance suggests modeling signalized intersections with an LOS that would deteriorate to "D" or worse due to a proposed project. By definition, intersections that do not warrant signalization, as well as signalized intersections that operate at LOS "C" or better have little if any potential to cause air quality impacts at nearby locations

In accord with EPA guidance, the three most congested signalized intersections that would also be affected by potential future traffic were selected for air quality analysis. These intersections were modeled CO for the evening peak commute period. These are the intersections are Mercer Street/Dexter Avenue N, Mercer Street/Westlake Avenue N and Mercer Street/Fairview Avenue N.

The air quality analysis involved review of the carbon monoxide (CO) implications of traffic using quantitative dispersion analysis with the CAL3QHC model (EPA 1995) or the WASIST intersection screening tool (WSDOT 2009). The former computerized analytical procedure is the recommended tool for assessing potential CO impacts at congested intersections; the latter is a simplified version of this same tool with built-in emission rates and intersection geometries.

The WASIST screening tool was used to evaluate potential impacts near the intersection of Mercer Avenue at Westlake Avenue N. For this effort, model defaults and WSDOT-suggested input parameters (speed of 15 mph) were used to determine CO concentrations. The remaining intersections were analyzed using the CAL3QHC model because the intersection geometry was not sufficiently similar to the types allowed in the WASIST screening tool. CAL3QHC requires additional input parameters that are "hard-coded" into the WASIST screening tool, so the CAL3QHC dispersion modeling analysis applied a number of assumptions regarding vehicle emission rates and atmospheric conditions as follows:

- meteorological parameters included a 1,000-meter mixing height, low wind speed (1 meter/second) and a neutral atmosphere (Class D);
- modeling evaluated 72 wind directions (in 5 degree increments) to ensure worst-case conditions were considered for each receptor location;
- a "background" 1-hour carbon monoxide concentration of 4 ppm was assumed to represent other sources in the project area;
- the modeling configuration considered road links extending up to 1,000 feet from single most project-affected intersection;

- both free-flow and queue links were configured approaching and departing intersection;
- near-road receptors were placed along both sides of each roadway about 3, 25, 50, and 100 meters from cross streets, 3 meters from the nearest traffic lane, and 1.8 meters above the ground (typical sidewalk locations at breathing height);
- modeled calculated 1-hour CO concentrations were converted to represent 8-hour concentrations using a 0.7 "persistence factor" (i.e., the ratio of 8-hour to 1-hour CO concentrations) to represent variability in both traffic volumes and meteorological conditions; and
- emission factors for the year 2031 determined by the WASIST model for the Puget Sound maintenance area were used with the CAL3QHC modeling for consistency of the analysis method.

These assumptions are consistent with EPA guidance for CO dispersion modeling.

Impacts Common to All Alternatives

The proposal analyzed in this EIS considers the use of incentive zoning to increase height and density in the South Lake Union neighborhood. By itself, this proposal would not directly result in impacts to air quality.

Future site-specific development proposals under any of the alternatives, however, could result in impacts to air quality. Potential impacts that could be associated with future site-specific development under any alternative are briefly discussed below.

Construction

Redevelopment in the study area could include demolition of existing buildings and construction of new buildings, as well as other infrastructure improvements. Construction could entail extensive grading and excavation for building foundations, as well as removal of existing pavement and grading for new development. Such activities could result in temporary, localized increases in particulate concentrations due to emissions from construction-related sources. For example, dust from construction activities such as excavation, grading, sloping and filling would contribute to ambient concentrations of suspended particulate matter. Construction contractor(s) are required to comply with PSCAA regulations requiring that reasonable precautions be taken to minimize dust emissions.

Demolition of existing structures would require removal and disposal of building materials that could possibly contain asbestos and lead based paint. Demolition contractors would, therefore, be required to comply with EPA and PSCAA regulations related to the safe removal and disposal of any asbestos-containing materials.

Construction would require the use of heavy trucks, excavators, graders, and pavers along with smaller equipment such as generators, pumps, and compressors. Emissions from existing traffic sources in the vicinity would likely outweigh any degradation of local air quality resulting from construction equipment emissions. Nonetheless, emissions from such sources and especially from diesel-fueled engines are coming under increased scrutiny, because of their suspected risk to human health. Specific dose/response effects are unknown, but long-term exposure to excessive amounts of diesel emissions is now understood to represent a human health risk, especially to sensitive individuals like the elderly, chronically ill, and the very young. Hence, although there is little or no danger of such emissions resulting in pollutant concentrations that would exceed an applicable ambient air quality standard, pollution control agencies are now urging that emissions from diesel equipment be minimized to the extent practicable in order to reduce potential health risks. By taking steps such as minimizing on-site diesel engine idling, construction-related diesel emissions are not expected to have any substantial impact on air quality within the South Lake Union neighborhood.

Although some construction activity could cause odors, particularly during paving operations using tar and asphalt, any odors related to construction activity would be short-term and localized. Construction contractors would have to comply with PSCAA regulations that prohibit the emission of any air contaminant in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

Construction equipment and material hauling can affect traffic flow in a project area if construction vehicles travel during peak periods or other heavy-traffic hours of the day and pass through congested areas, thereby further impeding traffic flow. Material hauling would likely be limited to daytime off-peak hours.

With implementation of the controls required for the various aspects of construction activities and consistent use of best management practices to minimize on-site emissions, construction activity would not be expected to significantly affect air quality.

Operation

Potential operational impacts that could be associated with future site-specific development under any alternative are briefly discussed below.

The traffic analysis determined the number of trips generated by each alternative during the PM Peak period. This data was used to assess changes in intersection performance at the three most congested intersections along Mercer Avenue. Modeling results indicate that maximum-predicted CO concentrations near each of the modeled signalized intersections meet the 1-hour and 8-hour ambient air quality standards of 35 ppm and 9 ppm respectively. In addition, increased traffic has no effect on ambient concentrations at two of the three intersections considered for analysis. However, maximum-predicted CO concentrations would increase with increased traffic at the Fairview Avenue/Mercer Street intersection in 2031.

Table 3.2-2
Estimated CO Concentration at Key Intersections in 2031

Intersection	Averaging Period	Alternative 4 (No Action)	Alternative 1
Fairview and Mercer Street	1-hour	9.0 ppm	9.3ppm
	8-hour	6.3	6.5
Westlake and Mercer Street	1-hour	7.1	7.1
	8-hour	6.2	6.2
Dexter and Mercer Street	1-hour	6.3	6.3
	8-hour	4.4	4.4

Source: ENVIRON International Corporation, 2010

Note: The estimated concentrations include a background of 4 ppm (parts per million), using a persistence factor of 0.7 to convert 1-hour values to 8-hour values.

Alternative 1

Under Alternative 1, predicted PM peak hour auto trips are expected to be the highest among the alternatives and represents a worst-case traffic scenario. Based on the modeling results, traffic sources would not cause an increase in ambient CO concentrations at receptors near two of the three intersections. Even with CO concentration increases at the Mercer Street/Fairview Avenue intersection, ambient concentrations would remain well below the NAAQS. Because increased traffic resulting from new development near the most congested intersections would not likely cause an impact to air quality, impacts are also unlikely at other less congested intersections. Therefore, Alternative 1 would be unlikely to affect air quality in the South Lake Union study area.

Alternative 2

Traffic generated by Alternative 2 is predicted to be the same as that associated with Alternative 1. Therefore, assuming the same traffic and modeling conditions, ambient concentrations with Alternative 2 would likely be the same as that under Alternative 1. No impacts to air quality are expected.

Alternative 3

Under Alternative 3, future development is expected to result in approximately 3,000 fewer vehicular trips than Alternatives 1 and 2. Although traffic conditions with Alternative 3 were not specifically modeled, it is likely that fewer trips would result in less traffic at the most congested intersections. Therefore, CO concentrations would likely be similar to or less than those predicted for Alternatives 1 or 2. No impacts to air quality are expected.

Alternative 4 (No Action)

Under the no action alternative, future development could occur up to the limits of the current zoning. Trips generated under this scenario would be slightly fewer than with Alternative 3. Based on the modeling, maximum-predicted CO concentrations in 2031 would be less than the ambient air quality standards, so no impacts to air quality are anticipated.

3.2.3 Mitigation Strategies

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives. These are briefly described below.

Although significant air quality impacts are not anticipated due to construction activities, construction contractors would be required to comply with all relevant federal, state, and local air quality rules. In addition, implementation of best management practices would reduce emissions related to the construction of the developments.

Possible management practices for reducing the potential for air quality impacts during construction address measures for reducing exhaust emissions and fugitive dust. The Washington Associated General Contractors brochure Guide to Handling Fugitive Dust from Construction Projects and the PSCAA suggest a number of methods for controlling dust and reducing the potential exposure of people to emissions from diesel equipment. A list of some of the possible control measures that could be implemented to reduce potential air quality impacts from construction activities include:

- use only equipment and trucks that are maintained in optimal operational condition;
- require all off-road equipment to have emission reduction equipment (e.g., require participation in Puget Sound Region Diesel Solutions, a program designed to reduce air pollution from diesel, by project sponsors and contractors);
- use car-pooling or other trip-reduction strategies for construction workers;
- implement restrictions on construction truck and other vehicle idling (e.g., limit idling to a maximum of 5 minutes);
- spray exposed soil with water or other suppressant to reduce emissions of PM and deposition of particulate matter;
- pave or use gravel on staging areas and roads that would be exposed for long periods;
- cover all trucks transporting materials, wetting materials in trucks, or providing adequate freeboard (space from the top of the material to the top of the truck bed), to reduce PM emissions and deposition during transport;
- provide wheel washers to remove particulate matter that would otherwise be carried off site by vehicles to decrease deposition of particulate matter on area roadways;
- cover dirt, gravel, and debris piles as needed to reduce dust and wind-blown debris; and
- stage construction to minimize overall transportation system congestion and delays to reduce regional emissions of pollutants during construction.

Operation

No impacts have been identified and no mitigation is proposed or necessary.

3.2.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to air quality are anticipated under any of the proposed alternatives.

3.3 WATER QUALITY

This section addresses the effects of the proposed alternatives on the water quality of stormwater runoff to Lake Union.

3.3.1 Affected Environment

The South Lake Union neighborhood is a highly urbanized area characterized by a high percentage of impervious coverage. With the exception of three parks in the neighborhood, the dominant land coverage is impervious rooftops, roadways, and sidewalks. As a result, nearly all the precipitation that falls on this area is runoff; there is little to no opportunity for infiltration and groundwater re-charge.

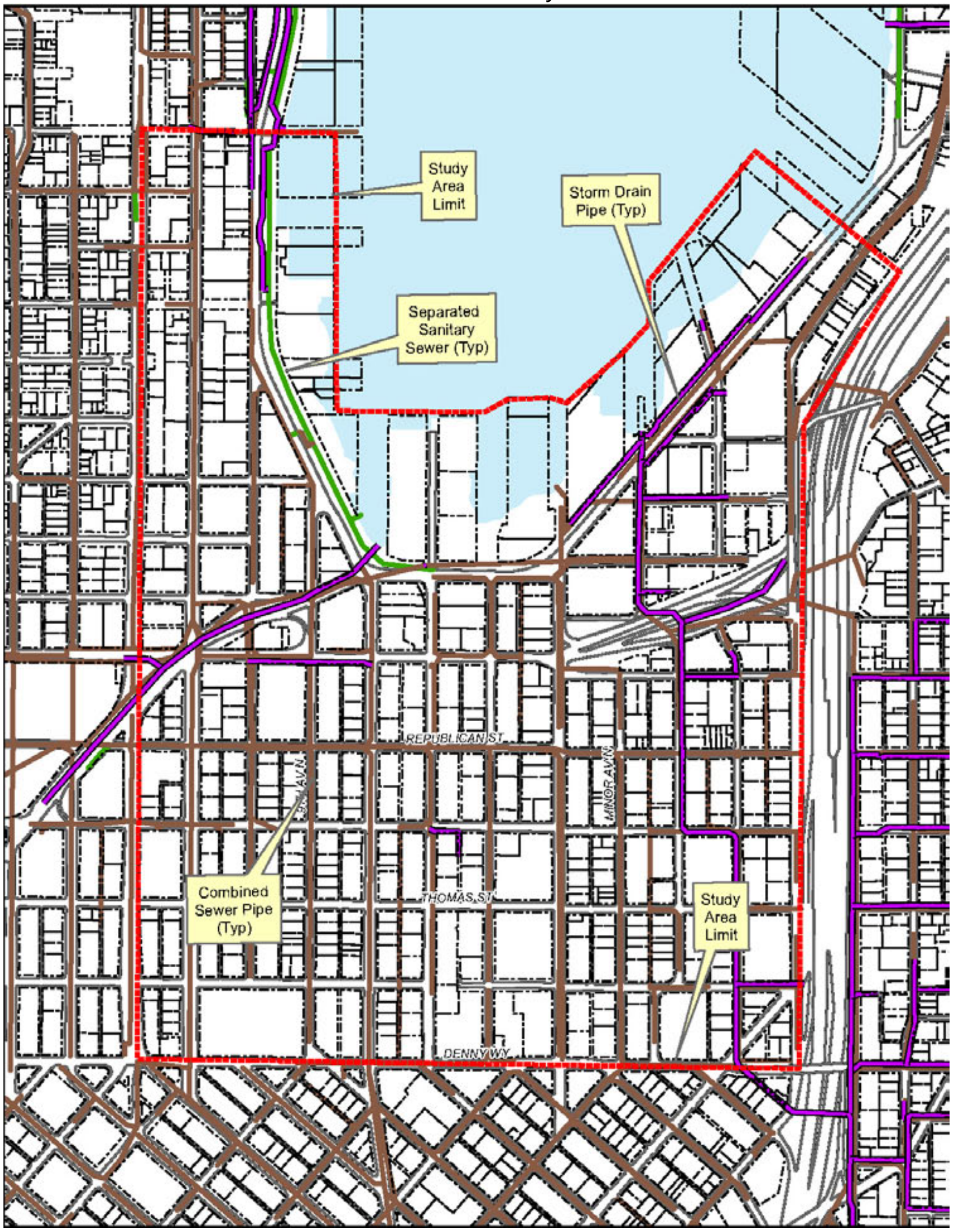

Lake Union from Lake Union Park

The South Lake Union neighborhood slopes generally from south to north toward Lake Union with flat to moderate grades. Stormwater runoff from the 340-acre study area either discharges directly to Lake Union or is captured in roof or surface drains and flows into one of two existing piped systems – a separated storm system or a combined sewer system (see **Figure 3.3-2**). Infrastructure for both systems is present within the study area (**Figure 3.3-1**). Approximately 75% of the study area is served by the combined sewer system.

Urban runoff from private development is primarily from building roof or plaza areas which are not considered "pollution-generating impervious surfaces (PGIS)" per the Seattle Stormwater Code[1]Runoff from these surfaces can contain pollutants from sources such as atmospheric deposition and roofing materials. However, pollutant concentrations are much lower than for PGIS surfaces such as surface parking lots and roadways, which are a significant source of pollution in highly urbanized commercial areas.

[1]As described in the Seattle Stormwater Code (Appendix A Definitions), PGIS is defined as "Those impervious surfaces considered to be a significant source of pollutants in drainage water. Such surfaces include those that are subject to: vehicular use; certain industrial activities; or storage of erodible or leachable materials, wastes, or chemicals, and which receive direct rainfall or the run-on or blow-in of rainfall. Erodible or leachable materials, wastes, or chemicals are those substances which, when exposed to rainfall, measurably alter the physical or chemical characteristics of the drainage water."

Figure 3.3-1
Sewer and Storm Systems



Source: Coughlin Porter Lundeen, 2010

Lake Union's watershed is highly urbanized and has been home to major industries over the last 100 years. Significant sediment contamination (heavy metals and organics) has been documented in Lake Union, primarily from historic industrial sources. Lake Union has a surface area of approximately 600 acres and a total volume of 20,000 acre-feet. During the last century, Lake Union has been affected by sewage, storm water, and industrial pollutants. Early activities affecting the lake included a gas plant on the north shore, a steam plant on the southeast shore, sawmills, a coal transport dock, brick and other industrial manufacturing, and numerous sewage outfalls. Current sources include point source discharges directly from stormwater and combined sewer overflow (CSO) outfalls (see below under Combined Sewer System for description of CSOs); nonpoint discharges resulting from storage, handling, and processing of materials at lakeside industries and from other predominantly auto-related sources; recreational and commercial boat sewage and bilge waste discharges; and precipitation. Lake Union is included on the WA Department of Ecology's list of impaired and threatened water bodies, pursuant to Clean Water Act 303(d). Lake Union/Lake Washington Ship Canal is 303(d) listed for total phosphorus, fecal coliform bacteria, lead and aldrin in the water column and for sediment bioassay.

Sediment bioassay is a procedure that measures the response of living plants, animals, or tissues to a sediment sample. (WAC 173-204-200)

At this time, little if any of the storm water discharged directly to the lake from the South Lake Union neighborhood is treated. In the portion of the study area served by separated storm sewers, stormwater from streets, parking lots, rooftops and other exposed surfaces is typically discharged to the lake without any water quality treatment.

Increased density will generate more vehicle traffic in the area. Higher concentrations of pollutants commonly associated with vehicles could be generated. Oils, grease, antifreeze, and metals are commonly found on surfaces subject to vehicle use.

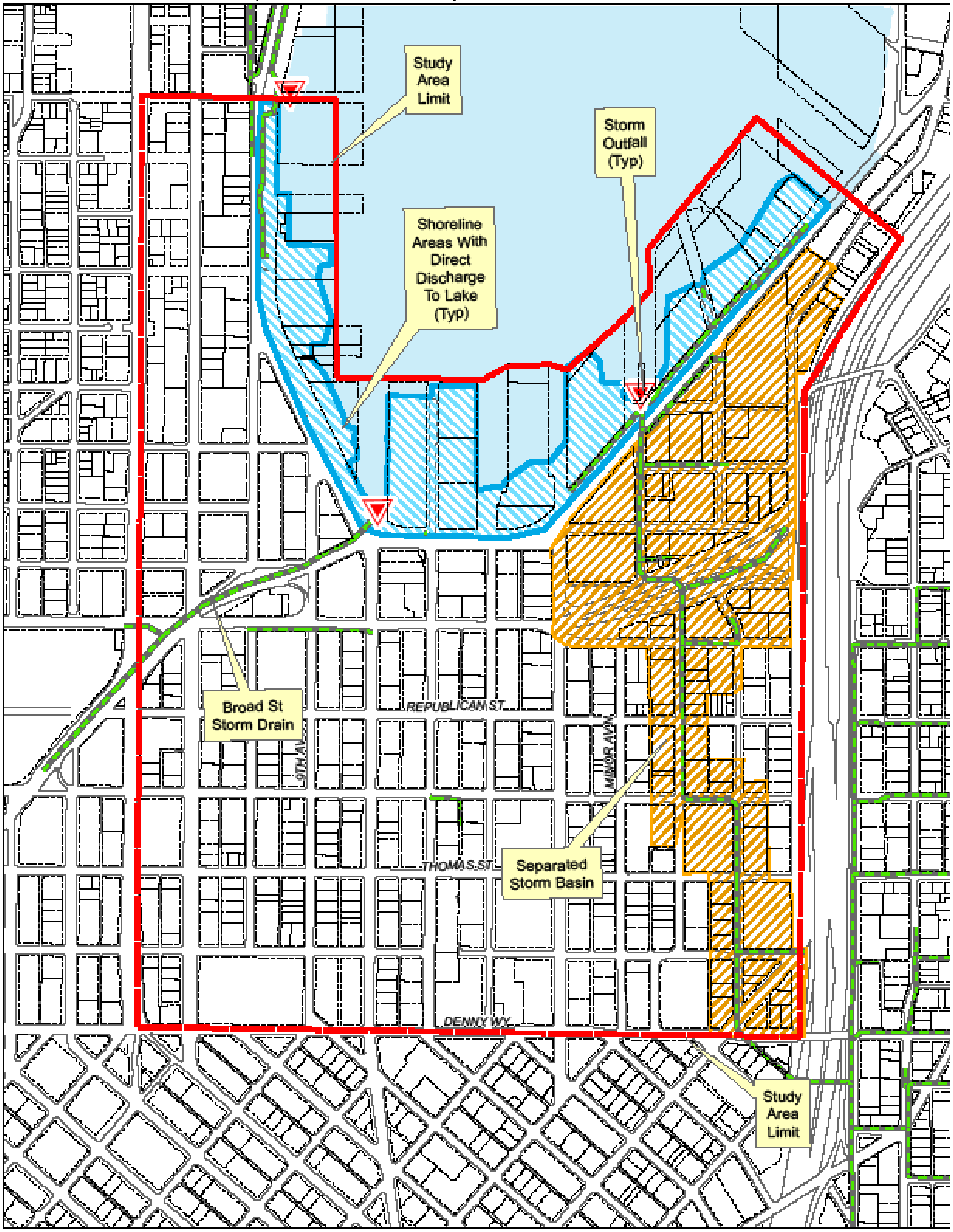
Separated Stormwater System

Within the study area, there are two methods for stormwater to directly enter Lake Union.

Parcels Directly Adjacent to Lake Union

As shown in **Figure 3.3-2**, most parcels adjacent to Lake Union and portions of the public streets that border the lake discharge surface water directly into the lake; runoff enters the lake from the surface or from small piped outfalls.

Figure 3.3-2
Separated Stormwater Systems



Source: Coughlin Porter Lundeen, 2010

Regional Piped Outfall

Near Minor Avenue and Fairview Avenue a 72-inch piped outfall discharges stormwater collected from the east side of the study area, portions of the I-5 freeway and Capitol Hill into Lake Union. This pipe serves a total basin of approximately 500-acres, of which the portion in the study area is about 75-acres (roughly 15 percent of the total basin).

With the exception of several recently re-developed parcels within this drainage basin, stormwater receives no water quality treatment prior to discharge to Lake Union.

Combined Sewer System

The rest of the study area is served by a public combined sewer system, see **Figure 3.3-3**. Surface water from private property and public streets is combined in a single pipe system with sanitary waste water from inside the buildings.

Combined sewers collect both stormwater and sanitary waste in a single pipe. Combined sewer overflow (CSO) are discharges of untreated sewage and stormwater released directly into marine waters, lakes and rivers during heavy rainfall, when the sewers have reached their capacity.

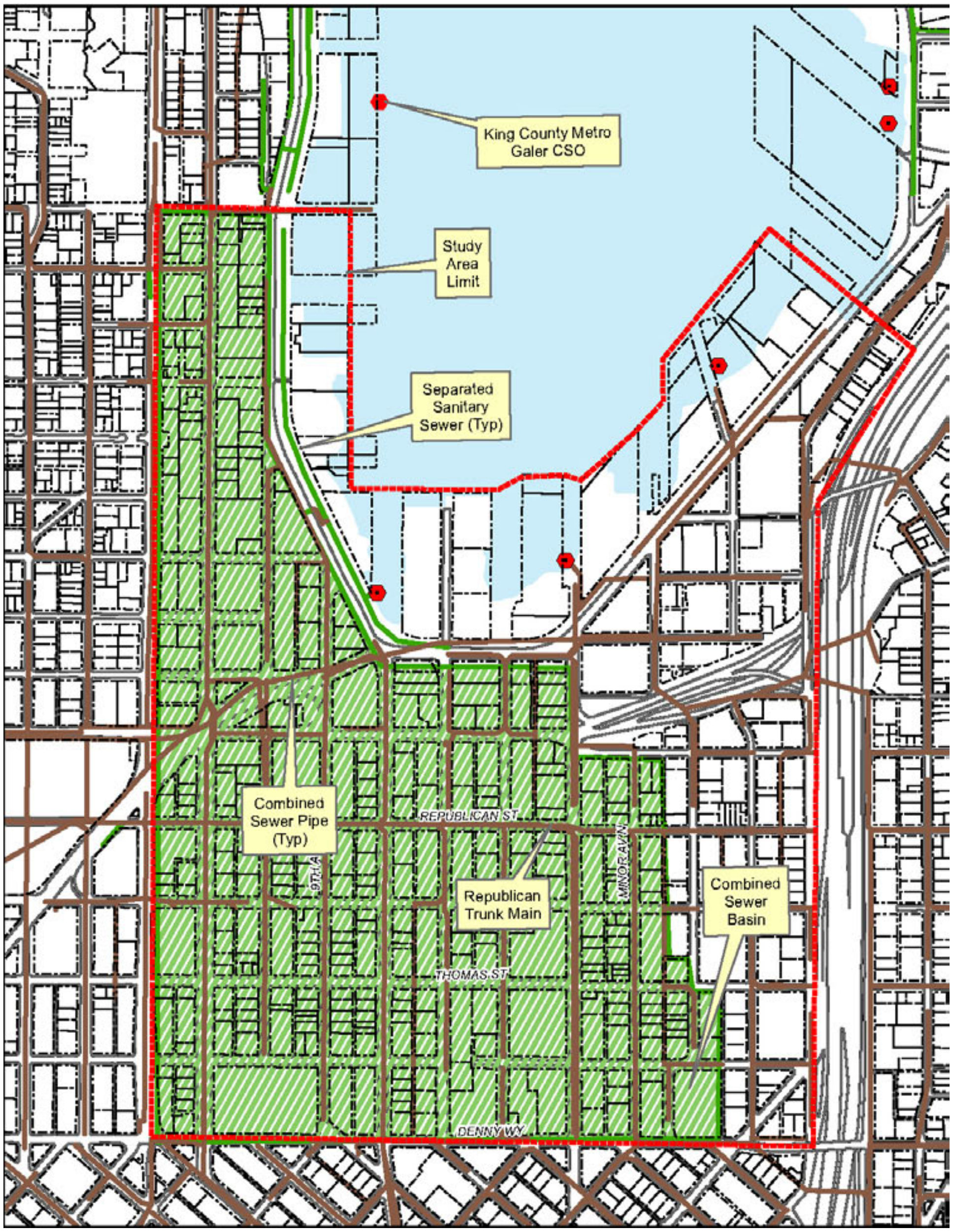
Stormwater runoff from approximately 75 percent of the 340-acre study area is routed to the City of Seattle's combined sanitary and stormwater system. This effluent is then conveyed to King County Metro's West Point Treatment Facility where, after processing, it is discharged to Puget Sound from a deep water outlet.

For those areas discharging to the combined sewer systems, water quality of stormwater runoff is usually not an issue since it is combined with the sanitary waste and treated accordingly, prior to discharge to the environment.

The combined sewer system does have "safety valves" in the form of over flow pipes in various locations in Lake Union and Elliott Bay. Commonly known as Combined Sewer Overflows (CSOs), these CSO outfalls allow the system to overflow un-treated sanitary and stormwater to the environment during large storms or other unusual events. Emergency CSOs are short-term events intended to prevent damage to the sewer infrastructure that could take the pipe system or treatment plant off line for an extended period of time and to prevent backups into buildings.

The South Lake Union neighborhood has at least five CSO facilities associated with it, see **Figure 3.3-3**. These CSOs are operated, monitored and maintained by King County Metro under a permit from Washington State Department of Ecology (WSDOE). One is located near Galer Street just north of the study area. The others are from the Metro mains along the Ship Canal and Elliot Bay, on the way to the treatment facility at West

Figure 3.3-3
Combined Sewers, CSO & ESOs



Source: Coughlin Porter Lundeen, 2010

Point. The CSO at Galer, per the Metro permit with the WSDOE, should not overflow more than once per year.

In addition to Combined Sewer Overflows, there are Emergency Overflow locations operated by Seattle Public Utilities along Lake Union. These Emergency Overflow locations are primarily for pump stations that serve small sewer basins near the shore line. These locations only overflow into

Lake Union in extreme events where mechanical or power failures prevent the pumps from operating.

Despite on-going efforts by the City and King County to add capacity and redundancy to the combined sewer system, combined sewer and emergency overflows occur occasionally for various reasons. Large storms, power outages and equipment breakdowns can result in a discharge of untreated sanitary and stormwater from the combined and separated sewersinto adjacent water bodies.

Focus Areas[2]

8th Avenue Corridor

Stormwater runoff from the 8th Avenue Corridor is routed to a 12 and 15-inch diameter combined sewer system in 8th Avenue. This sewer joins the main trunk sewer at Republican Street and 9th Avenue N.

The combined sewer in 8th Avenue has capacity issues starting with the 2-year storm event, in a 25-year event some manholes in the system could over top, causing local street flooding.

Fairview Avenue Corridor

Stormwater runoff from most of the Fairview Avenue Corridor is routed to a combined sewer system in Fairview Avenue N. The system in Fairview consists of two parallel pipes – one 8-inch and one 12-inch in diameter. Both pipes join the main trunk sewer at the intersection with Republican Street. Surface water from the west portion of this area (between Harrison and John Streets) enters the combined sewer system in an 8-inch sewer in Boren Avenue. This sewer connects to the main trunk sewer in Republican Street.

The 8-inch combined sewer main in Fairview begins to have capacity issues during the 2-year storm event, and the 12-inch has capacity problems starting in the 25-year storm. Over topping of some manholes near the north end of the system is predicted during the 25-year storm.

Valley/Mercer Blocks

Stormwater runoff from the Valley and Mercer Blocks is routed to the combined sewer system. Local sewer mains in Fairview, Boren, Terry,

[2]Focus areas are subareas in the South Lake Union neighborhood that are considered in greater detail, where applicable. Please discussion and Figure 2-3 in Chapter 2.

Westlake and 9th Avenues all convey collected surface water to the main trunk sewer in Republican Street.

During the 2-year storm, local collector sewers in 9th, Westlake, Terry and Fairview all begin to have capacity issues. In the 25-year storm manhole overflows and street flooding is possible from these systems.

As part of the Mercer Corridor project, the combined sewer in 9th Avenue, north of Republican will be replaced. The new design will relieve some of the capacity issues in this area. Additional changes to the existing combined and separated storm systems along the Mercer corridor will partially separate the sewer and storm systems in this area. Water quality treatment will be provided for the storm water runoff from new pavements that have direct discharge to Lake Union.

Beginning at the Republican Street trunk main, this sewer network flows either west, under Queen Anne, then north along Elliott Bay to the Metro main under Elliott Avenue, or north to the Ship Canal and then to the West Point treatment facility.

3.3.2 Pollution Sources

The primary source of pollution in urban runoff is material from motor vehicle usage. Stormwater running off various surfaces can carry pollutants from roads, buildings, parking lots, and parks to a down stream water body. Typical pollutants found in stormwater include, but are not limited to:

- street and parking lot deposits –street dirt, metals, fluids leaked from vehicles, and litter;
- from vehicles –hydrocarbons, oils, metals and antifreeze
- uncovered outdoor storage material – old cars and engines, leaking dumpsters, and storage drums; and
- bacteria – from various sources including pets, wildlife and sewage overflows.

3.3.3 Environmental Impacts

As noted above, the primary source of pollutants for urban runoff is from the roadways and other vehicle use surfaces. For those areas that drain directly to Lake Union or drain to the separated storm system, the analysis below is common for all four proposed alternatives.

Impacts Common to All Alternatives

Construction Stormwater Runoff

Construction activities associated with new development or redevelopment under any of the alternatives would be accompanied by ground disturbing activities such as clearing and grading. These activities could result in minor erosion and sedimentation that might result in short-term turbidity increases to local receiving waters (Lake Union). In addition to sediment transport, runoff may also carry other contaminants such as fuel or oil, from construction vehicles and machinery used on-site. The risk of these effects would be of short duration (limited to the length of each project construction period) and can largely be minimized or eliminated with the proper use of construction best management practices (BMPs).

Chapters 22.800 through 22.808 of the Seattle Municipal Code, referred to as *Volume 2 Construction Stormwater Control Technical Requirements Manual*, establish requirements for all discharges and land uses with respect to land disturbing activities. This manual presents approved methods, criteria, details, and general guidance for preventing contaminants from leaving a site during construction. All new development or redevelopment projects are required to adhere to these requirements.

Although no significant impacts to water resources would be anticipated during construction activities associated with redevelopment or new development, the implementation of construction best management practices, and compliance with applicable permit requirements and conditions would help to ensure that any impacts would be temporary and minor.

In addition to City of Seattle construction stormwater requirements, any project that will disturb an acre or more of soil is required to obtain coverage through the Washington State Department of Ecology (WSDOE) for Construction Stormwater discharges. The WSDOE permit coverage requires a Stormwater Pollution Prevention Plan (SWPPP) be developed, implemented and updated by the construction site operator. Stormwater discharged from the site must be sampled and analyzed for turbidity and pH balance. Departures from specified standards for turbidity and pH must be reported to the Department of Ecology, and remedial action taken to bring the discharges into compliance with the standard.

Urban Stormwater Runoff

In the separated storm sewer area, the City's Stormwater Code requires water quality treatment for new or replaced Pollution Generating Impervious Surfaces (PGIS) that are over 5,000 sq. ft. within a project.

It is expected that the majority of the development that is envisioned to occur within the South Lake Union neighborhood as a result of any of the alternatives will exceed the 5,000 sq. ft. threshold and would provide water quality treatment for PGIS surfaces. It is possible, however, that some smaller redevelopment projects may not reach the threshold. Multiple, independent small-scale developments in an area could create new areas of pollution generating surfaces, without any individual project tripping the 5,000 sq. ft. requirement.

With the exception of certain high-use vehicle sites (e.g., vehicle fleet use facilities), City of Seattle Stormwater Code requirements and water quality treatment facilities are designed based on surface area and not on traffic volumes. Therefore, there is no difference in the treatment requirements for a 5-story building or a 25-story building. Under the current Stormwater Code, increases in density do not require increased stormwater treatment.

As shown in **Figure 3.3-2**, only the eastern side of the study area is drained by a separated storm sewer system. The balance of the study area drains to the combined sewer system or discharges directly to Lake Union. All of the focus areas are served by the combined sewer system. Sites served by the combined sewer system would continue to have the storm water that drains to the combined sewer system treated by the West Point treatment facility except during large storm events CSOs may overflow to Lake Union or other water bodies in the area.

Although increased traffic is thought to result in more auto-related pollutants, there is not direct correlation in traffic and a specific increase in the amount of water-related pollution that is generated. Many factors relate to how much material is left on the roadway by the passage of vehicles (e.g., the types of vehicles, typical age of vehicles, maintenance quality, frequency, etc.).

The Transportation (See **Section 3.13**) section of this EIS projects a 27% increase in auto and bus trips for Alternatives 1 and 2 and an 8.6% increase for Alternative 3 over the No Action Alternative. These values were established for other corridors that are served by the separated storm system, but it can be reasonably assumed that similar increases could be expected for similar increased density.

The eastern portion of the study area that is served by the separated storm drain represents about 15% of a 500-acre drainage basin served by this pipe. While an increase in density and vehicular traffic within the study area would occur in conjunction with each of the alternatives, growth, albeit of a lesser intensity, may occur in other parts of this drainage basin that is served by the separated stormwater system. As noted previously, the majority of this drainage basin consists of similar urbanized areas including portions of the I-5 freeway. Pollution increases within the study area, would be expected to be small compared to this basin as a whole. Compliance with water quality provisions of the City's Stormwater Code will lessen any water quality-related impacts of redevelopment and could result in an overall decrease in water quality impacts from the basin as existing PGIS is replaced with new PGIS for which water quality treatment is required.

3.3.4 Mitigation Strategies

Although current City Stormwater Code provisions would not require additional mitigation for increased height or density within the study area, increased pollution would likely be generated as a result of increased vehicle traffic to support increased development under any of the alternatives. In addition to requiring water quality treatment in storm water basins and flow control in CSO basins for certain levels of development, the Stormwater Code requires the use of green stormwater infrastructure (GSI) to the maximum extent feasible on all projects. These GSI techniques can provide additional water quality and/or flow control benefits.

Sustainable Drainage Strategies

The alternatives to increase height and density within the study area would not require additional water quality or flow control measures; however, several strategies are provided below that could further mitigate impacts from urban road runoff.

- Water quality treatment best management practices (BMPs) are facilities that remove pollutants by some combination of the following: gravity settling of particulate pollutants, filtration, plant Uptake, biological processes, and/or adsorption. Examples include bio-filtration swales, sand filtration systems, raingardens and stormwater wet ponds.

  Urban settings are challenging to provide water quality facilities since the space needed to provide these systems is typically not readily available. Incorporating the water quality facility into the streetscape design is an option designers can use to ensure roadway runoff is properly treated. Typical examples of integrated water quality BMPs into streetscape design include: roadside raingardens, porous paving, bio-filtration swales, filter strips and ecology embankments.

Planning of streetscape improvements could consider incorporating water quality design features as noted above to treat runoff prior to discharging to the storm system. The City's Stormwater Code requires use of these and other Green Stormwater Infrastructure (GSI) methods as part of stormwater design.

- As noted, significant portions of the pollution generating surfaces are comprised of public rights-of-way. As such, the development of a regional or neighborhood treatment facility could become an alternative to individual solutions. Redevelopment of the area provides the opportunity for partnering to install regional stormwater treatment facilities. An example of this is the Swale on Yale/Capitol Hill Water Quality Facility which is the project being jointly developed through a public/private partnership with SPU to provide stormwater quality treatment via biofiltration for a large portion of the approximately 500-acre basin draining through the 72-inch storm drain.

3.3.5 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to water quality have been identified as a result of any of the proposed alternatives.

3.4 PLANTS AND ANIMALS

3.4.1 Affected Environment

Regulatory Framework

Some vegetation, fish, and wildlife species and their habitats are considered particularly sensitive based on their limited occurrence. The National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (FWS), and the Washington Department of Fish and Wildlife (WDFW) have assigned these species to several categories to assist with their management and protection. Federal threatened, endangered, and proposed species include those that are listed under the Endangered Species Act (ESA) or are proposed for listing. Endangered species are in imminent danger of extinction, while threatened species are at risk of becoming endangered. Proposed species are those for which enough information exists to warrant listing them as endangered or threatened but such listing has not yet occurred. The State of Washington also maintains a list of protected species, called species of concern. State listing categories include:

Lake Union wildlife

- Endangered. "Any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state" (WAC 232-12-297(2.4)).
- Threatened. "Any wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats" (WAC 232-12-297(2.5)).
- Sensitive. "Any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats" (WAC 232-12-297(2.6)).
- Candidate. "A species will be considered for designation as a State Candidate if sufficient evidence suggests that its status may meet the listing criteria defined for State Endangered, Threatened, or Sensitive" (WDFW 2007a).
- Monitor. "[Species] that require management, survey, or data emphasis for one or more of the following reasons: a. They were classified as endangered, threatened, or sensitive within the previous five years. b. They require habitat that is of limited

availability during some portion of their life cycle. c. They are indicators of environmental quality. d. There are unresolved taxonomic questions that may affect their candidacy for listing as endangered, threatened, or sensitive species" (WDFW 2007b).

WDFW also maintains a list and geographic database of Priority Habitats and Species (PHS). Priority habitats are crucial or important to many species. The WDFW priority species list includes species that are state or federally listed as threatened, endangered, candidate, or sensitive; animal aggregations that are considered vulnerable; and species of recreational, commercial, or tribal importance that are considered vulnerable. WDFW designation of priority habitat types is advisory and such designation may increase the significance of impacts as evaluated through the National Environmental Policy Act (NEPA) and SEPA processes.

City of Seattle

Seattle Municipal Code Chapter 25.05 - Chapter 25.05, Seattle Municipal Code (SMC) implements the State Environmental Policy Act (SEPA) and authorizes the Department of Planning and Development (DPD) to grant, condition, or deny land use and construction permit applications for public and/or private proposals that are subject to environmental review. This authority is exercised based on adopted City policies, plans, rules or regulations set forth in Chapter 25.05, SMC.

In addition, *Seattle Municipal Code Chapter 25.11* provides a means for protecting outstanding trees (or Exceptional Trees) in Seattle, especially on sites that are undergoing development.

Director's Rule 16-2008 - Director's Rule 16-2008 (DR16-2008) clarifies SMC 25.05 for the purpose of determining the value of outstanding trees on sites undergoing environmental review, in order to establish appropriate tree protection mitigating measures. This rule defines standards and procedures for identifying "exceptional trees", pursuant to SMC 25.11.

The SEPA policy articulated in SMC 25.05 calls for protecting three categories of trees and/or vegetation where development would reduce or damage:

1. rare, uncommon, unique or exceptional plant or wildlife habitat; or
2. wildlife travelways; or
3. habitat diversity for species (plants or animals) of substantial aesthetic, educational, ecological or economic value.

In DR 16-2008, the City provides a list of common and native Seattle tree species that should be considered for exceptional status along with a specified "threshold diameter." The City considers trees of these species that meet or exceed the diameter threshold to be exceptional if they meet the risk and condition criteria described in DR 16-2008.

DR 16-2008 defines "grove" as a group of 8 or more trees 12 inches in diameter or greater that form a continuous canopy. Trees that are part of a grove shall also be considered for exceptional status.

Heritage Tree Program - The Heritage Tree Program was initiated by the non-profit group PlantAmnesty in partnership with the City of Seattle in 1996 to recognize and preserve trees in the City of Seattle that are:


Tree at Denny Park

- tree specimens of exceptional size, form, or rarity;
- trees recognized by virtue of their age, association with or contribution to a historic structure or district, or association with a noted person or historic event;
- trees that are landmarks of a community; and
- trees that are in a notable grove, avenue, or other planting.

Heritage trees may be on City or private property. Each candidate tree is assessed by a certified arborist and evaluated by a review committee. Trees can be nominated individually or as a collection, but must have the owner's approval and meet the criterion for health.

Methodology

The Washington Department of Natural Resources (WDNR) Natural Heritage Program database was reviewed to determine whether any state or federal Endangered Species Act-listed plants or other rare plants are documented in the study area.

Due to the programmatic nature of this South Lake Union Height & Density EIS, a comprehensive tree inventory was not conducted for the neighborhood. As site-specific development occurs in the future within the South Lake Union neighborhood, an on-site tree inventory would be required – as part of the project-specific environmental and permit review processes for the project.

Existing Conditions

The dense and highly urban study area provides limited vegetation or natural habitat for wildlife. The majority of the study area is covered with impervious surfaces (buildings and parking lots). Vegetation is primarily ornamental lawns, shrubs, and trees. A narrow fringe of native vegetation is located along parts of Lake Union. Buildings taller than 400 feet are located in the downtown section of Seattle, immediately south of the study area.

A review of City data found no exceptional or heritage trees identified in the study area. Priority Habitats and Species (PHS) database information from Washington Department of Fish and Wildlife (WDFW) indicates no state or federal Endangered Species Act-listed species, or other documented species of concern, have been identified in the study area. Wildlife in the study area is likely limited to species adapted to urban areas and birds migrating through the study area.

Anadromous fish also complete annual migrations adjacent to the study area in Lake Union despite generally poor water quality and an altered aquatic environment dominated by docks and structural debris. Based on WDFW SalmonScape mapping, migration corridors for Puget Sound Chinook salmon, coho salmon, sockeye salmon, bull trout, and steelhead trout exist along the north and south shores of Lake Union. These migrations generally occur twice a year: in the spring and early summer for juveniles and in the fall for adults. Although juveniles are known to migrate along the northern and southern shorelines of Lake Union, studies suggest that adults move quickly from the ocean to Lake Washington, spending no more than a couple of days in the Lake Washington Ship Canal and generally remaining in the ship canal (northern) portion of Lake Union (Fresh et al, 2000). Puget Sound Chinook salmon, bull trout, and steelhead trout are listed species under the federal Endangered Species Act.

Seaward migration through Lake Union is hazardous for juvenile salmonids due to stressful water quality conditions combined with an abundance of predator cover along the route associated with overwater structure. To reach Puget Sound safely, juveniles generally remain close to the shoreline for safety, and must survive numerous encounters with freshwater predators such as smallmouth bass and pikeminnow. Because juvenile salmonids require time to adjust to changes in light, juvenile salmonid predators often hide under shading structure along urban waterfronts. Increased structure along shorelines may, therefore, reduce juvenile salmonid survival rates during migration by providing additional predator cover.

Foraging by juvenile salmonids may also occur in Lake Union. Various studies of salmonid juvenile foraging behavior indicate a preference for feeding during the evening dusk, presumably when light is adequate for juvenile foraging but insufficient for predators of juveniles (Bieber, 2004;

Benkwitt et al, 2009). Additional artificial lighting from neighboring areas, therefore, may increase foraging opportunities for juveniles if the lighting allows for an extended evening period of safe juvenile foraging.

Focus Areas[1]

From a plants and wildlife habitat perspective, the three focus areas within the study area (8th Avenue Corridor, Fairview Avenue Corridor, and Mercer/Valley Blocks) are similarly limited in available natural area. All are currently urbanized areas that drain to Puget Sound through the King County Metro sewage treatment plant combined sewage system.

8th Avenue Corridor

The 8th Avenue Corridor is developed with buildings and parking lots. Vegetation is limited to trees planted in landscape strips located (1) around the parking lots south of Harrison Street, between Dexter Avenue North and 8th Avenue North, and (2) around the warehouse located on the southeast corner of the Harrison Street and 8th Avenue North intersection.

Wildlife that uses or passes through this area is likely limited to highly urbanized species, such as small rodents, opossums, raccoons, and passerine birds; however, these species are more likely to use/inhabit Denny Park, which is located immediately south of the 8th Avenue Corridor.

Fairview Avenue Corridor

Development in the Fairview Avenue Corridor consists of buildings, parking lots, and a small, private park on the northeast corner of the John Street and Fairview Avenue North intersection. Vegetation is limited to (1) the small park, which is planted with trees, small shrubs, and lawn; and (2) trees planted in landscape strips along Fairview Avenue North and around the parking lot on the northwest corner of the John Street and Minor Avenue North parking lot.

Similar to the 8th Avenue Corridor, wildlife that uses or passes through the Fairview Avenue Corridor area is likely limited to highly urbanized species; however, wildlife is more likely to use/inhabit Cascade Park and

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[1] Focus areas are subareas in the South Lake Union neighborhood that are considered in greater detail, where applicable. Please discussion and Figure 2-3 in Chapter 2.

pea patch, which is located 1/2 block east of the Fairview Avenue Corridor.

Mercer/Valley Blocks

The Mercer/Valley Blocks focus area contains of buildings and parking lots. Vegetation is limited to (1) trees planted in landscape strips around the parking lot south of Valley Street, between Terry Avenue North and Boren Avenue North, and (2) three trees and a narrow strip of blackberries located on the west and north property boundaries of the gasoline station located on the northwest corner of the Mercer Street and Boren Avenue North intersection.

Similar to the 8th Avenue Corridor, wildlife that uses or passes through the Mercer/Valley Blocks area is likely limited to highly urbanized species; however, wildlife is more likely to use/inhabit Lake Union Park, which is located immediately north of the Mercer/Valley Blocks focus area.

3.4.2 Environmental Impacts

The proposal analyzed in this EIS considers the use of incentive zoning to increase height and density in the South Lake Union neighborhood. By itself, this proposal would not directly result in impacts to plant and animal habitat.

Future site-specific development proposals under any of the alternatives, however, could result in impacts to plant and animal habitat. Potential impacts that could be associated with future site-specific development under any alternative are briefly discussed below.

Vegetation

Vegetation is primarily ornamental lawns, shrubs, and trees, with the exception of a narrow fringe of native vegetation along parts of Lake Union. Because no height and density changes are proposed along Lake Union, and due to requirements associated with Seattle's Critical Areas Ordinance, no vegetation impacts are expected along Lake Union.

No exceptional or heritage trees have been listed for the study area. Existing ornamental lawns, shrubs, and trees may be cleared during future development in the study area; however, Seattle Municipal Code 23.47A.016 requires landscaping and screening for most commercial developments, which would likely mitigate any vegetation loss in the study area.

Wildlife


Geese at Lake Union Park

Urban Wildlife

Wildlife in the neighborhood is limited to highly urbanized species, such as small rodents, opossums, raccoons, and passerine birds. These species are adapted to urban environments, including impervious surfaces, lack of vegetation, and a human-dependent food source. These species may be temporarily displaced during construction, and potentially permanently displaced on lots that currently provide urban habitat (such as blackberry thickets, debris piles, and landscaped areas) that are converted to high-rise structures. However, these populations are not considered sensitive and no significant adverse impacts are anticipated.

Bird Strikes

Fatal daytime and nighttime bird strikes against high-rise buildings have been documented in urban areas, particularly in migratory flight corridors in the spring and fall. Daytime strikes are typically associated with windows that reflect habitat, such as sky or trees, or reveal habitat, such as sky on the other side of the building or greenery immediately inside the building. Nighttime strikes are generally associated with lights left on at night, both within the building and on the outside of the building, particularly skyward aesthetic flood lights (American Bird Conservancy 2007).

Urban avian species that inhabit the Seattle area are likely adapted/accustomed to the high rise structures found in downtown Seattle. Bird strikes likely occur, but not at a level that would significantly adversely affect their populations.

Numerous migratory bird species travel through the Puget Sound area moving generally north in the spring and south in the fall. Therefore, Alternatives 1, 2, and 3, which all allow increased building height, could indirectly result in increased bird strikes in the study area. However, the net effect on northward migrations of birds would likely be low since downtown buildings would still present the first obstacle to migratory birds. During the fall migration, the effect would be more measureable, but still not considered a significant adverse affect, as southward-flying birds would experience the barriers presented by taller building facades a few minutes sooner than they would today. More importantly, because Alternatives 1 through 3 are essentially in-fill proposals that do not extend the high-rise character of downtown further west or east, none would result in a wider high-rise obstacle to the north-south migratory pathway.

Fish Habitat

Migration corridors for Puget Sound Chinook salmon, coho salmon, sockeye salmon, bull trout, and steelhead trout are documented in Lake Union. Impacts to these species are generally related to stormwater runoff, shade, light pollution, and shoreline development. These potential impacts are discussed in more detail below.

Stormwater Runoff: Water Quality

Studies show that vehicular pollution in stormwater, particularly dissolved metals from brake pads, can stress juvenile salmonids and may increase juvenile predation rates (Pyle and Mirza, 2007; Sandahl et al, 2007; Baldwin et al. 2003; Hansen et al, 1999). Increasing vehicle use in the study area by allowing increased density may contribute, therefore, to adverse effects on juvenile salmonids associated with poor water quality. The potential for the proposed alternatives to alter water quality in Lake Union is discussed in Section 3.3, Water Quality. The conclusion of the water quality analysis is that no significant adverse effects to Lake Union water quality would likely occur as a result of the proposed alternatives, mainly due to the limited surface in the study area that is draining to Lake Union and exposed to stormwater and vehicular traffic.

Stormwater Runoff: Water Quantity

Most of the study area draining to Lake Union is already covered by impervious surfaces; only a small amount of this area is currently vegetated and pervious. Changes in density associated with the proposed alternatives may result in conversion of these areas to impervious surfaces. However, a subsequent potential increase in water quantity is not expected to impact fish habitat in Lake Union or downstream waters due to the following factors: (1) no spawning habitat exists in Lake Union or downstream waters, (2) there are no constrictions downstream that would cause scour if an increase in water quantity occurred, and (3) the lake is elevation-controlled by the Army Corps of Engineers via the Ballard Locks (therefore, an increase in water quantity would not equate to an increase in lake water levels).

Shade, Light Pollution, and Shoreline Development

As discussed above, shade from overwater structures is often associated with increased predation of juvenile salmonids. The proposed alternatives could allow increased direct shade of the Lake Union nearshore migratory corridor from higher buildings or could promote additional shoreline development over and near the water.

Several factors suggest, however, that the proposed alternatives would not result in increased predation of juvenile salmonids due to changes in shade or shoreline development:

1) The exposure of juvenile salmonids to changes in the Lake Union environment would generally be limited to the spring and summer months during the peak juvenile salmonid outmigration periods. Shade studies using maximum-height buildings (see Section 3.10, Aesthetics) indicate that potential shade impacts during the spring and summer months are minimal; only three lots in the study area are close enough to the lake edge to cast shadows on the water after a maximum-height build-out under Alternatives 1 and 2. If built to the maximum allowable height, one building on the west side of Lake Union (on tax parcels 0053000025 and 3025049035) and one building on the east side of Lake Union (on tax parcel 1984200105) would shade the water for a few additional hours during spring mornings (east building) and for a few additional hours during spring evenings (west building). Alternative 3 does not increase shade on the lake beyond what is currently possible under existing zoning height limits (Alternative 4).

2) None of the proposed alternatives include a change in the zoning adjacent to Lake Union, which currently allows building heights at or near existing levels. Significant changes in light and shade near the shoreline are therefore not expected as a result of the proposed alternatives.

3) Overwater development in the Lake Washington basin is highly regulated. Any proposed docks or proposed changes to existing dock widths or materials would need to comply with Seattle's Shoreline Master Program and Critical Areas Ordinance, Section 404 of the Clean Water Act, the Endangered Species Act, and those sections of the Washington Administrative Code addressing "hydraulic projects." Collectively, these regulations generally disallow a net loss of aquatic habitat from a proposed project.

Focus Areas

From a plant and animal habitat perspective, impacts associated with the three focus areas within the study area (8th Avenue Corridor, Fairview Avenue Corridor, and Mercer/Valley Blocks) are not appreciably different. Development in all three areas would be essentially infill and associated increases in tall buildings would more or less extend a high-rise building character further northward.

From an avian perspective, taller buildings may have a greater effect on birds that congregate on or near Lake Union if they are located in the Valley/Mercer blocks than in the 8th and Fairview Corridors, simply due to proximity, but also due to the fact that taller buildings in the 8th and Fairview Corridors are more of an extension of a high-rise building character further northward from downtown Seattle. Insufficient data are available on the bird species that migrate through Seattle to determine if a high percentage of birds migrating through the City (and therefore through the study area) are waterfowl. Waterfowl congregate in open water. Therefore, waterfowl may be more affected than songbirds by high-rises close to the waterfront. Waterfowl leaving the surface of Lake Union may be more likely to strike a tall building in the Valley/Mercer Block area than in the 8th/Fairview Corridor areas.

With regard to fish habitat, none of the focus areas are close enough to shade Lake Union under the proposed building heights.

3.4.3 Mitigation Strategies

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives, such as adverse impacts to vegetation, the avian patterns of use in the study area, and fish habitat in Lake Union. Potential impacts will be assessed in future project-level SEPA review associated with any specific development proposal to determine whether adverse impacts are significant. The mitigating measures described below address potential site-specific mitigation that may be associated with future site-specific actions.

When project-specific environmental review occurs in the future for development projects located within the South Lake Union neighborhood, an inventory of all non-native and native trees six inches or greater in diameter (measured 4.5 feet above the ground) would be required for the site-specific proposal. City staff would determine which trees qualify as exceptional and would determine protection requirements at that time. If exceptional trees or trees with a diameter of 2 ft. or greater are located within the site area of a new building, the project would be required to comply with the provisions of the City's code, as described above. In addition, Seattle Municipal Code 23.47A.016 requires landscaping and screening for most commercial developments, which would likely mitigate any vegetation loss in the study area.

City permitting of proposed redevelopment under all alternatives would require completion of the SEPA process, which includes an assessment of project impacts to fish and wildlife. Mitigation requirements could include treatment of project-related stormwater, evaluation of outside lighting, installation of native plant species to reduce potential light impacts, and implementation of a “lights out” program to educate and encourage high-rise building tenants to turn off lights at night, particularly during the fall (southward) avian migration period. The City could also choose to reduce height limits on the three lots discussed above that could shade the juvenile outmigration corridor during spring mornings and evenings under Alternatives 1 and 2.

No different or additional mitigating measures have been identified for the focus areas.

3.4.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to plants and animals are anticipated.

3.5 ENVIRONMENTAL HEALTH

3.5.1 Affected Environment

Hazardous Materials Policies and Regulations

Characterization of existing site conditions as they relate to environmental health, and the need for any future cleanup activities would be assessed in accordance with applicable local, state and federal regulations, including:

Federal Regulations:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Superfund Amendments and Reauthorization Act
- Resource Conservation and Recovery Act (RCRA)
- Toxic Substances Control Act
- Occupational Safety and Health Act
- Clean Air Act
- Clean Water Act
- National Environmental Policy Act

Washington State Regulations:

- Model Toxics Control Act Cleanup Regulation (MTCA)
- Dangerous Waste Regulations
- Solid Waste Regulations
- State Environmental Policy Act (SEPA)
- Water Pollution Control Act
- Washington Industrial Safety and Health Act
- Washington State Department of Transportation (WSDOT) Environmental Procedures Manual M31-11 (April 2007)

MTCA regulations, managed by the Washington Department of Ecology, define types and levels of contamination that are harmful to human health; provide guidelines for evaluation and investigation of potential contamination; and, specify appropriate cleanup levels and methods for cleanup actions involving soil, groundwater and media other than sediment. Under MTCA regulations, all cleanups must meet certain minimum requirements, including: compliance with cleanup standards; compliance with applicable state and federal laws; protecting human health and the environment; provision for compliance monitoring; use of permanent solutions to the maximum extent practical; provision for a reasonable restoration time frame; and, consideration of public concerns.

Methodology

This section of the Draft EIS identifies potential existing environmental hazards that have been documented in the South Lake Union Neighborhood and evaluates how each of the alternatives would be affected by the presence of these contaminants.

The Environmental Health sections of the following reports were reviewed to determine the types of contaminants that may be encountered in the South Lake Union Neighborhood:

- Draft and Final Environmental Impact Statements (including Environmental Health Technical Appendix) for the Seattle Commons/South Lake Union Plan (May, 1995);
- Draft Hazardous Materials Discipline Report, South Lake Union Park (April, 2005); and
- Mercer Corridor Improvements Project Environmental Assessment (December, 2008).

Historic and Present Day Uses

Historically, properties within the study area have been occupied by a range of industrial and commercial businesses, some of which used hazardous materials. Commercial properties are found throughout the study area, but are focused along major arterials, including Westlake, Fairview, Mercer, Denny Way and others. These businesses included gas stations, auto repair shops, dry cleaners, lead paint manufacturers, print shops, and metal working shops. Some of these uses continue to this day.

Many industrial businesses, including a sawmill, were formerly located along the south shoreline of Lake Union. During this time period, railroad tracks were also present along the south end of Lake Union. Based on its location adjacent to the south shore of the lake and downgradient from the rest of the study area, this formerly mostly industrial area is likely to have more fill material, and shallower groundwater, than the rest of the study area.

Based on the industrial and commercial businesses that have occupied the study area over the past 100 years, the following hazardous materials may be encountered during property redevelopment.

- **Gasoline-range petroleum** contamination generally results from leaks and spills associated with former gasoline stations and vehicle maintenance facilities. Gasoline is relatively mobile in the environment and is more toxic at lower concentrations than heavier grades of hydrocarbons (diesel and oil). Depending on the age of the gasoline release, it can also include benzene, toluene, ethylbenzene, and xylenes (BTEX), methyl tertiary butyl ether and/or lead. These fuel constituents can pose a substantial risk to humans and the environment, are highly soluble and mobile in groundwater, and will float on the water table or perched groundwater.

- **Diesel- and oil-range petroleum** is used to fuel vehicles and heat businesses and homes. Oil-range petroleum is also often associated with auto repair shops. For the most part, these contaminants are relatively low in toxicity, and are not particularly mobile. Diesel- and oil-range petroleum tends to bind to soil and float on the water table rather than dissolve or disperse throughout the water column. As a result, any given leak or release of diesel or oil is not likely to have resulted in widespread contamination.
- **Polycyclic aromatic hydrocarbons (PAHs**), some of which are carcinogenic, are present in heavy-range petroleum hydrocarbons and are also created during burning as a result of incomplete combustion. They are also present in creosote. PAHs may be associated with petroleum releases such as leaking heating oil USTs and lubricating oils used by railroads. In general, PAHs are relatively insoluble in water and bind to soil particles. Consequently, although some of the compounds are extremely toxic to humans, they are relatively immobile.
- **Heavy metals**, including arsenic, cadmium, chromium, lead, zinc, and copper, are associated with metal manufacturers, welders, paint manufacturers, and printers. Metals can become soluble and migrate to groundwater, depending on the chemistry of infiltrating water and/or the media into which the metals were initially released. However, metal contamination is more commonly found in shallow, subsurface soils.
- **Solvents**, such as trichloroethylene and tetrachloroethylene, were used historically as solvents in dry cleaning and for degreasing at a variety of businesses such as auto body shops and paint shops/manufacturers. Dry cleaners used large volumes of these solvents. Solvents are highly toxic at low concentrations and are highly mobile in soil and groundwater. Most solvents are denser than water and, therefore, tend to move downward through the subsurface and water column. Unlike most contaminants, solvents can migrate readily through fine-grained soils.
- **Creosote** is a yellowish to greenish-brown oily liquid containing polycyclic aromatic hydrocarbons (PAHs), such as phenols, creosols, and naphthalene. Creosote is derived from coal tar and is

commonly used to treat railroad ties, piles, and telephone poles. It can cause severe neurological disturbances if inhaled in high concentrations. Creosote-contaminated soil associated with railroad ties is typically relatively shallow. However, if creosote migrates to groundwater, it is considered relatively mobile because some constituents of creosote are water-soluble.

Other potential environmental concerns include:

- **Methane** gas may be encountered in the wood waste fill associated with the former lumber mill operations on the south shore of Lake Union. The decomposition of organics such as wood waste typically produces methane gas. Methane may build up to explosive levels in basements and other confined areas. Methane gas can also migrate laterally through coarser soils and subsurface utility corridors. Methane gas is a fire hazard because it is flammable and can be ignited in concentrations ranging 5 to 15 percent in air.
- **Asbestos-containing material (ACM)** and **lead-based paint** may be encountered during building demolition. Inhalation of ACM can lead to asbestosis (scarring fibrosis of the lung) and lung cancer. Ingestion of lead-based paint (through dust inhalation) can cause high blood pressure, digestive problems, nerve disorders, and memory and concentration problems.

8th Avenue Corridor

Based on prior studies, it is likely that the 8th Avenue Corridor contains sites that may still have underground storage tanks (USTs) and sites with the potential for chemical releases. Land uses of concern in this focus area were likely smaller, commercial businesses that used, transported, stored, and/or disposed of hazardous materials.

Fairview Avenue Corridor

Based on prior studies, it is likely that the Fairview Corridor contains sites that have had USTs removed, sites that may still contain USTs, sites that have leaking USTs and sites with the potential for chemical releases. Land uses of concern in this focus area were likely smaller, commercial businesses that used, transported, stored, and/or disposed of hazardous materials.

Two hazardous material sites have been mapped in previous studies in the Fairview Avenue Corridor. One hazardous material site is listed as a confirmed release and is mapped on the northeast corner of the intersection of Denny Way and Fairview Avenue North. The second hazardous material site is listed as cleaned up or having received no further action letter and is mapped on the southeast corner of Thomas Street and Boren Avenue North.

Valley/Mercer Blocks

According to prior studies conducted in the neighborhood, numerous hazardous material sites have been identified in the Valley/Mercer Blocks area, most of which have more than one environmental concern. These sites were likely smaller commercial and industrial businesses that used, transported, stored, and/or disposed of hazardous materials. Many larger industrial businesses, including a sawmill, were formerly located along the south shoreline of Lake Union, immediately north of the Valley/Mercer Blocks. Fill associated with the sawmill may extend beneath the focus area blocks.

The westernmost block (between 8th Avenue North and Westlake Avenue North) is mapped as one site with the following environmental concerns: a steam laundry (cleaning and dyeing), refuse burning, foundry/blacksmith/machine shop, gas station, auto service garage, auto cleaning, carpet manufacturing, auto wrecking, junk dealers, car dealers, and fill.

The next block east (between Westlake Avenue North and Terry Avenue North) contains six sites with the following environmental concerns: sawmill, brewery, tank house, stove heat, electric powerhouse, machine shop, refuse fill, auto service station, auto clearing and polishing, gas station, underground storage tanks and hydraulic hoists, paints, and grease shed. This block contains at least two sites that have had confirmed petroleum releases.

The block between Terry Avenue North and Boren Avenue North contains four sites with the following environmental concerns: junk warehouse, oil burner, wagon painting and repair, truck and auto repair, asphalt plant, testing station, fill, sash/door/blind factory, cabinet shop, glazing/painting shop, oil house, steel products manufacturing, blacksmith, machine shop, motor oil and greases, paint shop, gas station, and marine products. This block contains at least one site that has had a confirmed petroleum release.

The easternmost block, between Boren Avenue North and Fairview Avenue North, contains seven sites with the following environmental concerns: furniture factory, service station, graphics studio, boat company, print shop, soap factory, surfacing machine company, photography, towing company, stove heat, fuel shed, fuel and hauling company, and paint storage.

3.5.2 Environmental Impacts

The proposal analyzed in this EIS considers the use of incentive zoning to increase height and density in the South Lake Union neighborhood. By itself, this proposal would not directly result in impacts to environmental health.

Future site-specific development proposals under any of the alternatives, however, could result in impacts to environmental health. Development activities could include excavation associated with demolition of existing foundations and construction of new foundations. Potential indirect and cumulative impacts for all alternatives associated with property redevelopment include:

- Contaminated soil and/or groundwater may be encountered during excavation when properties in the study area are redeveloped.
- Asbestos Containing Material (ACM) and lead-based paint may be encountered during building demolition when properties in the study area are redeveloped.
- Contamination may be cleaned up as properties are redeveloped, resulting in less contamination in the study area.
- Contaminated materials may be uncovered during property redevelopment, allowing more direct exposure to the public.
- Contamination may be spread as a result of property redevelopment (for example, a new utility corridor could provide a new conduit for contamination to spread through; dewatering activities could pull contaminated groundwater into areas that were initially clean).

The amount of contamination encountered during redevelopment is related to the amount of excavation required. In general, the higher the building, the deeper the foundation excavation will need to be. Under this assumption, Alternative 1 would have the most excavation and Alternative 4 would have the least excavation. Therefore, Alternative 1 potentially could have more contamination encountered and remediated than the other alternatives.

Impacts to the focus areas would not be appreciably different than those anticipated for the study area as a whole.

3.5.3 Mitigation Strategies

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives. Mitigation measures that could be required during future property redevelopment include:

- Further site investigations to determine the potential for contamination to be present on the property.
- Soil and groundwater investigations to evaluate the type, concentration, and extent of contamination, if present.
- Cleanup of contamination sources (e.g. removal of underground storage tanks, excavation of contaminated soil).
- Handling and disposing of contaminated soil and groundwater according to local and state regulations.

No different or additional mitigating measures would be required for the focus areas.

3.5.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to environmental health are anticipated under any of the proposed alternatives.

3.6 NOISE

3.6.1 Affected Environment

Noise Contents

Noise Terminology and Descriptors

Noise is sometimes defined as unwanted sound, and the terms noise and sound are used more or less synonymously in this section. The human ear responds to a very wide range of sound intensities. The decibel (dB) scale used to describe and quantify sound is a logarithmic scale that provides a convenient system for considering the large differences in audible sound intensities. On this scale, a 10-dB increase represents a perceived doubling of loudness to someone with normal hearing. Therefore, a 70-dB sound level would sound twice as loud as a 60-dB sound level.

People generally cannot detect sound level differences (increases or decreases) of 1 dB in a given noise environment. Although differences of 2 or 3 dB can be detected under ideal laboratory conditions, such changes are difficult to discern in an active outdoor noise environment. A 5-dB change in a given noise source, however, would likely be perceived by most people under normal listening conditions.

When addressing the effects of noise on people, it is necessary to consider the "frequency response" of the human ear, or those frequencies that people hear best. Sound-measuring instruments are, therefore, often programmed to "weight" sounds based on the way people hear. The frequency-weighting most often used to evaluate environmental noise is A-weighting and measurements using this system are reported in "A-weighted decibels" or dBA. All sound levels discussed in this evaluation are reported in A-weighted decibels.

As mentioned above, the decibel scale used to describe noise is logarithmic. On this scale, a doubling of sound-generating activity (i.e., a doubling of the sound energy) causes a 3-dBA increase in average sound produced by that source, not a doubling of the loudness of the sound (which requires a 10-dBA increase). For example, if traffic along a roadway is causing a 60-dBA sound level at some nearby location, twice as much traffic on this same road would cause the sound level at this same location to increase to 63 dBA. Such an increase might not be discernible in a complex acoustical environment.

Relatively long, multi-source "line" sources such as roads emit cylindrical sound waves. Due to the cylindrical spreading of these sound waves, sound levels from such sources decrease with each doubling of distance from the source at a rate of 3 dBA. Sound waves from discrete events or stationary "point" sources (such as a backhoe operating in a stationary location) spread as a sphere, and sound levels from such sources decrease 6 dBA per doubling of the distance from the source. Conversely, moving half the distance closer to a source increases sound levels by 3 dBA and 6 dBA for line and point sources, respectively.

For a given noise source, a number of factors affect the sound transmission from the source, which in turn affects the potential noise impact. Important factors include distance from the source, frequency of the sound, absorbency and roughness of the intervening ground surface, the presence or absence of obstructions and their absorbency or reflectivity, and the duration of the sound. The degree of impact on humans also depends on existing sound levels, and who is listening.

Federal regulatory agencies often use the equivalent sound level (L_{eq}) to characterize sound levels and to evaluate noise impacts. The L_{eq} is the level that if held constant over the same period of time would have the same sound energy as the actual, fluctuating sound. As such, the L_{eq} can be considered an energy-average sound level. But this metric should not be confused with an arithmetic average which tends to de-emphasize high and low values; the L_{eq} gives most weight to the highest sound levels because they contain the most sound energy.

Typical sound levels of some familiar noise sources and activities are presented in **Table 3.6-1**.

Table 3.6-1
Sound Levels Produced by Common Noise Sources

Thresholds/ Noise Sources	Sound Level (dBA)	Subjective Evaluations 1	Possible Effects on Humans 1
Human Threshold of Pain Carrier jet takeoff at 50 ft	140		
Siren at 100 ft Loud rock band	130		
Jet takeoff at 200 ft Auto horn at 3 ft	120	Deafening	
Chain saw Noisy snowmobile	110		Continuous exposure to levels above 70 can cause hearing loss in majority of population
Lawn mower at 3 ft Noisy motorcycle at 50 ft	100	Very Loud	
Heavy truck at 50 ft	90		
Pneumatic drill at 50 ft Busy urban street, daytime	80		
Normal automobile at 50 mph Vacuum cleaner at 3 ft	70	Loud	Speech Interference
Air conditioning unit at 20 ft Conversation at 3 ft	60		
Quiet residential area Light auto traffic at 100 ft	50	Moderate	
Library Quiet home	40		Sleep Interference
Soft whisper at 15 ft	30	Faint	
Slight rustling of leaves	20		
Broadcasting Studio	10	Very Faint	
Threshold of Human Hearing	0		

Source: EPA 1974 and Others

[1] Note that both the subjective evaluations and the physiological responses are continuums without true threshold boundaries. Consequently, there are overlaps among categories of response that depend on the sensitivity of the noise receivers.

Regulatory Limits

Seattle Noise Code

The noise limits included in Seattle's Noise Control Code (Seattle Municipal Code Chapter 25.08) are applicable to the construction and operation of all development proposed as part of the project. The Noise Code sets levels and durations of allowable daytime/nighttime operational noise (upper portion of **Table 3.6-2**) and daytime construction noise (lower portion of **Table 3.6-2**). These limits are based on the zoning of the source and receiving properties.

Table 3.6-2
Seattle Maximum Permissible Levels and Construction Noise Limits (dBA)

Zoning District of Noise Source [25.08.410 & 420& 425]	Zoning District of Receiving Property Residential Day / Night	Commercial	Industrial
Operational Noise Limits[1]			
Residential	55 / 45	57	60
Commercial	57 / 47	60	65
Industrial	60 / 50	65	70
Daytime Construction Noise Limits[2]			
On-site sources like dozers, loaders, power shovels, cranes, derricks, graders, off-highway trucks, ditchers, and pneumatic equip (maximum+25) [25.08.425 A.1]			
Residential	80	82	85
Commercial	82	85	90
Industrial	85	90	95
Portable equip used in temporary locations in support of construction like chain saws, log chippers, and powered hand tools (maximum+20) [25.08.425 A.2]			
Residential	75	77	80
Commercial	77	80	85
Industrial	80	85	90
Impact types of equipment like pavement breakers, pile drivers, jackhammers, sand-blasting tools, or other impulse noise sources - may exceed maximum permissible limits between 8 AM and 5 PM weekdays and 9 AM and 5 PM weekends, but may not exceed the following limits [25.08.425 B]: Leq (1 hr) 90 dBA Leq (30 minutes) 93 dBA Leq(15 minutes) 96 dBA Leq (7.5 minutes) 99 dBA			

Source: Seattle Municipal Code - 25.08 - Specific sections indicated.

Note: All sound level limits (except those applied to impact type construction equipment) are based on the measurement interval equivalent sound level (Leq) and a not-to-be-exceeded Lmax level 15 dBA higher than the indicated limits.

1 The operational noise limits for residential receivers are reduced by 10 dBA during nighttime hours (i.e., 10 PM to 7 AM weekdays, 10 PM to 9 AM weekends). The operational noise limits are displayed for daytime/nighttime hours.

2 Construction noise limits apply at 50' or a real property line, whichever is greater. Construction noise is limited to the higher levels listed in the bottom portion of the table during daytime hours only, which are defined as 7 AM to 10 PM weekdays and 9 AM to 10 PM weekends. These limits effectively prohibit construction at night except in special cases.

The Seattle noise limits are based on the hourly equivalent sound level (L_{eq}) and short-term maximum sound level (L_{max}) attributable to a sound source.

Sounds created by motor vehicles on public roads and aircraft in flight are exempt from maximum permissible sound levels.

SMC 25.08.480 and 530

The Noise Code also identifies a number of noise sources or activities that are exempt from the maximum permissible sound levels described in SMC 25.08.410, including sounds created by motor vehicles on public streets (SMC 25.08.480) and aircraft in flight (SMC 25.08.530).

As mentioned previously, the City's Noise Code allows noise from temporary, daytime construction activities to exceed the noise limits that apply to operational activities by amounts that vary based on the types of equipment involved. These construction noise limits apply at exterior locations. In order to protect interior commercial uses from excessive levels of construction noise, Section 25.08.425C of the code also prohibits construction noise from exceeding more stringent operational noise limits (i.e., the levels shown in the upper portion of **Table 3.6-2**) in the interior of buildings in commercial districts between the hours of 8:00 AM and 5:00 PM. Compliance with this requirement is intended to be assessed after every reasonable effort, including but not limited to closing windows and doors, has been taken to reduce such noise in the interior space.

FHWA/WSDOT Noise Impact Criteria

Federal and State noise guidelines are presented below. Because these criteria are intended for analyzing noise impacts related to new, expanded or substantially modified roadways that are controlled by state or federal agencies, they are not applicable to this analysis. However, the Federal Highway Administration (FHWA) traffic noise criteria and the Washington State implementation of these rules through state policies are discussed below to provide readers a perspective on the noise levels related to traffic sources.

The FHWA defines a traffic noise impact as a predicted traffic noise level (peak hourly L_{eq}) approaching or exceeding 67 dBA at exterior locations associated with residential uses, or when the predicted traffic noise levels substantially exceed the existing noise levels. FHWA leaves the definition of "approach" to the states. The Washington State Department of Transportation (WSDOT) defines "approaching" the FHWA limits as sound levels within 1 dBA of the criterion level (i.e., 66 dBA for residential properties). WSDOT defines "substantially exceeding" existing noise levels as an increase greater than 10 dBA.

Zoning and Land Use

As mentioned previously, Seattle's Noise Code is based on the underlying zoning of the source and receiving properties. Most of the neighborhood is currently zoned Seattle Mixed (SM) which encourages pedestrian friendly neighborhoods with close residential and commercial developments. In addition, Commercial 2 (C2) zones are located in the northeast and in areas adjacent to Lake Union. Both SM and C2 zones are considered commercial districts when applying the Seattle's Noise Code. The Seattle Noise Code limits operational noise from commercial sources affecting other commercial receivers to 60dBA, day and night. Daytime construction noise limits are higher as shown in the bottom of **Table 3.6-2**.

An Industrial Commercial (IC) zone, which is classified as an industrial district, is located in the center of the South Lake Union neighborhood. The Noise Code limits operational noise from commercial sources affecting industrial receivers to 65 dBA, day and night and industrial sources affecting other industrial sources to 70 dBA day and night. Again, daytime construction noise limits are higher, as described previously.

Existing Sound Environment

The South Lake Union contains a mix of commercial and residential properties that are served by various forms of transportation. Bus stops line major east-west arterials including Denny Way, Mercer and Broad Streets as well as major north-south arterials: Aurora, Dexter, Westlake, Fairview, and Eastlake Avenues. The South Lake Union Streetcar's route includes Westlake Avenue and parts of Terry Avenue to Valley Street and northeast portions of Fairview Avenue.

The existing acoustic environment within the South Lake Union neighborhood is typical of an urban setting. Major contributing sources of ambient noise in this area include: traffic on local streets, I-5 and Aurora Avenue N; the streetcar; and aircraft overflights. Amplified public address systems associated with tour boats, marine engines from watercraft operating on the lake, and sounds from float planes (particularly taking off) are noticeable proximate to Lake Union.

Focus Areas[1]

In general, the noise environment in the three focus areas is very similar to the noise environment in the study area as whole. Distinctions, if any, in each focus area are noted below.

8th Avenue Corridor. Existing noise characteristics in the 8th Avenue Corridor are comparable the noise environment in the study area as a whole. The northern edge of the 8th Avenue Corridor is near the Lake Union Seaport Airport flight path and may experience increased noise associated with aircraft overflights.

Fairview Avenue Corridor. The majority of the Fairview Avenue Corridor is zoned Industrial Commercial (IC). As described above, this zoning designation permits slightly higher noise levels for construction and operations activities, compared to commercial designations.

Three noise measurements were taken in the study area on August 31, 2005 as part of the Mercer Corridor Improvement Project. These measurements, presented in **Table 3.6-3**, were primarily affected by traffic noise on local roadways. While measured sound levels exceeded the Seattle City noise limits for both residential and commercial zones, the dominant source of noise in the area (i.e., noise from motor vehicles on public roads) is exempt from the maximum permissible sound levels. The noise measurement at the corner of Fairview and Republican are in the Fairview Avenue Corridor.

Table 3.6-3
Sound Level Measurements

Location	Time	Leq (dBA)
Mercerview Apartments	13:34	70
Residences at the corner of Fairview and Republican	14:05	67
Lake Union Park	14:40	59

Source: Seattle Department of Transportation, January 2007

Mercer/Valley Blocks. Because the Valley/Mercer Blocks are relatively close to Lake Union, noise from the lake, including marine engines and float plan activity, is more present here than in the other focus areas. The

[1] Focus areas are subareas in the South Lake Union neighborhood that are considered in greater detail, where applicable. Please discussion and Figure 2-3 in Chapter 2.

western portion of the Valley/Mercer Blocks focus area is also located under the Lake Union Seaport Airport flight path.

As presented above in **Table 3.6-3**, measured sound levels taken in 2005 for the Mercer Corridor project exceeded the Seattle City noise limits for both residential and commercial zones. The Mercerview Apartments, located at 1200 Mercer Street, is within, and Lake Union Park immediately north of, the focus area. The dominant source of noise in the area (i.e., noise from motor vehicles on public roads) is exempt from the maximum permissible sound levels.

3.6.2 Environmental Impacts

The proposal analyzed in this EIS considers the use of incentive zoning to increase height and density in the South Lake Union neighborhood. By itself, this proposal would not directly result in noise impacts in the neighborhood.

Future site-specific development proposals under any of the alternatives, however, could result in impacts to noise. Depending on the nature of these site-specific actions, noise impacts could occur to existing, adjacent land uses in. Construction, parking, and mechanical equipment related to new developments have the potential to cause noise impacts to sensitive receivers (e.g., residences, schools, churches, parks, etc.). Larger residential and commercial structures could result in an increase in traffic volumes and traffic-related noise on local streets. Potential impacts that may be associated with future site-specific development under any of the alternatives are discussed below.

Impacts Common to All Alternatives

Construction

Noise from demolition and construction activities has the potential to affect nearby receivers, particularly sensitive uses. For daytime construction activities, the Seattle Noise Code allows temporary construction to exceed the noise limits applied to long-term operations by a set amount. This allows noisier construction activities to occur while still controlling the potential for noise impacts to nearby receivers. During nighttime hours (10 PM to 7 AM weekdays, 10 PM to 9 AM weekends), however, allowed increases to sound levels are not applied to construction activities. Because it is difficult for construction activities to meet these stricter nighttime noise limits, construction activities are generally limited to daytime hours. The temporary nature of construction coupled with its restriction to daytime hours would minimize the potential for significant impacts from construction activities and equipment.

The greatest potential for noise impacts would be to residential uses within or proximate to the study area. Although the entire area is classified as either a commercial or industrial noise district (depending on zoning), careful attention should still be given to demolition and construction activity relative to nearby residences -- to ensure that construction activities comply with the applicable noise limits and minimize potential disturbances.

As described above, variations in zoning establish varying construction noise limits. The daytime construction noise limits shown in the lower portion of **Table 3.6-2**, range from 80 to 95 dBA for commercial and industrial districts, depending on the type of equipment in use and the specific source and receiver combination. Under all of the action alternatives, the most applicable construction noise limit will be 85 dBA in the SM zoning district. Under the No Action alternative (Alternative 4), the majority of the area would also be subject to the SM noise limit, but a portion of the neighborhood would retain its Industrial Commercial (IC) zoning designation, with a slightly higher construction noise limit (see **Table 3.6-2**).

As can be seen in the upper portion of **Table 3.6-4**, construction activities at a distance of 50 feet have the potential to exceed 85 dBA. Therefore, construction noise management plans should be conceived and implemented for construction projects within about 50-100 feet of potentially affected receivers, particularly those containing more sensitive residential uses.

In addition to showing overall hourly noise levels from various construction activities, **Table 3.6-4** (in the lower portion) shows the range of sound levels (i.e., minimum to maximum levels) emitted by individual pieces of equipment. Because this equipment would not necessarily operate for an entire hour, it is not appropriate to compare these levels with Seattle's noise limits. However, these levels give an idea of the relative sound levels that can be expected from different kinds of equipment. In the absence of intervening terrain or structures, sounds from construction equipment and activities (usually point sources) decrease about 6 dBA for each doubling in distance from the actual source.

Table 3.6-4
Typical Noise Levels from Construction Activities Equipment (dBA)

Activity	**Range of Hourly Leqs**		
	At 50′	**At 100'**	**At 200'**
Clearing	83	77	71
Grading	75-88	69-82	63-76
Paving	71-88	66-82	60-76
Erection	72-84	66-78	60-72
Types of Equipment	Range of Noise Levels		
	At 50′	At 100'	At 200'
Bulldozer	77-96	71-90	65-84
Dump Truck	82-94	76-88	70-82
Scraper	80-93	74-87	68-81
Paver	86-88	80-82	74-76
Generators	71-82	65-76	59-70
Compressors	74-81	68-75	62-69
Pneumatic Wrenches	83-88	77-82	71-76
Jackhammers	81-98	75-92	69-86

Source: EPA, 1971

Operation

As described in Chapter 2 of this Draft EIS, the three action alternatives would allow an increase in building heights in the west-central portion of the study area – roughly from Prospect Street (extended) to Republican Street. This is the area that is also shown in **Figure 2-4** as the flight path for the Lake Union Seaport Airport. As indicated, the flight path elevation varies from approximately 150 feet (above average ground level) near the Lake Union shoreline to 200 feet in the vicinity of Aurora Avenue N. Existing height limits in this portion of the study area range from 40 – 65 feet. Increased building heights within this area associated with Alternatives 1, 2 or 3 could result in increased noise impacts to residences and/or offices in upper portions of new buildings from aircraft overflights. As noted previously, however, while sounds from seaplane operations may on occasion be a nuisance to some, such sounds levels are exempt from Seattle's Noise Code.

Elements of future development under any of the alternatives with the most potential to result in noise impacts at nearby noise-sensitive receivers include noise from mechanical equipment and noise from increased vehicular traffic. The following evaluates the potential for each of these noise factors.

Mechanical Equipment

Heating, ventilation, and air conditioning (HVAC) units may be installed to service commercial/retail uses and possibly new residences. Refrigeration units also may be required for potential future restaurants and/or cafes. Specific noise levels generated by such equipment would depend on the location, height, and design of individual equipment and building systems. Noise from these types of sources would need to be controlled to comply with the Seattle noise limits at the nearest sensitive receivers – during both day and nighttime hours. For noise sources and receivers in commercial districts (including residences), the noise limit would be 60 dBA, 24-hours a day (**Table 3.6-2**). Source or receiving properties in industrial districts would be subject to a higher noise limit. With proper placement and design, it is likely that future HVAC units and related mechanical equipment could meet these limits. However, if they are placed in areas near sensitive receivers, equipment vendors and contractors should ensure that the equipment would be installed with effective noise mitigating enclosures and/or directed away from sensitive areas.

Traffic

Increases in population density and commercial activity could add more traffic to local streets, which would increase noise levels in South Lake Union area. As mentioned previously, a doubling of sound-generating activity – in this case traffic – causes a 3-dBA increase in average sound produced by a noise source. Comparisons of projected related traffic volumes and maximum traffic-related noise increases in the future with and without the proposal are summarized in **Table 3.6-5**.

Based on the traffic analysis that is contained in this Draft EIS, traffic-related noise would increase by 0 to 3 dBA proximate to streets noted in **Table 3.6-5**. Fairview Avenue N between Harrison Street and Denny Way would experience the greatest increase in traffic volume under Alternative 2 – resulting in a 2.8 dBA increase in traffic-related noise from this roadway. However, as mentioned previously, differences of 2 or 3 dB are difficult to discern in an active outdoor noise environment. Therefore, no noise impacts are anticipated from changes in traffic volumes as a result of this or any of the alternatives.

Focus Areas

Under and near the flight path for the Lake Union Seaport Airport, (the western portion of the Valley/Mercer Blocks area and the northern portion of the 8th Avenue Corridor), taller buildings in the action alternatives would have relatively greater noise exposure to overhead aircraft. In the Fairview Avenue Corridor, the retention of the existing IC zoning under the No Action alternative (Alternative 4) would continue to allow for slightly higher noise levels for construction and operations activities, compared to permitted noise levels in the SM zoning designation contemplated in the action alternatives in this area. Other than these differences, noise impacts in the focus areas would generally be similar to those described for the study area as a whole.

Table 3.6-5
Maximum Traffic-Related Noise Level Increases

Road	Segment	2008 Existing Volume	2030 No Action Volume	2030 Alt 1 Volume	2030 Alt 2 Volume	2030 Alt 3 Volume	Maximum Increase over Existing (dBA)
Fairview Ave. N.	Harrison Street to Denny Way	745	1,400	1,424	1,427	1,420	2.8
Westlake Ave.	Denny Way to Stewart Street	357	571	612	614	590	2.4
Virginia St.	Westlake Ave N to 3rd Ave	832	1,378	1,425	1,429	1,409	2.3
Denny Way	Aurora Ave N to Stewart Street	1,233	1,637	1,712	1,720	1,661	1.4
E Pine St.	Boren Ave to Broadway	530	684	690	681	691	1.2
Fremont Bridge	N 35th Street to Westlake Ave	1,424	1,782	1,819	1,820	1,794	1.1
Mercer St.	5th Ave N to Dexter Ave N	1,445	1,761	1,803	1,801	1,785	1.0
Stewart St.	7th Ave to 3rd Ave	729	861	869	875	873	0.8
Broad St.	Denny Way to Westlake Ave N	1,643	1,727	1,769	1,769	1,744	0.3

Source: Fehr &Peers, 2010.

3.6.2 Mitigation Strategies

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives. The mitigating measures described below address potential site-specific mitigation that may be associated with future site-specific actions.

Construction

Practices which can reduce the extent to which people are affected by construction noise and ensure that construction noise levels stay within the applicable daytime sound level limits include:

- Use properly sized and maintained mufflers, engine intake silencers, engine enclosures, and turn off idle equipment.
- Construction contracts can specify that mufflers be in good working order and that engine enclosures be used on equipment when the engine is the dominant source of noise.
- Stationary equipment should be placed as far away from sensitive receiving locations as possible. Where this is infeasible, or where noise impacts are still significant, portable noise barriers could be placed around the equipment with the opening directed away from the sensitive receiving property. These measures are especially effective for engines used in pumps, compressors, welding machines, and similar equipment that operate continuously and contribute to high, steady background noise levels. In addition to providing about a 10-dBA reduction in equivalent sound levels, the use of portable barriers demonstrates to the public the contractor's commitment to minimizing noise impacts during construction.
- Substitute hydraulic or electric models for impact tools such as jack hammers, rock drills and pavement breakers could also reduce construction and demolition noise. And electric pumps could be specified if pumps are required.
- Although as a safety warning device, back-up alarms are exempt from noise ordinances, these devices emit some of the most annoying sounds from a construction site. One mitigation measure would be to ensure that all equipment required to use backup alarms utilize ambient-sensing alarms that broadcast a warning sound loud enough to be heard over background noise -- but without using a preset, maximum volume. Another alternative would be to use broadband backup alarms instead of typical pure tone alarms. Such devices have been found to be very effective in reducing annoying noise from construction sites. Requiring operators to lift rather than drag materials wherever feasible can also minimize noise from material handling.
- Construction staging areas expected to be in use for more than a few weeks should be placed as far as possible from sensitive receivers, particularly residences. Likewise, in areas where construction would occur within about 200 feet of existing uses (e.g., residences, schools/classrooms, and noise-sensitive

businesses), effective noise control measures (possibly outlined in a construction noise management plan) should be employed to minimize the potential for noise impacts. In addition to placing noise-producing equipment as far as possible from homes and businesses, such control could include using quiet equipment and temporary noise barriers to shield sensitive uses, and orienting the work areas to minimize noise transmission to sensitive off-site locations. Although overall construction sound levels would vary with the type of equipment used, common sense distance attenuation should be applied.

Operation

To minimize the potential for noise impacts, HVAC units should be located away from residences – or other sensitive receptors, whenever possible and/or shielded to comply with applicable noise limits. No other specific impacts have been identified and, therefore, no other specific mitigation measures are necessary.

3.6.3 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to noise are anticipated under any of the proposed alternatives.

3.7 CLIMATE CHANGE AND GREENHOUSE GAS EMISSIONS

Energy Contents

Global climate change is a change in the average weather of the earth, which can be measured by wind patterns, storms, precipitation and temperature. The extent of the change or the exact contribution from sources influenced by human activity, including the construction and operation of developments, such as the proposed alternatives, remains in debate. This analysis provides a qualitative discussion of the potential impacts of the proposed alternatives on global climate change based upon the best information available at this time.

3.7.1 Affected Environment

Climate Change and Greenhouse Gas Emissions

The global climate is continuously changing, as evidenced by repeated episodes of warming and cooling documented in the geologic record. The rate of change has typically been incremental, with warming or cooling trends occurring over the course of thousands of years. The past 10,000 years have been marked by a period of incremental warming, as glaciers have steadily retreated across the globe. Scientists have observed, however, an unprecedented increase in the rate of warming in the past 150 years. This recent warming has coincided with the global Industrial Revolution, which resulted in widespread deforestation to accommodate development and agriculture and an increase in the use of fossil fuels, which has released substantial amounts of greenhouse gases into the atmosphere.

Greenhouse gases (GHG), such as carbon dioxide, methane, and nitrous oxide, are emitted by both natural processes and human activities and trap heat in the atmosphere. The accumulation of GHG in the atmosphere affects the earth's temperature. While research has shown that Earth's climate has natural warming and cooling cycles, evidence indicates that human activity has elevated the concentration of GHG in the atmosphere beyond the level of naturally- occurring concentrations resulting in more heat being held within the atmosphere. The International Government on Climate Change (IPCC), an international group of scientists from 130 governments, has concluded that it is "very likely" - a probability listed at more than 90 percent – that human activities and fossil fuels explain most of the warming over the past 50 years."[1]

The IPCC predicts that under current human GHG emission trends, the following results could be realized within the next 100 years:[2]

- global temperature increases between 1.1 – 6.4 degrees Celsius;
- potential sea level rise between 18 to 59 centimeters or 7 to 22 inches;
- reduction in snow cover and sea ice;
- potential for more intense and frequent heat waves, tropical cycles and heavy precipitation; and
- impacts to biodiversity, drinking water and food supplies.

The Climate Impacts Group (CIG), a Washington-state based interdisciplinary research group that collaborates with federal, state, local, tribal, and private agencies, organizations, and businesses, studies impacts of natural climate variability and global climate change on the Pacific Northwest. CIG research and modeling indicates the following possible impacts of human-based climate change in the Pacific Northwest:[3]

- changes in water resources, such as decreased snowpack; earlier snowmelt; decreased water for irrigation, fish and summertime hydropower production; increased conflict over water; increased urban demand for water.
- changes in salmon migration and reproduction.
- changes in forest growth and species diversity and increases in forest fires; and
- changes along coasts, such as increased coastal erosion and beach loss due to rising sea levels; increased landslides due to increased winter rainfall, permanent inundation in some areas; and increased coastal flooding due to sea level rise and increased winter streamflow.

[1] IPCC, Fourth Assessment Report, February 2, 2007.
[2] IPCC, Summary for Policymakers, April 30, 2007.
[3] Climate Impacts Group, Climate Impacts in Brief, accessed 2/7/2008, http://www.cses.washington.edu/cig/pnwc/ci.shtml.

Energy

One source of greenhouse gas emissions is the fossil fuels (especially coal) used to produce power used by consumers for electrical power and home heating needs. In the Pacific Northwest - unlike other regions in the United States - power companies are generally able to utilize hydro-electric energy sources which are considered renewable.

Electrical service is provided to Seattle, including the South Lake Union subarea, by Seattle City Light. Seattle City Light has a variety of sources of power including: hydro-electric (88.83 percent), nuclear (5.68 percent), wind (3.43 percent), coal (1.38 percent) and natural gas (0.58 percent)[4]. Only a small percentage (less than 2 percent) of the power provided by Seattle City Light is generated from fossil fuels. Seattle City Light offers consumers options for reducing or offsetting their energy carbon footprint, such as providing energy audits and providing the option to participate in the "green-up" program which allows customers to purchase renewable energy sources (solar and wind) for a portion of their electricity use.

Other strategies that can further reduce greenhouse gas from energy use are: employing design features that naturally reduce energy use, such as daylighting and green roofs; retaining mature trees to provide carbon sequestration, air purification and cooling; and, providing onsite power generation such as solar panels or wind turbines.

Regulatory Context

United States Environmental Protection Agency

The United States Environmental Protection Agency (EPA) is charged with enforcing the Clean Air Act and has established air quality standards for common pollutants. In addition, the EPA has been directed to develop regulations to address the GHG emissions of cars and trucks.

On September 22, 2009, the EPA released final regulations that require 29 categories of facilities to report their GHG emissions annually, starting in 2011. Covered facilities include oil refineries, pulp and paper manufacturing, landfills, and a variety of other manufacturing and industrial sources of emissions. Programmatic development projects, such as the alternatives discussed in this Draft EIS are not subject to these regulations.

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[4] Seattle City Light, http://www.seattle.gov/light/FuelMix/, accessed July 10, 2010.

Western Regional Climate Action Initiative

On February 26, 2007, the governors of Arizona, California, New Mexico, Oregon and Washington signed the Western Climate Initiative (WCI) to develop regional strategies to address climate change. WCI is identifying, evaluating and implementing collective and cooperative ways to reduce greenhouse gases in the region. Subsequent to this original agreement, the governors of Utah and Montana, as well as the premiers of British Columbia and Manitoba joined the WCI. The WCI objectives include setting an overall regional reduction goal for GHG emissions to 15 percent below 2005 levels by 2020, developing a design to achieve the goal and participating in the Climate Registry, a multi-state registry to enable tracking, management, and crediting for entities that reduce their GHG emissions.

On June 8, 2007, Washington Governor Christine Gregoire and British Columbia Premier Gordon Campbell signed a Memorandum of Understanding to launch a collaborative effort to cap and significantly reduce greenhouse gas emission and to collaborate on the innovation and implementation of clean technologies.

On September 23, 2008, the WCI released its final design recommendations for a regional cap-and-trade program. On July 27, 2010, the WCI released the report, *Design for the WCI Regional Program*, which identifies specific elements of the program. This program would cover GHG emissions from electricity generation, industrial and commercial fossil fuel combustion, industrial process emissions, gas and diesel consumption for transportation, and residential fuel use. The first phase of the program, which will cover electricity emissions and some industrial emission sources, is to begin January 1, 2012. Programmatic development projects, such as the alternatives discussed in this Draft EIS, are not currently covered by the WCI cap-and-trade program.

State of Washington

In February of 2007, Governor Gregoire signed Executive Order No. 07-02, establishing goals for Washington regarding reductions in climate pollution, increases in "green" jobs, and reductions in expenditures on imported fuel.[5] This Executive Order established Washington's goals for reducing greenhouse gas emissions as the following: to reach 1990 levels by 2020, 25 percent below 1990 levels by 2035, and 50 percent below

[5] http://www.governor.wa.gov/execorders/eo_07-02.pdf

1990 levels by 2050. This order was intended to address climate change, grow the clean energy economy and move Washington toward energy independence. In 2007, the Washington State Legislature passed SB 6001, which among other things, adopted the Executive Order No. 07-02 goals into statute.

In 2008, the Legislature built on SB 6001 by passing E2SHB 2815, the Greenhouse Gas Emissions Bill (codified as RCW 70.235). While SB 6001 set targets to reduce emissions, E2SHB 2815 established reductions in emissions as requirements to be met by the state, and directed the Department of Ecology to submit a comprehensive greenhouse gas reduction plan to the Legislature by December 1, 2008. As part of the plan, Ecology was to describe the actions necessary to achieve the emission reductions, develop a system for reporting and monitoring greenhouse gas emissions within the state, and identify a design for a regional multi-sector, market-based system to reduce statewide greenhouse gas emissions. Ecology's report was submitted to the Legislature in December 2008. The Plan addresses measures to be taken at the state-level and does not apply to individual development projects, such as the alternatives discussed in this Draft EIS.

In 2008[6], the Department of Ecology issued a memorandum stating that climate change and greenhouse gas emissions should be included in all State Environmental Policy Act (SEPA) analyses and committing to providing further clarification and analysis tools.

In 2009, Governor Gregoire signed Executive Order 09-05, ordering Ecology and the Washington State Department of Transportation to take certain actions to reduce climate-changing greenhouse gas emissions, to increase transportation and fuel-conservation options for Washington residents, and to protect the state's water supplies and coastal areas. The Executive Order directs these state agencies to develop a regional emissions reduction program; develop emission reduction strategies and industry emissions benchmarks to make sure 2020 reduction targets are met; work on low-carbon fuel standards or alternative requirements to reduce carbon emissions from the transportation sector; address rising sea levels and the risks to water supplies; and increase transit options, such as buses, light rail, and ride-share programs, to give Washington residents more choices for reducing the effect of transportation

[6] Manning, Jay. RE: Climate Change - SEPA Environmental Review of Proposals, April 30, 2008.

emissions. The measures described in the Executive Order do not apply to individual development projects, such as the alternatives discussed in this Draft EIS.

On June 1, 2010, the Department of Ecology issued draft guidelines entitled, *Guidance on Climate Change and SEPA*, for a 25-day public comment period. These draft guidelines include guidance regarding the types of greenhouse gas emissions that should be calculated, a discussion of how to determine if emissions surpass a threshold of "significance", and a description of different types of mitigation measures. Guidance is also provided regarding the requirement to discuss the ability of a proposal to adapt to climate changes as a result of global warming. After closure of the public comment period on June 25, 2010, the Department of Ecology issued a statement indicating that significant changes would be required to the Draft Guidelines before they are issued. If the final *Guidance on Climate Change and SEPA* is issued subsequent to the issuance of this Draft EIS but before issuance of the Final EIS, additional analysis may be included in the Final EIS.

City of Seattle

In 2007, the Seattle City Council adopted Comprehensive Plan goals and policies, related to achieving reductions in GHG emissions. In December 2007, the City Council adopted Ordinance No. 122574, which requires City departments that perform environmental review under SEPA to evaluate greenhouse gas (GHG) emissions when reviewing permit applications for development.

Methodologies

King County SEPA GHG Spreadsheet

Tabulation of existing greenhouse gas emissions within the South Lake Union subarea was based on the SEPA Greenhouse Gas Emissions spreadsheet tool developed by King County[7]. The King County spreadsheet is a comprehensive spreadsheet tool that encompasses a variety of emissions categories that estimates GHG emissions related to the building materials, energy consumed at the development, and transportation to and from the development. In accordance with findings regarding the primary sources of greenhouse gas emissions, this

[7] http://www.kingcounty.gov/property/permits/publications/~/media/property/permits/documents/forms/SEPA_GHG_EmissionsWorksheet_Bulletin26PDF.ashx

tabulation focused on three areas/sources of emissions as described below.

- Building materials and processes (Embodied emissions). This portion of the calculation considered both the "upstream" (i.e., mining, harvest, manufacturing, and transport) and the "downstream" (i.e., subsequent, "in place" use and maintenance) of building materials. The King County spreadsheet lifespan of the buildings is projected to be 80.5 years for multi-family buildings and 62.5 years for office and retail uses.
- Post-development energy usage (Energy). This element considered energy consumption such as heating and electrical usage. No consideration was made to whether or not the buildings would incorporate Built Green or Energy Star ratings, or LEED® ratings. Some studies suggest that these ratings could represent at least 20 percent reductions in overall energy usage.
- Transportation (Transport). This component considered GHG emissions related to vehicle travel of residences and employees. The King County default calculation was used to calculate existing conditions in **Table 3.7-1**, which includes annual miles traveled and mileage assumptions for King County residents.

To estimate the GHG emissions of the existing development within the South Lake Union neighborhood, this analysis used data from the City of Seattle travel demand model, consistent with the transportation analysis documented in Section 3.13 of this EIS. Data in the travel demand model is based on existing travel characteristics and is a reliable basis for measuring the incremental differences in GHG emissions resulting from the action alternatives, the most significant of which are transportation –related emissions.

Table 3.7-1 provides greenhouse gas emissions estimates from the existing development within the South Lake Union subarea based upon the *King County Greenhouse Gas Emissions Inventory Worksheets*.

Table 3.7-1
Existing Greenhouse Gas Emissions
Based on the King County SEPA Greenhouse Gas Emissions Inventory Worksheets

Methodology	Embodied Emissions (MTC02e)	Energy Emissions (MTC02e)	Transportation Emissions (MTC02e)	Total Estimated Existing GHG Emissions (MTC02e)*
King County SEPA GHG Emissions Worksheet	374,151	6,327,793	5,675,947	12,372,531

Source: EA|Blumen, 2010.
**** Total may differ than sum due to rounding during calculation.***

Based upon the calculations from the King County SEPA GHG Emissions worksheet, the South Lake Union subarea currently generates roughly 12,372,531 $MTCO_2e$[8] GHG emissions.

VMT-GHG Analysis Tool

As described in the Transportation Chapter (3.13) of the EIS, the unique characteristics of the South Lake Union neighborhood (high density, mix of land uses, proximity to downtown Seattle, robust pedestrian and bicycle network), will lead to less vehicle travel when compared to a typical area within King County. The King County SEPA GHG spreadsheet has no way to account for the travel characteristics of a dense urban area like South Lake Union. As stated in the King County spreadsheet, the transportation GHG analysis is based on the average vehicle-miles-traveled (VMT) estimate of Washington State residents. To prepare a more accurate transportation GHG analysis, an alternative approach based on the MXD trip generation model (described in **Section 3.13**) was used.

The tailored transportation GHG analysis starts with the trip generation estimates described in **Section 3.13**, transportation analysis, in this EIS. These trip generation estimates are based on a trip generation model that accounts for the built environment within South Lake Union.

The trip generation estimates were input into the City of Seattle travel model to estimate the neighborhood's total VMT, stratified by speed. The VMT/speed data were processed using CO_2 emissions factors from the

[8] $MTCO_2e$ is defined as Metric Tonne Carbon Dioxide Equivalent; equates to 2204.62 pounds of CO_2. This is a standard measure of amount of equivalent CO2 emissions

California Air Resources Board's EMFAC air quality model.[9] The emissions factor estimates from EMFAC were further factored to estimate CO_2 equivalent (which accounts for trace amounts of other GHGs like hydrocarbons and HFCs) using a factor from the US EPA.

The results of the EMFAC analysis indicates that the South Lake Union area generates about 397 metric tons of CO_2e per day. Using the building lifespan assumptions from the King County GHG SEPA spreadsheet and the results from the EMFAC analysis, the lifetime transportation GHG emissions from the existing uses in the South Lake Union area amounts to 8,910,451 metric tons of CO_2e[10].

Table 3.7-2 presents greenhouse gas emissions estimates from the existing development within the South Lake Union subarea based on the *King County Greenhouse Gas Emissions Inventory Worksheet* for embodied and energy emissions. Lifetime transportation GHG emissions as described above were substituted for the transportation estimates included in the King County worksheets.

Table 3.7-2
Existing Greenhouse Gas Emissions Based on the King County SEPA Greenhouse Gas Emissions Inventory Worksheets with the VMT GHG Tool

Methodology	Embodied Emissions (MTC02e)	Energy Emissions (MTC02e)	Transportation Emissions (MTC02e)	Total Estimated Existing GHG Emissions (MTC02e)*
King County SEPA GHG Emissions Worksheet w/VMT-GHG Transportation Emissions	374,151	6,327,793	8,910,451	15,610,858

Source: EA|Blumen, Fehr & Peers, 2010.
**** Total may differ than sum due to rounding during calculation.***

[9] The more traditional US EPA MOBILE6 air quality model was not used since it does not consider variations in speed when estimating CO_2 emissions and therefore tends to produce inaccurate results.

[10] The King County lifetime GHG emissions data is not quite relevant for existing development since some buildings may be demolished prior to the lifespan assumption from the spreadsheet. However, the overall magnitude of GHG emissions from this analysis can be compared to the results of the 2030 impact analysis since the same assumptions about building lifespan were used.

The amount of CO_2e generated per person (residents and employees) was calculated in South Lake Union during the three-hour PM peak period of travel. This result indicates that under existing conditions, each person who lives/works in the area generates about 6.64 pounds per person in the PM peak period. This result is higher than the 2030 CO_2e emissions estimates discussed under Impacts of the Alternatives later in this section (which were between 5.92 and 5.55 pounds per person), which is expected given the lower densities and the relatively poor balance between jobs and housing under existing conditions.

Based upon the calculations from the table above, the South Lake Union subarea currently generates roughly 15,610,858 $MTCO_2e$ GHG emissions.

3.7.2 Environmental Impacts

The scale of global climate change is so large a project's impacts can only be considered on a "cumulative" scale. It is not anticipated that a single development project or programmatic action, even one on the scale of the development alternatives in this Draft EIS, would have an individually discernable impact on global climate change. It is more appropriate to conclude that the greenhouse gas emissions from future development in the South Lake Union subarea would combine with emissions across the state, country and planet to cumulatively contribute to global climate change.

This section describes the assumed impacts of the development alternatives on climate change, and greenhouse gas emissions. This analysis does not quantify or take into consideration any potential efforts to reduce climate change impacts by incorporating sustainable features into future redevelopment. However, it is assumed that some sustainable features would be incorporated into future development to reduce the impacts quantified in this section.

Climate Change

The assumed impacts of climate change would not be anticipated to have a disproportionate impact on the South Lake Union subarea as compared to other sites in Seattle. The site is not located along a saltwater coastline, does not include significant forest growth, and no rivers are located within the subarea. Existing landslide/erosion areas located within the neighborhood would be sufficiently shored, per City of Seattle regulations, to reduce the potential for landslide hazards. Any changes in water resource levels would be similar to changes experienced region-wide and would not disproportionately impact the South Lake Union subarea.

Greenhouse Gas Emissions

As described in the Transportation section of this Draft EIS, each of the alternatives contains land use assumptions that were determined by the City of Seattle, which result in a total number of households and a total number of jobs that are targeted under each alternative (**Table 3.7-3** below). Alternatives 1, 2, and 3 all have the same employment and housing growth targets, but each alternative proposes accomplishing these targets by using different methods.

Table 3.7-3
Total Number of Households and Total Number of Jobs
that are Assumed Under Each Alternative

Totals	Existing Conditions	No Action Alternative	Alternatives 1, 2 and 3
Households	1,686	9,686	13,586
Jobs	23,336	39,336	45,236

Source: Fehr & Peers and EA|Blumen, 2010.

1 Assumes one job/350 square feet of commercial development and 45% of new development will be for commercial use.
2 Assumes recent residential development trends (see Appendix B) and 55% of new development will be for residential use
3 Assumes that retail jobs would account for 15% of all jobs within SLU for each of the future year alternatives. This proportion was based on the retail/non-retail ratio of the surrounding more established areas (Belltown, Uptown, Capitol Hill).

Using the assumptions contained in **Table 3.7-4**, total square footage of office and retail uses were derived for each alternative as well and are contained in **Table 3.7-4**.

Table 3.7-4
Total Number of Households and Total Square Footage of Office and Retail
Development that are Assumed Under Each Alternative

Totals	Existing Conditions	No Action Alternative	Alternatives 1, 2 and 3
Households	1,686	9,686	13,586
Office (sq. ft)	6,942,460	11,702,460	13,457,710
Retail (sq. ft.)	1,225,140	2,065,140	2,374,890

Source: Fehr & Peers and EA|Blumen, 2010.

King County SEPA GHG Spreadsheet

These square footages and number of households were then used to derive GHG emissions totals using the *King County Greenhouse Gas Emissions Inventory Worksheets*.

Table 3.7-5 shows greenhouse gas emissions associated with existing conditions and the development alternatives based upon the *King County*

Greenhouse Gas Emissions Inventory Worksheets. The completed SEPA Greenhouse Gas Emissions Worksheets for all alternatives, as well as an explanation of the methodology employed to create the formulas, are included as **Appendix F** to this Draft EIS.

Table 3.7-5
Greenhouse Gas Emissions Estimates King County SEPA GHG Spreadsheet

Alternative	Estimated GHG Emissions Associated by Alternative ($MTC0_2e$)
Existing Conditions	12,372,531
No-Action Alternative	28,765,685
Alternatives 1, 2 and 3	35,909,798

Source: EA|Blumen, 2010.

Based upon the calculations from the SEPA GHG Emissions worksheet, Alternatives 1, 2, and 3 would generate roughly 23,537,267 $MTCO_2e$ additional GHG emissions over existing conditions during the lifespan of future development, and the No-Action Alternative would generate roughly 16,393,154 $MTCO_2e$ additional GHG emissions.

VMT-GHG Analysis Tool

Based on the results discussed in the Affected Environment section and the "average building life span" estimates in the King County SEPA spreadsheet, the following total transportation lifetime emissions estimates were derived for existing conditions, as well as each alternative using the VMT-GHG analysis tool:

Existing Conditions:	8,910,451 $MMCO_2e$
No Action Alternative:	19,709,284 $MMCO_2e$
Alternative 1:	22,756,080 $MMCO_2e$
Alternative 2:	22,740,150 $MMCO_2e$
Alternative 3:	21,282,472 $MMCO_2e$

Since the numbers above are large and difficult to put in perspective, the transportation GHG emissions can be summarized in another way, which compares the three-hour PM peak period CO_2e emissions in pounds per person (residents plus employees in South Lake Union). As a point of comparison, driving an average car for one mile emits approximately one pound of CO_2e.

Table 3.7-6
Estimated Transportation GHG Emissions: VMT-GHG Analysis Tool

Scenario	PM Peak Period pounds of CO2e per person (residents and employees)
Existing Conditions	6.64
No Action Alternative	5.92
Alternative 1	5.65
Alternative 2	5.65
Alternative 3	5.55
Bel-Red Corridor Comparison Site	6.47

Source: Fehr & Peers, 2010.

The table above illustrates that under existing conditions, each person who lives/works in the area generates about 6.64 pounds per person in the PM peak period. This result is higher than the CO_2e emissions estimates for each of the three height and density alternatives, which is expected given the lower densities and the relatively poor balance between jobs and housing under existing conditions.

As is also shown in the table above, the three height and density alternatives produce transportation GHG emissions per capita that are about five percent lower than the No Action Alternative. The table also shows the result of the transportation GHG emissions rates for a more suburban employment center along the Bel-Red Corridor in Bellevue and Redmond. This corridor has about 15 percent higher CO_2e emissions per person because the corridor is more isolated and is less dense than South Lake Union. Both the Bel-Red Corridor and South Lake Union have a similar mix of land uses and both areas are assumed to be served by relatively high quality transit in the 2030 horizon year.

Table 3.7-7 compares greenhouse gas emissions from the development alternatives based on the *King County Greenhouse Gas Emissions Inventory Worksheets* for embodied and energy emissions. Lifetime transportation GHG emissions as described above were substituted for the transportation estimates included in the King County Worksheets. The completed SEPA Greenhouse Gas Emissions Worksheets for all alternatives, as well as an explanation of the methodology employed to create the formulas, are included as **Appendix F** to this Draft EIS.

Table 3.7-7
Greenhouse Gas Emissions Based on the King County SEPA Greenhouse Gas Emissions Inventory Worksheets and the VMT GHG Tool

Alternative	Estimated GHG Emissions Associated with Alternative (MTC02e)
Existing Conditions	15,610,858
No-Action Alternative	33,674,061
Alternative 1	39,770,938
Alternative 2	39,755,008
Alternative 3	38,297,330

Source: EA|Blumen, Fehr & Peers, 2010.

Based on these calculations, Alternative 1 would generate roughly 24,160,080 $MTCO_2e$ additional GHG emissions during the lifespan of future development, Alternative 2 roughly 24,144,150 $MTCO_2e$ additional GHG emissions, Alternative 3 roughly 22,686,472 $MTCO_2e$ additional GHG emissions, and the No-Action Alternative roughly 18,063,203 $MTCO_2e$ additional GHG emissions.

3.7.3 Mitigation Strategies

The following potential mitigation strategies would address potential impacts to climate change, energy use and greenhouse gas emissions from future development in the South Lake Union subarea:

- **Natural Drainage and Green Roofs** – Green roofs can provide additional open space, opportunities for urban agriculture, and decreased energy demands by reducing the cooling load for the building. Green Stormwater Infrastructure (GSI) could also be used for flow control and water quality treatment.
- **Tree Protection** – The City of Seattle has aggressive urban forest goals in order to help restore tree cover which has been lost due to development. Trees can provide stormwater management, habitat value, noise buffering, air purification, carbon sequestration, and mitigation of the urban heat island effect. Trees also have a positive effect on property values and neighborhood quality. Protection of existing trees, as feasible, and careful attention to new tree planting could help meet the Seattle Comprehensive Urban Forest Management Plan Goals for multi-family residential and commercial office development by achieving 15-20 percent overall tree canopy within 30 years.
- **Urban Agriculture** – New P-patch Community Gardens and rooftop gardens could be provided or encouraged within the

neighborhood for residents to grow food. Balconies, decks, and right-of-way planting strips could also be utilized for individual residents' agriculture needs. A farmer's market could be established for residents to sell locally grown food.

- **Native Plants** – Native plants are adapted to the local climate and do not depend upon irrigation after plant establishment for ultimate survival. Landscaping with native plants, beyond that required by City code, could be planted to reduce water demand and integrate with the local urban ecosystem.
- **District Infrastructure Systems for Energy, Water and Waste** – District Infrastructure Systems aggregate enough service demands to make local neighborhood utility solutions feasible, and may reduce greenhouse gases by utilizing renewable sources of energy and increasing the use of local resources, materials and supplies. District parking solutions and car sharing are designed to reduce vehicle trips. Water reuse and anaerobic digesters may reduce sewer flows. Rainwater capture may reduce stormwater flows. Water reuse and rainwater capture could also reduce potable water demands. District systems for the South Lake Union subarea could potentially include energy, potable water, wastewater, and solid waste.
- **Waste Management and Deconstruction** – When existing buildings need to be demolished, there are often opportunities to reduce the amount of waste being sent to the landfill with sustainable waste management strategies. In the Seattle area, standard practice for building construction and demolition results in fairly high recycling rates of over 50 to 60 percent. However, these rates can be increased by implementing aggressive demolition recycling. Such efforts can require considerable additional effort on the part of the contractor.
- **Building Design** – Green building encompasses energy and water conservation, waste reduction, and good indoor environmental quality. Tools and standards that are used to measure green building performance, such as Built Green, LEED, and the Evergreen Sustainable Development Criteria, could be encouraged or required for development within the South Lake Union subarea.

3.7.4 Significant Unavoidable Adverse Impacts

Declaring an impact significant or not significant implies an ability to measure incremental effects of global climate change. The body of research and law necessary to connect individual land uses, development projects, operational activities, etc. with the broader issue of global warming remains weak. Scientific research and analysis tools sufficient to determine a numerical threshold of significance are not available at this time and any conclusions would be speculative. For these reasons, a determination of significance cannot be made at this time.

3.8 LAND USE

This section of the EIS focuses on the consistency of each alternative with existing state, regional and local planning policies. This section is comprised of two major topic areas.

The first is a general land use policy review of the following documents:

- *Washington Growth Management Act*
- *Washington State Greenhouse Gas Emissions Reduction Law*
- *Washington State Commute Trip Reduction Law*
- *Puget Sound Regional Council VISION 2040*
- *City of Seattle Comprehensive Plan*
- *City of Seattle Climate Action Plan*
- *City of Seattle Pedestrian Master Plan*
- *City of Seattle Bicycle Master Plan*
- *City of Seattle Transit Master Plan*
- *City of Seattle Urban Village Transit Network*
- *South Lake Union Transportation Study*
- *Terry Avenue North Street Design Guidelines*
- *Lake to Bay Loop*
- *City of Seattle Parks and Recreation 2006 Development Plan*
- *City of Seattle North Downtown Park Plan*
- *City of Seattle Consolidated Plan for Housing and Community Development, 2009-2012*
- *South Lake Union Urban Center Neighborhood Plan*
- *South Lake Union Design Framework*
- *South Lake Union Multimodal Transportation Mitigation Plan*
- *City of Seattle Land Use Code*
- *City of Seattle Environmental Policies and Procedures*
- *Federal Air Regulations Part 77*

The second topic area focuses on regulations and potential impacts associated with the flight path of float planes in and out of Lake Union. This topic area reviews the requirements of the Federal Air Regulation and includes a discussion of the potential impacts of building heights in the immediate vicinity of the departure corridor with special consideration for wind shear and mechanical turbulence in the lee of buildings.

Seaplane landing on Lake Union

3.8.1 Affected Environment

Plans, Policies, and Regulations

<u>Growth Management Act</u>

The Growth Management Act (GMA) (RCW 36.70A), adopted in 1990 and subsequently amended, provides a comprehensive framework for managing growth and coordinating land use planning with the provision of infrastructure. The general goals of the GMA include, in part: directing growth to urban areas; reducing sprawl; encouraging economic development consistent with adopted comprehensive plans; protecting private property rights; providing efficient multi-modal transportation systems; encouraging a variety of housing types and densities affordable to all economic segments of the population; protecting the environment; and ensuring that public facilities and services necessary to support development meet locally established minimum standards at the time development is in place (RCW 36.70A.020).

Jurisdictions subject to GMA must prepare and adopt countywide planning policies; comprehensive plans containing policies with specific elements for land use, transportation, housing, capital facilities, utilities, rural lands, and economic development; and development regulations implementing those plans. The Growth Management Act requires that each city and county in Washington comprehensively review and revise its comprehensive plan and development regulations as necessary every seven years to ensure that they comply with the GMA.

The GMA has concurrency provisions to ensure sufficient public facilities are available for new development. Developers may assume that funded projects scheduled to be completed within six years are in place at the time of development. To evaluate the effect of proposed development on facilities, local jurisdictions must set level of service (LOS) standards. If the impacts associated with a proposed development will cause a facility to fall below the LOS standard established by the jurisdiction, the local government may deny permits for the project or change the LOS standard to allow the development. Changes may be made to the development to meet the concurrency requirements, such as reducing the size or employing travel demand management to reduce the number of trips generated.

The GMA authorizes a financing option for roadway improvements in the form of impact fees. Local jurisdictions may impose these fees on developers based upon the number of trips generated by a proposed development. These fees contribute funding to specific projects identified in the local Transportation Master Plan that offset the expected traffic impacts of the development.

> Discussion: Consistent with the GMA, the City of Seattle has adopted a Comprehensive Plan to guide future development and fulfill the City's responsibilities under the GMA (latest major update in 2004). The Alternatives, as identified and discussed in detail in Chapter 2 of this Draft EIS, would encourage economic development and provide a variety of housing types and densities within the South Lake Union Urban Center consistent with the GMA goals and policies outlined above. Pursuant to the GMA, the City of Seattle maintains LOS standards and concurrency requirements. The City of Seattle does not have a mandatory impact fee program. The relationship of the alternatives to the City of Seattle Comprehensive Plan is discussed in greater detail below.

Washington State Greenhouse Gas Emission Reduction Law

In 2008, Washington State passed a law aimed at reducing greenhouse gas (GHG) emissions. The law requires Washington State to reduce its GHG emissions to 1990 levels by 2020; to 25 percent below 1990 levels by 2035; and to 50 percent below 1990 levels by 2050. The Washington State Legislature also adopted a bill recognizing that the emissions goals will not be met without a substantial reduction in transportation emissions. Furthermore, the bill acknowledges the effect of land use development patterns on transportation emissions. The Department of Commerce provides assistance and evaluation tools to local agencies that choose to address the GHG reductions through their planning activities.

> Discussion: Consistent with the intent of this law, the proposed land use pattern in South Lake Union consists primarily of compact mixed-use development that would support an efficient multimodal transportation system. This EIS considers the greenhouse gas impacts of the alternatives (see Section 3.7 of this EIS). Information contained in this analysis will be considered as part of the decision-making process.

Commute Trip Reduction Law

In 1991, Washington State passed the Commute Trip Reduction (CTR) Law. CTR is meant to reduce traffic congestion, air pollution, and oil consumption and applies to employers with more than 100 employees. Employers implement programs that encourage employees to reduce drive alone commutes. Employers may offer financial incentives to encourage employees to forego a drive alone commute. For example, employees may be reimbursed for some transit pass or vanpool costs.

Goals are set for each participating company and periodic surveys measure progress.

The Growth and Transportation Efficiency Center (GTEC) program is a part of the CTR law described above and provides commute options programs to smaller employers, residents, and students. Common program elements include trip reduction incentives, transit passes, outreach and information for commuters, small-scale infrastructure investments, and local policy development and implementation.

> Discussion: Seattle's GTEC program includes the downtown area, and there have been discussions of expanding the GTEC program into South Lake Union, however, no action has been taken in this direction.

Puget Sound Regional Council VISION 2040

VISION 2040 (updated in 2008) is the long-range growth management, economic and transportation strategy for the central Puget Sound region encompassing King, Kitsap, Pierce and Snohomish counties. VISION 2040 provides a regional framework for achieving the goals of the Growth Management Act and meets the multi-county planning requirements of the Growth Management Act for King, Kitsap, Pierce, and Snohomish counties. The vision is for diverse, economically and environmentally healthy communities framed by open space and connected by a high-quality, multimodal transportation system that provides effective mobility for people and goods. VISION 2040 calls for locating development in urban growth areas so services can be provided efficiently, and farmlands, forests and other natural resources are conserved. Within urban areas, it supports creating compact communities with employment and housing growth focused in regional growth centers. The strategy is designed to ensure that development contains a greater mix of land uses and a more complete and efficient network of streets and other public rights-of-way, making it easier to walk, bicycle, use transit, and drive. Seattle is one of the five designated Regional Growth Centers in Vision 2040.

> Discussion: The action alternatives in this EIS are consistent with VISION 2040 in that they would provide for a significant increase in development capacity within a designated regional growth center, specifically the South Lake Union neighborhood in the City of Seattle. Consistent with VISION 2040, the proposal, including the action and no action alternatives, would support creation of a compact mixed-use community, with a development pattern that would support a multi-modal transportation system.

City of Seattle Comprehensive Plan (1994, as amended)

The City of Seattle developed its Comprehensive Plan in compliance with the Growth Management Act (GMA) and the King County Countywide Planning Policies (CPP), both of which provide a comprehensive framework for managing growth and coordinating land use planning with the provision of infrastructure. The City of Seattle's Comprehensive Plan – *Toward a Sustainable Seattle*, was adopted in 1994 and has been amended nearly every year since. The plan contains the elements that are required by GMA, Multiple Urban Center concepts associated with the PSRC Vision 2040 Multi-County Planning Policies, King County's Countywide Planning Policies (King County, 1992), and Seattle's *Framework Policies* (Seattle 1992).

GMA requires a review of the 20-year plan every 7 years with action taken to revise the plan, if necessary. The City completed its last revision in December 2004 and the next Comprehensive Plan update must be completed by 2014 (the State Legislature recently revised the update cycle in recognition of local government budget shortfalls). The 2004 update involved the City working with King County, other cities in the County, and the Growth Management Planning Council to establish new growth allocations. In addition, during the update process, the City's Planning Commission and City departments analyzed the effectiveness of policies contained in the current plan, and an extensive community outreach/public participation effort occurred. Annual updates to the *Comprehensive Plan* also occur in order to provide the opportunity to amend the Plan to address changing conditions or to manage new issues.

The City's updated *Comprehensive Plan* consists of eleven major elements – urban village, land use, transportation, housing, capital facilities, utilities, economic development, neighborhood, human development, cultural resources and environment. Each element contains goals and policies that are intended to "guide the development of the City in the context of regional growth management" for the next 20 years. The *Urban Village*, *Land Use*, *Housing*, *Transportation* and *Neighborhood Planning Elements* are the most relevant elements to the proposal.

The following goals and policies from the Comprehensive Plan are the most applicable to the proposed alternatives.

Urban Village Element

Urban Village Strategy

Goals

Goal UVG4 – Promote densities, mixes of uses and transportation improvements that support walking, use of public transportation, and other transportation demand management (TDM) strategies, especially with urban centers and urban villages.

Goal UVG5 – Direct the greatest share of future development to centers and urban villages and reduce the potential for dispersed growth along arterials and in other areas not conducive to walking, transit use, and cohesive community development.

Goal UVG6 – Accommodate planned levels of household and employment growth. Depending on the characteristics of each area, establish concentrations of employment and housing at varying densities and with varying mixes of uses.

Goal UVG8 – Accommodate the City's existing and future housing needs through maintenance of existing residential neighborhoods and the creation of new residential neighborhoods. Encourage housing development so that by 2024, a citywide ratio of 1.8 jobs per household is maintained.

Goal UVG9 – Use limited land resources more efficiently and pursue a development pattern that is more economically sound, by encouraging infill development on vacant and underutilized sites, particularly within urban villages.

Policies

Policy UV1 – Promote the growth of urban villages as compact mixed use neighborhoods in order to support walking and transit use, and to provide services and employment close to residences.

Policy UV3 – Consider the following characteristics appropriate to all urban village categories except Manufacturing and Industrial Centers:

1. *Clearly defined geographic boundaries that reflect existing development patterns, functional characteristics of the area, and recognized neighborhood boundaries.*
2. *Zoning sufficient to accommodate the residential and employment growth targets established for that village.*

3. *The ability to accommodate a range of employment or commercial activity compatible with the overall function, character, and intensity of development specified for the village.*
4. *Zoning that provides locations for commercial services convenient to residents and workers and, depending on the village designation, serving a citywide and regional clientele.*
5. *Zoning sufficient to allow a diversity of housing to accommodate a broad range of households.*
6. *Zoning regulations that restrict those public facilities that are incompatible with the type of environment intended in centers and villages.*
7. *Most future households accommodated in multi-family housing.*
8. *Additional opportunities for housing in existing single-family areas, to the extent provided through neighborhood planning, and within other constraints consistent with this Plan.*
9. *Public facilities and human services that reflect the role of each village category as the focus of housing and employment and as the service center for surrounding areas.*
10. *Parks, open spaces, street designs, and recreational facilities that enhance environmental quality, foster public health and attract residential and commercial development.*
11. *A place, amenity, or activity that serves as a community focus.*
12. *Neighborhood design guidelines for us in the City's design review process.*

Discussion: Consistent with the goals and policies identified for the City's Urban Village Strategy, the EIS Alternatives would increase residential and employment density within the South Lake Union Urban Center to accommodate planned levels of household and employment growth, which would result in a compact mixed-use area where residents of the neighborhood could live near services, employment, and transit.

Categories of Urban Villages – Urban Centers

Goals

Goal UVG17 – Guide public and private activities to achieve the function, character, amount of growth, intensity of activity, and scale of development of each urban village consistent with its urban village designation and adopted neighborhood plan.

Goal UVG18 – Designate as urban centers unique areas of concentrated employment and housing, with direct access to high-capacity transit, and a *wide range of supportive land uses such as retail, recreation, public facilities, parks, and open space.*

Goal UVG19 – Recognize areas that provide a regionally significant focus for housing and employment growth as urban centers. Enhance the unique character and collection of businesses and housing types of each center.

Policies
Policy UV16 – Designate the following locations as urban centers:

1. *Downtown Seattle*
2. *First Hill/Capitol Hill*
3. *Uptown Queen Anne*
4. *University Community*
5. *Northgate*
6. ***South Lake Union***

Policy UV18 – Promote the balance of uses in each urban center or urban center village indicated by one of the following functional designations, assigned as follows:

3. *Mixed Residential and Employment – South Lake Union*

   Discussion: Consistent with the goals and policies identified for designating Urban Centers within the City, all of the alternatives would contribute to increased employment and housing density within the South Lake Union neighborhood, which would help to achieve the 2024 Urban Center housing targets established by the City. Under the all of the EIS alternatives, a mix of uses is assumed for future development within the neighborhood, which would help to create a mixed-use community where residents could live near employment opportunities, public facilities, services, transit, recreational facilities, and parks and open space areas.

Distribution of Growth

Goals
Goal UVG30 – Encourage growth in locations within the city that support more compact and less land-consuming, high quality urban living;

Goal UVG31 – Concentrate a greater share of employment growth in locations convenient to the city's residential population to promote walking and transit use and reduce the length of work trips.

<u>Goal UVG32</u> – Plan for urban centers to receive the most substantial share of Seattle's growth consistent with their role in shaping the regional growth pattern;

<u>Goal UVG35</u> – Achieve growth in urban centers that is consistent with the 20-year residential and employment growth targets contained in Urban Village Appendix A, below;

2024 Household and Employment Growth Targets
for the Urban Centers & Center Villages

		Households (HH)				Employment (Jobs)			
Center or Village	**Land Area in Acres**	*Existing (2004)*	*Existing Density (HH/ Acre)*	*Growth Target (HH Growth)*	*2024 Density (Est.)*	*Existing (2002)*	*Existing Density (Jobs/ Acre)*	*Growth Target (Job Growth)*	*2024 Density (Est.)*
		Urban Centers & Center Villages							
Downtown Urban Center Total	*952*	*15,700*	*16*	*10,000*	*27*	*156,960*	*165*	*29,015*	*195*
First Hill/Capitol Hill Center Total	*916*	*22,520*	*25*	*3,500*	*28*	*37,940*	*41*	*4,600*	*46*
Northgate Urban Center Total	*411*	*3,490*	*8*	*2,500*	*15*	*11,030*	*27*	*4,220*	*37*
South Lake Union Urban Center Total	***340***	***1,210***	***4***	***8,000***	***27***	***19,690***	***58***	***16,000***	***105***
University Community Urban Center Total[1]	*758*	*6,850*	*9*	*2,450*	*12*	*32,360*	*43*	*6,140*	*51*
Uptown Queen Anne Urban Center Total	*297*	*4,580*	*15*	*1,000*	*19*	*15,570*	*52*	*1,150*	*56*

Source: City of Seattle Comprehensive Plan Urban Village Element Appendix A.

1 The University of Washington campus is part of the University Community Urban Center, but is not a distinct urban village. These numbers includes jobs and housing on the University of Washington campus not reflected in Ravenna and the University District Northwest figures.

<u>Discussion</u>: Consistent with the goals and policies identified for Urban Centers, the action alternatives would increase residential and employment density within the South Lake Union Urban Center, which would help to create a mixed-use area where residents of the City can live near services, employment, and transit adjacent to the Office and Retail Cores, and near numerous bus routes, the South Lake Union Streetcar, and Sound Transit's Link Light Rail Westlake Station.

Of the four EIS Alternatives, Alternative 1 would provide development capacity for the most jobs, the greatest number of residential units, and would represent the potential for the highest density within the neighborhood. Alternative 1 would also have the potential through incentive zoning programs to supply the highest number of low income housing units. Alternatives 2 and 3 would also provide increased development capacity for employment and residential units, as well as low income housing, but at a lower level than Alternative 1. Alternative 4 would retain the existing zoning and would essentially represent a continuation of the current development trend within the neighborhood.

All of the alternatives are consistent with the City's adopted 2024 growth targets for the South Lake Union neighborhood. As discussed in Chapter 2 of this Draft EIS, King County and its cities have allocated new growth targets that extend the planning horizon to 2031. It is expected that the updated target will be the basis for the City's next 10-year comprehensive plan update, due in 2014. However, the City has not yet adopted those targets into the Comprehensive Plan or allocated portions of the targets to individual urban centers or urban villages.

As a proxy for a 2031 South Lake Union growth target, this EIS contains an estimated growth target (see Chapter 2, Section 2.2.2). All of the action alternatives have development capacities that exceed the 2031 target estimate. The development capacity of the no action alternative is less than the 2031 target estimate. Formal City action to establish a growth target will occur in the future based on an analysis of the capacity of all of the urban centers and other areas in the City. The South Lake Union 2031 growth target that is ultimately proposed and adopted by the City will reflect an understanding of overall development capacity.

<u>Land Use Element</u>

The City of Seattle Future Land Use Map designates the South Lake Union neighborhood as a Commercial/Mixed Use Area with an Urban Center overlay. The following are goals and policies that have been identified for these areas.

Mixed-Use Commercial Areas

Goals

<u>Goal LUG17</u> – Create strong and successful commercial and mixed use areas that encourage business creation, expansion and vitality by allowing

for a mix of business activities, while maintaining compatibility with the neighborhood-serving character of business districts, and the character of surrounding areas.

<u>Goal LUG18</u> – Support the development and maintenance of areas with a wide range of characters and functions that provide for the employment, service, retail and housing needs of Seattle's existing and future population.

<u>Goal LUG19</u> –Include housing as part of the mix of activities accommodated in commercial areas in order to provide additional opportunities for residents to live in neighborhoods where they can walk to services and employment.

Policies
<u>Policy LU104</u> – Consistent with the urban village strategy, prefer the development of compact concentrated commercial areas, or nodes, in which many businesses can be easily accessed by pedestrians, to the designation of diffuse, sprawling commercial areas along arterials, which often require driving from one business to another.

<u>Policy LU105</u> – Designate as mixed-use commercial areas, existing areas that provide locations for accommodating the employment, service, retail and housing needs of Seattle's existing and future population. Allow for a wide range in the character and function of individual areas consistent with the urban village strategy.

<u>Policy LU117</u> – Generally permit a greater intensity of development in pedestrian and transit supportive environments found in pedestrian-oriented commercial areas within urban villages than is permitted in general commercial areas or outside of urban villages.

<u>Discussion</u>: As mentioned above, the City of Seattle Future Land Use Map designates the South Lake Union neighborhood as a Commercial/Mixed-Use Area with an Urban Center Overlay.

Notwithstanding the portion of the No Action Alternative that would retain Industrial Commercial zoning, all of the EIS Alternatives would increase residential and employment density within the South Lake Union Urban Center, which would help to create a mixed-use area where residents of the City can live near services, employment, and transit adjacent to the Downtown Office and Retail Cores, and near numerous bus routes, the South Lake Union Streetcar, and Sound Transit's Link Light Rail Westlake Station. The built character and compatibility of the alternatives is illustrated and discussed in Section 3.10, Aesthetics.

Housing Element

The Housing Element contains goals for the percentage of housing units that will be affordable to lower income households and identifies incentives and other tools the City can use to achieve these goals.

Accommodating Growth & Maintaining Affordability

Goals

Goal HG1 – Accommodate 47,000 additional households over the 20 years covered by this Plan;

Policies

Policy H2 – Maintain sufficient zoned development capacity to accommodate Seattle's projected share of King County household growth over the next 20 years;

Policy H8 – Consider providing incentives that encourage public agencies, private property owners and developers to build housing that helps fulfill City policy objectives. Examples of development incentives include height and density bonuses, minimum densities and transferable development rights. Consider programs that make maximum use of City resources such as bridge loans, credit enhancement, and tax exemptions.

Policy H9 – Promote housing preservation, development and affordability in coordination with transit plans and in proximity to light rail stations and other transit hubs, and coordinating housing, land use, human services, urban design, infrastructure and environmental strategies to support pedestrian-friendly communities at light rail station areas and other transit hubs;

Encouraging Housing Diversity & Quality

Goals

Goal HG4 – Achieve a mix of housing types that are attractive and affordable to a diversity of ages, incomes, household types, household sizes, and cultural backgrounds;

Goal HG7 – Accommodate a variety of housing types that are attractive and affordable to potential home buyers;

Goal HG11.5 – Implement strategies and programs to help ensure a range of housing opportunities affordable to those who work in Seattle;

Policies

Policy H10 – Reflect anticipated consumer preferences and housing demand of different sub-markets in the mix of housing types and densities permitted *under the City's Land use Code. Encourage a range of housing types….which are needed to accommodate most of the growth over the 20-year life of this Plan;*

<u>Policy H11</u> – Strive to make the environment, amenities and housing attributes in urban villages attractive to all income groups, ages and household types;

Providing Housing Affordable to Low Income Households

Goals
<u>Goal HG13</u> – Provide new low income housing through market rate housing production and assisted housing programs.

<u>Goal HG14</u> – Preserve existing low income housing, particularly in urban centers and urban villages where most redevelopment pressure will occur.

Policy
<u>Policy H30</u> -- Address the city's share of affordable housing needs resulting from expected countywide household growth, consistent with the countywide affordable housing policies, by planning for:

a. *at least 20 percent of expected housing growth to be affordable to households earning up to 50 percent of median income (estimated 9,400 affordable units).*
b. *at least 17 percent of expected housing growth to be affordable to households earning between 51 percent and 80 percent of median income (estimated 7,990 affordable units).*
c. *At least 27 percent of expected housing growth to be affordable to households earning between 81 percent and 120 percent of median income (estimated 12,690 units).*

Both new housing and existing housing that is acquired, rehabilitated or preserved for long-term low-income and affordable occupancy count toward meeting this policy.

<u>Discussion</u>: Consistent with the goals and policies outlined above, the EIS Alternatives, as identified and discussed in detail in Chapter 2 of this EIS, would encourage economic development and promote a variety of housing types and densities within the South Lake Union Urban Center, which would help to create a mixed-income, mixed-use community where residents can live near services, employment, and transit.

Of the four EIS Alternatives, Alternative 1 would provide the greatest development capacity, which would also have the potential through incentive zoning programs to supply the highest number of low income housing units. Alternatives 2 and 3 would also provide increased development capacity, as well as low income housing, but at a lower level than Alternative 1. Alternative 4 would retain the existing zoning and would essentially represent a continuation of the current development trend within the neighborhood.

All of the action proposals will provide additional capacity and opportunity for development of affordable housing, consistent with adopted City policy. Consolidation of parcels for tower development may create remainder parcels available for affordable housing development. At the same time, potential increases in land values and construction costs of high-rise development may serve as deterrents to future development of affordable housing. Similarly, redevelopment may displace existing affordable housing stock. Please see Section 3.9, Housing, for additional discussion of potential affordability impacts associated with each of the alternatives.

Transportation Element

The Transportation Element details citywide goals and related policies which are strongly tied to the urban village strategy. The City seeks to strike a balance between achieving an improved pedestrian, bicycle and transit network and maintaining the auto access necessary for growth. The competition between uses is complicated by the limited space available in a mature city, so Seattle aims to make the best use of the existing facilities by employing Complete Streets principles. The City recognizes that alternative modes must be made more convenient and accessible to effectively reduce single occupancy vehicle (SOV) travel.

Specific mode choice goals are stated for the South Lake Union neighborhood: by 2020, 50 percent of work trips to South Lake Union should be non-SOV and 75 percent of all South Lake Union residents' trips should be non-SOV. The Transportation Element provides policies to achieve increased travel choices through transit, pedestrian, and bicycle improvements as well as through parking management. In working towards this multimodal transportation system, the City requires that economic development, the environment, regional connectivity, and efficient operation and maintenance be considered.

The *Seattle Transportation Strategic Plan* (TSP) is the implementation document for the goals and policies set out in the Comprehensive Plan. Specific programs and projects are designated to bring the City closer to its goals. The TSP considers budgetary constraints and prioritizes projects. The Plan also sets out performance reporting process for the Seattle Department of Transportation. The most recent TSP was released in 2005, and a 2010 update is currently in progress.

The goal and policies pertaining to transportation and land use in urban villages and other centers are excerpted below.

Goal
<u>Goal TG1</u> – Ensure that transportation decisions, strategies and investments are coordinated with land use goals and support the urban village strategy.

Policies
<u>Policy T1</u> – Design transportation infrastructure in urban villages to support land use goals for compact, accessible, walkable neighborhoods.

<u>Policy T2</u> – Make the design and scale of transportation facilities compatible with planned land uses and with consideration for the character anticipated by this Plan for the surrounding neighborhood.

<u>Policy T4</u> – Provide sufficient transportation facilities and services to promote and accommodate the growth this Plan anticipates in urban centers, urban villages, and manufacturing/industrial centers while reducing reliance on single occupancy vehicles.

<u>Policy T5</u> – Establish multi-modal hubs providing transfer points between transit modes in urban centers and urban villages.

> <u>Discussion:</u> In support of the goal and policies listed above, the transportation analysis in this EIS uses the mixed-use development (MXD) model, to analyze the future year land use scenarios. The MXD model is based on a growing body of research, which focuses on the relationship between travel and the built environment. This method supplements conventional trip generation methods employed by the City of Seattle to capture effects related to built environment variables (known as the Ds) like **d**ensity, **d**iversity of land uses, **d**estinations (accessibility), **d**evelopment scale, pedestrian and bicycle **d**esign, and **d**istance to transit services, and **d**emographics. The proposed height and density alternatives in the South Lake Union area incorporate changes in a number of these built environment D variables that, in turn, would influence the neighborhood's travel characteristics.

Use of this approach ensure that estimated trip generation accurately reflects the likely travel associated with future mixed use development, recognizes and supports multi-modal travel, and allows the City to plan for sufficient transportation facilities to support future growth.

Neighborhood Planning Element - South Lake Union Urban Center Neighborhood Plan

Neighborhood Character

Goals
Goal SLU-G1 – A vital and eclectic neighborhood where people both live and work, where use of transit, walking and bicycling is encouraged, and where there are a range of housing choices, diverse businesses, arts, a lively and inviting street life and amenities to support and attract residents, employees and visitors.

Goal SLU-G2 – A neighborhood that recognizes its history as a maritime and industrial community and embraces its future as a growing urban center that provides for a wide range of uses.

Policies
Policy SLU-P1 – Encourage the co-location of retail, community, arts and other pedestrian-oriented activities in key pedestrian nodes and corridors.

Policy SLU-P2 – Promote diversity of building styles and support the diverse characters of neighborhood sub-areas.

Policy SLU-P6 – Establish incentives to encourage preservation, reuse and rehabilitation of historically significant structures in the neighborhood; explore incentives to encourage the adaptive reuse of other older buildings in the neighborhood that provide a visual reminder of the past and promote diversity of character and building types.

Policy SLU-P9 – Support the growth of innovative industries in South Lake Union including biotechnology, information technology, environmental sciences and technology, and sustainable building.

Discussion: Development under the proposed EIS alternatives would be consistent with the emerging pattern of development that is occurring throughout the South Lake Union area, but each alternative describes a different approach to the pattern of height and density in the neighborhood. In general, Alternative 1 proposes the greatest increases for both commercial and residential development. Similarly, Alternative 2 provides for height and density increases for both residential and commercial development, but relatively less than Alternative 1. Alternative 3 would focus height and density increases primarily in residential development, although some commercial increases are permitted. Alternative 4 would retain the existing zoning standards and height limits. Under all alternatives, assumptions regarding floor plate and building heights considered the needs of innovative industries. Please see Chapter 2 for a detailed description of each alternative.

Future building design under each of the alternatives would be consistent with the South Lake Union design guidelines, which include consideration of neighborhood character, sustainable development, and encouragement of the preservation, reuse and/or rehabilitation of older structures, as well as historically significant structures in the neighborhood.

Housing

Goals
Goal SLU-G11 – A wide range of housing types is integrated into the community, accommodating households that are diverse in their composition and income.

Goal SLU-G12 – Housing in South Lake Union is affordable for and attractive to workers in South Lake Union, to enable people to live near their jobs.

Policies
Policy SLU-P33 – Provide incentives to encourage housing for people across a range of incomes in a variety of housing types, particularly in mixed-income buildings.

Policy SLU-P34 – Encourage affordable housing units throughout the community through new construction and preservation of existing buildings.

Policy SLU-P35 – Encourage both rental and ownership housing.

Discussion: Consistent with the goals and policies of the Housing section of the *Neighborhood Planning Element*, the EIS Alternatives would promote more intensive urban development in the neighborhood and would promote additional housing development opportunities within the South Lake Union Urban

Center. All of the action proposals will provide additional capacity and opportunity for development of affordable housing, consistent with adopted City policy. Of all of the action proposals, Alternative 3 emphasizes future residential uses relative to commercial uses by primarily focusing height and density increases for residential development, while allowing for some height increases for commercial development as well.

Seattle Climate Action Plan

In 2007, the City adopted policies and goals aimed at reducing the effects of climate change. By 2024, Seattle's goal is to reduce its GHG emissions to 30 percent below 1990 levels. By 2050, Seattle plans to reduce its GHG emissions to 80 percent below 1990 levels. The City also released a Climate Action Plan in 2006 which included programs geared toward residents (Seattle Climate Action Now) and businesses (Seattle Climate Partnership). In 2008, the City reached the Climate Action Plan's goal of reducing Seattle's global warming pollution by at least 7 percent below 1990 levels.

Discussion: The scale of global climate change is so large that a project's impacts can only be considered on a cumulative scale. It is not anticipated that a single development project or programmatic action, even one on a scale of the development alternatives in this EIS, would have an individually discernable impact on global climate change. It is more appropriate to consider that the greenhouse gas emissions from future development in the South Lake Union neighborhood would combine with emissions from across the state, country and planet to cumulatively contribute to global climate change.

Section 3.7 of this EIS considers potential greenhouse gas emissions associated with the alternatives. In general, the analysis concludes that the three action alternatives produce transportation greenhouse gases per capita that are about five percent lower than the no action alternative. Compared to a similar suburban employment center, per capita transportation greenhouse gas emissions are about 15 lower in South Lake Union. This is due to the relatively higher density of development and proximity to other uses in South Lake Union compared to the suburban setting. Please see Section 37 for the complete discussion of potential greenhouse gas impacts associated with the proposal.

Seattle Transportation Planning Documents

In addition to the Comprehensive Plan, which establishes a land use and transportation vision and direction for the City, there are several specialized implementing plans that address pedestrian, bicycle, transit. These plans provide additional context for the transportation analysis and are briefly described below.

Seattle Pedestrian Master Plan

The *Seattle Pedestrian Master Plan*, published in 2009, aims to make Seattle the most walkable city in the country. To accomplish this mission, the Master Plan lays out four goals: safety, equity, vibrancy, and health. The Plan identifies the physical design elements of a walkable street and the types of destinations that create high pedestrian demand. Six objectives are presented:

> *Objective 1.* Complete and maintain the pedestrian system identified in the Pedestrian Master Plan.
>
> *Objective 2.* Improve walkability on all streets.
>
> *Objective 3.* Increase pedestrian safety.
>
> *Objective 4.* Plan, design, and build complete streets to move more people and goods.
>
> *Objective 5.* Create vibrant public spaces that encourage walking.
>
> *Objective 6.* Get more people walking for transportation, recreation, and health.

A web-based toolbox of strategies provides possible solutions to address various pedestrian issues. The *Pedestrian Master Plan* also contains an analysis that prioritizes each neighborhood's infrastructure needs and most of South Lake Union is rated as high priority.

Seattle Bicycle Master Plan

The Seattle *Bicycle Master Plan* was published in 2007 and sets forth actions to be completed by 2017. This is to be accomplished using the Complete Streets Policy as a guide and the "Bridging the Gap" initiative as a funding source. The *Bicycle Master Plan* has two central goals:

- *Goal 1*: Increase use of bicycling in Seattle for all trip purposes. Triple the amount of bicycling in Seattle between 2007 and 2017.
- *Goal 2*: Improve safety of bicyclists throughout Seattle. Reduce the rate of bicycle crashes by one third between 2007 and 2017.

The plan aims to provide bicycle facilities within a quarter mile of 95 percent of Seattle residents. In addition to simply adding bicycle facilities, the *Bicycle Master Plan* contains guidance regarding the provision of supporting elements such as parking, showers, and integrated transit service. The plan also recommends partnering with other agencies to help provide education, enforcement, and encouragement programs.

Seattle Transit Master Plan

The Seattle Transit Master Plan (TMP) is currently being developed by SDOTthe Seattle Department of Transportation and builds upon the 2005 Seattle Transit Plan. The TMP is proposed to addresses transit planning through 2030. The plan will determine which corridors require transit, and what mode should be implemented in each corridor. The TMP is aimed at creating an integrated transit system between SDOTthe City of Seattle, King County Metro, and Sound Transit.

Seattle Transit Master Plan

Urban Village Transit Network

In 2005, the Seattle Department of Transportation (SDOT) established the Urban Village Transit Network (UVTN). The UVTN is a recommended network of transit corridors to connect Seattle's urban villages. The goal is for UVTN lines to provide transit service at least every fifteen minutes in both directions, eighteen hours a day, seven days a week. This frequency of service allows for rapid transfers and removes the need for travelers to consult schedules. The UVTN calls for local transit service on the following streets in the study area:

Urban Village Transit Network

- Dexter Avenue N
- Westlake Avenue N/Terry Avenue N
- Valley Street
- Fairview Avenue N
- Denny Way

There are no bus rapid transit or light rail lines planned in the South Lake Union neighborhood, however, Mercer Street is a candidate UVTN corridor.

While the UVTN establishes a vision for transit service in Seattle, King County Metro and Sound Transit operate the transit systems and have their own procedures related to transit system planning, expansion, financing, and operations that are outside the control of the City of Seattle.

South Lake Union Transportation Study

The South Lake Union Transportation Study was released in 2004. It analyzed the changing transportation needs of the neighborhood due to expected housing and employment growth through 2020. The transportation study set out potential strategies to manage congestion and enhance mobility that can be used throughout the study area. Some of the recommendations have since been (or are in the process of being) implemented, including converting Mercer Street, Roy Street, 9th Avenue N, and Westlake Avenue N to two-way operations.

South Lake Union Transportation Study

Terry Avenue North Street Design Guidelines

The Seattle Department of Transportation and the Seattle Department of Planning and Development released the Terry Avenue North Street Design Guidelines in 2005. The document aims to develop Terry Avenue N into a pedestrian-oriented streetscape. Terry Avenue N was chosen due to its central location within South Lake Union, its connection from downtown straight into the Lake Union Park, and its relatively low vehicle volumes. The guidelines lay out the design principles (including curb specifications, landscaping, materials and Americans with Disabilities Act standards implementation) that should be used as Terry Avenue N is redeveloped.

Terry Avenue North Street Design Guidelines

Lake to Bay Loop

The Lake to Bay Loop is a planned multi-use path with a pedestrian focus. It may include public sidewalks and open spaces as well as private land. The route takes on a figure-eight shape, running from Myrtle Edwards Park through Seattle Center to Lake Union Park along Broad Street, 5th Avenue N, Mercer Street, Terry Avenue N, and Thomas Street. The Lake to Bay Loop would be implemented incrementally as various transportation and private development projects are completed.

Lake to Bay Loop

> Discussion: The mixed use development pattern considered under all of the alternatives is consistent with the multimodal transportation system anticipated by these transportation system plans. These plans provided context for the transportation analysis documented in this EIS.
>
> As shown in the Transportation section (Figure 3.13.1), not all existing headways through South Lake Union meet the frequency goal of 15 minutes throughout the day. Those routes include 16,

17, 25, 26, 28, 30, 66, and 70. The City of Seattle travel model forecasts all existing route headways[1] to decrease between the base year and future year. Therefore, some of these routes may meet the UVTN goals in the future. This change in frequency is independent of any of the alternatives analyzed in this document.

Please see Section 3.13 for the full transportation analysis.

Parks and Recreation 2006 Development Plan

In 2006, the City of Seattle adopted the *Parks and Recreation 2006 Development Plan*, which replaced the *Parks and Recreation Plan 2000*. The *2006 Development Plan* identifies goals, objectives and policies for the Parks and Recreation system, identifies distribution guidelines for parks and open space, and provides an analysis of gaps in areas of the City where parks and open space distribution guidelines remain to be met.

As it relates to the South Lake Union neighborhood, distribution guidelines are broken up into two categories: Total Open Space (Breathing Room) and Usable Open Space.

- Total Open Space (Breathing Room) – The combined acreage of all dedicated open spaces (parks, greenspaces, trails, and boulevards), but not including tidelands and shorelands. One acre per 100 residents is desirable; one-third acre per 100 resident or community approved offset is acceptable.
- Usable Open Space – Relatively level and open, easily accessible, primarily green open space available for drop-in use. Publicly owned or dedicated open space that is easily accessible and intended to serve the immediate urban village. This encompasses various types of open space for passive enjoyment as well as activity and includes green areas and hard-surfaced plazas, street parks and pocket parks. One acre per 1,000 households, one acre of urban space per 10,000 jobs in the Downtown urban and one-quarter acre within 1/8 mile of all locations in urban villages density areas is desirable. One-quarter acre within one-half mile or community approved offset is acceptable.

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[1] This excludes Route 30 which no longer serves South Lake Union in 2031 per the City of Seattle travel model.

Discussion: The South Lake Union neighborhood contains approximately 15.7 acres of usable open space (Lake Union Park, Cascade Playground, and Denny Park/Playfield). The *2006 Development Plan* and associated gap analysis identifies the South Lake Union neighborhood as an area that has exceeded the existing and projected distribution guideline goals for urban centers. Please see Section 3.16, Open Space and Recreation, for additional discussion of parks and open space standards.

North Downtown Park Plan

In addition to the city-wide parks development plan, the City of Seattle also adopted a park plan for the North Downtown area (Denny Triangle and South Lake Union Neighborhoods) in 2004. The *North Downtown Park Plan* includes an analysis of existing and future parks and open space needs in the North Downtown area and provides recommendations to address park and open space goals and deficiencies.

Discussion: As described above, the South Lake Union neighborhood would have a surplus of parks and open space in 2024; however, the Denny Triangle Neighborhood, located immediately south of South Lake Union, would have a deficit of approximately 10 acres by 2024. Therefore, the combined North Downtown area would need approximately 8 acres of parks and open space by 2024 to meet future needs. Please see Section 3.16, Open Space and Recreation, for additional discussion of parks and open space standards.

City of Seattle Consolidated Plan for Housing and Community Development, 2009-2012

The Consolidated Plan for Housing and Community Development is a four year plan, updated annually, which outlines Seattle's housing and community development needs, and provides strategies for meeting identified needs. The city's Office of Housing prepares this plan to meet the Department of Housing and Urban Development's requirements for financial assistance. Using a five-year horizon, the plan describes the City's housing, public service and community development needs, and demonstrates how anticipated funding from HUD will be used to address those needs. The Plan also provides policy guidance for implementing City programs funded by four U.S. Department of Housing and Urban Development (HUD) grants.

The three primary HUD goals outlined in the 2009-2012 Plan are:

1. *Promote suitable living environments;*

2. *Support decent housing; and,*
3. *Promote economic opportunity.*

City strategies for achieving these goals that are relevant to the proposed alternatives include:

1 – C. Increase availability of affordable housing.
2 – A. Prevent homelessness
2 – F. Develop and maintain Seattle's supply of affordable rental housing
2 – G. Increase opportunities for low income households to purchase and/or maintain their own home.

> Discussion: Consistent with the goals and strategies outlined above, the EIS alternatives, as identified and discussed in detail in Chapter 2 of this Draft EIS, would encourage economic development and allow a variety of housing types and densities within the South Lake Union Urban Center, which would help to create a mixed-income, mixed-use community where residents can live near services, employment, and transit.
>
> Of the four EIS alternatives, Alternative 1 would provide the greatest development capacity, and would also have the potential through incentive zoning programs to supply the highest number of low income housing units. Alternatives 2 and 3 would also provide increased development capacity, as well as low income housing, but at a lower level than Alternative 1. Alternative 4 would retain the existing zoning and would essentially represent a continuation of the current development trend within the neighborhood.

South Lake Union Urban Center Neighborhood Plan

Completed in 2007, the South Lake Union Urban Center Neighborhood Plan (Neighborhood Plan) is a free-standing plan that establishes goals, policies and strategies supportive of its urban center designation. The Neighborhood Plan is intended to help to implement the adopted neighborhood goals and policies in the City's Comprehensive Plan. Plan elements include neighborhood character, transportation, parks and open space, housing and sustainable development. Portions of the Neighborhood Plan have been adopted as part of the City's Comprehensive Plan.

The Plan states that the South Lake Union Neighborhood will:

- *balance housing and job growth, providing a live/work neighborhood;*
- *provide a model for sustainable redevelopment and infrastructure;*
- *respect the neighborhood's marine and industrial past, but welcome change;*
- *be easy to get around on foot, bike, boat, transit and car;*
- *attract innovative industries and organizations; and*
- *be safe and attractive to a diverse range of families and households.*

The following goals, policies and strategies from the *South Lake Union Urban Center Neighborhood Plan* are the most applicable to the proposed alternatives.

Neighborhood Character

Strategy 1d – *Encourage residential and job growth to promote a vital and vibrant neighborhood and to meet neighborhood growth targets.*

Strategy 2a – *Support the key characteristics of neighborhood sub-areas.*

Strategy 2b – *Provide incentives for the retention and adaptive reuse of existing buildings that meet goals for subareas or that can help maintain a diversity of building styles.*

Strategy 2c – *Use additional height and density as an incentive for projects that implement multiple neighborhood plan policies where the additional height will not negatively affect the surrounding area, flight paths or key public view corridors.*

Discussion: Development under the proposed EIS alternatives would be consistent with the emerging pattern of development that is occurring throughout the South Lake Union area, but each alternative describes a different approach to the pattern of height and density in the neighborhood. In general, Alternative 1 proposes the greatest increases for both commercial and residential development. Similarly, Alternative 2 provides for height and density increases for both residential and commercial development, but relatively less than Alternative 1. Alternative 3 would focus height and density increases primarily in residential development, although some commercial increases are permitted. Alternative 4 would retain the existing zoning standards and height limits. Please see Chapter 2 for a detailed description of each alternative.

Future building design under each of the alternatives would be consistent with the South Lake Union design guidelines, which include consideration of neighborhood character and encouragement of the preservation, reuse and/or rehabilitation of older structures, as well as historically significant structures in the neighborhood.

Transportation

Goals
SLU-G6. A livable, walkable community that is well served by transit and easy to get around by foot, bicycle, or transit.

SLU-G7. A transportation system that provides safe, convenient access to businesses, residences, and other activities in the neighborhood.

SLU-G8. A well-connected neighborhood with bicycle, pedestrian, waterborne, and vehicular access to adjacent neighborhoods.

SLU-G9. A neighborhood with principal arterials that move people and freight efficiently through the neighborhood, support local access, and provide circulation for all modes.

Policies
SLU-P17. Work with transit agencies to provide transit service to and through South Lake Union to meet growing demand and changing markets.

SLU-P18. Promote a system of safe pedestrian and bicycle connections linking key activity areas and destinations, such as open spaces, schools, and arts facilities.

SLU-P19. Collaborate with businesses, developers, housing providers and transit providers to reduce demand for automobile trips by making transit and other alternative modes attractive choices for residents and commuters.

SLU-P20. Develop flexible off-street parking requirements that provide parking adequate to a building's occupants and encourage the use of transit, walking, bicycling, and other non-automotive modes.

SLU-P21. Encourage the efficient use of on-street parking for neighborhood businesses, residents and attractions through innovative parking management and pricing strategies.

SLU-P22. Explore transportation improvements to link South Lake Union with its surrounding neighborhoods.

SLU-P23. Seek to provide improved access to and connections across Aurora Avenue North that result in a more integrated and efficient transportation system for multiple transportation modes.

SLU-P24. Create a street network that enhances local circulation and access for all modes of travel by balancing the need to move people and freight efficiently through the neighborhood with the need for increased accessibility and safety for pedestrians and bicyclists.

SLU-P25. Encourage improvements to Mercer and Valley Streets that support development of South Lake Union Park, improve neighborhood circulation for all modes, and move people, and freight efficiently through this corridor.

> Discussion: The transportation analysis conducted in this EIS considers all modes of travel and potential trip/travel patterns specifically associated with mixed use infill development. Please see the discussion under the Transportation Element of the Seattle Comprehensive Plan, above.

Housing

Strategy 33a – Provide programs and incentives that support the development of housing affordable to lower- and moderate-income households.

Strategy 33c – Support the adaptive reuse of existing buildings for housing.

Strategy 33d – Consider incentives to encourage the development of street-oriented units, such as townhouses and live-work units.

Strategy 34b – Provide affordable and workforce housing units at the same time as other new units.

Strategy 34c – Seek new sources of housing subsidies for affordable housing.

Strategy 34d – Work with property owners to identify sites for low-income housing.

Strategy 34e – Assess City-owned parcels in, or adjacent to, South Lake Union for their potential to facilitate low income housing development.

Strategy 35a – Market incentive programs to apartment, townhouse, cooperative and condominium developers.

> Discussion: Consistent with the strategies in the Housing section of the *Neighborhood Plan*, the EIS Alternatives would promote more intensive urban development in the neighborhood and would promote additional housing development opportunities within the South Lake Union Urban Center. All of the action proposals would provide additional capacity and opportunity for

development of affordable housing, consistent with adopted City policy and any potential incentive zoning programs that could be adopted and implemented by the City in the future.

South Lake Union Urban Design Framework

The South Lake Union Urban Design Framework (Design Framework) is intended to establish a design vision and implementation strategy that will help realize the vision described in the Neighborhood Plan. The Design Framework was developed in in 2008 and 2009 through an interactive public process that progressed through a series of workshops with participation by public and private planners, urban designers, architects, landscape architects and neighborhood members. The UDF will guide the work of the Seattle Department of Planning and Development and other departments within the City.

The Design Framework provides specific recommendations for the following areas:

- Gateways, hearts, and edges
- Street character
- Residential and retail focus areas
- Residential open space strategies
- Public space network
- Views
- Upper-level setbacks
- Urban form
- Lakefront
- Neighborhood connections
- Green stormwater infrastructure
- Incentive zoning priorities

The guiding principles identified in the Urban Design Framework are excerpted below:

- *Set a clear vision for South Lake Union's future development that reflects the neighborhood's unique setting*
- *Integrate South Lake Union with adjacent neighborhoods*
- *Create a network of great streets with safe connections for all modes*
- *Development a diverse system of open spaces and community services*

- *Revise zoning and design guidelines to support an urban form appropriate to SLU's physical setting and Urban Center designation*
- *Create opportunities for families in clusters along 8th Avenue and around Cascade Park*
- *Guide new affordable housing investment*[2]

The Executive Summary of the Design Framework summarizes the intent of the design recommendations as follows:

> *Specific recommendations include organizing the neighborhood around community "hearts" including Lake Union Park, Westlake Avenue, and Cascade People's Center, creating innovative new green streets and other street types, and clustering residential and retail uses, including a requirement for pedestrian-oriented uses along Westlake and Valley Streets. Residential clusters in these recommendations would be anchored by highrise towers wrapped with ground-level housing and open space. View corridors and sunlight access to streets were carefully considered, leading to recommendations to limit the number of new towers allowed close to Lake Union and for upper-level setbacks to preserve a range of public views.*[3]

> Discussion: Work conducted on the Design Framework provided the groundwork for the alternatives considered in this EIS, including alternatives that provide for a residential focus in the 8th Avenue Corridor, maintain a residential focus in the Cascade neighborhood, and provide for pedestrian-oriented uses at street level. Recommendations also inform applicable mitigation strategies in this EIS, especially those identified in the aesthetics element, see Section 3.10 of this EIS.

South Lake Union Multimodal Transportation Mitigation Program

South Lake Union was the pilot area for Seattle's multimodal transportation mitigation program. The program was developed to

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[2] City of Seattle Department of Planning an d Development. South Lake Union Urban Design Framework. December 31, 2010.

[3] City of Seattle Department of Planning and Development. South Lake Union Urban Design Framework. December 31, 2010.

address not only the road impacts, but also the pedestrian, bicycle and transit impacts, caused by new developments. As described previously, the GMA authorizes impact fees, but only allows payments for road improvements. In response, Seattle has implemented a multimodal impact fee using the voluntary agreement provision in the State Environmental Policy Act (SEPA). The impact fee is calculated using the person trips generated by the proposed development and the expected cost per trip. The funds are used for transportation projects that meet at least one of the following criteria:

- Add capacity to the transportation system in the area (considering all modes)
- Provide better multimodal mobility
- Reduce congestion

The funds may not be used to address existing deficiencies in the transportation system. Examples of eligible projects in the South Lake Union neighborhood include adding bicycle lanes to Fairview Avenue N between Eastlake Avenue and Valley Street, adding stop signs at uncontrolled intersections along Thomas Street and Harrison Street, and installing additional bus shelters.

> Discussion: The process and criteria established in this program were used as background context in consideration of mitigation strategies for the transportation analysis see section 3.13 of this EIS.

Seattle Land Use and Zoning Code

Consistent with provisions of the Growth Management Act, Seattle's Land Use Code implements the goals and policies of the City's Comprehensive Plan. Most of the neighborhood is currently zoned Seattle Mixed (SM) with height limits ranging from 40 feet to 125 feet with most areas in the 65-foot to 85-foot height range. Generally, the tallest buildings are allowed at the southern edge of the neighborhood abutting downtown, and decrease moving northward to the lake, with the lowest height areas along the shoreline. The SM zone provides for a range of residential and commercial uses to support a pedestrian-oriented mixed-use neighborhood. The Cascade neighborhood, east of Fairview and south of the Mercer ramps to I-5, is zoned Seattle Mixed (SM) and Seattle Mixed/Residential (SM/R). Both of these zones allow mixed residential and non-residential uses, but the SM/R zone includes special provisions to encourage residential development. An Industrial Commercial (IC) designation is located in the central part of the neighborhood. This designation allows for a mix of industrial and commercial uses, including high technology research and development uses, and prohibits most types of residential development. To the northeast and near Lake Union, property is zoned Commercial 2 (C2), providing for auto-oriented, primarily non-retail commercial uses.

As with Seattle's other zoning districts, these zones contain provisions relating to land uses and development regulations, including maximum building heights and Floor Area Ratio (FAR). Use provisions in these zones identify land uses that are permitted outright, uses that may be conditionally authorized, and land uses that are prohibited; a wide variety of land uses are permitted outright in each of these zoning districts.

> Discussion: Consistent with the City's Comprehensive Plan and in order to meet the goals of the South Lake Union Urban Center Neighborhood Plan, the City proposes to change the existing zoning designations to increase height and density in certain areas of the South Lake Union neighborhood. Four EIS Alternatives have been identified by the City, each of which describes a different approach to the pattern of height and density in the neighborhood – please see **Figures 2-6** through **2-8** for newly proposed changes to existing zoning. **Table 2-3** also summarizes the key features of each of the alternatives.
>
> In general, Alternative 1 would provide for the greatest proposed increases for both commercial and residential development through incentive zoning provisions. Under Alternative 1, the existing IC area would be rezoned to a Seattle Mixed zone and the neighborhood would permit varying maximum building heights through incentive zoning provisions. Similarly, Alternative 2 provides for height and density increases for both residential and commercial development, but relatively less than Alternative 1. Alternative 3 would focus height and density increases primarily in residential development, although some commercial increases are permitted. Alternative 4 would retain the existing zoning standards and height limits.

Seattle Environmental Policies and Procedures

Federal Air Regulations Part 77

<u>Seattle Environmental Policies and Procedures</u>

Seattle Municipal Code Chapter 25.05 establishes local SEPA Rules, as authorized by WAC 197-11. The City's SEPA Rules are intended to establish a process that provides useful information to decision-makers in clear documents that are supported by environmental analysis, SMC 25.05.675 provides specific policy guidance for review of the environmental topics established under SEPA.

> <u>Discussion:</u> This EIS follows the guidance provided by the City's SEPA Rules. Where appropriate, analyses of specific elements of the environment included in Chapter 3 provide a short summary of the environmental policies found in SMC 25.05.675 for the topic under consideration. Please see individual elements of the environment in Chapter 3 of this EIS.

<u>Federal Air Regulations Part 77</u>

The navigable airspace around an airport is delineated in accordance with standards set forth in Federal Aviation Regulations (FAR) Part 77. The regulations define a set of imaginary surfaces in the air around an airport. FAR 77 approach/departure surface width, length, angles and slopes vary depending on the category of airport to which they are applied and the kinds of approaches (visual or instrument) that are anticipated. A key feature is their slope ratio, or angle of rise-over distance. Any object – including structures, trees, antennae – that penetrate the airspace is considered an obstruction and problematic.

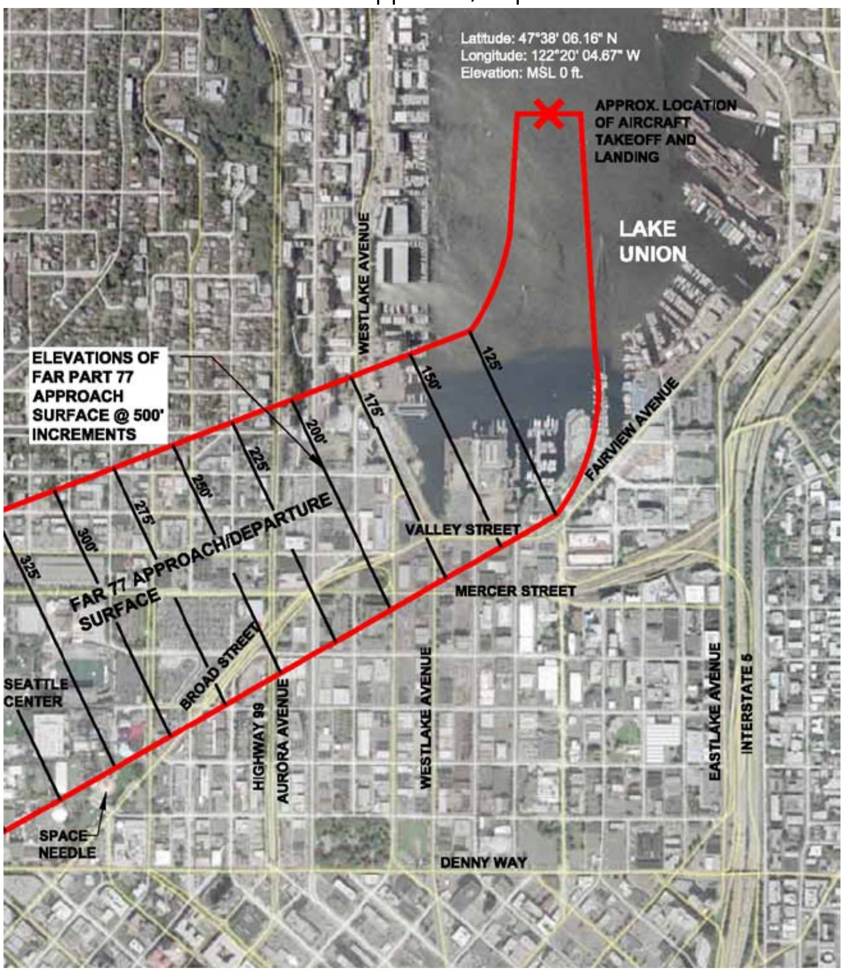
For Lake Union air operations, the key issue is the height, width and location of the approach surface for departures. A 20:1 (5 percent) slope has been identified as appropriate for Lake Union air operations.[4] As the slope rises from the lake surface at a 20:1 ratio, it also widens at a 10:1 angle. **Figure 3.8-1** shows the FAR 77 approach/departure imaginary surface as it rises and widens over the South Lake Union area. In this figure, the red "x" identifies the approximate location where aircraft will depart and land on the water. The red lines define the width of the flight path south and west of Lake Union that is necessary to protect the airspace for approaches and departures associated with Lake Union. The

20:1 Ratio: This is a ratio of the horizontal distance to the vertical rise. For example, for every 200 feet of horizontal distance, the height would increase by 10 feet.

[4] Washington State Department of Transportation, Aviation Division. Letter from Carter Timmerman dated February 3, 2011.

black lines identify the height of the flight path surface as that surface rises at a 20:1 slope and widens at a 10:1 angle.

Figure 3.8-1
FAR 77 Approach/Departure Surface



Source: Washington Department of Transportation, Aviation Division, 2010

This flight path represents a refinement by the Washington State Department of Transportation (WSDOT) of earlier flight path information that was available. Lake Union is considered a general use airport. WSDOT has jurisdiction and Washington State Regulations (RCW 36.70.547, RCW 36.70A.510, and RCW 36.70.547) require that "[e]very county, city, and town in which there is located a general aviation airport … shall, through its comprehensive plan and development regulations, discourage the siting of incompatible uses adjacent to such general aviation airport."

In the South Lake Union neighborhood, the flight path crosses over the northwest portion of the study area in a northeast/southwest diagonal direction. At the northern most point, the flight path enters the study area from the Lake Union shoreline at roughly Highland Street. At the southernmost point, the flight path exits the study area at Aurora Avenue N, roughly between Republican and Harrison streets. The approach/departure surface within the flight path (shown in **Figure 3.8-1**) rises from approximately 150 feet in elevation at the Lake Union shoreline to between 200 to 250 feet in elevation as it leaves the study area. This surface represents the height of the flight corridor over the study area. Buildings or other obstructions above this surface would create an obstruction into the flight path.

In addition, establishment of a vertical buffer below the approach surface, would ensure safety in the event of mechanical or other problems in the departure or arrival of aircraft. A vertical buffer would establish a minimum distance for structures and appurtenances from the identified approach surface. FAR 77 does not require a vertical buffer.

8th Avenue N. Corridor and Fairview Avenue N. Corridor

The 8th Avenue N. and the Fairview Avenue N. corridors are outside of the identified flight path. Development in these areas would not directly impact the approach/departure surface.

Valley/Mercer Blocks

The entire block between Westlake and 9th Avenues and portions of the blocks between Westlake and Boren avenues is located within the approach/departure surface (see **Figure 3.8-1**). In this area, the approach/departure surface increases from approximately 160 feet in elevation near the Lake Union shoreline to about 175 feet in elevation near the intersection of Westlake and Mercer.

Wind Analysis

This section reviews the potential for the proposed alternatives to affect wind conditions, and ultimately approaches and departures associated with float planes into and out of Lake Union.

Affected Environment

Flight Operations

Lake Union has been the site of commercial seaplane operations since the early 1920s. Kenmore Air, presently the largest commercial operator on Lake Union, has operated commercial flights from the lake since the mid 1940s. In the mid-to-late 1980s, scheduled commercial seaplane operations were initiated by Kenmore Air from a temporary base on the east side of the lake. In 1991, Kenmore's operations moved to a permanent location at the lake's southwest corner. From Lake Union, the airline connects downtown Seattle with destinations in the San Juan Islands and Canada. Flights are operated year around from 8 am (weekdays) or 9 am (weekends) to dusk. During the most active time, late spring through early fall, Kenmore Air operates an average of 80 daily arrivals and departures. Total passengers served at the Kenmore Air Lake Union base, which also acts as a US Customs Service Port of Entry, exceeded 80,000 in 2009.

Flights to and from Lake Union operate in either a northerly or southerly direction, depending on wind conditions. When wind is from the south, departures from Lake Union are to the southwest and approaches to Lake Union are from the northwest. When wind is from the north, departures are to the northwest and approaches are from the southwest. Consequently, regardless of wind direction, the area between the south shore of Lake Union over Seattle Center to Puget Sound is a primary flight path. A secondary route, used occasionally for approaches to Lake Union, is from the southeast over Fairview Avenue.

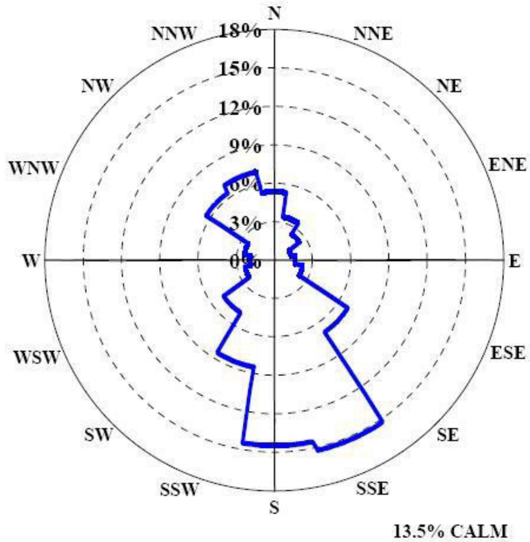
Existing Wind Conditions

Wind statistics from Boeing Field/King County and Seattle-Tacoma International Airports were reviewed to understand typical wind conditions in the region. Dominant winds at Boeing Field/King County International Airport are from the south and south-southeast directions (see **Figure 3.8-2**). Seattle-Tacoma International Airport shares the strong southerly dominance, but also has notable southwest and north winds. For the purpose of this review, southerly winds were considered to be dominant, coming directly over the study area and into the southern tip of Lake Union. Westerly winds are also important because, although they do not occur frequently, these winds blow over the development area coinciding with the aircraft approach/departure surface.

Diurnal Trends

The majority of air flights to and from Lake Union operate between 8AM and dusk. Wind direction can often change from day to night due to land and sea breeze effects. A review of diurnal ("daily") average wind statistics from the closer Boeing/King County airport confirms the strong southerly dominance during the daytime and early evening hours, although the summertime brings more northwesterly winds in the afternoon and evening.

Figure 3.8-2
Dominant Wind Pattern, Puget Sound Area



ALL ANNUAL WINDS

Source: RWDI, 2010

3.8.2 Environmental Impacts

Land Use Plans, Policies and Regulations

As described above, the proposed action is generally consistent with adopted City plans, policies and regulations. With regard to development capacity and growth targets, all of the alternatives provide adequate capacity to meet 2024 growth targets. Although the City has been assigned a citywide growth target for 2031, it has not yet allocated the citywide number among the neighborhoods. Therefore, it is not possible to confirm whether each of the alternatives will provide sufficient development capacity to meet a future 2031 growth target for the neighborhood. Based on an initial estimate of the 2031 target (see discussion in Chapter 2, section 2.2.2), all of the action alternatives have capacity that exceeds the 2031 estimated target. The no action alternative does not have capacity to meet the 2031 estimate.

The proposal will provide additional capacity and opportunity for development of affordable housing, consistent with adopted City policy. At the same time, factors such as market conditions, individual developer decisions and availability of financing also impact future development decisions about affordable housing. Zoning incentives to promote

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provision of affordable housing units can help expand the affordable housing inventory. Please see Section 3.9, Housing, of this EIS for additional discussion of housing in the neighborhood.

With respect to FAR Part 77, some of the proposed building heights for any of the action alternatives could penetrate the identified approach/departure airspace. The relative impacts of each alternative are described below.

Alternative 1

Within the area beneath the flight path, Alternative 1 allows a maximum building height of 300 feet for residential uses and up to 240 feet for commercial uses. If built to the maximum height limit allowed, conceivably some buildings under this alternative would rise above the approach/departure surface.

Depending on whether a vertical buffer is established below the approach surface and the size of this buffer, some proposed buildings could protrude into the buffer.

Valley/Mercer Blocks

Under Alternative 1, structures built to the maximum 300 feet in height would obstruct the approach/departure surface. At a maximum height of 85 feet, commercial development would not penetrate the approach/departure surface. However, depending on whether a vertical buffer below the surface is established and the size of the buffer, development to 85 in height could intrude into the buffer.

Alternative 2

Within the area beneath the flight path, Alternative 2 would allow a maximum building height of 300 feet for residential uses and 85 to 160 feet for commercial uses. If built to the maximum height limit allowed under this alternative, some buildings could penetrate the approach/departure airspace.

Depending on whether a vertical buffer below the approach surface is established and the size of this buffer, some proposed buildings could protrude into the buffer.

Valley/Mercer Blocks

Under Alternative 2, structures built to the maximum height of 160 feet may, depending on building location, obstruct the approach/departure airspace. At a maximum height of 65 feet, commercial development would not obstruct the approach/departure surface. However, depending on whether a vertical buffer is established below the approach/departure surface and the size of the buffer, new residential or commercial development could penetrate the buffer.

Alternative 3

Within the area under the flight path, Alternative 3 would allow a maximum building height of 160 feet for residential uses and 65 to 160 feet for commercial uses. In general, building heights permitted under this alternative are lowest near the shoreline and increase in height further south. Therefore, permitted building heights under this alternative appear to be at or below the approach/departure airspace.

Depending on whether a vertical buffer below the approach/departure surface is established and the size of this buffer, some proposed buildings could protrude into the buffer.

Valley/Mercer Blocks

Under Alternative 3, it is unlikely that structures built to the maximum allowed height of 125 feet would penetrate the approach/departure airspace. At a maximum height of 85 feet, commercial development would not obstruct the approach/departure surface. However, depending on whether a vertical buffer below the surface is established and the size of the buffer, new residential or commercial development could intrude into the buffer.

Alternative 4

The No Action alternative would not impact the approach/departure airspace. Permitted building heights of 40 to 85 feet are below the flight path. Depending on whether a vertical buffer below the approach surface is established and the size of this buffer, some proposed buildings may protrude into the buffer.

Valley/Mercer Blocks

Under Alternative 4, permitted buildings heights of 40 feet would not penetrate the approach/departure airspace and it is unlikely that such buildings would protrude into any future buffer.

Wind Analysis

The addition of significantly taller buildings directly south of Lake Union could generally increase the potential for:

- increased height of vertical wind wake zones and consequently shear layers;
- introduction of wake effects extending into Lake Union;

- increase in turbulence intensity north of the neighborhood; and;
- change in local wind speed patterns.

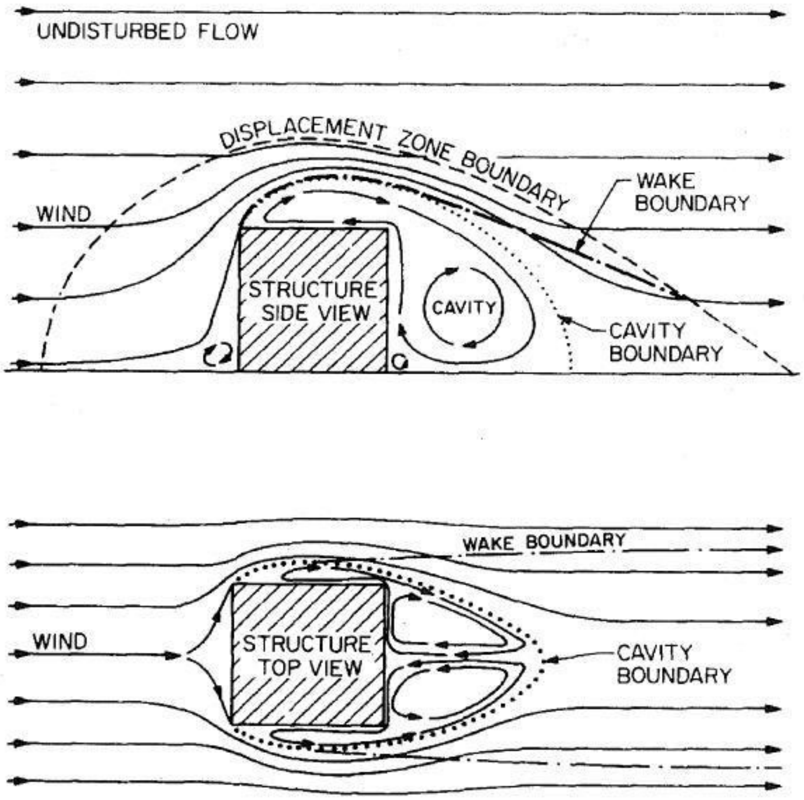
Wind shear describes an atmospheric boundary in which there is a rapid change in speed and/or direction. Wind shear can affect aircraft by resulting in sudden changes in altitude. Large buildings push wind up and over their roofs, resulting in a relatively calm "wake zone" resembling a bubble (see **Figure 3.8-3**). The wind speeds at the outer edge of these wake zones are accelerated while speeds within the zone are calmer, resulting in a wind speed differential shear layer above the buildings.

Turbulence is caused by rapid irregular motion of air and does not typically influence the intended flight path of an aircraft significantly. However, in severe cases abrupt changes in the attitude and altitude of an aircraft may occur and the pilot may suffer a momentary loss of control.

The ambient wind to which an aircraft is exposed is an important factor affecting aircraft performance. Sudden changes in wind speed or high levels of turbulence can have significant effects on the small aircraft aerodynamic response and thus can affect their safety margin (Peterka & Cermak [1975]).

Although the size of these building induced wake zones and shear layers is defined by the shape of the building or structure itself, the wind speed differential would be higher as the approaching wind speed increases. It is, therefore, important that aircraft, particularly small aircraft, fly beyond these zones.

Figure 3.8-3
Illustration of Building Wake Zones, both in Section (top) and Plan (bottom) view.



Source: RWDI, Inc., 2010

Similarly, winds flowing over top of a large structure will form large wakes on the leeward (downwind) side of the structure (see **Figure 3.8-3**). This is another important shear layer as the winds within this zone would be lower than outside it. However, there can be an increase in the creation of turbulent eddies both within the zone and further downwind where the zone is less defined. The most significant effects of these leeward zones can extend three building heights downwind (Drivas & Shair [1974]); however, full recovery of the wind stream (i.e., back to undisturbed state) would occur much farther downstream. For example, turbulence recovers up to 10 building heights downwind (Kothari *et al.* [1986]) and velocity even farther at 20 or more building heights (Peterka & Cermak [1975]). Within the main leeward zone, the wind direction can also change, flowing opposite the approaching wind direction heading back towards the structure.

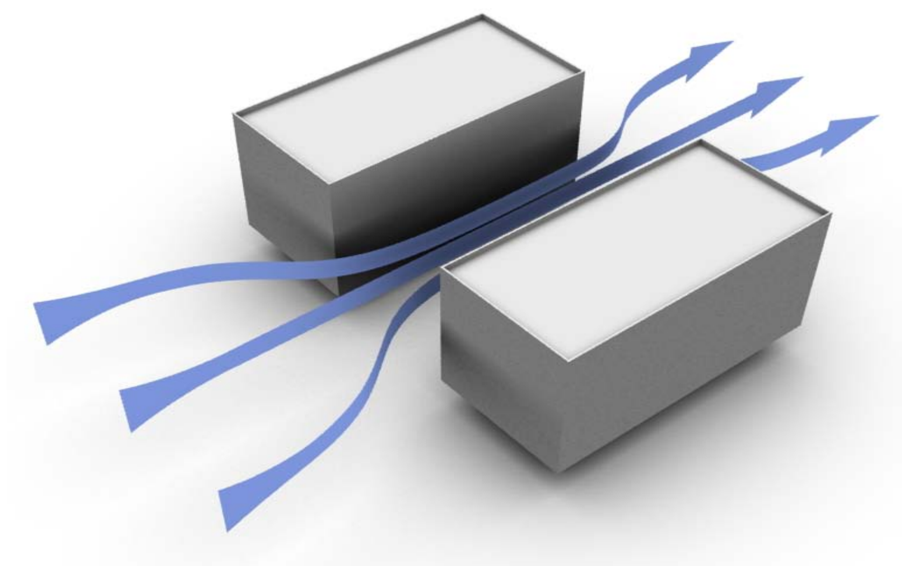
The size and potential for wake zones depends on many factors such as the height and width of buildings, shape and orientation of buildings, development density, variability in building heights across a neighborhood, wind direction, etc.

Impacts Common to All Alternatives

Development under the action alternatives would result in increased building façade area fully exposed to winds at their perimeters. This is where the most significant rooftop wakes (and shear layers) would be created.

Under some of the alternatives, the maximum height of buildings is higher than the anticipated elevation of float planes travelling over/through this area. Apart from the risk of physical impact, small aircraft flying through a "canyon" or "corridor" of tall structures can be significantly affected by turbulent, local winds channeling and accelerating between buildings (see **Figure 3.8-4**).

Figure 3.8-4
Illustration of "channeling" of wind between buildings. The channeled winds are accelerated.



Source: RWDI, 2010

Alternative 1

Alternative 1 includes the potential for the largest/tallest building massing among the three action alternatives. **Table 3.8-1** summarizes the estimated size and extent of the more critical vertical (above building) and leeward (into Lake Union) wake/shear layer zones.

Table 3.8-1
Estimated Wake Zone / Shear Layer Boundary (Alternative 1)

Wind Direction (from)	**Building Block (upwind street)**	**Height of Vertical Wake Effect[1,2] (ft)**	**Length of Leeward Wake Effect (ft)**
South	Denny Way	90 – 200	800 – 1200
South	Mercer Street	60 – 150	300 – 600
West	Aurora Avenue N	70 – 170	600 – 900

Source: RWDI, 2010

1 *Values are approximate and were estimated using methodologies published by the American Society of Heating Refrigeration and Air Conditioning Engineers (2007).*

2 *Heights are referenced above the tallest building roof level. For example, a height range of 90 – 200 ft for the Denny Way block represents 90 – 200 ft above the tallest 400 ft building for a total of 490 – 600 ft above local grade. The range of wake zones accounts for potential separation between buildings. The upper end of the range assumes high building density in which buildings would act more like a solid mass, pushing vertical wake up higher. The lower end of the range assumes lower building density, in which spaces between buildings would help maintain a lower vertical wake.*

Vertical Wakes

The tallest buildings that would be responsible for the highest vertical shear layers would be located at the extreme south end of the study area. This would help separate the tallest buildings from the Kenmore Air approach/departure surface.

However, as shown in **Table 3.8-2** below, when the estimated vertical wakes are added to proposed building heights, the result exceeds the flight path elevation in the vicinity around Mercer Street and Aurora Avenue N. Where the building height plus the vertical wake exceed the flight path elevation, safety for planes taking off or landing is compromised. Along Denny Way, the tallest buildings would be located between Denny Way and John Street, outside of the flight path, and is shown for information only.

This information is provided to illustrate the magnitude of the potential impact. Regardless of the building height permitted by local zoning, building heights in the approach/departure corridor for the Lake Union Seaport Airport would continue to be limited according to FAA requirements.

Table 3.8-2
Alternative 1 Building Height and Vertical Wake
Compared to Estimated Flight Path Elevation

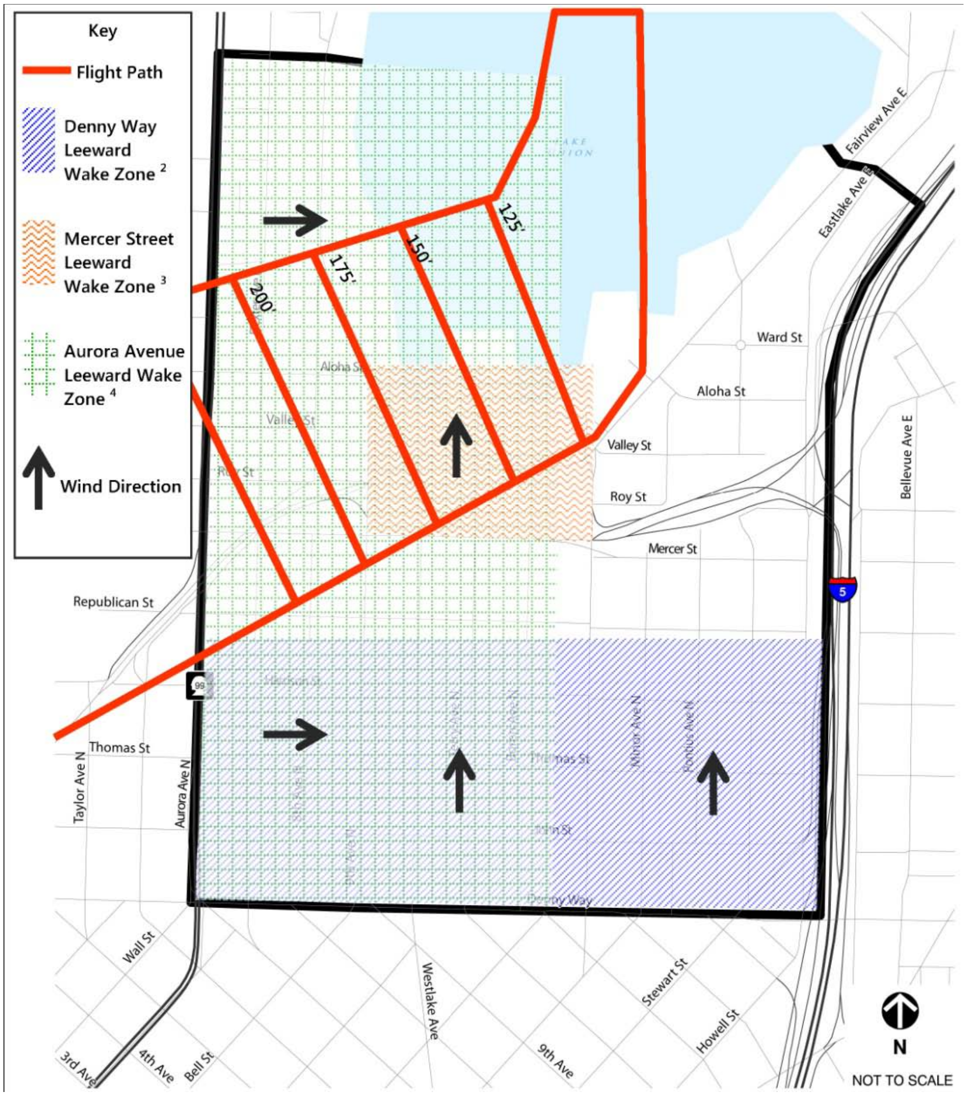
	Mercer Street Vicinity	Aurora Avenue Vicinity	Denny Way Vicinity
Maximum Proposed Building Height	300 feet	300 feet	400 feet
Estimated Vertical Wake	60 to 150 feet	70 to 170 feet	90 to 200 feet
Combined Building Height and Vertical Wake	360 to 450 feet	370 to 470 feet	490 to 600 feet
Estimated Flight Path Elevation	150 to 175 feet	175 to 225 feet	Outside flight path
Maximum Building Height and Vertical Wake Compared to the Flight Path Elevation	Exceeds estimated flight path elevation by 185 to 300 feet	Exceeds estimated flight path elevation by 145 to 295 feet	Outside of flight path

Source: RWDI, EA|Blumen, WSDOT, 2010

Leeward Wakes

In general, the largest estimated leeward wake from Denny Way could reach approximately Harrison Street; from Mercer Street, approximately the southern edge of the Lake Union shoreline and from Aurora Avenue, to the Lake Union shoreline to the north and just west of 8th Avenue North to the south. Although the most significant wake effects would occur within the areas shown in figure 3.8-5, residual effects such as turbulent eddy formation would extend farther into Lake Union and could act to change local wind conditions at the lake. For example, large building massing surrounding the lake could act to slow wind speeds in the approach/departure surface near the lake. (See **Figure 3.8-5**)

Figure 3.8-5
Alternative 1 Estimated Leeward Wake Zone[1]



Source: RWDI, EA|Blumen, 2010

1. *Assumes longest potential leeward wake zone, as shown in **Table 3.8-1**, but does not include residual turbulence area*
2. *Assumes building heights of 400 feet in the area between Denny Way and John St*
3. *Assumes building heights of 300 feet in the area bounded by Westlake Ave N, Fairview Ave N, Mercer St and Valley St*
4. *Assumes building heights of 300 feet in the area between Aurora Ave N and Westlake Ave N*

Note: This figure shows the area of the most significant wake effect; residential effects such as turbulent eddies would extend farter.

Buildings in the northwest portion of the study area, adjacent to Aurora Avenue N may have multiple effects. First, notable wakes, both above the buildings and leeward into Lake Union, would be created for westerly winds. The primary leeward wake would extend well into the approach/departure surface at 600-900 feet from the trailing edge of the development. When the height of the wake is added to the height of the tallest building, the overall elevation of the resulting shear layer may be upwards of 400+ feet above grade. This is significant as the elevation of the aircraft approach/departure surface through this area is only a maximum of 225 feet elevation. Either the flight path would need to be significantly modified, or buildings even as low as 100 ft or less would need to be avoided directly underneath and adjacent to the approach/departure surface, within at least a city block (plan view).

Overall, Alternative 1 is expected to have the most significant effect on local wind patterns and the south approach/departure airspace for float plane accessing Lake Union.

Alternative 2

Compared to Alternative 1, Alternative 2 represents a reduction in building height across the majority of the study area. The southward pattern of buildings is also modified compared to Alternative 1, with heights decreasing from south to north. This is positive as the upwind buildings provide a measure of protection to the shorter downwind buildings, which in turn reduces the potential of these closest buildings influencing the local winds. **Table 3.8-3** summarizes the estimated size and extent of vertical (above building) and leeward (into Lake Union) wake/shear layer zones.

Table 3.8-3
Estimated Wake Zone / Shear Layer Boundary (Alternative 2)

Wind Direction (from)	Building Block (upwind street)	Height of Vertical Wake Effect[1,2] (ft)	Length of Leeward Wake Effect (ft)
South	Denny Way	50 – 130	400 – 700
South	Mercer Street	30 – 90	150 – 400
West	Aurora Avenue N	50 – 130	400 – 700

Source: RWDI, 2010

1 *Values are approximate and were estimated using American Society of Heating Refrigeration and Air Conditioning Engineers (2007).*

2 Heights are referenced above the tallest building roof level. For example, a height range of 50 – 130 ft for the Denny Way block represents 50 – 130 ft above the tallest 240 ft building for a total of 290 – 370 ft above local grade. *The range of wake zones accounts for potential separation between buildings. The upper end of the range assumes high building density in which buildings would act more like a solid mass, pushing vertical wake up higher. The lower end of the range assumes lower building density, in which spaces between buildings would help maintain a lower vertical wake.*

Vertical Wakes

The extent of potential vertical wakes/shear layers resulting from Alternative 2 are significantly lower compared to Alternative 1, particularly when accounting for the differences in building height. However, as shown in **Table 3.8-4** below, when the estimated vertical wakes are added to proposed building heights, the result still exceeds the flight path elevation in the vicinity around Mercer Street and Aurora Avenue N. Where the building height plus the vertical wake exceed the flight path elevation, safety for planes taking off or landing is compromised. Along Denny Way, the tallest buildings would be located between Denny Way and John Street, outside of the flight path, and is shown for information only.

This information is provided to illustrate the magnitude of the potential impact. Regardless of the building height permitted by local zoning, building heights in the approach/departure corridor for the Lake Union Seaport Airport would continue to be limited according to FAA requirements.

Table 3.8-4
Alternative 2 Building Height and Vertical Wake
Compared to Estimated Flight Path Elevation

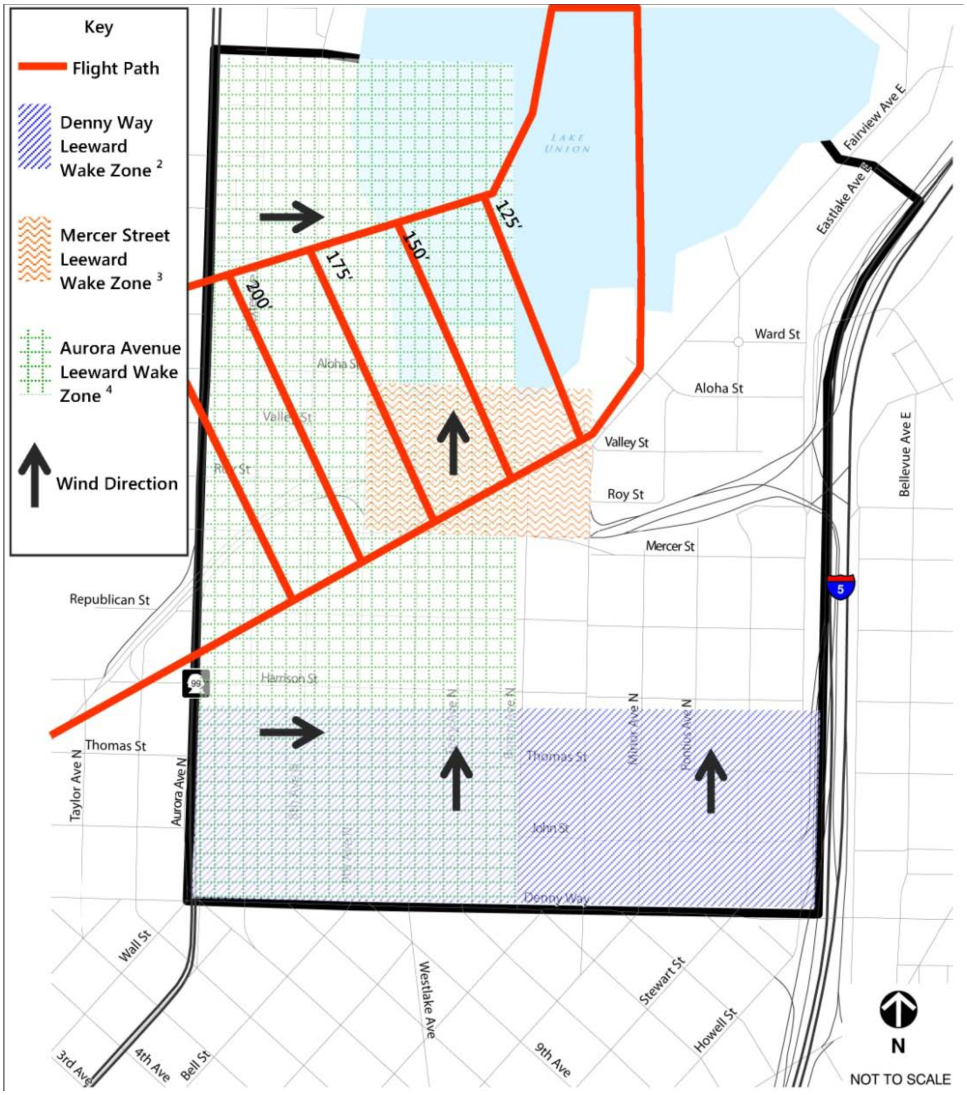
	Mercer Street Vicinity	**Aurora Avenue Vicinity**	**Denny Way Vicinity**
Maximum Building Height	160 feet	300 feet	240 feet
Estimated Vertical Wake	30 to 90 feet	50 to 130 feet	50 to 130 feet
Combined Building Height and Vertical Wake	180 to 250 feet	350 to 430 feet	290 to 370 feet
Estimated Flight Path Elevation	150 to 175 feet	175 to 225 feet	Outside flight path
Maximum Building Height and Vertical Wake Compared to Flight Path Elevation	Exceeds estimated flight path elevation by 5 to 100 feet	Exceeds estimated flight path elevation by 125 to 255 feet	Outside of flight path

Source: RWDI, EA|Blumen, WSDOT, 2010

Leeward Wakes

As shown in **Figure 3.8-6**, the primary leeward wake into Lake Union for south winds is expected to be less significant as well, and is estimated to extend to 400 feet (although residual turbulence would extend further).

Figure 3.8-6
Alternative 2 Estimated Leeward Wake Zone[1]



Source: RWDI, EA|Blumen, 2010

1. *Assumes longest potential leeward wake zone, as shown in **Table 3.8-1**, but does not include residual turbulence area*
2. *Assumes building heights of 400 feet in the area between Denny Way and John St*
3. *Assumes building heights of 300 feet in the area bounded by Westlake Ave N, Fairview Ave N, Mercer St and Valley St*
4. *Assumes building heights of 300 feet in the area between Aurora Ave N and Westlake Ave N*

Note: This figure shows the area of the most significant wake effect; residential effects such as turbulent eddies would extend farter.

This is expected to fall short of the approach/departure surface. This benefit is mainly attributed to the shorter buildings at the lake edge and the overall pattern of consistent building height reductions from south to north.

In the northwest portion of the study area, the shorter building massing in the Aurora Avenue vicinity would still influence winds in the vicinity of the approach/departure surface. However, the shorter buildings represent an improvement over Alternative 1, as they would tend to reduce the extent of the primary leeward wake by about 200 feet. Although the most significant wake effects would occur within the areas shown in **Figure 3.8-6**, residential effects such as turbulent eddy formation would extend farther into Lake Union and could act to change local wind conditions at the lake. For example, large building massing surrounding the lake could act to slow wind speeds in the approach/departure surface near the lake.

Alternative 3

Alternative 3 would have the shortest buildings of the three action alternatives. It also includes a similar reducing progression of building height across the site from south to north as Alternative 2, which is a positive means of reducing wind effects. Of particular interest would be buildings directly adjacent to Lake Union, which are the shortest on the site resulting in the smallest wake/shear effect into the lake among the action alternatives. **Table 3.8-5** summarizes the estimated size and extent of vertical (above building) and leeward (toward Lake Union) wake/shear layer zones.

Table 3.8-5
Estimated Wake Zone / Shear Layer Boundary (Alternative 3)5

Wind Direction (from)	Building Block (upwind street)	Height of Vertical Wake Effect[1,2] (ft)	Length of Leeward Wake Effect (ft)
South	Denny Way	50 – 130	300 – 600
South	Mercer Street	20 – 70	100 – 300
West	Aurora Avenue N	40 – 100	250 – 500

Source: RWDI, 2010

1 *Values are approximate and were estimated using American Society of Heating Refrigeration and Air Conditioning Engineers (2007).*

2 Heights are referenced above the tallest building roof level. For example, a height of 50 – 130 ft for the Denny Way block represents 50 f- 130 t above the tallest 240 ft building for a total of 290 – 370 ft above local grade. *The range of wake zones accounts for potential separation between buildings. The upper end of the range assumes high building density in which buildings would act more like a solid mass, pushing vertical wake up higher. The lower end of the range assumes lower building density, in which spaces between buildings would help maintain a lower vertical wake.*

Vertical Wakes

The extent of potential vertical wakes/shear layers resulting from Alternative 3 would be the lowest among the action alternatives. . As shown in **Table 3.8-6** below, when the estimated vertical wakes are added to proposed building heights, the lowest end of the range would be below the estimated flight path elevation in the Mercer Street vicinity and the amount exceeded in other areas is less than in the other action alternatives, but still above the estimated flight path elevation. Along Denny Way, the tallest buildings would be located between Denny Way and John Street, outside of the flight path, and is shown for information only.

This information is provided to illustrate the magnitude of the potential impact. Regardless of the building height permitted by local zoning, building heights in the approach/departure corridor for the Lake Union Seaport Airport would continue to be limited according to FAA requirements.

Table 3.8-6
Alternative 3 Building Height and Vertical Wake
Compared to Estimated Flight Path Elevation

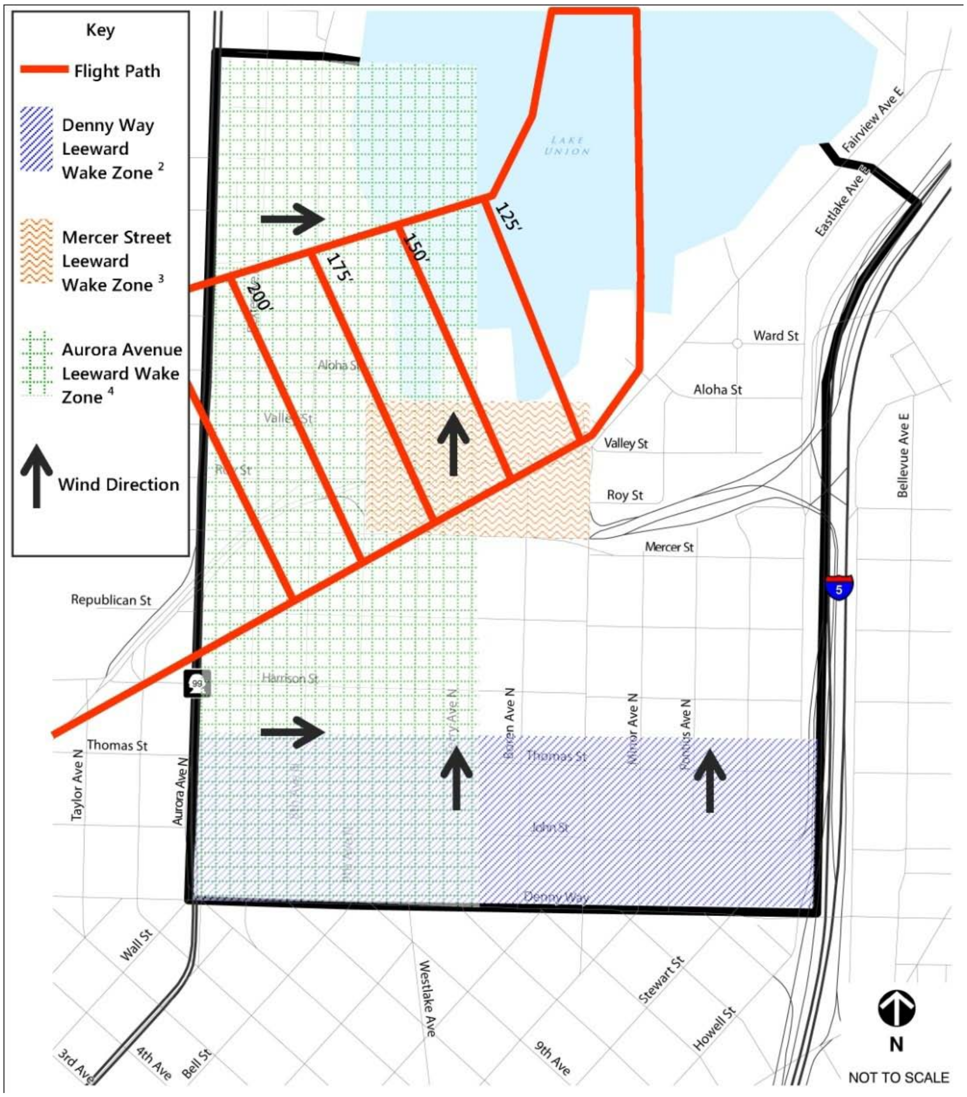
	Mercer Street Vicinity	Aurora Avenue Vicinity	Denny Way Vicinity
Maximum Building Height	125 feet	240 feet	240 feet
Estimated Vertical Wake	20 to 70 feet	40 to 100 feet	50 to 130 feet
Combined Building Height and Vertical Wake	145 to 195 feet	280 to 340 feet	290 to 370 feet
Estimated Flight Path Elevation	150 to 175 feet	175 to 225 feet	Outside flight path
Maximum Building Height and Vertical Wake Compared to Flight Path Elevation	At low end of range, below estimated flight path, at high end of range, exceeds estimated flight path elevation by 45 feet	Exceeds estimated flight path elevation by 55 to 165 feet	Outside of flight path

Source: RWDI, EA|Blumen, WSDOT, 2010

Leeward Wakes

As shown in **Figure 3.8-7**, the primary leeward wake into Lake Union for south winds is expected to be the least significant, estimated to extend to 300 feet (although residual turbulence would extend further). Similar to Alternative 2, this is expected to fall short of the approach/departure airspace with a benefit attributed to shorter building massing toward the water's edge. Although the most significant wake effects would occur within the areas shown in **Figure 3.8-7**, residual effects, such as turbulent eddy formation would extend farther into Lake Union and could act to change local wind conditions at the lake. For example, large building massing surrounding the lake could act to slow wind speeds in the approach/departure surface near the lake.

Figure 3.8-7
Alternative 3 Estimated Leeward Wake Zone[1]



Source: RWDI, EA|Blumen, 2010

1. *Assumes longest potential leeward wake zone, as shown in **Table 3.8-1**, but does not include residual turbulence area*
2. *Assumes building heights of 400 feet in the area between Denny Way and John St*
3. *Assumes building heights of 300 feet in the area bounded by Westlake Ave N, Fairview Ave N, Mercer St and Valley St*
4. *Assumes building heights of 300 feet in the area between Aurora Ave N and Westlake Ave N*

Note: This figure shows the area of the most significant wake effect; residential effects such as turbulent eddies would extend farter.

Overall, of the action alternatives, Alternative 3 would have the least impact on the south approach/departure surface for Lake Union.

Alternative 4 (No Action)
No significant impacts on wind patterns affecting the approach/departure airspace is anticipated for Alternative 4 (No Action), as the wake effects of the existing buildings would not be significant.

For comparison with the action alternatives, the Alternative 4 (No Action) estimated vertical wake in the vicinity of Mercer Street is estimated at 15 to 30 feet and in the vicinity of Aurora Avenue N 20 to 45 feet (RWDI, 2011). As shown in **Table 3.8-7**, below, the combined building height and vertical wake for buildings in the flight path falls below the estimated flight path elevation.

Table 3.8-7
Alternative 4 Building Height and Vertical Wake
Compared to Estimated Flight Path Elevation

	Mercer Street Vicinity	Aurora Avenue Vicinity
Maximum Building Height	40 feet	65 to 85 feet
Estimated Vertical Wake	15 to 30 feet	20 to 45 feet
Combined Building Height and Vertical Wake	55 to 70 feet	85 to 130 feet
Estimated Flight Path Elevation	150 to 175 feet	175 to 225 feet
Maximum Building Height and Vertical Wake Compared to Flight Path Elevation	Below estimated flight path elevation	Below estimated flight path elevation

Source: RWDI, EA|Blumen, WSDOT, 2010

Similarly, leeward wake effects are not anticipated to be significant.

3.8.3 Mitigation Strategies

Plans, Policies and Regulations

- Please see the Housing section of this EIS for potential mitigating measures to address housing affordability.
- In order to ensure that buildings do not obstruct the flight path and airspace established by FAR 77, maximum building heights in this area of South Lake Union will be adjusted to ensure that buildings do not penetrate the airspace.

- A vertical safety buffer – below the approach surface – should be considered to ensure adequate separation between the airspace and building rooftops.
- Consideration should be given to limiting the height of rooftop appurtences (e.g., antennae, flag poles, etc.) proximate to the flight path that could penetrate the airspace or the associated safety buffer.
- Consideration should also be given as part of the City's design review process to limiting rooftop specular surfaces that can act as a distraction for pilots.
- Proximate to the flight path, consideration should be given to limiting electrical interference on frequencies used by aircraft.

Wind Analysis

The mitigation measures presented below apply to all action alternatives.

- The area of the tallest height limit should be located near the outer perimeter of the South Lake Union neighborhood most distant from Lake Union. The largest buildings would tend to create the most significant, far reaching shear layers and would need a maximum separation from the lake.
- Reduce overall building massing and height progressively, approaching the lake. The upwind buildings would provide a measure of wind shielding of the downwind buildings. The shorter buildings adjacent to the lake would result in smaller wakes that extend towards the south approach/departure surface.
- The building height and space relationships and their influence on the approach/departure surface winds should be assessed as part of future consideration of building heights in the flight path vicinity. In order to establish a more specific definition of the extent of wakes and other significant wind dominated effects, quantitative wind modeling with a scale model of proposed development in a boundary layer wind tunnel would be required.

3.8.4 Significant Unavoidable Adverse Impacts

If proposed mitigation strategies are implemented, no significant unavoidable adverse impacts are anticipated.

3.9 HOUSING

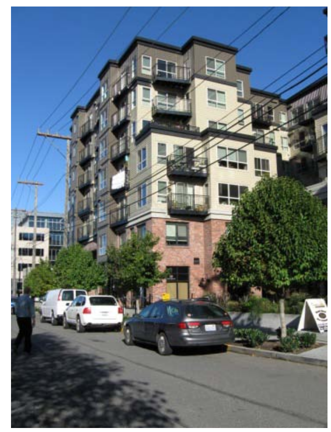
This section of the Draft EIS describes existing housing conditions within the South Lake Union neighborhood and surrounding vicinity and evaluates how future housing within the neighborhood would be affected under each of the proposed alternatives.

3.9.1 Affected Environment

The following is a summary of existing housing conditions within the South Lake Union neighborhood and surrounding vicinity.

Inventory of Existing Housing

According to City of Seattle Department of Planning and Development (DPD) data, there were 849 housing units within what is today the South Lake Union neighborhood, which equated to approximately 3 percent of the City's total housing supply at that time[1]. Since 2000, there have been approximately 2,226 housing units built within the neighborhood, for a current total of approximately 3,075 units[2].



Cairns Apartments

As described in the South Lake Union Urban Center Plan, most housing units within this neighborhood are in multi-family buildings and less than 10 percent of the units are owner-occupied.[3] The study area has approximately eight City-funded affordable housing developments containing more than 400 housing units, which currently make up more than 13 percent of the total number of dwelling units within the neighborhood.[4]

The majority of the residential development is located within or near the Cascade subarea of the neighborhood with additional residential development scattered throughout the neighborhood.

Table 3.9-1 contains a listing of most of the apartment and condominium buildings within the neighborhood and the affordability and number of housing units available in each. Additionally, **Table 3.9-2** contains a listing of subsidized rental housing available within the South Lake Union neighborhood.

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1 DPD Urban Center/Village Residential Growth Report, 3Q 2010.
2 Ibid.
3 City of Seattle. South Lake Union Urban Center Neighborhood Plan. September 2007.
4 Ibid.

As illustrated by these tables, currently existing housing units available in the South Lake Union neighborhood are affordable to varying income levels.

Table 3.9-1
Multi-Family Apartment Buildings within the South Lake Union Neighborhood

Building	Housing Units % Median Income (AMI) Rent/Income Limit 30%	40%	50%	60%	70%	80%	Unres-tricted	Total # of Units
502 Minor Avenue N							11	11
Alcyone Apts							161	161
Alley24				35			137	172
Amli 535							199	199
Bart Harvey Apts			50					50
Borealis							53	53
Brewster Apts		9	26					35
The Cairns					30		70	100
Canady House	83							83
The Carlton							30	30
Carolina Court							72	72
Carolyn Manor Apts							22	22
Casa Pacifica			24	39			2	65
Compass Ctr	34							34
David Colwell Bldg.	25		75	24		2		126
Denny Park Apts	20		25	5				50
Dexter Lake Union							201	201
Grandview Apts							25	25
Jensen Block Apts	2	24	4					30
Kerner-Scott House	40							40
Lakeview Apts	20		26	13		13		59
Mercerview Apts							67	67
Mirabella						31	349	380
Neptune							222	222
Rollin Street Flats							208	208
Union Bay Apts							73	73
Veer Lofts							99	99
TOTALS	**224**	**33**	**230**	**116**	**30**	**46**	**2,001**	**2,680**

Sources: City of Seattle, Office of Housing, 2010. Vulcan Real Estate, 2010, King County Assessor's Office, 2010.

Table 3.9-2
Existing Subsidized Rental Housing
within the South Lake Union Urban Center

	Regulatory Agency or Program				
Building	**CITY**[1]	**WSHFC**[2]	**K CTY**[3]	**CTED**[4]	**MFTE**[5]
Alley24					√
Brewster Apts	√			√	
The Cairns					√
Canady House	√		√		
Casa Pacifica	√	√			
Compass Ctr	√			√	
David Colwell Bldg.	√	√			
Denny Park Apts	√	√		√	
Jensen Block Apts	√	√		√	
Kerner-Scott House	√	√	√	√	
Lakeview Apts	√	√			
Mirabella		√			

Sources: City of Seattle, Office of Housing

1 CITY -- City of Seattle
2 WSHFC - Washington State Housing Finance Commission
3 K CTY - King County
4 CTED - State of Washington
5 MFTE - Seattle Multifamily Property Tax Exemption Program

Housing Occupancy

According to 2000 census data, the total housing vacancy rate in the City of Seattle was 4.4 percent. In Fall 2010, Dupre + Scott reported a market vacancy rate of 3.5 percent citywide.[5]

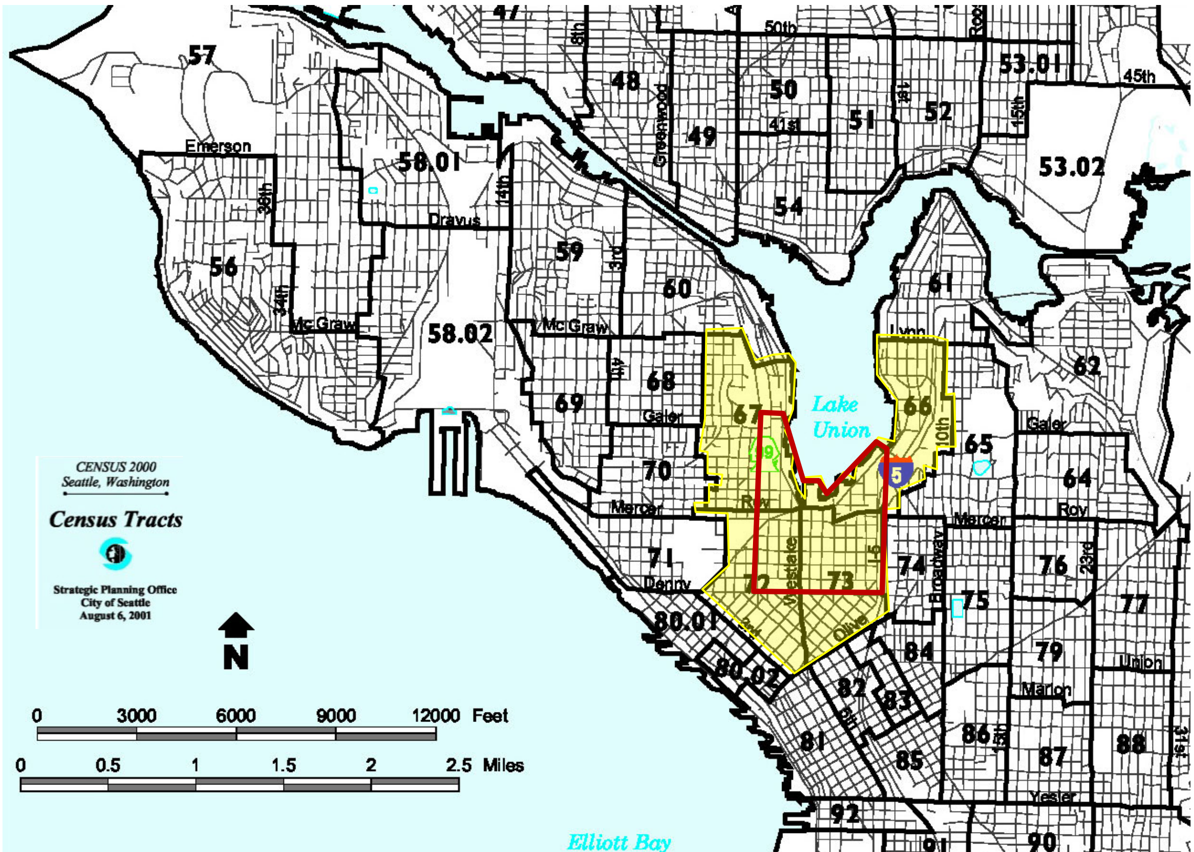
US Census data for the South Lake Union neighborhood reported a housing vacancy rate of 14 percent in 2000. Updated data specific to the South Lake Union neighborhood is not available. However, updated Dupre + Scott data is available for the several census tracts that encompass the neighborhood (census tracts 66, 67, 72 and 73). As depicted by Figure 3.9-1 below, Census Tracts 72 and 73 represent roughly two-thirds of the South Lake Union neighborhood area; however, they also include portions of Belltown and the Denny Triangle,

Census Tracts 66, 67, 72, and 73 together extend roughly 1/2 mile in each direction beyond the boundary of the South Lake Union neighborhood into areas of lower Queen Anne, First Hill, Belltown and the Denny Triangle. Although these census tracts contain the South Lake Union subarea, the majority of the housing is located in the surrounding neighborhoods.

5 Dupre+Scott Apartment Advisors, , Fall 2010 (custom City of Seattle report run by Seattle Office of Housing).

respectively. Similarly, Census Tract 66 extends further north and east of the neighborhood and Census Tract 67 extends further north and west of the neighborhood.

Figure 3.9-1
Census Tracts that Encompass the South Lake Union Neighborhood



Source: DPD, 2010.

Table 3.9-3 contains the autumn 2010 vacancy rate data for these census tracts. As shown in this table, market vacancy rates are similar to the estimated 3.5 percent citywide vacancy rate.

Table 3.9-3
2010 Vacancy Rate for Census Tracts Containing the South Lake Union Neighborhood

Census Tract	Market Vacancy Rate[1] (%)
66	2.06
67	4.33
72	3.36
73	3.34

Source: Dupre + Scott Apartment Advisors, Fall 2010, (custom report for Census Tracts 66, 67, 72 and 73 run by Seattle Office of Housing).

[1] Market Vacancy rate excludes vacancies in new construction still in lease-up, as well as properties going through extensive renovation.

Housing Affordability

As shown in **Tables 3.9-1** and **3.9-2** above, the South Lake Union neighborhood contains a range multi-family housing units affordable to varying income levels, including market rate housing and subsidized rental buildings restricted to specific incomes.

The City's Comprehensive Plan[6] includes policies that address the city's low-income housing needs. Specifically, Housing Policy 30 establishes affordability goals for at least 20 percent of expected housing growth to be affordable to households earning up to 50% of the Area Median Income (AMI), at least 17 percent of expected housing growth affordable to households earning 51 to 80% of AMI, and at least 27 percent of expected housing growth to be affordable to households earning 81 to 120%of AMI.

See Table 3.9-4 for information showing South Lake Union affordable housing growth between 2004 and 2009 compared to Seattle Comprehensive Plan Housing Policy 30. Between 2004 and 2009, 11percent of new housing units in South Lake Union were available to income groups earning 0 to 50 percent of median income, compared to the City's 20 percent goal. For the 51 to 80 percent of median income group, 8 percent of new housing units were affordable, compared to the goal of 17 percent. Because data was not collected for the 80 to 120 percent of median income group, it is not possible to assess attainment of the goal of 27 percent of total housing growth affordable to this income group.

Table 3.9-4
2004 – 2009:5-Year Change – Projected vs. Actual Number of Household Units
South Lake Union Urban Center

Median Income	2004 Total Housing Units	2009 Total Housing Units	2004 – 2009 Housing Growth
0-50%	479	657	178 (11%)
51-80%	299	428	129 (8%)
81%+	528	1,855	1,327 (81%)
TOTAL	**1,306**	**2,940**	**1,634 (100%)**

Source: Seattle Office of Housing, 2009; EA|Blumen, 2010.

[6] Seattle Comprehensive Plan, Housing Element, 2010.

Residential Character

As described in the South Lake Union Urban Center Plan, the neighborhood is characterized by a mix and variety of uses, which include large and small retail businesses, a cancer research center, car dealerships, studio space for artists, the state's largest newspaper and a Russian Orthodox church. This complexity of uses is further reflected along the south shore of Lake Union where Kenmore Air's seaplanes share the waterfront with the City's new Lake Union Park, the Center for Wooden Boats, the future home of MOHAI, private moorage, restaurants, office buildings and marine-oriented service industries. There are also two other parks located within this neighborhood besides Lake Union Park --Denny Park (Seattle's oldest public park) and Cascade Playground.

Recent development in the South Lake Union neighborhood has experienced a shift in land use away from the neighborhood's traditional industrial and Downtown support services to that of office, biotechnology and residential development. Since 1998, over two million square feet of office and biotechnology lab space and three large hotels have been built[7]. Also over the same period more than 2,229[8] residential units have been built or were under construction (as of autumn 2010).

Within the neighborhood, there are currently five independent schools that serve a diverse population of approximately 300 students in grades pre-K through 8. There are no public schools in South Lake Union and the neighborhood is split into two different school clusters (Magnolia/Queen Anne and Central), meaning that children in different parts of the neighborhood are assigned to schools in different areas of Seattle.[9]

With regard to community facilities, the closest community center to the South Lake Union neighborhood is located at the top of Queen Anne Hill. The closest City libraries are the Queen Anne Branch, the Capitol Hill Branch, and the Central Library (Downtown).The Cascade People's Center, which is located in the Cascade subarea of South Lake Union, is a small family and community support center, which focuses on family support and environmental sustainability and provides free programs and meeting space for the surrounding community.The community center site also includes the Cascade P-Patch garden, as well as the adjacent Garden of

7 City of Seattle. South Lake Union Urban Center Neighborhood Plan. September 2007.

8 DPD Permit Data Warehouse Building Construction Permits, Urban Center/Village Residential Growth Report Through 3Q 2010.

9 City of Seattle. South Lake Union Urban Center Neighborhood Plan. September 2007.

Happiness, which is another community-based garden project only with a native plant focus.

Focus Areas[10]

8th Avenue North Corridor

The 8th Avenue Corridor currently contains two apartment buildings; including the recently constructed Denny Park Apartments (230 8th Avenue N). This facility contains approximately 50 low-income housing units (see **Table 3.9-1**).

8th Avenue N/Harrison Street looking south

Fairview Avenue Corridor

The Fairview Avenue Corridor, which is located along the western boundary of the Cascade subarea, does not currently contain residential uses.

Valley/Mercer Blocks

The Valley/Mercer Blocks, which are located along the south end of Lake Union, do not currently contain residential uses.

3.9.2 Environmental Impacts

This subsection focuses on the probable significant environmental impacts on housing in the South Lake Union neighborhood as a result of redevelopment under Alternatives 1-4. Impacts that would be common to Alternatives 1-4 are discussed at the beginning of this subsection followed by a discussion of impacts that would be unique to each alternative.

Impacts Common to All Alternatives

Potential increases in height and density associated with Alternatives 1-3 would result in an increase in population and employment as future development occurs in the South Lake Union neighborhood. Increases in population and employment in this area would result in an associated increase in demand for diverse housing opportunities and public facilities (e.g., community centers and libraries, parks and open spaces, public schools, etc.) within the neighborhood. Each alternative provides different capacity levels to meet increased demand. With capacity for 21,000 units, Alternative 1 provides the greatest housing capacity, followed by

10 Focus areas are small areas in the South Lake Union neighborhood, which are considered in greater detail, where applicable. Please see discussion and Figure 2-3 in Chapter 2.

Alternative 2 with capacity for 19,000 units, Alternative 3 with capacity for 15,000 units and Alternative 4, with capacity for 11,500 units. Incentive zoning provisions under any of the action alternatives can ensure that the City has adequate capacity to meet current and future housing targets for the neighborhood.

<u>Housing Affordability</u>

As noted previously, Comprehensive Plan Housing Policy 30 establishes citywide affordable housing goals to "address the city's share of affordable housing needs resulting from expected countywide household growth [2004-2024], consistent with the countywide affordable housing policies…"Those goals are:

- at least **20 percent** of the expected housing growth affordable for households earning up to 50% of the Area Median Income (AMI);
- at least **17 percent** of the expected housing growth affordable for households earning 51 to 80% of AMI; and
- at least **27 percent** of the expected housing growth affordable for households earning 81 to 120%of AMI.

According to DPD data, there are approximately 3,075 existing housing units in the South Lake Union neighborhood. To meet the adopted 2024 housing target of 8,000 additional housing units, there would need to be approximately 4,925 new housing units developed by 2024. Using the affordable housing goals listed above, roughly 985 units would need to be affordable to households earning up to 50 percent of AMI, approximately 837 units would need to be affordable to households earning between 51 to 80 percent of AMI, and approximately 1,330 units would need to be affordable to households earning 81 to 120 percent of AMI.

For comparison, to meet the 2031 estimated goal of 11,900 additional housing units, there would need to be approximately 8,825 new housing units developed by 2031. Of these, roughly 1,765 units would need to be affordable to households earning up to 50 percent of AMI, approximately 1,500 units would need to be affordable to households earning between 51 to 80 percent of AMI, and approximately 2,383 units would need to be affordable to households earning 81 to 120 percent of AMI.

Table 3.9-5 illustrates the potential for affordable housing if the affordable housing goals listed above are met. Because the goal is the same regardless of the alternative, these estimates apply equally to all alternatives.

Table 3.9-5
Affordable Housing Goals

	Total New Housing Units[1]	Affordable Housing Targets[11]		
		0-50% AMI	51-80% AMI	81%+ AMI
Estimated Growth to Achieve Affordability Goal				
Adopted 2024 Target				
All Alternatives	4,925	985	837	1,330
Estimated 2031 Target				
All Alternatives	8,825	1,765	1,500	2,383

Source: City of Seattle, EA|Blumen, 2010

1. New housing development estimated based on 3,075 existing housing units (see p 3.9-1) subtracted from the 2024 total housing target (8,000 units) or the estimated 2031 housing target (11,900 units) to arrive at estimated future growth.

In general, the increased residential capacity provided by the action alternatives has potential to result in an increased number of affordable units, compared to the No Action Alternative. However, there are a number of factors that impact the potential for affordable housing development, including potential development costs, property values, market demand, individual property owner goals, and opportunities for financing of affordable housing. To a greater or lesser extent, these factors will affect the actual number of affordable housing units that are built for low- and moderate-income households under any of the alternatives.

Alternative 1

Alternative 1 would provide the largest capacity for housing development and the largest amount of development that would likely occur through increased height provided under incentive zoning provisions. Because of this, Alternative 1 may have the potential through incentive zoning provisions to generate the greatest amount of developer financial contributions for affordable housing for lower wage workers.

Alternative 1 may also provide market-driven opportunities for new construction of affordable housing separate from the residential towers. Development of new towers will require a minimum of 22,000 square feet of lot area in most of the subarea. Depending on lot configurations, consolidation of parcels to create the minimum lot required for a tower may create remainder lot area that is not large enough for another tower

[11] City of Seattle Comprehensive Plan, Housing Element, Housing Policy 30, December 2010.

and potentially available at a lower cost for other types of low scale development, including affordable housing. Development of remainder parcels for affordable housing could occur through a market-driven process and could also be encouraged through an incentive zoning provision that addresses such parcels.

Single family residence in South Lake Union neighborhood

While providing capacity for new development of housing, development of residential towers through incentive zoning provisions would increase the potential for displacement of existing wood frame buildings and older single family residences located throughout the neighborhood, but particularly in the Cascade subarea. To the extent that these units provide relatively lower-cost affordable housing, redevelopment under Alternative 1 has the potential to reduce that inventory of older stock affordable housing. As noted above, however, (assuming the City's current incentive zoning system is expanded to South Lake Union) development in any zone with a height limit of 85' or greater would require production of housing affordable to households with incomes up to 80 percent of area median income or a cash contribution to the City's bonus fund, which would then be used for production or long-term preservation (at least 50 years) of very low-income housing (≤50 percent of area median income) or even extremely low-income housing (≤30 percent of area median income) in the South Lake Union neighborhood.

Under Alternative 1, height and density increases in the focus areas could result in increased residential development within these corridors, especially in the 8th Avenue Corridor due to residential height allowances that are significantly higher than those allowed for commercial uses. Similarly, the change in zoning from IC to SM in the Fairview corridor provides new capacity for residential development, expanding overall residential development opportunities in the neighborhood.

Alternative 2

Relative to the other alternatives, Alternative 2 is neither the highest nor the lowest regarding capacity for housing development amount of development that would likely occur through increased height provided under incentive zoning provisions. Because of this, Alternative 2 may have a relatively moderate potential through incentive zoning provisions to generate developer financial contributions for affordable housing for lower wage workers.

Alternative 2 also provides development opportunities on remainder lots that may be attractive to low scale development, including affordable housing. Development of remainder parcels for affordable housing could occur through a market-driven process and could also be encouraged through an incentive zoning provision that addresses such parcels.

Alternative 2 would also have the potential for displacement of existing wood frame buildings and older single family residences located throughout the neighborhood, but particularly in the Cascade subarea for new construction of towers. To the extent that these units provide relatively lower-cost affordable housing, redevelopment under Alternative 2 has the potential to reduce that inventory of older stock affordable housing. (See discussion under Alternative 1 above.)

Height and density increases in the focus areas could result in increased residential development within these corridors, especially in the 8th Avenue Corridor due to residential height allowances that are significantly higher than those allowed for commercial uses. Similarly, the change in zoning from IC to SM zoning in the Fairview corridor provides new capacity for residential development, expanding overall residential development opportunities in the neighborhood.

Alternative 3

Relative to the other action alternatives, Alternative 3 provides the least capacity for housing development and amount of development that would likely occur through increased height provided under incentive zoning provisions. Because of this, Alternative 3 may have the least potential through incentive zoning provisions to generate developer financial contributions for affordable housing for lower wage workers.

Similar to the other action alternatives, development under Alternative 3 could result in development opportunities on remainder lots that may be attractive to low scale development, including affordable housing. Development of remainder parcels for affordable housing could occur through a market-driven process and could also be encouraged through an incentive zoning provision that addresses such parcels.

Alternative 3 would also have the potential for displacement of existing wood frame buildings and older single family residences located throughout the neighborhood, but particularly in the Cascade subarea for new construction of towers. To the extent that these units provide relatively lower-cost affordable housing, redevelopment under Alternative 3 has the potential to reduce that inventory of older stock affordable housing. (See discussion under Alternative 1 above.)

Under Alternative 3, height and density increases in the focus areas could result in increased residential development within these corridors, due to residential height allowances that are significantly greater than those allowed for commercial development. Height limits on residential development in the focus areas would range from 125 feet near Lake Union to 240 feet near Denny Way. Similarly, the change in zoning from IC to SM zoning in the Fairview corridor provides new capacity for residential development, expanding overall residential development opportunities in the neighborhood.

Alternative 4 (No Action)

Alternative 4 would retain the existing zoning with no new incentive zoning provisions and essentially represent a continuation of current development trends within the neighborhood. As described previously, Alternative 4 would provide the least amount of additional housing capacity within the South Lake Union neighborhood.

Under Alternative 4, current residential development trends occurring in the focus areas would likely continue, as this alternative would retain the existing zoning in these corridors.

3.9.3 Mitigation Strategies

Housing Contents
Effected Environment
Environmental Impacts
Mitigation Strategies
Significant Unavoidable Adverse Impacts

Future population and employment increases in the South Lake Union neighborhood under Alternatives 1-4 would be incremental and would result in associated increases in demand for diverse housing opportunities within the neighborhood. In order to address the City's goals of providing affordable housing, the following incentives and programs could be implemented in the South Lake Union neighborhood:

Existing Development Incentives

Multi-Family Property Tax Exemption

Seattle's Multifamily Tax Exemption (MFTE) program allows developers to receive a property tax exemption on the residential portion of a development for a specified number of years in exchange for providing a specified percentage of housing units in rental projects that are affordable for moderate-wage workers during the time the exemption is utilized. The current MFTE program expired on Dec. 31, 2010; however the Seattle City Council is currently reviewing the program for renewal. There may be changes to existing program requirements once the City Council renews the program. It is assumed that the MFTE Program will continue to be available in 39 target areas in Seattle, one of which is the South Lake Union Urban Center.

Incentive Zoning

Incentive zoning is a strategy to both encourage the desired density while ensuring growth contributes to livability and sustainability. The goal of incentive zoning is to link code flexibility, increased density and development potential with public benefits in the form of affordable housing and other amenities valued by communities. By helping to direct growth to areas targeted in the Comprehensive Plan, incentive zoning could also work to preserve the character of many of Seattle's neighborhoods. Incentive zoning is used to offer extra floor area for new development in exchange for community amenities. A baseline height limit or Floor Area Ratio (FAR) limit is created in a given neighborhood or a zone. Developers can then take advantage of additional height or FAR by purchasing TDR and/or acquiring bonus floor area in exchange for providing public benefits, which include low-income housing (defined as affordable to households making less than 80 or 100 percent of Area Median Income depending on tenure) and a long list of on-site public amenities (SMC 23.50.051).

The commercial/industrial bonus provision of Seattle's incentive zoning enables developers to achieve additional floor area ratio (FAR) in exchange for housing and childcare that is affordable to lower-wage workers. The housing and/or childcare can be provided by the developer or a contribution of $18.75 per bonus square foot for housing and $3.25 per bonus square foot for childcare facilities may be made to the City for those purposes. This bonus is currently available in high-rise downtown commercial zones and on a few IC-zoned lots in the South Lake Union Urban Center (SMC 23.50.052).

The residential bonus provision of Seattle's incentive zoning enables residential developers to achieve extra floor area above the base height limit when affordable housing is provided. Developers can build affordable housing as part of their development or, in certain zones, make a contribution of approximately $19 per bonus square foot to the City to fund new affordable housing. The housing is intended to primarily serve Seattle's modest-wage workers. The residential bonus is currently available in midrise and high-rise zones, in certain Downtown zones, and in certain areas of the Dravus neighborhood; this program is not presently available in the South Lake Union neighborhood.

Transferable Development Rights (TDR)

This option helps Seattle maintain a more variable scale of buildings in the South Lake Union neighborhood by allowing density to be moved from one site to another (SMC 23.50.053). Owners of certified TDR sites — ones with low-income housing, an arts facility, or a designated Landmark building— can sell excess development rights to developers in certain IC zones and use the proceeds for preservation of those priority uses. A TDR program is also in effect in downtown.

<u>Other Strategies Specific to South Lake Union to Achieve Affordable Housing Objectives</u>

Preservation

Structure incentive programs to allow use of TDR to preserve the following older residential buildings (all red brick buildings):

- Grandview Apartments (409 Eastlake East)
- Carolina Court (527 Eastlake North)
- Carlton Apartments (603 Pontius North)
- 502 Minor North
- Carolyn Manor Apartments (1309 Dexter North)
- Jensen Apartments

Employers Promoting Living near Work

Involve employers in identifying strategies to promote living near work.

- Create innovative ways for employers to help develop a "live and work" community.
- Explore ways for South lake Union employers to contribute to housing if employees live in South Lake Union through Transportation Management Plans.

Surplus Sites for Affordable Housing

- Inventory publicly owned property in South Lake Union suitable for development in affordable housing.
- Identify key community properties for particular uses, including affordable housing.

Family Housing

- Encourage affordable family sized homes through employer-developer partnerships and direct City funding.
- Use surplus property to achieve housing objectives not being met through private market, such as family housing.
- Use zoning and design guidelines to encourage ground-related housing in the six block area along 8th Avenue from John to Republican.
- Encourage ground-related housing units with good access to open space around Denny Park and Cascade Park.

Subsidized Housing Resources

- Leverage public funding to preserve existing and create new subsidized housing within South Lake Union.
- Use South Lake Union commercial/industrial bonus payment option funds for new low-income housing in the South Lake Union neighborhood.

3.9.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to housing are anticipated.

3.10 AESTHETICS

This section illustrates and describes the physical character of the South Lake Union neighborhood and its immediate surroundings using 3-D computer modeling and photographic simulations. These simulations provide representative views of both the existing neighborhood and each of the proposed Alternatives 1 – 4. Representations include selected viewpoints inside and outside the neighborhood, shadow studies of each alternative and possible light and glare impacts.

Aesthetics Contents

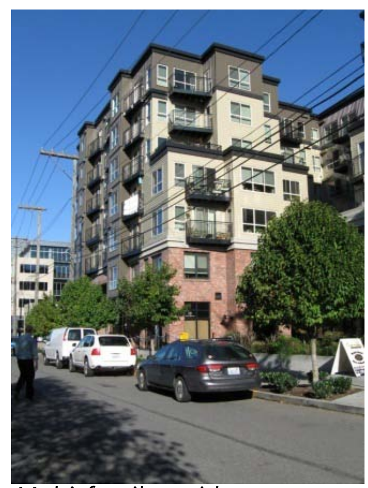
HEIGHT, BULK AND SCALE

3.10.1 Affected Environment

Area Context

The South Lake Union neighborhood is immediately north of Seattle's Downtown Urban Center and the Denny Triangle neighborhood, west of the Capitol Hill Urban Center and east of the City's Uptown Urban Center. Each area is urban in character and is typically dominated by mid-rise and high-rise structures (commercial, residential and institutional). The area proximate to the boundary between the Capitol Hill neighborhood and the South Lake Union neighborhood is entirely residential in character with mid-rise multi-family buildings. The Uptown and Queen Anne neighborhoods to the west and northwest are also predominantly residential in the vicinity of the South Lake Union neighborhood with mid-rise multi-family buildings being the most common building type.

Single family residences



Multi-family residences

Office development

Much of the Uptown Urban Center, however, is dominated by the structures and open space of Seattle Center. While not currently part of the South Lake Union neighborhood, the Uptown Triangle (formed by Broad Street, Denny Way and Aurora Avenue) will be physically re-attached to the South Lake Union neighborhood once the SR 99 Bored Tunnel is completed and three east-west streets – John, Thomas and Harris Streets – are again reconnected across Aurora Avenue N. The existing character of the Uptown Triangle is similar to the South Lake Union neighborhood – largely commercial and light industrial, with multi-family residential development interspersed throughout.

Due to their heights, predominant features visible from the South Lake Union neighborhood are located outside the study area and include: Queen Anne Hill, the Space Needle, Capitol Hill and the Downtown Seattle Skyline. An exception is Lake Union, which is partially visible at the north-end of 5 of the neighborhood's 12 north-south streets.

Neighborhood Character

The visual character varies widely within the South Lake Union neighborhood due to substantial growth and changes in building types and uses in recent decades. Several structures or building features stand out due to their size (or the relative size of adjacent structures), unusual shape or dynamic character, including: the high-rise AGC Building on Lake Union, the former Naval Reserve Center (proposed new location for the Museum of History and Industry [MOHAI}), the consistent red brick buildings that constitute the Fred Hutchinson Cancer Research Center, the complex of new development associated with Amazon.com, the Mirabella Continuing Care Retirement Community (CCRC), the steeple of the Immanuel Lutheran Church and the domes of St. Spiridon Orthodox Cathedral, the glass enclosed REI Climbing Wall, and the digital sign atop the Pemco Insurance Headquarters.

Immanuel Lutheran Church

The variety of these building types demonstrates the changing nature of the study area. The area was predominantly light industrial and commercial in nature for most of the twentieth century with residential uses in several areas – the largest being the Cascade subarea, which occupies the eastern one-third of the study area. The Industrial Commercial (IC) and later Seattle Mixed (SM) zoning has accommodated a wide variety of commercial and light industrial uses, as well as continued multi-family residential development. Numerous underdeveloped and vacant parcels have buffered land uses from each other and kept the population density (day and night) at relatively low levels. This pattern began to change after the Seattle Commons initiative in the 1990s, when development attention turned toward this neighborhood.

Interwoven through the South Lake Union neighborhood, but largely in its eastern half, are a number of older brick structures that serve as one of the neighborhood's defining features. These structures are a combination of industrial and residential buildings from the first half of the twentieth century. Some, but not all, of these buildings are designated Seattle Landmarks (see Section 3.11). The largest examples include the former Ford Motor Company Assembly Plant (now Shurgard Storage) and the multiple commercial laundry facilities (e.g.,Troy Laundry, New Richmond Laundry [now incorporated into Alley 24] and the Supply Laundry, which features a tall brick smokestack). While visible only on the streets they face, smaller brick buildings, such as The Webster and Van Vorst Buildings, add to the character of their immediate surroundings and the neighborhood as a whole.

Incremental growth over time has resulted in the emergence of multiple neighborhood epicenters. These epicenters tend to be oriented around parks or boulevards. The most established is the Cascade subarea, which is distinguished by a predominantly residential character with Cascade Playground as its centerpiece. A number of half-block apartment buildings have also contributed to the neighborhood's emerging character, including the Alcyone, the Neptune, the Cairns and Union Bay Apartments.

The South Lake Union waterfront, separated from the rest of the neighborhood by heavy traffic on Mercer and Valley Streets, is dominated by restaurants and public amenities, such as the new Lake Union Park, the non-profit Center for Wooden Boats and in the immediate future MOHAI; as well as a passenger terminal for float plane operations.

A largely new commercial and institutional core has emerged along (or proximate to) the axis of Westlake Avenue. Two multi-phase projects currently under construction in the study area – the multi-block office campuses for Amazon.com and the University of Washington's School of Medicine's expanding biotechnology and medical research facility – are already altering the built character of this portion of the South Lake Union neighborhood. The largest complex under construction in the vicinity of the South Lake Union neighborhood is the Bill and Melinda Gates Foundation facility in the Uptown Triangle.

Height, Bulk and Scale

Height, bulk and scale relate to the size of buildings and their relationship to neighboring structures. The City's SEPA policies recognize that physical characteristics of buildings affect the character of neighborhoods. These policies also recognize a need to address building height, bulk and scale as a means to achieve appropriate transition from one zoning district to another.

There is currently a broad range of building types and sizes in the South Lake Union neighborhood – from single-family residences, churches and one- and two-story commercial and/or light industrial (fabrication and storage) buildings, multi-block biotech campuses, and high-rise office towers. It is a neighborhood in transition where the differences between the new and old, small and large, intimate and public, are noticeable.

With regard to the surrounding neighborhoods, there are significant differences in allowed height. Development standards in the Denny Triangle to the south allow for buildings up to 400 feet in height. Properties in the Uptown/Queen Anne area that border the South Lake Union neighborhood are zoned to allow increasingly tall structures from north to south, starting with 30 foot structures in the L-3 zones, rising to

65 foot structures in the C1-65 and SM-65 zones, and 85 foot structures in the SM 85 zones that border on Denny Way. Properties on Capitol Hill that face the study area are zoned L-3 at the north-end and MR on the south, which limits building height to 30 feet and 75 feet respectively.

The height of Queen Anne and Capitol Hills can provide territorial views for existing low-rise and mid-rise buildings – overlooking existing buildings in the South Lake Union neighborhood. This is particularly true of the buildings on Capitol Hill, which are separated from the study area by I 5.

Aside from Seattle Center, much of the Uptown Urban Center is similar in use, texture and character to the South Lake Union neighborhood. As noted previously, Seattle Center is an assemblage of rather bulky, low-rise structures – with the important exception of the iconic Space Needle. The SR 99 right-of-way has historically provided a clear separation between the South Lake Union and the Uptown neighborhoods. However, as noted earlier, plans associated with the SR 99 Bored Tunnel would involve reconnection of the east-west John, Thomas and Harrison Streets.

Focus Areas[1]

8th Avenue North Corridor

This area is currently only lightly developed with a broad range of uses and building types, including Denny Park Lutheran Church and the Unity Church of Truth, which anchor either side of 8th Avenue N where it terminates at Denny Park. Other than one two-story and another six-story apartment building midway along this corridor, 8th Avenue N is edged with surface parking lots and two-story commercial or light industrial buildings. Mature street trees line both sides of the corridor for most of its length.

8th Avenue N

Fairview Avenue Corridor

While the blocks and half-blocks that constitute the Fairview Avenue Corridor have experienced recent development at either end, for the most part, this corridor remains largely underdeveloped. There is currently a broad mix of uses along the corridor, starting at the north-end with biomedical uses associated with the Fred Hutchinson Cancer Research Center campus and the large Shurgard storage facility and anchored at

Seattle Times building at John Street and Fairview Avenue N

[1] Focus areas are subareas in the South Lake Union neighborhood that are considered in greater detail, where applicable. Please discussion and Figure 2-3 in Chapter 2.

the south-end by the Mirabella Continuing Care Retirement Community (CCRC) and buildings associated with the Seattle Times. In between is a mix of low-rise commercial structures with surface parking – including restaurants, professional offices and retail services. Mature street trees line both sides of this corridor for most of its length.

Valley/Mercer Blocks

The four east-west blocks between Valley and Mercer Streets, Westlake and Fairview Avenues are currently vacant in conjunction with the City's Mercer Corridor Project, which is under construction.

3.10.2 Environmental Impacts

This section describes changes to the aesthetic character of the built environment that could occur in conjunction with any one of the four EIS alternatives. The EIS alternatives prescribe potential zoning envelopes, but do not locate, size or architecturally define particular buildings. Therefore, for purposes of this EIS and to provide a worst-case – yet realistic scenarios – assumptions have been formulated to allow for analysis of potential aesthetic impacts. These assumptions strive to be realistic in terms of development footprints, tower dimensions and orientations, but also conservative in terms of potential build-out on each respective site.

The assumptions include the following:

- All undeveloped and under-developed sites will redevelop in the future. Under-developed sites are defined as those that contain development square footage that is 40 percent or less than currently allowed by zoning;
- Property owners with sites larger than 22,000 sf will use available zoning incentives to build the maximum gross building area allowable, while sites with less than 22,000 sf will develop consistent with underlying zoning;
- Where individual parcels with separate ownership are contiguous and can be assembled to create a lot size of 22,000 sf or greater, a developer or property owner will do so in order to build the maximum gross building area allowable;

- Since they will not be constrained by Floor Area Ratio (FAR) [2] restrictions, the towers of new residential buildings will be built to the maximum height and footprint allowable;
- Commercial towers will be built to the maximum FAR available and footprint allowable;
- Commercial and residential projects will maximize the size and height of their podiums;
- On-site structured parking will be provided half above grade and half below grade.
- Since contemporary office buildings generally have footprints of 20,000 sf or greater, lots under 20,000 sf will generally be used for residential development;
- A mix of commercial and residential projects are expected in the future, but since residential development will typically be allowed to build greater total square footage than commercial development (which is restricted by FAR maximums), more residential than commercial development is shown in the alternatives;
- Future development on lots within the defined flight path of the Lake Union Seaplane Airport will be limited by the lowest elevation indicated in the *FAR Part 77 Study*,[3] but no additional height buffer[4] has been included in the studies for purpose of this analysis (see **Figure 3.10-1**); and
- New public open space, although a likely incentive for accessing maximum FAR, is not shown because the amount and location of open space is unknown and would be speculative.

The Preliminary Draft of the "South Lake Urban Design Framework" document being developed by the City of Seattle has informed the study for locations of proposed uses.

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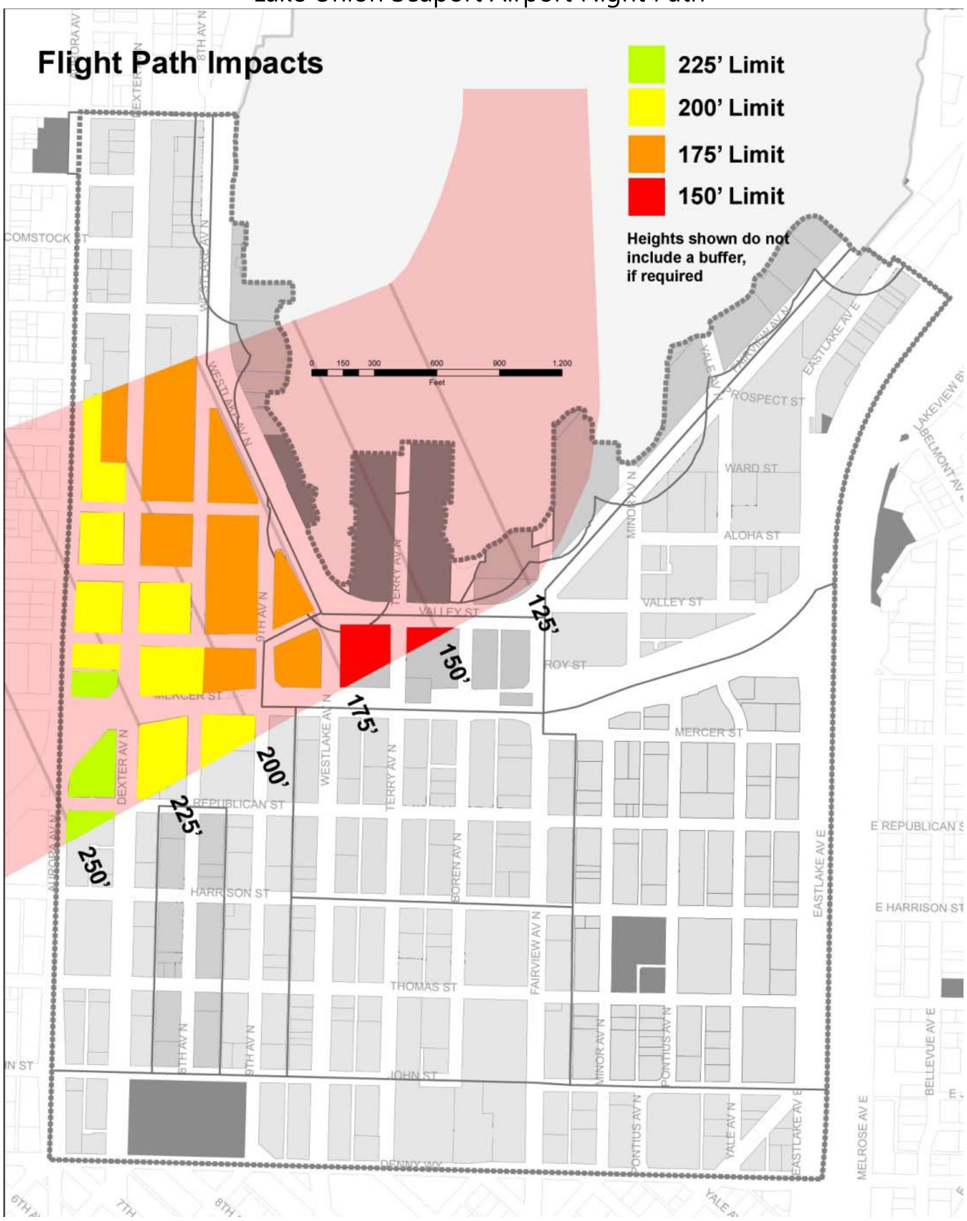
[2] "Floor area ratio" … (FAR is) … a ratio expressing the relationship between the amount of gross floor area or chargeable floor area permitted in one or more structures and the area of the lot on which the structure is, or structures are, located…" (23.84A.012).

[3] Washington State Department of Transportation, Aviation Division. Letter from Carter Timmerman, Aviation Planner. February 3, 2011.

[4] This is a vertical separation between building heights allowed by zoning and the floor or lowest height of the flight path within each block.

Figure 3.10-1
Lake Union Seaport Airport Flight Path



Source: Kenmore Air, NBBJ, 2010.

Impacts Common to All Alternatives

All the alternatives assume that every currently undeveloped or under-developed site, including surface parking lots, is built out to its maximum potential using the prescribed land use criteria. Therefore, all alternatives envision a significantly more dense urban environment.

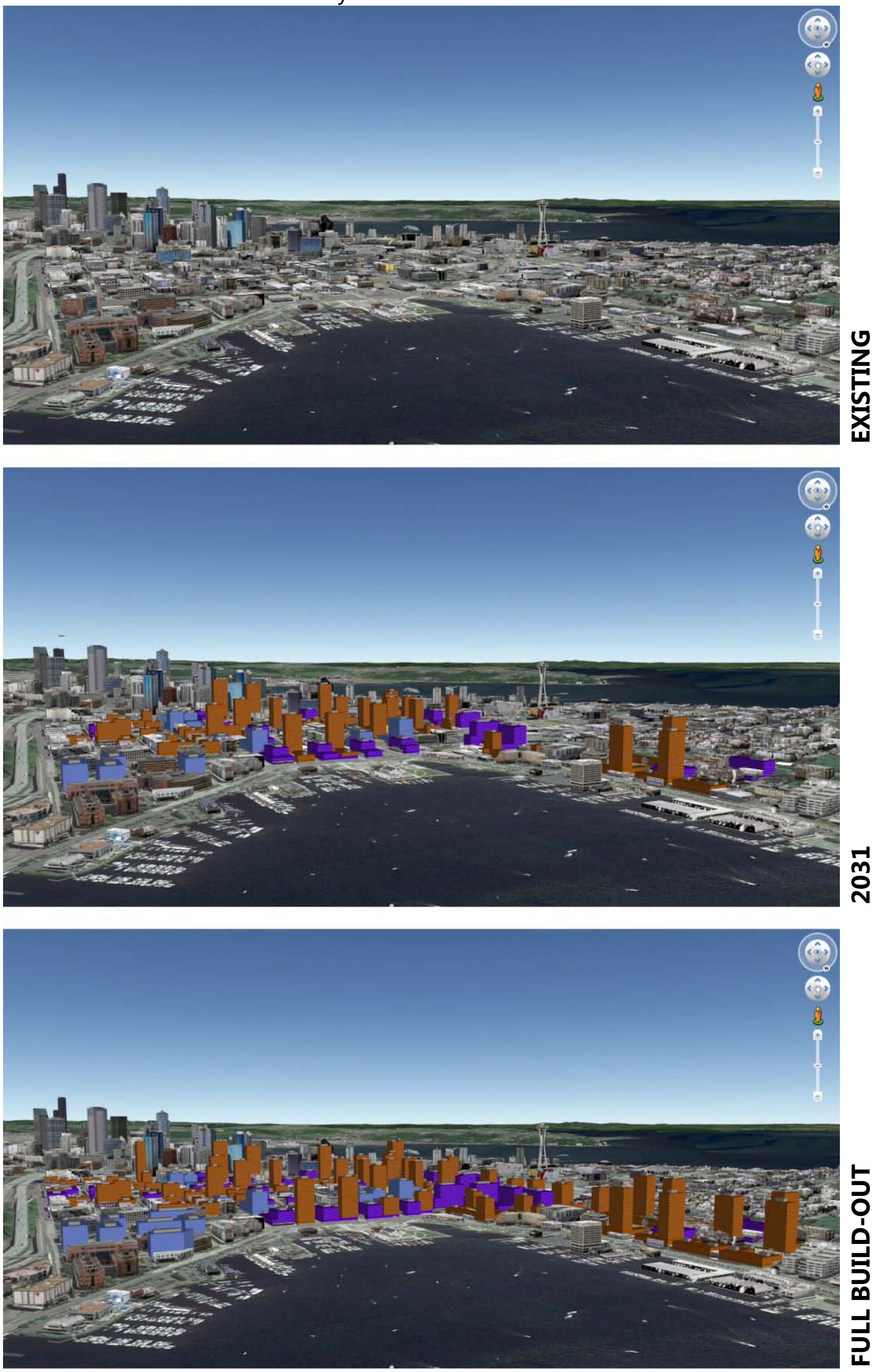
Further, it should be noted that the assumed development pattern would result in employment and residential development that would exceed the estimated 2031 South Lake Union growth target and meet the estimated capacity described in Chapter 2 of this EIS (see tables 2-1 and 2-2). From a cumulative perspective, it is unlikely that full build-out would ever occur under any scenario. However, by assuming a full build-out scenario, this aesthetics analysis considers a development pattern under each alternative that would result in the greatest possible impact on a neighborhood-wide basis.

Actual development and associated visual impacts would likely be less than those shown in this EIS. For comparative purposes, massing studies are included for both the full build-out version and one associated with the 2031 growth targets; however, the view analyses and shadow studies were all performed only using the full-build-out version.

Figures 3.10-2 through **3.10-9** illustrate multiple views of each developed alternative over the South Lake Union neighborhood. Two views are typically shown for each alternative, one is a birds-eye view looking southwest and the other approximates the view from the top of the hill in Gas Works Park at the north end of Lake Union.

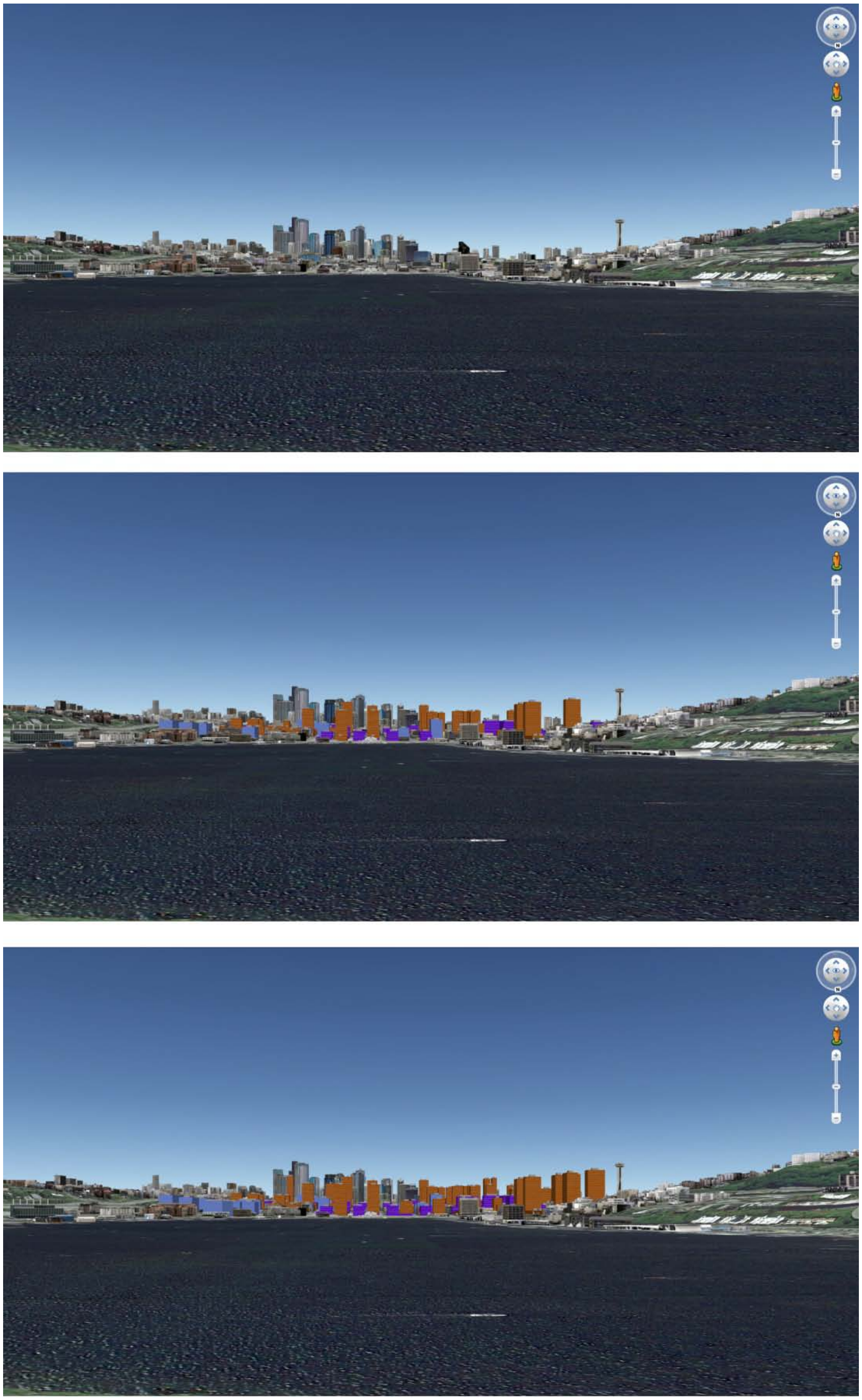
In the views for Alternatives 1 and 2, the top view shows the existing condition, the middle view portrays a 2031 growth target version and the bottom view a full build-out version. Since Alternatives 3 and 4 do not fully achieve the growth targets (times 1.25), the top view is of existing conditions and the bottom view portrays full build-out.

Figure 3.10-2
Birds-eye View – Alternative 1



Source: NBBJ, 2010.

Figure 3.10-3
Gasworks Park View – Alternative 1



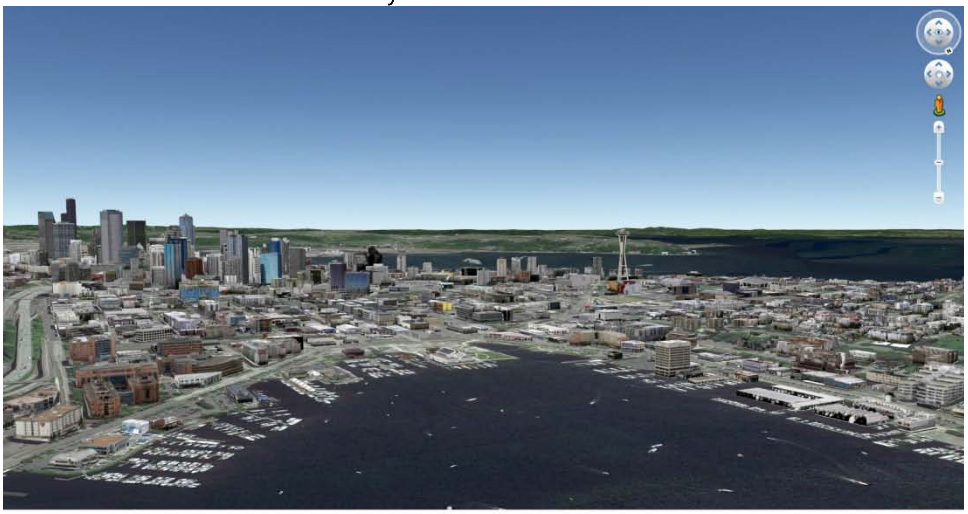
EXISTING

2031

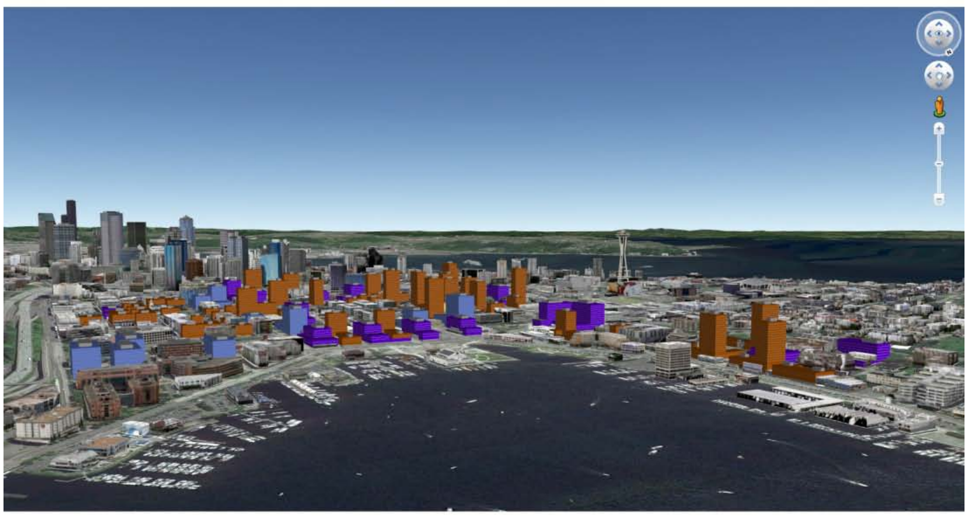
FULL BUILD-OUT

Source: NBBJ, 2010.

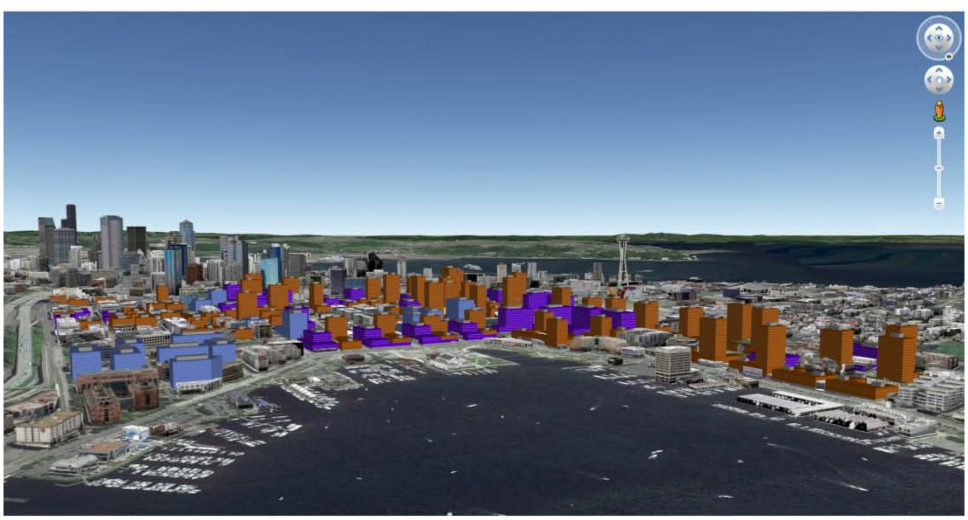
Figure 3.10-4
Birds-eye View – Alternative 2



EXISTING



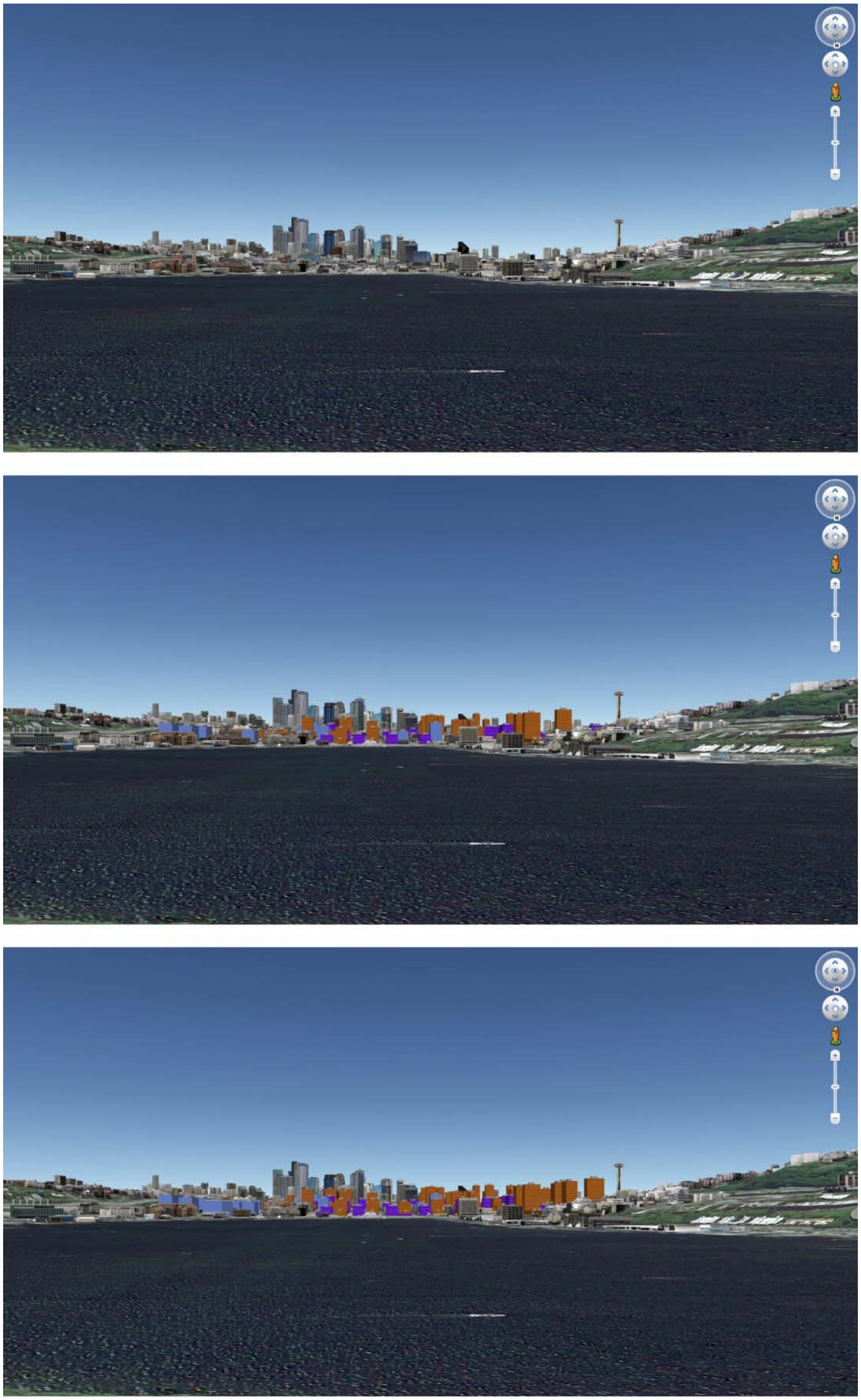
2031



FULL BUILD-OUT

Source: NBBJ, 2010.

Figure 3.10-5
Gasworks Park View – Alternative 2



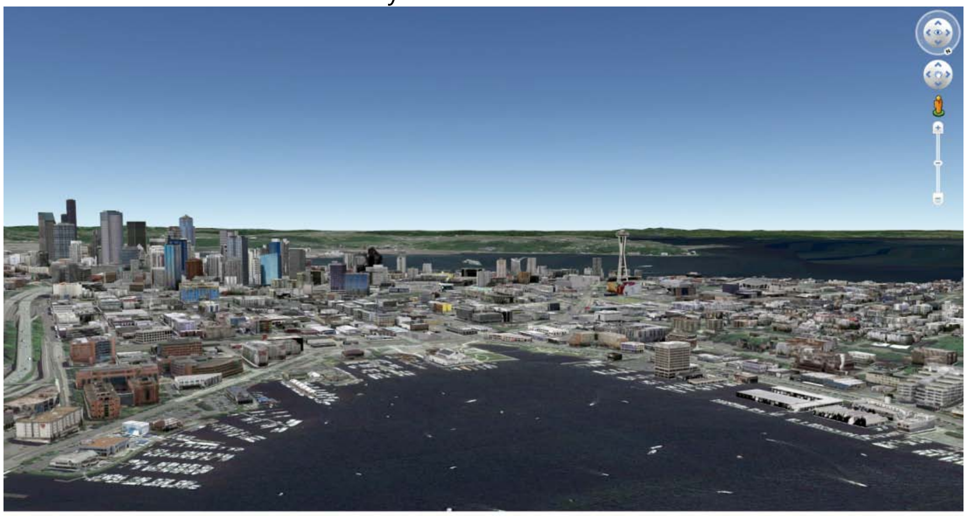
EXISTING

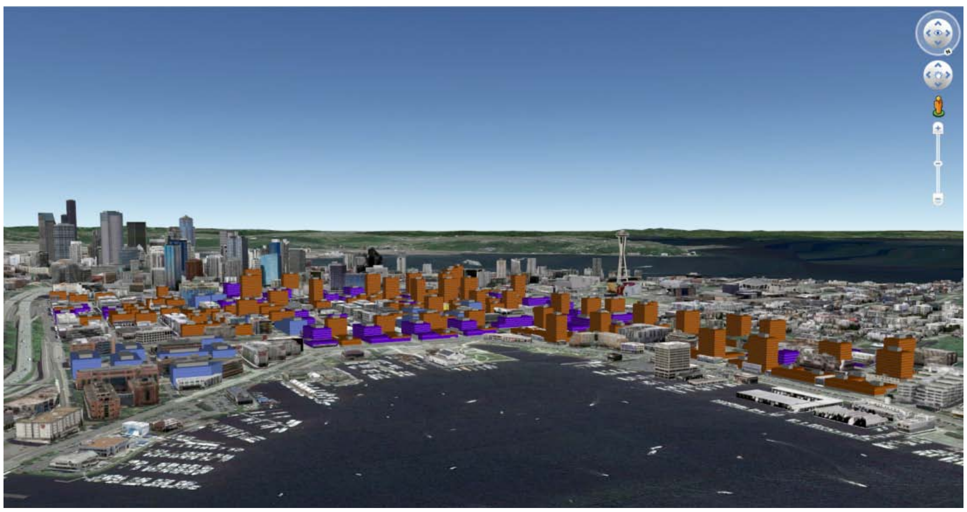
2031

FULL BUILD-OUT

Source: NBBJ, 2010.

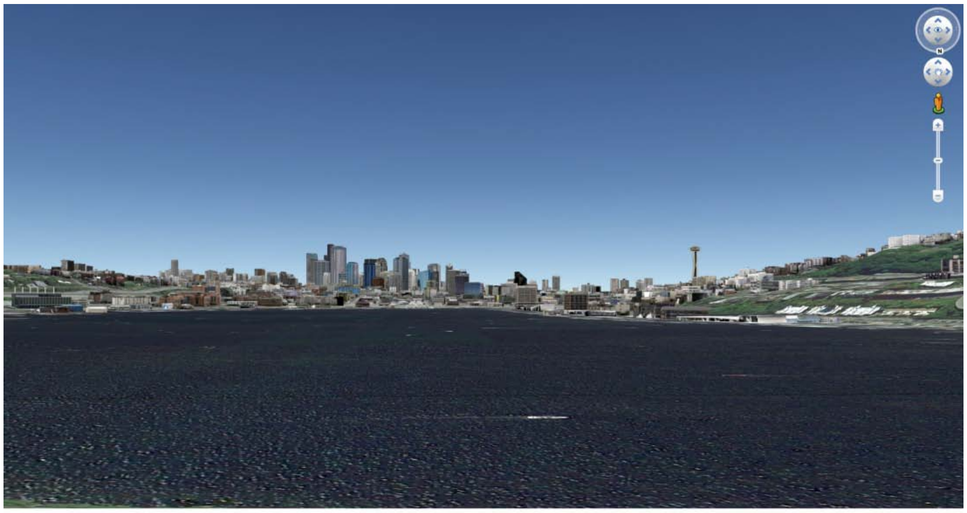
Figure 3.10-6
Birds-eye View – Alternative 3



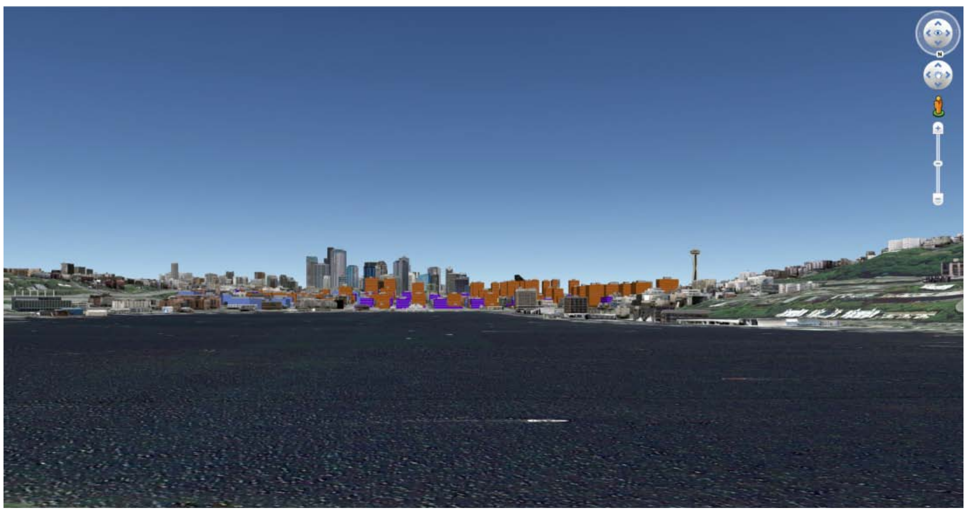


Source: NBBJ, 2010.

Figure 3.10-7
Gasworks Park View – Alternative 3



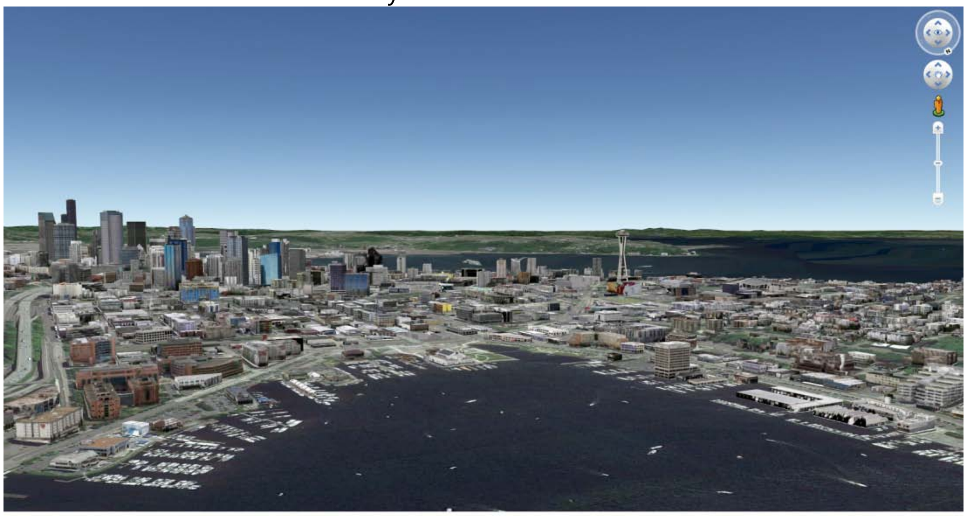
EXISTING

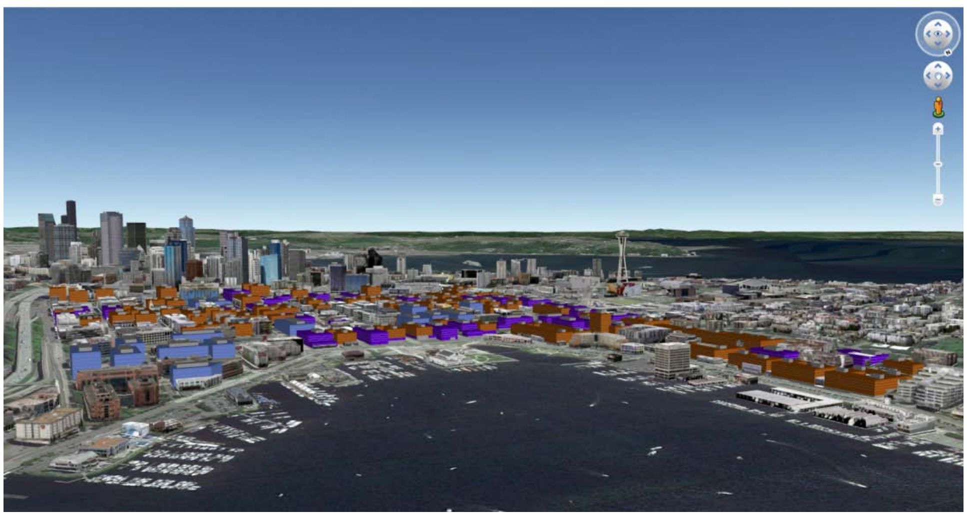


FULL BUILD-OUT

Source: NBBJ, 2010.

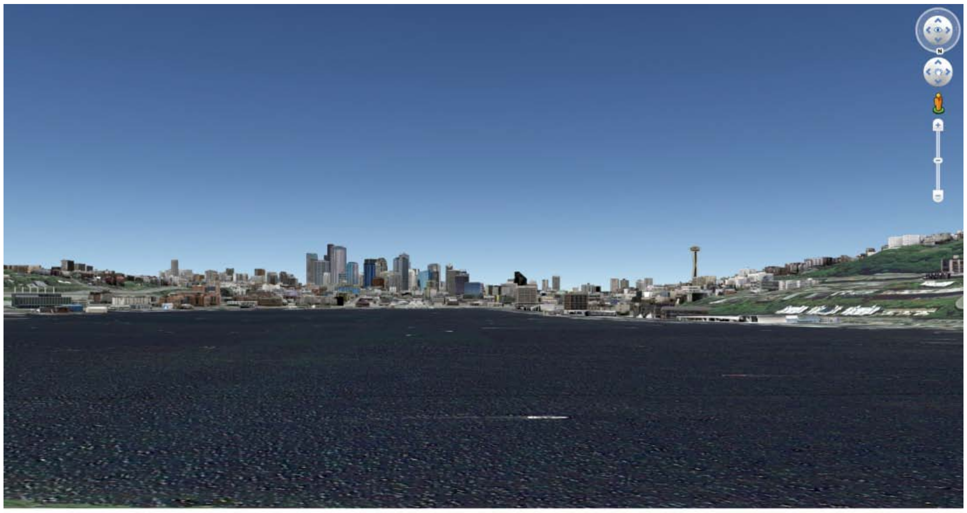
Figure 3.10-8
Birds-eye View – Alternative 4



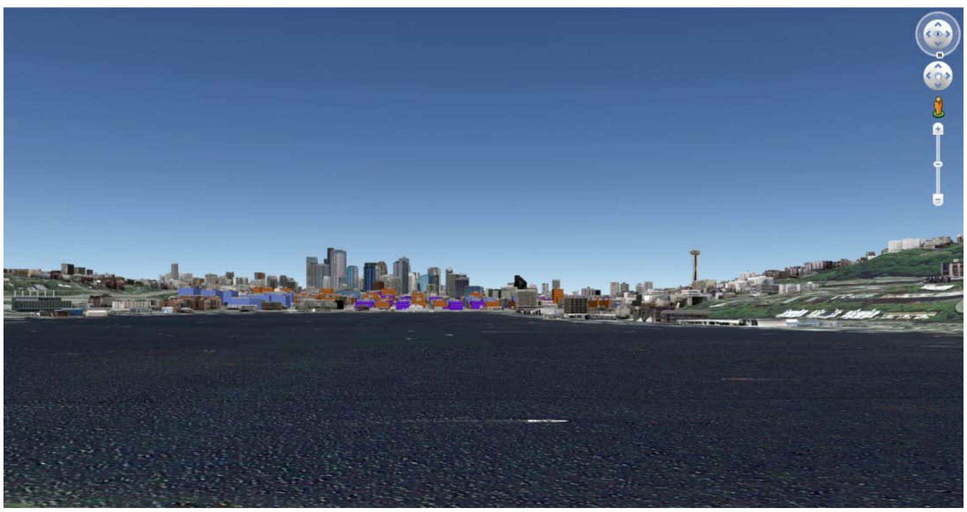


Source: NBBJ, 2010.

Figure 3.10-9
Gasworks Park View – Alternative 4



EXISTING



FULL BUILD-OUT

Source: NBBJ, 2010.

Area Context

The difference between Alternatives 1 and 2 is largely a matter of scale. The lines between height zones are drawn almost identically to those in Alternative 1, but building heights are reduced through much of the neighborhood.

As infill occurs in both the Denny Triangle and the South Lake Union neighborhoods, the greatest aesthetic difference resulting from the development under the first three alternatives – to greater or lesser degrees determined by the allowed height and density of development – will be the visual expansion of the Downtown Seattle skyline north to the shores of Lake Union. Although higher in elevation, territorial views of residents in the surrounding neighborhoods could be affected by new high-rise buildings within the study area. This impact, however, would not occur relative to development under Alternative 4 – No Action.

Neighborhood Character

All alternatives contemplate a significantly greater amount of development, with vacant lots, surface parking lots and under-utilized properties being developed to their full economic potential. Greater density of buildings, residents and employees will create a more urban environment with a consequent increase in street-front retail, employment opportunities and housing options, as well as pedestrian and vehicular traffic.

Height, Bulk and Scale

Alternatives 1 through 3 propose a relatively new building typology for the South Lake Union neighborhood. The new building type would feature a high-rise tower with a limited floor plate area positioned atop a bulkier low-rise podium that would potentially fill the site from property line to property line.

The heights of the towers would vary with the alternatives – potentially ranging from 125 feet to 240 feet for commercial buildings and from 125 feet to 400 feet for residential buildings. Floor plate sizes of towers would be limited to 24,000 sf above the podium for commercial use and an average of 10,500 sf (maximum of 11,500 sf) for residential development. Thus, although the same building typology would apply to both commercial and residential projects, the residential towers would typically be taller and narrower compared to the commercial towers.

The FAR limitation on commercial buildings would reinforce the physical difference between commercial and residential projects. Not being constrained by maximum FAR restrictions, residential development would always have the potential to build to the maximum allowed building height for the use, but commercial development would be restricted by FAR and typically not rise to the maximum allowable building height.

Podiums at the base of the towers would provide the towers with a visual base and create a clear edge along the street.

To a greater or lesser degree, all of the alternatives for the South Lake Union neighborhood would gradually transition down in height from the south boundary of the neighborhood toward Lake Union on the north. However, Alternative 1 would allow buildings of similar height to the maximum allowed in the Denny Triangle – up to 400 feet – for one block of depth along its border (Denny Way) with the Denny Triangle before decreasing to 300 feet at John Street.

Tower bulk (length and width) is not expected to create significant impacts given the restrictions on floor plate size in the alternatives using incentive zoning. Similarly, the bulk of podiums created under incentive zoning would not be expected to be impactful given the restrictions on their height – with the possible exception of the double length blocks along Dexter Avenue N between Aloha and Galer Streets where the street grid is interrupted. In addition, it should be noted that podiums are not required and towers may be developed without a podium base.

While for purposes of this EIS maximum development has been assumed, it is possible that some property owners may not choose to maximize their full development potential. In addition, owners with properties of less than 22,000 sf would still have the option to develop projects to the standards of the underlying zoning. The typology for these buildings is well established within the neighborhood and includes (in plan view) simple rectangles, L-shapes and U- shapes that fill out their zoning envelope from property line to property line and to the maximum height allowed by zoning code, typically ranging between 65 and 85 feet (exceptions being a narrow zone along Denny Way that has a 125 foot height limit and another between Mercer and Valley that is restricted to 40 feet).

Focus Areas

The impacts of potential development in the Focus Areas are shown in conceptual massing studies for each alternative. The orientation of each of these views is described and depicted by computer modeling relative to each alternative (see Focus Area discussion within each alternative later in this section). The depictions show massing of the buildings relative to the street width and surrounding context, but do not attempt to show designs for the individual building or streetscapes.

Alternative 1

Of the development alternatives, full development under Alternative 1 could have the greatest impact on aesthetics in that this alternative would permit the greatest building heights and could result in the greatest increase in development density. The difference between this alternative and Alternative 2, however, is largely a matter of scale.

Area Context

The greatest difference to the surrounding context envisioned in Alternative 1 would be the apparent visual expansion of the Downtown Seattle skyline to the shore of Lake Union due to the potential for new high-rise construction.

Neighborhood Character

As previously discussed, a greater density of buildings, residents and employees would create a more urban environment with consequently an increase in street-front retail, employment and housing, as well as pedestrian and vehicular access. Over time, it is anticipated that small-scale buildings would redevelop to the larger building typology permitted under the proposed zoning. Relative to the other alternatives, the South Lake Union neighborhood would likely experience the greatest change in character as a result of Alternative 1, although the difference between Alternatives 1 and 2 is incremental in nature.

Similar to Alternative 2, Alternative 1 would encourage a future residential character of the 8th Avenue corridor, through a greater emphasis on residential development compared to commercial. In this corridor, residential building heights allowed at up to 300 feet, while commercial uses in residential buildings are limited to 20 feet in height and free-standing commercial buildings are limited to a maximum of 85 feet.

Alternative 1 is the only alternative that would change the existing Seattle Mixed Residential (SMR) zoning designation in the Cascade neighborhood to Seattle Mixed (SM) and allow commercial building heights to increase from 55 to 85 feet, with potential for greater increases through use of incentive zoning. Compared to the other alternatives, this change could allow for the greatest increase in non-residential floor area and significantly impact the existing residential character of the Cascade neighborhood.

Height, Bulk and Scale

Alternative 1 would allow the greatest building heights of the alternatives under consideration – potentially ranging from 85 feet for commercial buildings in the Cascade area and within the Mercer Blocks to 240 feet for much of rest of the study area, and ranging from 160 feet for residential buildings in the Cascade subarea up to 400 feet along Denny Way. This alternative would allow future buildings that may be more than twice the height than is currently allowed by zoning in the Cascade area and three or more times the allowed height in the rest of the South Lake Union neighborhood.

The impact of these differentials in zoning may be an abrupt juxtaposition of building heights as sites within the neighborhood redevelop. Potential impacts associated with height, bulk and scale differences between new and existing development could occur in the following situations.

- Areas where neighborhood character is more established and consistent (e.g., the Cascade area). Until recently, high-rise buildings were a rarity in the South Lake Union neighborhood and non-existent in the Cascade area. Alternative 1 would allow for substantial change in the physical scale of individual buildings, create greater differential in the neighborhood skyline and reduce the visual presence of older structures – including Landmark structures.
- Places of transition with neighboring low and mid-rise neighborhoods, such as Uptown. The border with the Uptown Urban Center has numerous available sites for high-rise towers, as well as many additional sites along Dexter Avenue N and 8th Avenue N. The impact of this scale differential could be substantial at full build-out. Given the anticipated re-connection of the Uptown and South Lake Union neighborhoods across Aurora Avenue N, it may be appropriate to address this potential issue by addressing the zoning of the Uptown Triangle and South Lake Union neighborhoods together rather than independently.
- Areas now only very lightly developed, such as the 8th Avenue Corridor and the Dexter Avenue Corridor north of Mercer Street These are areas where the density of new high-rises, if fully developed, could create a potential wall of building to the neighbors. This concern also applies to the Valley/Mercer Blocks, but to a lesser degree. Towers within the Valley/Mercer Blocks would have less impact due to limitation on the number of towers imposed, as a result of the requirement to assemble 60,000 sf of site area for each potential tower (although the relatively tall podium

heights of up to 85 feet permitted by Alternative 1 in the Valley/Mercer Blocks could contribute to a more bulky appearance in this area).This impact could be mitigated by a requirement to limit building height within the flight path of the Lake Union Seaplane Airport, which restricts building height to 150 feet (or less if a height buffer is mandated). This restriction could severely constrain building height on two of the four blocks in this area (see **Figure 3.10-1**).

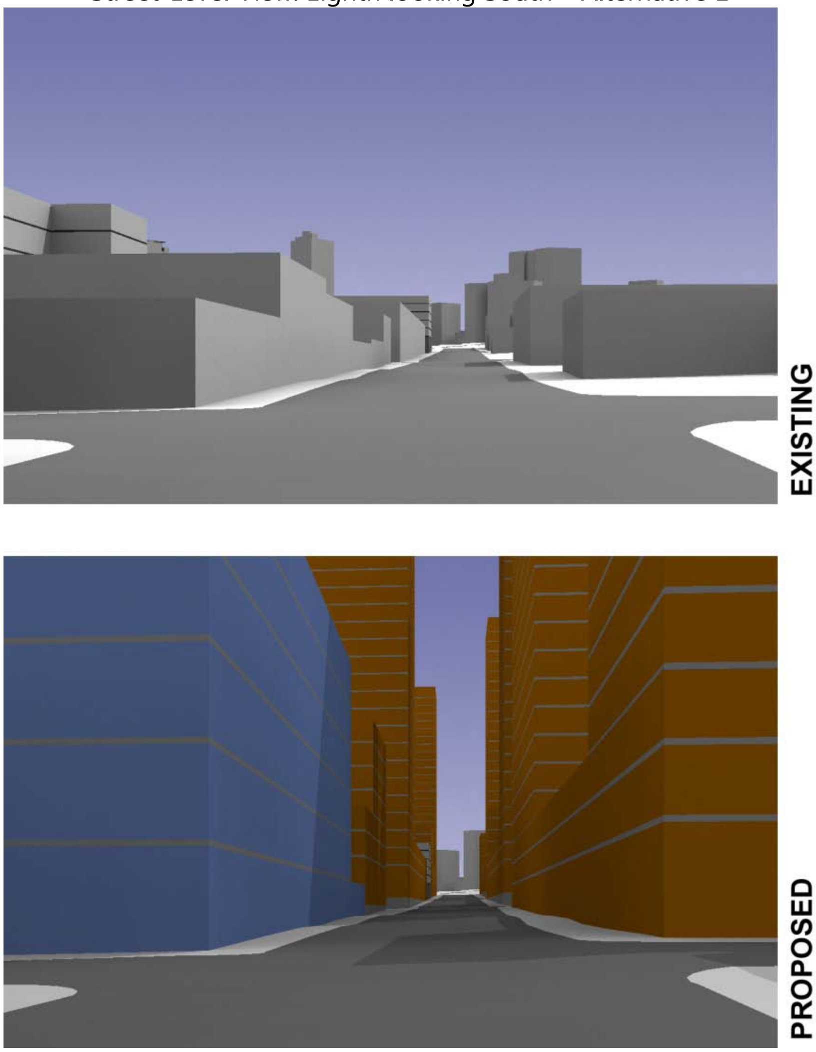
Focus Areas

Alternative 1 would allow the greatest degree of development and could potentially result in the greatest amount of change within the designated Focus Areas. Such changes would be particularly noticeable within the Fairview and 8th Avenue Corridors

8th Avenue Corridor

Figure 3.10-10 is a computer-generated graphic depicting the existing, as well as a developed street-level view associated with Alternative 1 along 8th Avenue N from the intersection at Republican Street. This view looks south toward Denny Park. A concentration of multi-family residential development that could be expected to occur on blocks facing onto 8th Avenue N could result in a neighborhood with one or two new towers on every block between Denny Way and Republican Street. Lower podium heights and the retention of the mature street trees that currently line both sides of this corridor could partially mitigate the building heights. Furthermore, there is a natural association between the concentration of residential buildings in this corridor with the existing open space and amenities provided by a renovated Denny Park.

Figure 3.10-10
Street-Level View: Eighth looking South – Alternative 1

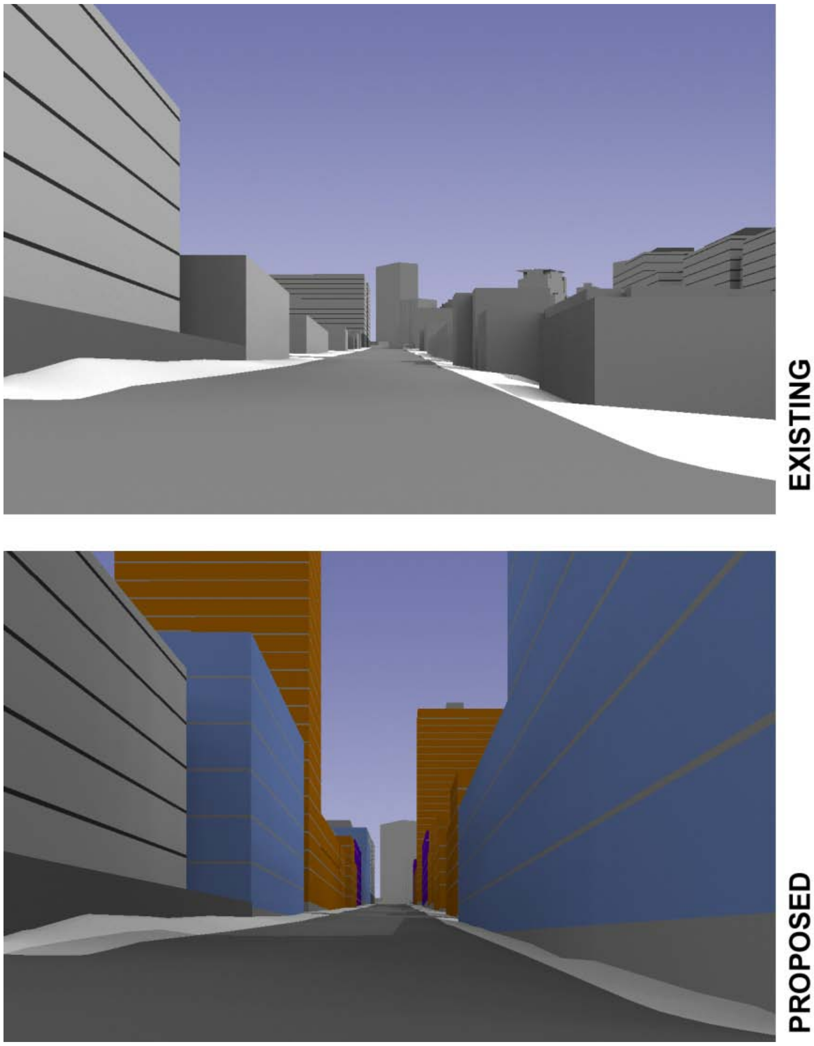


Source: NBBJ, 2010.

Fairview Avenue Corridor

Figure 3.10-11 is a computer-generated graphic depicting the existing and developed view (Alternative 1) along Fairview Avenue N from the intersection with the Mercer Street ramp to I-5. This view looks south toward looks south toward Downtown Seattle. The anticipated mix of new residential towers with significantly shorter commercial structures, together with the retention of some existing (including landmark) structures would result in a neighborhood character with a great variety of building types and heights.

Figure 3.10-11
Street-Level View: Fairview Avenue N – Alternative 1

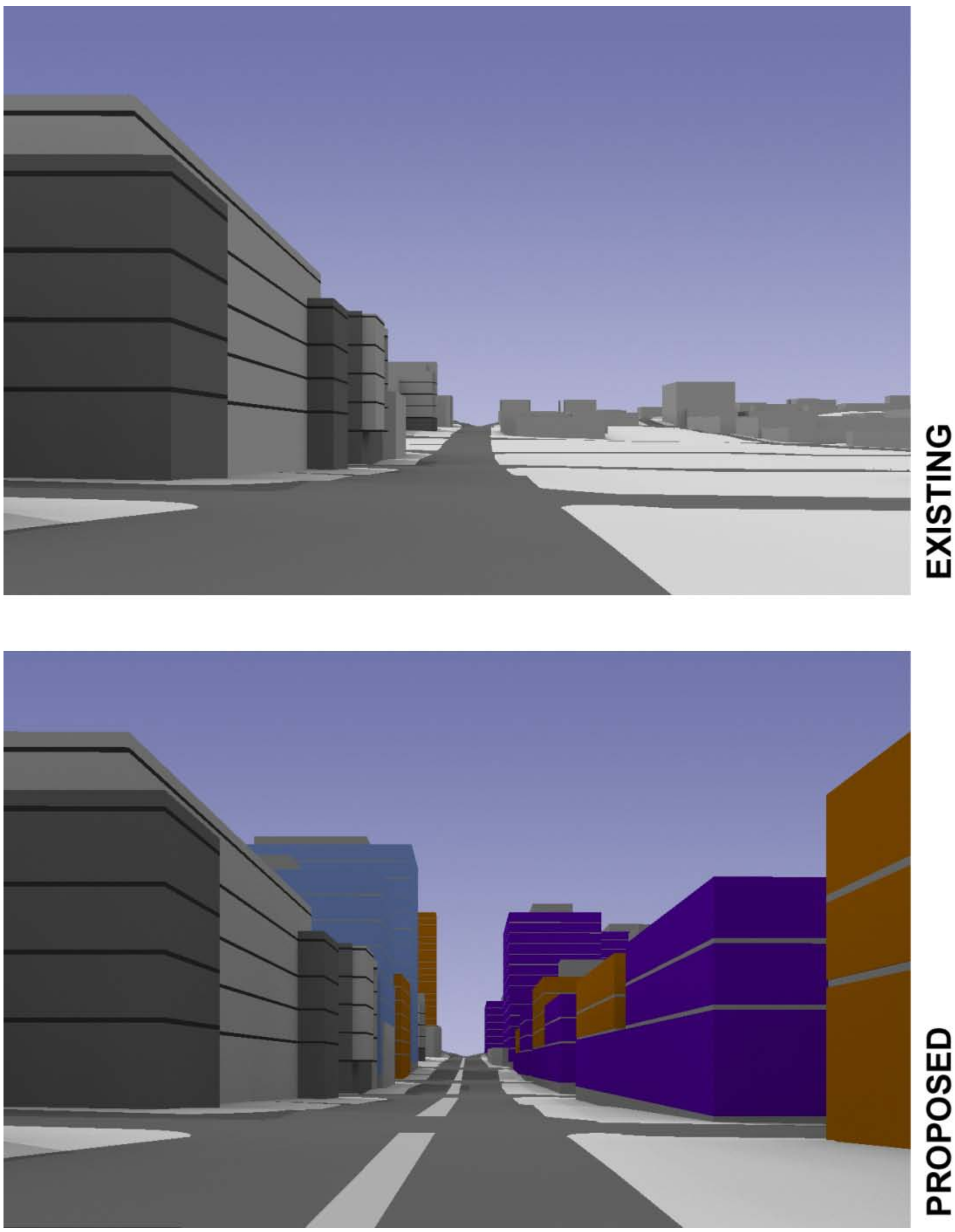


Source: NBBJ, 2010.

Valley/Mercer Blocks

Figure 3.10-12 is a computer-generated graphic depicting the existing and developed view (Alternative 1) along Mercer Street from the intersection of Mercer and Boren Avenue N. The view associated with this corridor looks west toward Uptown and Queen Anne along Mercer Street. The Valley/Mercer Blocks are on the right in this view. Alternative 1 would produce less impact on the Mercer Corridor and the Valley/Mercer Blocks than on the other two Focus Areas. This is due not only to the limit of a single tower in each block on the north-side of Mercer, but also the reduction in tower height due to the air corridor study associated with the Lake Union Seaplane Airport, which would affect three of the Valley/Mercer Blocks (see **Figure 3.10-1**). Improvement of the Mercer Way corridor (presently under construction) is expected to provide an enhanced pedestrian environment and would be important to mitigating the scale of future development associated with this alternative. In particular, the addition of a new median with a row of street trees and public art should both improve conditions for all forms of mobility, but also add foreground elements that would mitigate the scale of surrounding buildings. New development also has the potential to create a synergistic relationship with the new Lake Union Park that could benefit both the public and private realms.

Figure 3.10-12
Street-Level View: Mercer Street – Alternative 1



Source: NBBJ, 2010.

Alternative 2

The difference between Alternatives 1 and 2 is largely incremental and a matter of scale.

Area Context

The greatest difference to the surrounding context envisioned in Alternative 2, like Alternative 1, will be the visual expansion of the Seattle City skyline to the shores of Lake Union as a direct consequence of new high-rise construction. There will, however, be a more noticeable height change from neighborhoods to the south and the South Lake Union neighborhood due to the reduction in allowable building heights across Denny Way, from 400 feet in the Triangle to 240 feet in South Lake Union.

Also like the first alternative, Alternative 2 creates an abrupt transition with the Uptown neighborhood (see "Height, Bulk and Scale" below) and impacts some views from neighboring communities (see "Viewshed" later in this Chapter).

Neighborhood Character

Generally speaking, the South Lake Union neighborhood would become more urban in its physical appearance, but maintain a distinct character commensurate with its unique community of uses and the retention of its historic structures. Since this alternative would retain existing zoning in the Cascade area, Cascade would continue to stand apart with its combination of low-rise and mid-rise buildings.

As noted in Alternative 1, the 8th Avenue Corridor and Valley/Mercer Blocks Focus Areas would likely be those areas within the study area that would experience the greatest change. Both have an opportunity to create a synergistic relationship with their neighboring parks – a renovated historic Denny Park at the south end of the 8th Avenue Corridor and the new Lake Union Park adjacent the Valley/Mercer Blocks.

Similar to Alternative 1, Alternative 2 emphasizes residential development in the 8th Avenue corridor, with commercial building heights limited to 20 feet and residential development permitted at building heights of up to 240 feet. In contrast to Alternative 1, Alternative 2 would maintain the existing SMR zoning designation in the Cascade neighborhood.

Height, Bulk and Scale

In terms of height, bulk and scale, Alternative 2 would have similar, but fewer, impacts as compared to Alternative 1.

Outside of the Cascade area, building heights could potentially range from 160 feet for residential buildings on the Valley/Mercer Blocks up to 300 feet along the western border with Uptown. Although there are significant differences in the allowed maximum height for commercial buildings between alternatives, the FAR limitation would be the controlling factor and the commercial building envelopes in Alternative 2 would be largely unchanged compared to Alternative 1, except for some size reduction (approximately one floor) in the Cascade area. As noted, the Cascade area would retain its existing zoning.

The tallest buildings anticipated by Alternative 2 would be 300-foot residential towers that are proposed for the portion the study area that borders the Uptown Urban Center. Therefore, potential impacts described in Alternative 1 under 'Height, Bulk and Scale' would also apply to Alternative 2 relative to the abrupt scale transition between the two neighborhoods. As noted in Alternative 1, one approach may be to address this potential issue by addressing the zoning of the two Urban Centers together rather than independently.

Unlike Alternative 1, podium heights associated with Alternative 2 would not vary with street width, but would remain relatively consistent – typically 45 feet. This would translate to a reduced building profile at the street edge. In turn, the scale of the 'urban room' formed by street and podium – and its sense of enclosure – would also be commensurately reduced.

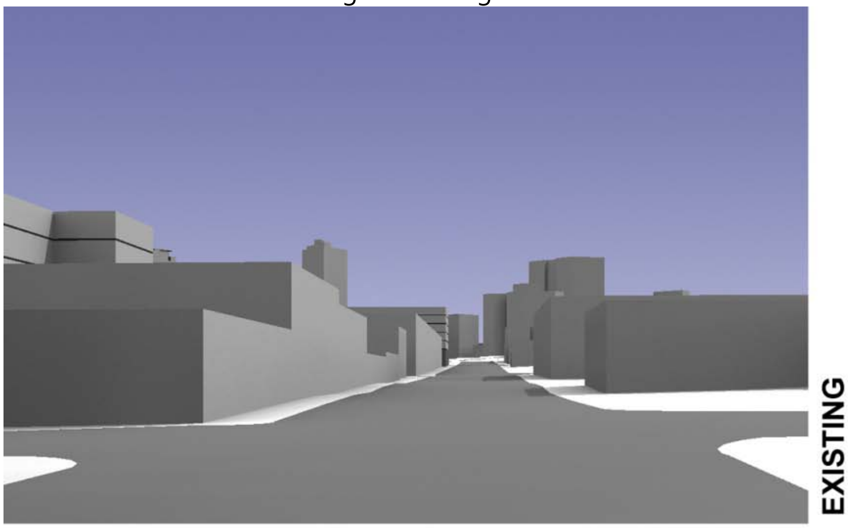
Focus Areas

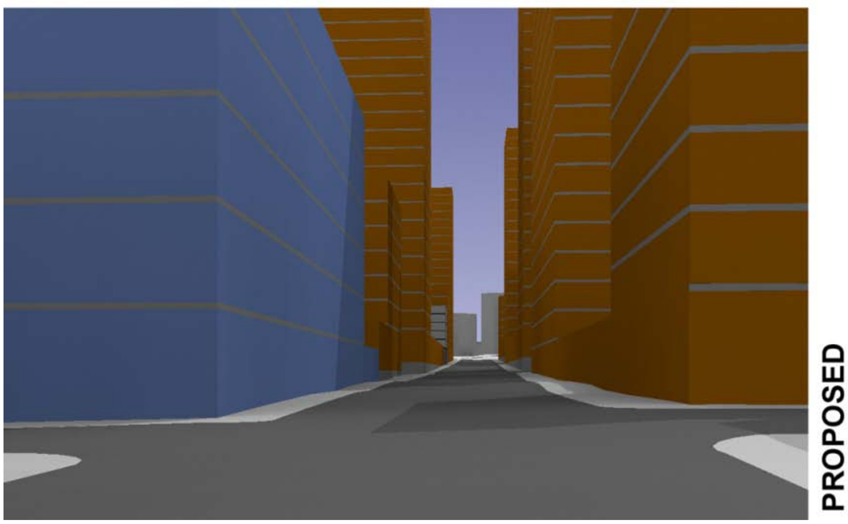
For all practical purposes, the impacts of Alternative 2 would be the same as Alternative 1 within the designated Focus Areas. While a reduction in height could occur, no substantial differences in aesthetic impacts are anticipated.

8th Avenue Corridor

See **Figure 3.10-13** and the discussion under Alternative 1.

Figure 3.10-13
Street-Level View: Eighth looking South – Alternative 2



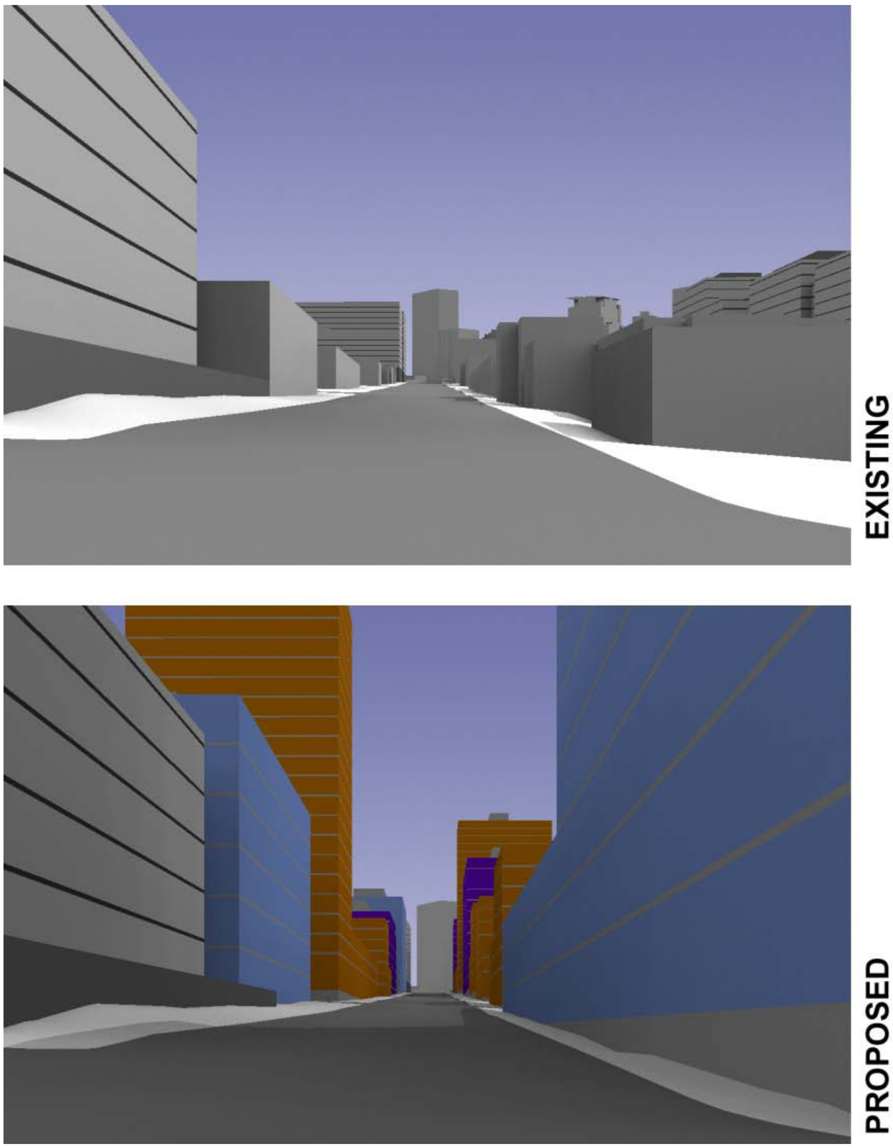


Source: NBBJ, 2010.

Fairview Avenue Corridor

See **Figure 3.10-14** and the discussion under Alternative 1.

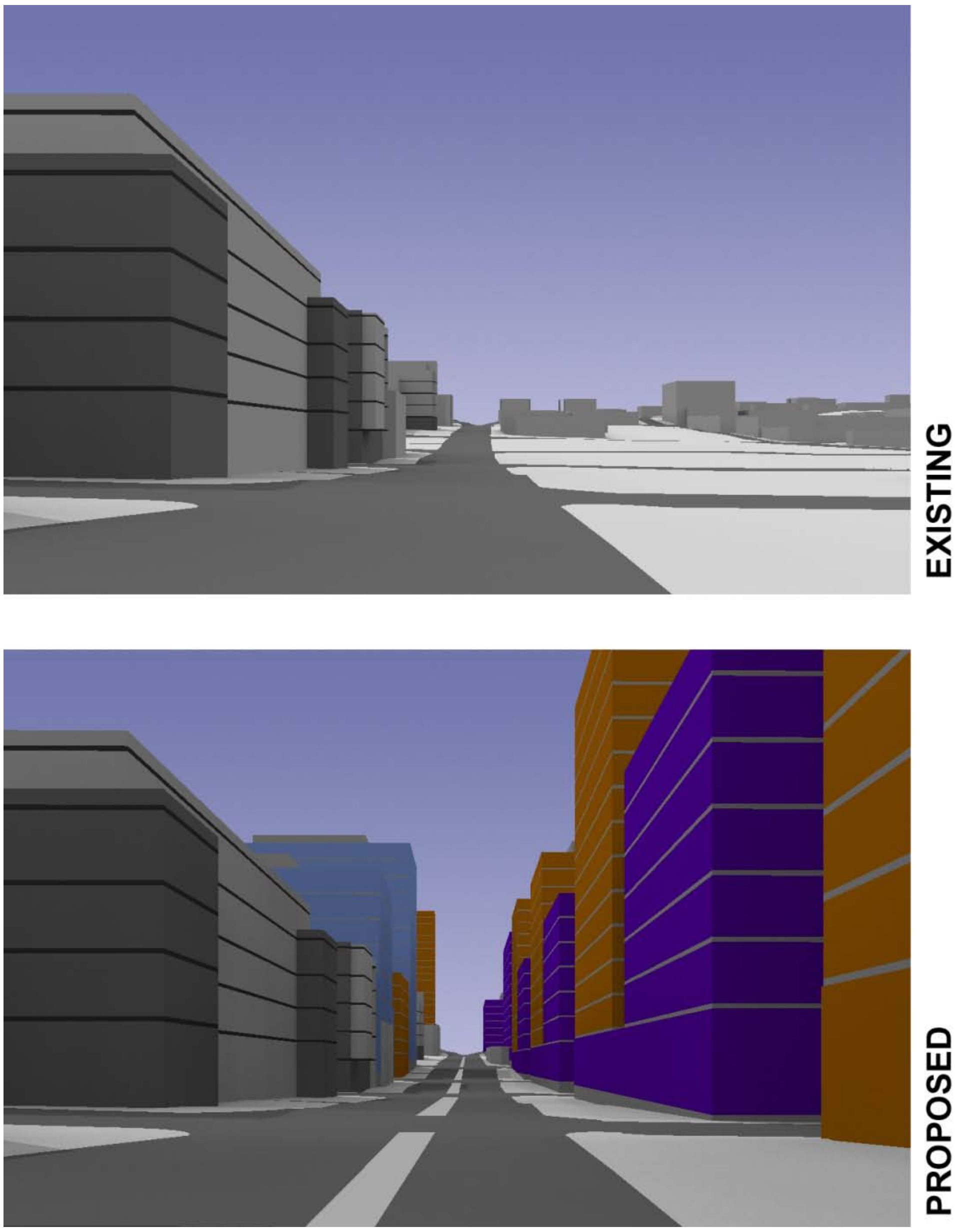
Figure 3.10-14
Street-Level View: Fairview Avenue N – Alternative 2



Source: NBBJ, 2010.

Valley/Mercer Blocks
See **Figure 3.10-15** and the discussion under Alternative 1.

Figure 3.10-15
Street-Level View: Mercer Street – Alternative 2



Source: NBBJ, 2010.

Alternative 3

Alternative 3 would envision a neighborhood with graduated heights from north to south – with the tallest buildings located closest to Denny Triangle and the lowest building heights proximate to Lake Union. The Cascade area would be an exception in that that area would retain existing zoning.

Area Context

The greatest difference to the surrounding context envisioned by Alternative 3 – like Alternative 1 and 2 – would be the visual expansion of the Downtown Seattle skyline to the shore of Lake Union as a result of potential new high-rise construction. As in Alternative 2, there may be a noticeable stepping down between the Denny Triangle and the South Lake Union neighborhood due to the reduction in allowable building heights north of Denny Way – from 400 feet in the Denny Triangle to 240 feet in South Lake Union. In Alternative 3, there would also be a graduated stepping down toward Lake Union that would be less abrupt than the transition between the Denny Triangle and the study area.

Also like the first and second alternative, development under Alternative 3 would create an abrupt transition with the Uptown neighborhood (see "Height, Bulk and Scale" below) and could affect some views from neighboring communities (see "Viewshed" later in this chapter).

Neighborhood Character

As is the case with Alternatives 1 and 2, the South Lake Union neighborhood would become more urban in its physical appearance with the changes envisioned by Alternative 3, but still maintain a distinct character commensurate with its unique community of uses and the retention of its historic structures. Compared to the other alternatives, future development under Alternative 3 would be lower in height and more likely to be residential in character. Since this alternative would also retain the existing SMR zoning in the Cascade area, Cascade would continue to stand apart with its combination of low-rise and mid-rise buildings and current residential character.

Similar to Alternatives 1 and 2, the 8th Avenue Corridor and Valley/Mercer Blocks Focus Areas would likely be the most changed portions of the study area. Both have an opportunity to create a more residential character with a concentration of housing synergistic relationship with their neighboring parks – a renovated historic Denny Park at the south-end of the 8th Avenue Corridor and the new Lake Union Park adjacent to the Valley/Mercer Blocks.

Height, Bulk and Scale

As in Alternative 2, the Cascade area would retains its existing zoning in this alternative. Other than that, Alternative 3 would substantially differ from Alternatives 1 and 2 in terms of the location and orientation of allowable building heights. With the exception of the Cascade area, allowable heights of residential buildings would transition down between Denny Way and South Lake Union. Except for a narrow band that would allow 125-foot buildings along a portion of Denny Way and 65-foot buildings along the north-half of the Dexter and Westlake Avenue N corridors, commercial building height would be uniformly limited to 85 feet.

Although the graduated building height would differ from Alternative 1 and 2, Alternative 3 could also have a potential impact on development within the Uptown Urban Center relative to an abrupt scale transition between the two neighborhoods (see 'Height, Bulk and Scale' in Alternative 1); the difference, however, being between 65-foot or 85-foot buildings in Uptown and potentially 160-foot or 240-foot buildings in the South Lake Union neighborhood. As noted with regard to Alternative 1, one approach may be to address this potential height differential issue by zoning the two Urban Centers together rather than independently.

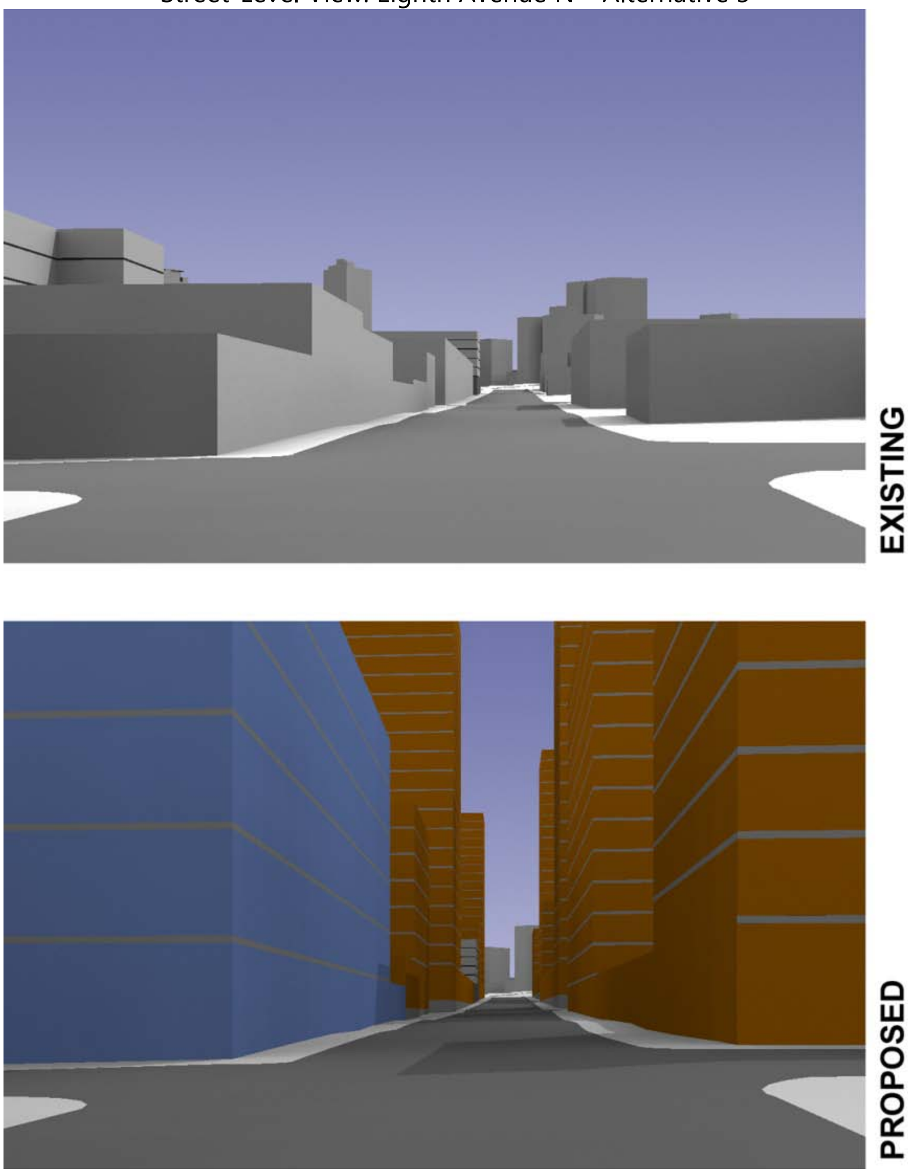
Focus Areas

For all practical purposes, the impacts of Alternative 3 would be the same as Alternative 1 within the designated Focus Areas. While a reduction in overall height would occur in conjunction with this alternative (compared to Alternative 1 and 2), the changes in aesthetic impacts are not expected to differ greatly.

8th Avenue Corridor

See **Figure 3.10-16** and discussion under Alternative 1.

Figure 3.10-16
Street-Level View: Eighth Avenue N – Alternative 3



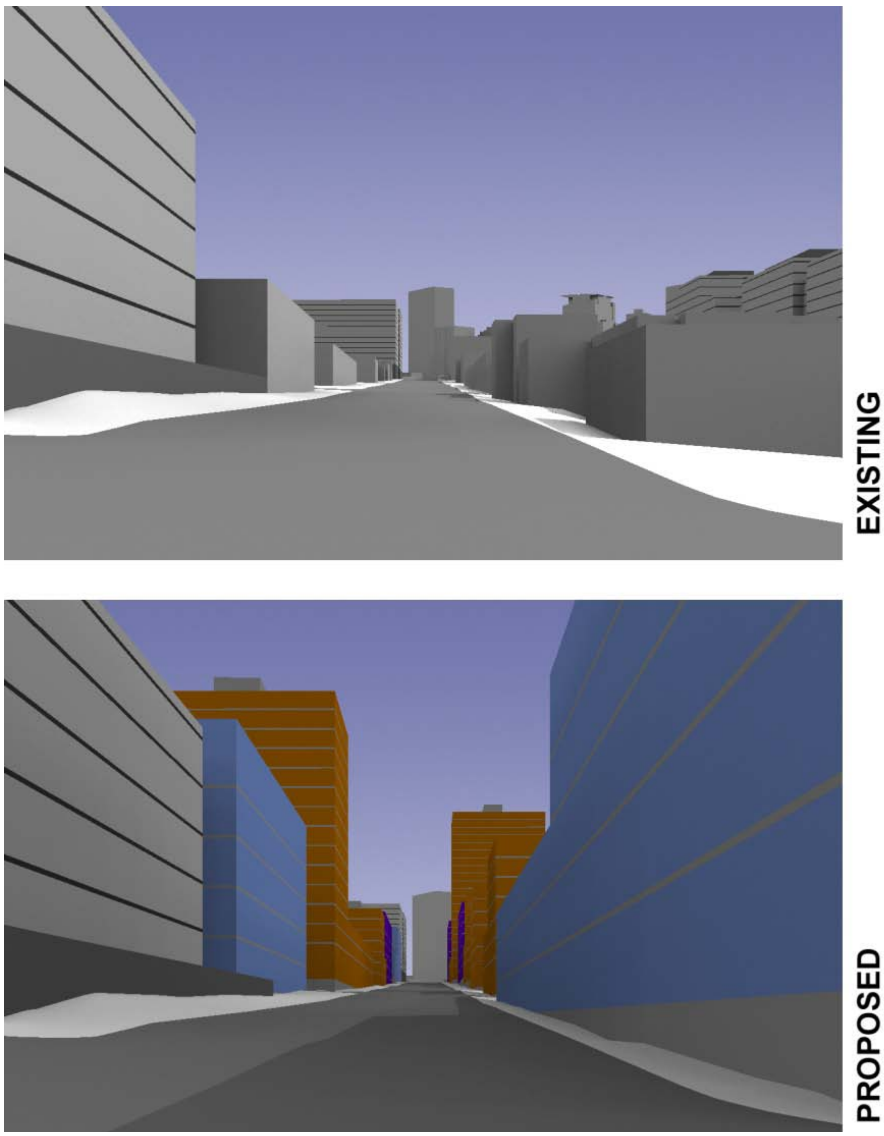
Source: NBBJ, 2010.

Fairview Avenue Corridor

See **Figure 3.10-17** and discussion under Alternative 1.

Figure 3.10-17

Street-Level View: Fairview Avenue N – Alternative 3



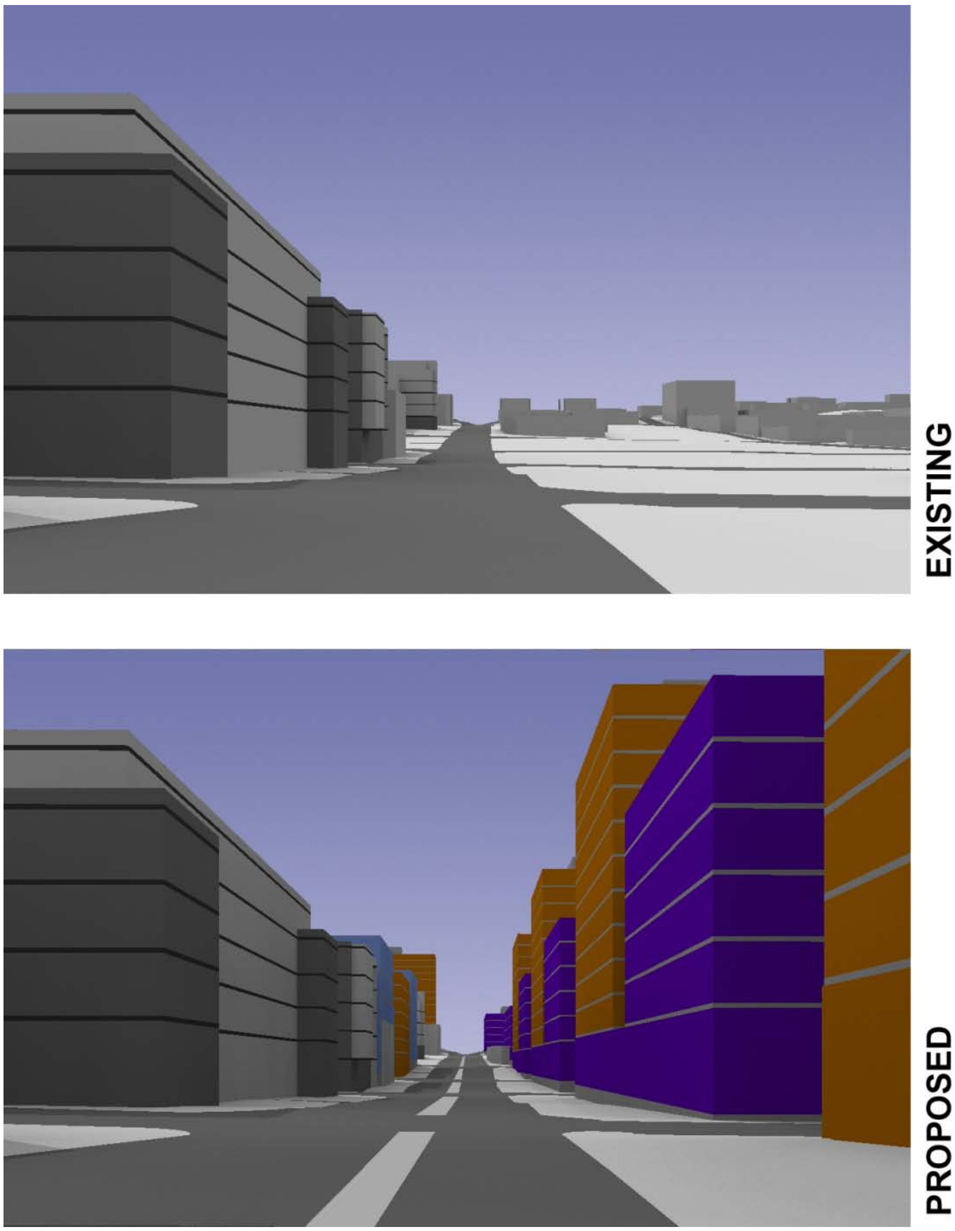
Source: NBBJ, 2010.

Valley/Mercer Blocks

See **Figure 3.10-18** and discussion under Alternative 1.

Figure 3.10-18

Street-Level View: Mercer Street – Alternative3



Source: NBBJ, 2010.

Alternative 4 (No Action)

Alternative 4 would retain the existing zoning for the entire South Lake Union neighborhood.

Area Context

No significant change to the area context is anticipated with regard to future development of the neighborhood under current zoning.

Neighborhood Character

No significant change to neighborhood character is anticipated with future development under current zoning. In particular, the existing Industrial Commercial (IC) zone would continue as an employment area with residential development prohibited and the residential character of the SMR zoning would maintained. Over time, the neighborhood would become more urban in character, but retain its current low- and mid-rise character.

Height, Bulk and Scale

Because the entire neighborhood would retain current zoning, Alternative 4 would have the least impact on neighboring communities compared to the other three alternatives. Heights of new buildings would be roughly equivalent to those in the Uptown Urban Center and would remain significantly less than those in Denny Triangle.

While height is not an issue with Alternative 4, bulk could be. Within the South Lake Union neighborhood, recent experience has shown that buildings built to the existing zoning typically fill their site from property line to property line and to the maximum height allowable. This has resulted in bulky buildings with a massive footprint and no mediating base or podium that would tend to dominate the immediate street environment. The best examples have carved out street level plazas and through-block connections that can significantly mitigate building bulk by introducing welcome interruptions in otherwise unrelieved street facades.

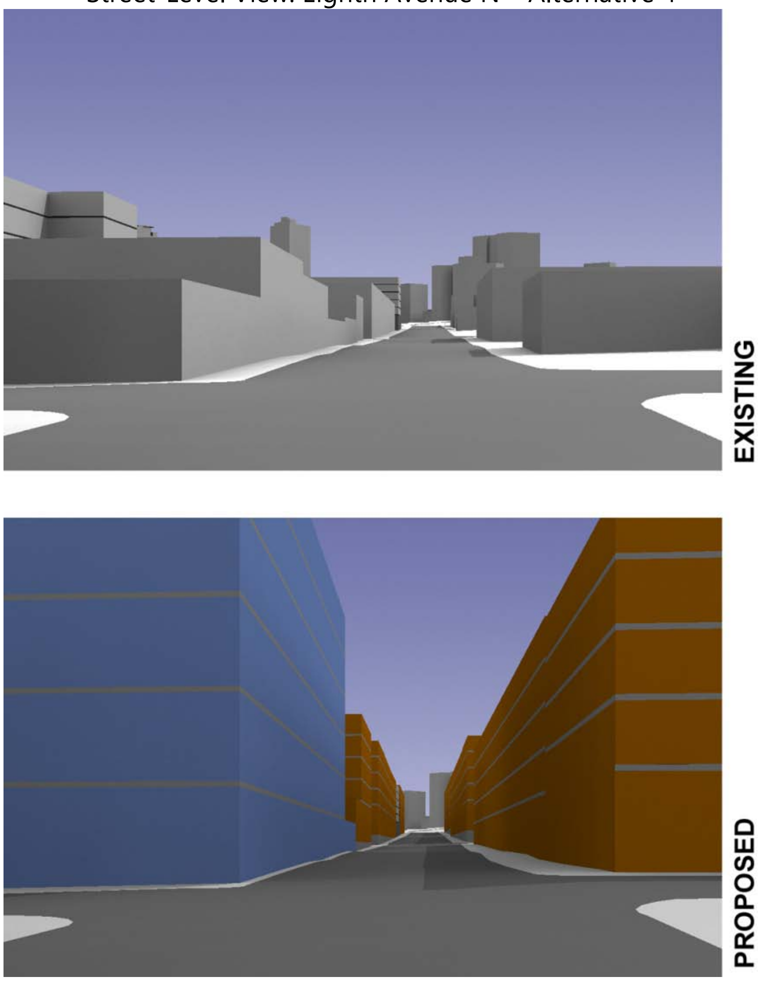
Focus Areas

Under Alternative 4, existing development regulations would be retained and no significant change to neighborhood character and height, bulk and scale are anticipated.

8th Avenue Corridor

See **Figure 3.10-19**.

Figure 3.10-19
Street-Level View: Eighth Avenue N – Alternative 4

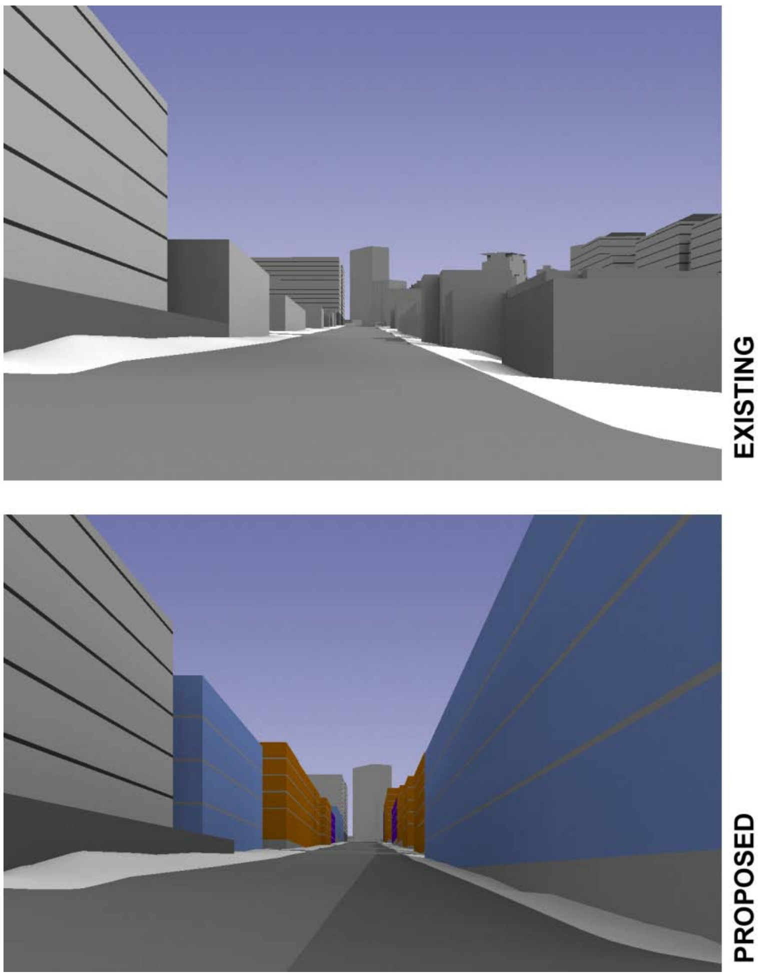


Source: NBBJ, 2010.

Fairview Avenue Corridor

See **Figure 3.10-20**.

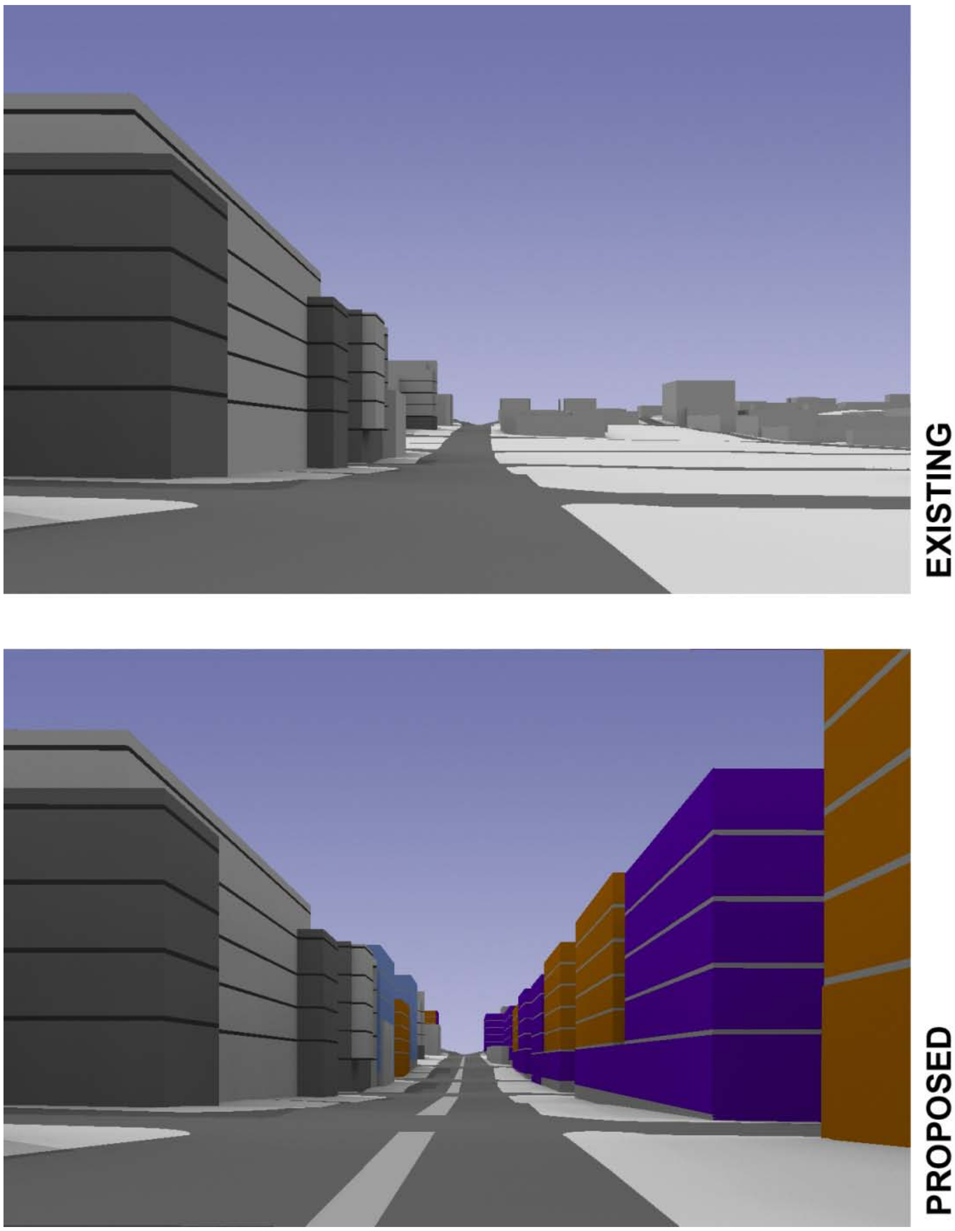
Figure 3.10-20
Street-Level View: Fairview Avenue N – Alternative 4



Source: NBBJ, 2010.

Valley/Mercer Blocks
See **Figure 3.10-21**.

Figure 3.10-21
Street-Level View: Mercer Street – Alternative 4



Source: NBBJ, 2010.

3.10.3 Mitigation Strategies

A number of potential approaches for mitigation are discussed below. See also mitigation recommendations contained in SMC 25.05.675, some of which are incorporated below.

Possible mitigation strategies to reduce the impact of height, bulk and scale that may apply to all alternatives include:

a. Either limit the height of development or create additional zones that transition building heights down more gradually.
b. Implement measures to modify the bulk of development.
c. Modify building façades or envelopes through adjustments in building modulation, finish material, color, architectural detailing or fenestration (including type or percentage of glazing).
d. Reduce, relocate or rearrange of accessory structures.
e. Modify required building setbacks.
f. Relocate buildings on-site.
g. Modify building orientation.
h. Redesign the building profile of a project.
i. Create or modify on-site view corridors.
j. Reduce or modify walls, fences, screening or landscaping.
k. Require or encourage incorporation of open space or through-block pedestrian connections as part of development projects.
l. Develop and adopt design guidelines to specifically address bulk impacts identified with each alternative.

3.10.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to height, bulk and scale are anticipated.

Affected Environment
Environmental Impacts
Mitigation Strategies
Significant Unavoidable Adverse Impacts
Height, Bulk and Scale

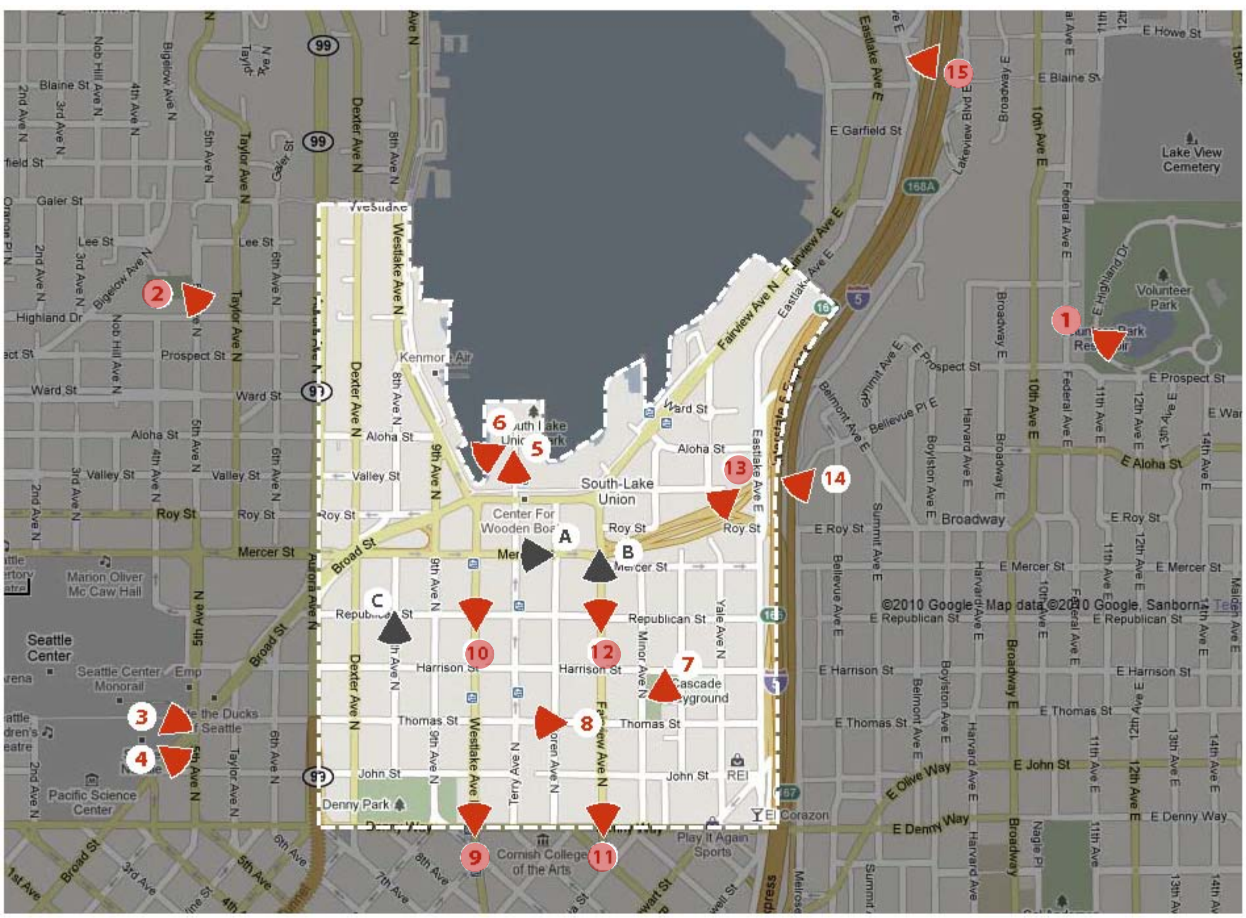
VIEWSHED

This section illustrates and describes the physical character of the South Lake Union neighborhood and its immediate surroundings using 3-D computer modeling and photographic simulations. These simulations provide representative views from selected viewpoints of both the existing neighborhood and each of the proposed alternatives.

3.10.5 Affected Environment

To evaluate the potential impact of the four alternatives relative to views, 15 viewpoints have been identified. Six of the viewpoints are officially-designated viewpoints (discussed below) and photosimulations for these are provided in this section of the Draft EIS. Photosimulations for non-designated viewpoints are contained in **Appendix D** of this Draft EIS. **Figure 3.10-22** depicts all 15 viewpoint locations; those that are color coded are included in this section of the Draft EIS.

Figure 3.10-22
Viewshed Locations



Source: NBBJ, 2010.

Each of the simulations is based on a photograph that was taken at the viewpoint. To evaluate the impact of each alternative on the viewshed, a 3-D computer model for each alternative was inserted into Google Earth and view angles were set to match the viewpoints used for the photos. Since Google Earth does not typically show the height of plant material, trees and other growth that play a prominent role in specific views were added directly from the photos using Photoshop to provide as much realism as possible.

The City of Seattle Municipal Code Section 25.05.675 P contains SEPA policies related to public view protection. Specifically, ,"(i)t is the City's policy to protect public views of significant natural and human-made features: Mount Rainer, the Olympic and Cascade Mountains, the downtown skyline, and major bodies of water including Puget Sound, Lake Washington, Lake Union and the Ship Canal, from public places consisting of the specified viewpoints, parks, scenic routes, and view corridors …"(SMC 25.05.675 P2a). Designated viewpoints are identified in Attachment 1 to that section of the code.

There are three City-designated **viewpoints**[5] in the vicinity of the South Lake Union neighborhood – Volunteer Park, Bhy Kracke Park and Plymouth Pillars Park (formerly known as Four Columns Park/Boren-Pine-Pike Park). Views toward the South Lake Union neighborhood from Plymouth Pillars Park were analyzed and it was determined that the majority of the neighborhood is not visible from this viewpoint. The viewpoint analysis contained in this Draft EIS, therefore, addresses Volunteer Park and Bhy Kracke Park.

While not identified as City-designated viewpoints based on Attachment 1, there are additional locations in and proximate to the South Lake Union neighborhood that provide a public (or quasi-public) view of the this neighborhood, including: Lake Union Park, the Cascade Playground, Bellevue Place, and the Space Needle. Simulations associated with these viewpoints are contained in **Appendix D** of this Draft EIS.

The following is an overview of the existing viewsheds associated with Volunteer Park and Bhy Kracke Park.

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5 Based on Seattle's SEPA Code 25.05.675, Attachment 1.

Volunteer Park

The park is located in the Capitol Hill neighborhood approximately three-quarters of a mile northeast of the South Lake Union neighborhood. The designated viewpoint is atop the cylindrical water tower near the reservoir in the southern portion of the park. This designated viewpoint provides southwesterly views toward the study area from the tower including views of the Space Needle, the Downtown Seattle skyline, the Olympic Mountains and Puget Sound. During part of the year, views of portions of the South Lake Union neighborhood from this location are obscured by mature deciduous and coniferous trees.

Bhy Kracke Park

This park is located on the southeast side of Queen Anne Hill, west of Lake Union (1215 - 5th Avenue N) and approximately one-half mile northwest of the South Lake Union neighborhood. This designated viewpoint provides southeasterly views toward the study area. The park is situated on a hillside and features a narrow pedestrian path that winds from the bottom to the top of the hill. From the outlook at its highest point, Bhy Kracke Park offers views of the Downtown Seattle skyline, Mount Rainier, the Space Needle and Lake Union. Only portions of the South Lake Union neighborhood are visible from the higher elevations in the park and even then, part of the view of the study area is obscured during portions of the year by mature deciduous trees.

In addition to City-designated public viewpoints of significant natural and human-made features, the City has identified 10 viewpoints from which views of the **Space Needle** are to be protected.[6] Of these ten viewpoints, only one has a line of sight through the South Lake Union neighborhood – Volunteer Park.

City policy also protects public views of **historic landmarks** that have been officially designated by the City's Landmarks Preservation Board and, "which, because of their prominence of location or contrasts of siting, age, or scale are easily identifiable visual features of their neighborhood or the City and contribute to the distinctive quality or identity of their neighborhood or the City."[7] Nine historic structures or objects have been designated as Landmarks in the South Lake Union neighborhood.[8] Each of

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6 Seattle Municipal Code Chap. 25.05.675 P2c. and Seattle DCLU, 2001,

7 Seattle Municipal Code Chap. 25.05.675 P.2.b.i.

8 The South Lake Union, Eastlake and Fremont areas are combined as part of the City's Lake Union region.

these is at least 25 years old and each meets one or more of the City's designation criteria.[9]

Lastly, City ordinances[10] identify specific **scenic routes** throughout the City from which view protection is to be encouraged. Portions of several streets within the study area are designated as scenic routes, including: Westlake Ave. N, Fairview Avenue N, the Mercer St. off-ramp from I-5, I-5 and portions of Aurora Avenue N and Dexter Avenue N,

While not identified as a City-designated scenic route, Thomas Street provides a public westerly view through the South Lake Union neighborhood toward the Space Needle. Simulations associated with this route are contained in **Appendix D** of this Draft EIS.

The following is an overview of four key scenic routes: Westlake Avenue N., Fairview Avenue N, the I-5/Mercer off-ramp, and I-5 (southbound).

<u>Westlake Avenue N and Fairview Avenue N</u>

Northerly views from Westlake Avenue N and Fairview Avenue N toward Lake Union improve as the viewer moves closer to the water and the view corridor widens. Due to the fact that Seattle city blocks are typically longer in the north-south dimension, many east-west views are already obscured by buildings. However, some east–west views are still possible from these corridors in conjunction with streets that intersect Westlake Avenue N and Fairview Avenue N Especially notable are westerly views toward the Space Needle along John and Thomas Streets (see **Appendix D**).

<u>I-5 and the Mercer Street Off-ramp</u>

Southbound I-5 and a segment of the Mercer Street Off-ramp are elevated and each provides scenic views of the South Lake Union area, the Space Needle, the Downtown skyline, Elliott Bay and the Olympic Mountains beyond.

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9 Refer to Seattle Municipal Code Chap. 25.12.350 for the specific standards associated with designation.

10 Ord. #97025 (Scenic Routes Identified by the Seattle Engineering Department's Traffic Division) and Ord. #114057 (Seattle Mayor's Recommended Open Space Policies).

3.10.6 Environmental Impacts

This section describes changes to the aesthetic character of the built environment relative to existing views that could be affected under the four alternatives.

Impacts Common to All Alternatives

All of the alternatives assume that every vacant or underdeveloped site is built out to its maximum potential. Therefore, all alternatives – even No Action – envision a significantly more dense urban environment. The following discussion pertains to designated viewpoints and scenic routes relative to the four alternatives. As noted previously, simulations for non-designated viewpoints are contained in **Appendix D**.

Alternative 1

A number of views inside and outside the South Lake Union neighborhood will be potentially impacted by Alternative 1 at full build-out, although none of the protected views are significantly impacted. The most significant changes are to Views #6, #8 and #13. Less significant but notable changes occur to Views #1, #5 and #14.

View #1 – Volunteer Park (**Figure 3.10-23**)

New high-rise buildings within the study area would be prominent in the view Volunteer Park. However, the Space Needle, Elliott Bay, Bainbridge Island and the Olympic Peninsula would still be visible. Conceivably, the base of the Space Needle may be screened to about one-third of the tower height. As noted previously, the view of the Space Needle from Volunteer Park is a protected view per SMC 25.05.675 P2c. Views of Elliott Bay from this location would be affected by the new high-rise buildings.

Figure 3.10-23
Volunteer Park – Alternative 1

Existing

Proposed

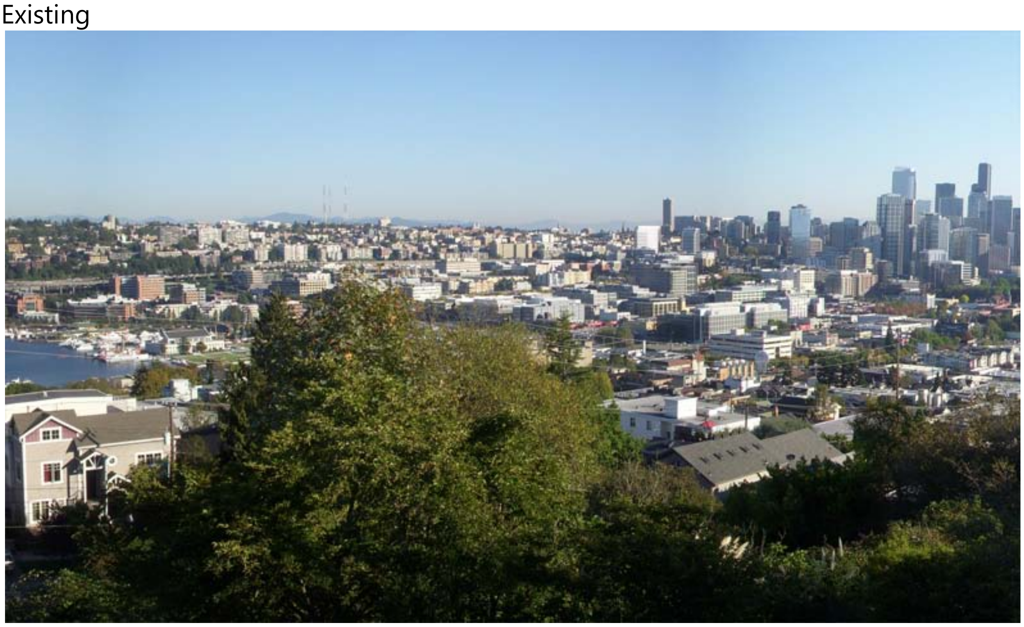
Source: NBBJ, 2010.

View #2 – Bhy Kracke Park (**Figure 3.10-24**)

New high-rise buildings within the study area would be prominent in the view from Bhy Kracke Park. Views of the Seattle Downtown skyline, the Cascade Mountains and Capitol Hill, however, would remain. Although the new buildings do not significantly change the profile of the skyline, individual high-rises could obscure portions of Capitol Hill and would dominate the foreground.

Figure 3.10-24
Bhy Kracke Park – Alternative 1

Existing



Proposed

Source: NBBJ, 2010.

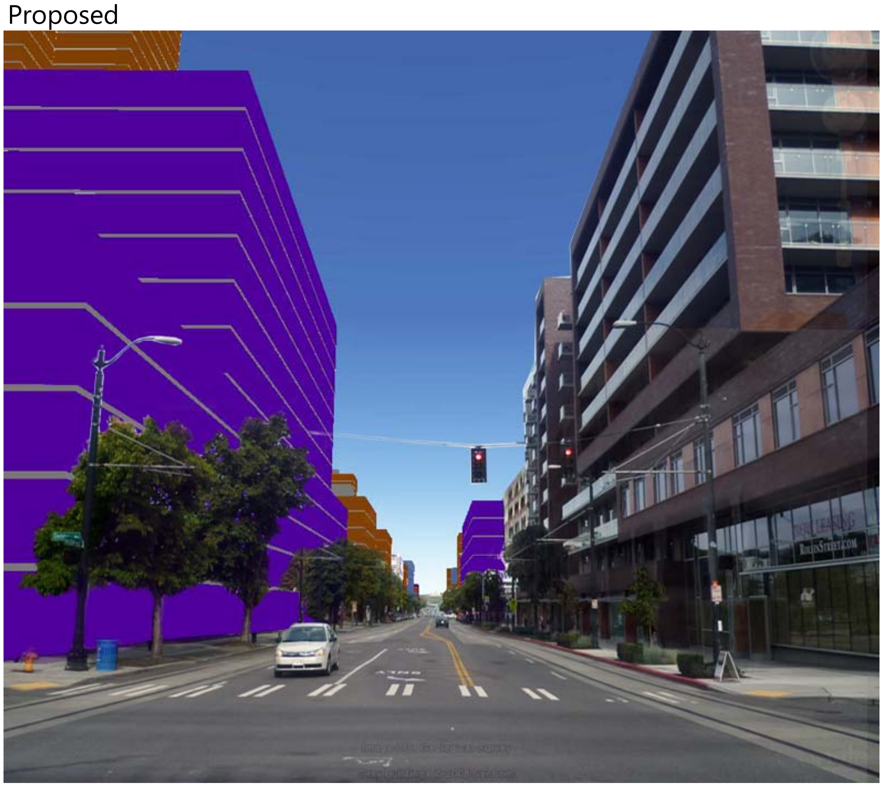
View #9 – Westlake Avenue N (**Figure 3.10-25**)

New high-rise buildings would frame the north-facing viewshed down the Westlake Avenue N view corridor from the intersection of Westlake Avenue N and Denny Way. Lake Union would remain visible in the distance and the focal point of the view. Mature street trees are prominent in the foreground and, because of perspective, would continue to be a determining factor concerning the width of the water view.

Figure 3.10-25
Westlake Avenue N – Alternative 1

Existing

Proposed



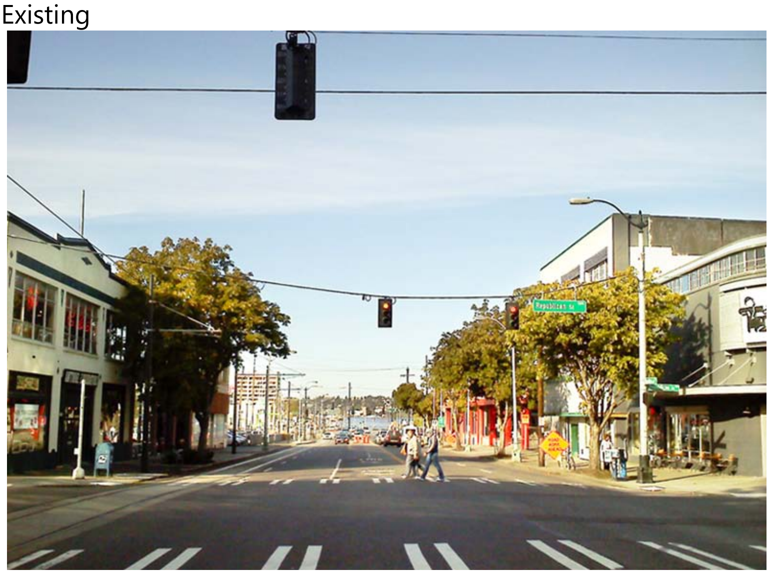
Source: NBBJ, 2010.

View #10 – Westlake Avenue N (**Figure 3.10-26**)

New high-rise buildings would frame this north-facing view down the Westlake Avenue N view corridor from the intersection of Westlake Avenue N and Republican Street. Lake Union would remain visible in the distance and the focal point of the view, but the width of the water view may be diminished by as much as 25%. However, the anticipated view reduction would be entirely the result of a new building being built to the property lines on the currently vacant Valley Mercer blocks. This view reduction would occur with development under current zoning and is, therefore, not considered significant.

Figure 3.10-26
Westlake Avenue N – Alternative 1

Existing



Proposed

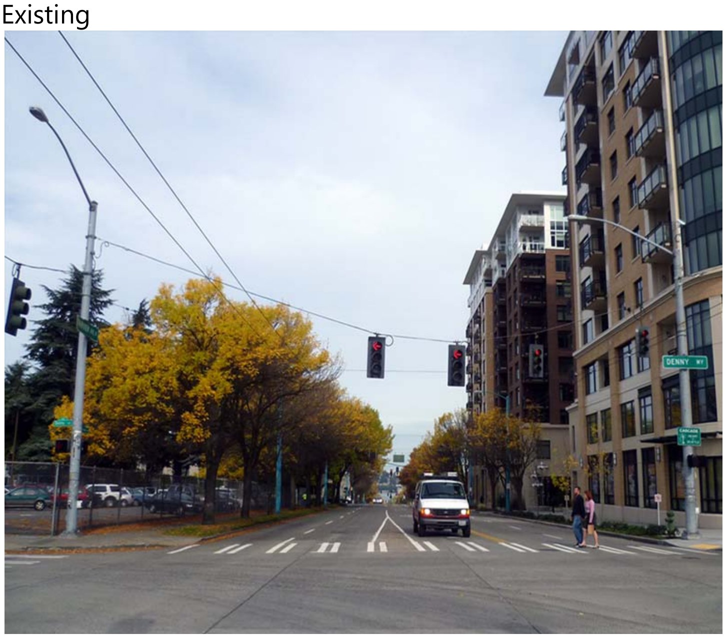
Source: NBBJ, 2010.

View #11 – Fairview Avenue N (**Figure 3.10-27**)

New high-rise buildings would frame this north-facing view down the Fairview Avenue N view corridor from the intersection of Fairview Avenue and Denny Way. Lake Union would remain visible in the distance and the focal point of the view. As with Westlake Avenue N, mature street trees are prominent in the foreground and would be the determining factor concerning the width of the water view.

Figure 3.10-27
Fairview Avenue N – Alternative 1

Existing



Proposed

Source: NBBJ, 2010.

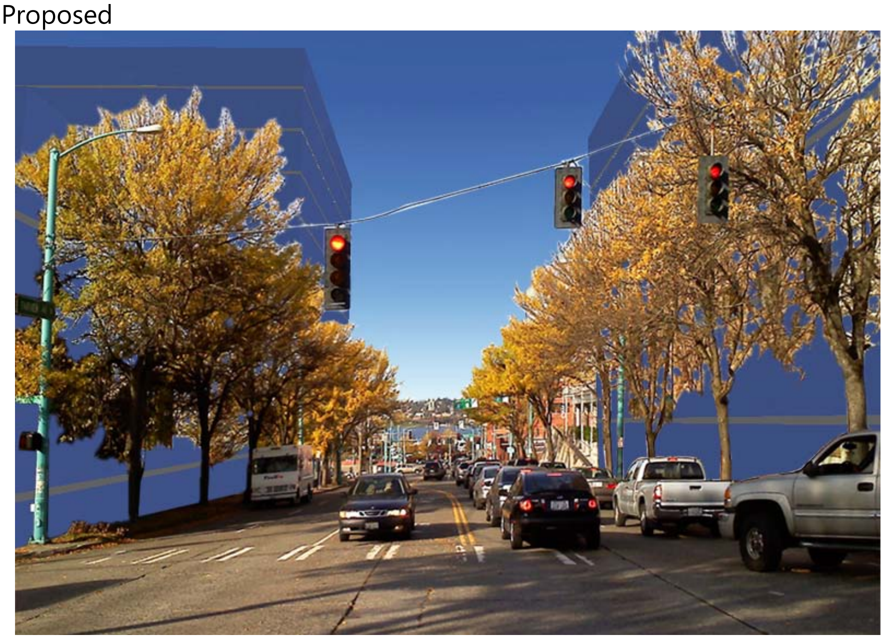
View #12 – Fairview Avenue N (**Figure 3.10-28**)

New high-rise buildings would frame the north-facing vista down the Fairview Avenue view corridor from a viewpoint at the intersection of Fairview Avenue and Republican Street. If preserved, mature street trees would remain prominent in the foreground and determine the width of the water view from this perspective. Lake Union would remain visible in the distance and the focal point of the view.

Figure 3.10-28
Fairview Avenue N – Alternative 1

Existing

Proposed



Source: NBBJ, 2010.

View #13 – Mercer Street Off-ramp (**Figure 3.10-29**)

New mid-rise and high-rise buildings in the South Lake Union neighborhood would have the potential to completely block some views of the Space Needle from the Mercer Street exit off I-5. Although the selected view offers a glimpse of the Space Needle and not an official Space Needle protected view, the changing perspective of the driver would result in the Space Needle being partially or fully obscured from other points-of-view along this off-ramp.

Figure 3.10-29
Mercer Street Off-ramp – Alternative 1

Existing

Proposed

Source: NBBJ, 2010.

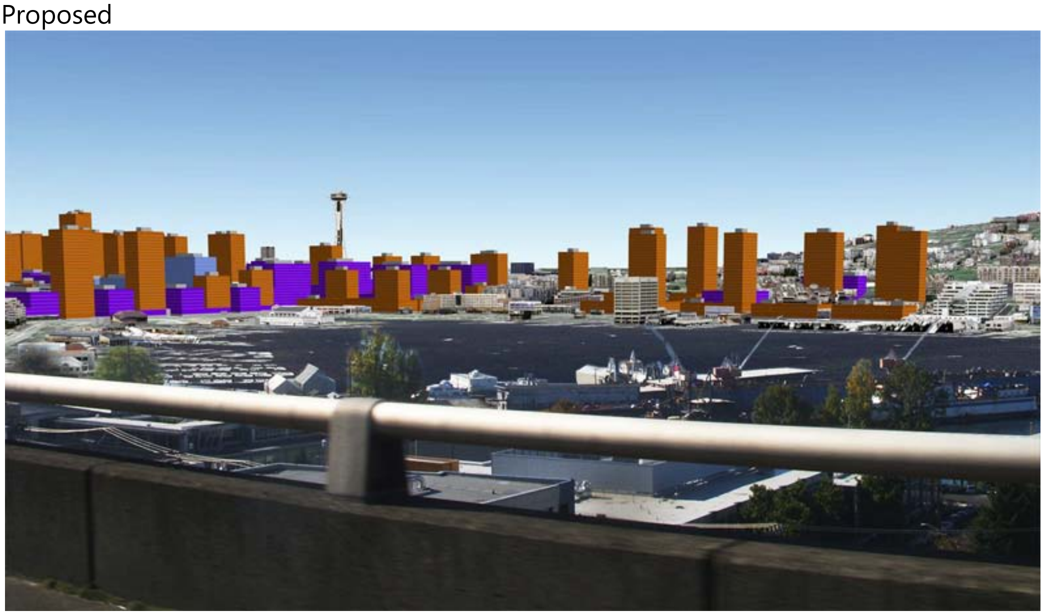
View #15 – I-5 (**Figure 3.10-30**)

New high-rise buildings within the study area would dominate the view from southbound lanes of I-5 in the vicinity of Boylston Avenue E. Lake Union and the Space Needle would remain prominent, but the lower third of the Space Needle could be screened by future development. This scenic route is not an official Space Needle protected view.

Figure 3.10-30
I-5 – Alternative 1

Existing

Proposed



Source: NBBJ, 2010.

Focus Areas

Alternative 1 could result in the greatest amount of development and result in the greatest change to existing designated viewsheds. Street-level changes would be most pronounced in the Fairview Avenue N and the Eighth Avenue N Corridors. Street-level views for the Eighth Avenue N and the Mercer Street Corridors were discussed earlier in this section under Height, Bulk, and Scale. Views along Fairview Avenue, which is a City-designated scenic route, are discussed under Views 11 and 12.

Alternative 2

Although some tower heights would be reduced with this alternative, compared to those of Alternative 1, the view impacts of Alternative 2 would be very similar to those of Alternative 1. The following is a discussion of viewshed changes that could occur relative to Alternative 2.

View #1 – Volunteer Park (**Figure 3.10-31**)

New high-rise buildings within the study area would be prominent as viewed from Volunteer Park. As noted with regard to Alternative 1, the Space Needle, Elliott Bay, Bainbridge Island and the Olympic Peninsula would still be visible. Conceivably, the base of the Space Needle may be screened to about one-third of the tower height and views of Elliott Bay would be affected by the new high-rise buildings.

Impacts from other designated viewpoints (e.g., #2, 9, 10, 11, 12 and 15) would not differ significantly from those noted with regard to Alternative 1. See **Figure 3.10-32** through **36** and **3.10-38**).

Figure 3.10-31
Volunteer Park – Alternative 2

Existing

Proposed

Source: NBBJ, 2010.

Figure 3.10-312
Bhy KrackePark – Alternative 2

Existing

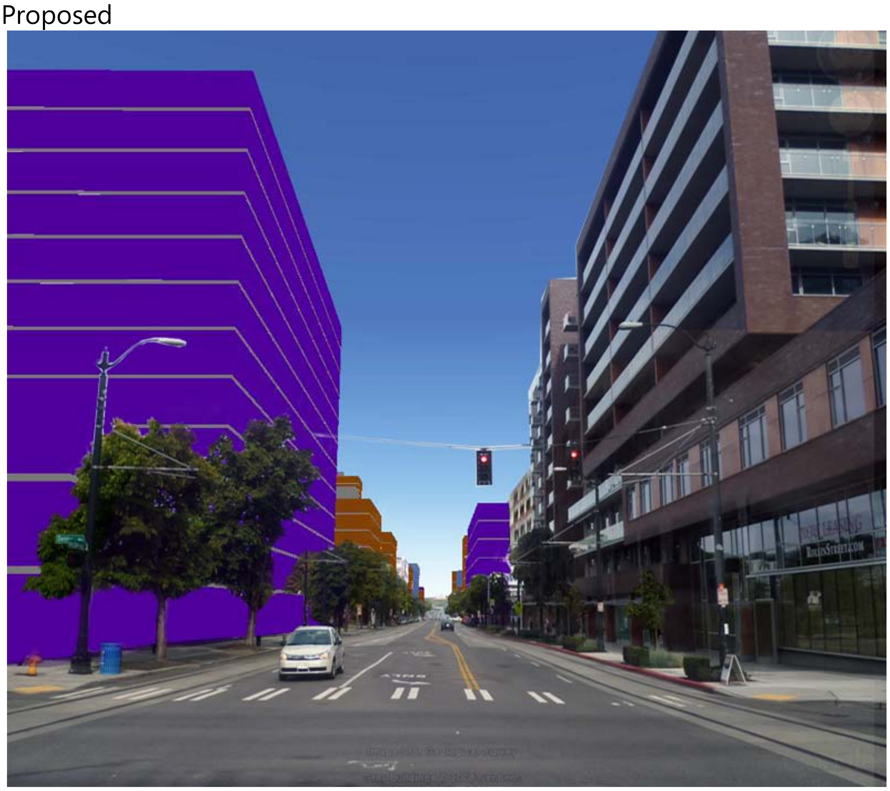
Proposed

Source: NBBJ, 2010.

Figure 3.10-33
Westlake Avenue N – Alternative 2

Existing

Proposed



Source: NBBJ, 2010.

Figure 3.10-34
Westlake Avenue N – Alternative 2

Existing

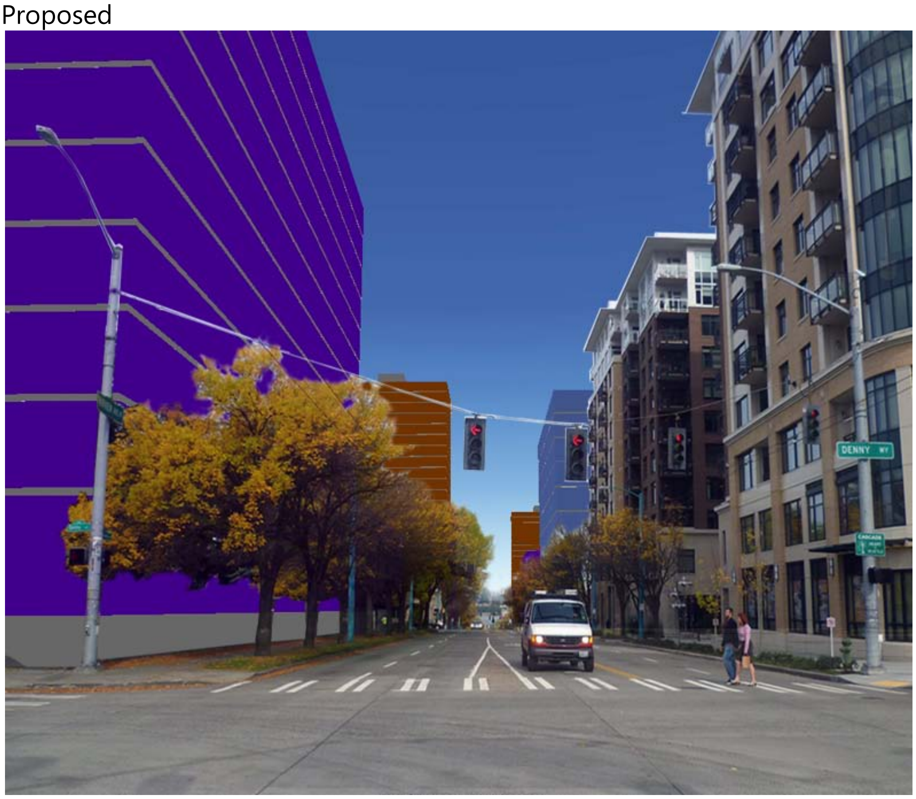
Proposed

Source: NBBJ, 2010.

Figure 3.10-35
Fairview Avenue N – Alternative 2

Existing

Proposed

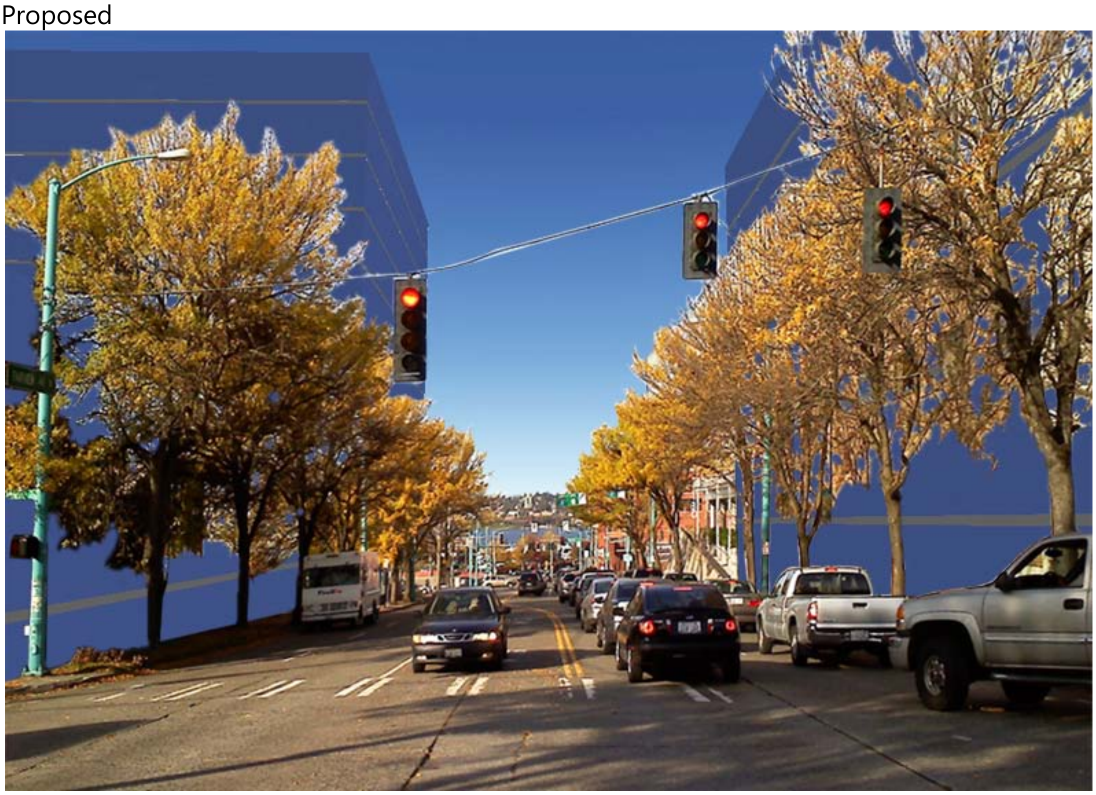


Source: NBBJ, 2010.

Figure 3.10-36
Fairview Avenue N – Alternative 2

Existing

Proposed



Source: NBBJ, 2010.

View #13 – Mercer Street Off-ramp (**Figure 3.10-37**)

New mid-rise and high-rise buildings in the South Lake Union neighborhood would have the potential to completely block some views of the Space Needle from the Mercer Street Off-ramp from I-5. As noted with regard to Alternative 1, although the selected view offers a glimpse of the Space Needle and is not an official Space Needle protected view, the changing perspective of the driver would result in the Space Needle being partially or fully obscured from other points-of-view along this off-ramp.

Figure 3.10-37
Mercer Street Off-ramp – Alternative 2

Existing

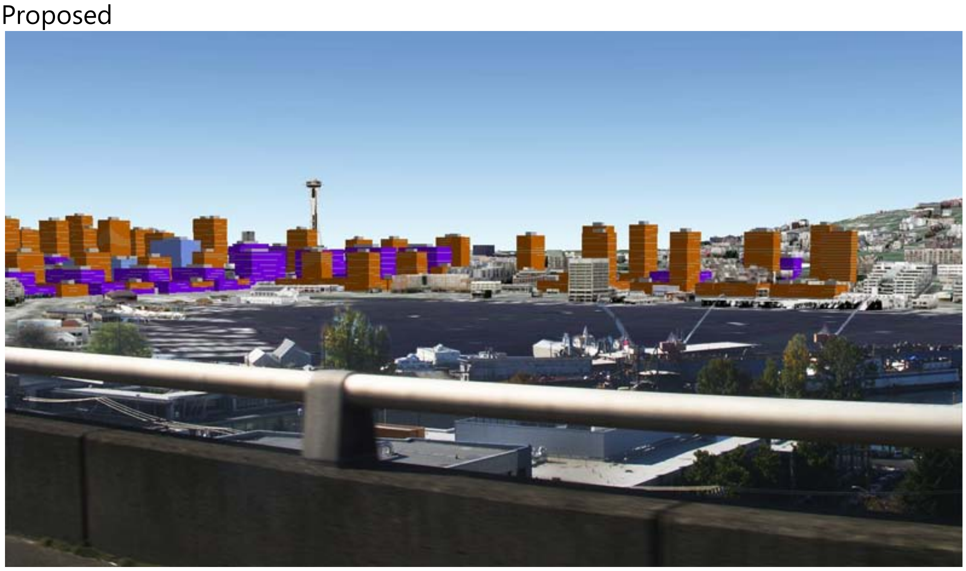
Proposed

Source: NBBJ, 2010.

Figure 3.10-38
I-5 – Alternative 2

Existing

Proposed



Source: NBBJ, 2010.

Focus Areas

For all practical purposes, viewshed impacts associated with Alternative 2 would the same as Alternative 1 relative to the designated Focus Areas. There would be an important reduction in overall height, but the changes are not expected to significantly change the overall street-level impacts from those identified under Alternative 1. Street-level views for the Eighth Avenue N and the Mercer Street Corridors were discussed earlier in this section under Height, Bulk, and Scale for each alternative. Views along Fairview Avenue, a City-designated scenic route, are discussed in Alternative 1 relative to Views 11 and 12.

Alternative 3

Although tower heights are further reduced with this alternative compared with Alternatives 1 and 2, the view impacts of Alternative 3 would be similar to the previous alternatives. The following is a discussion of viewshed changes that could occur relative to Alternative 3.

View #1 – Volunteer Park (**Figure 3.10-39**)

New high-rise buildings in the study area would be prominent in the view from Volunteer Park, but the Space Needle, Elliott Bay, Bainbridge Island and the Olympic Peninsula would still be visible. The base of the Space Needle may be screened slightly less than that associated with Alternative 1 and 2 – to about one-quarter of the tower height. Views of Elliott Bay would be affected by the new high-rise buildings.

Impacts from other designated viewpoints (e.g., #2, 9, 10, 11, 12 and 15) would not differ significantly from those noted with regard to Alternatives 1 and 2. See **Figure 3.10-40** through **3.10-44** and **3.10-46**).

Figure 3.10-39
Volunteer Park – Alternative 3

Existing

Proposed

Source: NBBJ, 2010.

Figure 3.10-40
Bhy Kracke Park – Alternative 3

Existing

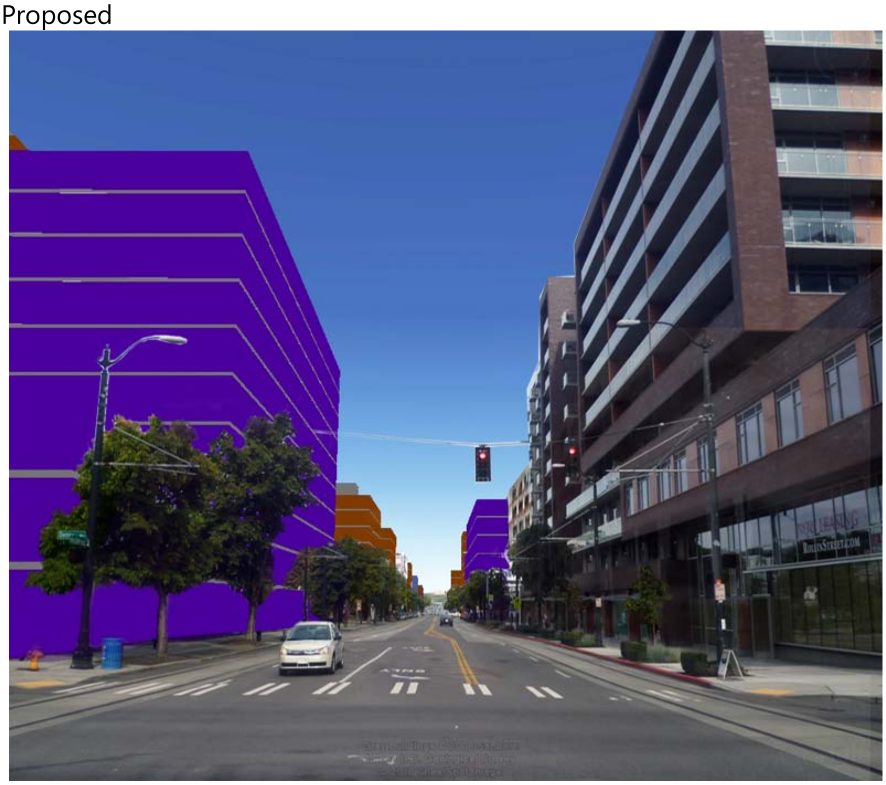
Proposed

Source: NBBJ, 2010.

Figure 3.10-41
Westlake Avenue N - Alternative 3

Existing

Proposed



Source: NBBJ, 2010.

Figure 3.10-42
Westlake Avenue N – Alternative 3

Existing

Proposed

Source: NBBJ, 2010.

Figure 3.10-43
Fairview Avenue N – Alternative 3

Existing

Proposed

Source: NBBJ, 2010.

Figure 3.10-44
Fairview Avenue N – Alternative 3

Existing

Proposed

Source: NBBJ, 2010.

View #13 – Mercer Street Off-ramp (**Figure 3.10-45**)
New mid-rise and high-rise buildings in the South Lake Union neighborhood would have the potential to partially block some views of the Space Needle from the Mercer Street Off-ramp from I-5. As noted with regard to Alternative 1 and 2, although the selected view offers a glimpse of the Space Needle and is not an official Space Needle protected view, the changing perspective of the driver would result in the Space Needle being partially or substantially obscured from other points-of-view along this off-ramp.

Figure 3.10-45
Mercer Street Off-ramp – Alternative 3

Existing

Proposed

Source: NBBJ, 2010.

Figure 3.10-46
I-5 – Alternative 3

Existing

Proposed

Source: NBBJ, 2010.

Focus Areas

Viewshed impacts associated with Alternative 3 would be the same as Alternative 1 relative to the designated Focus Areas. The reduction in building heights is not expected to result in substantially different street-level view impacts from those noted previously for Alternative 1.

Alternative 4 (No Action)

This alternative assumes that underdeveloped properties within the study area would be developed to the extent allowed by existing zoning. As such, views could be expected to change from what currently exists.

However, no significant impacts to views are anticipated as a result of development under current zoning. Simulations associated with views from designated viewpoints are depicted in **Figures 3.10-47** through **3.10-54**).

Figure 3.10-47
Volunteer Park – Alternative 4

Existing

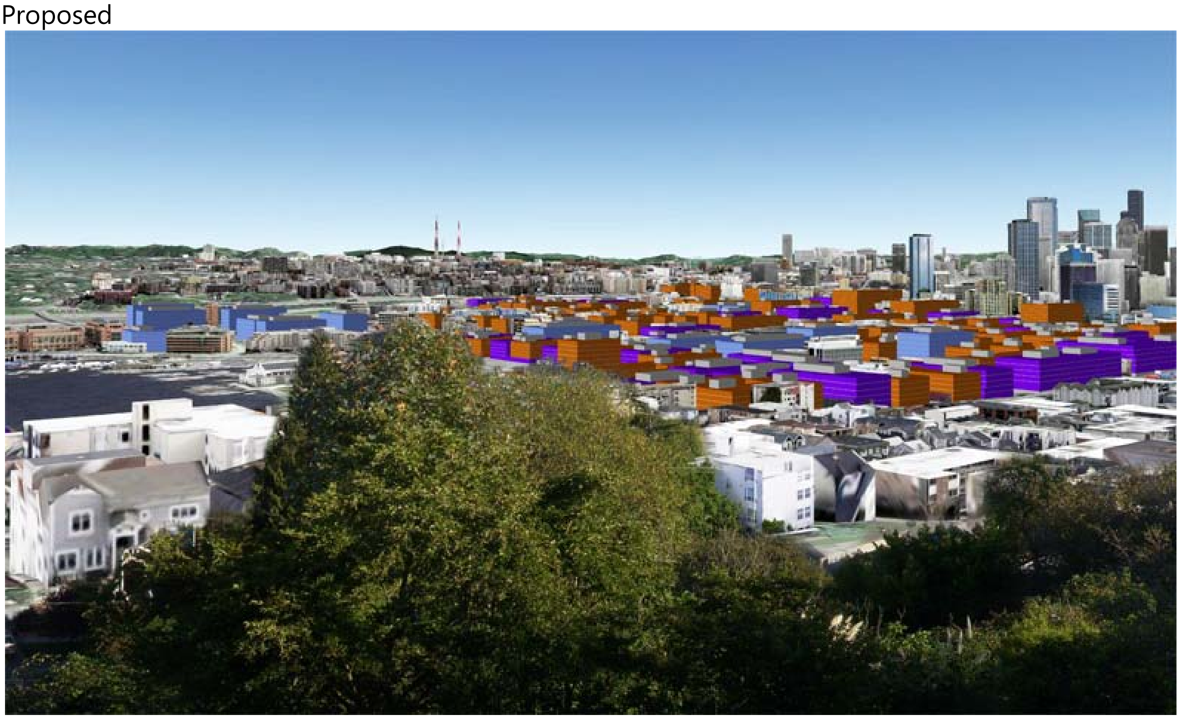
Proposed

Source: NBBJ, 2010.

Figure 3.10-48
Bhy Kracke Park – Alternative 4

Existing

Proposed

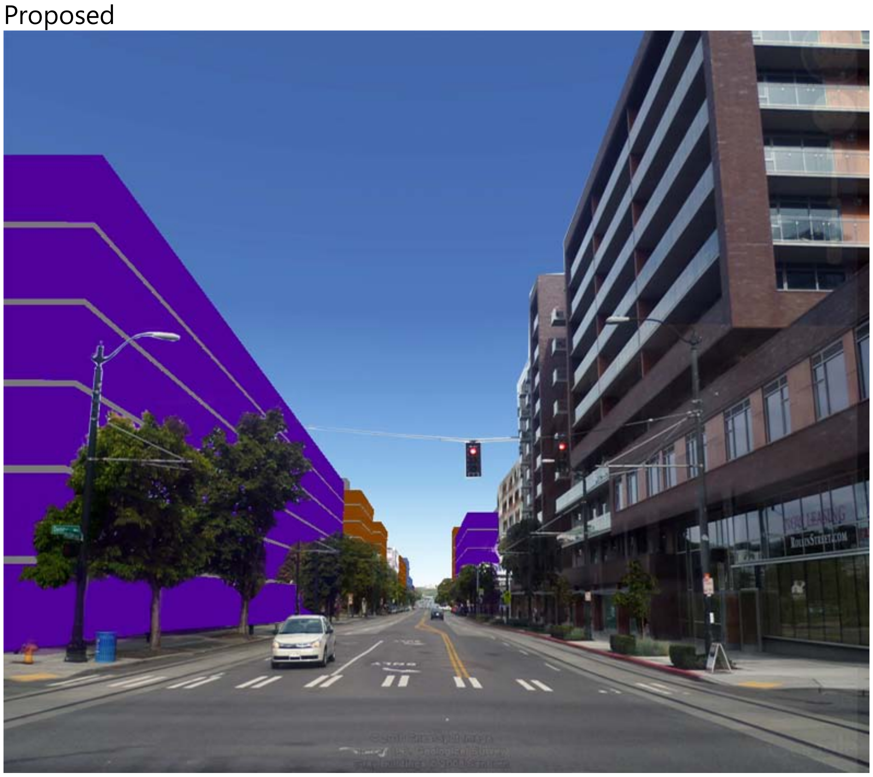


Source: NBBJ, 2010.

Figure 3.10-49
Westlake Avenue N – Alternative 4

Existing

Proposed



Source: NBBJ, 2010.

Figure 3.10-50
Westlake Avenue N – Alternative 4

Existing

Proposed

Source: NBBJ, 2010.

Figure 3.10-51
Fairview Avenue N – Alternative 4

Existing

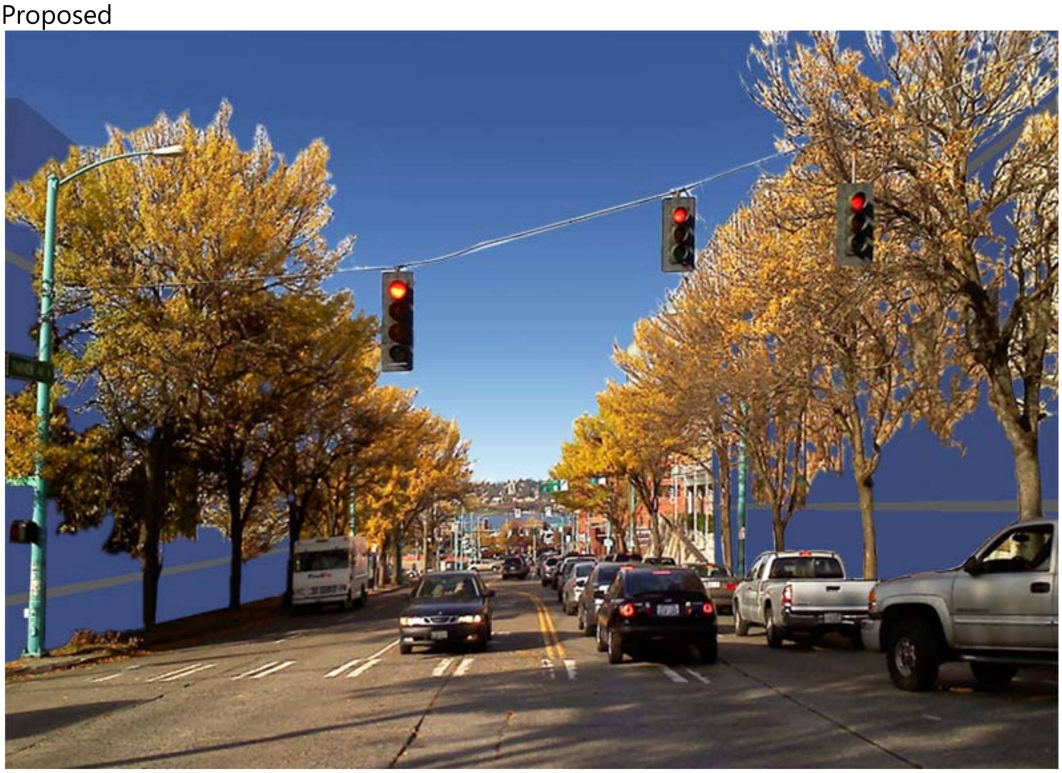
Proposed

Source: NBBJ, 2010.

Figure 3.10-52
Fairview Avenue N – Alternative 4

Existing

Proposed



Source: NBBJ, 2010.

Figure 3.10-53
Mercer Street Off-ramp – Alternative 4

Existing

Proposed

Source: NBBJ, 2010.

Figure 3.10-54
I-5 – Alternative 4

Existing

Proposed

Source: NBBJ, 2010.

3.10.7 Mitigation Strategies

No significant impacts have been identified relative to protected viewpoints as a result of this programmatic analysis and, therefore, no mitigation is necessary.

At such time site-specific development occurs, detailed viewshed analysis should be performed relative to any development that would be within the view corridor between Volunteer Park and the Space Needle.

3.10.8 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to views are anticipated.

SHADOWS

3.10.9 Affected Environment

Seattle's SEPA policies aim to "minimize or prevent light blockage and the creation of shadows on open spaces most used by the public". Of particular concern is the amount and the timing of shading that occurs to key public places. Besides weather conditions, the relative amount of shadow and sun available at the pedestrian level depends upon multiple factors; the most important of these for this study area include: topography, the built environment (structures and street grid orientation) and vegetation.

In terms of topography, the South Lake Union neighborhood is shaped like half of a shallow bowl with the landform sloping downward and inward from the neighborhood boundaries on the east, south and west – with the low point being the shoreline of Lake Union. Furthermore, the surrounding neighborhoods are much higher in elevation. Portions of Capitol Hill on the east casts shadows the neighborhood in the early morning hours and portions of Queen Anne Hill on the west does the same in the late afternoon and early evening. Due to a lower sun angle, the effect of this shading is more noticeable in the winter than at other seasons. The elevation differential between the study area and the landform to the south is not significant enough to create shadows in the study area, but the shadows of a few recently constructed high-rise buildings built in the Denny Triangle neighborhood penetrate the South Lake Union neighborhood in late morning and early afternoon hours during the winter months.

Shadows cast by buildings create a striped or stepped pattern of alternating sunny and shady areas at street level. These patterns are constantly changing with the sun angle and vary according to the season. The orientation of the street grid in the South Lake Union neighborhood closely follows the cardinal directions, so that the north-south streets typically experience full sun near midday – the specific time of day changing during the period when daylight savings time is in effect. Streets with an east-west orientation receive full sunlight in the early morning and late afternoon. At all other times of the day, both streets and avenues are affected, to varying degrees, by shadows from neighboring structures.

Generally speaking, greater building heights extend the length of the shadow cast, and increased mass (or cross-sectional width) widens the shadow cast by a building. The shadows of tall buildings extend farther from a building, but their effects on more distant locations are of shorter duration, because the sun's motion translates into faster movement of the shadow over the ground. Buildings with greater mass would create wider shadows and an increased amount of shaded area on the immediately adjacent streets and public spaces, but the reach of the shadow would be limited by the building's height.

The amount and impact of shadows cast by a group of buildings depends upon their relative location, spacing and orientation (e.g., some building arrangements may result in overlapping shadows, or cast shadows in patterns that are not detrimental to public areas where solar access is desirable).

Building height and bulk are the main factors with regard to shadow analyses, but other characteristics – such as street level and/or upper level setbacks, the location of highrises within a block, spacing between buildings, roof overhangs, rooftop appurtenances, street level canopies and marquees – can significantly modify the total amount and pattern of sun and shadow on the streetscape.

In areas of the City outside Downtown City policy[11] indicates that the following areas are to be protected:

- Publically owned parks;
- Public schoolyards;
- Private schools which allow public use of schoolyards during non-school hours; and
- Publically owned street-ends in shoreline areas.

Within the South Lake Union neighborhood, the particular areas that could meet the City's criteria for minimizing or preventing light blockage and the creation of shadows include:

Denny Park

Denny Park is in the southwest corner of the South Lake Union neighborhood and is bordered by major roadways on three sides: Denny Way to the south, Dexter Avenue N on the west and 9th Avenue N on the east. John Street on the north is a less busy street, but traffic is expected to increase once John Street is reconnected across Aurora Avenue N as part of the SR 99 Bored Tunnel Project.

Dedicated in 1883, Denny Park is one of Seattle oldest public parks. The park is shaded by mature trees (both evergreen and deciduous) and

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[11] SMC 25.05.675 Q2b

features generous lawns and broad pathways leading to a central circle. A one-story Parks and Recreation Building is located on the west side of the park. In 2009, a children's playground was completed on the east side of the park.

Cascade Park and Playground

Centrally located in the Cascade subarea, Cascade Park and Playground is surrounded by relatively quiet streets on all four sides. After decades of minimal use, the park has recently undergone a major resurgence due to the surrounding growth of residential construction and a successful park renovation.

The park has a strong residential focus and features the Cascade People's Center in its southeast quadrant; an active P-Patch in the southwest quadrant, a children's play area in the northeast quadrant and permanent public restrooms in the northeast quadrant. Most of the middle of the block is occupied by a large recreational lawn area.

The park is well used during daylight hours; the playground, in particular, is activated by school and pre-school children. While not striped or set up for any particular sport, the open lawn area is occasionally used for informal recreational activities and is popular with dog owners at all hours of the day. The growing season sees the P-Patch well utilized by nearby residents. Both residents and office workers can be found strolling in and around the park on sunny days – regardless of season –but especially over the noon hour.

Lake Union Park

Located at the south end of Lake Union and bordering on Valley Street, this 12-acre Lake Union Park was just completed in September 2010. The park features a lawn with sculpted land forms and boat-shaped planters, a waterfront promenade and steps, a model boat pond, interactive fountains, a beach for hand-launched boats, a tree grove, and interpretive History Trail. A new pedestrian bridge connects the east and west segments of the park.

The park is a stop on the Seattle Streetcar South Lake Union Line and is part of larger complex of public amenities that currently includes the Center for Wooden Boats. The former Naval Reserve Center, which is located at this park, is in the process of being renovated as the new home of the Museum of History and Industry (MOHAI). Other 'public' activities that occur proximate to this park include the Northwest Native Canoe Center by the United Indians of All Tribes

Lake Union Park has excellent solar exposure and is used by strollers and pet owners during all daylight hours, but especially the noon hour and at the beginning and end of the workday. Once MOHAI is complete, the most intense usage is likely to be during museum hours, but especially schools hours.

Per the Municipal Code, "(t)he analysis of sunlight blockage and shadow impacts shall include an assessment of the extent of shadows, including times of the year, hours of the day, anticipated seasonal use of open spaces, availability of other open spaces in the area, and the number of people affected" (25.05.675 Q2c).

In areas outside Downtown, if analysis indicates that a proposed project would substantially block sunlight from protected open spaces "at a time when the public most frequently uses that space, …(the City) … may condition or deny the project to mitigate the adverse impacts of sunlight blockage."

Appendix D contains 15 shadow diagrams. Collectively, they depict probable shading from each of the proposed alternatives (assuming weather conditions are conducive) for the four key solar days of the year: vernal equinox (approx. March 21st), summer solstice (approx. June 21st), autumnal equinox (approx. Sept. 21st), and winter solstice (approx. December 21st). The analysis depicts shadows cast by proposed development for three specific times during each day - 9 AM, noon, and 3 PM; shadow impacts are indicated in the right column of each shadow diagram). The maximum allowable heights and bulk including height exceptions for rooftop equipment were modeled to identify the 'worst case' impacts. In addition to shading resulting from possible development associated with each alternative, the figures also depict shadow impacts resulting from existing buildings within and proximate to the study area (shown in the left column of each figure).

These key days of the solar year and times of the day depict worst-case impacts. Shadow-related impacts, however, can also occur at other times of the day throughout the year. Because of the earth's rotation, the duration of shadow-related impacts varies for a stationary observer[12] based on season, depending upon the width of the shadow. The shadow

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12 The rate of change of the sun's angle relative to the earth varies widely by season – from about 5 degrees horizontally and 2 degrees vertically every 15 minutes in June to 3 degrees horizontally and 1 degree vertically every 15 minutes in December.

graphics have been adjusted to compensate for topography and, in the case of vernal equinox, summer solstice and autumnal equinox, daylight savings time.[13]

3.10.10 Environmental Impacts

This section describes changes to the aesthetic character of the built environment related to shadow impacts that could occur under the four EIS alternatives.

Impacts Common to All Alternatives

Cumulative shadow impacts would result from all alternatives due to the increased amount of development in the South Lake Union neighborhood. Generally, the infill development on undeveloped or under-developed sites would increase the local shadows on streets and adjacent properties.

Shadows would generally be longest during winter afternoons when the sun is less likely to be out under clear skies. At noon on winter solstice, when the sun angle is low on the horizon, shadow impacts could extend great distances and result from each alternative. Conversely, at noon on summer solstice, when the sun is at its greatest height above the horizon shadow impacts would be shorter and would be less likely to cause impacts.

Each of the alternatives could shade portions of the water area of Lake Union in the winter morning (southeast lake shore) and in the winter afternoon (southwest lake shore) hours. See Section 3.4 for discussion of potential shadow impacts on marine habitat.

Comparison of the alternatives reveals slight differences in the impacts to the noted public parks and SEPA protected places. The location and extent of shadows vary and are described in each alternative. However, overall, the shadow impacts are not expected to result in significant adverse environmental impacts. The impacts are typical of an urbanizing area changing from lower intensity development to that of more intensive development.

[13] Pacific Daylight Savings Time (PDST) applies to shadow impacts associated with spring equinox, summer solstice and autumnal equinox.

Alternative 1

At full build-out, Alternative 1 could result in the greatest potential impact of the alternatives due to the fact this alternative would allow the tallest buildings heights and could result in the greatest increase in population (residents and employees) that may utilize the parks/open spaces. The difference between this alternative and Alternative 2, however, is largely a matter of scale.

The taller buildings along the Denny and Mercer corridors would cast the longest shadows impacting neighborhood parks at the times of the day when usage may be at its highest (e.g., noon [all seasons], summer morning and summer afternoon). At noon, shadows may just touch the corners of Denny Park and Cascade Park and Playground in all seasons except winter. Mid-morning shadows may cover up to 20 percent of Denny Park and Cascade Park and Playground during the summer. Shadows may cover between 30 percent to approximately one-half of these parks at mid-morning during the spring and fall. The eastern and northern portions of these parks would be most affected by the shadows of new buildings.

At Lake Union Park, because of the scale of the existing building the largest shadows are those cast within the park by the former Naval Reserve Center. It does not appear that the park would be significantly impacted by the alternative's development during spring, summer or autumn. (Note: This finding assumes that new towers on the Mercer Blocks would be located on the southern-half of the blocks. Allowing tower construction on the northern-half of the blocks could result in a more significant impacts.)

During the winter months, building shadows would cover all or a majority of the three parks in the morning and Lake Union and Cascade Parks in the afternoon. Shadows at noon in winter are expected to have minimal impact on Denny and Lake Union Parks, but may cover up to 60 percent of Cascade Park and Playground. Although this is the season when sunlight is typically obscured by clouds/poor weather in our region, the noontime shadows could impact the children's play area on the west side of the block.

Focus Areas

Alternative 1 would allow the greatest degree of development and envisions the greatest degree of change on the designated Focus Areas. The changes would be most apparent in the Fairview and 8th Avenue Corridors.

Alternative 2

Denny Park and Cascade Park and Playground could experience morning shadow impacts during all seasons. Portions of Lake Union Park would periodically be shaded in the morning and afternoon in winter.

<u>Focus Areas</u>

For all practical purposes, the impacts of Alternative 2 would be the same as Alternative 1 on the designated Focus Areas. While this alternative would result in a reduction in overall height, the changes in shadow impacts would not differ substantially from those noted with regard to Alternative 1.

Alternative 3

Small portions of Denny Park and Cascade Park and Playground could be affected by morning shadows in spring and autumn. Winter morning shadows would periodically affect portions of Denny Park and Cascade Park and Playground. Winter noontime and afternoon shadows would periodically shade portions of all three open spaces.

<u>Focus Areas</u>

The impacts of Alternative 3 would be the same as Alternative 1 in the focus areas. As with Alternative 2, while height reduction would occur, but the changes in shadow impacts would not differ substantially from those noted with regard to Alternative 1.

Alternative 4 (No Action)

Portions of Denny Park could periodically be affected by morning shadows during each season. Winter morning, noon and afternoon shadows could affect all three open spaces.

<u>Focus Areas</u>

Alternative 4 anticipates no significant change.

3.10.11 Mitigation Strategies

At such time site-specific development occurs, detailed shadow analysis should be performed relative to any development that could affect Denny Park, Cascade Playground or Lake Union Park with attention to times of the year and hours of the day the open space could be affected, the geographical area(s) of the open space affected, anticipated seasonal use of the open space, availability of other open spaces in the area, and the number of people affected.

SMC 25.05.675Q2e authorizes the City to employ measures to mitigate adverse shadow impacts to key open spaces, including:

a. limiting the height of development;
b. limiting the bulk of the development;
c. redesigning the profile of the development;
d. limiting or rearranging walls, fences or plant material;
e. limiting or rearranging accessory structures, i.e., towers, railings, antennae; and
f. relocating the project on the site.

3.10.12 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to shade and shadow are anticipated.

LIGHT & GLARE

3.10.13 Affected Environment

The major sources of artificial illumination in the South Lake Union neighborhood include street lights, building lighting, vehicle headlights, signage, security lighting and other lighting typical of an urban setting.

There are no major sources of unusually bright artificial lighting, such as sports field illumination. Major arterials are particularly well lighted corridors, including Denny Way, Mercer Street, Fairview Avenue N, Westlake Avenue N, and Aurora Avenue N. The mixture of commercial and residential uses does not appear to create any significant sensitivity to nighttime light exposure.

Natural daylight is also typical of an urbanized area with expanded exposures due to the north-south orientation of the topographic basin. The rising elevations along the east side (Eastlake Avenue E and Capitol Hill) and along the west side (Aurora Avenue N and Queen Anne Hill) reduce local morning and afternoon daylight exposures respectively.

There is high visibility and light exposure of the taller buildings in South Lake Union because of the natural basin setting. The I-5 freeway extends along the eastern edge of South Lake Union and SR-99 extends along the western edge and there is high visibility and possible glare exposure as a result of vehicular traffic. While the water surface of the lake can, at times, become a potentially reflective surface, currently there are no highly reflective building surfaces that could at times present light and glare hazards to motorists or pedestrians.

Air traffic from the Lake Union Seaplane Airport generally takes off and lands facing south or south west and could be a sensitive receptor for light and glare impacts.

Focus Areas

Existing light and glare in the three focus areas is typical of an urban environment.

3.10.14 Environmental Impacts

This section describes changes to the aesthetic character of the built environment including light and glare impacts that could occur under the four EIS alternatives.

Impacts Common to All Alternatives

The increased amount of buildings would increase the cumulative level of artificial illumination in South Lake Union. The level of building and site lighting would be greater than current conditions, incrementally expanding with the density of development. The new buildings will include towers that may potentially incorporate reflective surfaces that could on occasion create glare impacts. The exposure may extend to adjacent hillsides and the freeway because of the topographic basin location.

Potential increases in building heights in this area and specular surfaces on buildings could, at times, generate increased light and glare impacts that may affect seaplane approaches to the south.

Focus Areas

Future development under any of the action alternatives would likely result in a significant increase in the cumulative level of artificial illumination in the focus areas.

Alternative 1

Glare impacts may occur from new tower development along the south and west frontages of Lake Union because of the morning and afternoon exposures to sunlight over open water. Tower glare could impact seaplane approaches to the south.

The distant visibility from Capitol Hill and Gas Works Park of artificial illumination of the towers is high because of their currently unobstructed location. Artificial illumination from new towers will be highly visible from those portions of Capitol Hill, Queen Anne Hill and Gas Works Park that currently have unobstructed views toward the study area.

Focus Areas

Because Alternative 1 allows the greatest degree of development and the potential for increased light and glare is greatest. However, light and glare would be typical of an urban environment and is not anticipated to be significantly different or greater than the rest of the neighborhood.

Alternative 2

As in Alternative 1, glare impacts may occur from tower development along the south and west frontages of Lake Union because of the morning and afternoon exposures to sunlight over open water. Tower glare could impact seaplane approaches to the south.

The towers and buildings of Alternative 2 are generally shorter than those in Alternative 1, so potential glare impacts may be slightly less because of the reduced surface area.

Artificial illumination from new towers will be highly visible from those portions of Capitol Hill, Queen Anne Hill and Gas Works Park that currently have unobstructed views toward the study area.

Focus Areas

For all practical purposes, the impacts of Alternative 2 are relatively less, but similar to Alternative 1 in the Focus Areas. Light and glare would be typical of an urban environment and is not anticipated to be significantly different or greater than the rest of the neighborhood.

Alternative 3

As in Alternatives 1 and 2, glare impacts may occur from tower development along the south and west frontages of Lake Union because of the morning and afternoon exposures to sunlight over open water. Tower glare could impact seaplane approaches to the south.

The towers and buildings of Alternative 3 are generally shorter than those in both Alternative 1 and 2 so potential glare impacts should be less because of the reduced surface area. The exposure is different – especially adjacent to Lake Union – due to the graduated concept. Artificial illumination from new towers will be highly visible from those portions of Capitol Hill, Queen Anne Hill and Gas Works Park that currently have unobstructed views toward the study area.

Focus Areas

For all practical purposes, the impacts of Alternative 3 are relatively less, but similar to Alternatives 1 and 2 in the Focus Areas. Light and glare would be typical of an urban environment and is not anticipated to be significantly different or greater than the rest of the neighborhood.

Alternative 4 (No Action)

Glare impacts may occur from the lower scaled development along the south and west frontages of Lake Union because of the morning and afternoon exposures to sunlight over open water. With no towers, there would not be any distinctive sources for possible glare.

Artificial illumination from new buildings will still be visible from those portions of Capitol Hill, Queen Anne Hill and Gas Works Park that currently have unobstructed views toward the study area, but will be less a factor due their reduced height.

Focus Areas
Alternative 4 anticipates no significant change.

3.10.15 Mitigation Strategies

SMC 25.05.675K2d authorizes the City to employ measures to mitigate adverse light and glare impacts, including the following:

a. "limiting the reflective qualities of surface materials that can be used in the development;
b. limiting the area and intensity of illumination;
c. limiting the location or angle of illumination;
d. limiting the hours of illumination; and
e. Providing landscaping."

Other measures that may be also employed include:

f. install screening, overhangs, or shielding to minimize spillover lighting impacts – particularly near sensitive residential receivers;
g. shield exterior lighting fixtures and directing site security lighting away from nearby residential uses;
h. include pedestrian-scaled and pedestrian-oriented lighting for safety along sidewalks, parking areas, street crossings and building access points;
i. employ timers or motion sensors for lighting to reduce spillover lighting and generally reduce ambient light levels;
j. avoid large expanses of smooth, uniform, reflective building surfaces;
k. incorporate architectural relief and detail, such as exterior sun shades, deep spandrels, mullions or other features of façade articulation, that reduce reflectivity; and
l. as necessary, undertake project-specific solar impact analysis studies to determine the extent of light and/or glare impacts and to identify specific mitigation measures.

3.10.16 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to light and glare are anticipated.

Light and Glare
Affected Environment
Environmental Impacts
Mitigation Strategies
Significant Unavoidable Adverse Impacts

3.11 HISTORIC RESOURCES

This chapter characterizes existing historic resources within the South Lake Union neighborhood. It identifies potential impacts of possible future development patterns under the proposed height and density alternatives and identifies potential mitigation measures.

Historic Resources Contents

3.11.1 Affected Environment

Designated landmarks are those properties that have been recognized locally, regionally, or nationally as significant resources to the community, city, state or nation. Recognition may be provided by listing in the National Register of Historic Places (NRHP) or the Washington Heritage Register (WHR), through a nomination process managed by the Washington State Department of Archaeology and Historic Preservation (DAHP) or by listing as a local landmark. Typically, a property is not eligible for consideration for listing in the NRHP or WHR until it is at least 50 years old. For City of Seattle Landmarks properties are eligible when they are at least 25 years old.

Naval Reserve Building at Lake Union Park

SEPA and Cultural Resource Regulations

SEPA refers to the State Environmental Policy Act (Chapter 43.21C RCW), which addresses effects of proposed actions on certain environmental elements, including Historic Resources. The City of Seattle has adopted SEPA and established policies and procedures in SMC 25.05. SMC 25.05.675.H sets forth Policies and Procedures for Historic Preservation, excerpted below.

National Register Criteria:

A. Association with events that have made a significant contribution to the broad patterns of our history; or

B. Association with the lives of significant persons in our past; or

C. Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. Have yielded or may be likely to yield, information important in history or prehistory.

Policy Background

a. Historic buildings, special historic districts, and sites of archaeological significance are found within Seattle. The preservation of these buildings, districts, and sites is important to the retention of a living sense and appreciation of the past.
b. Historic sites, structures, districts, and archaeological sites may be directly or indirectly threatened by development or redevelopment projects.
c. Historic buildings are protected by the Landmarks Preservation Ordinance as administered by the Landmarks Preservation Board. However, not all sites and structures meeting the criteria for historic landmark status have been designated yet.
d. Special districts have been established to protect certain areas, which are unique in their historical and cultural significance, including for example Pike Place Market, Pioneer Square, and the

International District. These areas are subject to development controls and project review by special district review boards.

e. Archaeologically significant sites present a unique problem because protection of their integrity may, in some cases, eliminate any economic opportunity on the site.

Policies

a. It is the City's policy to maintain and preserve significant historic sites and structures and to provide the opportunity for analysis of archaeological sites.
b. For projects involving structures or sites, which have been designated as historic landmarks, compliance with the Landmarks Preservation Ordinance shall constitute compliance with the policy set forth…above.
c. For projects involving structures or sites which are not yet designated as historical landmarks but which appear to meet the criteria for designation, the decision maker or any interested person may refer the site or structure to the Landmarks Preservation Board for consideration. If the Board approves the site or structure for nomination as an historic landmark, consideration of the site or structure for designation as an historic landmark and application of controls and incentives shall proceed as provided by the Landmarks Preservation Ordinance. If the project is rejected for nomination, the project shall not be conditioned or denied for historical preservation purposes, except pursuant to paragraphs d or e of this subsection.
d. When a project is proposed adjacent to or across the street from a designated site or structure, the decision maker shall refer the proposal to the City's Historic Preservation Officer for an assessment of any adverse impacts on the designated landmark and for comments on possible mitigating measures. Mitigation may be required to insure the compatibility of the proposed project with the color, material and architectural character of the designated landmark and to reduce impacts on the character of the landmark's site. Subject to the Overview Policy set forth in SMC Section 25.05.665 mitigating measures may be required.
e. On sites with potential archaeological significance, the decision maker may require an assessment of the archaeological potential of the site. Subject to the criteria of the Overview Policy set forth in SMC Section 25.05.665 mitigating measures … may be required to mitigate adverse impacts to an archaeological site …

National Register of Historic Places

The National Park Service administers the National Register of Historic Places (National Register or NRHP). The National Register is the official federal list of districts, sites, buildings, structures and objects significant in American history, architecture, archeology, engineering and culture. National Register properties have significance to the history of their community, state or the nation. Nominations for listing historic properties come from State Historic Preservation Officers, from Federal Preservation Officers for properties owned or controlled by the United States Government, and from Tribal Historic Preservation Officers for properties on tribal lands. Private individuals and organizations, local governments, and American Indian tribes often initiate this process and prepare the necessary documentation. In Washington State, the Washington State Advisory Council on Historic Preservation, organized and staffed by the Department of Archaeology and Historic Preservation (DAHP), considers each property proposed for listing and makes a recommendation on its eligibility.

To be eligible for listing, a property must normally be at least 50 years of age and possess significance in American history and culture, architecture, or archaeology to meet one or more of four established criteria.

Historic resources eligible for listing in the National Register may include buildings, sites, structures, objects, and historic districts. A resource less than 50 years of age may be eligible if it can be demonstrated that sufficient time has passed to understand its historic importance or if the resource is determined to have ‘exceptional’ importance. To be eligible for listing in the National Register, a property must also have integrity, which is defined in the NRHP listing criteria as "the ability of a property to convey its significance." Within the concept of integrity, the NRHP recognizes seven aspects or qualities that in various combinations define integrity. These are feeling, association, workmanship, location, design, setting and materials.

Washington Heritage Register

The Washington Heritage Register (WHR) is an official listing of historically significant sites and properties found throughout the state. The list is maintained by DAHP and includes districts, sites, buildings, structures, and objects that have been identified and documented as being significant in local or state history, architecture, archaeology, engineering or culture. Sites which are listed in the NRHP are automatically added to the WHR.

Anyone may prepare and submit a nomination to DAHP. Complete nominations are scheduled for consideration by the State Advisory Council. To be eligible for listing in the WHR, a property must qualify under the following:

- A building, site, structure, or object must be at least 50 years old. If newer, the resource should have documented exceptional significance.
- The resource should have a high to medium level of integrity, i.e. it should retain important character defining features from its historic period of construction.
- The resource should have documented historical significance at the local, state or federal level.

City of Seattle Landmarks Process

Local recognition of historical significance in Seattle is provided through the process of designation of the property as a Seattle Landmark. The process consists of three sequential steps involving the Landmarks Preservation Board: submission of a nomination and its review and approval by the Board; designation by the Board; and negotiation of controls and incentives by the property owner and the Board staff, which is then forwarded to the Board for approval at a public meeting. A final step in Seattle's landmarks process is approval of the designation by an ordinance passed by City Council.

The City of Seattle's Landmarks Preservation Ordinance (SMC 25.12) requires that a property, object or site be more than 25 years old and "have significant character, interest or value as part of the development, heritage or cultural characteristics of the City, state or nation." It must also have integrity or the ability to convey its significance. Seattle's landmarks ordinance also requires a property meet one or more of six designation criteria.

SMC 25.12.350 Standards for Designation

A. It is the location of, or is associated in a significant way with, an historic event with a significant effect upon the community, City, state, or nation; or

B. It is associated in a significant way with the life of a person important in the history of the City, state, or nation; or

C. It is associated in a significant way with a significant aspect of the cultural, political, or economic heritage of the community, City, state or nation; or

D. It embodies the distinctive visible characteristics of an architectural style, or period, or of a method of construction; or

E. It is an outstanding work of a designer or builder; or

F. Because of its prominence of spatial location, contrasts of siting, age, or scale, it is an easily identifiable visual feature of its neighborhood or the City and contributes to the distinctive quality or identity of such neighborhood or the City.

Existing Conditions

The consultant reviewed previously existing studies in order to determine the presence of historic resources and potentially historic resources within the study area. New research and fieldwork was not undertaken for this analysis

Development of Seattle's South Lake Union Area

Lake Union became an early transportation route for shipments of logs and coal, which were cut or extracted east of Lake Washington. Sawmills and shingle mills were predominant early industrial uses along the lake. In 1883, Seattle annexed what had been David Denny's original claim.

Gradually, both the South Lake Union and Cascade neighborhood to the east of it developed as mixed-use urban communities with industries and commercial buildings, wood-frame apartment buildings, boarding houses and single family houses, seven separate churches, several breweries and at least five commercial laundries, several clothing manufacturing plants, and a public school. Wharves were constructed along the lake, and commercial service businesses developed along the main north-south access, Westlake Avenue N.

The construction of electric streetcars in the 1880s and 1890s connected passengers from downtown to South Lake Union and beyond. The streetcars ran along the west and east sides of the lake and to "streetcar suburbs" like Fremont, Edgewater, Latona, and Wallingford.

In 1909, the Northern Pacific Railway was granted a franchise by the City to extend a spur line to the neighborhood, by way of Fremont and along the western shoreline of Lake Union. The line split at Valley Street, with one portion continuing south on Terry Avenue N and another continuing eastward to Fairview Avenue N. This line was used by the 1913 Ford Assembly Plant, located at the southeast edge of the lake, for delivery of vehicle parts. Ford operated the assembly plant from 1913 to 1932. Another vehicle manufacturer in the area, the Kenworth Truck Company at Yale Avenue North and Mercer, may also have benefited from the railroad's transportation link.

When the Lake Washington Ship Canal finally opened July 4, 1917, it dramatically transformed Lake Union, industrializing and eventually militarizing the lake. The small tanneries and cooperages along the southern shoreline disappeared or declined and were displaced by fishing vessel fleets, asphalt plants, the auto assembly plant, sawmills, and boatyards and shipyards. Bill Boeing began to fly his experimental seaplanes in 1916, using a boatyard on the east side of Lake Union and the skills of local boatwrights.

The large Naval Reserve Armory was completed at the lake's south end in 1942, and during World War II Lake Union served military ship repair needs. After the war, the South Lake Union industrial base contracted and much of the older housing stock and residential population in the community declined. Meanwhile, commercial and manufacturing uses continued to increase. Auto-related businesses such as garages, service shops, and retail showrooms became common along Westlake Avenue from the late teens and continued through the post-World War II era.

In 1952, the Battery Street tunnel was built beneath the Denny Regrade and southern portion of the South Lake Union area. This tunnel served to connect Aurora Avenue N to the new viaduct for Highway 99 along the city's central waterfront. The area north of the tunnel (north of Thomas Street) was bisected into east and west halves, with only Broad and Mercer Streets providing access across Aurora in the South Lake Union neighborhood. In this way, Aurora Avenue N established the western edge of the neighborhood.

In the early 1960s, the construction of I-5 further defined the identity of the nearby Cascade and Eastlake neighborhoods, linking them with Lake Union as a result. The freeway's Mercer Street access ramps also divided the northeastern part of the South Lake Union neighborhood, placing several blocks of it in the Eastlake area.

Vehicle traffic on Mercer Street continued to increase in recent decades, effectively separating the area south of Mercer Street from the nearby lakeside amenities. At the same time, the proximity to I-5 and downtown made the South Lake Union area increasingly attractive for business development. Maps dating from after the 1960s show increasingly large-scale parcels and development, alley vacations, and replacement of small-scale buildings by empty sites, typically with parking lots.

In an urban survey from 1975, the neighborhood was described as "a collection of auto showrooms, small businesses and manufacturing enterprises, and parking lots supplementary to, rather than integral with downtown" (Nyberg and Steinbrueck). Those neighborhood industries persisted into the late 1980s. They included older auto repair shops and retail showrooms near Westlake Avenue N, headquarters for general contractors, construction supply distributors, and floral and furniture warehouses. Businesses that moved into the area in the 1980s included printing/photography, childcare facilities, and telecom concerns. The northeast portion of the neighborhood, north of Mercer Street, was redeveloped extensively during this period by two new high-tech medical interests—the Fred Hutchinson Cancer Research Center and Zymogenetics.

Old and new multi-family development

Development in the South Lake Union area over 2000–2010 has consisted mainly of five- and six-story buildings as well as apartment buildings and condominiums of up to six and seven stories on consolidated, full- and half-block parcels. The character of the area has largely shifted from lower-scale light industrial and manufacturing buildings and warehouses to these more dense commercial and mixed uses. The South Lake Union Streetcar line was completed in 2007. Amazon's new South Lake Union campus is currently under construction and includes several blocks of new buildings of up to 12 stories.

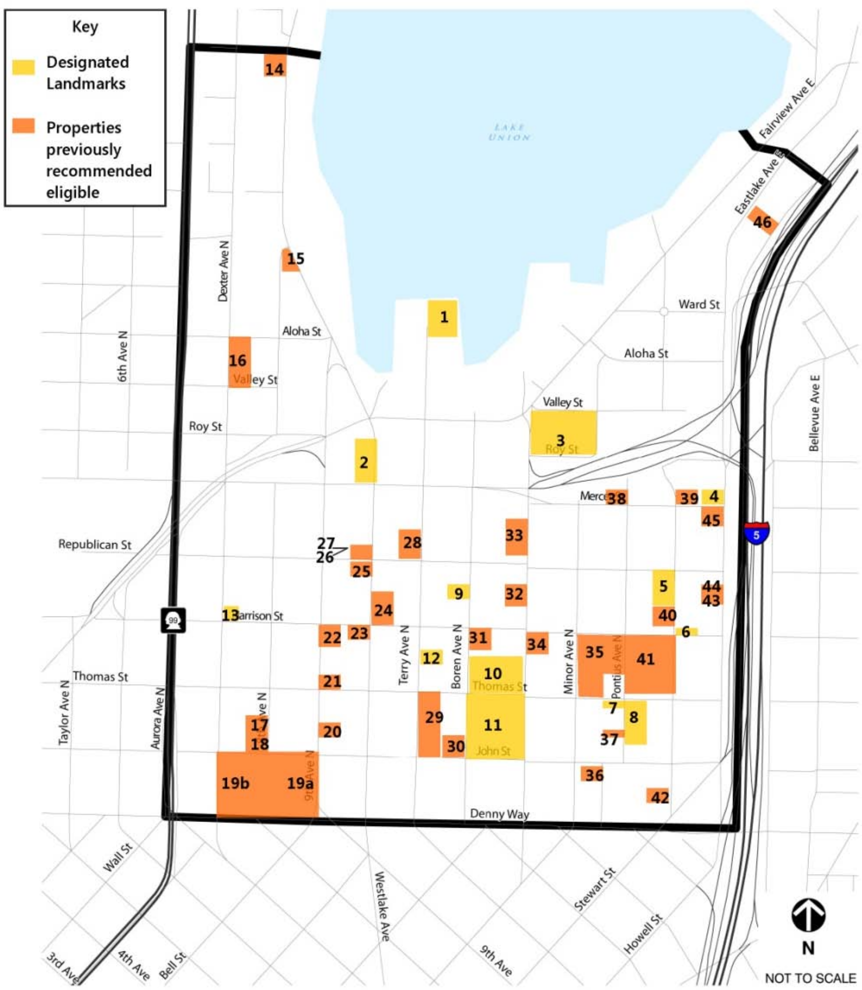
Historic Resources

Thirteen properties within the study area are designated City of Seattle Landmarks, two of which are also listed in the National Register of Historic Places. (See **Table 3.11-1**) Another 34 properties within the study area have been identified in earlier studies as potentially eligible for listing as local landmarks or in the National Register and are still extant. (See **Table 3.11-2** and **Figure 3.11-1**)

Designated Properties

The following 13 properties within the study area are designated Seattle Landmarks. Two are also National Register-listed, noted with an asterisk (*).

Figure 3.11-1
Eligible and Designated Historic Sites



Source: City of Seattle, BOLA Architecture + Planning, 2010

Table 3.11-1
Designated Landmarks

Site no.	Parcel no.	Name	Address
1	4088803210	Naval Reserve Armory* (1942)	860 Terry Ave N
2	4088803385	Ford McKay & Pacific McKay Buildings (1922 & 1925)	600–615 Westlake Ave N
3	1984200035	Ford Assembly Plant (1913)	1155 Valley Street / 700 Fairview Ave N
4	2925049097	Jensen Block Apts.(1906)	601 Eastlake Ave E
5	6849200110	Supply Laundry (ca. 1906)	1265 Republican St
6	6847700030	St. Spiridon Russian Orthodox Cathedral (1938)	400 Yale Ave N
7	2467400455	Immanuel Lutheran Church*	1215 Thomas St
8	6849700100	New Richmond Laundry (1917, 1927, 1944)	224 Pontius Ave N
9	1983200270	Van Vorst Building (1909–1915)	413–421 Boren Ave N
10	1986200480	Troy Laundry (1927)	311–329 Fairview Ave N
11		Seattle Times Building (1931)	1120 John St
12	1986200450	Terry Avenue Building (1914)	310–320 Terry Ave N
13		West Earth Co. Street Clock (1915)	406 Dexter Ave N

Source: City of Seattle Department of Neighborhoods, 2010

St Spiridon Orthodox Cathedral

Properties Previously as Potentially Eligible for Historic Designation

In addition to the designated properties, 34 properties have been identified in earlier studies as potentially eligible for local and/or National Register listing. Both Washington State and City of Seattle historic property inventory forms were also searched for properties within the study area.

The properties cited in this section are those within the present study area that were identified in one or more of the earlier studies as potentially eligible for designation. Some buildings that were identified in earlier reports as potentially eligible have since been demolished; these properties are not included in the following list.

Table 3.11-2
Properties Previously Identified as Potentially Eligible for Historic Designation

Site no.	Parcel no.	Name (constr. date)	Address	Source
14	3025049003, 3025049004	National Sign Corp. (1920 and 1922)	1247–1255 Westlake Ave N	1995 Commons
15	2249500180	Christie Building/American Meter & Appliance (1926)	1001 Westlake Ave N	1995 Commons
16	2249000330	Seattle School District Warehouse (1920–21, remodeled 1934)	810 Dexter Ave N	1995 Commons
17	1991201100	J. Lister Holmes Architectural Office/Holly Press (1954)	215 8th Ave N	2008 DAHP (Nifty from the Last 50)
18	1991201110	Denny Park Lutheran Church (1939, 1955–56 addn.)	766 John Street	1995 Commons / 2005 City Inventory
19A	1991201077	Denny Park (1884)	Denny Wy, Dexter Ave N, John St, & 9th Ave N	1995 Commons / 1970 WHR
19B	1991201077	Seattle Parks Dept. Headquarters (1948)	118 Dexter Ave N	1995 Commons / 2005 City Inventory
20	1986200105	A-One Ornamental Iron Works	216 9th Ave N	2005 City Inventory
21	1986200155	Garage/Brian Uttig School of Massage (1920)	900 Thomas St	1995 Commons
22	1986200175	City Hardware (1927)	901 Harrison St	1995 Commons
23	1986200125	Durant Motor Co./Pande Cameron (1928)	333 Westlake Ave N	1995 Commons / 2005 Streetcar EIS
24	1983200230	Firestone Tire (1929)	400 Westlake Ave N	1995 Commons / 2005 Streetcar EIS
25	1983200005	(1920)	425 Westlake Ave N	1995 Commons
26	1983200095	Antique Liquidators (1919)	503 Westlake Ave N	1995 Commons / 2005 Streetcar EIS
27	1983200090	MBI Seattle (1925)	507 Westlake Ave N	1995 Seattle Commons
28	1983200160	(1924, altered)	964 Republican St	1995 Commons *greatly altered
29	1986200380	Fred Rogers Building (1954)	200 Terry Ave N	2005 Streetcar EIS *SHPO det. not eligible (7/14/2005)
30	1986200370	Taskett Agency Office Bldg. (1954)	201 Boren Ave N	2010 DAHP (Nifty from the Last 50) *denied Seattle Landmark designation (May 7, 2008)

Site no.	Parcel no.	Name (constr. date)	Address	Source
31	1986200515	US Radiator/David Smith & Co. (1925)	334 Boren Ave N	1995 Commons / 2005 DAHP (Streetcar)
32	1983200615	Wold Building (1924)	413 Fairview Ave N	1995 Commons
33	1983200545	Washington State Dept. of Game (1948)	509 Fairview Ave N	2005 DAHP (Mercer Corridor)
34	2467400065	Bricklayers' Building	318 Fairview Ave N	2003 City Inventory
35	2467003335	Cascade Playground & Comfort Station (ca. 1936)	Harrison St & Pontius Ave N	
36	2468400070	Brewster Apts (1916)	133 Pontius Ave N	1995 Commons / 2003 City Inventory
37	2467400455	Single-family res. (ca. 1911)	223 Pontius Ave N	2003 City Inventory
38	2467400190	Carlton Apts (1926, alt. 1942)	603 Pontius Ave N	1995 Commons / 2003 City Inventory
39	2925049034	Mercer Building (1959)	1310 Mercer St/600–610 Yale Ave N	2003 City Inventory
40	6849200100	Fuller Brush Building (ca. 1907)	409 Yale Ave N	2003 City Inventory
41	6849200005	Seattle School District Warehouse (1955)	1255 Harrison Street	2003 City Inventory / 2006 DAHP *denied Seattle Landmark designation (Jan 4, 2006)
42	6849700075	Feathered Friends & 911 Media Arts Center (1927)	117 Yale Ave N	1995 Commons / 2003 City Inventory
43	6847700050	Foreign Auto Rebuild (1926)	421 Eastlake Ave E	1995 Commons / 2003 City Inventory
44	6847700055	Apartments/offices (1910)	425 Eastlake Ave E	1995 Commons / 2003 City Inventory
45	0209000075	Carolina Court Apts (1916)	527 Eastlake Ave E	1995 Commons / 2003 City Inventory
46	2163901095	Buffalo Shoe Factory/commercial (1917)	1124 Eastlake Ave E	1995 Commons

Source: City of Seattle Department of Neighborhoods, 2010

Focus Areas[1]

8th Avenue Corridor

The 8th Avenue Corridor contains no designated landmarks. The Denny Park Lutheran Church (#18) and Holly Press (#17) on 8th Avenue N just north of Denny Park are located at the southwest end of the corridor and have been inventoried as potentially eligible for historic designation in previous reports. Denny Park and the Parks Department Headquarters (#19A & B) are located adjacent to the south end of the corridor, across John Street.

Fairview Avenue Corridor

The Fairview Avenue Corridor contains two designated Seattle Landmarks—the Troy Laundry and the Seattle Times Building. In addition, David Smith & Co. (334 Boren Avenue, #31), Wold Building (413 Fairview Avenue N, #32), Washington State Dept. of Game (509 Fairview Ave N, #33), and Bricklayers' Building (318 Fairview Ave N, #34) were inventoried as potentially eligible for historic designation in previous reports.

Valley/Mercer Blocks

The Valley/Mercer Blocks contain one designated Seattle Landmark at the west end—the Ford McKay and Pacific McKay Buildings. Currently the site is vacant, as the historic building elements have been salvaged, catalogued, and stored in anticipation of the Mercer Corridor project. These building elements are required to be reinstalled on a new frame, in a manner approved by the Seattle Landmarks Preservation Board, as a condition of construction on the subject block. Additionally, the Ford Assembly Plant is located immediately east of the Valley/Mercer Blocks, across the street from the east end of the focus area.

3.11.2 Environmental Impacts

When zoning allows for increases in building heights and density, there is increased potential for greater growth, development and land values than prior to the change. Where there is increased demand for development, there may be greater pressure on parcels with low-scale, smaller buildings to redevelop. Under these circumstances, the operation and maintenance

[1] Focus areas are subareas in the South Lake Union neighborhood that are considered in greater detail, where applicable. Please discussion and Figure 2-3 in Chapter 2.

of small historic buildings may be perceived as being infeasible from an economic perspective.

Smaller-scale, one- and two-story buildings tend to be particularly vulnerable to demolition for redevelopment, including structures that are not already recognized by listing in a historic register but which may be eligible for local designation and the protection that it affords.

Impacts Common to All Alternatives

In all of the action alternatives, zoning would allow denser future development patterns than that represented by the historic neighborhood fabric. The alternatives could encourage the aggregation of parcels to form half- or full-block sites on which larger buildings may be constructed, which could result in conversion of low-scale existing buildings and also significantly change their context.

In all alternatives, higher buildings could be constructed directly across the street to the north of historic Denny Park. See Section 3.10, **Aesthetics**, for further discussion of potential shading issues at Denny Park.

Alternative 1

Alternative 1 allows for the greatest amount of development, which could also result in the greatest amount of development pressure on existing small scale structures that may be eligible for historic designation.

Alternative 1 also allows for the greatest relative bulk and scale of development compared to all alternatives. If new development occurs adjacent to a designated historic structure or a structure that is potentially eligible for historic designation, the difference in character, height, and bulk could negatively impact the historic value of the existing structure.

Alternative 2

While increased bulk and scale of allowed buildings would be somewhat less in Alternative 2 than in Alternative 1, the impacts on historic resources are likely to be similar.

Alternative 3

While increased bulk and scale of allowed buildings would be somewhat less in Alternative 3 than in Alternatives 1 or 2, the impacts on historic resources are likely to be similar.

Alternative 4 (No Action)

Maintaining the existing zoning in the study area would not change the development pressure on historic resources.

Focus Areas

Impacts associated with any of the focus areas are not expected to be substantively different from those described for the study area as a whole. The mitigating measures described below for the study area as a whole would also apply to sites within the focus areas.

3.11.3 Mitigation Strategies

Historic Resources Contents

Affected Environment

Environmental Impacts

Mitigation Strategies

Significant Unavoidable Adverse Impacts

In order to comprehensively assess existing resources and identify historic preservation priorities, potentially undertake a new inventory of historic resources in the South Lake Union neighborhood. Up-to-date information will allow proper assessment of potentially eligible properties. A new survey would address buildings such as 501 Dexter Avenue N, which appears to have architectural significance yet has not been cited in earlier surveys.

If higher-density alternatives (1, 2, or 3) are chosen, funding to the Department of Neighborhoods Historic Preservation Office for preparation of landmark nominations should be considered as mitigation. The work would allow the properties to be taken through the nomination process to clarify the status of potentially significant properties.

The *South Lake Union Urban Center Neighborhood Plan* of September 2007 identifies goals and policies that specifically relate to historic or older buildings in the neighborhood. The plan identifies the following policies, which would be appropriate as mitigation measures for increased height and density allowed in the neighborhood (under Alternatives 1, 2, or 3).

> **Goal 2:** A neighborhood that recognizes its history as a maritime and industrial community and embraces its future as a growing urban center that provides for a wide range of uses.
>
> Source: South Lake Union Urban Center Neighborhood Plan, 2007.

- Establish incentives to encourage preservation, adaptive use, and rehabilitation of historically significant structures in the neighborhood.
- Explore incentives to encourage the adaptive use of older, character-providing buildings in the neighborhood.
- Provide incentives to support property owners who wish to maintain existing buildings.

A zoning capacity and financial feasibility model should be created and analyzed to determine whether an expanded transfer of development rights (TDR) program would be an effective financial incentive and mitigation tool for preservation of local landmark properties in the South Lake Union neighborhood.

A certified arborist should undertake a conditions analysis of the trees in Denny Park, including an assessment of their need for seasonal sunlight from the north. Design standards should be modified accordingly to allow ample light.

3.11.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to historic resources are anticipated under any of the proposed alternatives.

3.12 Cultural Resources

Cultural Resources Contents

This section describes existing cultural resources in the South Lake Union neighborhood and identifies potential impacts of the proposed alternatives, together with potential mitigating measures. This section summarizes key information from a more detailed cultural resources assessment contained in **Appendix C**.

Assessment methods included a review of previous ethnographic and archaeological investigations in the local area; an online search of records maintained by the Washington Department of Archaeology and Historic Preservation (WA DAHP) for known sites in the immediate area; a review of relevant background literature and maps (including General Land Office (GLO), Sanborn, and Kroll maps); and the preparation of this report. This assessment utilized research design that considered previous studies, the magnitude and nature of the undertaking, the nature and extent of potential effects on historic properties, and the likely nature and location of historic properties within the study area, as well as other applicable laws, standards, and guidelines (per 36 CFR 800.4 (b)(1); WA DAHP 2010b).

3.12.1 Affected Environment

Forty-three cultural resource assessments have previously been prepared within approximately one mile of the study area. Many of these were conducted within the study area. Of note are recent assessments that included subsurface archaeological investigations within the boundaries of the current study area. Durio and Bard (2008:4-10–4-11) conducted archaeological testing near Broad Avenue and Mercer Street in the vicinity of a Duwamish camp or longhouse and did not recover any archaeological evidence of pre-contact or historic-period habitation. Dellert and Larson (2004) reported archaeological monitoring of excavations to remove a tunnel boring machine north of Valley Street. Deposits observed consisted of fill up to 18 feet below surface, lakebed sands, and underlying peat; no archaeological sites were identified.

As a result of these assessments, one historic-period archaeological site has been recorded within the study area (**Table 3.12-1**). Site 45KI502 is a historic-period railroad segment east of Westlake Avenue from Aloha Street north to the Fremont Bridge (Cole 2000; Nelson 2001). It was supported on a wooden trestle built in 1911 over the steeply sloped margins of Lake Union. Because the site has been altered and lacks integrity, it is not eligible for inclusion in the National Register of Historic

Places (NRHP). Subsequent archaeological monitoring of construction excavations in and adjacent to the site did not identify any pre-contact archaeological materials. Historic-period and/or recent refuse items (e.g., bottle glass, wood debris) were observed during monitoring but their age could not confidently be assessed at 50 years or older; therefore, they were not considered archaeological or potentially eligible for the NRHP (Shong and Miss 2004).

Table 3.12-1
Archaeological sites recorded within an approximately 1-mile radius of the study area (WA DAHP 2010a).

Site Number	Site Name	Site Type	Location Relative to Study Area	Evaluation Status	Potential Impacts due to Proposal	Recommended Mitigation
45KI405	--	Historic Maritime Properties, Pre Contact and Historic Components	1 mile west-southwest	Site has not been evaluated for NRHP.	None.	N/A
45KI456	Baba'k^{w}ob Site	Historic Object(s), Pre Contact Camp; Pre Contact Shell Midden	0.6 miles south-southwest	Site recommended not eligible for NRHP.	None.	N/A
45KI482	World Trade Center North Historic Site	Historic Object(s), Pre Contact Burial	0.5 miles southwest	Site recommended not eligible for NRHP.	None.	N/A
45KI502	Northern Pacific Railroad Belt Line	Historic Railroad Properties	Within the study area along the east side of Westlake Avenue between Galer Street and Aloha Street (Cole 2000:4)	Site recommended not eligible for NRHP.	None. Prior construction has compromised this site. Construction in the site area under the current proposal not anticipated to generate additional impacts to this site.	None.

Site Number	Site Name	Site Type	Location Relative to Study Area	Evaluation Status	Potential Impacts due to Proposal	Recommended Mitigation
45KI737	Old Pine Street Stub Tunnel Site	Historic Commercial Properties, Historic Object(s), Historic Road, Historic Structures Not Specified	0.2 miles south	Site has not been evaluated for NRHP but is considered potentially eligible.	None.	N/A
45KI809	Great Northern Railroad Tunnel	Historic Railroad Properties	0.75 miles south	Determined eligible for NRHP.	None.	N/A
45KI946	--	Historic Commercial Properties, Historic Residential Structures	0.3 miles east	Site has not been evaluated for NRHP but is considered potentially eligible.	None.	N/A
45KI958	SDOT Maintenance Yard	Historic Commercial Properties, Historic Object(s), Historic Residential Structures, Pre Contact and Historic Components, Pre Contact Lithic Material	100 feet west	Site has not been evaluated for NRHP but is considered potentially eligible.	None.	N/A

Source: Cultural Resources Consultants, 2010

No pre-contact archaeological sites have been identified within the study area. The nearest recorded pre-contact archaeological site is the Baba´k^{w}ob site (45KI456) on Elliott Bay in Belltown (Lewarch 1998). The site was first identified as human skeletal elements encountered in construction excavations (Larson and Lewarch 1998). Archaeological testing and monitoring identified additional archaeological materials including shell midden, wood planks, charcoal, and a variety of historic-period personal, domestic, and commercial items (Lewarch 1998; Lewarch, et al. 2002:Table 4). Examination of stratigraphy in archaeological test units and construction trench exposures, along with artifacts dating from the 1830s to 1860s, indicated that the archaeological materials were contained within historic-period (1880s to 1912) and recent fill and landslide deposits, and dated to the historic period. Because the site did not retain depositional or locational integrity, it was recommended not eligible for the NRHP (Lewarch, et al. 2002:123).

Archaeological Context

The study area is located on what were formerly a seasonally wet meadow, a ravine and stream, the northeastern flank of Denny Hill, and steeply sloped forested uplands adjacent to the Lake Union shoreline. Native American villages in this region were typically located very near or adjacent to water bodies (Suttles and Lane 1990). It is probable that the main pre-contact human activities in the study area were hunting and plant gathering based in associated seasonal camps. Historic-period Lakes Duwamish people continued to obtain resources from Lake Union and lived in the area southwest of the study area. Over the last approximately 130 years, activity in the study area has included logging, construction and demolition of residential and commercial structures, construction of manufacturing and other industrial facilities, shoreline filling and construction of artificial waterways, construction and regrading of roadways, and construction of buried water lines and other utilities. This suggests that undisturbed evidence of earlier human occupation is unlikely to be present in the study area. Archaeological materials that could potentially be found in the study area would most likely date to the historic period.

Potential for Discovery of Archaeological Sites in the Study Area

Forsman, et al. (1997) identified two locations within the current study area that have higher archaeological potential than other portions of the study area. The first is a ravine south of Republican Street, centered roughly between Westlake Avenue and Terry Avenue (Tobin 1987:46, in Lewarch, et al. 1999:8). This low-elevation area, identifiable using contour lines on historical maps (e.g., USC&GS 1875, 1899; USGS 1897), would have contained a seasonally wet meadow or prairie with numerous valuable plant and animal resources (Forsman, et al. 1997; Waterman 1922). Located just east of the eastern boundary of the Denny Regrade, it was filled with regrade spoils and other refuse and debris materials. The second is the pre-industrial shoreline of Lake Union. Lakes Duwamish and other Coast Salish peoples used the lakeshore and margins of Lake Union for hunting, fishing, and other resource extraction and processing activities. This part of the study area has also been heavily modified by emplacement of large volumes of fill including sawdust, regrade spoils, household refuse, and demolition debris. A third formerly low-elevation area is present in the vicinity of the Fairview Avenue Corridor (USC&GS

1899; USGS 1897; USSG 1856). In all three areas, archaeological sites could potentially be buried beneath the fill in intact native soils. Archaeological materials such as stone tools and flaking debris, shell midden deposits, faunal and botanical remains, fire-modified rock, charcoal, and postmolds, depressions, or other features could be present, reflecting a range of subsistence, domestic, and ceremonial activities. Such materials, if present, could be pre-contact or historic in age, and could potentially be eligible for the NRHP.

Historic-period archaeological sites could also be present in the study area. These could include domestic, commercial, and industrial materials such as personal ornamentation, food scraps and packaging, structural, mechanical, or manufacturing waste items. However, historic-period archaeological materials would be expected to be contained within historic and recent fill deposits and not in intact native soils. Such materials would lack aspects of integrity (e.g., association and location) and would not likely be eligible for the NRHP (NRHP 1991).

The long history of industrial and public works activities in the study area has disturbed most natural land surfaces. As a result of more than a century of urban development, undisturbed landforms are not available for inspection within the study area. Therefore, archaeological survey was not conducted as a part of this assessment.

8th Avenue Corridor

The 8th Avenue Corridor, covering the area one-half block east and west of 8th Avenue between Republican and John Streets, is within the area cut during the Denny Regrade (Corley 1969; Forsman, et al. 1997: **Figure 3.12-1**; Seattle Engineering Department 1907, 1910). Up to 60 vertical feet of soils were removed in this area, just north of Denny Park (Corley 1969). Natural land surfaces that were exposed and available for human occupation from the end of the Pleistocene to 1907 are no longer extant in this area. As a result, the 8th Avenue Corridor is considered to have no potential to contain pre-contact archaeological sites or historic-period archaeological sites from before 1907. The area is considered to have a low potential to contain intact historic-period archaeological sites postdating the Denny Regrade due to impacts of subsequent urban development. Historic-period debris items are expected to be contained within deposits previously impacted by construction and earthmoving activities. Such materials would lack aspects of integrity (e.g., association and location) and would not likely be eligible for the NRHP (NRHP 1991).

Figure 3.12-1
Intersection of 9th Avenue and Harrison Street

Source: King County, 2010.

Fairview Avenue Corridor

The Fairview Avenue Corridor, covering the area one-half block east and west of Fairview Avenue between Mercer Street and Denny Way, is in a formerly low-elevation area with a stream that entered Lake Union near the present-day intersection of Valley Street and Fairview Avenue (USC&GS 1899; USSG 1856).

This environment would have supported resources attractive to humans from deglaciation to the historic era. If land surfaces exposed from the end of the Pleistocene to the pre-urban historic era are preserved beneath fill deposits, then pre-contact and early historic-period archaeological sites could be present. Pre-contact archaeological sites could include the remains of fish weirs, basketry, stone implements, and other evidence of resource procurement and processing or domestic activities. Historic-period archaeological sites buried beneath fill could include remains of logging operations or deposits related to the residence of W. P. Smith, which was east of the corridor. Historic-period debris items are expected to be contained within fill and other deposits previously impacted by construction and earthmoving activities. Such materials would lack aspects of integrity (e.g., association and location) and would not likely be eligible for the NRHP (NRHP 1991).

Valley/Mercer Blocks

The Valley/Mercer Blocks are located atop filled lakeshore. The pre-industrial Lake Union shoreline extended to approximately Republican Street near Terry Avenue (Chrzastowski 1983; Durio and Bard 2008:Exhibit 4-1; USC&GS 1875). The former shoreline and its margins would have contained a variety of plant and animal resources used by Coast Salish peoples. Archaeological sites in this part of the study area would likely be low-density, diffuse concentrations of materials lost or discarded in hunting, fishing, and other resource extraction and processing activities in the lake, such as fish weirs, basketry, stone tools, and wood or bone implements. This part of the study area now contains large volumes of fill including sawdust, regrade spoils, household refuse, and demolition debris, and has been affected by subsequent urban development. It is estimated that fill in the area containing the Valley/Mercer Blocks is 25 feet thick (Durio and Bard 2008:4-5). Historic-period debris items are expected to be contained within fill and other deposits previously impacted by construction and earthmoving activities. Such materials would lack aspects of integrity (e.g., association and location) and would not likely be eligible for the NRHP (NRHP 1991).

3.12.2 Environmental Impacts

Because the study area is considered to have a low potential to contain intact archaeological deposits, no significant impacts to archaeological sites are anticipated. No pre-contact archaeological sites have been identified within the study area. One historic-period archaeological site (45KI502) has been recorded within the study area and was previously impacted by sewer line and trail construction. Further development is not anticipated to generate additional impacts to this site.

The proposal analyzed in this EIS considers the use of incentive zoning to increase height and density in the South Lake Union neighborhood. By itself, this proposal would not directly result in impacts to the earth element of the environment. Although unlikely, as noted above, future site-specific development proposals under any of the alternatives, however, could result in impacts to cultural resources. Potential impacts that could be associated with future site-specific development under any alternative are briefly discussed below.

Impacts Common to All Alternatives

The potential for the study area to contain archaeological sites is generally considered to be low. This is due primarily to the long history of disturbance including construction and demolition of buildings, transportation developments, major earthmoving projects (i.e. Denny Regrade), and installation of buried utilities. While the area could have potentially been the location of repeated or regular pre-contact and early historic-period activities, extensive construction and landform modifications since the 1880s have most likely destroyed the integrity of any archaeological evidence of these activities that may have been present, seriously compromising their potential significance. There appears to be a low probability for intact pre-contact or historic-period archaeological deposits to be present within the study area.

Based on existing archaeological data for this region, pre-contact archaeological sites that might potentially have been present in the general vicinity prior to urbanization could have included the remains of habitation sites, lithic scatters, fish weirs, trails, or similar features, which could represent a range of domestic, subsistence, and ceremonial activities. Site significance could potentially be related to changes in site types and use of environmental resources over time (Lewarch et al. 2002:16-17). Additionally, pre-contact sites may potentially have significance as Traditional Cultural Properties to one or more tribal and/or ethnic groups (Parker and King 1990).

The area may have been used by Lakes Duwamish people as a habitation site repeatedly or consistently for centuries or it may have been first occupied in the nineteenth century. However, any physical evidence of this occupation is not likely to have been preserved due to its location in the Denny Regrade area and the vicinity of the present-day Broad Street and Mercer Street roadways, where road construction has disturbed soils from 6 to 30 feet or more below surface (Durio and Bard 2008:Exhibit 4-1). The trail connecting Lake Union and Belltown (Thrush and Thompson 2007; USSG 1856) most likely passed through the southwestern portion of the study area, but any physical evidence of this route also would have been removed by urban development.

Historic uses of the study area have included logging, transportation, and domestic, industrial, and commercial activities. These activities could potentially have resulted in deposition of archaeological materials; such deposits could arguably be significant if they retained depositional integrity and could result in data that would inform research questions regarding ethnicity, domestic behavior, or other facets of historical life relevant to the social, economic, or cultural development of Seattle (Weaver 1989). Frequencies of materials found at domestic artifact scatters may provide economic data relevant to larger historical trends, and potentially may be suggestive of relative economic status and possibly ethnicity. Structures may provide data on occupational specialization, construction styles, and agricultural/subsistence practices. Pre-structural remains could suggest early settlers' domestic, social, and commercial activities (Weaver 1989). However, such activities are unlikely to leave a distinctive archaeological signature that would be recognizable following major construction excavation and building episodes within the current study area over more than a century of urban development. Physical evidence of the residences of W. P. Smith and Thomas Mercer is not expected to persist due to the effects of earthmoving and construction activities in these locations.

Alternative 1

Under Alternative 1, construction excavations that reach buried native intact terminal Pleistocene or Holocene deposits may have the potential to disturb archaeological sites. However, the contact between near-surface fill deposits and underlying natural deposits has been previously disturbed by prior construction in most of the study area. Any as-yet unknown potentially NRHP-eligible archaeological sites, if discovered in construction, would be subject to mitigation.

Alternative 2

Although the proposed changes to building heights and densities are different under Alternative 2, their potential impacts to cultural resources are the same as for Alternative 1. Construction excavations that reach buried native intact terminal Pleistocene or Holocene deposits may have the potential to disturb archaeological sites. However, the contact between near-surface fill deposits and underlying natural deposits has been previously disturbed by prior construction in most of the study area.

Alternative 3

Under Alternative 3, although the specifics of height and density changes are different, potential impacts to cultural resources are expected to be the same as for Alternatives 1 and 2. Construction excavations that reach buried native intact terminal Pleistocene or Holocene deposits may have the potential to disturb archaeological sites. However, the contact between near-surface fill deposits and underlying natural deposits has been previously disturbed by prior construction in most of the study area.

Alternative 4 (No Action)

Continued development of South Lake Union within current zoning regulations is not anticipated to affect any recorded archaeological sites. As for Alternatives 1, 2, and 3, construction excavations that reach buried native intact terminal Pleistocene or Holocene deposits may have the potential to disturb archaeological sites. However, the contact between near-surface fill deposits and underlying natural deposits has been previously disturbed by prior construction in most of the study area.

Focus Areas[1]

Impacts associated with any of the focus areas are not expected to be substantively different from those described for the study area as a whole. The mitigation strategies described below for the study area as a whole would also apply to sites within the focus areas.

3.12.3 Mitigation Strategies

Cultural Resources Contents
Affected Environment
Environmental Impacts
Mitigation Strategies
Significant Unavoidable Adverse Impacts

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the location and nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives.

Mitigation measures could potentially include archaeological monitoring, testing, or data recovery excavations; development of interpretive signs, markers, or exhibits; and/or minimization or avoidance of further impacts through redesign.

3.12.4 Significant Unavoidable Adverse Impacts

Cultural Resources Contents
Affected Environment
Environmental Impacts
Mitigation Strategies
Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to cultural resources are anticipated.

[1] Focus areas are subareas in the South Lake Union neighborhood that are considered in greater detail, where applicable. Please discussion and Figure 2-3 in Chapter 2.

3.13 TRANSPORTATION

This section presents a multi-modal transportation analysis prepared for proposed height and density increases that could result from incentive zoning provisions in the South Lake Union neighborhood. It presents existing transportation conditions in South Lake Union, as well as future transportation conditions (2031) under three future alternatives. Significant transportation impacts and potential mitigation measures are identified for each future alternative based on the policies and recommendations established in state and local plans. Below is an executive summary of significant impacts and potential mitigation measures.

As shown in the following table and described fully in the transportation analysis chapter, there will be significant impacts to the future year transportation system with any of the proposed height and density alternatives.

Table 3.13-ES1
Summary of Signification Impacts to the Transportation System

Type of Impact	Future Year Height and Density Alternative (2031)		
	Alternative 1	**Alternative 2**	**Alternative 3**
Traffic Operations (congestion)	✓	✓	✓
Transit (capacity)	✓	✓	✓
Pedestrian and Bicycle Circulation			
Parking	See note below on parking impacts		
Freight Mobility	✓	✓	✓
Traffic Safety	✓	✓	✓

Note: The analysis indicated that there could be significant short-term parking impacts as individual projects in South Lake Union build out. However, over time parking prices will adjust to meet demand and travelers will shift to other modes, thus reducing the demand for parking.
Source: Fehr & Peers, 2010

The table above indicates that all three alternatives have similar overall impacts on the transportation system. However, as described more fully in the transportation chapter, the magnitude of the impacts varies based on the total trip generation of the alternatives. **Table 3.13-ES2** summarizes the PM peak hour trip generation of each alternative.

Table 3.13-ES2
PM Peak Hour Trip Generation by Alternative

Alternative	Auto Trips (mode share %)	Non-auto Trips (mode share %)	
		Internal, Bicycle & Pedestrian	Transit
No Action Alternative - Current Zoning	12,648 (51.4%)	7,279 (26.9%)	6,091 (21.7%)
Alternative 1 - Maximum Increases to Height and Density	15,554 (50.5%)	9,429 (27.8%)	7,371 (21.7%)
Alternative 2 - Mid-Range Increases to Height and Density	15,548 (50.4%)	9,435 (27.8%)	7,371 (21.7%)
Alternative 3 - Moderate Increases to Height and Density	13,605 (50.3%)	8,334 (28.0%)	6,449 (21.7%)

Note: See Appendix E for details on the mode split calculation. Auto trips include both SOV and HOV trips, so the number reported is not equivalent to person-trips. The Internal, Bicycle & Pedestrian and Transit categories are person-trips.
Source: Fehr & Peers 2010

To mitigate the impacts of the three Action Alternatives, a comprehensive strategy for potential mitigation measures was developed in close coordination with the City of Seattle. Because each of the three Action Alternatives have similar impacts, a single mitigation strategy was developed that could be applied to all alternatives. The transportation chapter gives a full description of the potential mitigation strategy, however, a brief summary is provided below:

- *Improve the bicycle and pedestrian network*: Research has shown that vehicle trip generation and traffic congestion impacts can be reduced if a robust bicycle and pedestrian system is provided. Potential mitigation measures to provide this system include the implementation of bicycle and pedestrian improvements identified in plans and documents such as the *Seattle Pedestrian Master Plan*, *Bicycle Master Plan*, and *South Lake Union Urban Design Guidelines*. Specific projects include sidewalk gap closures, new bikeways, new hill-climbs, and marked/signalized pedestrian crossings.


Neighborhood bicycle storage

- *Expand travel demand management strategies:* This potential mitigation measure looks to expand on the existing Commute Trip Reduction program and Transportation Management Program in the South Lake Union area. Specifically, parking management strategies such as maximum parking limits and unbundled parking pricing have been shown by research to reduce demand for parking, vehicle trip generation, and traffic congestion. An expansion of the City's GTEC program could further support the goal to reduce vehicle trip generation and traffic congestion in the area.
- *Transit Service Expansion:* Traffic congestion, transit load factor, and transit frequency impacts could be reduced through expanded transit service in the area. The City of Seattle and King County Metro should work together to identify capital and operations funding for additional transit service and increased frequencies on key routes.
- *Roadway Capacity Enhancements:* A potential mitigation measure to reduce traffic congestion and improve freight mobility would be the implementation of the planned Mercer West Corridor Project.

Seattle Streetcar in the South Lake Union neighborhood

The potential mitigation measures above reduce transportation impacts of the proposed Action Alternatives. However, even with the potential mitigations implemented, significant unavoidable transportation impacts to traffic congestion, transit capacity, and freight mobility are likely to remain. It should be noted that the potential mitigation strategy identified in the transportation chapter is expected to substantially reduce vehicle trip generation in South Lake Union. As shown in **Table 3.13-ES3**, the three Action Alternatives with mitigation are expected to have lower PM peak hour vehicle trip generation than the less dense No Action alternative.

Table 3.13-ES3
PM Peak Hour Trip Generation by Mitigated Alternative

Alternative	Auto Trips (mode share %)	Non-auto Trips (mode share %)	
		Internal, Bicycle & Pedestrian	Transit
No Action Alternative - Current Zoning	12,648 (51.4%)	7,279 (26.9%)	6,091 (21.7%)
Alternative 1 With Mitigation	12,244 (37.5%)	11,835 (36.2%)	8,606 (26.3%)
Alternative 2 With Mitigation	12,236 (37.4%)	11,844 (36.2%)	8,606 (26.3%)
Alternative 3 With Mitigation	10,715 (37.4%)	10,435 (36.4%)	7,526 (26.2%)

Note: See Appendix E for details on the mode share calculation. Auto trips include both SOV and HOV trips, so the number reported is not equivalent to person-trips. The Internal, Bicycle & Pedestrian and Transit categories are person-trips.
Source: Fehr & Peers 2010

3.13.1 Affected Environment

This section describes the existing conditions of the area that would be affected by the proposed height and density alternatives.

The South Lake Union neighborhood is located in the center of the City of Seattle. The study area is adjacent to many neighborhoods, including Downtown, First Hill, Capitol Hill, Eastlake, and Uptown. South Lake Union is a neighborhood in transition with a mix of older industrial buildings and new medical research buildings, office buildings, and residential developments.

As shown in **Figure 3.13-1**, the South Lake Union neighborhood is bounded by Lake Union to the north, Aurora Avenue to the west, Denny Way to the south, and I-5 to the east.

Existing Transportation Network

This section describes the existing transportation system in South Lake Union for all modes, including bicyclists, pedestrians, transit riders, and drivers.

Transportation Contents
Affected Environment
Planning Scenarios
Environmental Impacts
Mitigation Strategies
Significant Unavoidable Adverse Impacts

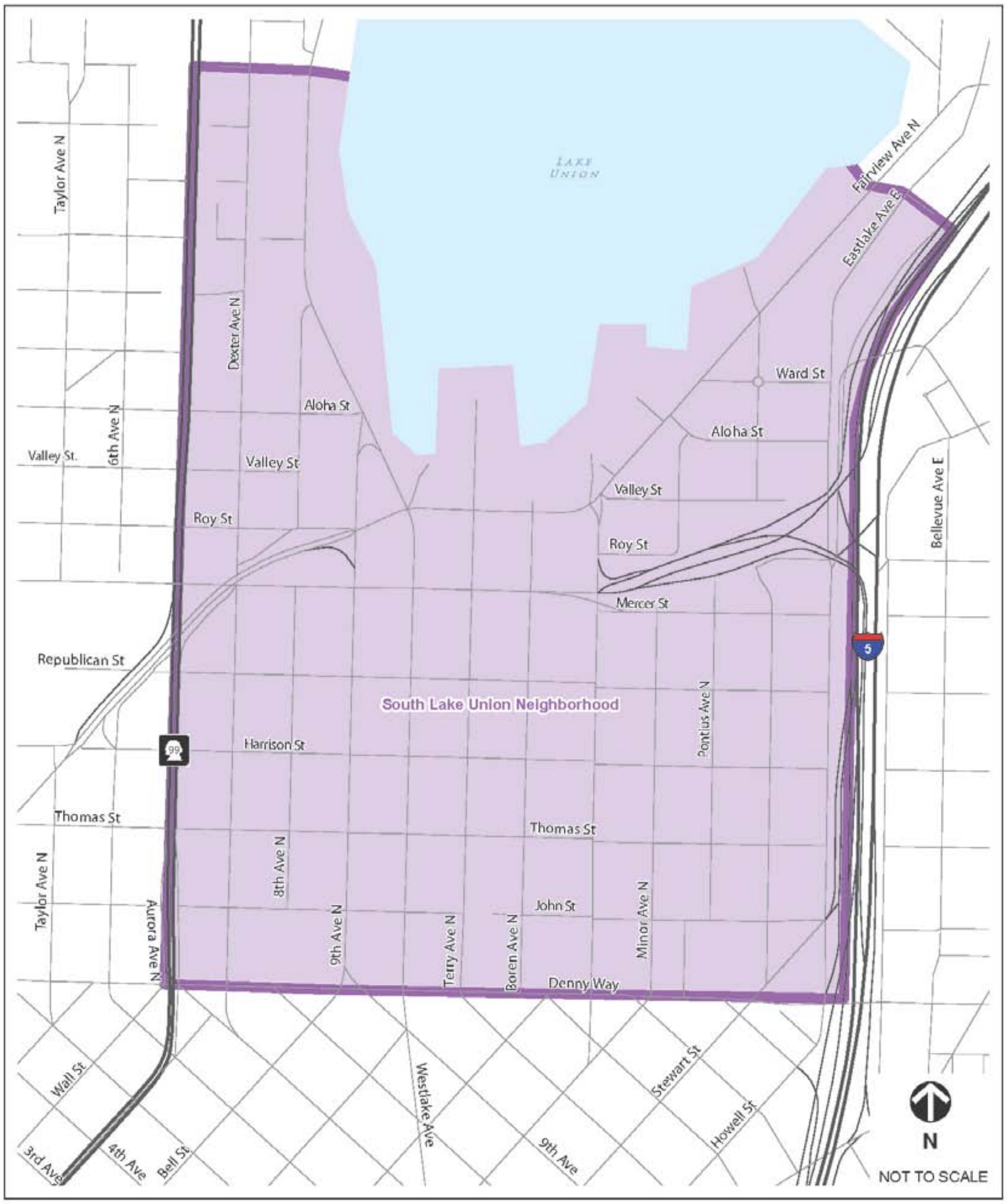
Affected Environment
Existing Transportation Network
Analysis Methodology
Analysis Results

Pedestrian System

Accessing the Neighborhood

Lake Union (to the north), SR 99 (to the west), and I-5 (to the east) limit pedestrian access to the study area. Listed below are specific routes that pedestrians can use to access the South Lake Union neighborhood from other parts of Seattle.

Figure 3.13-1
South Lake Union Neighborhood Map



Source: Fehr & Peers, 2010

From the west: SR 99 underpasses at Mercer and Broad Streets with sidewalks on both sides.

From the south: pedestrians and bicyclists can cross SR 99 at Denny Way.

From the north: a pedestrian bridge over SR 99 at Galer Street.

From the east: Denny Way and Lakeview Boulevard E I-5 overpasses. The Denny Way overpass over I-5 has a sidewalk on the south side only. The Lakeview Boulevard E overpass is a somewhat indirect connection because it runs parallel to I-5 for approximately one-third of a mile, but has sidewalks on both sides.

Sidewalk Facilities within South Lake Union

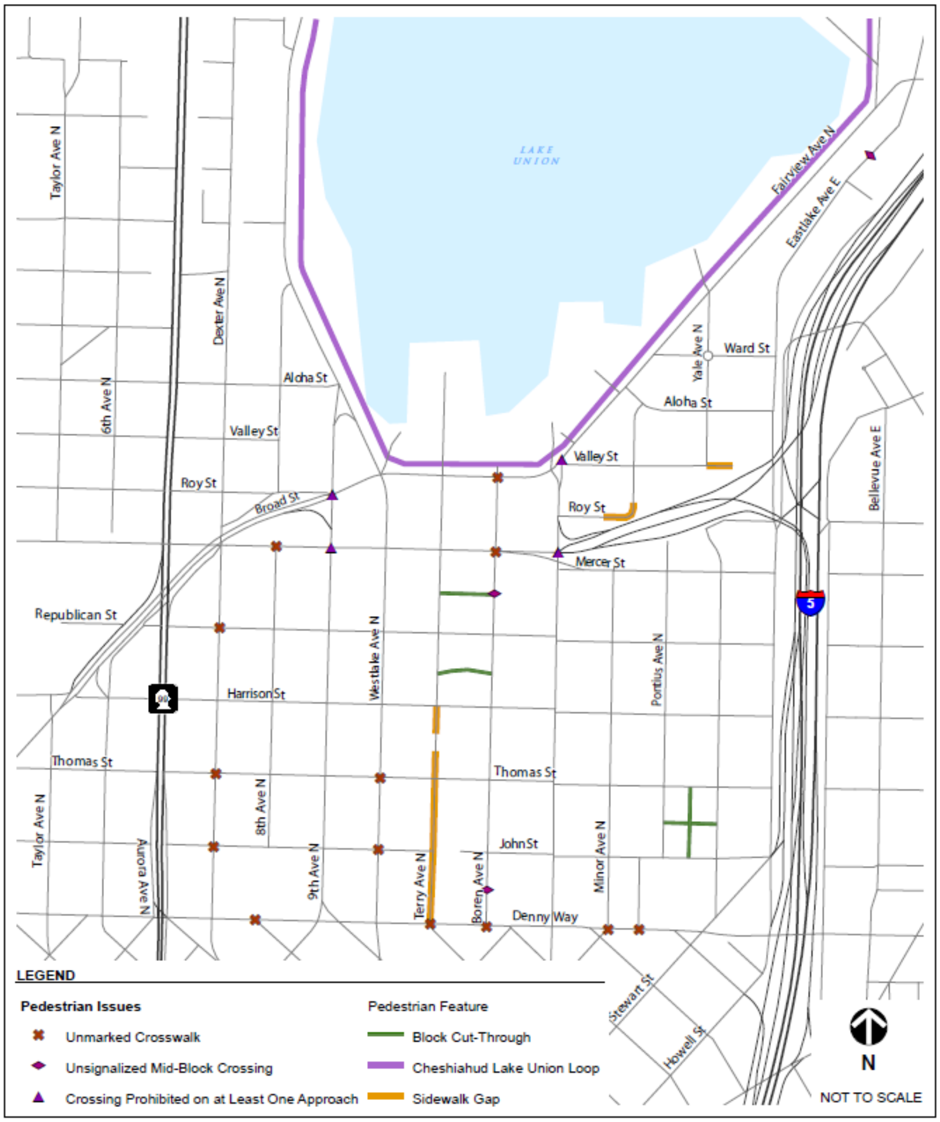
In general, sidewalk coverage in the South Lake Union neighborhood is complete, and most sidewalks are in good condition. However, there are areas where sidewalks are missing or need repair as described below. **Figure 3.13-2** shows the pedestrian facilities in the study area.

Gaps in the Pedestrian System. Terry Avenue N has no sidewalks from Denny Way to Thomas Street and limited sidewalks from Thomas Street to Harrison Street. In addition, there are gaps in the sidewalk system on Roy Street near Minor Avenue and on Valley Street near Yale Avenue.

Pedestrian Facilities in Poor Condition. There are damaged sidewalks at some locations such as on Westlake Avenue N south of Broad and Valley Streets.

Sidewalk condition varies significantly from new sidewalks at recent developments to cracked and overgrown sidewalks in older areas. The general sidewalk width tends to be 5.5 to 6 feet with wider sidewalks along some new developments. Wide planting strips along new developments provide a buffer between pedestrians and vehicles. Some newer planting strips match the width of the walkway while older planting strips are narrower: between 1.5 and 2.5 feet.

Figure 3.13-2
Pedestrian Facilities – Existing Conditions



Source: Fehr & Peers, 2010

Pedestrian Crossings

Some intersections have missing or inconveniently located marked crosswalks. For example, there is no marked crosswalk on the west side of the 9th Avenue N/Broad Street intersection. One block south, at the 9th Avenue N/Mercer Street intersection, there is no marked crosswalk across the ramp from Broad Street to Mercer Street. A pedestrian traveling along the north side of Mercer Street would have to walk a block north to reach a marked crosswalk in order to cross the curved ramp and then rejoin the sidewalk on Mercer Street. John Street does not go through the block east of Terry Avenue N so all traffic (pedestrians, bicycles, and vehicles) must travel around the block via Thomas Street or Denny Way.

There are two unsignalized mid-block crossings along Boren Avenue N; one between Mercer and Republican Streets and the other between John Street and Denny Way. Another unsignalized mid-block crossing is provided on Eastlake Avenue E north of E Nelson Place.

Multi-Use Paths

Alley 24

Several paths or plazas cut through city blocks in the east/west direction. Two plazas connect Terry Avenue N to Boren Avenue N in the blocks between Mercer and Republican Streets and between Republican and Harrison Streets. A path connects Yale Avenue N and Pontius Avenue N between Thomas and John Streets. On the Yale Avenue N end of the walkway, mid-block ramps are provided to access the REI store to the east, but there is no marked crosswalk. The Cheshiahud Lake Union Loop is a multi-use path that circles Lake Union and serves as a connection within South Lake Union as well as to other neighborhoods such as Fremont, Wallingford, University District, Capitol Hill, and Queen Anne. The Lake to Bay Loop is a planned multi-use connection between Elliot Bay at the Olympic Sculpture Park and South Lake Union Park. Within the South Lake Union neighborhood, the proposed Lake to Bay Loop would traverse Thomas Street, Terry Avenue, and Mercer Street.

Bicycle System

South Lake Union has three north/south bicycle routes, consisting of either striped lanes, sharrow pavement markings[1] or shared parking/bicycle lanes.

- Eastlake Avenue E has bicycle facilities throughout the South Lake Union neighborhood. From Denny Way to approximately Mercer Street, sharrows are provided, and from Mercer Street to Fairview Avenue N, bicycle lanes are provided. Field observations indicate that idling busses often occupy the outside northbound lane on Eastlake Avenue E between Stewart Street and Lakeview Boulevard E. These busses block the path of travel indicated by the sharrows, forcing cyclists to travel in the general purpose lane in this section.
- 9th Avenue N has bicycle lanes from Denny Way to approximately Republican Street.

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[1] A sharrow is a pavement marking indicating the recommended path for bicycle travel in a shared-use lane. Sharrows are often used to notify drivers about the potential for bicycles in the lane.

- Dexter Avenue N has bicycle lanes from Denny Way to Mercer Street. North of Mercer Street, there are signs for the "Interurban North" bicycle facility which is a shared parking and bicycle lane. Field observations indicate that this is a heavily traveled bicycle route.

There are no east/west bicycle facilities except for the portion of the Cheshiahud Lake Union Loop that runs along the south shore of Lake Union. The I-5 overpass at Lakeview Boulevard E, which connects South Lake Union to Capitol Hill, has a bicycle lane followed by sharrows in the north/east direction and sharrows in the south/west direction; however, the grade between South Lake Union and Capitol Hill is steep. **Figure 3.13-3** shows the bicycle facilities in the South Lake Union neighborhood.

The Seattle Bicycle Master Plan identifies existing bicycle issues in the South Lake Union neighborhood, including the need to improve bicycle facilities along Westlake Avenue N.

Existing Transit Services

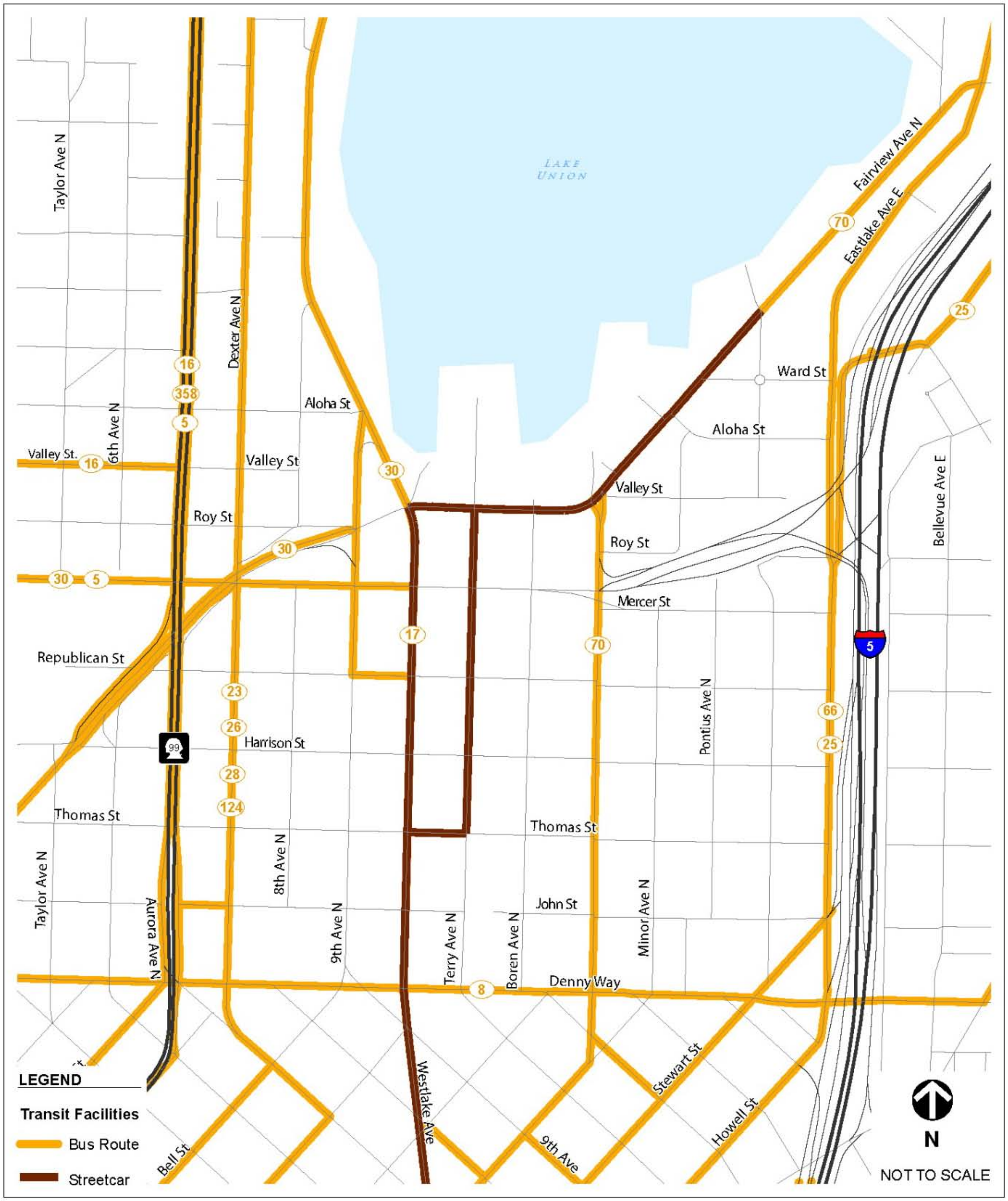
The project area is served by the South Lake Union Streetcar and several King County Metro bus routes. The streetcar runs from Westlake Center in Downtown Seattle through the South Lake Union neighborhood and terminates at the Fred Hutchinson Cancer Research Center located at Fairview Avenue N and Ward Street. Within the study area, the streetcar runs along Westlake Avenue N, Terry Avenue N, Valley Street, Fairview Avenue N, and a one-block segment of Thomas Street. Along these streets, the streetcar runs in the outside travel lane with no lane restrictions when the streetcar is not present. The primary bus connections reach north, central and southeast Seattle.

Figure 3.13-4 shows the transit routes in the South Lake Union neighborhood.

Figure 3.13-3
Bicycle Facilities – Existing Conditions

Source: Fehr & Peers, 2010

Figure 3.13-4
Transit Facilities – Existing Conditions



Source: Fehr & Peers, 2010

Table 3.13-1 summarizes the transit routes that serve the South Lake Union neighborhood. The table includes average headways for the AM peak period, PM peak period and mid-day period. The average headways were calculated as the ratio of minutes to number of busses in the period. These headways give a general indication of frequencies, but route times vary substantially on some routes. For instance, Route 17 runs anywhere from every nine to thirty minutes in the afternoon peak period.

Existing Roadway Network

Interstate 5 (I-5) and State Route (SR) 99 form the eastern and western boundaries of the South Lake Union neighborhood and also serve as the major roadways providing regional access. The local street network is a combination of one-way and two-way streets that serve multiple travel modes. Most local streets have multiple lanes, on-street parking, and sidewalks. Some arterial streets include bicycle lanes or sharrows. Arterial streets have speed limits of 30 miles per hour (mph) unless otherwise posted. Exceptions include local commercial and residential streets which generally have speed limits of 25 mph. **Figure 3.13-5** shows the roadway facilities in the South Lake Union study area.

Regional Access

I-5 is a north/south freeway that serves both local and regional traffic. Adjacent to the South Lake Union neighborhood, I-5 experiences congestion during a substantial portion of the day due to the intense land uses in Downtown Seattle, the limited crossings of the Ship Canal, and the lack of ramp capacity at the SR 520 interchange. The primary access to the South Lake Union area from I-5 is at the Mercer Street interchange.

SR 99 is a north/south highway located immediately west of the South Lake Union neighborhood. Northbound SR 99 can be accessed from various east/west streets in the project area, including Valley Street, Roy Street, Republican Street, Harrison Street, and Thomas Street. Southbound SR 99 is only accessible from the west side of the highway.

Table 3.13-1
King County Metro Routes in South Lake Union

Route	Destinations	Average Headways		
		Peak Periods (6-9 AM & 3-6 PM)		Midday (9 AM-3 PM)
		Peak Direction	Off-peak Direction	
5	Downtown Seattle, Fremont, Woodland Park Zoo, Greenwood, North Seattle Community College, Northgate Transit Center, Northgate Mall, Shoreline Community College	11	15	15
8	Rainier Beach, Rainier Beach Station, Othello Station, Columbia City Station, Rainier Valley, Mt. Baker Transit Center, Central District, Capitol Hill, Group Health Hospital, Seattle Center, Lower Queen Anne	15	15	15
16	Colman Dock-Ferry Terminal, Downtown Seattle, Seattle Center, Wallingford, East Green Lake, North Seattle Community College, Northgate Mall, Northgate Transit Center	20	23	20
17	Downtown Seattle, Westlake, Seattle Pacific University, Ballard, Sunset Hill, Loyal Heights	20	26	30
25	Downtown Seattle, Eastlake, Montlake, University Village, Children's Hospital, Laurelhurst	26	36	65
26	Downtown Seattle, Fremont, Wallingford, East Green Lake	23	30	29
28	Stadium Station, Downtown Seattle, Fremont, Ballard, Whittier Heights, Broadview	20	26	30
30	Seattle Center, Fremont, Wallingford, University District, Ravenna, Sand Point, NOAA	30	36	31
66	Colman Dock-Ferry Terminal, Downtown Seattle, Eastlake, University District, Maple Leaf, Northgate Transit Center	30	30	30
70	Downtown Seattle, Eastlake, University District	15	20	15
358	Downtown Seattle, West Green Lake, Aurora Ave N, Shoreline P&R, Aurora Village Transit Ctr	9	15	15

Source: King County Metro, 2010.

Figure 3.13-5
Roadway Functional Class – Existing Conditions

Source: Fehr & Peers, 2010

Arterial and Local Access

Dexter Avenue N is a north/south street classified as a minor arterial located just east of SR 99. South of Aloha Street, there are four travel lanes, parking, and sidewalks on both sides of the street. Dexter Avenue N does not have a center turn lane in this area, with the exception of a southbound left-turn lane at Denny Way. North of Aloha Street, Dexter Avenue N transitions to one through lane in each direction with a center turn lane, parking, and sidewalks. Bicycle lanes are provided from Denny Way to Mercer Street; north of Mercer Street, bicycles are allowed in the wide parking lane signed as part of the "Interurban North" trail. Dexter Avenue N is a heavily-traveled bicycle route between Downtown Seattle and the Fremont Bridge.

8th Avenue N runs north-south, but is not contiguous through the study area. 8th Avenue N has two sections, one from Mercer Street to John Street and the second from Roy Street to Westlake Avenue N. Each section has one lane in each direction, on-street parking, and sidewalks. Some intersections are stop-controlled while others are uncontrolled.

9th Avenue N is a two-way principal arterial between Broad Street and Denny Way. South of Mercer Street, 9th Avenue N has one lane in each direction with parking on one or both sides of the street. Sidewalks are provided on both sides of the street, and there are bicycle lanes southbound between Harrison Street and Denny Way and northbound between Republican Street and Denny Way. Major intersections are signalized and minor intersections are stop-controlled.

Westlake Avenue N is a two-way arterial between Broad Street and Denny Way. The street has two travel lanes in each direction, provides turn pockets at some locations, and has sidewalks on both sides. Parking is generally on one or both sides of the street although some blocks have no parking provided. The South Lake Union Streetcar travels in the outside lane southbound along Westlake Avenue N from Broad Street to Denny Way and northbound from Denny Way to Thomas Street. Major intersections are signalized and minor streets are stop-controlled at other intersections. Westlake Avenue N continues north around Lake Union, eventually connecting to the Fremont Bridge.

Terry Avenue N is a north/south street that varies between one-way and two-way operations through the study area. Terry Avenue N is a two-way street from Denny Way to Thomas Street, a one-way street from Thomas Street to Mercer Street, and transitions back to two-way operations between Mercer Street and Valley Street. Along the entire stretch of Terry Avenue N, there are two travel lanes (one lane in each direction for the areas with two-way operations). There is generally parking on both sides of the street. Some sections of Terry Avenue N have sidewalks on both sides of the street while other sections have none. The South Lake Union Streetcar travels northbound on Terry Avenue N from Thomas Street to Valley Street. Major intersections are signalized and minor intersections are stop-controlled.

Fairview Avenue N is a two-way north/south principal arterial with one to two travel lanes in each direction. In addition, there are either turn pockets or a center left-turn lane throughout the South Lake Union neighborhood. Sidewalks are provided on both sides of Fairview Avenue N. Parking is generally allowed on both sides of the street between Mercer Street and Denny Way; however, there are restrictions during peak periods. Parking is prohibited on the east side of Fairview Avenue N (northbound direction) between 4 and 6 PM and on the west side (southbound direction) between 7 and 9 AM. The empty parking lane provides an extra travel lane in the peak direction. There is no parking provided on Fairview Avenue N north of Mercer Street. The South Lake Union Streetcar travels in both directions of Fairview Avenue N from Valley Street to Yale Avenue N.

Valley Street is a two-way east/west street stretching from Westlake Ave N to Yale Avenue N. It is a principal arterial connecting Westlake Ave N and Broad Street to the I-5 interchange at Mercer Street, and a local access street for the remaining eastern portion. Along the arterial segment, there are three westbound lanes, and two eastbound lanes with turn pockets. Intersections are signalized and no parking is provided. Sidewalks are provided on the south side of the street, while a multi-use trail is provided on the north side of the street.

Mercer Street is an east/west principal arterial with four eastbound travel lanes extending west of Fairview Avenue N. From Dexter Avenue N to 9th Avenue N, one westbound lane is also provided as a connection from Broad Street to Dexter Avenue N. Sidewalks are provided on both sides of the street; however some of the sidewalks on the southern side of the street have been temporarily closed due to building construction. Mercer Street provides the main access to I-5 at Fairview Avenue N. Mercer Street continues eastward as a two-lane one-way minor arterial to Eastlake Avenue E with parking and sidewalks on both sides. During our field visits the buildings on the north side of Mercer Street were being demolished to make way for the upcoming conversion of Mercer Street into a two-way six-lane arterial between I-5 and Broad Street.

Republican Street is a lightly traveled two-way east/west minor arterial with two travel lanes extending from SR 99 to Eastlake Avenue E. Parking and sidewalks are provided on both sides of the street.

Denny Way is a two-way principal arterial with two lanes in each direction. Sidewalks are provided on both sides, but there is no on-street parking. Major intersections are signalized and there are left-turn bays provided at the Fairview Avenue N intersection. Left turns are prohibited at all other signalized intersections in the study area. Denny Way is a major east/west connector between the Seattle Center and waterfront areas to the west, and First Hill and Capitol Hill to the east.

Parking

This section summarizes the existing on-street and off-street parking supply and utilization in South Lake Union. Most of the source data for this analysis is based on the *2006 Parking Inventory* (Puget Sound Regional Council) and the *2006 South Lake Union On-Street Parking Study* (Seattle Department of Transportation). The parking conditions are substantially different today when compared to 2006 conditions. Between 2006 and 2010 several major office buildings were completed that increased off-street supply while also increasing overall parking demand. Additionally, the City of Seattle expanded the paid parking program throughout most of South Lake Union and a Restricted Parking Zone (RPZ) program was also established in the more residential portions of the neighborhood. While more recent data from a 2010 study has also been included, this data covers a small portion of South Lake Union, and many of the findings of the 2006 surveys are still valid. More information may be found in **Appendix E**.

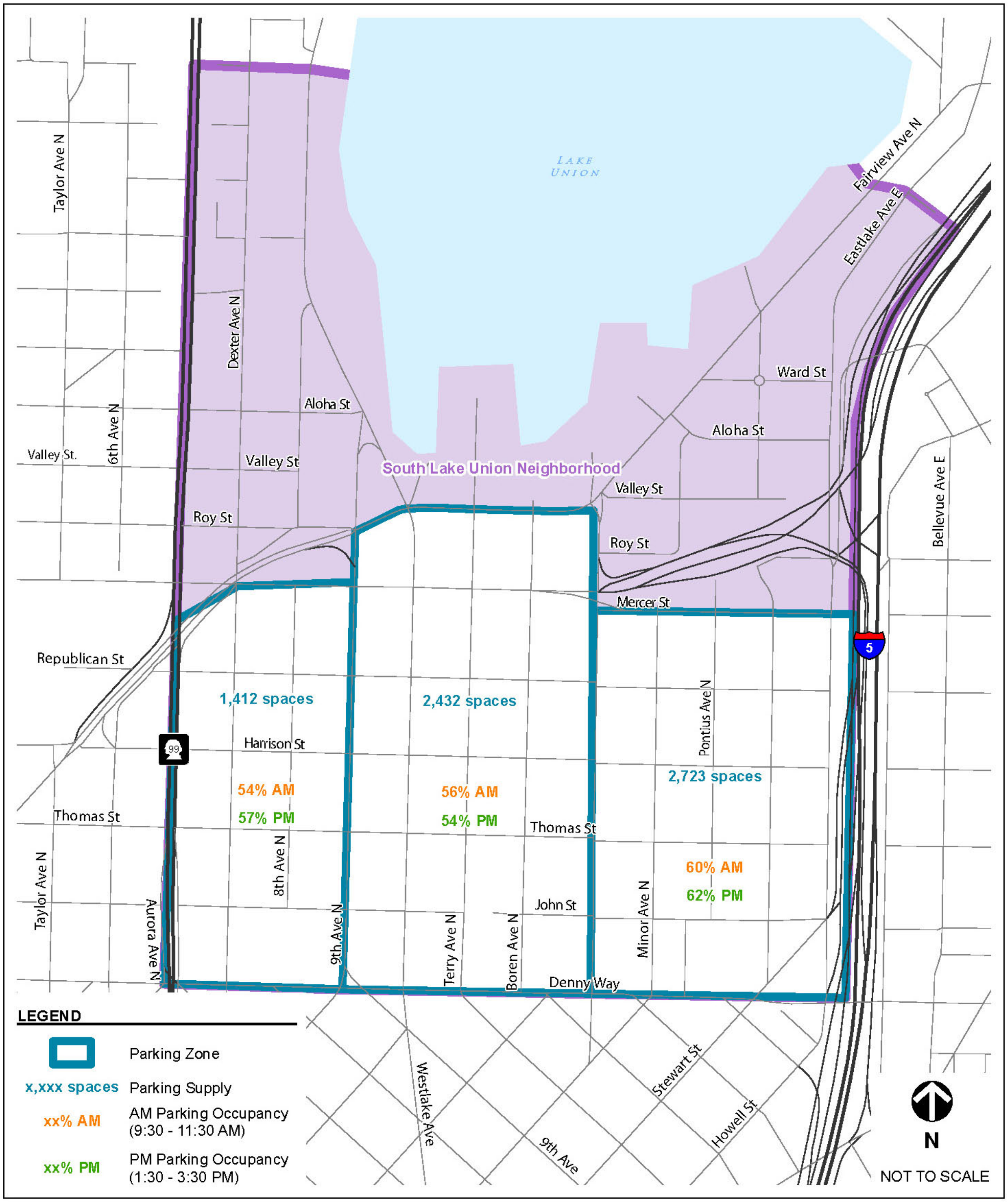
Off-Street Parking

The 2006 Puget Sound Regional Council (PSRC) off-street parking inventory included most of the study area; those areas excluded were primarily north of Mercer. Results were aggregated into three subareas:

- Denny Park area bounded by Mercer Street/Broad Street, Denny Way, 9th Avenue N, and Aurora Avenue N
- South Waterfront/Westlake area bounded by Valley Street, Denny Way, Fairview Avenue N, and 9th Avenue N
- Cascade area bounded by Mercer Street, Denny Way, I-5 and Fairview Avenue N

Figure 3.13-6 summarizes the parking supply, morning occupancy, and afternoon occupancy within each subarea in 2006.

Figure 3.13-6
Off-Street Parking Supply and Occupancy (2006)



Source: Fehr & Peers, 2010

As indicated in **Figure 3.13-6**, occupancy was relatively uniform between the morning and afternoon periods. The highest occupancies (60 percent in the morning and 62 percent in the afternoon) were observed east of Fairview Avenue N in the Cascade neighborhood where most of South Lake Union's residences are located. West of Fairview Avenue N, occupancies were slightly lower, ranging from 54 to 57 percent.

Recent field observations generally confirm the results from the 2006 PSRC study; however, discussions with property managers and field observations suggest that off-street facilities are often full in the vicinity of the Amazon headquarters along Terry and Boren Avenues.

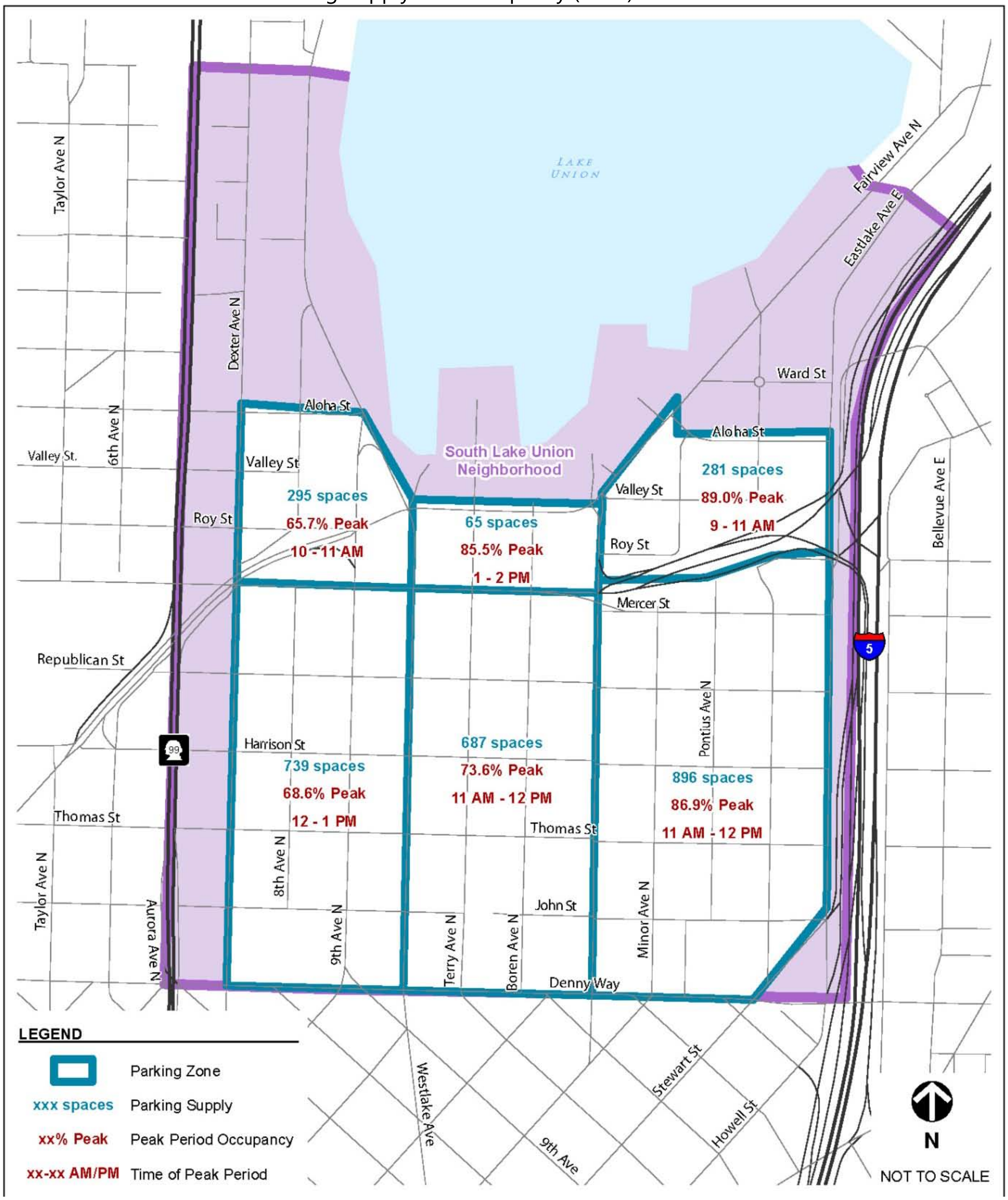
On-Street Parking

The *2006 South Lake Union On-Street Parking Study* counted nearly 3,000 on-street parking spaces in the South Lake Union neighborhood. The study provides the supply and utilization data presented in **Figure 3.13-7**. The study sampled approximately 40 percent of the spaces between the hours of 8 AM and 6 PM. Note that this study was completed when most parking spaces were unrestricted in terms of time limits, and there was no Restricted Parking Zone. When the survey was completed, only 76 spaces were metered.

Following the completion of the 2006 study, pay stations were implemented in the South Lake Union area. The time limits and prices are as follows:

- Two-hour parking at a rate of $1.50 per hour, which is geared towards higher demand areas such as along Westlake Avenue N
- Ten-hour parking at a rate of $1.25 per hour, tailored for long-term users, such as local employees

Figure 3.13-7
Off-Street Parking Supply and Occupancy (2006)



Source: Fehr & Peers, 2010

In addition, a Restricted Parking Zone (RPZ) with the following boundaries was created: Mercer Street to the north, John Street to the south, Fairview Avenue N to the west, and Eastlake Avenue E to the east. Eligible residents within these boundaries may purchase RPZ permits that allow them free parking not subject to the two-hour time limit on RPZ signed streets (not all block faces within the RPZ are subject to the restrictions). Non-permitted vehicles are prohibited from long-term parking in this RPZ (Zone 24) from 8 AM to 6 PM, Monday through Sunday.

Figure 3.13-8 shows the type of on-street parking currently available on each block within South Lake Union.

In November 2010, the Seattle Department of Transportation conducted a parking study that included parts of South Lake Union. The results are summarized in **Figure 3.13-9**. The areas included in the study were:

- The area bounded by Republican Street to the north, John Street to the south, Dexter Avenue N to the west, and Westlake Avenue to the east
- The area bounded by Republican Street to the north, John Street to the south, Fairview Avenue N to the west, and Yale Avenue N to the east

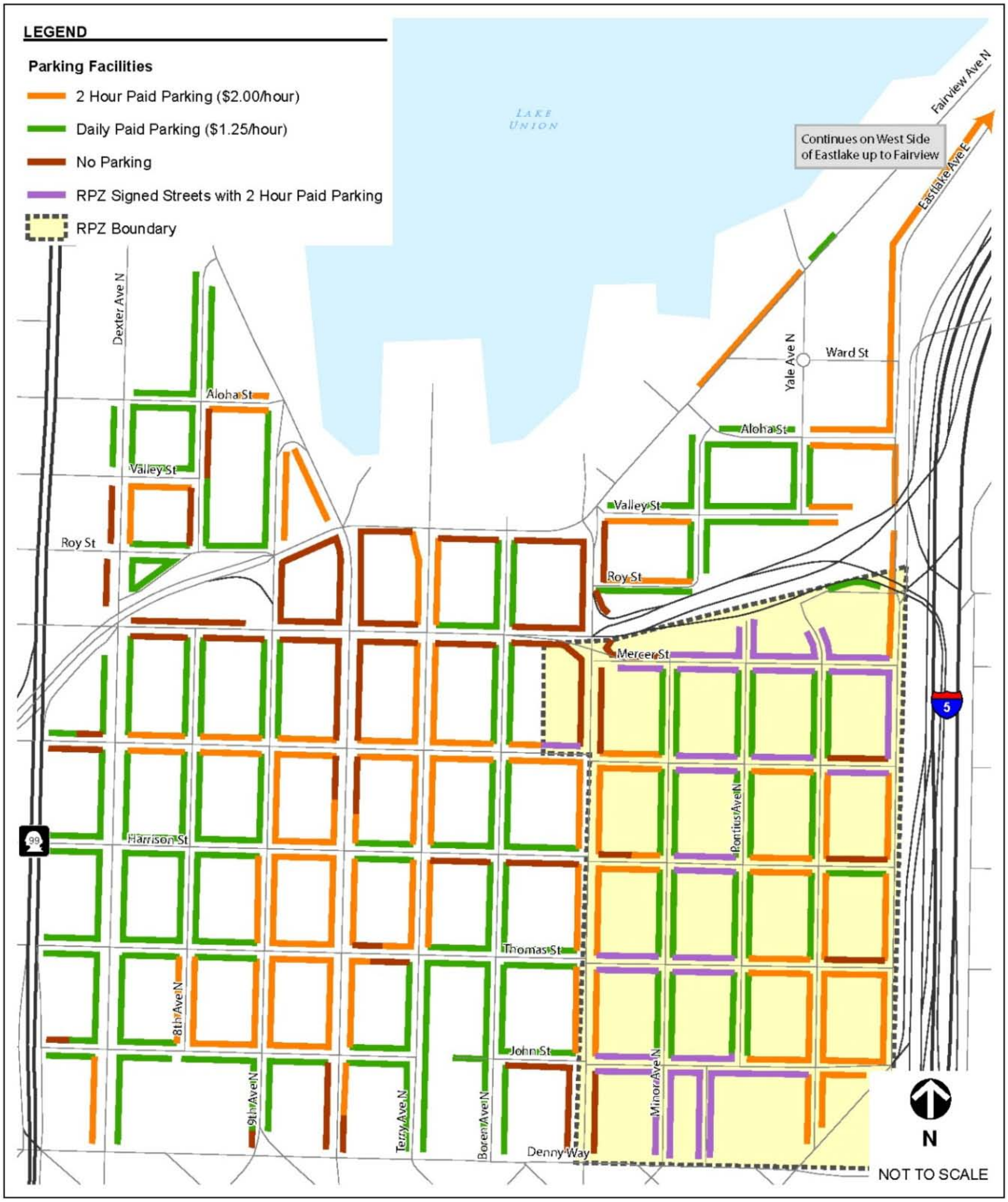
The eastern subarea, which lies within the RPZ, experienced its peak occupancy of 82 percent from 7 to 8 PM. The western subarea experienced its peak occupancy of 51 percent from 11 AM to 12 PM. Overall, the ten-hour spaces had higher occupancy rates than the two-hour spaces from 10 AM to 5 PM, after which the two-hour spaces had higher occupancy.

As was the case with off-street parking, recent field observations indicate that the ten-hour parking spaces are full in the vicinity of the Amazon headquarters along Terry and Boren Avenues. Outside of that area, there are usually 10-hour parking spaces available.

The 2006 and 2010 on-street parking studies both indicate high occupancy in the Cascade area east of Fairview Avenue N and south of the I-5 ramps, however the peak time of day differed. In 2006, the occupancy peaked at 86.9 percent between 11 AM and 12 PM, while in 2010 the occupancy peaked at 82 percent between 7 and 8 PM. The 2006 study found similarly high occupancy rates (peaking at 85.5 to 89 percent) in the area east of Westlake Avenue N and north of Mercer Street. The other area of comparison between the two studies is the southwest corner of South Lake Union. In 2006, occupancy peaked at 68.6 percent between

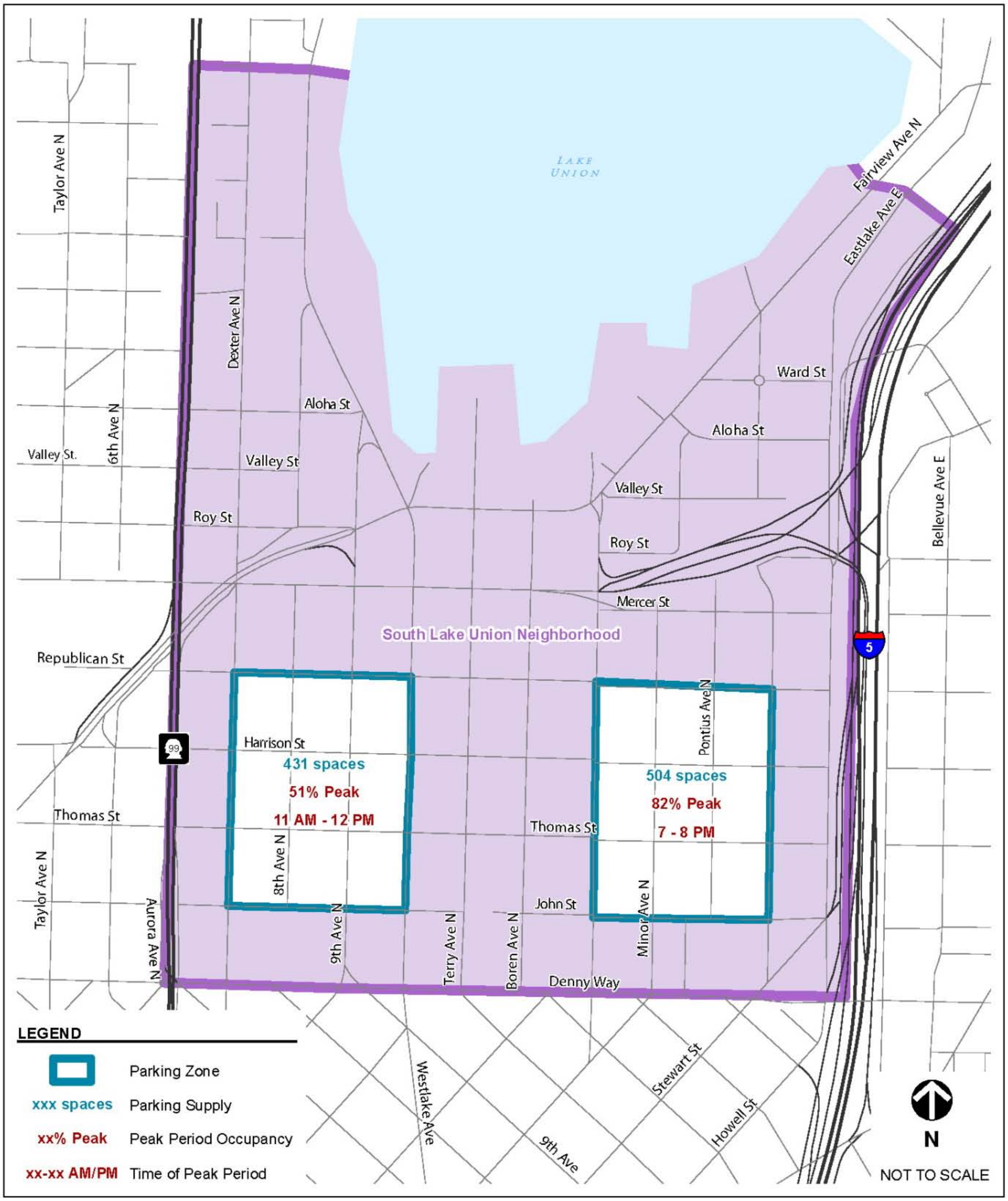
12 and 1 PM, but in 2010 the peak dropped to 51 percent between 11 AM and 12 PM. These changes in occupancy may be due to different economic conditions between 2006 and 2010, and also due to the introduction of paid parking and the subsequent rate increase in 2009.

Figure 3.13-8
On-Street Parking Facilities – Existing Conditions



Source: Fehr & Peers, 2010

Figure 3.13-9
On-Street Parking Supply and Occupancy (2010)



Source: Fehr & Peers, 2010

Freight

While South Lake Union is continuing to transition from a light industrial center to a mixed-use neighborhood with service employment and residential uses, freight movement is an important consideration in the area. In particular, Mercer Street, Valley Street, and Broad Street provide an important connection between the industrial uses in the Interbay area and I-5. Westlake Avenue N north of Mercer Street also provides an important freight connection to the Fremont neighborhood north of the Ship Canal.

While the City of Seattle allows truck traffic on all arterials in the City, a specific set of "major truck streets" has been defined to serve as primary routes focused on moving trucks through the City. Major truck streets within and in the vicinity of South Lake Union are shown in **Figure 3.13-10**.

Figure 3.13-10
Major Truck Streets – Existing Conditions

Source: Fehr & Peers, 2010

Analysis Methodology

This section describes the methodology used to analyze the existing conditions of the South Lake Union neighborhood transportation network.

Roadway Network

Level of Service

Level of Service (LOS) is a common metric used to assess the level of congestion of the roadway network and average driver delay. Historically, transportation impact analyses in the City of Seattle have used intersection LOS, which purely measures a road's performance for autos. The measure does not reflect the performance of the network for other users such as bicyclists and pedestrians.

Further, while intersection-level analysis may be appropriate for assessing the effects of individual parcels or block development, a more broad-based assessment is typical for the analysis of larger scale zoning or comprehensive planning efforts. The following reasons describe why a corridor analysis is appropriate for the South Lake Union height and density alternatives analysis:

1) Single intersection analysis will not provide a systematic, area-wide impact assessment for a neighborhood like South Lake Union where complex transportation facilities and services are inter-related. A "pin map" approach might give some information about individual intersections in a vacuum, but it would not portray the effects of long queues, side-street diversions, and the spill back effect of congestion on regional roads such as I-5.
2) Intersection analysis measured purely from the driver's perspective ignores other potential effects of development; in particular, impacts on bicyclists and pedestrians. This approach is not able to effectively evaluate improvement projects (including pedestrian and bicycle projects) as mitigation measures that are not part of, or immediately adjacent to an intersection.

Measuring delay and congestion on a corridor or roadway segment basis effectively addresses the first issue. The *Highway Capacity Manual* (HCM) defines how LOS is calculated for many types of transportation facilities, including urban roadway segments and corridors.

Many agencies and departments of transportation have translated the corridor congestion levels defined above into a series of volume-to-capacity ratios. As further discussed below, this type of analysis provides the opportunity to consider mobility in the area from a multi-modal perspective, not only the driver's perspective. One of the most commonly accepted set of thresholds is defined by the Florida Department of Transportation[2], and is summarized in **Table 3.13-2,** along with definitions for each level of service[3].

Table 3.13-2
Levels of Service

LOS	Description	Percentage of Free Flow Speed	Volume-to-Capacity Ratio[1]
A	Primarily free-flow **operations at** average travel speeds. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream and average driver delay at signalized intersections is minimal.	90	<0.40[2]
B	Reasonably unimpeded operations at average travel speeds. The ability to maneuver within the traffic stream is only slightly restricted and average driver delays at signalized intersections are not significant.	70	<0.40[2]
C	Stable operations; however, ability to maneuver and change lanes in midblock locations may be more restricted than at LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds.	50	<0.40[2]
D	Borders on substantial delay and decreases in travel speed. May be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors.	40	0.40-0.89
E	Characterized by significant delays. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.	33	0.90-0.99[3]

[2] In the *2009 FDOT Quality/Level of Service Handbook*, the Florida Department of Transportation applied the methodologies described in Chapter 10 of HCM for a variety of rural, suburban, and urban roadway facilities to simplify the definition of roadway segment operations.

[3] *Highway Capacity Manual 2000*, p. 10-5.

LOS	Description	Percentage of Free Flow Speed	Volume-to-Capacity Ratio[1]
F	Characterized by urban street flow at extremely low speeds. Intersection congestion is likely at critical signalized locations, with high delays, high volumes, and extensive queuing.	<33	>1.00

Notes:
[1] Valid for one-way roads/two-way roads with turn lanes at major intersections, which is representative of the South Lake Union street network
[2] Based on the HCM definition, there is no distinction between LOS A, B, or C for urban roadway segments since speed limits are low for these streets
[3] The HCM defines roadway capacity as LOS E. Any roadway that has a volume or traffic demand that exceeds 1.0 is defined as operating at LOS F conditions

Source: Highway Capacity Manual, Transportation Research Board, 2000; 2009 FDOT Quality/Level of Service Handbook, Florida Department of Transportation, 2009.

Corridor LOS Analysis

To assess the level of vehicle congestion in the vicinity of South Lake Union, a set of study corridors were selected based primarily on the average volume of traffic and speed of the roadway and the proportion of traffic related to the South Lake Union neighborhood. All road segments within the traffic impact analysis area were considered for inclusion as a study corridor. In general, corridors satisfying both of the following conditions were selected.

- Classification as a principal or minor arterial (generally higher volume streets)
- Carries at least five percent of traffic generated within the South Lake Union neighborhood (as estimated by the City's travel model for 2031)

Ten corridors satisfied both criteria. Exceptions to the basic criteria were made to better capture the traffic operations in the traffic impact analysis area. For example, less than five percent of South Lake Union related traffic travels on E Pine Street, but of arterials accessing First Hill, it carries the highest percentage of such traffic. Therefore, E Pine Street was included as a study corridor. Likewise, the Lakeview Boulevard E and Denny Way I-5 overpasses were selected to capture the traffic impacts of the main Capitol Hill access points. Another exception was made to ensure that an east-west connection within the South Lake Union neighborhood would be studied. Thomas and Harrison Streets are study corridors despite being classified as access streets. Republican Street was not selected as a study corridor since, despite being classified as minor arterial, the traffic conditions on Thomas and Harrison Streets are similar based on existing traffic counts and any development-related impacts are expected to be similar on all three streets. Some corridors were broken into multiple segments to reflect the differing characteristics along a single route. For example, Fairview Avenue N was split at Yale Avenue N and Harrison Street to reflect the congestion that occurs on both sides of the intersection with Mercer Street. **Table 3.13-3** lists the selected study segments and **Figure 3.13-11** displays them on a map of the area.

Demand-to-Capacity Ratios. For each study segment, demand-to-capacity (d/c) ratios were calculated using traffic count data provided by the City of Seattle and roadway capacity estimates described below. D/C ratios give an indication of the level of congestion that exists today. The d/c ratios are very similar to the v/c ratios described earlier; however the d/c ratio has a slightly broader definition:

> Under existing conditions, the d/c ratio is equal to the volume of traffic traveling along a segment during a set period, plus the vehicles that are waiting in a queue to traverse the segment.

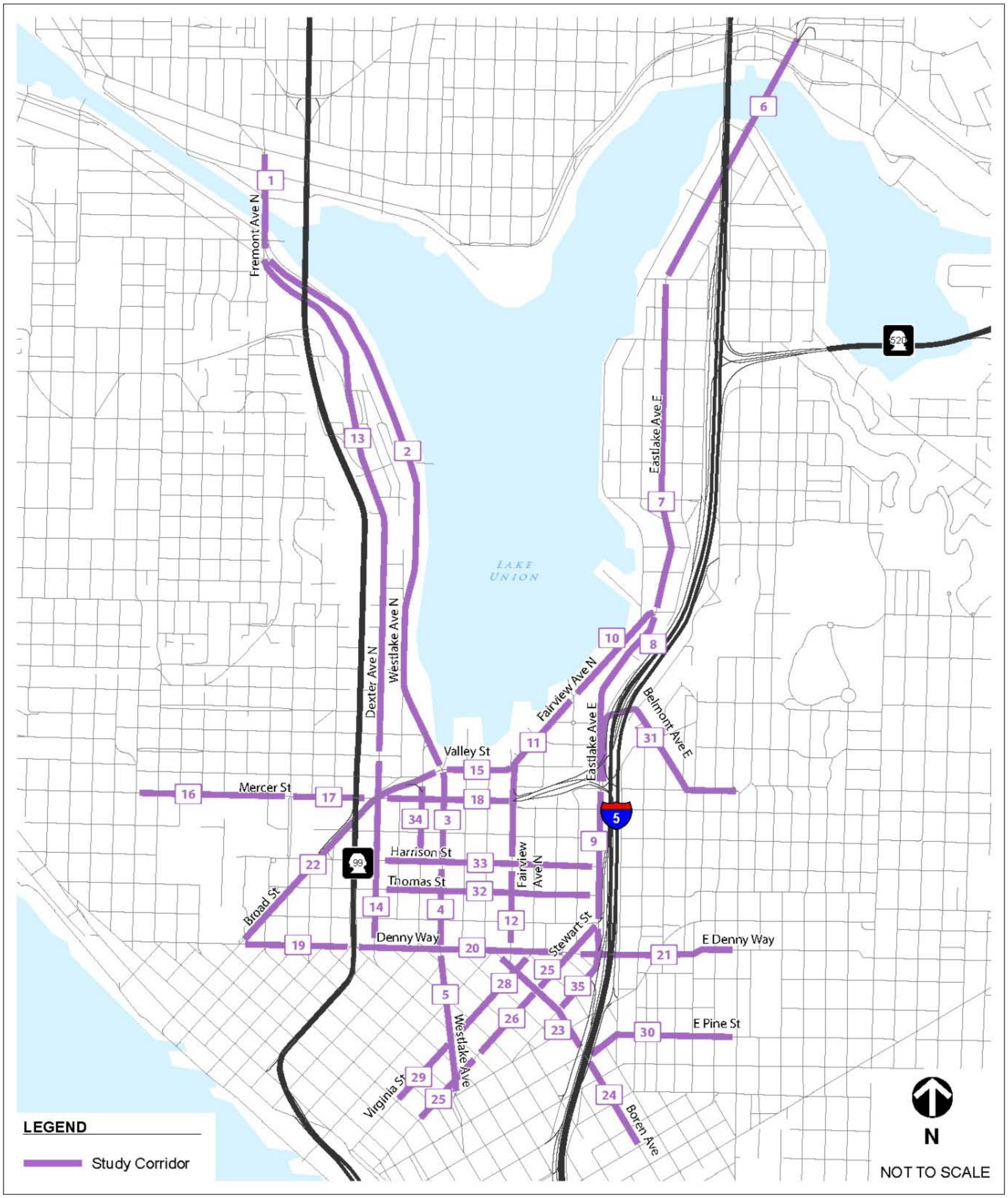
For most of the corridors in the South Lake Union neighborhood, the d/c ratio is equivalent to the v/c ratio. However for congested corridors like Mercer Street and Fairview Avenue N, the d/c ratio is higher because of the queues waiting to access these streets.

Table 3.13-3
Study Corridors

Road	Segment
Fremont Bridge	1) N 35th Street to Westlake Avenue N
Westlake Avenue N	2) Fremont Bridge to Valley Street
	3) Valley Street to Harrison Street
	4) Harrison Street to Denny Way
	5) Denny Way to Stewart Street
Eastlake Avenue E	6) N 40th Street to E Hamlin Street
	7) E Hamlin Street to Fairview Avenue N
	8) Fairview Avenue to Lakeview Blvd E
	9) Lakeview Blvd E to Stewart Street
Fairview Avenue N	10) Eastlake Avenue to Yale Avenue N
	11) Yale Avenue N to Harrison Street
	12) Harrison Street to Denny Way
Dexter Avenue N	13) Fremont Bridge to Valley Street
	14) Valley Street to Denny Way
Valley Street	15) Westlake Avenue N to Fairview Avenue N
Mercer Street	16) Queen Anne Avenue N to 5th Avenue N
	17) 5th Avenue N to Dexter Avenue N
	18) Dexter Avenue N to Fairview Avenue N
Denny Way	19) Broad Street to Aurora Avenue N
	20) Aurora Avenue N to Stewart Street
	21) Stewart Street to Broadway E
Broad Street	22) Denny Way to Westlake Avenue N
Boren Avenue	23) Denny Way to Pine Street
	24) Pine Street to University Street
Stewart Street	25) Eastlake Avenue E to Boren Avenue
	26) Boren Avenue to 7th Avenue
	27) 7th Avenue to 3rd Avenue
Virginia Street	28) Denny Way to Westlake Avenue N
	29) Westlake Avenue N to 3rd Avenue
E Pine Street	30) Boren Avenue to Broadway
Lakeview/Belmont/Roy	31) Eastlake Avenue to Broadway E
Thomas Street	32) Aurora Avenue N to Eastlake Avenue E
Harrison Street	33) Aurora Avenue N to Eastlake Avenue E
9th Avenue N	34) Roy Street to Republican Street
Howell/Eastlake	35) Stewart Street to Boren Avenue

Source: Fehr & Peers, 2010

Figure 3.13-11
Study Corridors – Existing Conditions



Source: Fehr & Peers, 2010

The d/c ratio measures the typical observed peak period queue and adds those queued vehicles to the congested segments. The advantage of this approach is that it more accurately captures the total traffic demand and the inter-related nature of the roadways in South Lake Union.

For example, Mercer Street is congested for a considerable portion of the afternoon peak period due to congestion at the Mercer Street/Fairview Avenue N intersection. Based on several field visits, the queue typically extended back from this intersection approximately a half mile. Based on this level of queuing and the location of the bottleneck, the d/c ratio of the segment of Mercer Street was calculated by adding the observed traffic counts and the estimated number of vehicles waiting in the queue. This type of calculation better captures the level of traffic congestion on the roadway network than v/c ratios, which only measure the number of vehicles that pass through the count location (which ignores the vehicles in queue due to congestion).

As described in the HCM, LOS definitions above, a d/c ratio exceeding 0.9 (corresponding to LOS E and F conditions) suggests that drivers, transit vehicles (and their passengers) likely experience undesirable delays and queues at key intersections along the corridor. Therefore, this analysis methodology speaks to both roadway and intersection congestion on the study corridors for drivers and transit passengers.

A key consideration in measuring d/c ratios was determining the lane capacity of each segment. Lane capacity is a measurement of how many vehicles per hour can travel within the travel lanes on various streets. Lane capacity was determined by starting with the assumptions in the City of Seattle travel model, which were then adjusted, based on each segment's location and operational characteristics, such as whether it was one-way or two-way or had turn pockets. In general, these capacity adjustments are consistent with those listed in the *2009 FDOT Quality/Level of Service Handbook*. Based on these considerations, the following base lane capacities were assigned.

Principal and Minor Arterials: Principal and Minor Arterials are streets that generally carry the highest number of vehicles on an average weekday.

- Downtown— lane capacity is 600 vehicles per hour (vph)
- South Lake Union—lane capacity is 700 vehicles per hour
- Outside South Lake Union and Downtown—lane capacity is 800 vehicles per hour

Non-Arterials: Non-Arterials are access roads and other streets that carry fewer vehicles per day.

- Harrison and Thomas Streets—lane capacity is 600 vehicles per hour

As shown above, the lane capacity of arterial streets is assumed to be lowest in Downtown, slightly higher in South Lake Union, and highest in areas outside of South Lake Union and Downtown. The reason for this difference in capacity has to do with how fast vehicles can travel along a stretch of roadway.

Downtown has the lowest base lane capacity since this portion of the study area has the greatest number of traffic signals per mile and the greatest level of pedestrian and transit activity. Research in the HCM indicates that closely spaced traffic signals generally degrade the vehicle capacity of roadway corridors; however, short blocks and frequent crossing opportunities are better for pedestrians. The high level of pedestrian and bus activity in Downtown reduces the lane capacity further since busses can block travel lanes when loading and heavy pedestrian traffic can block turning vehicles. We verified these lane capacities with field observations, which indicated that pedestrian activity and queue spillback between signalized intersections reduced roadway capacities in Downtown and portions South Lake Union.

Base lane capacities were increased by 20 percent for one-way streets since they operate more efficiently than two-way streets due to reduced turning conflicts and more efficient traffic signal operations. In addition, a 20 percent adjustment was made in some locations to account for turn lanes, which further increase the capacity of a street, since vehicles waiting for a gap in traffic to execute a turn are not blocking through traffic. Some additional adjustments were made at select locations to reflect actual lane capacities. For example, although E Pine Street has no turn lane, the road is wide enough to allow through traffic to pass turning cars so it was treated as if it had a turn lane. These increases in base capacity for one-way streets and streets with turn lanes is consistent with the methodology recommended by the Florida Department of Transportation (see **Appendix E**).

Certain streets have unique circumstances that affect their lane capacities. For instance, on Mercer Street there are four through lanes, but only three of them lead onto the I-5 ramps. Because the vast majority of motorists are accessing the ramps, the fourth lane is underutilized. Counting it as a full lane would overestimate the capacity of the street. In this case, the number of through lanes was adjusted to 3.5 to accurately represent the traffic operations on Mercer Street. A similar lane adjustment was used on Westlake Avenue N where the streetcar tracks run in the outside lane. Motorists tend to avoid driving in that lane resulting in a reduced capacity. Some streets like Eastlake Avenue N have parking allowed in certain directions during portions of the day. The capacity analysis took into account the variations in the number of lanes on these streets.

Transit

Based on correspondence with King County Metro, which owns and operates the transit system, passenger load factor of bus service was selected as the key performance measure for transit in the study area. Information about transit frequency and span of service was also described, but since the Height and Density alternatives do not affect these factors, an impact analysis was not performed.

While documents like the *Urban Village Transit Network*, and the *2005 Transit Master Plan* identify transit reliability as another important service measure, reliability is difficult to measure and forecast without a detailed traffic/transit simulation model and this measure was not considered as part of this study.

Load factor is the ratio of passengers to seating capacity on a bus line during the peak hour. King County Metro provided data from Spring 2010 for routes serving the South Lake Union neighborhood. Details of the transit analysis methodology may be found in **Appendix E**.

Traffic Safety

The traffic safety analysis is based on previous transportation analyses prepared in the South Lake Union area. These earlier studies have used the concept of High Accident Locations, which the City of Seattle defines as follows:

- Signalized intersections with an average of ten or more traffic collisions per year
- Unsignalized intersections with an average of five or more collisions per year

High Accident Locations will be targeted for future safety improvements in an effort to reduce the number of collisions.

While the previous studies evaluated High Accident Locations in general, they did not specifically define any High Accident Location standards for pedestrian or bicycle collisions. Given the substantial increase in new land uses (and therefore additional demand for pedestrian and bicycle travel in the area) associated with the height and density alternatives, a pedestrian/bicycle intersection of interest is identified if *either* of the criteria below are met:

- Any intersection with an average of 1.7 or more pedestrian ***or*** bicycle collisions per year (which equates to five or more collisions in a three-year period),
- Or any intersection with average of 2.3 or more pedestrian ***and*** bicycle collisions per year (which equates to seven or more collisions in a three-year period).

The first criteria treats pedestrian and bicycle collisions separately, while the second combines the two measures.

Analysis Results

This section presents the results of the existing traffic conditions analysis.

Existing Study Corridor Demand-to-Capacity Ratios

Table 3.13-4 and **Figure 3.13-12** display the results of the d/c ratio analysis. In some instances, a road segment may operate with standing queues despite having a d/c ratio well below 1.0. Such instances are noted below with an asterisk to indicate that standing queues were observed in the field. As described earlier, the intersection of Mercer Street and Fairview Avenue N is congested and causes queue spillbacks onto adjacent streets like 9th Avenue N, Westlake Avenue N, and Fairview Avenue N. While the d/c ratio technique takes into account congestion on the street with the main bottleneck, it does not account for intersection queues on minor streets as traffic attempts to merge into the major-street queue. The following facilities have d/c ratios greater than 1.0:

- Valley Street from Westlake Avenue N to Fairview Avenue N
- Denny Way from Aurora Avenue N to Stewart Street

Table 3.13-4
Existing Condition Demand-to-Capacity Ratios of Study Corridors

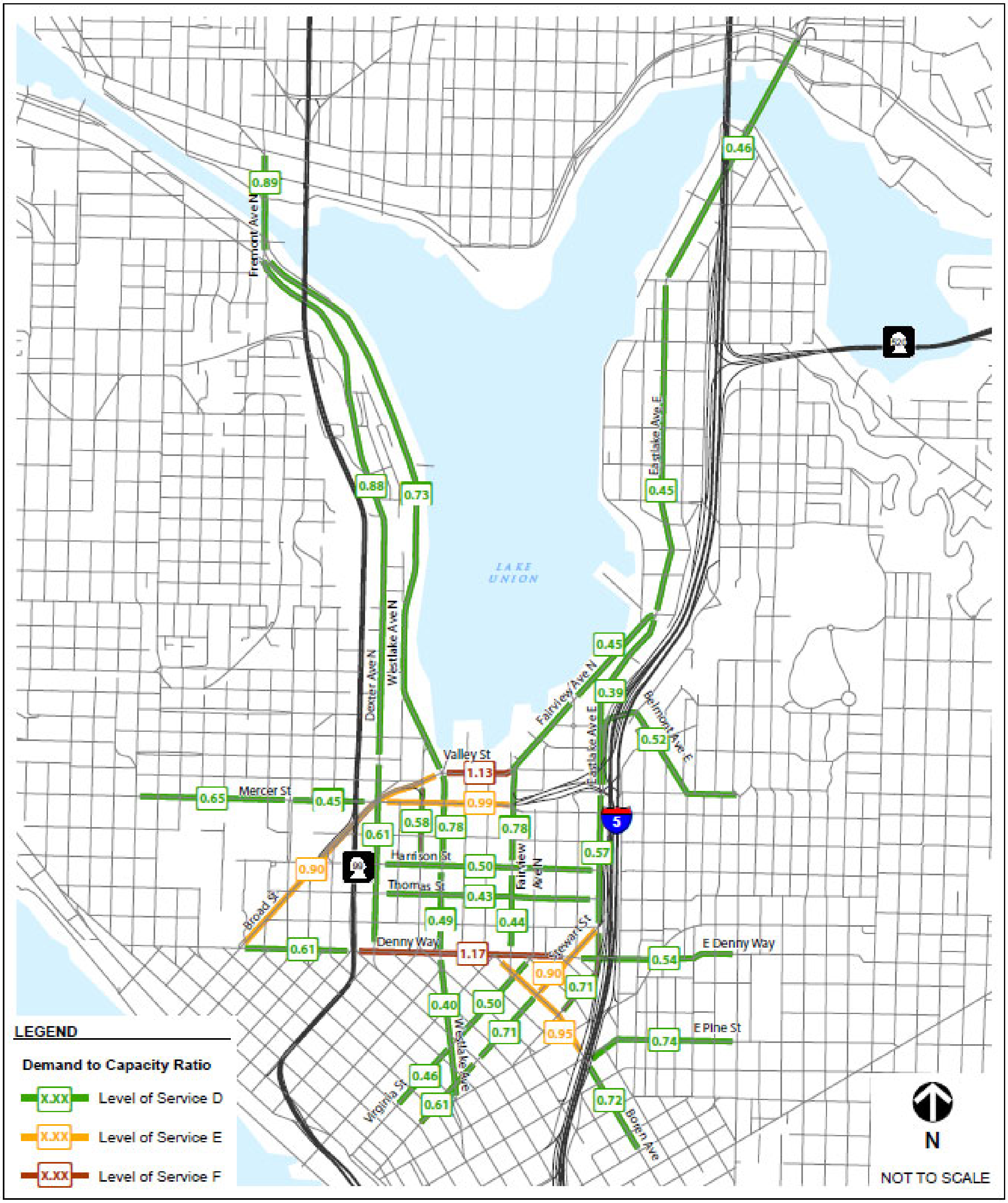
Road	Segment	Volume	Peak Hour	Peak Direction	Number of Through Lanes	Total Capacity	d/c Ratio/LOS
Fremont Bridge	1) N 35th Street to Westlake Avenue N	1,424	PM	N	2	1,600	0.89/D
Westlake Avenue N	2) Fremont Bridge to Valley Avenue	1,169	PM	N	2	1,600	0.73/D
	3) Valley Street to Harrison Street	1,093	PM	N	2	1,400	0.78*/D
	4) Harrison Street to Denny Way	685	PM	N	2	1,400	0.49/D
	5) Denny Way to Stewart Street	357	PM	N	1.5	900	0.40/D
Eastlake Avenue E	6) N 40th Street to E Hamlin Street	890	PM	NE	2	1,920	0.46/D
	7) E Hamlin Street to Fairview Avenue N	871	PM	N	2	1,920	0.45/D
	8) Fairview Avenue to Lakeview Blvd E	549	PM	S	1	700	0.78/D
	9) Lakeview Blvd E to Stewart Street	802	PM	N	2	1,400	0.57/D
Fairview Avenue N.	10) Eastlake Avenue to Yale Avenue N	479	PM	SW	1	700	0.68/D
	11) Yale Avenue N to Harrison Street	1,186	AM	S	2	1,680	0.78*/D
	12) Harrison Street to Denny Way	745	PM	N	2	1,680	0.44/D
Dexter Avenue N	13) Fremont Bridge to Valley Street	848	AM	S	1	960	0.88/D
	14) Valley Street to Denny Way	848	AM	S	2	1,400	0.61/D
Valley Street	15) Westlake Avenue N to Fairview Avenue N	2,372	PM	W	3	2,100	1.13/F
Mercer Street	16) Queen Anne Avenue N to 5th Avenue N	1,091	PM	E	2	1,680	0.65/D
	17) 5th Avenue N to Dexter Avenue N	1,445	AM	E	3.5	3,185	0.45*/D
	18) Dexter Avenue N to Fairview Avenue N	2,929	PM	E	3.5	3,185	0.99*/E
Denny Way	19) Broad Street to Aurora Avenue N	1,031	PM	W	2	1,680	0.61/D
	20) Aurora Avenue N to Stewart Street	1,233	PM	E	1.5	1,050	1.17/F
	21) Stewart Street to Broadway E	864	PM	W	2	1,600	0.54/D
Broad Street	22) Denny Way to Westlake Avenue N	1,643	PM	SW	2	1,820	0.90/E

Road	Segment	Volume	Peak Hour	Peak Direction	Number of Through Lanes	Total Capacity	d/c Ratio/LOS
Boren Avenue	23) Denny Way to Pine Street	1,136	PM	NW	2	1,200	0.95/E
	24) Pine Street to University Street	862	PM	NW	2	1,200	0.72/D
Stewart Street	25) Eastlake Avenue E to Boren Avenue	1,894	AM	SW	3.5	2,100	0.90*/E
	26) Boren Avenue to 7th Avenue	1,278	AM	SW	3	1,800	0.71/D
	27) 7th Avenue to 3rd Avenue	729	AM	SW	2	1,200	0.61/D
Virginia Street	28) Denny Way to Westlake Avenue N	603	PM	NE	2	1,200	0.50/D
	29) Westlake Avenue N to 3rd Avenue	832	PM	NE	3	1,800	0.46/D
E Pine Street	30) Boren Avenue to Broadway	530	PM	W	1	720	0.74/D
Lakeview/Belmont/ Roy	31) Eastlake Avenue to Broadway E	415	PM	E	1	800	0.52/D
Thomas Street	32) Aurora Avenue N to Eastlake Avenue E	260	PM	W	1	600	0.43/D
Harrison Street	33) Aurora Avenue N to Eastlake Avenue E	300	PM	W	1	600	0.50/D
9th Avenue N	34) Roy Street to Republican Street	1,214	PM	S	3	700	0.58/D
Howell/Eastlake	35) Stewart Street to Boren Avenue	424	AM	S	1	600	0.71/D

Source: City of Seattle count data, 2004-2010.

* Standing queues observed. As a result, actual LOS may be worse.

Figure 3.13-12
Demand to Capacity Ratios – Existing Conditions



Source: Fehr & Peers, 2010

In addition, queue spillbacks were observed on the following segments:

- 9th Avenue N from Westlake Avenue N to Mercer Street (because of the queues on Mercer Street)
- Westlake Avenue N from Valley Street to Harrison Street (because of the queues on Mercer Street)
- Fairview Avenue N from Yale Avenue N to Harrison Street (because of the queues on Mercer Street)
- Mercer Street from 5th Avenue N to Dexter Avenue N
- Mercer Street from Dexter Avenue N to Fairview Avenue N
- Stewart Street from Eastlake Avenue E to Boren Avenue

Transit

Tables 3.13-5 and 3.13-6 summarize the load factors for transit routes serving the South Lake Union neighborhood in 2010. **Table 3.13-1** summarizes the AM peak period, PM peak period, and Midday period transit frequencies for the bus lines serving the area. The AM peak hour load factor is calculated based on the highest one-hour ridership on the route between 6 to 9 AM. The PM peak hour load factor is based on the highest one-hour ridership between 3:15 to 6:30 PM. For each route, the peak hour load factors for both directions are shown.

According to King County Metro, load factor is based on the highest ridership along the route. Therefore, the maximum load does not necessarily occur in the South Lake Union neighborhood. King County Metro aims for an aggregate load factor of 0.5 to 0.8 for each peak period. A load factor below 0.5 indicates too much capacity and a load factor above 0.8 indicates that some trips will have standing passengers. As described above, since King County Metro owns and operates the transit system, their load factor criteria is used to identify impacts; a peak hour load factor exceeding 1.25 is considered by King County Metro to be deficient.

Table 3.13-5
South Lake Union Transit AM Peak Hour Load Factors

Route	Termini Locations	Peak Hour Load Factor	
		NB	SB
5/54/55	Shoreline, West Seattle	0.41	0.86
8	Uptown, Rainier Valley	0.70	0.81
16	Downtown, Northgate	0.67	0.93
17/27	Loyal Heights, Leschi	0.52	0.86
25/37	Laurelhurst, West Seattle	0.47	0.63
26/124	Green Lake, Tukwila	0.46	0.71
23/28	Broadview, White Center	0.45	0.81
30	Sandpoint, Seattle Center	0.83	0.84
66	Downtown, Northgate	0.69	1.17
70	Downtown, University District	0.73	0.89
358	Downtown, Aurora Village Transit Center	0.66	0.81

Source: King County Metro, Spring, 2010.

Table 3.13-6
South Lake Union Transit PM Peak Hour Load Factors

Route	Termini Locations	Peak Hour Load Factor	
		NB	SB
5/54/55	Shoreline, West Seattle	0.76	0.45
8	Uptown, Rainier Valley	0.56	0.97
16	Downtown, Northgate	0.80	1.08
17/27	Loyal Heights, Leschi	0.87	0.71
25/37	Laurelhurst, West Seattle	0.43	0.40
26/124	Green Lake, Tukwila	0.63	0.63
23/28	Broadview, White Center	0.70	0.55
30	Sandpoint, Seattle Center	0.96	1.08
66	Downtown, Northgate	0.83	0.63
70	Downtown, University District	0.63	0.67
358	Downtown, Aurora Village Transit Center	0.84	0.87

Source: King County Metro, Spring 2010.

Travel Demand Management

In 2004, the City Council directed the Seattle Department of Transportation to create a transportation demand management (TDM) program for South Lake Union. That report suggested strategies for the neighborhood to minimize the negative travel effects brought on by substantial growth. Those strategies included increased management of on-street and off-street parking, expansion of transit service, and the creation of a single transportation management organization that would conduct marketing and customer service to promote alternatives to driving alone.

Two types of travel demand management programs affect South Lake Union. The State's Commute Trip Reduction Law applies to larger employers. The City's Transportation Management Program applies to larger buildings (even if those buildings are occupied by small employers). Both programs are aimed at encouraging employees to reduce their drive-alone rate by implementing TDM programs and progress is monitored periodically.

Surveys are conducted every two years to measure the progress of companies affected by the State's Commute Trip Reduction Law. In a recent evaluation of these surveys, sixteen participating South Lake Union companies produced varied results. Each employer has its own mode split and VMT goals, based on a targeted reduction to its past rates. Nine companies achieved their single-occupant vehicle (SOV) mode-split goal, four reduced their SOV rate but did not reach their goal, while three increased their SOV rate. These results represent roughly 8,750 South Lake Union commuters. Of companies who have reached their mode-split goals, SOV rates range from 30 to 61 percent. The complete table may be found in **Appendix E**.

More detailed mode-split information was available for eight South Lake Union companies. That data is summarized in **Table 3.13-7**.

Table 3.13-7
Sample Mode-Split of South Lake Union CTR Participants

	Most Recent	Mode Split (%)				
Company	**SOV Goal***	**SOV**	**HOV**	**Transit**	**Bicycle**	**Walk**
Alley 24 East & West	63	58	9	18	2	8
Gates Foundation	56	62	10	8	4	7
Group Health	47	37	14	38	2	3
Microsoft	34	37	15	23	2	14
Pemco	50	49	13	25	0	2
REI	39	39	4	20	16	5
Seattle Cancer Care Alliance	39	39	20	23	3	3
Tommy Bahama	50	45	19	25	2	5

Source: CTR Survey Reports, 2007-2010.

Freight

For the purposes of this study, the quality of freight mobility within South Lake Union will be assessed using the roadway segment d/c ratios on major truck streets. As described earlier, d/c ratios are correlated with traffic congestion and truck streets with high d/c ratios will be more difficult for trucks to navigate and have lower travel speeds, which can lead to delays.

As shown in **Table 3.13-4**, with the exception of Westlake Avenue N and Mercer Street west of Dexter Avenue N, all the major truck streets in the South Lake Union area (Mercer Street, Valley Street, and Broad Street) currently operate at LOS E or F conditions, with d/c ratios of 0.90 or greater.

Traffic Safety

The most recent (January 2007-December 2009) three-year collision records from the Seattle Department of Transportation were analyzed to determine if there were any High Accident Locations within the South Lake Union study area. The collision records identified only one High Accident Location at the intersection of Mercer Street and Taylor Avenue N. This unsignalized intersection experienced an average of five collisions per year over the last three years. A closer inspection of the collision data indicates that 40 percent of the collisions involved left turning vehicles while another 20 percent were right angle collisions. Most of the other collisions (33 percent) were sideswipes. These types of collisions are typical of unsignalized side-street intersections and often involve failure of a driver to properly yield right of way.

Previous studies in the area have identified other High Accident Locations within the South Lake Union study area, particularly at the intersections of Mercer Street and Fairview Avenue N, Mercer Street and Westlake Avenue N, Mercer Street and Dexter Avenue N, and Mercer Street and 5th Avenue N. These locations were reviewed for the average annual number of collisions over the three-year analysis period, but none of these locations met the City threshold defining a High Accident Location, with the highest collision rate of 8.7 occurring at Mercer Street and Fairview Avenue N.

The January 2007-December 2009 collision records from the Seattle Department of Transportation were also reviewed for pedestrian and bicycle collisions within the study area. Using the criteria defined in Analysis Methodology Section, the following two intersections were identified:

- Mercer Street and Dexter Avenue N – 1.7 bicycle collisions per year
- Eastlake Avenue and Fuhrman Avenue (south end of University Bridge) – 2.3 bicycle collisions per year

These two intersections correspond with intersections of major bicycle routes. Dexter Avenue N is also signed as the Interurban North bikeway and Eastlake Avenue near the University Bridge serves as a link on the Cheshiahud Lake Union Loop.

While this section identified several intersections with a relatively high number of collisions per year, the High Accident Location analysis methodology does not calculate a collision rate. Collision rates are often reported by state departments of transportation to identify locations that have a high number of collisions relative to the total traffic flow through the area.

3.13.2 Planning Scenarios Evaluated

This section describes the planning scenarios that will be evaluated in this document and presents the methodology and assumptions used to analyze the alternatives.

Four alternatives are evaluated under future year 2031conditions. These include a No Action scenario that maintains South Lake Union's current zoning and three Action alternatives, which would increase the neighborhood's height and density zoning by varying degrees. Specifically, Alternatives 1 and 2 allow for increases to both residential and commercial development. Alternative 1 has higher allowable heights and densities, and Alternative 2 has more moderate standards. Alternative 3 allows commercial height and density focused primarily on residential development.

Transportation Network and Land Use Assumptions

This chapter assesses transportation system operations under 2031 conditions for all four future year scenarios. In general, the City of Seattle travel model forecast future background vehicle and transit volumes. For the South Lake Union area, we used a more refined method to project traffic volumes.

Per the direction of the Seattle Department of Transportation, the version of the City travel model used for this analysis was developed as a part of the Alaskan Way Viaduct (AWV) Replacement study and was used for the *AWV Supplemental Draft Environmental Impact Statement* (WSDOT, FHWA, and City of Seattle, July 2006). The following is a description of some of the travel model's key features.

- Analysis Years: This version of the model has a base year of 2008 and a horizon year of 2030. 2031 transportation forecasts for South Lake Union were developed by updating the land use forecasts and trip generation rates within the study area.
- Network Representation: The highway and major street systems (Westlake Avenue N, Fairview Avenue N, Mercer Street etc.) within South Lake Union are fully represented in the model.

- Land Use: The City of Seattle developed the estimates of citywide land use (residential, commercial, and industrial) for base and horizon year conditions.
- Transit: The travel model has a full representation of the transit system under base year conditions. The horizon year transit system is based on assumptions of service from the City of Seattle and the Puget Sound Regional Council.
- Travel Costs: The model accounts for the effects of auto operating costs, parking, transit fares, and tolls (on SR 520) on travel demand.
- Travel Demand: The model predicts travel demand for seven modes of travel: drive alone, carpool (2 person), carpool (3 plus), transit, trucks, walking, and bicycling. Travel demand is estimated for five time periods, morning (6 to 9 AM), midday (9 AM to 3 PM), afternoon (3 to 6 PM), evening (6 to 10 PM), and overnight (10 PM to 6 AM).

This chapter assumes several modifications to the transportation network in the Seattle travel model to better represent 2031 conditions. These modifications were to ensure that only "reasonably foreseeable" transportation improvement projects were included in the future year analysis. The definition of reasonably foreseeable is based on the following criteria:

- Projects that have full funding commitments
- Projects with partial funding commitments but with a well-defined strategy in place to raise the remaining funds

Figure 3.13-13 shows the reasonably foreseeable projects in the study area. The bulk of the projects are related to the Mercer East and Mercer West projects, which will convert Mercer Street to two-way operations between I-5 and 1st Avenue N. This project affects several adjacent streets. The North Portal portion of the Alaskan Way Viaduct Replacement project is also assumed. This project will affect the southwestern corner of the South Lake Union neighborhood by completing the street grid across Aurora Avenue at John, Thomas, and Harrison Streets. The north portal of the bored tunnel will also require Broad Street to be vacated between 5th and 9th Avenues N.

Transportation projects that do not meet the definition for reasonably foreseeable are shown in **Figure 3.13-14** (roadway improvements) and

Figure 3.13-15 (pedestrian and bicycle improvements)[4]. These projects are not assumed to be completed by 2031 and were not included in the travel model. Note that the full Mercer West project includes widening the Mercer Street underpass between Dexter Avenue N and 5th Avenue N to three lanes in each direction with left-turn lanes, wider sidewalks, and a bicycle path. Due to an expected funding shortfall, this part of the Mercer West project is not considered to be reasonably foreseeable. Instead, it is assumed that the Mercer Street underpass would operate with two lanes in each direction and no improvements to pedestrian or bicycle facilities. All other components of the Mercer West project are assumed to be reasonably foreseeable.

No changes were made to the travel model's horizon year transit network, since the region has a proven record of increasing transit service to keep up with population growth over the long-term. The current financial troubles faced by transit agencies would be speculative to assume for 2031 since there is no precedent for a long-term stagnation of transit funding.

A close review of the travel model indicated several bus route changes expected by 2031. Route 30 will no longer serve the study area[5]. The following new bus routes are expected to serve South Lake Union:

- Rapid Ride Line D: Ballard to Downtown Seattle
- Rapid Ride Line E: Aurora Avenue - Shoreline to Downtown Seattle
- Route 21: Arbor Heights to Downtown Seattle
- Route 29: Woodland Park to Downtown Seattle
- Route 56: Alki/West Seattle to South Lake Union
- Route 121: Burien to Downtown Seattle
- Route 308: Lake Forest Park to Downtown Seattle
- Route 313: Bothell to Uptown
- Route 316: Shoreline to Uptown

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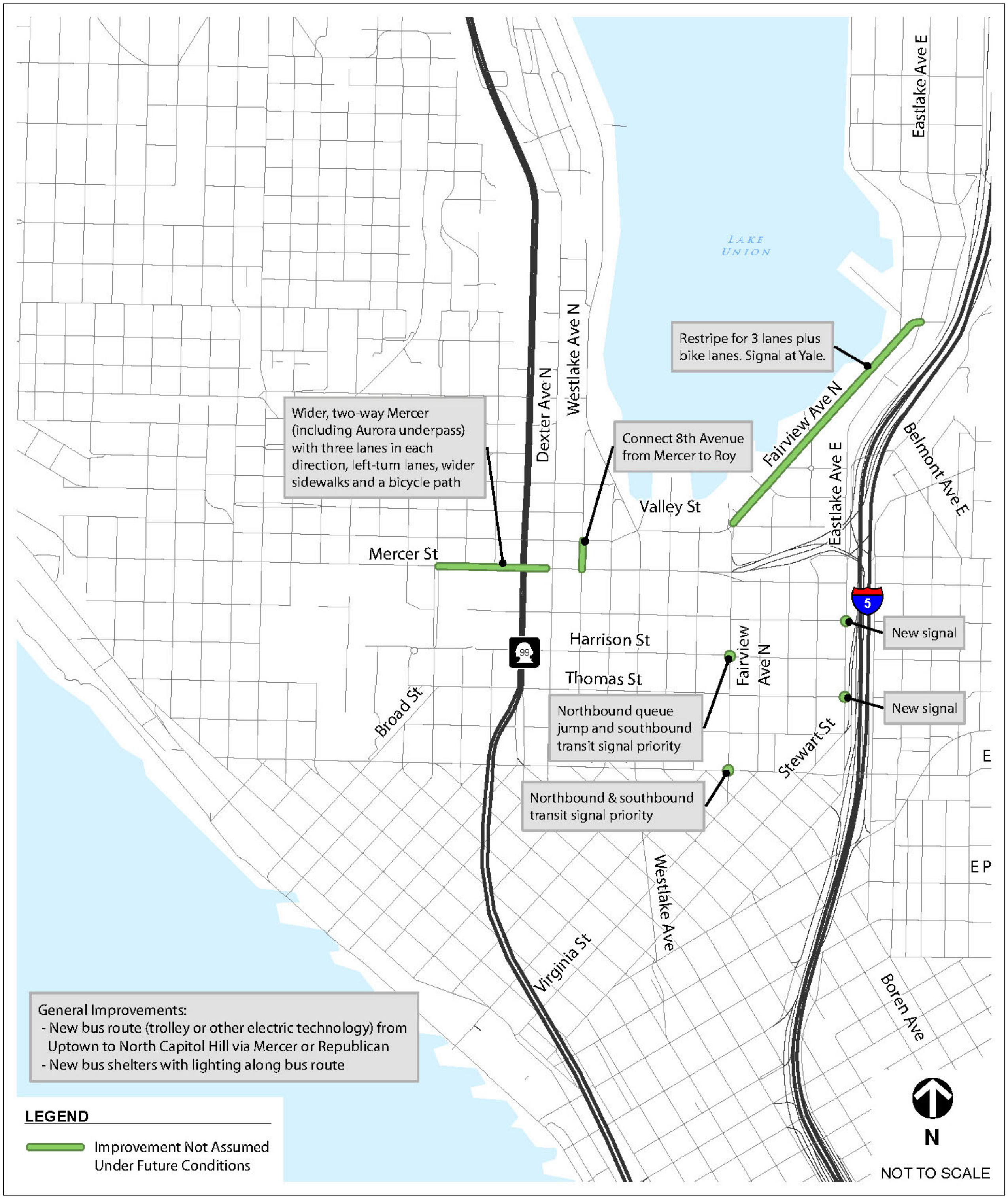
[4] The PMP identifies locations where improvements are desirable, but does not identify specific projects. In those instances when it was reasonably clear what the general improvement would be, such as building a sidewalk where one was missing or adding a crosswalk, the location is shown in **Figure 3.13-15**.

[5] The Seattle travel model does not describe why Route 30 would no longer serve the study area (it would run only between Sand Point and the University District rather than continuing south to South Lake Union/Lower Queen Anne). However, it is likely the southern portion of this route will be unnecessary when the University Link of Light Rail is completed.

Figure 3.13-13
Reasonably Foreseeable Transportation Improvements

Source: Fehr & Peers, 2010

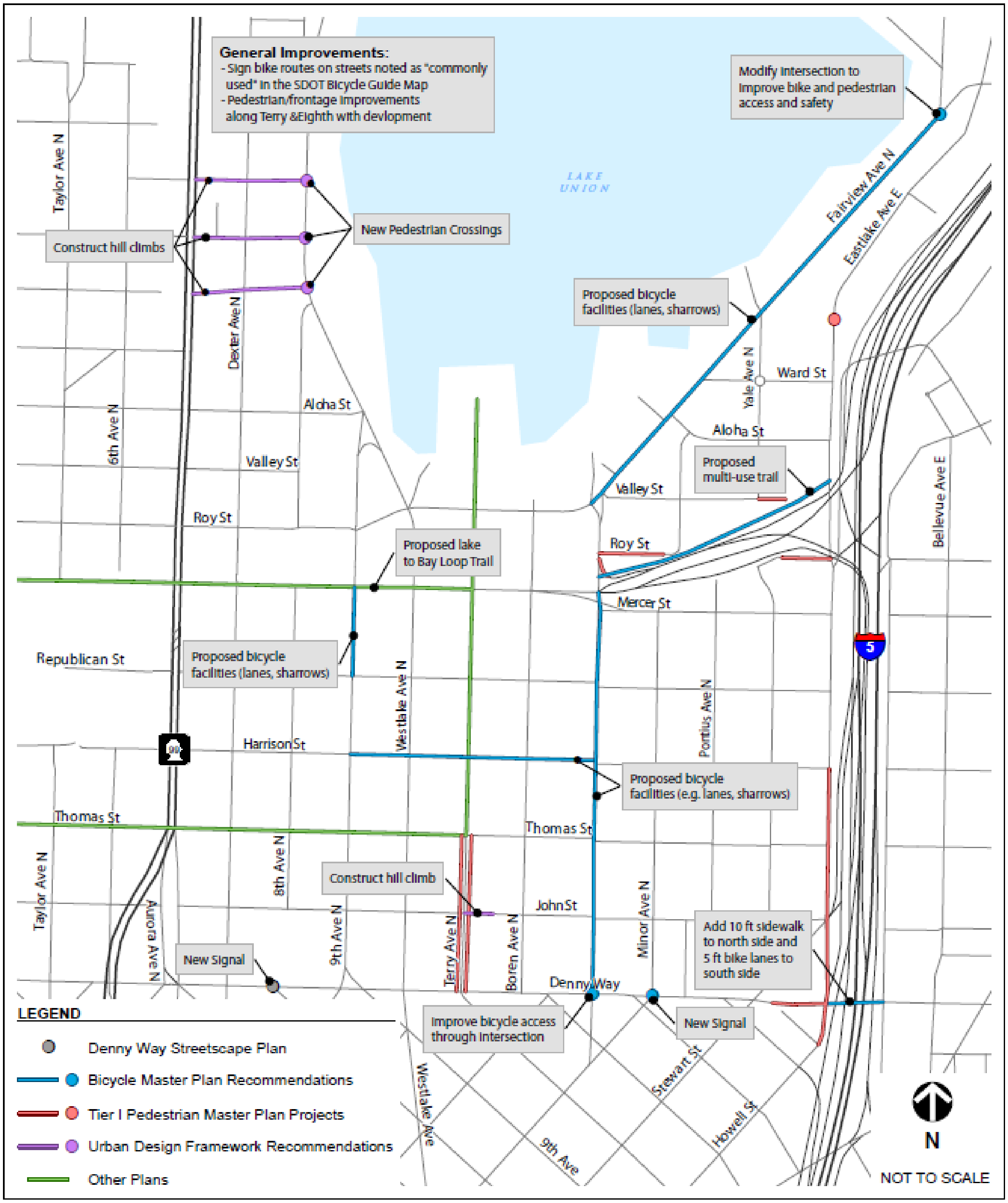
Figure 3.13-14
Roadway Improvement Not Assumed Under Future Conditions



Source: Fehr & Peers, 2010

Figure 3.13-15

Pedestrian and Bicycle Improvements Not Assumed Under Future Conditions



Source: Fehr & Peers, 2010

Trip Generation Methodology

The project team used an innovative trip generation analysis technique, known as the mixed-use development (MXD) model, to analyze the future year land use scenarios. The MXD model is based on a growing body of research, which focuses on the relationship between travel and the built environment. This method supplements conventional trip generation methods to capture effects related to built environment variables (known as the Ds) like **d**ensity, **d**iversity of land uses, **d**estinations (accessibility), **d**evelopment scale, pedestrian and bicycle **d**esign, and **d**istance to transit services, and **d**emographics. The proposed height and density alternatives in the South Lake Union area incorporate changes in a number of these variables that, in turn, would influence the neighborhood's travel characteristics. In short, projects with higher densities, a rich variety of land uses close to one another, and high quality bicycle, pedestrian, and transit environments have a lower vehicle trip generation rate. Travelers have more choices in terms of both the travel mode they choose and the distance they must travel to reach various destinations. When these projects are located in urban areas, this effect intensifies. This method avoids overestimating the number of vehicle trips that infill projects generate and provides a more reasonable picture of how travel characteristics change over time.

Traditional trip generation methodologies are not well suited to analyze the proposed height and density alternatives. These methods often take trip generation estimates from the Institute of Transportation Engineers (ITE) and factor the results using mode split data from the City's travel model, US Census Bureau, or engineering judgment.

While traditional trip generation methods can account for the high share of non-auto modes in the City, they have limited ability to consider shifts in mode choice caused by major land use changes like those considered in South Lake Union for the following reasons:

- Typical mode split adjustments tend to assume continuation of current trends and have limited responsiveness to changes in the land use and the built environment (e.g., increased density, increased mix of uses) or transportation system (e.g., improved pedestrian and bicycle connectivity, improved transit service).
- Mode split data are often derived from the US Census Bureau. As time passes the, mode split estimates may not be applicable given changes in development patterns and socioeconomic conditions. This may be the case for the current study, as the Census results were ten years old at the time of this analysis.

The MXD model overcomes many of these shortcomings and explicitly accounts for how built environment variables, such as building forms, the mix of land uses (jobs/housing balance), densities, transit accessibility, and neighborhood connectivity, affect travel behavior and mode choice.

The MXD model was developed in cooperation with the US Environmental Protection Agency (EPA) and ITE. Over 200 mixed-use development sites across the United States were surveyed as part of the model development process and the model was validated using data from 16 independent mixed use sites. Additional details regarding the model development, validation, and statistical performance can be found in **Appendix E**.

Figure 3.13-16 compares the traditional trip generation methodology to the enhanced MXD model applied for this analysis.

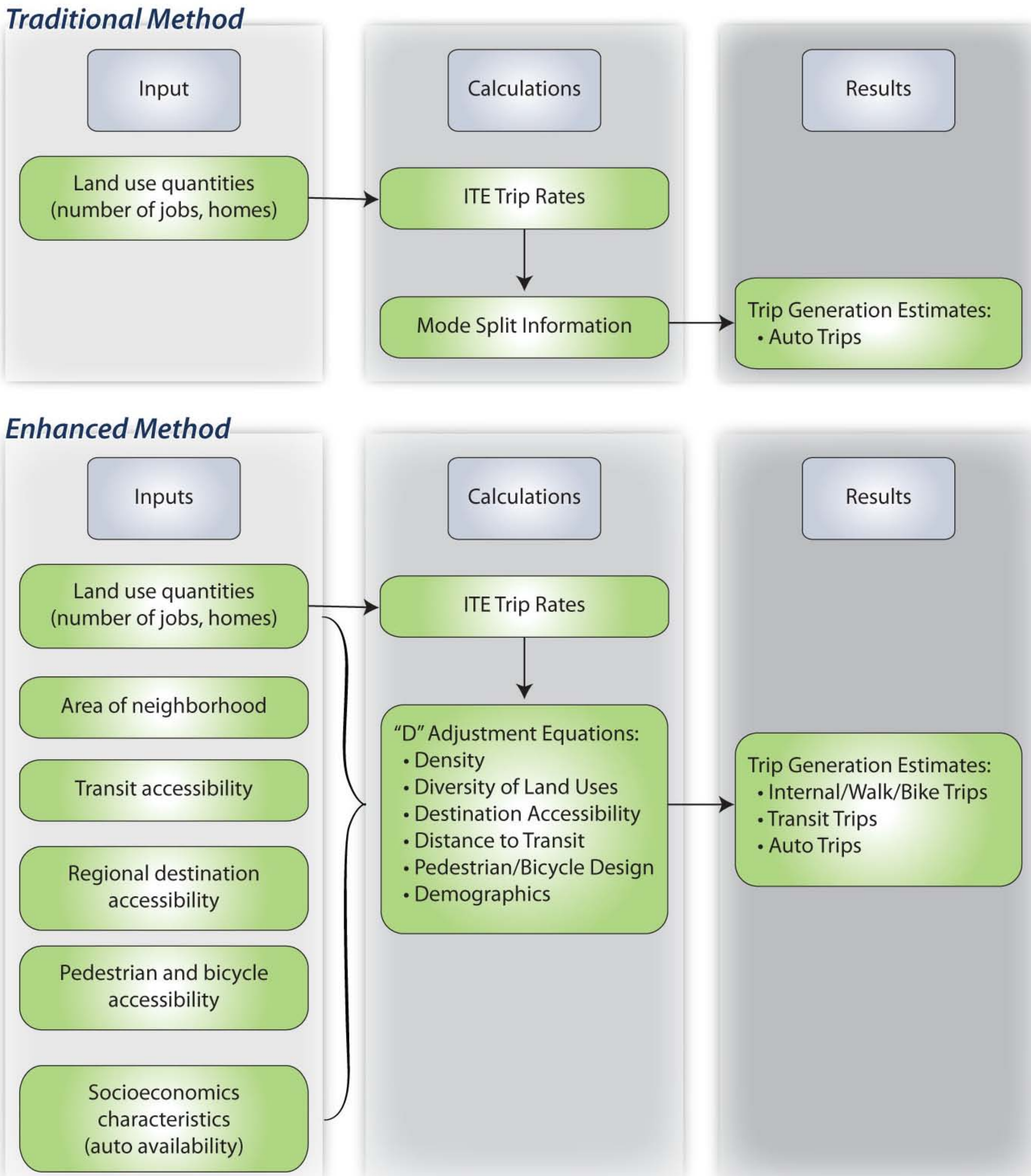
2031 South Lake Union Land Uses

The City of Seattle provided 2031 land use data (number of new housing units and jobs) for each of the four height and density alternatives:

- No Action Alternative – Development under Current Zoning
- Alternative 1 – Maximum Increases to Allowed Height and Density
- Alternative 2 – Mid-Range Increases to Allowed Height and Density
- Alternative 3 – Modest Increases to Allowed Height and Density

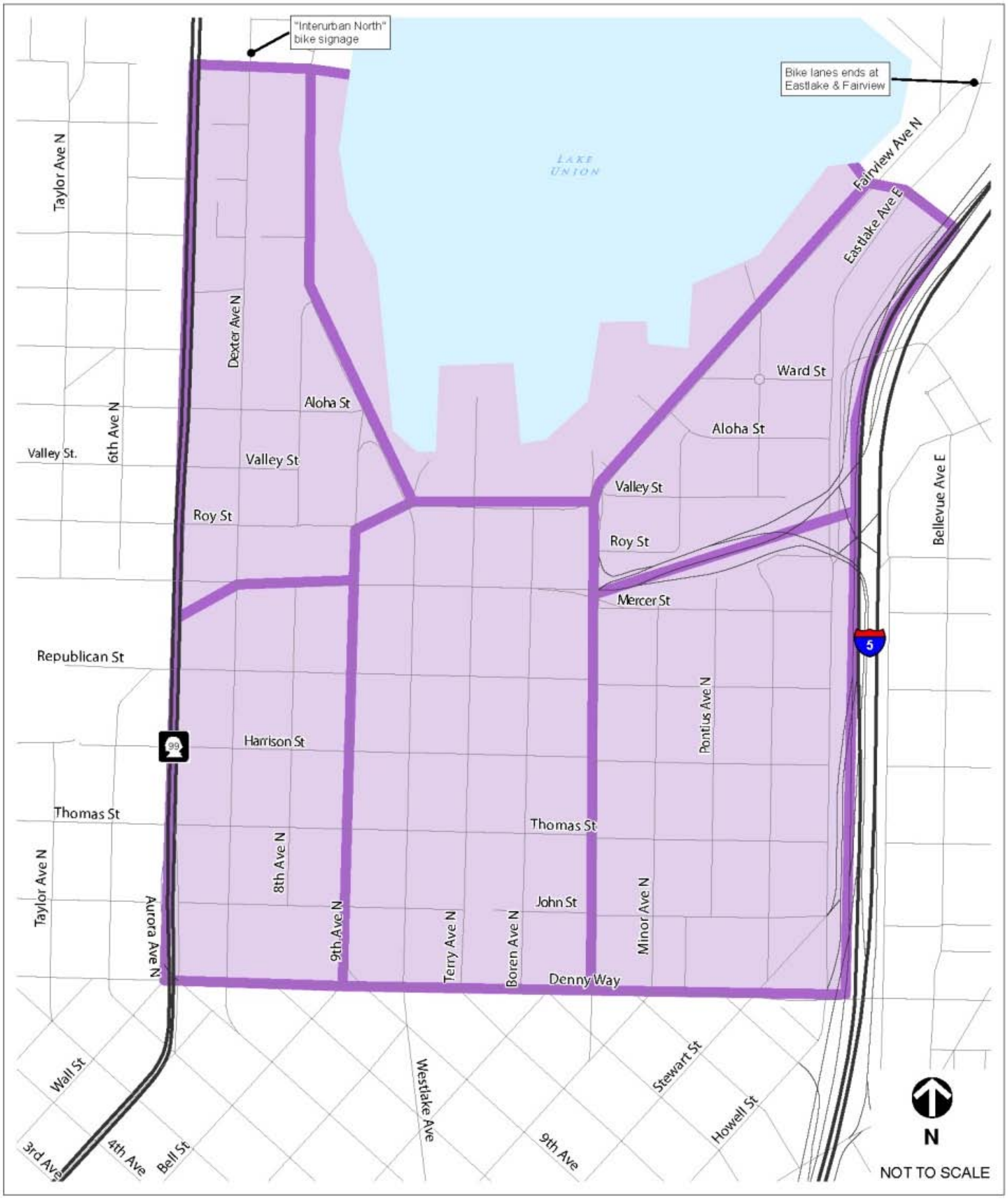
The 2031 land use data were developed according to the neighborhoods shown in **Figure 3.13-17**. The neighborhood boundaries were determined based on a number of factors, including the location of barriers (such as South Lake Union) and the clustering of land uses.

Figure 3.13-16
Comparison of Traditional and Enhanced Trip Generation Methods



Source: Fehr & Peers, 2010

Figure 3.13-17
Neighborhood Boundaries Used for Trip Generation



Source: Fehr & Peers, 2010

The chart below compares the 2031 land use totals (for housing units and jobs) for each of the height and density alternatives. The totals for each alternative take into account existing uses, those that will be lost when parcels are redeveloped, and new development. For comparison purposes, the 2008 existing conditions land use totals from the latest version of the City of Seattle travel model are also summarized. The development totals shown below represent total land uses (number of households and jobs) for each of the time periods shown below and should not be confused with the growth targets or development capacities described in Chapter 2. The growth shown below is consistent with both the growth targets and development capacities.

As shown in the above chart, the No Action Alternative would have the fewest jobs and households under 2031 conditions (10,800 households and 34,047 jobs). Among the three height and density alternatives, all have the same number of households assumed under 2031 (13,500), and Alternatives 1 and 2 have the same number of jobs assumed (39,945). Alternative 3 has slightly fewer jobs assumed (36,449) since, as described earlier, this alternative has lower densities and a residential focus.

The chart above shows that Alternatives 1 and 2 have an identical level of development expected over the next 20 years despite different allowable densities and tower heights. This similarity is related to the assumption that only a limited amount (11,900 households and 21,900 jobs) of development is expected to be built over the next 20 years, despite the differing zoning capacities. This is because Alternatives 1 and 2 will allow densities in excess of market demand for both housing and jobs. Alternative 3 will allow densities in excess of housing demand but not job demand, while the No Action Alternative will not provide enough density to meet market demand for housing or jobs.

Based on the land use totals described above, a GIS analysis was prepared for each of the future year alternatives (No Action, and Alternatives 1-3). This analysis measured key changes (as shown in **Figure 3.13-16**) such as the density of each neighborhood, the quality of the pedestrian environment (as measured by the frequency of crossing opportunities and block size), the mix of housing, retail, and employment, and other factors. **Table 3.13-8** presents the results of the trip generation estimate by mode for Daily and PM peak hour conditions. AM peak hour conditions were also calculated and those results, along with details of the calculations are presented in **Appendix E**.

As the table shows, the level of vehicle trip generation reflects the amount of land use development assumed under each future year alternative. For example, under PM peak hour conditions, Alternative 1 generates about 23 percent more vehicle trips when compared to the No Action Alternative. This result is reasonable considering that Alternative 1 contains about 25 percent more homes and 17 percent more employment than the No Action Alternative. Alternatives 1 and 2 generate about the same number of vehicle trips, and Alternative 3 generates trips at a level between Alternatives 1 and 2 and the No Action Alternative.

Table 3.13-8 also shows that the mode share predicted by the MXD model is relatively similar for each of the future year alternatives. This result is a reflection of several factors:

- The density of all the alternatives is relatively high
- The mix of land uses for all the alternatives is similar
- The roadway, pedestrian, bicycle, and transit networks are the same for all alternatives
- All the alternatives have the same proximity to major employment centers like Downtown Seattle and the University of Washington

Table 3.13-8 illustrates the gross ITE trip rates, followed by the breakdown by mode predicted by the MXD model.

Table 3.13-8
Trip Generation by Alternative

Alternative	Daily			PM Peak		
	Auto Trips (mode share %)	Non-auto Trips (mode share %)		Auto Trips (mode share %)	Non-auto Trips (mode share %)	
		Internal, Bicycle & Pedestrian	Transit		Internal, Bicycle & Pedestrian	Transit
No Action Alternative - Current Zoning	108,946 (49.4%)	70,540 (29.1%)	52,337 (21.6%)	12,648 (51.4%)	7,279 (26.9%)	6,091 (21.7%)
Alternative 1 - Maximum Increases to Height and Density	136,973 (48.3%)	93,828 (30.1%)	67,509 (21.6%)	15,554 (50.5%)	9,429 (27.8%)	7,371 (21.7%)
Alternative 2 - Mid-Range Increases to Height and Density	136,888 (48.3%)	93,908 (30.1%)	67,509 (21.6%)	15,548 (50.4%)	9,435 (27.8%)	7,371 (21.7%)
Alternative 3 - Moderate Increases to Height and Density	117,326 (48.1%)	81,403 (30.3%)	57,855 (21.6%)	13,605 (50.3%)	8,334 (28.0%)	6,449 (21.7%)

Source: Fehr & Peers, 2010.

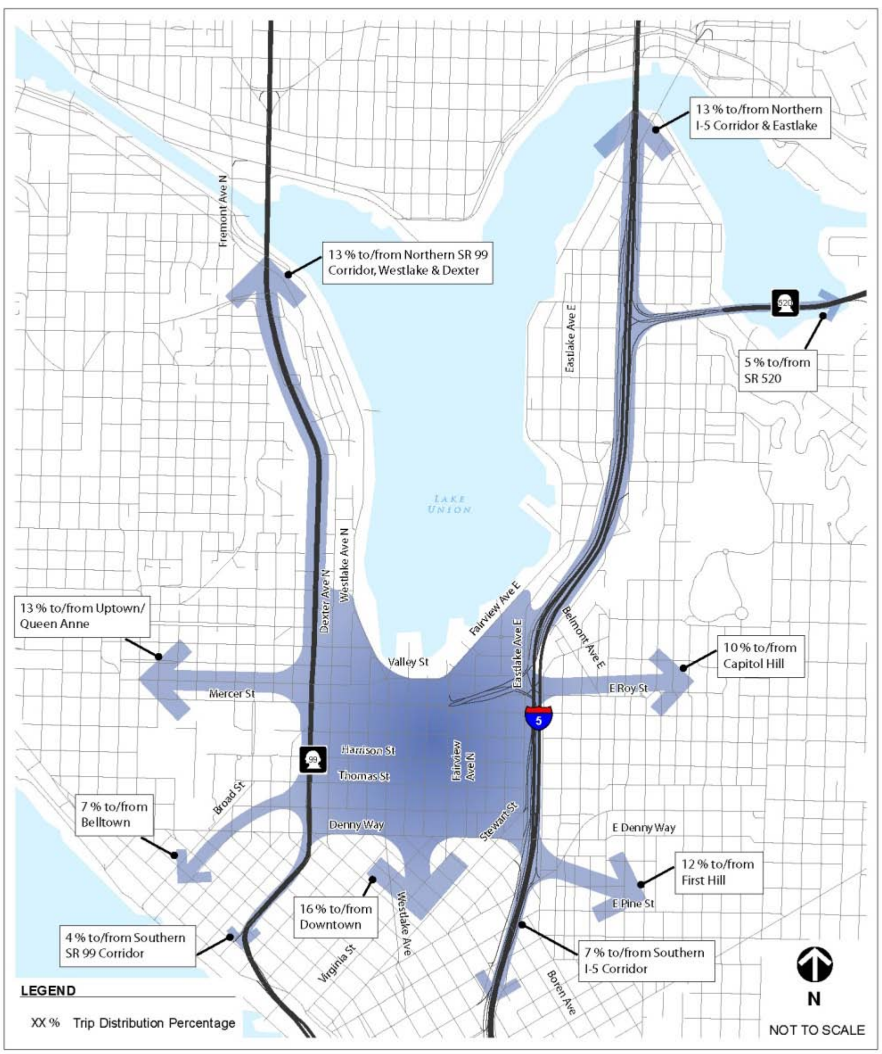
Note: See Appendix E for details on the mode share calculation. Auto trips include both SOV and HOV trips, so the number reported is not equivalent to person-trips. The Internal, Bicycle & Pedestrian and Transit categories are person-trips.

Trip Distribution

The City of Seattle model distributed the vehicle and transit trips presented in **Table 3.13-8** to the transportation system. The City of Seattle travel model indicated the following general distribution pattern for vehicle trips to and from the South Lake Union neighborhood in the PM peak period in 2031 (shown in **Figure 3.13-18**):

- 26% north via SR 99, I-5, or city streets
- 23% to Downtown/Belltown
- 22% east via city streets to Capitol Hill or First Hill
- 13% west via city streets to Queen Anne
- 11% south via SR 99 or I-5
- 5% east via SR 520

Figure 3.13-18
External Vehicle Trip Distribution



Source: Fehr & Peers, 2010

3.13.3 Environmental Impact – Deficiencies of the No Action Alternative

Affected Environment
Planning Scenarios
Environmental Impacts
Mitigation Strategies
Significant Unavoidable Adverse Impacts
Transportation Contents

Analysis results and environmental deficiencies of the No Action Alternative are summarized in this section. Deficiencies are defined as:

- A study corridor operating at a d/c ratio of 0.90 or greater (LOS E or F conditions)
- A transit line operating at a load factor of 1.25 or greater
- An increase in pedestrian or vehicle traffic in an area experiencing pedestrian safety concerns
- An increase in pedestrian delay at signalized intersections
- An increase in bicycle or vehicle traffic in an area experiencing bicycle safety concerns

As defined above, deficiencies are future transportation operations that do not meet existing service standards. These deficiencies would be caused by future development and individual project-level mitigation could reduce the magnitude of the deficiency; however, this level of detail is not known and cannot be considered in this EIS. In this case, the term deficiency does not refer to an existing transportation system issue is the responsibility of the City to address.

The No Action Alternative serves as the baseline for the impact analysis. It represents the operations of the transportation system if no actions were taken by the City Council and no zoning changes are made in the South Lake Union neighborhood. As mentioned previously, all reasonably foreseeable[6] transportation improvements (see **Figure 3.13-13**) are assumed to be in place in 2031. The same transportation network is assumed for the No Action and all three height and density alternatives.

AM and PM peak period traffic volume and transit ridership estimates were generated using the City's travel model. The City travel model accounts for background growth in traffic and transit ridership associated with increases in city and regional land uses anticipated over the next 20 years.

Analysis Results

The following section describes the results of the evaluation of transportation conditions under the 2031 No Action Alternative. Transportation deficiencies are identified according to the criteria outlined in Section 3.13.4.

[6] As defined in Section 3.13.2, reasonably foreseeable improvements include projects that have full funding commitments and projects with partial funding commitments but with a strategy in place to raise the remaining funds.

Study Corridors

Table 3.13-9 and **Figure 3.13-19** summarize the d/c ratios of the study corridors under the No Action Alternative. The following study corridors would operate at LOS E or F, exceeding the City's LOS standard, which constitutes a traffic operations deficiency:

- Fremont Bridge from N 35th Street to Westlake Avenue N
- Westlake Avenue N from Valley Street to Harrison Street
- Westlake Avenue N from Harrison Street to Denny Way
- Fairview Avenue N from Eastlake Avenue to Yale Avenue N
- Dexter Avenue N from Fremont Bridge to Valley Street
- Dexter Avenue N from Valley Street to Denny Way
- Mercer Street from Dexter Avenue N to Fairview Avenue N
- Denny Way from Aurora Avenue N to Stewart Street
- Boren Avenue from Denny Way to Pine Street
- Stewart Street from Eastlake Avenue E to Boren Avenue
- E Pine Street from Boren Avenue to Broadway
- Harrison Street from Aurora Avenue N to Eastlake Avenue N
- 9th Avenue N from Roy Street to Republican Street
- Howell Street/Eastlake Avenue from Stewart Street to Boren Avenue

Table 3.13-9
No Action Alternative: Demand-to-Capacity Ratios of Study Corridors

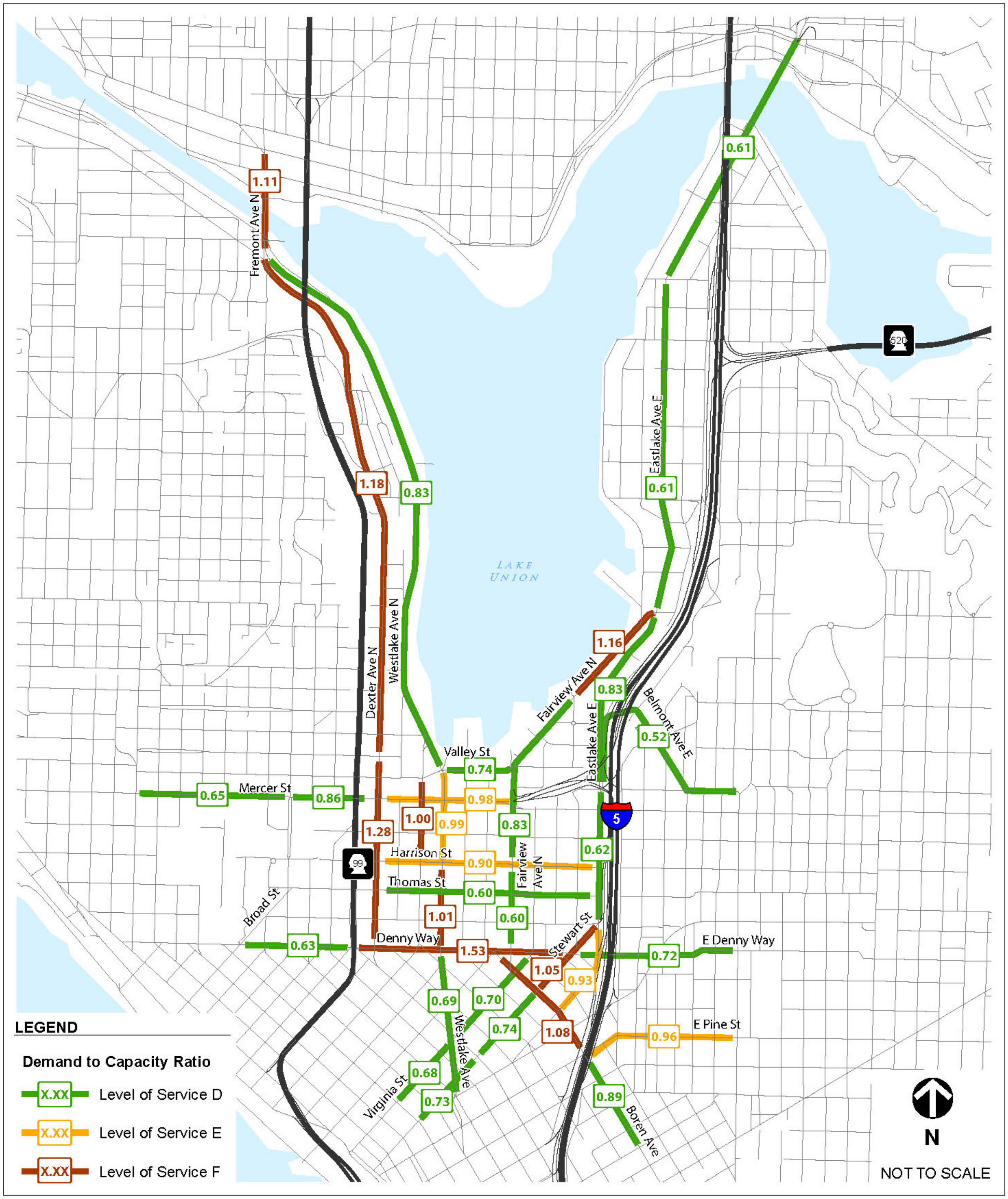
Road	Segment	Volume	Peak Hour	Peak Direction	Number of Through Lanes	Total Capacity	d/c Ratio/LOS
Fremont Bridge	**1) N 35th Street to Westlake Avenue N**	**1,768**	**PM**	**N**	**2**	**1,600**	**1.11/F**
Westlake Avenue N	2) Fremont Bridge to Valley Street	1,330	PM	N	2	1,600	0.83/D*
	3) Valley Street to Harrison Street	**1,040**	**PM**	**S**	**1.5**	**1,050**	**0.99/E**
	4) Harrison Street to Denny Way	**1,061**	**PM**	**S**	**1.5**	**1,050**	**1.01/F**
	5) Denny Way to Stewart Street	624	PM	N	1.5	900	0.69/D*
Eastlake Avenue E	6) N 40th Street to E Hamlin Street	1,166	AM	SW	2	1,920	0.61/D
	7) E Hamlin Street to Fairview Avenue N	1,163	AM	S	2	1,920	0.61/D
	8) Fairview Avenue to Lakeview Blvd E	578	AM	N	1	700	0.83/D*
	9) Lakeview Blvd E to Stewart Street	867	PM	S	2	1,400	0.62/D*
Fairview Avenue N.	**10) Eastlake Avenue to Yale Avenue N**	**810**	**AM**	**SW**	**1**	**700**	**1.16/F**
	11) Yale Avenue N to Harrison Street	1,389	PM	N	2	1,680	0.83/D
	12) Harrison Street to Denny Way	1,009	PM	N	2	1,680	0.60/D*
Dexter Avenue N	**13) Fremont Bridge to Valley Street**	**1,132**	**AM**	**S**	**1**	**960**	**1.18/F***
	14) Valley Street to Denny Way	**1,787**	**PM**	**N**	**2**	**1,400**	**1.28/F**
Valley Street	15) Westlake Avenue N to Fairview Avenue N	624	PM	E	1	840	0.74/D
Mercer Street	16) Queen Anne Avenue N to 5th Avenue N	1,091	PM	E	2	1,680	0.65/D
	17) 5th Avenue N to Dexter Avenue N	1,445	AM	E	2	1,680	0.86/D
	18) Dexter Avenue N to Fairview Avenue N	**2,057**	**AM**	**W**	**3**	**2,100**	**0.98/E**
Denny Way	19) Broad Street to Aurora Avenue N	1,053	AM	W	2	1,680	0.63/D
	20) Aurora Avenue N to Stewart Street	**1,607**	**PM**	**E**	**1.5**	**1,050**	**1.53/F***
	21) Stewart Street to Broadway E	1,151	AM	W	2	1,600	0.72/D

Road	Segment	Volume	Peak Hour	Peak Direction	Number of Through Lanes	Total Capacity	d/c Ratio/LOS
Broad Street	22) Denny Way to Westlake Avenue N	Segment does not exist under future conditions					
Boren Avenue	**23) Denny Way to Pine Street**	**1,297**	**AM**	**NW**	**2**	**1,200**	**1.08/F***
	24) Pine Street to University Street	1,068	PM	SE	2	1,200	0.89/D
Stewart Street	**25) Eastlake Avenue E to Boren Avenue**	**2,196**	**AM**	**SW**	**3.5**	**2,100**	**1.05/F**
	26) Boren Avenue to 7th Avenue	1,334	AM	SW	3	1,800	0.74/D
	27) 7th Avenue to 3rd Avenue	873	AM	SW	2	1,200	0.73/D
Virginia Street	28) Denny Way to Westlake Avenue N	839	PM	NE	2	1,200	0.70/D
	29) Westlake Avenue N to 3rd Avenue	1,215	PM	NE	3	1,800	0.68/D
E Pine Street	**30) Boren Avenue to Broadway**	**691**	**PM**	**W**	**1**	**720**	**0.96/E**
Lakeview/Belmont/Ro y	31) Eastlake Avenue to Broadway E	415	PM	E	1	800	0.52/D
Thomas Street	32) Aurora Avenue N to Eastlake Avenue E	429	PM	E	1	720	0.60/D
Harrison Street	**33) Aurora Avenue N to Eastlake Avenue E**	**537**	**PM**	**E**	**1**	**600**	**0.90/E**
9th Avenue N	**34) Roy Street to Republican Street**	**698**	**PM**	**N**	**1**	**700**	**1.00/F**
Howell/Eastlake	**35) Stewart Street to Boren Avenue**	**1,113**	**PM**	**N**	**2**	**600**	**0.93/E**

Source: Fehr & Peers, 2010

Note: * These study corridors intersect or are adjacent to other study corridors that are expected to operate at LOS F conditions. Actual LOS may be worse because of queuing. Corridors that do not meet the City LOS standard are shown in bold.

Figure 3.13-19
Demand-to-Capacity Ratios – No Action Alternative



Source: Fehr & Peers, 2010

As defined by the HCM, the poor operations on the study corridors identified above can also be assumed to translate to poor intersection operations (LOS E and F) at key intersections along these corridors, such as Mercer Street/Westlake Avenue N, Mercer Street/Fairview Avenue N, Denny Way/Westlake Avenue N, and Denny Way/Boren Avenue.

<u>Transit</u>

As was the case under the existing conditions analysis, transit operations are assessed using load factors. Ridership, frequency, and capacity will change by 2031, so the City of Seattle travel model was used to predict future load factors. Details of the calculations and assumptions can be found in **Appendix E**.

The 2031 No Action Alternative AM peak hour load factors are shown in **Table 3.13-10**. Since the Seattle travel model does not explicitly model PM peak period transit trips (they are modeled as the reverse of the AM trips), these load factors would also apply to PM peak hour conditions.

Table 3.13-10
No Action Alternative: 2031 South Lake Union Transit AM Peak Hour Load Factors

Route	Termini Locations	Northbound	Southbound
5	Downtown, Shoreline	0.64	0.84
8	Uptown, Rainier Valley	0.89	0.88
16	Downtown, Northgate	0.53	0.77
17	Downtown, Loyal Heights	0.77	0.68
21	Downtown, Arbor Heights	1.17	-
25	Downtown, Laurelhurst	0.65	1.00
26	Downtown, Green Lake	0.83	0.77
28	Downtown, Broadview	1.19	0.84
29	**Downtown, Woodland Park**	1.19	**1.49**
56	**South Lake Union, West Seattle**	**1.38**	-
66	Downtown, Northgate	0.53	0.76
70	Downtown, University District	0.65	0.62
121	Downtown, Burien	0.67	-
308	Downtown, Lake Forest Park	-	0.97
313	Uptown, Bothell	-	0.45
316	Uptown, Shoreline	-	0.82
Rapid Ride	Downtown, Aurora Village Transit Center	0.62	0.80

Source: Fehr & Peers, 2010

Note: Dashes indicate either that the route does not serve South Lake Union or does not exist in the travel model in that direction.

Based upon the results above, two transit routes serving South Lake Union will not operate with acceptable load factors under the No Action Alternative.

- Route 29 (southbound in the AM peak hour and northbound in the PM peak hour)
- Route 56 (northbound in the AM peak hour and southbound in the PM peak hour)

Table 3.13-11 displays the estimated AM peak hour headways under 2031 conditions. Lines with headways greater than 15 minutes in at least one direction are noted in bold since they do not meet the UVTN transit frequency standards. Since the Action Alternatives themselves do not affect transit frequency, the headways in **Table 3.13-11** also apply to the Action Alternatives. The table highlights which routes do not meet the UVTN frequency goal; however, overall transit delay on these routes (caused by infrequent service) will increase with the additional ridership generated by each of 2031 development alternatives.

Based on the results, eight transit lines do not meet the UVTN frequency goal of 15 minute headways during the AM peak hour[7]. Those lines include Routes 16, 25, 28, 29, 66, 308, 313, and 316. The UVTN calls for 15 minute frequencies 18 hours of the day, every day of the week. The travel model does not provide transit information for that length of time. Therefore, the travel model's expected frequency improvements within the peak period along with current midday and weekend schedules were considered (see **Appendix E** for details). It appears likely that all routes with the exception of Aurora RapidRide would not meet the UVTN frequency goal. Although service within the weekday peak periods, as well as the midday period for many routes, would conform to the UVTN standards, it is unlikely that weekend schedules would change enough to meet the frequency goal.

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[7] Since the Seattle travel model does not explicitly model PM peak hour conditions, similar conditions are also assumed in the evening peak hour.

Table 3.13-11
No Action Alternative: 2031 South Lake Union Transit AM Peak Hour Headways

Route	Termini Locations	Northbound	Southbound
5	Downtown, Shoreline	12	11
8	Uptown, Rainier Valley	7	7
16	**Downtown, Northgate**	**17**	**17**
17	Downtown, Loyal Heights	15	15
21	Downtown, Arbor Heights	9	-
25	**Downtown, Laurelhurst**	**24**	**26**
26	Downtown, Green Lake	15	12
28	**Downtown, Broadview**	**12**	**16**
29	**Downtown, Woodland Park**	**26**	**26**
56	South Lake Union, West Seattle	13	-
66	**Downtown, Northgate**	**26**	**26**
70	Downtown, University District	14	14
121	Downtown, Burien	13	-
308	**Downtown, Lake Forest Park**	**-**	**20**
313	**Uptown, Bothell**	**-**	**20**
316	**Uptown, Shoreline**	**-**	**20**
Rapid Ride	Downtown, Aurora Village Transit Center	6	6

Source: Fehr & Peers, 2010

Note: Headways were determined by applying the change between base and future year model headways to existing headways when possible. For new transit lines, the headways provided are direct model outputs. Actual headways will vary when transit lines are implemented.

Pedestrian and Bicycle System

As shown in the trip generation table (**Table 3.13-8**), the land use development anticipated to occur under the No Action Alternative will result in a substantial number of pedestrian and bicycle trips within the study area. Typically, pedestrian and bicycle travel demand-to-capacity analyses are not performed since commonly accepted analysis methodologies, like the HCM, would not identify any capacity shortages outside of exceptional cases like Manhattan or Downtown Chicago. Further, bicycle and pedestrian environments are more often measured by the quality of experience they provide rather than by their levels of congestion.

While pedestrian and bicycle demand/capacity issues are not likely, buildout under the No Action Alternative could lead to consequences such as:

- Additional pedestrian and vehicle travel at major intersections could lead to increased pedestrian delays if the City retimes traffic signals to facilitate vehicle flow.
- Additional vehicle traffic at the Mercer Street/Dexter Avenue N could increase vehicle-bicycle conflicts at this High Bicycle Accident intersection.

Parking

Although it is unknown how many off-street parking spaces will be provided by 2031, parking code requirements, typical market demand, and expected growth can give some indication of future supply, as shown in **Table 3.13-12**. Current parking code requirements were assumed for retail and non-retail commercial land uses. No parking is required for multifamily residential uses in urban centers, which applies to most of the study area; however, parking is still usually provided. It was assumed that one parking space per dwelling unit would be supplied for residential uses. The growth in households and jobs was used to estimate future additional off-street parking spaces under the No Action Alternative. Details of the calculation may be found in **Appendix E**.

Table 3.13-12
No Action Alternative: Estimated Additional Off-Street Parking Supply

Alternative	Residential	Retail	Non-Retail	Total
Assumed Supply	1 space/ dwelling unit	2 spaces /ksf[1]	1 space/ksf[1]	
No Action	9,200	2,087	4,870	16,157

Source: City of Seattle Municipal Code 23.54.015, 2010

Note: Basic retail and office requirements published in the City Code were used for this analysis, and mirror the assumptions used in the Downtown Height & Density EIS. Residential parking was assumed to be provided based on market demand at one space per unit.

1. ksf – 1,000 square feet

The City and King County Metro are currently considering locations to be used as bus layover areas, which has the potential to remove on-street parking from the South Lake Union neighborhood. If current parking demand trends continue as highlighted by the existing peak period parking shortages near the Amazon campus, there will likely be at least temporary shortages for both on-street and off-street parking under the No Action Alternative, particularly around office uses. The relationship between parking supply and cost will cause prices to climb as demand approaches or exceeds supply. In turn, this will cause some travelers to switch to modes such as transit, thereby freeing up some parking.

Off-street parking shortages often result in spillover to adjacent neighborhoods, but this may not be a problem in South Lake Union. The adjacent areas in Capitol Hill, Lower Queen Anne, and Downtown are either difficult to access or offer paid parking only, making them inconvenient parking locations.

Freight

As described in the Existing Conditions analysis section, the quality of freight movement is assessed based on the d/c ratios on major truck streets. As shown in **Table 3.13-9**, traffic congestion on Mercer Street between Dexter Avenue and Fairview Avenue N would increase substantially when compared to existing conditions. This increase in traffic congestion will lead increased difficulty for trucks to maneuver and increased travel times, which could delay trucking operations. This is considered a freight mobility deficiency in the area.

Note that the increase in traffic congestion is caused by both additional development in South Lake Union and regional traffic growth. While Valley Street would operate at an acceptable level of congestion under the No Action Alternative; however, it is unlikely that this would remain a major truck street after the Mercer East Corridor project is complete.

Additionally, as the South Lake Union neighborhood develops under the No Action Alternative, there could be localized freight deficiencies related to the lack of loading areas and small curb radii that trucks cannot navigate.

The removal of Broad Street between 5th Avenue N/Thomas Street and Mercer Street will leave a gap in the City of Seattle Major Truck Street network. This gap does not constitute a freight mobility deficiency since freight traffic can use arterial streets. However, the City should update its Major Truck Street system to identify a replacement for Broad Street.

Traffic Safety

As described earlier, the City of Seattle evaluates traffic safety concerns based on the definition of High Accident Locations. Since High Accident Locations calculate the average rate of collisions per year at intersections without any regard to the traffic flow through the intersection, the increased traffic volumes anticipated under the No Action Alternative could lead to the identification of additional High Accident Locations. While there may be more High Accident Locations under future conditions with the No Action Alternative, there is no data available to suggest that a volume-based collision rate (e.g., collisions per million entering vehicles) will increase with buildout of the No Action Alternative.

3.13.4 Environmental Impact – Identification

The 2031 No Action Alternative serves as the baseline for identifying impacts to transportation facilities in 2031 caused by the Action Alternative. This section describes the methodology used to identify impacts under each of the height and density alternatives.

A *significant* transportation impact is said to occur if any of the proposed alternatives would:

- Cause an increase in traffic demand that results in a study corridor, that operates acceptably under the 2031 No Action Alternative, to operate unacceptably (d/c ratio of 0.9, which equates to LOS E or F conditions)
- Cause an increase in traffic on a study corridor that operates unacceptably (as measured by d/c ratios and LOS) under the 2031 No Action scenario that results in the d/c ratio increasing by at least .01 (increases in d/c ratios of less than .01 are less than typical daily fluctuations and are not noticeable by drivers – see **Appendix E** for clarification)
- Lead to an increase in the peak hour load factor on a transit line which exceeds King County Metro's standard of 1.25

A transportation impact is said to occur if any of the proposed alternatives would:

- Increase pedestrian or vehicle traffic in an area experiencing pedestrian safety concerns
- Increase pedestrian delay at signalized intersections
- Increase bicycle or vehicle traffic in an area experiencing bicycle safety concerns

3.13.5 Environmental Impacts – Action Alternatives

This section provides the evaluation of each of the height and density alternatives in year 2031. Due to the similarities among the alternatives, they are all addressed in the same section to minimize redundancy. The impacts and potential mitigation measures for all alternatives are described in the following section.

Traffic volume estimates for each of the three height and density alternatives uses the same methodology as described for the No Action Alternative. See the trip generation discussion in Sections 3.13.1 and 3.13.3 for the full details.

Analysis Results

The following section describes the results of the evaluation of transportation conditions under each of the project alternatives in 2031.

Study Corridors

Table 3.13-13 and **Figures 3.13-20, 3.13-21 and 3.13-22** summarize the demand-to-capacity ratios of the study corridors under the action alternatives. Significant transportation operations impacts, which are based on the criteria and thresholds described in Section 3.13.4, are noted in bold and highlighted below.

Under all three height and density alternatives, the following study corridors experience significant impacts to traffic operations:

- Westlake Avenue N from Valley Street to Harrison Street
- Westlake Avenue N from Harrison Street to Denny Way
- Mercer Street from Dexter Avenue N to Fairview Avenue N
- Denny Way from Aurora Avenue N to Stewart Street
- Boren Avenue from Denny Way to Pine Street
- Boren Avenue from Pine Street to University Street
- Stewart Street from Eastlake Avenue E to Boren Avenue
- Harrison Street from Aurora Avenue N to Eastlake Avenue E
- 9th Avenue N from Roy Street to Republican Street

In addition to those previously listed, the following study corridors are significantly impacted under Alternatives 1 and 2:

- Fremont Bridge
- Eastlake Avenue E from Fairview Avenue to Lakeview Blvd E
- Dexter Avenue N from Valley Street to Denny Way
- E Pine Street from Boren Avenue to Broadway
- Howell Street/Eastlake Avenue from Stewart Street to Boren Avenue

As defined by the HCM, the poor operations on the study corridors identified above can also be assumed to translate to poor intersection operations (LOS E and F) at key intersections along these corridors, such as Mercer Street/Westlake Avenue N, Mercer Street/Fairview Avenue N, Denny Way/Westlake Avenue N, and Denny Way/Boren Avenue.

Table 3.13-13
Demand-to-Capacity Ratios of Study Corridors

		NO ACTION ALTERNATIVE			ALTERNATIVE 1			ALTERNATIVE 2			ALTERNATIVE 3			
Road	**Segment**	**Volume**	**Peak Hour/ Direction**	**d/c Ratio/ LOS**	**Volume**	**Peak Hour/ Direction**	**d/c Ratio/ LOS**	**Volume**	**Peak Hour/ Direction**	**d/c Ratio/ LOS**	**Volume**	**Peak Hour/ Direction**	**d/c Ratio/ LOS**	
Fremont Bridge	1) N 35th Street to Westlake Avenue N	1,768	PM/N	1.11/F	**1,813**	**PM/N**	**1.13/F**	**1,805**	**PM/N**	**1.13/F**	1,779	PM/N	1.11/F	
Westlake Avenue N	2) Fremont Bridge to Valley Street	1,330	PM/N	0.83/D	1,336	PM/N	0.84/D	1,336	PM/N	0.84/D	1,332	PM/N	0.83/D	*
	3) Valley Street to Harrison Street	1,040	PM/S	0.99/E	**1,130**	**PM/S**	**1.08/F**	**1,123**	**PM/S**	**1.07/F**	**1,071**	**PM/S**	**1.02/F**	*
	4) Harrison Street to Denny Way	1,061	PM/S	1.01/F	**1,137**	**PM/S**	**1.08/F**	**1,135**	**PM/S**	**1.08/F**	**1,090**	**PM/S**	**1.04/F**	*
	5) Denny Way to Stewart Street	624	PM/N	0.69/D	657	PM/N	0.73/D	649	PM/N	0.72/D	640	PM/N	0.71/D	*
Eastlake Avenue E	6) N 40th Street to E Hamlin Street	1,166	AM/SW	0.61/D	1,210	AM/SW	0.63/D	1,208	PM/NE	0.63/D	1,177	AM/SW	0.61/D	
	7) E Hamlin Street to Fairview Avenue N	1,163	AM/S	0.61/D	1,224	PM/N	0.64/D	1,221	PM/N	0.64/D	1,175	AM/S	0.61/D	*
	8) Fairview Avenue to Lakeview Blvd E	578	AM/N	0.83/D	**641**	**PM/N**	**0.92/E**	**628**	**PM/N**	**0.90/E**	608	PM/N	0.87/D	
	9) Lakeview Blvd E to Stewart Street	867	PM/S	0.62/D	921	PM/S	0.66/D	922	PM/S	0.66/D	888	PM/S	0.63/D	*
Fairview Avenue N.	10) Eastlake Avenue to Yale Avenue N	810	AM/SW	1.16/F	801	AM/SW	1.14/F	808	AM/SW	1.15/F	792	AM/SW	1.13/F	
	11) Yale Avenue N to Harrison Street	1,389	PM/N	0.83/D	1,392	PM/N	0.83/D	1,418	PM/N	0.84/D	1,388	PM/N	0.83/D	*
	12) Harrison Street to Denny Way	1,009	PM/N	0.60/D	1,033	PM/N	0.61/D	1,030	PM/N	0.61/D	1,014	PM/N	0.60/D	*
Dexter Avenue N	13) Fremont Bridge to Valley Street	1,132	AM/S	1.18/F	1,115	AM/S	1.16/F	1,102	AM/S	1.15/F	1,127	AM/S	1.17/F	*
	14) Valley Street to Denny Way	1,787	PM/N	1.28/F	**1,810**	**PM/N**	**1.29/F**	**1,807**	**PM/N**	**1.29/F**	1,795	PM/N	1.28/F	*
Valley Street	15) Westlake Avenue N to Fairview Avenue N	624	PM/E	0.74/D	657	PM/E	0.78/D	664	PM/E	0.79/D	646	PM/E	0.77/D	
Mercer Street	16) Queen Anne Avenue N to 5th Avenue N	1,091	PM/E	0.65/D	1,091	PM/E	0.65/D	1,091	PM/E	0.65/D	1,091	PM/E	0.65/D	
	17) 5th Avenue N to Dexter Avenue N	1,445	AM/E	0.86/D	1,445	AM/E	0.86/D	1,445	AM/E	0.86/D	1,445	AM/E	0.86/D	*
	18) Dexter Avenue N to Fairview Avenue N	2,057	AM/W	0.98/E	**2,097**	**AM/W**	**1.00/F**	**2,109**	**AM/W**	**1.00/F**	**2,078**	**AM/W**	**0.99/E**	*
Denny Way	19) Broad Street to Aurora Avenue N	1,053	AM/W	0.63/D	1,058	AM/W	0.63/D	1,084	PM/E	0.65/D	1,057	AM/W	0.63/D	*
	20) Aurora Avenue N to Stewart Street	1,607	PM/E	1.53/F	**1,642**	**PM/E**	**1.56/F**	**1,648**	**PM/E**	**1.57/F**	**1,616**	**PM/E**	**1.54/F**	*
	21) Stewart Street to Broadway E	1,151	AM/W	0.72/D	1,195	AM/W	0.75/D	1,193	AM/W	0.75/D	1,161	AM/W	0.73/D	*
Broad Street	22) Denny Way to Westlake Avenue N	Segment does not exist under future conditions												
Boren Avenue	23) Denny Way to Pine Street	1,297	AM/NW	1.08/F	**1,329**	**AM/NW**	**1.11/F**	**1,333**	**AM/NW**	**1.11/F**	**1,309**	**AM/NW**	**1.09/F**	
	24) Pine Street to University Street	1,068	PM/SE	0.89/D	**1,095**	**PM/SE**	**0.91/E**	**1,097**	**PM/SE**	**0.91/E**	**1,080**	**PM/SE**	**0.90/E**	
Stewart Street	25) Eastlake Avenue E to Boren Avenue	2,196	AM/SW	1.05/F	**2,262**	**AM/SW**	**1.08/F**	**2,283**	**AM/SW**	**1.09/F**	**2,232**	**AM/SW**	**1.06/F**	*
	26) Boren Avenue to 7th Avenue	1,334	AM/SW	0.74/D	1,347	AM/SW	0.75/D	1,356	AM/SW	0.75/D	1,335	AM/SW	0.74/D	
	27) 7th Avenue to 3rd Avenue	873	AM/SW	0.73/D	898	AM/SW	0.75/D	898	AM/SW	0.75/D	884	AM/SW	0.74/D	

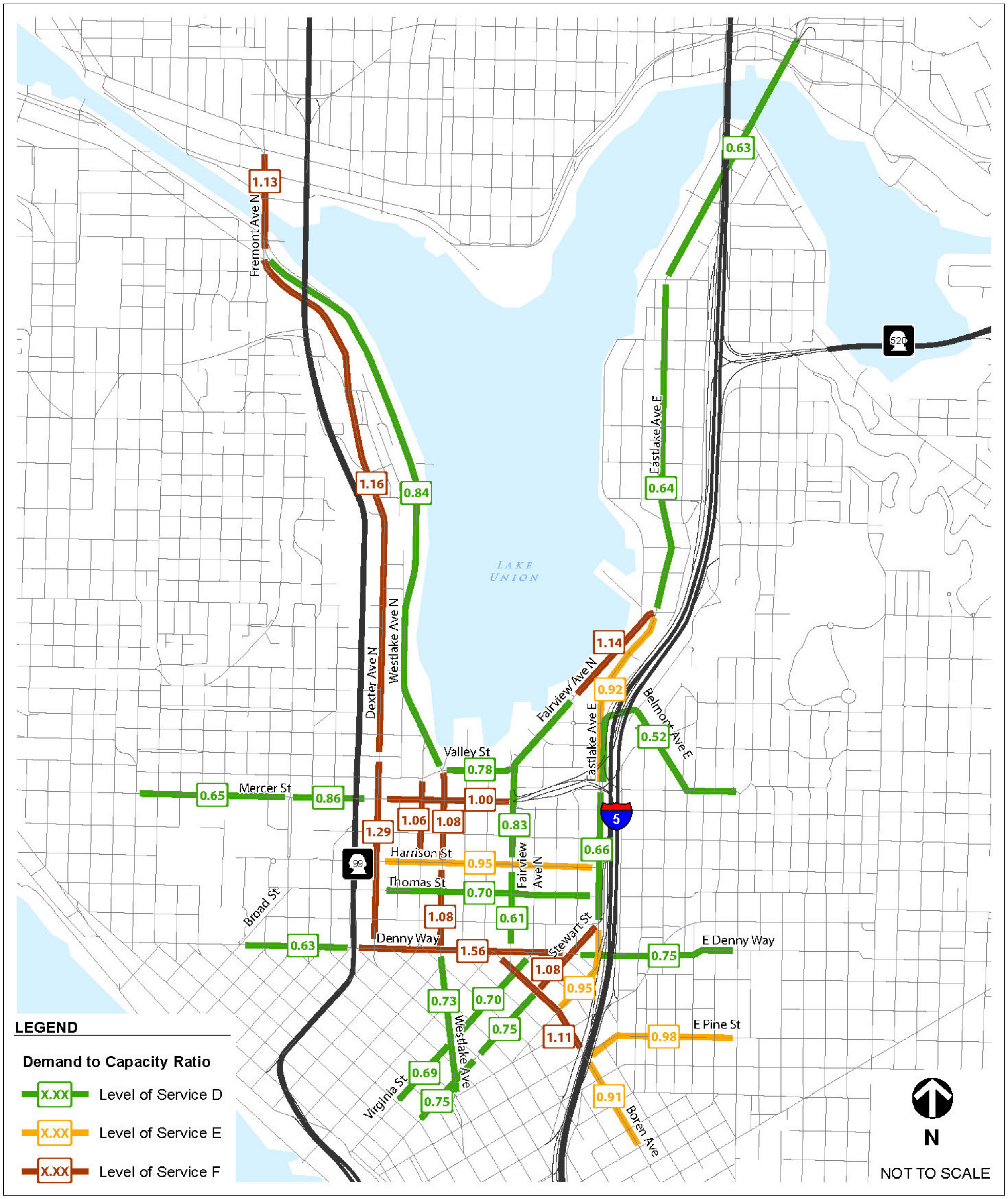
Road	Segment	NO ACTION ALTERNATIVE Volume	Peak Hour/ Direction	d/c Ratio/ LOS	ALTERNATIVE 1 Volume	Peak Hour/ Direction	d/c Ratio/ LOS	ALTERNATIVE 2 Volume	Peak Hour/ Direction	d/c Ratio/ LOS	ALTERNATIVE 3 Volume	Peak Hour/ Direction	d/c Ratio/ LOS	
Virginia Street	28) Denny Way to Westlake Avenue N	839	PM/NE	0.70/D	834	PM/NE	0.70/D	835	PM/NE	0.70/D	839	PM/NE	0.70/D	*
	29) Westlake Avenue N to 3rd Avenue	1,215	PM/NE	0.68/D	1,233	PM/NE	0.69/D	1,230	PM/NE	0.68/D	1,222	PM/NE	0.68/D	
E Pine Street	30) Boren Avenue to Broadway	691	PM/W	0.96/E	**705**	**AM/W**	**0.98/E**	**705**	**PM/W**	**0.98/E**	692	AM/W	0.96/E	
Lakeview/Belmont/Roy	31) Eastlake Avenue to Broadway E	415	PM/E	0.52/D	415	PM/E	0.52/D	415	PM/E	0.52/D	415	PM/E	0.52/D	
Thomas Street	32) Aurora Avenue N to Eastlake Avenue E	429	PM/E	0.60/D	505	PM/E	0.70/D	505	PM/E	0.70/D	459	PM/E	0.64/D	*
Harrison Street	33) Aurora Avenue N to Eastlake Avenue E	537	PM/E	0.90/E	**569**	**PM/E**	**0.95/E**	**588**	**PM/E**	**0.98/E**	**549**	**PM/E**	**0.92/E**	*
9th Avenue N	34) Roy Street to Republican Street	698	PM/N	1.00/F	**741**	**PM/N**	**1.06/F**	**753**	**PM/N**	**1.08/F**	**713**	**PM/N**	**1.02/F**	
Howell/Eastlake	35) Stewart Street to Boren Avenue	1,113	PM/N	0.93/E	**1,140**	**PM/N**	**0.95/E**	**1,130**	**PM/N**	**0.94/E**	1,115	PM/N	0.93/E	

Note: Bold text signifies a significant impact.

*These study corridors intersect or are adjacent to other study corridors that are expected to operate at LOS F conditions. Actual LOS may be worse because of queuing.

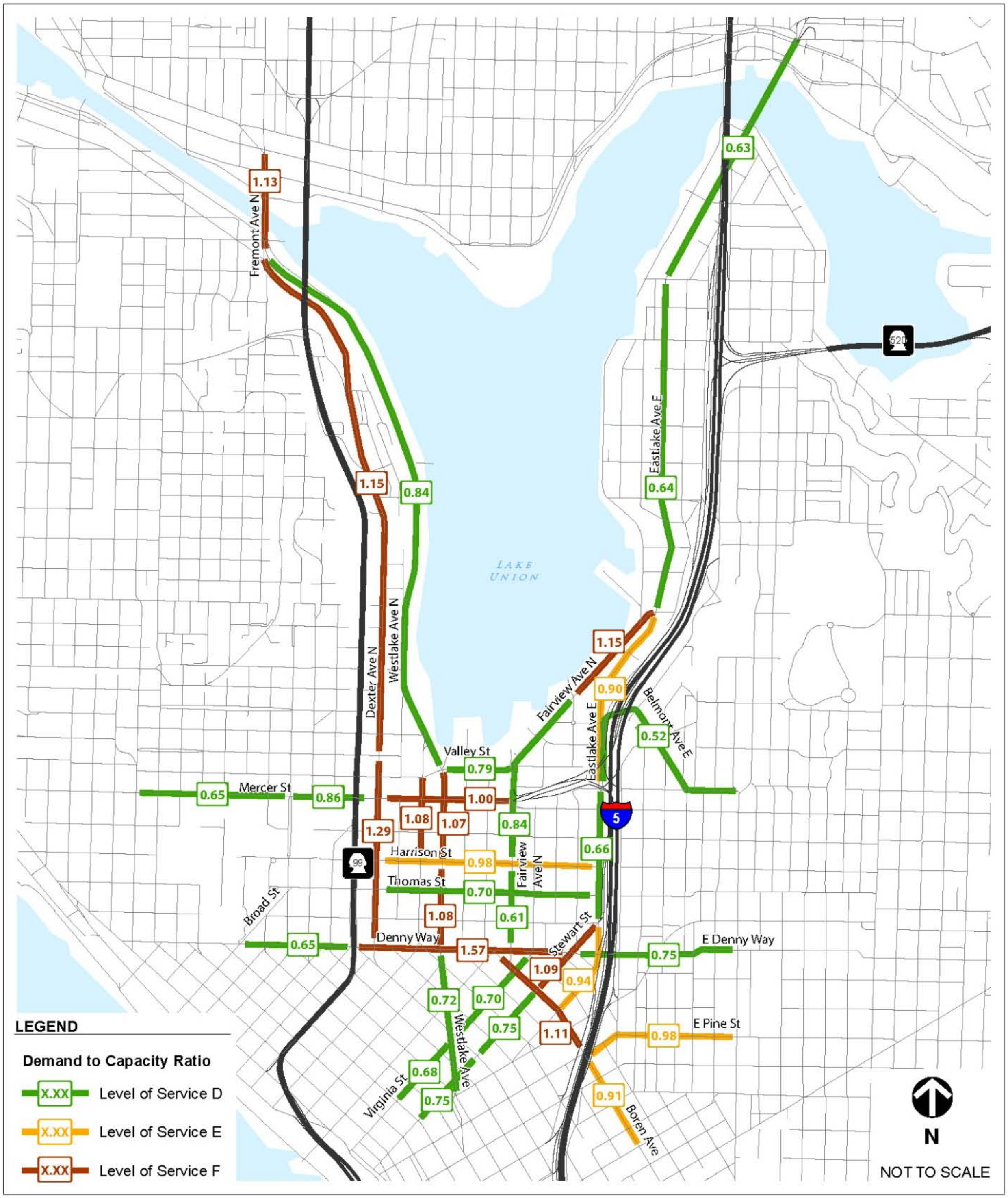
Source: Fehr & Peers, 2010

Figure 3.13-20
Demand-to-Capacity Ratios – Alternative 1



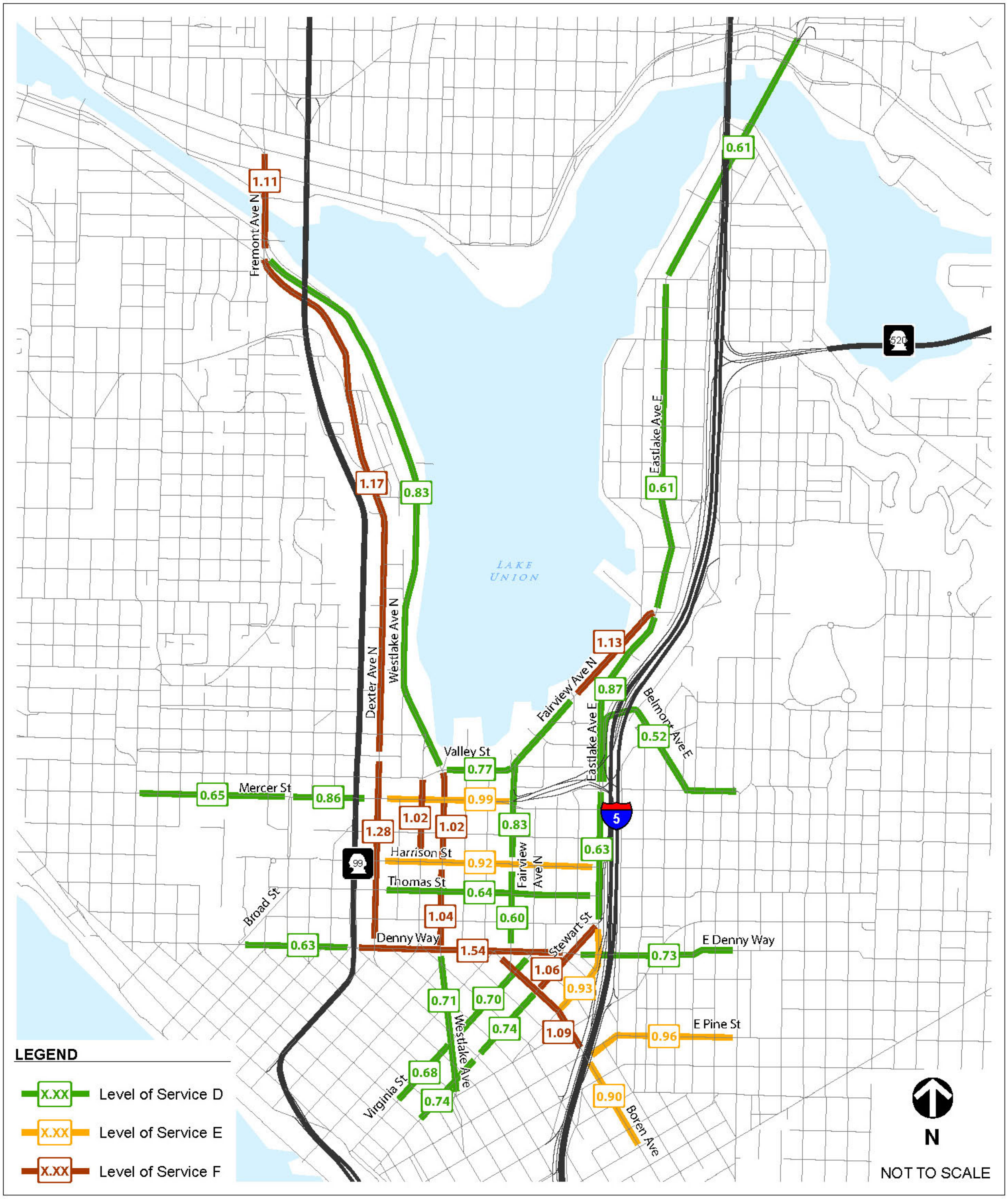
Source: Fehr & Peers, 2010

Figure 3.13-21
Demand-to-Capacity Ratios – Alternative 2



Source: Fehr & Peers, 2010

Figure 3.13-22
Demand-to-Capacity Ratios – Alternative 3



Source: Fehr & Peers, 2010

Transit

Transit ridership among the three height and density alternatives is very similar and the Action results shown in **Table 3.13-14** are representative of the load factors expected under all three height and density alternatives. The results from the No Action Alternative are included for comparison.

Table 3.13-14
Action and No Action Comparison: 2031 South Lake Union Transit Route AM Load Factors

Route	Termini Locations	No Action		Action	
		NB	SB	NB	SB
5	Downtown, Shoreline	0.64	0.84	0.68	0.84
8	Uptown, Rainier Valley	0.89	0.88	1.01	0.95
16	Downtown, Northgate	0.53	0.77	0.53	0.77
17	Downtown, Loyal Heights	0.77	0.68	0.93	0.86
21	**Downtown, Arbor Heights**	1.17	-	**1.35**	-
25	**Downtown, Laurelhurst**	1.19	0.84	0.65	1.19
26	Downtown, Green Lake	0.65	1.00	1.04	0.88
28	**Downtown, Broadview**	0.83	0.77	**1.40**	0.97
29	**Downtown, Woodland Park**	1.19	**1.49**	**1.49**	**1.79**
56	**South Lake Union, West Seattle**	**1.38**	-	**1.53**	-
66	Downtown, Northgate	0.53	0.76	0.53	0.76
70	Downtown, University District	0.65	0.62	0.81	0.92
121	Downtown, Burien	0.67	-	0.87	-
308	Downtown, Lake Forest Park	-	0.97	-	1.05
313	Uptown, Bothell	-	0.45	-	0.60
316	Uptown, Shoreline	-	0.82	-	0.93
Rapid Ride	Downtown, Aurora Village Transit Center	0.62	0.80	0.68	0.80

Source: Fehr & Peers, 2010

Note: Dashes indicate either that the route does not serve South Lake Union or does not exist in the travel model in that direction.

Transit lines that would operate unacceptably under the Action Alternatives include:

- Route 21 (northbound AM and southbound PM)
- Route 28 (northbound AM and southbound PM)
- Route 29 in both directions (AM and PM peak hours)
- Route 56 (northbound AM and southbound PM)

The transit lines above are considered to be significantly impacted by the three height and density alternatives.

The load factor of the South Lake Union Streetcar was also analyzed. The streetcar seats 29, but has a total capacity of 140. Ridership data from 2010 indicates the current load factor is 0.27 (assuming total capacity rather than seating capacity). The City of Seattle travel model assumes headways will decrease from 15 minutes to 10 minutes by 2031[8], resulting in a 50 percent increase in capacity. This capacity increase will keep pace with the future ridership estimates from the City's travel model, causing the load factor to remain at 0.27 in 2031.

Since the Action Alternatives do not include any changes to transit headways in the area, transit frequency is the same as under the No Action Alternatives (see **Table 3.13-11**). As described in the previous section, only the Aurora Rapid Ride Line is expected to meet the frequency goals outlined in the UVTN.

Pedestrian and Bicycle System

As described in the No Action Alternative analysis, the increased land uses associated with the height and density alternatives will lead to a substantial increase in the number of bicycle and pedestrian trips within the study area. However, because of the exceptional levels of pedestrian and bicycle activity required to trigger poor LOS conditions as defined by the HCM, no pedestrian or bicycle demand/capacity impacts are anticipated under the three height and density alternatives.

While no bicycle or pedestrian demand/capacity impacts are anticipated, there are several adverse impacts to the pedestrian and bicycle system based on the impact identification criteria listed in Section 3.13.4:

- The increased heights and densities associated with each of the alternatives will lead to additional traffic demand on area

[8] This reduction in headways assumes that a fourth car is purchased.

roadways, which could result in longer traffic signal cycle lengths. Longer cycle lengths are associated with increased pedestrian delay, which discourages pedestrian travel. Any increases in pedestrian delay at intersections would be an impact to pedestrian mobility.

- Additional vehicle traffic at the Mercer Street/Dexter Avenue N could increase vehicle-bicycle conflicts at this High Bicycle Accident intersection.

Parking

The growth in households and jobs for each action alternative was used to estimate future additional parking spaces given current parking code requirements for commercial uses. Despite no minimum requirements for multifamily residential uses in the study area, parking is usually provided. The assumption for this analysis is that one parking space per dwelling unit would be built, as shown in **Table 3.13-15**. Details of the calculation may be found in **Appendix E**.

Table 3.13-15
No Action and Action Alternatives Comparison: Estimated Additional Parking Supply

Alternative	Residential	Retail	Non-Retail	Total
Assumed Supply	1 space/ dwelling unit	2 spaces /ksf[1]	1 space/ksf[1]	
No Action	9,200	2,087	4,870	16,157
Alternative 1	11,900	2,856	6,664	21,420
Alternative 2	11,900	2,856	6,664	21,420
Alternative 3	11,900	2,400	5,600	19,900

Source: City of Seattle Municipal Code 23.54.015, 2010

Note: Parking codes vary depending on specific use. Basic retail and office requirements were used for this analysis, and mirror the assumptions used in the Downtown Height & Density EIS.

1. ksf – 1,000 square feet

As was noted in the No Action Alternative parking discussion, if current parking demand trends continue as highlighted by the existing peak period parking shortages near the Amazon campus, there will likely be shortages of both on-street and off-street parking in the future particularly around office uses. The level of impact will vary depending on the intensity of land use. The balance between parking supply, parking cost, and alternative mode use will cause some travelers to change modes. Therefore, the parking impact may not be long-term since travelers will shift to other modes in response to limited parking supply and higher parking cost.

Although Alternatives 1 and 2 would have the most demand, they would also provide more supply based on market trends. Likewise, the No Action Alternative would have less demand, but also less supply. Because of the relationship between development intensity, parking supply, and parking demand, all Action alternatives are expected to have short-term parking impacts.

Parking shortages typically result in spillover to adjacent neighborhoods, but this may not be a problem in South Lake Union. The adjacent areas in Capitol Hill, Lower Queen Anne, and Downtown are either difficult to access or offer only paid parking, making them unattractive places to park.

Freight

As shown in **Table 3.13-13**, d/c ratios on Mercer Street between Dexter Avenue and Fairview Avenue N would increase under the three height and density alternatives. This increase in traffic will exacerbate LOS E and F conditions, which will increase delay and reduce mobility for freight vehicles on these routes. This is considered a significant impact to freight mobility.

As was the case under the No Project Alternative, the increase in traffic congestion along the Major Truck Streets is caused by both additional development in South Lake Union and regional traffic growth. Also, with the removal of Broad Street between 5th Avenue N/Thomas Street and Mercer Street to accommodate the SR 99 bored tunnel, the City should update its Major Truck Street system to identify a replacement route.

In addition to the area-wide issues described above, there are also potential localized freight impacts that could occur as the South Lake Union neighborhood develops. As was the case under the No Action Alternative, impacts to freight mobility could be caused by lack of loading areas and small curb radii that cannot be navigated by trucks.

Traffic Safety

As described under the No Action Alternative analysis, while it is likely that the total number of vehicle collisions will increase proportionally with the increase in traffic in the South Lake Union area, there is nothing to suggest that the volume-based rate of vehicle-to-vehicle collisions will increase with the implementation of the height and density alternatives. Therefore, no significant traffic safety impacts are anticipated.

3.13.6 Mitigation Strategies

This section identifies potential mitigation measures that could be implemented to lessen the magnitude of the impacts identified in the previous section.

Mitigation strategies to address traffic impacts can take one of two approaches: increase the supply of facilities, which usually takes the form of projects that increase roadway capacity, or decrease the demand for roadway capacity by reducing the number of vehicle trips. The MXD trip generation measures the reduction in demand that results from improving the bicycle, transit, and pedestrian environment. Other proven strategies to decrease vehicle demand include incentives to take transit (such as employer-subsidized transit passes) and disincentives to drive (such as parking management strategies). From both a policy and feasibility perspective, increasing roadway capacity is undesirable and cost-prohibitive. Therefore, the mitigation strategy for South Lake Union focused on methods to decrease the number of vehicle trips and maximize the number of bicycle, pedestrian, and transit trips, in order to impact mode splits.

Given the large scale of the height and density alternatives, the mitigation strategy focused on four main themes:

1) Improving the pedestrian and bicycle network. Projects listed in various plans/documents including the *Pedestrian Master Plan*[9], *Bicycle Master Plan*, and *South Lake Union Urban Design Framework* were considered as mitigation measures to address roadway corridor impacts and pedestrian and bicycle safety impacts. As described earlier, there is a well documented link between improved bicycle and pedestrian accessibility and reduced demand for vehicle travel.
2) Expanding travel demand management strategies. Given cost, right-of-way, and environmental constraints, it was deemed infeasible to provide additional roadway and intersection capacity beyond what is currently planned to reduce impacts to traffic congestion and freight mobility. Therefore managing demand for auto travel is a critical element to reducing traffic

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[9] The Pedestrian Master Plan identifies locations where sidewalk or crossing improvements are desirable, but does not propose specific solutions. The project team assumed sidewalks and crossings would be added where it was reasonably clear that was the relevant improvement.

congestion and freight impacts. The City has well established Commute Trip Reduction and Transportation Management Programs in the area. This mitigation strategy looks to expand on the travel demand management strategies proposed as part of the CTR and TMP programs to include new parking-related strategies.

3) City of Seattle and King County Metro should work together to identify capital and operational funding options to support increased transit service. Provide capital improvement funding support for new transit vehicles to reduce headways and decrease the passenger load on key routes and to free resources for other potential transit service expansion.
4) Increasing roadway capacity through limited roadway and intersection improvement projects identified in existing plans. No currently unplanned roadway or intersection widening projects were considered because of limited right-of-way and "induced vehicle travel[10]" impacts that are counter to the mode share goals in the *Seattle Comprehensive Plan* and the *South Lake Union Neighborhood Plan*. Moreover, City policies limit the ability to consider additional capacity expansion that is not in existing plans.

Using the framework described above, four packages of potential mitigation measures were developed to lessen the transportation impacts in the South Lake Union area. The packages are: bicycle and pedestrian system improvements, travel demand management measures, transit system enhancements, and roadway capacity enhancements. This packaged approach is different from the mitigation strategy that is typically used for smaller block or parcel-sized development projects. For smaller projects, discrete mitigation measures are typically identified for each impact. Because of the widespread land use changes associated with the height and density alternatives, a larger-scale mitigation approach aimed at reducing the demand for roadway capacity is appropriate in this case. For example, implementation of Alternative 1 will cause significant traffic operations impacts to many study roadway corridors. This impact

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[10] Induced travel is a well documented phenomenon where the addition of roadway capacity leads to a temporary reduction in travel congestion on a route. The decreased congestion attracts other drivers to the route that would have otherwise used a different mode, traveled at a different time, or not made the trip. Induced travel has the effect of encouraging more driving and increasing the mode share of automobiles.

can be lessened by implementing a well connected and integrated bicycle and pedestrian network, which will encourage some travelers to switch modes. An isolated signalized crossing or bicycle lane will not substantially improve the pedestrian and bicycle environment at a level that will encourage travelers to consider other modes. A robust, well-connected network is necessary to the mitigation strategy.

The four potential mitigation packages are listed below; many of the potential individual mitigation measures are also shown in **Figure 3.13-23**.

It is important to note that the baseline condition already includes major roadway projects like the Mercer East and Bored Tunnel projects, increased transit frequency on several bus routes and the Aurora and Ballard Rapid Ride services per the Seattle travel demand model. The baseline condition also already includes the employer-based travel demand management programs (required by the CTR Law and TMP program) currently in place in South Lake Union[11].

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[11] The City of Seattle travel demand model has built in trip generation and mode-split assumptions that are consistent with the existing level of implementation of CTR/TMP programs in South Lake Union. The model does not forecast that the CTR/TMP program will be more or less effective under 2031 conditions.

Figure 3.13-23
Mitigation Measures

Source: Fehr & Peers, 2010

Bicycle and Pedestrian System

Research has shown that vehicle trip generation and traffic congestion impacts can be reduced if a robust pedestrian system is provided.

Based on a review of the Pedestrian Master Plan, several improvements could be implemented in South Lake Union. Some of the improvements related to Tier 1 Pedestrian mobility issues in the South Lake Union neighborhood include, but are not limited to:

- Complete missing sidewalks along Terry Avenue consistent with the *Terry Avenue Street Design Guidelines*
- Add sidewalk to north side of Denny Way between Stewart Street and Melrose Avenue consistent with the proposed *Denny Way Streetscape Concept Plan*[12]
- Add sidewalk along the east side of Eastlake Avenue from Denny Way to Harrison Street and add a signalized[13] crossing at the Eastlake Avenue/Republican Street intersection
- Close pedestrian system gaps on Roy Street between Fairview Avenue and Minor Avenue and on Valley Street between Minor Avenue and Yale Avenue

The Bicycle Master Plan identifies the following relevant actions in the South Lake Union neighborhood including but not limited to:

- Add bikeways along Fairview Avenue from Valley Street to Eastlake Avenue E to connect to facilities provided as part of Mercer East and West projects on Valley and Roy Streets
- Add bikeways along Harrison or Thomas street between Fifth N and Eastlake and along Fairview Avenue between Denny Way and Valley Street
- Improve bicycle access through the Fairview Avenue/Denny Way intersection
- Signalize intersection at Minor Avenue N and Denny Way consistent with the *Denny Way Streetscape Concept Plan*

All Bicycle Master Plan improvements were considered for this analysis. However, before implementation, SDOT would review the projects during

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[12] *The Denny Way Streetscape Concept Plan* has not yet been adopted.

[13] To be implemented, a signal must meet warrants and be approved by SDOT.

the design stage to address any potential concerns, such as safety. Other pedestrian and bicycle network projects include the following:

- Implement the planned Lake to Bay Loop
- Repair facilities in poor condition
- Require that projects which develop above the "base height" implement the mid-block connector concept consistent with the South Lake Union Urban Design Framework
- Provide additional signalized crossings on Thomas Street at the Dexter Avenue, 9th Avenue, and Westlake Avenue N intersections[14]
- Provide additional signalized crossings on John Street at the Dexter Avenue and Westlake Avenue N intersections[15]
- Evaluate opportunity to provide enhanced, marked crossing locations across Westlake Avenue N, between Galer Street and 9th Avenue N[16], and implement improvement as appropriate
- Implement the hill climbs defined in the Urban Design Framework
- Improve street lighting and way finding

Travel Demand Management and Parking Strategies

Implement best management practices for travel demand management including maximum parking limits and unbundled parking costs for residential and commercial properties. Research by the California Air Pollution Control Officers Association (CAPCOA), which is composed of air quality management districts in that state has shown that implementation of travel demand management programs can substantially reduce vehicle trip generation (see **Appendix E** for details), which, in turn, reduces traffic congestion impacts. Parking maximums would limit the number of parking spaces which can be built with new development. Unbundled parking separates parking costs from total property cost, allowing buyers or tenants to forego buying or leasing parking spaces. These types of potential mitigation measures would tend to reduce the number of work-

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[14] Given the multi-lane nature of these streets, a pedestrian signal or half-signal is necessary to provide a safe crossing. The signal is required because of the adjacent land uses and likely pedestrian desire lines.

[15] To be implemented, a signal must meet warrants and be approved by SDOT..

[16] The frequency of marked crossings is a key component of the pedestrian network. The exact location of each crossing is not known at this time. In the future, the City would evaluate pedestrian desire lines to determine the precise location and treatment for each crossing.

based commute trips and all types of home-based trips. Shopping-based trips would also decrease, but at a lower level since these types of trips are less sensitive to parking costs and limited supply for short-term use.

The parking-based travel demand management strategies described above could be further supported by implementing the car sharing incentives identified in the Seattle Municipal Code[17] and through the development of a parking management program like the recently deployed e-park system in Downtown Seattle to better utilize private parking resources.

Note that the parking analysis in the previous sections identified potential short-term parking impacts related to an imbalance between supply and demand. Any reductions to the parking supply in the South Lake Union area would exacerbate this short-term impact. However, as described in the previous sections, while reduced supply will create a short-term shortage in parking spaces, over time prices will adjust and some drivers will switch to other modes. This shift to other modes is the primary goal of the potential travel demand management mitigation measures since it will reduce the impacts to traffic congestion and freight mobility.

In addition to the parking management strategies described above, the City of Seattle could also seek to expand the Downtown Growth and Transportation Efficiency Center (GTEC) program to include the South Lake Union area, or institute a separate GTEC for South Lake Union. As described in *Growth and Transportation Efficiency Center Program 2009 Report to the Legislature*, WSDOT describes the GTEC program as an extension of the existing CTR program. The GTEC program engages employers of all sizes in vehicle trip reduction programs through an area-wide approach. GTECs must also include an evaluation of transportation and land use policies to determine the extent to which they complement and support trip reduction goals. The South Lake Union Height and Density land use changes along with the potential mitigation packages conform well to the general goals of the GTEC program.

Transit Service Expansion

Impacts to transit load factors could be reduced and frequencies could increase by providing capital and/or operational support existing and planned transit service between Uptown and Capitol Hill. King County Metro should consider options to increase the frequency and capacity on

[17] SMC – 23.54.020.J

the impacted routes by running additional busses. A South Lake Union shuttle service connecting destinations along Eastlake, the streetcar line, and the Aurora Rapid Ride line would provide additional transit service opportunities in the area, while supporting the shift to other modes caused by the potential travel demand management mitigation measures.

Additional improvements to the transit network are shown on **Figure 3.13-23**, including transit signal priority at the Fairview Avenue N./Denny Way intersection, and a northbound queue jump lane and southbound transit signal priority at the Fairview Avenue N./Harrison Street intersection.

Roadway Capacity Enhancements

Impacts to traffic congestion and freight mobility along the Mercer Street corridor could be reduced by the completion of the Mercer West Corridor Project. The roadway changes include:

- Widen the Mercer Street underpass between Dexter and 5th Avenues N to include three lanes in each direction, left-turn lanes, wider sidewalks, and a bicycle path
- Connect 8th Avenue N between Mercer and Roy Streets
- Consider separating southbound left turn phase at 9th Avenue/Denny Way/Bell Street intersection

Potential Mitigation Measure Implementation

Implementation of the potential mitigation measures described above is anticipated to be achieved through an update of the South Lake Union Voluntary Impact Fee Program and updates to the City Code to support the potential travel demand management/parking mitigation measures. As the South Lake Union neighborhood builds out, the Seattle Department of Transportation will monitor the transportation system, prioritize projects, and use the fees collected to construct projects, much as the current Voluntary Impact Fee Program is operated.

Projects that develop within the South Lake Union neighborhood may pay the voluntary mitigation fee in order to receive a Master Use Permit. Alternatively, if a project applicant does not wish to pay the voluntary impact fee, project applicants must perform a supplemental environmental analysis to determine transportation impacts and appropriate measures to mitigate project impacts.

Specific Mitigation Measures

This section summarizes each impact along with potential mitigation measures.

Impact 1: Under all three alternatives, there will be significant impacts to study corridor traffic operations.

Potential Mitigation 1: The Roadway Capacity Enhancement mitigation measure, which includes the completion of the Mercer West Corridor Project, will reduce the impact on Mercer Street corridor and improve overall pedestrian and bicycle circulation in the area by implementing a key section of the Lake to Bay Loop.

Since no other roadway capacity expansion projects are planned or considered feasible, many of the remaining impacts can be lessened by implementing the Bicycle and Pedestrian System and Travel Demand Management mitigation measures, as described below.

Based on the output from the MXD model, the Bicycle and Pedestrian System mitigation measures will reduce vehicle trip generation by approximately 7 percent (for PM peak hour trips, see **Appendix E** for other time periods). The MXD trip generation tool predicts mode share based primarily on land use and demographic information, and does not take additional travel demand management into account. To estimate the reduction in trips prompted by travel demand management programs, research summarized by CAPCOA[18] was consulted. According to this research, the travel demand management strategies will reduce vehicle trip generation by 15 percent[19]. Combined, these two measures would reduce overall PM vehicle trip generation by about 21 percent for all three height and density alternatives[20]. Additional information regarding these calculations and the CAPCOA research are available in **Appendix E**.

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[18] *Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from GHG Mitigation Measures,* CAPCOA, August, 2010.

[19] 15 percent reduction in trip generation assumes that the maximum parking limits reduce parking supply (on a per square foot/dwelling unit basis) by 25 percent compared to the No Action alternative. Unbundled parking is assumed to cost an average of $100 per month per space.

[20] As noted in Appendix E, the combined effects of two trip reduction strategies are not additive since there are diminishing returns when multiple strategies are implemented.

As shown in **Table 3.13-16**, these trip generation rates would be lower than what is anticipated under the No Action Alternative and the impact on many study roadway segments would be reduced to a less-than-significant level. However, because the change in traffic congestion would affect drivers' behavior, some roadway segments would continue to be impacted, as described in the next section.

The Transit Service Expansion mitigation measure is also recommended. Based on the CAPCOA research, providing capital support that would lead to increased transit frequency would lead to an additional two percent reduction in vehicle trip generation. CAPCOA estimates an additional five percent reduction in vehicle trip generation could be achieved by providing new transit service (e.g., new service between Queen Anne, South Lake Union, and Capitol Hill via Mercer Street; South Lake Union shuttle service connecting the neighborhood with the Streetcar and the Aurora Rapid Ride). However, additional studies would need to be conducted to determine the exact level of ridership on new transit lines.

Any additional transit would also support and enhance the pedestrian, bicycle, and travel demand management mitigation measures described above. However, since the City of Seattle does not generally own and operate the transit service in South Lake Union, there is no guarantee that expanded transit service (beyond what is assumed in the Seattle travel model) will occur. Therefore, this mitigation measure was not assumed when reporting the results with mitigation in **Table 3.13-17**.

Impact 2: Under all three height and density alternatives, there will be impacts to bicycle and pedestrian mobility.

Potential Mitigation 2: To reduce the significance of this impact, it is recommended that the Bicycle and Pedestrian System mitigation measures be implemented.

Impact 3: Under all three height and density alternatives, freight mobility is significantly impacted.

Potential Mitigation 3: As discussed, the Roadway Capacity Enhancements will not address congestion on Mercer Street between Dexter Avenue and Fairview Avenue N. Therefore it is recommended that the Bicycle and Pedestrian System and Travel Demand Management mitigation measures also be implemented to reduce the automobile trip generation from residents and employees of South Lake Union. These measures will free up more capacity on the Mercer Street corridor for freight traffic.

It is also recommended that the City update the Major Truck Street network to identify a replacement for Broad Street. Further, improvements to major truck streets and arterials expected to carry heavy vehicles on a regular basis will continue to be considered pursuant to the City's adopted Complete Streets policy which guiding principle is to design, operate and maintain Seattle's streets to promote safe and convenient access and travel for all users. For example, the need for wider corner radii to accommodate turning trucks must be balanced with the need to shorten pedestrian crossings and slow regular passenger vehicles. The City will evaluate these trade-offs on a case-by-case basis.

Also, as specific projects seek a Master Use Permit, the City should review the applications to ensure that adequate loading and truck circulation facilities are provided based on the proposed use.

Impact 4: Under all three height and density alternatives, there will be significant impacts to transit in terms of load factors.

Potential Mitigation 4: To reduce the significance of this impact, it is recommended that King County Metro increase the frequency and capacity on the impacted routes by running additional busses.

Impact 5: Under all three height and density alternatives, there will be significant short-term impacts to parking. The impacts would be felt by employees who must pay more for parking, and building owners who must maintain active TDM programs to accommodate all the tenants.

Potential Mitigation 5: To reduce the significance of this impact, it is recommended that the Bicycle and Pedestrian System, Travel Demand Management, and Transit Service Expansion mitigation measures be implemented. There is a strong relationship between parking supply, parking cost, and mode share. Although there may be short-term impacts as individual developments are completed (causing parking demand to exceed supply), over the long-term the situation will reach equilibrium as drivers shift to other modes.

The City may have to review its on-street parking policies and consider implementing variable parking pricing to maintain supply. The shift from driving to transit may also require more transit service from King County Metro. The parking maximum limits suggested as mitigation for Impact 1 would also reduce supply and shift travelers to other modes.

Mitigation Results

The potential mitigation measures were taken into account and analysis was repeated on the three height and density alternatives. The Pedestrian and Bicycle System and Travel Demand Management mitigation packages were factored in at the trip generation level. The Roadway Capacity Enhancement mitigation measures were integrated into the travel model. The trip generation results of the mitigated height and density alternatives are summarized in **Table 3.13-16** (more details may be found in **Appendix E**). The d/c ratios of the three action alternatives with mitigation are shown in **Table 3.13-17**, along with the No Action Alternative for comparison.

Table 3.13-16
PM Peak Hour Trip Generation with and without Mitigation

Alternative	No Mitigation			Mitigation		
		Non-auto Trips (mode share %)			Non-auto Trips (mode share %)	
	Auto Trips (mode share %)	Internal, Bicycle & Pedestrian	Transit	Auto Trips (mode share %)	Internal, Bicycle & Pedestrian	Transit
No Action Alternative - Current Zoning (Mitigation Not Applicable)	12,648 (51.4%)	7,279 (26.9%)	6,091 (21.7%)	12,648 (51.4%)	7,279 (26.9%)	5,871 (21.7%)
Alternative 1 - Maximum Increases to Height and Density	15,554 (50.5%)	9,429 (27.8%)	7,371 (21.7%)	12,244 (39.7%)	11,835 (34.9%)	8,606 (25.4%)
Alternative 2 - Mid-Range Increases to Height and Density	15,548 (50.4%)	9,435 (27.8%)	7,371 (21.7%)	12,236 (39.7%)	11,844 (34.9%)	8,606 (25.4%)
Alternative 3 - Moderate Increases to Height and Density	13,605 (50.3%)	8,334 (28.0%)	6,449 (21.7%)	10,715 (39.6%)	10,435 (35.1%)	7,526 (25.3%)

Source: Fehr & Peers, 2010

Note: See Appendix E for details on the mode share calculation. Auto trips include both SOV and HOV trips, so the number reported is not equivalent to person-trips. The Internal, Bicycle & Pedestrian and Transit categories are person-trips.

Table 3.13-17
Mitigated Action Alternatives: Demand-to-Capacity Ratios of Study Corridors

		NO ACTION ALTERNATIVE			ALTERNATIVE 1			ALTERNATIVE 2			ALTERNATIVE 3		
Road	**Segment**	**Volume**	**Peak Hour/ Direction**	**d/c Ratio/ LOS**	**Volume**	**Peak Hour/ Direction**	**d/c Ratio/ LOS**	**Volume**	**Peak Hour/ Direction**	**d/c Ratio/ LOS**	**Volume**	**Peak Hour/ Direction**	**d/c Ratio/ LOS**
Fremont Bridge	1) N 35th Street to Westlake Avenue N	1,768	PM/N	1.11/F	1,754	PM/N	1.10/F	1,755	PM/N	1.10/F	1,733	PM/N	1.08/F
Westlake Avenue N	2) Fremont Bridge to Valley Street	1,330	PM/N	0.83/D	1,316	PM/N	0.82/D	1,316	PM/N	0.82/D	1,320	PM/N	0.83/D
	3) Valley Street to Harrison Street	1,040	PM/S	0.99/E	988	PM/S	0.94/E	991	PM/S	0.94/E	946	PM/S	0.90/E
	4) Harrison Street to Denny Way	1,061	PM/S	1.01/F	1,029	PM/S	0.98/E	1,030	PM/S	0.98/E	994	PM/S	0.95/E
	5) Denny Way to Stewart Street	624	PM/N	0.69/D	610	PM/N	0.68/D	616	PM/N	0.68/D	598	PM/N	0.66/D
Eastlake Avenue E	6) N 40th Street to E Hamlin Street	1,166	AM/SW	0.61/D	1,130	AM/SW	0.59/D	1,129	PM/NE	0.59/D	1,108	AM/SW	0.58/D
	7) E Hamlin Street to Fairview Avenue N	1,163	AM/S	0.61/D	1,130	AM/S	0.59/D	1,127	AM/S	0.59/D	1,109	AM/S	0.58/D
	8) Fairview Avenue to Lakeview Blvd E	578	AM/N	0.83/D	547	PM/N	0.78/D	544	PM/N	0.78/D	549	PM/S	0.78/D
	9) Lakeview Blvd E to Stewart Street	867	PM/S	0.62/D	849	PM/N	0.61/D	851	PM/N	0.61/D	858	PM/N	0.61/D
Fairview Avenue N.	10) Eastlake Avenue to Yale Avenue N	810	AM/SW	1.16/F	781	AM/SW	1.12/F	766	AM/SW	1.09/F	774	AM/SW	1.11/F
	11) Yale Avenue N to Harrison Street	1,389	PM/N	0.83/D	1,381	PM/N	0.82/D	1,384	PM/N	0.82/D	1,396	PM/N	0.83/D
	12) Harrison Street to Denny Way	1,009	PM/N	0.60/D	1,000	PM/N	0.60/D	1,000	PM/N	0.60/D	985	PM/N	0.59/D
Dexter Avenue N	13) Fremont Bridge to Valley Street	1,132	AM/S	1.18/F	**1,140**	**AM/S**	**1.19/F**	1,134	AM/S	1.18/F	**1,151**	**AM/S**	**1.20/F**
	14) Valley Street to Denny Way	1,787	PM/N	1.28/F	1,737	PM/N	1.24/F	1,734	PM/N	1.24/F	1,709	PM/N	1.22/F
Valley Street	15) Westlake Avenue N to Fairview Avenue N	624	PM/E	0.74/D	636	PM/E	0.76/D	633	PM/E	0.75/D	611	PM/E	0.73/D
Mercer Street	16) Queen Anne Avenue N to 5th Avenue N	1,091	PM/E	0.65/D	1,091	PM/E	0.65/D	1,091	PM/E	0.65/D	1,091	PM/E	0.65/D
	17) 5th Avenue N to Dexter Avenue N	1,445	AM/E	0.86/D	1,980	PM/W	0.79/D	1,983	PM/W	0.79/D	1,970	AM/W	0.78/D
	18) Dexter Avenue N to Fairview Avenue N	2,057	AM/W	0.98/E	2,054	AM/W	0.98/E	**2,072**	**AM/W**	**0.99/E**	2,040	AM/W	0.97/E
Denny Way	19) Broad Street to Aurora Avenue N	1,053	AM/W	0.63/D	1,031	PM/W	0.61/D	1,031	PM/W	0.61/D	1,032	AM/W	0.61/D
	20) Aurora Avenue N to Stewart Street	1,607	PM/E	1.53/F	1,591	PM/E	1.52/F	1,586	PM/E	1.51/F	1,573	PM/E	1.50/F
	21) Stewart Street to Broadway E	1,151	AM/W	0.72/D	1,126	AM/W	0.70/D	1,122	PM/W	0.70/D	1,102	AM/W	0.69/D
Broad Street	22) Denny Way to Westlake Avenue N	Segment does not exist under future conditions											
Boren Avenue	23) Denny Way to Pine Street	1,297	AM/NW	1.08/F	1,289	AM/NW	1.07/F	1,282	AM/NW	1.07/F	1,270	AM/NW	1.06/F
	24) Pine Street to University Street	1,068	PM/SE	0.89/D	1,063	PM/SE	0.89/D	1,068	PM/SE	0.89/D	1,051	PM/SE	0.88/D
Stewart Street	25) Eastlake Avenue E to Boren Avenue	2,196	AM/SW	1.05/F	2,194	AM/SW	1.04/F	2,208	AM/SW	1.05/F	2,163	AM/SW	1.03/F
	26) Boren Avenue to 7th Avenue	1,334	AM/SW	0.74/D	1,344	AM/SW	0.75/D	1,347	AM/SW	0.75/D	1,340	AM/SW	0.74/D
	27) 7th Avenue to 3rd Avenue	873	AM/SW	0.73/D	860	AM/SW	0.72/D	862	AM/SW	0.72/D	840	AM/SW	0.70/D
Virginia Street	28) Denny Way to Westlake Avenue N	839	PM/NE	0.70/D	854	PM/NE	0.71/D	851	PM/NE	0.71/D	856	PM/NE	0.71/D
	29) Westlake Avenue N to 3rd Avenue	1,215	PM/NE	0.68/D	1,195	PM/NE	0.66/D	1,203	PM/NE	0.67/D	1,177	PM/NE	0.65/D
E Pine Street	30) Boren Avenue to Broadway	691	PM/W	0.96/E	676	AM/W	0.94/E	689	PM/W	0.96/E	678	AM/W	0.94/E
Lakeview/Belmont/Roy	31) Eastlake Avenue to Broadway E	415	PM/E	0.52/D	415	PM/E	0.52/D	415	PM/E	0.52/D	415	PM/E	0.52/D

Road	Segment	NO ACTION ALTERNATIVE Volume	Peak Hour/ Direction	d/c Ratio/ LOS	ALTERNATIVE 1 Volume	Peak Hour/ Direction	d/c Ratio/ LOS	ALTERNATIVE 2 Volume	Peak Hour/ Direction	d/c Ratio/ LOS	ALTERNATIVE 3 Volume	Peak Hour/ Direction	d/c Ratio/ LOS
Thomas Street	32) Aurora Avenue N to Eastlake Avenue E	429	PM/E	0.60/D	419	PM/E	0.58/D	436	PM/E	0.61/D	390	PM/E	0.54/D
Harrison Street	33) Aurora Avenue N to Eastlake Avenue E	537	PM/E	0.90/E	522	PM/E	0.87/D	515	PM/E	0.86/D	502	PM/E	0.84/D
9th Avenue N	34) Roy Street to Republican Street	698	PM/N	1.00/F	661	PM/N	0.94/E	667	PM/N	0.95/E	648	PM/N	0.93/E
Howell/Eastlake	35) Stewart Street to Boren Avenue	1,113	PM/N	0.93/F	1,099	PM/N	0.92/E	1,093	PM/N	0.91/E	1,095	PM/N	0.91/E

Source: Fehr & Peers, 2010

Note: Bold text signifies a significant impact.

* These study corridors intersect or are adjacent to other study corridors that are expected to operate at LOS F conditions. Actual LOS may be worse because of queuing.

Potential transit mitigation calculations were completed independently of the other potential mitigation measures. **Table 3.13-18** shows the number of additional busses that would need to run during the peak hour to reduce the load factor to acceptable levels. Details of the calculations may be found in **Appendix E**.

Table 3.13-18
South Lake Union Peak Hour Transit Mitigation

Route	Termini Locations	No Action Load Factor	Action Load Factor	Peak Hour Ridership	Additional busses required	Mitigated Load Factor
21 NB	Downtown, Arbor Heights	1.17	1.35	520	1	1.18
28 NB	Downtown, Broadview	1.19	1.40	240	1	1.06
29 NB	Downtown, Woodland Park	1.19	1.49	120	1	1.04
29 SB	Downtown, Woodland Park	1.49	1.79	144	1	1.25
56 NB	South Lake Union, West Seattle	1.38	1.53	396	2	1.07

Source: Fehr & Peers, 2010

3.13.7 Significant Unavoidable Adverse Impacts

This section describes the significant and unavoidable adverse impacts to transportation that would occur as a result of implementation of the height and density alternatives.

As shown in **Table 3.13-16** the potential Pedestrian and Bicycle System and Travel Demand Management mitigation packages substantially reduce the trip generation of each of the height and density alternatives. However, **Table 3.13-17** shows that even with this lower trip generation, several study corridors would continue to have traffic operations and freight mobility impacts:

- Dexter Avenue N from the Fremont Bridge to Valley Street – Alternatives 1 and 3
- Mercer Street from Dexter Avenue N to Fairview Avenue N – Alternative 2

The above impacts could be mitigated through additional roadway corridor widening. However, as described earlier, the City has no additional roadway widening plans and additional roadway widening would have right-of-way, cost, and environmental consequences. Additionally roadway widening would tend to induce more vehicle trips in the South Lake Union neighborhood, which could conflict with the transportation goals outlined in the Seattle Comprehensive Plan. Therefore, additional widening is considered infeasible.

In addition to the traffic operations impacts described above, the impacts to transit load factors may remain. Although transit service expansion was identified as a potential mitigation measure, the City of Seattle does not generally own and operate the transit service in South Lake Union. Therefore, expanded transit service cannot be guaranteed by the City and no expansion was assumed in the analysis.

All other impacts were reduced to a less-than-significant level with mitigation.

3.14 PUBLIC SERVICES

This section of the Draft EIS describes the existing status of City of Seattle entities that provide public services to the South Lake Union Neighborhood and evaluates the impacts of added demand on such services from redevelopment under the alternatives. Public services considered in this section include fire and emergency services and police services.

Public Services Contents

3.14.1 Affected Environment

Fire and Emergency Services

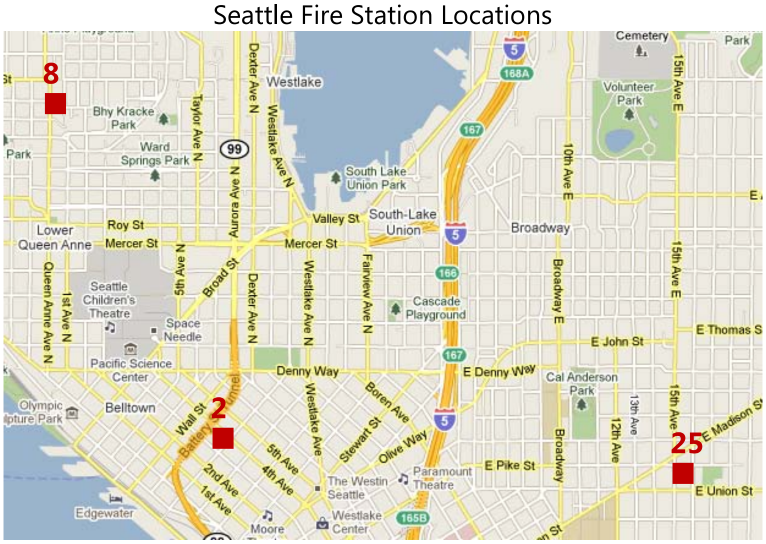
The City of Seattle Fire Department provides fire protection, Basic Life Support (BLS) and Advanced Life Support (ALS) throughout the City, including the South Lake Union Neighborhood, from 33 fire stations. Fire Department apparatus is distributed amongst each of the 33 fire stations and includes 33 fire engines, 12 ladder trucks, 7 medic units (ALS), 4 aid units (BLS), 4 fire boats, 2 air trucks and 2 hose wagons.

BLS is used for patients with life-threatening injuries until full medical care can be given. Generally no drugs or invasive skills are utilized.

Three fire stations are located in proximity to the South Lake Union Neighborhood, including Fire Station 2 (2334 4th Avenue), Fire Station 8 (110 Lee Street), and Fire Station 25 (1300 E Pine Street). Harborview Medical Center is also located to the south of the neighborhood and is the Medic One headquarters for the Department. See **Figure 3.14-1** for the location of these fire stations in relation to the South Lake Union Neighborhood.

ALS includes advanced procedures involving invasive methods such as defibrillation, medication, and intravenous cannulation (IVs).

Figure 3.14-1
Seattle Fire Station Locations



Source: Seattle Fire Department, 2010.

The Department employs 1,020 uniformed personnel, with an on-duty strength of 208 firefighters. The three fire stations in the vicinity of the South Lake Union Neighborhood have a minimum of 29 on-duty personnel available each day. Fire Apparatus at these stations include fire engines, ladder trucks, aid units, a power unit, and a hose wagon[1] **Table 3.14-1** provides a summary of equipment and minimum staffing at each fire station in the vicinity of the South Lake Union Neighborhood.

Table 3.14-1
Seattle Fire Department Staffing and Equipment

Station	Staffing	Equipment
Fire Station 2	Minimum of 10 on-duty personnel.	- Fire Engine (Engine 2) - Ladder Truck (Ladder 4) - Aid Unit (Aid 2)
Fire Station 8	Minimum of 8 on-duty personnel.	- Fire Engine (Engine 8) - Ladder Truck (Ladder 6)
Fire Station 25	Minimum of 11 on-duty personnel.	- Fire Engine (Engine 25) - Ladder Truck (Ladder 10) - Aid Unit (Aid 25) - Power Unit - Hose Wagon

Source: Seattle Fire Department Chief Paul Fletcher, 2010.

Fire and Emergency Incidents

Between 2005 and 2009, Seattle Fire Department incident responses ranged from 77,000 to 80,000. During this time frame, incident responses by the Department have increased by less than one percent. **Table 3.14-2** provides a summary of incident responses from 2005 to 2009.

[1] Personal communication with Chief Paul Fletcher. Seattle Fire Department. September 2010.

Table 3.14-2
2005-2009 Seattle Fire Department Incident Responses

Year	BLS Incidents	ALS Incidents	Fire Incidents	Total Incidents
2005	41,848	20,010	15,260	77,118
2006	43,476	20,330	16,717	80,523
2007	43,488	20,330	15,292	79,070
2008	44,598	19,829	14,840	79,267
2009	44,373	18,866	14,551	77,790

Source: Seattle Fire Department Emergency Response Report, 2009.

In contrast with the overall Department, Fire Stations 2, 8, and 25 in the vicinity of the South Lake Union Neighborhood have all experienced a decrease in incident responses from 2005 to 2009. Incident responses at Station 2 have declined by approximately 10 percent since 2005; responses at Station 8 have declined by approximately two percent; and, responses at Station 24 have decline by approximately 12 percent. **Table 3.14-3** summarizes the incident responses for each station.

Table 3.14-3
2005-2009 Incident Responses – Station 2, Station 8, and Station 25

	2005	2006	2007	2008	2009
Station 2					
EMS	7,326	7,937	8,243	8,269	6,779
Fire	2,718	2,870	2,651	2,567	2,253
Total	10,044	10,807	10,894	10,836	9,032
Station 8					
EMS	1,234	1,217	1,272	1,520	1,219
Fire	713	811	738	809	692
Total	1,947	2,028	2,010	2,329	1,911
Station 25					
EMS	6,943	6,947	7,107	6,929	6,305
Fire	2,582	2,723	2,378	2,417	2,176
Total	9,525	9,670	9,485	9,346	8,481

Source: Leonard Roberts, Seattle Fire Department. 2010.

Level of Service

The Seattle Fire Department has established a response time goal of four minutes (to be achievable 90 percent of the time) for the first engine company to arrive at the scene of a reported fire or BLS medical emergency. Between 2006 and 2009, the Department achieved this goal 83 to 87 percent of the time. The Department has also established a response time goal of eight minutes for full first alarm assignment (15 firefighters) and ALS medical emergencies (two Paramedics). Between

2006 and 2009, the Department achieved this goal 80 to 88 percent of the time.

Between 2005 and 2008, fire stations in the vicinity of the South Lake Union Neighborhood have generally met the Department's response time goals for BLS, ALS and fire emergencies. Aid Units 2 and 25 have consistently met the response time goal of eight minutes for ALS emergencies. Engines 2 and 25 have consistently met the response time goal of four minutes for BLS and fire emergencies; however, Engine 8 has been slightly over the response time goal for fire emergencies (ranging from 4.53 to 4.93 minutes). **Table 3.14-4** summarizes the response times (minutes) for each company associated with Fire Station 2, Fire Station 8 and Fire Station 25.

Table 3.14-4
2005-2008 Response Times – Station 2, Station 8, and Station 25

Company	2005	2006	2007	2008
Aid Unit 2 – BLS	3.33	3.40	3.41	3.39
ALS	3.45	3.50	3.51	3.56
Fire	6.12	6.03	5.52	5.62
Aid Unit 25 – BLS	3.46	3.41	3.55	3.58
ALS	3.50	3.43	3.61	3.67
Fire	6.25	6.36	5.91	6.40
Engine 2 – BLS	3.20	3.28	3.18	3.34
ALS	3.11	3.10	3.13	3.22
Fire	3.79	3.79	3.68	3.77
Engine 8 – BLS	3.82	3.61	3.73	3.68
ALS	3.77	3.66	3.77	3.81
Fire	4.93	4.60	4.62	4.53
Engine 25 – BLS	3.27	3.19	3.12	3.30
ALS	3.28	3.15	3.04	3.31
Fire	3.85	3.73	3.84	3.84

Source: Seattle Fire Department Website, 2010.

Fire Department Planning

In 2003, a Fire Facilities and Emergency Response Levy was approved by the Seattle voters to improve and upgrade the Department's fire facilities and emergency response system. All of the Department's fire stations were evaluated as needing major upgrades, renovation or replacement in order to provide service. The Levy provided approximately $167 million for multiple projects including upgrades, renovations or replacement of 32 neighborhood fire stations.

Funds from this Levy facilitated the renovation of Fire Station 2, Fire Station 8 and Fire Station 25. The major renovation and expansion of Fire Station 2 was completed in July 2010. The renovation included seismic upgrades and a remodeled interior space to provide more room for fire operations, space for one of the City's fragmentation caches, and a new occupational health center; the renovations were also intended to maintain the integrity of the building's historic character.

Fire Station 8 is scheduled for renovation in 2010, which would include seismic upgrades and an expansion that would include space for decontamination and emergency medical service (EMS) equipment and vehicle maintenance. The renovation is tentatively scheduled to be completed by 2012.

Fire Station 25 is also scheduled for renovation in 2010 and would primarily include seismic and safety upgrades. Additional work would include a reconfiguration of apparatus support space and the addition of storage space. The Plan would also move the existing battalion chief and reserve battalion chief unit to Station 2. The renovation of Fire Station 25 is tentatively scheduled to be completed in 2012.

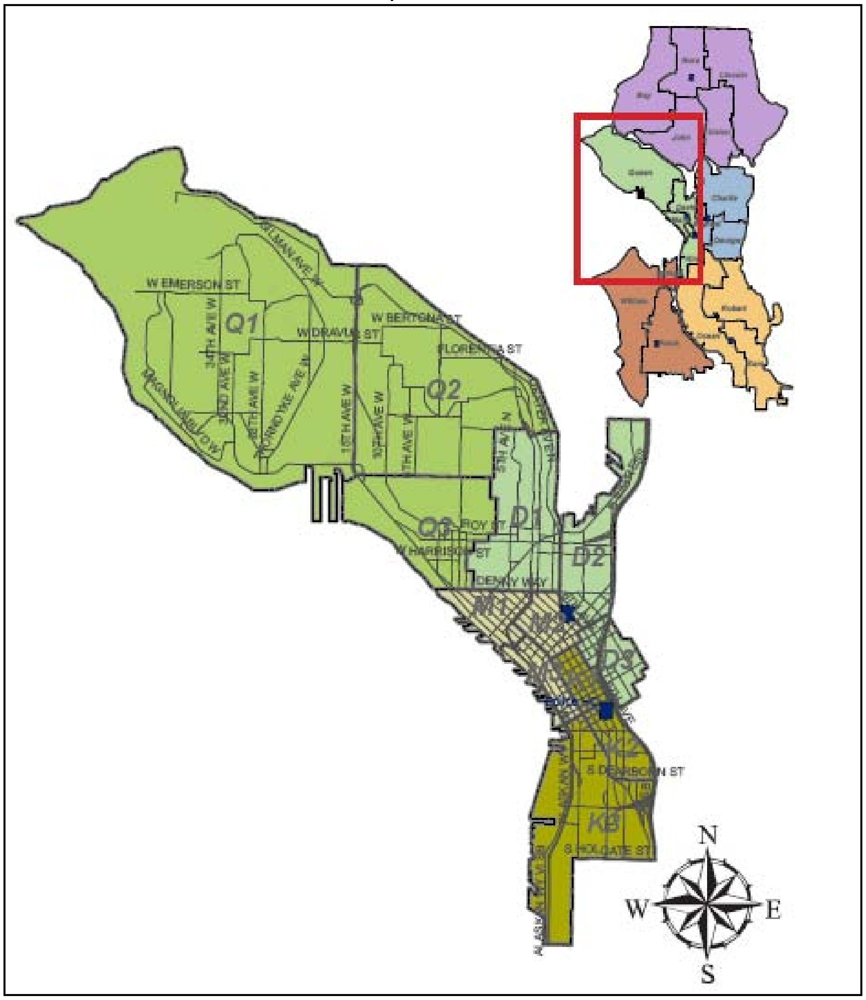
The City of Seattle *Comprehensive Plan* also identifies potential needs for the Fire Department to serve future growth in the City. It is anticipated that additional EMS capabilities would be needed near the South Lake Union, SODO, Northgate, and Central District Neighborhoods. Additional fire stations in South Lake Union and Northgate could also be needed within the next 20 years.

Police Services

The Seattle Police Department provides police protection service to the City of Seattle, including the South Lake Union Neighborhood. The Department includes approximately 1,860 authorized personnel, including 868 officers. Personnel are divided amongst five precincts: north, west, east, south and southwest. Each precinct is further divided into sectors and beats which are dependent on the geographic area of each precinct. The South Lake Union Neighborhood is located in the West Precinct area.

The West Precinct headquarters are located at 810 Virginia Street (approximately 0.2 miles south of the South Lake Union Neighborhood). In 2008, the West Precinct boundaries were shifted from 14 beats to 12 beats; the number of sectors remained the same but their boundaries were changed as well. The Precinct is currently comprised of four sectors and each sector includes three beats. The South Lake Union Neighborhood is located in the David sector and is generally comprised of beats D1 and D2. Staffing at the West Precinct currently includes: 176 officers, 23 sergeants, 4 lieutenants, 1 captain, and 6 civilians[2]. Refer to **Figure 3.14-2** for a map of the West Precinct area.

Figure 3.14-2
Seattle Police Department West Precinct



Source: Seattle Police Department, 2010.

Calls for Service and Incidents

In 2009, the Seattle Police Department received approximately 339,000 calls for service, including 201,700 dispatched calls and 137,300 on-views (events that officers log during routine patrols). Total calls for service represented an 11 percent decrease from the previous year and a 20

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[2] Personal Communication with Mimi Walsh. Seattle Police Department. September 2010.

percent decrease from 2005. **Table 3.14-5** summarizes the Department's call volumes between 2005 and 2009.

Table 3.14-5
2005 – 2009 Seattle Police Department Calls for Service

Year	Dispatched Calls	On-Views	Total
2005	251,582	173,487	425,069
2006	249,033	175,470	424,503
2007	233,948	167,944	401,892
2008	223,976	154,907	378,883
2009	201,704	137,307	339,011

Source: Seattle Police Department, 2010.

Following the pattern of the City of Seattle in general, the West Precinct area received approximately 109,000 incoming calls in 2009, which represented an approximately five percent decline since 2005[3]. A majority of the calls for the West Precinct typically involved traffic offenses, theft, suspicious circumstances, premise checks, narcotics, and disturbances. **Table 3.14-6** summarizes the total number of calls to the West Precinct between 2005 and 2009.

Table 3.14-6
2005-2009 West Precinct Calls for Service

Year	Incoming Calls
2005	115,040
2006	115,134
2007	110,954
2008	103,723
2009	109,681

Source: Seattle Police Department, 2010.

The West Precinct also experienced a decline in major crimes from 2004 to 2007. During this time frame, major crimes in the West Precinct area decreased by approximately 18 percent. In 2008, major crimes increased by two percent from the previous year; however, this can be attributed in part to a shift in Precinct boundary areas as part of the Department's *Neighborhood Policing Staffing Plan*. This shift in boundary areas resulted in an overall increase in the size of the West Precinct boundaries. **Table**

[3] It should be noted that data from 2009 is not strictly comparable with data from 2005-2008 due to the fact that the Department implemented changes to the Computer Aided Dispatch coding system.

3.14-7 summarizes the total major crimes in the West Precinct between 2004 and 2008.

Table 3.14-7
2004-2008 West Precinct Major Crimes

	2004	2005	2006	2007	2008
West Precinct	12,381	11,683	10,618	10,144	10,409

Source: Seattle Police Department, 2010.

Level of Service

The Seattle Police Department does not have adopted level of service standards for police service, but does have an emergency response time guideline of seven minutes. On average, the Department currently meets or exceeds this goal Citywide; however, performance is geographically uneven and can be slower at certain times of day and during certain days of the week.

Police Department Planning

In 2007, the Seattle Police Department published the *Neighborhood Policing Staffing Plan 2008-2012* that called for a net increase of 105 patrol officers between 2008 and 2012. The Department proceeded with its recruitment efforts in 2008 and 65 patrol officers have been added to the Department thus far. However, the City's present budget issues have caused a delay in the hiring plan for 2010 and 2011.

The *Neighborhood Policing Staffing Plan* also revised officer work shifts to match the workload and reconfigured Department patrol shifts to allow for more balanced and effective deployment of officers.

The City of Seattle *Comprehensive Plan* also identifies potential facility needs for the Department to serve potential future growth in the City. The North Precinct is currently overcrowded and it has been determined by the Department that it does not meet the needs of precinct personnel. It is anticipated that the North Precinct would need to be renovated and expanded within the next 20 years. No additional facility needs are identified at this time; however, as the City further considers neighborhood-based policing options, the long-range plans for police facilities may change.

8th Avenue Corridor

The nearest fire station to the 8th Avenue Corridor is Fire Station 2, which is located approximately 0.35 miles from the Corridor. The 8th Avenue Corridor is also located approximately 0.35 miles from the West Precinct headquarters and is situated in the D1 beat area.

Fairview Avenue Corridor

The nearest fire station to the Fairview Avenue Corridor is Fire Station 2, which is located approximately 0.55 miles away. The Fairview Avenue

Corridor is located approximately 0.20 miles from the West Precinct headquarters and is covered by the D2 beat area.

Valley/Mercer Blocks

Fire Station 2 is also the closest station to the Valley/Mercer Blocks and is located approximately 0.70 miles away. The Valley/Mercer Blocks are located approximately 0.60 miles from the West Precinct headquarters and straddle the D1 and D2 beat areas. The area west of Westlake Avenue is located in the D1 beat and the area east of Westlake Avenue is located in the D2 beat.

3.14.2 Environmental Impacts

The proposed action would adopt new or maintain existing zoning regulations. By itself, this action would not directly result in impacts to the public services. However, zoning regulations would allow for potential future development at increased heights and densities and an associated increase in population and employment, which could result in a subsequent impact to public services and utilities. The impacts described below relate to the development that could result from the adoption of any of the proposed zoning alternatives.

Impacts Common to All Alternatives

Fire and Emergency Services

Construction activities associated with potential development under the proposed alternatives could result in an increase in demand for fire services. Fire Department service calls related to inspection of specific construction projects and calls to respond to potential construction-related accidents could increase as a result of construction. Existing Fire Department staffing and equipment are anticipated to be sufficient to handle increased service needed for construction activities.

Potential increases in population and employment in the South Lake Union Neighborhood would be incremental and would be accompanied by subsequent incremental increases in demand for Fire Department services, including fire protection and EMS service (BLS and ALS). EMS service typically generates the highest demand for the Fire Department. Potential impacts on EMS services were projected by the Fire Department using a trend line projection based on past demand for the area. Potential development in the South Lake Union Neighborhood under the Action Alternatives could result in an increase in EMS calls of approximately 15 percent by 2031. **Table 3.14-8** summarizes the potential increases in EMS calls for each Alternative.

Table 3.14-8
Projected EMS Service Calls – Alternatives 1-4

	Projected EMS Calls	Percent Increase[2]
Projected 2031 Baseline Condition[1]	9,498	
Action Alternatives	10,967	15%
No Action Alternative	10,781	13%

Source: Leonard Roberts, Seattle Fire Department, 2010.

[1] Represents the projected EMS calls that would occur in 2031 without development under any of the Alternatives.

[2] Represents the percent increase of EMS calls under each alternative when compared to the baseline condition.

Potential development in the South Lake Union Neighborhood under the Action Alternatives would result in an associated increase in EMS calls of approximately 15 percent; the No Action Alternative would result in an increase of approximately 13 percent. The Fire Department would attempt to maintain response times consistent with current performance levels and an additional one or two EMS companies could be required over the next 10 years in order to maintain performance levels. However, given that Station 2 and Station 25 are two of the busiest stations in the Department, additional EMS companies could be required in this area even without potential development under Alternative 1-4[4].

As described under the Affected Environment, all fire stations in the vicinity of the South Lake Union Neighborhood have been recently renovated or are in the process of being renovated as part of the *Fire Facilities and Emergency Response Levy* and would not be anticipated to need renovations in the near future. Any potential future facility needs of the Fire Department could be included as part of the City's annual Capital Improvement Program process.

All potential new development in the South Lake Union Neighborhood would be constructed in compliance with the *2006 City of Seattle Fire Code*, which is comprised of the *2006 International Fire Code* with Seattle Amendments. Adequate fire flow to serve potential development would be provided as required by the Fire Code. Potential development would also be required to comply with code requirements for emergency access to structures.

[4] Personal communication with Leonard Roberts, MIS Director. Seattle Fire Department. October 2010

Police Services

Potential construction under the alternatives could result in an increase in demand for police services. Service calls to the Seattle Police Department could increase during construction due to construction site theft and vandalism. Existing Department staff and equipment are anticipated to be sufficient to handle the potential increase in service from construction activities.

Potential increases in onsite population and employment associated with development in the South Lake Union Neighborhood would be incremental and would result in associated incremental increases in demand for police services. It is expected that call volumes to the Police Department would increase under all of the proposed alternatives.

It is anticipated that the Police Department would have sufficient staffing and facilities to accommodate the increased demand for service from the South Lake Union Neighborhood and no additional safety problems would occur. Part of this can be attributed to the Department's ability to deliver proactive police-community project solving services to the area and the City of Seattle in general through the implementation of the *Neighborhood Policing Staffing Plan*. As described under the Affected Environment, although the hiring of new officers under the *Neighborhood Policing Staffing Plan* has been delayed due to recent City of Seattle budget issues, it is anticipated that the remaining officers would be hired prior to 2031. Any potential future facility needs for the Police Department could be included in the future as part of the City's annual Capital Improvement Program process.

The potential increase in residential and employment density that could occur under the alternatives would result in a more consistent and increased level of activity in the South Lake Union Neighborhood. Such an increase in activity would contribute to safety improvements and potentially reduce criminal activity. In addition, potential development in the area could include design features to help reduce criminal activity and calls for service such as orienting buildings towards the street, providing public connections between buildings, and providing adequate lighting and visibility.

3.14.3 Mitigation Strategies

Future population and employment increases associated with potential development in the South Lake Union Neighborhood under Alternatives 1-4 would be incremental and would result in associated increases in demand for fire and emergency services and police services in the area. These impacts could be addressed by the following mitigation measures.

1. A portion of the tax revenue generated from potential redevelopment in the Neighborhood – including construction sales tax, business and operation tax, property tax and other fees, licenses and permits – would accrue to the City of Seattle and could help offset demand for police and fire services.
2. All new buildings would be constructed in accordance with the 2006 Fire Code which is comprised of the 2006 International Fire Code with Seattle amendments or the applicable fire code in effect at the time of permit submittal.
3. Design features could be incorporated into potential development in the South Lake Union Neighborhood that would help reduce criminal activity and calls for police service, including orienting buildings towards the sidewalk and public spaces, providing connections between buildings, and providing adequate lighting and visibility.

3.14.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to fire and emergency services or police services are anticipated.

3.15 UTILITIES

This section will address the affect of the alternatives on the existing utility infrastructure in the study area. Affected public utilities include water, sewer, stormwater, and electric power. Natural gas and communications are franchise utilities; each private provider is responsible for upgrades and improvements to their systems in response to development.

3.15.1 Affected Environment

Water

Water for domestic use and fire fighting is provided to the area by Seattle Public Utilities (SPU). A 30-inch water main from Lincoln Reservoir (on Capitol Hill), entering the study area near I-5 and Denny Way, is the principal source of water supply to the neighborhood. A 24-inch water main from the Volunteer Park Reservoir enters the neighborhood near I-5 and Valley Street and continues west and north through the study area to serve Queen Anne Hill. The water supply network shows a reasonably strong grid of interconnected pipes (see **Figure 3.15-1**). The network of local water mains in the streets distributes water to the properties in the study area.

Most of the water distribution system in this area was installed in the early 1900s; many portions of the pipe network are 100 or more years old. The expected design life of these pipes is 100 to 120-years. Pipe sizes vary from 6-inches to 24-inches in diameter. Most of the local distribution piping is 8-inch. Older pipes are cast-iron, newer pipes (since the 1960s) are ductile-iron.

The network is maintained by SPU and repaired or replaced as needed. SPU has adopted a triple bottom line asset management approach for managing its infrastructure. A triple bottom line evaluation considers the economic, social, and environmental benefits of capital needs, as well as the ability to meet customer service levels[1]. This framework determines which pipes are scheduled for replacement. Age alone is not a factor in the replacement cycle of pipes within the distribution network. Break history, soil conditions, and reliability also play an important part in the

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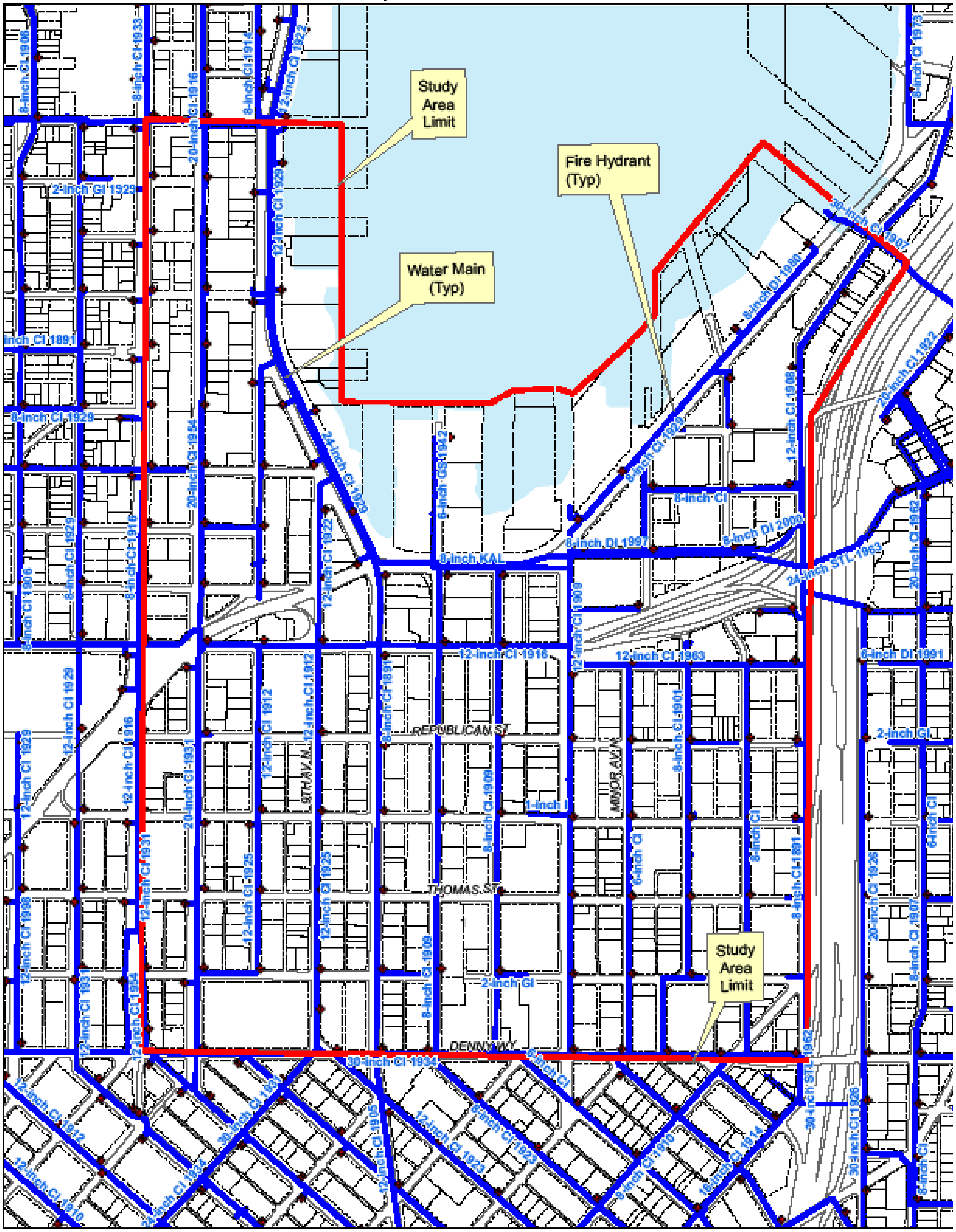
[1] http://www.seattle.gov/financedepartment/0914proposedcip/Water_narrative.pdf
Accessed 1/13/11

Figure 3.15-1
Water System



Source: Coughlin Porter Lundeen, 2010

process. In some instances, developers are asked to make replacements or improvements to the system near their properties as a development condition.

The entire study area is in the same pressure zone (326), water availability and adequate pressure for domestic use and firefighting are generally not a problem. High-rise buildings will usually need on-site facilities to provide for adequate domestic and fire fighting water pressure.

Water pressure zones are areas in which a certain maximum water pressure can be expected from the potable water distribution network.

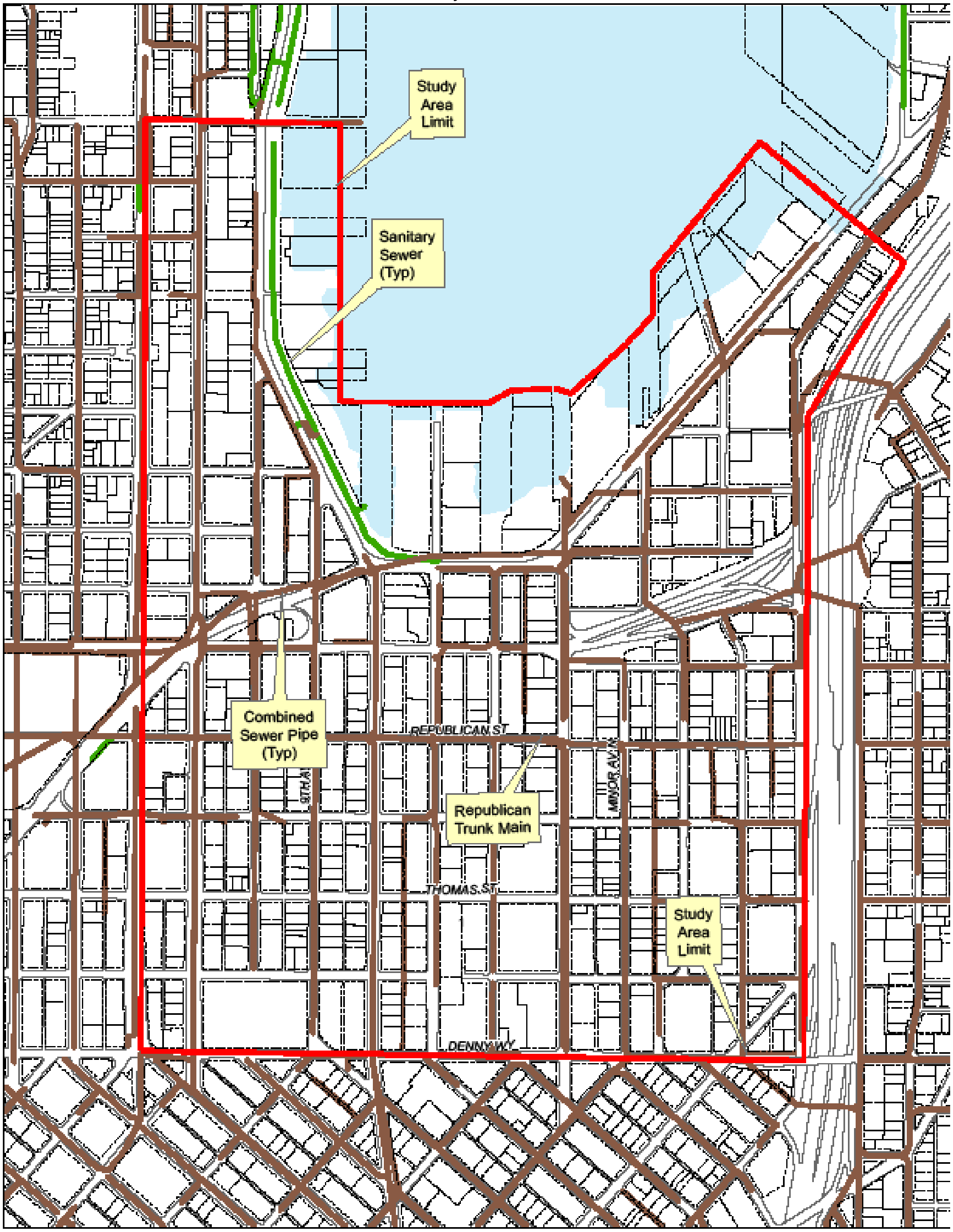
Sanitary Sewer

Sanitary sewer service in the area is provided in most of the study area by a combined sewer system. A network of pipes in the area collects both stormwater and sanitary waste water from properties and streets and routes it to a large trunk main under Republican Street (see **Figure 3.15-2**). At the west end of Republican Street, the trunk main joins the King County Metro Mains that flow to the West Point Treatment Plant, prior to discharge to Puget Sound from a deep-water pipe.

As the combined sewer system was designed to convey both waste and storm water, during dry weather, there is not a capacity issue for wastewater flow alone. For storm conveyance, system capacity varies considerably. There are several known trouble spots in the local collector systems; the areas around Mercer and Valley streets have very some very flat pipes, which can cause local back-ups during even small storm events. Other collection pipes in the basin have similar issues. Sewers in Boren and Westlake have good capacity, and tend not to show any trouble until large events (25-year or greater storm)

During major storm events the combined system can over flow untreated water into Lake Union through one or more Combined Sewer Overflow (CSO) facilities. CSOs to the lake and other water bodies from regulated outfalls are allowed at times, when the system reaches capacity, and as permitted by agreements with the Washington Department of Ecology. The City and King County have made significant up-grades to the conveyance and detention capacity of the combined sewer system to limit these overflows but, some storms and other circumstances will still exceed the limit of the system. See the discussion of CSO in section 3.3 for greater detail.

Figure 3.15-2
Combined Sewer System



Source: Coughlin Porter Lundeen, 2010

Sewer system installations in the neighborhood date back to the late 1800s, significant portions of this system are over 100-years old.

Brick sewers built starting in the late 1890s make up most of the larger transmission pipes in the combined sewer system. The expected life span of these sewers is indeterminate. With lining or other rehabilitation methods, regular inspection and spot maintenance they could last for an indefinite period of time.

Clay pipe was used in the smaller sewers during the original construction. These pipes are usually considered to have a 100-year life span.

Portions of the pipe network built in the last 75-years are concrete. Concrete pipe is generally considered to have a 100-year life span.

In the *Seattle Public Utilities 2006 Waste Water Systems Plan*, the combined sewer portions of this neighborhood were identified (along with 18 other areas of the city) as being Priority 1 for sewer pipe capacity. Priority 1 areas are described as areas with the highest risk for having sewer capacity deficiencies.[2]This finding was based on hydraulic analysis, past history of capacity-related sewer backups or claims, the area's growth potential, and the association of the area with a major project. The 2006 report made the finding, but did not identify a plan or time line for resolution of this problem.

The Mercer Corridor project, currently underway, will replace the combined sewer in 9th Avenue, north of Republican Street, and make other improvements to the combined and separated storm sewers in Mercer, Valley and other streets. No significant diversion of surface water from the combined sewer system is expected to occur as a result of this project.

The pipe network is maintained by SPU and repaired or replaced as needed. In some instances, developers are asked to make replacements or improvements to the system near their properties as a condition of development. This is done on a case-by-case basis.

Stormwater Sewer

For the majority of this study area, stormwater is collected from streets and properties in the combined sewer system as described above (see **Figure 3.15-2**). About 25% of the study area, mainly in the east portion, near the freeway, and the properties immediately along the lake shore,

Typical storm drain

[2]Seattle Public Utiltiies. 2006 Wastewater Systems Plan. 2006.

collected surface water discharges directly to Lake Union (see **Figure 3.15-3**). This runoff includes water from both buildings and streets. A large 72-inch main under the east side of the study area conveys water from Capitol Hill and the I-5 Freeway for discharge to Lake Union. The complete basin for this discharge pipe is about 500-acres, the portion in the study area that drains to it is about 75-acres. A second system on the west side of the study area collects water from Broad Street and discharges it to the lake at the west side of Lake Union Park. Little if any water from private parcels is collected and discharged by this pipe.

Separated stormwater pipes in this neighborhood are relatively new; most are concrete or plastic pipe and have been installed in the last 60-years. All the public storm drainage facilities in the neighborhood are inspected and maintained by SPU.

See **Chapter 3.3** for a discussion of the water quality issues of surface water discharged directly to Lake Union.

Electric Power

Power in the neighborhood is provided and maintained by Seattle City Light. Much of the area has over-head power poles. Overhead poles carry both power and communications. Recently developed areas tend to have undergrounded power and communications infrastructure.

The power infrastructure in this area is updated as needed for current development, the required infrastructure upgrades are usually paid for by the developer.

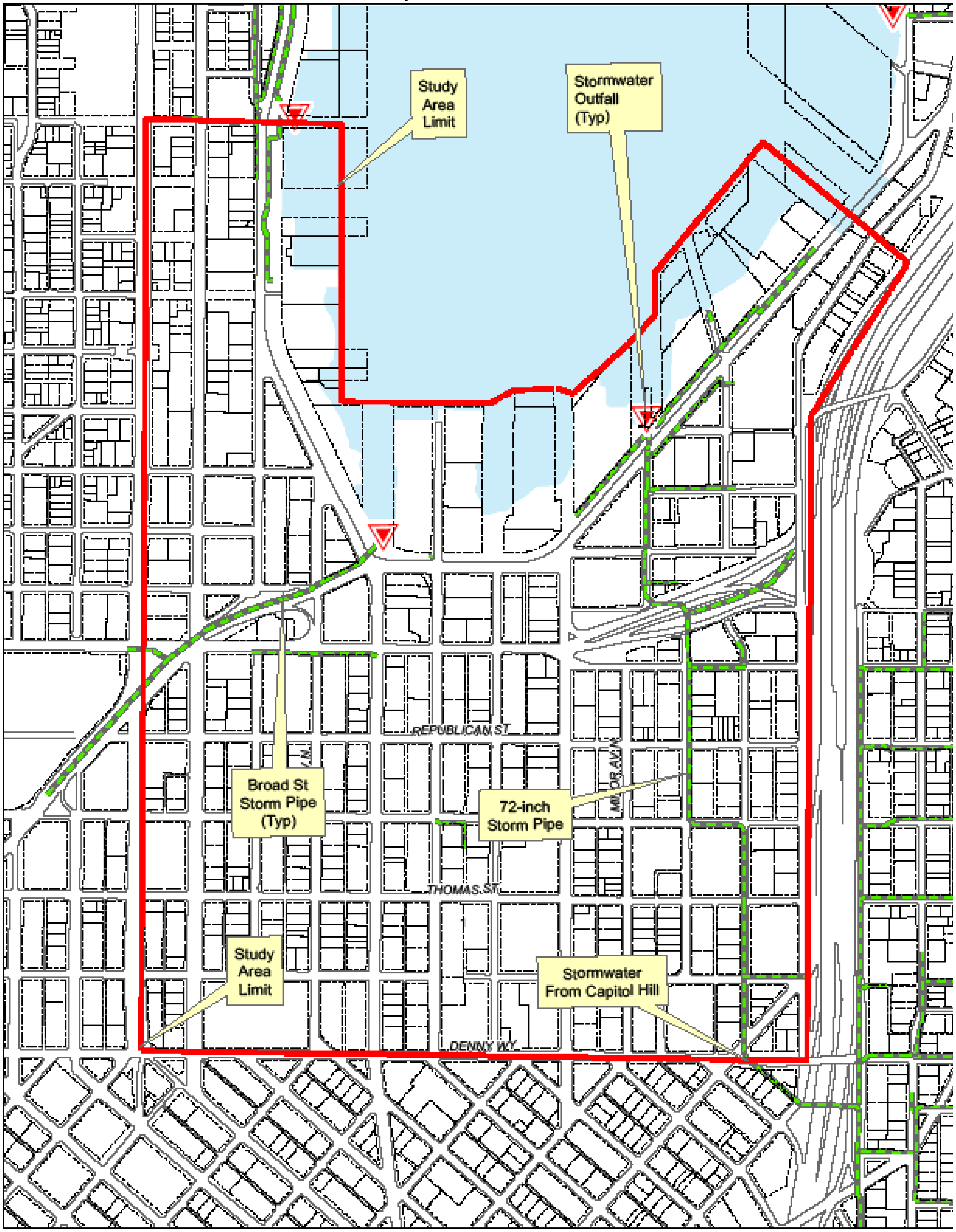
Gas

Puget Sound Energy (PSE) serves the planning area for natural gas. They manage the distribution of natural gas to customers, which involves pressure regulation and the development and maintenance of a network of gas mains. There is an extensive network of gas mains in the planning area, with pipes under most streets or alleys to serve most properties.

Telecommunications

Qwest is the principal provider of wired telephone and communications infrastructure to the study area. Other providers have moved in to certain areas of the neighborhood. With wireless solutions becoming more common, Qwest and other telecommunications service providers are expanding the options available to businesses and residents.

Figure 3.15-3
Stormwater Systems



Source: Coughlin Porter Lundeen, 2010

Focus Areas[3]

8th Avenue Corridor

Water pipes in 8th Avenue are 12-inch diameter cast iron and were installed in 1912 and 1925, per city records.

Stormwater runoff and sanitary sewage from the 8th Avenue Corridor is routed to a 12 and 15-inch diameter combined sewer system in 8th Avenue. This sewer joins the main trunk sewer at Republican Street and 9th Avenue. This sewer appears to have been installed in 1910.

Electric power is available from overhead wires in the alleys to the east and west of 8th Avenue.

Natural gas is available from a PSE main in 8th Avenue.

Telecommunications is available from Qwest and other providers in this area.

Fairview Avenue Corridor

Water distribution is from a 12-inch cast-iron main installed in 1930, per city records.

Stormwater runoff from most of the Fairview Avenue Corridor is routed to a combined sewer system in Fairview Avenue. The system in Fairview consists of two parallel pipes, one 8-inch and one 12-inch in diameter. Both pipes join the main trunk sewer at the intersection with Republican Street. Surface water from the west portion of this area (between Harrison and John Streets) enters the combined sewer system at the 8-inch sewer in Boren Avenue. This sewer connects to the main trunk sewer in Republican Street. The mains in Fairview date back to at least the 1920s.

Electric power is available from underground conduit in Fairview Avenue.

Natural gas is available from a PSE main in Fairview Avenue.

Telecommunications is available from Qwest and other providers in this area.

[3] Focus areas are subareas in the South Lake Union neighborhood that are considered in greater detail, where applicable. Please discussion and Figure 2-3 in Chapter 2.

Valley/Mercer Blocks

Water distribution is from 8 to 24 inch diameter mains in the streets within this area. Pipes are primarily cast iron, installed from the 1910s to the 1930s.

Stormwater runoff from the Valley and Mercer Blocks is routed to the combined sewer system. Local sewer mains in Fairview, Boren, Terry, Westlake and 9th Avenues all convey collected surface water to the main trunk sewer in Republican Street. Sewer pipes vary in age around this block, the pipes in Terry Avenue were replaced in the 1960s, the older sewers in this area date to the 1920s.

Electric power is available from overhead wires and underground conduits in the area. Recent developments in the blocks bounded by Republican, Terry, Mercer and Boren have installed underground power and telecom. Older areas still have overhead wires.

Natural gas is available from a PSE main in Mercer Street.

Telecommunications is available from Qwest and other providers in this area.

3.15.2 Environmental Impacts

The proposal analyzed in this EIS considers the use of incentive zoning to increase height and density in the South Lake Union neighborhood. By itself, this proposal would not directly result in impacts to utilities.

In addition, as described above, many of the water, sewer and storm systems in this neighborhood are at or near the end of their expected life. Increased failure rates in these systems can be expected with or without future development. While this is an issue of concern, it is not an impact associated with the proposal. Therefore, the need of replacement of aging systems is not discussed below.

Future site-specific development proposals under any of the alternatives would create additional load on the utility infrastructure in this area and is briefly discussed below.

Impacts Common to All Alternatives

Water System

The increased density and intensity of development that would be permitted by the action alternatives could result in greater demands on the water supply and distribution system. There will be an overall greater demand for water with increased density. However, new development will be required to include practices which will incorporate efficient plumbing fixtures, water conserving landscape, and water reuse opportunities that can reduce per capita water demand. These practices will reduce the overall impact to water use within the area of the proposed alternatives.

Combined Sewer System

The increased density and intensity of development that would be permitted by the action alternatives could result in greater demands on the local sewer collection system and on the downstream conveyance and treatment facilities. Although there will be a greater overall need for sewage facilities with increased density, new development can reduce per capita demand, as newer, low flow or no-flow plumbing fixtures and equipment replaces older, less efficient, installations. This could help reduce this overall impact.

Potential development under any of the alternatives is not expected to result in increased demand on the stormwater component of combined sewer systems in the neighborhood. Current drainage code will require re-developed sites that discharge to the combined sewers to provide stormwater detention with either Green Stormwater Infrastructure (GSI) that allows some water to infiltrate, and be kept on site, or traditional underground tanks and vaults that temporarily hold the water and slowly release it to the sewer. Either of these methods will help control peak rates of stormwater through the local combined sewer systems, limiting the frequency of street flooding from the local collector pipes and reducing the risk of CSOs from the trunk mains.

Storm Sewer System

Potential development under any of the alternatives is not expected to result in increased demand on the storm water systems of the neighborhood. Current drainage code will require re-developed sites that discharge to the storm sewers to provide stormwater detention with Green Stormwater Infrastructure (GSI) that allows some water to infiltrate, and be kept on site, before the rest is released to the storm sewer. Many of the GSI detention systems double as water quality treatment systems. See also Water Quality (Section 3.3) for additional discussion.

Electric Power

The increased density and intensity of development that would be permitted by the action alternatives could result in greater demands on electrical energy. However, when new development and modern power consuming equipment is installed, there can be a reduction in per-capita demand, which will help reduce this impact. It is anticipated that power infrastructure will need to be upgraded and capacity increased to support development. Specific improvements will need to be addressed on a project by project basis.

Affected Environment
Environmental Impacts
Mitigation Strategies
Significant Unavoidable Adverse Impacts
Utilities Contents

3.15.3 Mitigation Strategies

No mitigation measures are necessary or proposed to address potential impacts associated with the proposal or alternatives.

Depending on the nature of future site-specific development, mitigation may be necessary to address site-specific impacts that could occur under any of the alternatives.

Leadership in Energy and Environmental Design (LEED) provides a framework and ranking system to reduce the impact of development on the environment including the utility infrastructure. By using LEED methods to reduce energy and other resources, projects can reduce the overall effects of new or re-development. Encouraging the use of the LEED or a similar standard score card (such as Built Green) for resource use reduction with some type of development incentives would help to reduce the effects on the utility infrastructure.

Water

1. The use of low or no-flow fixtures and water saving devices in new construction and renovations.
2. Collection and re-use of storm water for non-potable uses (irrigation, toilet flushing, mechanical make up water, etc.) would reduce demand on the public water supply.
3. A replacement or rehabilitation plan for the oldest water mains in this neighborhood should be developed by SPU. Pipes adjacent to re-developed sites could be replaced as part of the related street improvements.

Combined Sewer & Storm Sewers

1. Modern low flow or no-flow plumbing will reduce the per capita waste water volume discharged to the combined sewer pipes and sent to the treatment facility.
2. New development in the area will be required to meet the 2009 City of Seattle Stormwater Code. Stormwater collected on site will be required to be held on site with Green Stormwater Infrastructure (GSI) methods, or detained before discharge to the city storm system. These measures will reduce the peak rate of water discharged to the combined and storm sewer systems.

3. A replacement or rehabilitation plan for the oldest sewer pipes in this neighborhood should be developed by SPU. Pipes adjacent to re-developed sites could be replaced as part of the related street improvements.
4. Installation of a separated storm sewer system in this area, sized for the approved level of development, would reduce the load of storm water sent to the treatment plant, and nearly eliminate combined sewer over flows in this area. The existing combined sewer system would be retained for use as a sanitary sewer.

Electric Power

1. The installation of photovoltaic and other local generating technologies will reduce the demand on the public generating and distribution facilities.
2. Construction and operation of LEED compliant (or similar ranking system) buildings will reduce the level of increase required in power systems.
3. Reduce the use of power in building heating and cooling with passive systems and modern power saving units.

3.15.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to utilities are anticipated.

3.16 OPEN SPACE AND RECREATION

This section of the Draft EIS describes the existing open space and recreation opportunities in the South Lake Union neighborhood and surrounding site vicinity, and evaluates how each of the alternatives would affect open space and recreation opportunities.

3.16.1 Affected Environment

The South Lake Union neighborhood is located in the center of the City of Seattle, immediately north of Downtown. The area contains several existing open space and recreation areas; additional areas are located in the site vicinity. The following provides a summary of existing open space and recreation areas on the site and site vicinity, and summarizes existing parks and recreation plans for the area.

Open Space and Recreation Areas

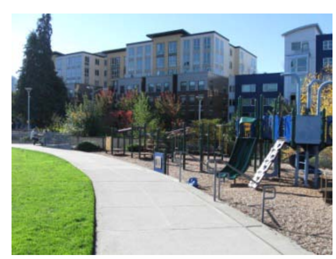
The South Lake Union neighborhood currently contains four City of Seattle Parks, including: Lake Union Park, Denny Park and Playfield, Cascade Playground, and the Eastlake Triangle.

Lake Union Park

- Lake Union Park is an approximately 9-acre park located at the north portion of the South Lake Union neighborhood, on the shore of Lake Union. The park is currently undergoing a renovation that is scheduled to be completed in September 2010. Park features include an interactive water fountain, model boat pond, views of Lake Union, and a history trail; the Center for Wooden Boats is also located in the park.
- Denny Park is an approximately 5-acre park located at the southwest portion of the South Lake Union neighborhood. The park features pedestrian pathways, seating areas, mature landscaping, and a play area. Denny Playfield is also located adjacent to Denny Park and contains basketball courts; however, Denny Playfield is a privately owned facility that is proposed for potential commercial development in the future.

Denny Park

- Cascade Playground is an approximately 2-acre park located at the western portion of the South Lake Union neighborhood. The park includes basketball courts, a play area, a p-patch garden, picnic areas, and restrooms.
- Eastlake Triangle is a less than 1-acre park located in the northeast portion of the South Lake Union neighborhood. The park includes small gathering and seating areas.



Cascade Playground

Open Space and Recreation Areas – Site Vicinity

The City of Seattle parks and recreation system is comprised of a variety of parks, open space, boulevards and trails, lakes and creeks, recreational, cultural, environmental and educational facilities, and a broad variety of programs. The Parks and Recreation Department is responsible for the operation and maintenance of 430 parks, 185 athletic fields, 151 outdoor tennis courts, 112, neighborhood play areas, 26 community centers, 11 off-leash areas, 10 swimming pools, and 4 golf courses. **Table 3.16-1** identifies the City of Seattle parks and open space within the site vicinity of the South Lake Union neighborhood (less than 0.5 miles from the South Lake Union neighborhood.

Table 3.16-1
Existing Parks and Open Space in the South Lake Union Neighborhood Vicinity

Park	Acres	Facilities/Features	Distance
Bellevue Place	1.4	Walking paths, open space, and views.	Adjacent to east border.
Thomas Street Mini-Park	0.25	Open space.	Adjacent to east border.
Tashkent Park	0.5	Open space, picnic tables, and benches.	0.25 miles east
Belmont Place	0.02	Open space.	0.25 mile east
Summit Place	0.02	Open space.	0.10 miles east
St. Marks Greenbelt	2.9	Green space, creek, and trails.	0.20 miles northeast
Volunteer Park	48.3	Play area, tennis courts, walking paths, wading pool, views, Volunteer Park Conservatory, and Seattle Asian Art Museum.	0.40 miles northeast
I-5 Colonnade	7.5	Walking paths, bike trail, off-leash area, and views.	0.45 miles northeast
Bhy Kracke Park	1.5	Play area, walking paths, benches, and views.	0.20 miles west
Ward Springs Park	0.34	Play area, walking paths, open space, rental facility, and views.	0.25 miles west
Tilikum Place	0.01	Decorative fountain and historic landmark.	0.20 miles west
Northeast Queen Anne Greenbelt	10.5	Green space and trails.	0.10 miles northwest
Trolley Hill Park	0.9	Play area, p-patch, picnic tables, and views.	0.20 miles northwest
Maclean Park	1.0	Walking paths, open space, and views.	0.25 miles northwest
Cal Anderson Park	7.37	Play area, historic landmark, tennis courts, wading pool, fountain, walking paths, and athletic fields.	0.40 miles southeast
Plymouth Pillars Park	0.6	Off-leash area and views.	0.35 miles south
Regrade Park	0.3	Play area, picnic tables, basketball court, off-leash area.	0.30 miles southwest

Source: City of Seattle Parks and Recreation, 2010.

City of Seattle Parks Planning

Park Distribution Guidelines

The *City of Seattle Comprehensive Plan – Capital Facilities Element* provides an inventory of existing parks and recreation facilities in the City of Seattle; however, it does not include adopted level of service standards relative to parks and recreation opportunities. The Comprehensive Plan indicates that while additions to the existing parks and recreation facilities would enhance the City's quality of life, such additions are not necessary to accommodate new households.

In 2006, the City of Seattle adopted the *Parks and Recreation 2006 Development Plan*, which replaced the *Parks and Recreation Plan 2000*. The *2006 Development Plan* identifies goals, objectives and policies for the Parks and Recreation system, identifies distribution guidelines for parks and open space, and provides an analysis of gaps in areas of the City where parks and open space distribution guidelines remain to be met.

As it relates to the South Lake Union neighborhood, distribution guidelines are broken up into two categories: Total Open Space (Breathing Room) and Usable Open Space.

- Total Open Space (Breathing Room) – The combined acreage of all dedicated open spaces (parks, greenspaces, trails, and boulevards), but not including tidelands and shorelands. One acre per 100 residents is desirable; one-third acre per 100 resident or community approved offset is acceptable.
- Usable Open Space – Relatively level and open, easily accessible, primarily green open space available for drop-in use. Publicly owned or dedicated open space that is easily accessible and intended to serve the immediate urban village. This encompasses various types of open space for passive enjoyment as well as activity and includes green areas and hard-surfaced plazas, street parks and pocket parks. One acre per 1,000 households, one acre of urban space per 10,000 jobs in the Downtown urban and one-quarter acre within 1/8 mile of all locations in urban villages density areas is desirable. One-quarter acre within one-half mile or community approved offset is acceptable.

The South Lake Union neighborhood contains approximately 15.7 acres of usable open space (Lake Union Park, Cascade Playground, and Denny Park/Playfield). The *2006 Development Plan* and associated gap analysis identifies the South Lake Union neighborhood as an area that has exceeded the existing and projected distribution guideline goals for urban centers. **Table 3.16-2** summarizes the distribution goals for the South Lake Union neighborhood based on existing and projected households and employment from the *Comprehensive Plan*.

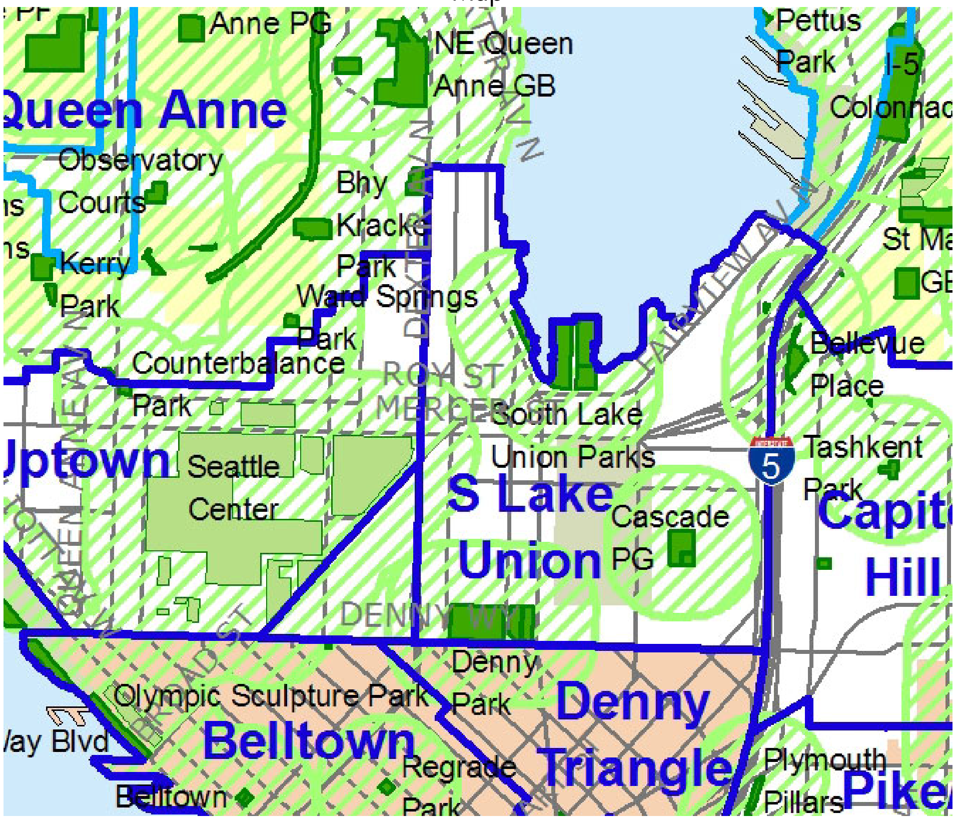
Table 3.16-2
South Lake Union Neighborhood Parks and Open Space Goals

Guideline	Goal	Existing Open Space	Status
Usable Open Space to meet 2024 Open Space Household Goal	9.21 acres	15.7 acres	Goal Met
Usable Open Space to meet 2024 Household and Jobs Goal	12.78 acres	15.7 acres	Goal Met

Source: City of Seattle, 2006 Gap Report Update.

Although the *2006 Development Plan* and associated gap analysis identifies the South Lake Union neighborhood as an area that has exceeded the existing and projected distribution guideline goals for urban centers, certain parts of the neighborhood, (e. g., the area north of Mercer Street, generally in the Fairview subarea and the northwest portion of the study area, generally in the northern portion of the Dexter subarea) fall outside of the 1/8 Mile Service Areas of Usable Open Space for this Urban Center.

Figure 3.16-1
Parks and Open Space Gap Analysis
Map



Source: City of Seattle 2006 Gap Report Update.

1/8 Mile Service Area of Usable Open Space over 10,000 sf

North Downtown Park Plan

In addition to the city-wide parks development plan, the City of Seattle also adopted a park plan for the North Downtown area (Denny Triangle and South Lake Union neighborhoods) in 2004. The *North Downtown Park Plan* includes an analysis of existing and future parks and open space needs in the North Downtown area and provides recommendations to address park and open space goals and deficiencies. As stated previously, the South Lake Union neighborhood would have a surplus of parks and open space in 2024; however, the Denny Triangle Neighborhood, located immediately south of the South Lake Union neighborhood, would have a deficit of approximately 10 acres by 2024. Therefore, the combined North Downtown area would need approximately 8 acres of parks and open space by 2024 to meet future needs.

Improvements to Denny Park are identified as one of the highest priority actions in the *North Downtown Park Plan*, due to the high potential to fulfill a variety of open space functions and the cost-effective nature of such improvements. Potential improvements to Denny Park could include a plaza area, sport courts, children's play area, an off-leash area, and a community center. These potential improvements would be further analyzed in future site programming and planning for Denny Park. Other priorities identified in *North Downtown Park Plan* for the South Lake Union neighborhood include new sport courts, off-leash areas, play areas, and a community garden. Additional recommendations to address park and recreation needs for the North Downtown area include:

- Seek opportunities to acquire and develop park and recreational facilities in North Downtown, especially within Denny Triangle.
- Incorporate public open space and/or recreation facilities into the development of Convention Place.
- Consider developing a large, active open space on SDOT's maintenance site between Broad and Harrison Streets.
- Consider park and recreational opportunities associated with proposed substation improvements in the area.
- Consider purchasing or leasing a portion of a new development for community and recreation facilities.

Parks Capital Facilities Planning

The City of Seattle Parks and Recreation Department uses a three-step process to identify specific maintenance and development projects for funding: (1) project identification, (2) project selection, and (3) project budgeting and scheduling. The process is based on the latest department assessments of its parks and recreation facilities and an assessment of the demand for new, renovation or replacement projects. Park and recreational facility needs for the City are reviewed annually and are reflected in the City's Capital Improvement Program. The 2010-2015 Capital Improvement Program identifies two projects in the South Lake Union neighborhood, including the completion of the Lake Union Park Renovation and the replacement of lighting facilities at Denny Park.

8th Avenue Corridor

The 8th Avenue Corridor is located directly north of Denny Park/Playfield. A portion of the 8th Avenue Corridor is located more than 1/8 of a mile from Denny Park and is identified in the City of Seattle *Gaps in Useable Open Space in the Southwest Sector* (2005) as a gap area for useable open space.

Fairview Avenue Corridor

The Fairview Avenue Corridor is located one block west of Cascade Playground. According to the City of Seattle *Gaps in Useable Open Space in the Southwest Sector* (2005), the northern and southern portions of the

Fairview Avenue Corridor are outside of the Cascade Playground service area and are in a gap area.

Valley/Mercer Blocks

The Valley/Mercer Blocks are located immediately south of Lake Union Park. The entire Valley/Mercer Blocks area is within 1/8 of a mile from Lake Union Park and contains no identified gaps in useable open space service.

3.16.2 Environmental Impacts

Affected Environment
Environmental Impacts
Mitigation Strategies
Significant Unavoidable Adverse Impacts
Open Space and Recreation Contents

This section focuses on the probable significant impacts on parks, open space, and recreation facilities in the South Lake Union neighborhood and site vicinity with redevelopment under Alternatives 1-4. Impacts that would be common to Alternatives 1-4, such as construction impacts and impacts to City-owned parks and recreation facilities are discussed at the beginning of this section. Impacts that would be unique to each alternative are discussed later in the section.

Potential increases in height and density associated with Alternatives 1-4 would subsequently result in an increase in population and employment when future development occurs in the South Lake Union neighborhood. Increases in population and employment in the area would result in an associated increase in demand for parks, open space and recreation facilities in the area.

Due to the programmatic nature of this proposal, no specific parks, open space, or recreation facilities are proposed within the South Lake Union neighborhood at this time; however, such features could be included as part of future development in South Lake Union neighborhood.

Impacts Common to All Alternatives

Construction

Construction activities that would be associated with potential redevelopment under the alternatives would result in temporary and periodic increases in dust and noise levels which could affect users of existing parks in the South Lake Union neighborhood, including Lake Union Park, Denny Park and Cascade Playground. These impacts would be temporary in nature and would not be anticipated to be significant.

Impacts from Potential Redevelopment

Potential redevelopment in the South Lake Union neighborhood under the action alternatives would result in an increase in population due to new permanent residents and employees that could exceed the growth projections from the *Comprehensive Plan*. Such an increase in population would result in an associated incremental increase in demand for parks and recreation facilities during the 20-year growth period.

Based on current parks and recreation distribution guidelines outlined above and the estimated 2031 household and employment targets for South Lake Union, the total estimated park and recreation demand under any of the alternatives would be approximately 14.1 acres. This is an increase over the total 2024 estimated demand of 12.78 acres, but still less than the existing 15.7 acres of open space.

However, when compared against the North Downtown area (Denny Triangle and South Lake Union neighborhoods) the estimated deficit of parks and open space will increase by approximately 1.5 acres.

Table 3.16-3
Potential Increase in Park and Recreation Demand
Estimated Jobs and Housing Targets

	Estimated 2031 Targets for South Lake Union*	Park and Recreation Demand Guidelines	Estimated Demand	Total Demand
Households	11,900	1 acre/1000 housing units	11.9 acres	14.085 acres
Jobs	21,850	1 acre/10,000 jobs	2.185 acres	

Source: Blumen Consulting Group, City of Seattle, 2010.

Note that these targets are estimated for the purpose of this EIS analysis and have not been adopted by the City. Please see discussion in Chapter 2, Section 2.2.2.

Existing gaps in service described previously, including those in the 8th Avenue Corridor and Fairview Avenue Corridor focus areas, would remain and, with additional population, would become more significant.

Increased Demand for Existing Facilities

Future residential and employment growth under Alternatives 1-4 would tend to increase the overall use and activity levels of existing parks and recreation facilities in the South Lake Union neighborhood and site vicinity. In some circumstances this could better activate and improve the safety of public spaces. However, with a large increase in population, there could be volumes of use at some parks or recreation facilities that could represent overuse.

Passive recreation areas emphasize the open space aspect of a park and involve a low level of development, such as trails, walking areas and picnic areas.

Passive park and recreation areas that would likely receive increased demand would include existing facilities in the South Lake Union neighborhood and adjacent areas. Such facilities would include Denny

Park, Eastlake Triangle, Thomas Street Mini-Park, Summit Place, Bellevue Place, Tashkent Park, St Marks Greenbelt, I-5 Colonade, NE Queen Anne Greenbelt, Maclean Park, and Tilicum Place. While these facilities are anticipated to experience increases in use associated with the alternatives, due to the variety of passive recreation areas in proximity to the South Lake Union neighborhood, such increases in use would likely be distributed amongst the numerous facilities and significant impacts would not be expected.

Demand for active park and recreation areas, such as athletic fields, basketball and tennis courts, swimming and wading pools, and play areas would also increase under Alternatives 1-4. The most likely parks and recreation facilities to experience increased use would include Lake Union Park, Denny Playfield, Cascade Playfield, Volunteer Park, Bhy Kracke Park, Ward Springs Park, Trolley Hill Park, Cal Anderson Park, and Regrade Park. These facilities are also anticipated to experience an increase in use associated with the alternatives; however, due to the variety of active recreation facilities in proximity to the South Lake Union neighborhood, such increases in use would likely be distributed amongst the numerous facilities and significant impacts would not be anticipated.

Active recreation areas are those which involve more intensive levels of development and often involve cooperative or team activities.

Potential Park and Recreation Facilities under the Alternatives

Although no specific park and recreation facilities are proposed under the alternatives, Alternatives 1-3 include an incentive program that offers development bonuses for projects (typically an allowance for additional height or floor area). Potential public benefits that could be considered as part of a development incentive program include new park and recreation facilities such as a new center for community, arts, and culture, pocket plazas, and/or children's play areas.

3.16.3 Mitigation Strategies

Future population and employment increases in the South Lake Union neighborhood under Alternatives 1-4 would be incremental and would result in associated increases in demand for park and recreation facilities in the area. These impacts could be addressed by the following mitigation measures.

1. A portion of the tax revenues generated from potential future development in the South Lake Union neighborhood would accrue to the City of Seattle and could help offset demands for park and recreation facilities.
2. Future increases in population and employment in the South Lake Union neighborhood could be planned for through the City's ongoing capital facilities planning process.

3. New park and recreation facilities could be provided in conjunction with potential future development as part of the development bonus process under Alternatives 1-3.
4. New open space facilities could be provided in the Fairview and Dexter subareas in conjunction with potential future development.
5. Consider facilities to address the identified gaps in service in the 8th Avenue Corridor and the Fairview Corridor focus areas in conjunction with potential future development.

3.16.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to parks, open space and recreation facilities are anticipated.

Chapter 4

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Appendix A

Distribution List

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Seattle, WA 98101

U.S. Fish & Wildlife Service
Field Office
510 Desmond Drive SE, Ste. 102
Lacey, WA 98503

Muckleshoot Indian Tribe
39015 172nd Ave. SE
Auburn, WA 98092-9763
Attn: Planning staff

Duwamish Tribe
4717 W. Marginal Way SW
Seattle, WA 98106

Suquamish Tribe
Port Madison Indian Reservation
PO Box 498
Suquamish, WA 98392

Wa. State Dept. of Fish & Wildlife
600 Capitol Way N.
Olympia, WA 98501-1091

Wash. Dept of Social & Health Services
Lands & Buildings Division
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Olympia, WA 98504-5848
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Wash. State Dept. of Archaeology and Historic Preservation
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Tulalip Tribes of Washington
6700 Totem Beach Road
Tulalip, WA 98271

Puget Sound Regional Council
1011 Western Avenue, Ste 500
Seattle, WA 98104-1035
Attn: Ivan Miller

Puget Sound Clean Air Agency
1904 Third Avenue, Suite 105
Seattle, WA 98101
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Sound Transit
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Wa. State Dept. of Transportation
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900 Oakesdale Ave. SW
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Attn: Harold Taniguchi

King County Dept of Natural Resources
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King County Executive's Office
Room 400, KC Courthouse
701 Fifth Avenue, Ste. 3210
Seattle, WA 98104
Attn: Carolyn Duncan

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Seattle, WA 98104-3856
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Olympia WA 98504-7703
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National Marine Fisheries Service
7600 Sand Point Way NE
Seattle, WA 98115-0070

Appendix B

Target/Capacity Methodology

Growth Targets and Zoned Development Capacity

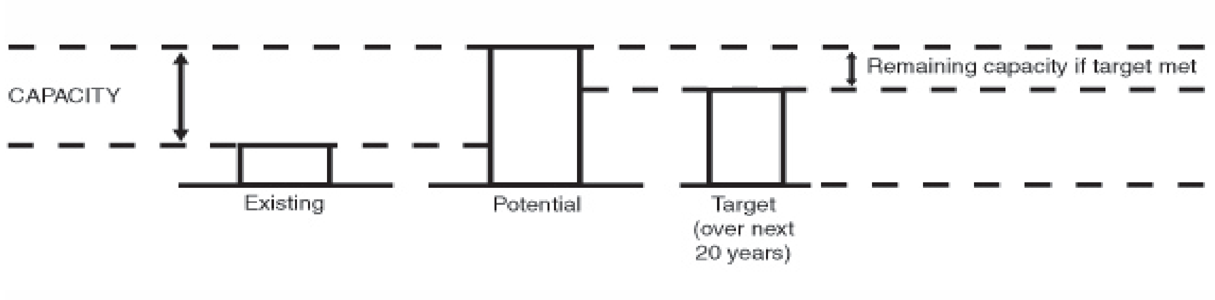
The Department of Planning and Development uses a development capacity model. This model estimates the amount of new development that could be built in the City by comparing existing land uses, housing units and commercial square feet to what could be built under current or proposed zoning. The difference between potential and existing development yields the capacity for new development. This capacity is measured as the number of housing units, the amount of commercial square feet and the number of potential jobs that could be added.

Evaluation of each of the EIS alternatives and their potential impacts references two distinct measures – growth targets and development capacity. The Growth target represents the assumed level of growth that will occur in the South Lake Union neighborhood by the year 2031 and is based on allocating a share of citywide growth that is expected by the year 2031. Development Capacity represents the maximum level of development possible under each alternative with no effort to estimate the likely level of development that will actually occur. Growth targets are based on actual growth projections prepared by the State of Washington Department of Finance. Development capacity is based on assumptions about how much land is redevelopable and the type of projects that could be developed under existing zoning. Below is a brief description of how capacity estimates are achieved and their relationship to growth targets.

Indefinite Time Period Covered by the Estimates

Development capacity is not a prediction that a certain amount of development will occur in some fixed time period. The capacity estimates do not include a time dimension because they do not incorporate any direct measurement of demand, which would help determine when parcels would be developed. Many parcels in the city today have zoning that allows for more development than currently exists on them, but not all of them are available or have a demand for development. Consider a single-family house in a commercial zone that is occupied by an owner who has no plans to sell. Some day that land will change hands and the new owner may be more willing to develop the parcel to its full development potential.

Aside from the relatively small number of parcels that have either active or pending development permits, there is no way to know when actual redevelopment will happen. For the purposes of determining development capacity, though, it is assumed within the model that development will eventually occur regardless of market forces. Therefore, development capacity is not a forecast and has no planning horizon. It is simply an estimate of the additional development that could occur under the current zoning regulations. This additional development could happen all in one year or not at all depending on the economy, attractiveness to development, or other market conditions. Capacity represents the amount of new growth that could be accommodated. The amount of growth that is expected to occur and that City policy intends to accommodate is established as the 20-year growth targets in the Comprehensive Plan.



Comparison of existing development to potential to expected, or target.

Development Capacity Analysis

The actual level of development activity that occurs is controlled by a variety of future factors, many of which are beyond our ability to predict or influence. These factors include such things as the future demand for a particular type of development (such as for townhouses, high-amenity multifamily or small-unit multifamily), whether the owner of any particular land is willing to sell or redevelop it, the financial feasibility of developing the land, and the intensity of development when it does occur. Other factors, such as the relative attractiveness of certain areas for living and commerce, and the relative densities allowed by the existing zoning, can cause some areas to be developed earlier or later than others. No one can predict with certainty the total effect of all these factors on the choices made by land developers.

These limitations notwithstanding, the City has created a model that identifies parcels that have the potential to develop and to estimate the amount of development that could occur. The two key determinants in this model are: 1) available land and 2) zoning. Available land refers to land that is either vacant or developed sufficiently below the potential allowed by the zoning to allow a significant increase in density if it were redeveloped. Zoning represents the rules to which new development must adhere including the uses and densities that are allowed.

In its simplest form, an estimate of capacity is the product of: 1) determining what land is available; 2) multiplying the area of that land by the future expected densities of development zoning allows; and 3) subtracting the existing development. The formulas below summarize the model process.

Potential Development =
Developable Land Area x Future Density Assumption

Development Capacity =
Potential Development - Existing Development

The City's development capacity estimate is the difference between the amount of development on the land today and the amount that could be built under the current zoning. On vacant land, we only need to estimate what the zoning would permit. For a parcel that already contains one or more buildings, the amount of development in those buildings is subtracted from the total that zoning would allow.

Availability of Land for Development

The first task is to determine the land that is available for development. Seattle's capacity model excludes a number of parcels from the calculations based on ownership, use or zoning. For instance, all parcels owned by a public entity—federal, state, county, city, school district, port district—are excluded from the calculations. Parcels used for cemeteries, public and private schools, churches, nursing homes, boarding houses, military bases, public utilities, railroads, hospitals, libraries, law enforcement and that contain landmark structures are excluded. All of the land within the major institution overlay (MIO) is excluded; the jobs and housing units that institutions may provide are determined by each institution's master plan and are counted over and above the capacity. In addition, some parcels are excluded based on specific knowledge of unique circumstances.

No land is excluded to represent additional rights-of-way or other public purposes because Seattle's street system is nearly completely laid out, and most facilities to satisfy public purposes are already in place to the point that no significant quantity of land now within private parcels will be needed for these uses. Nor was land excluded from the calculations because of critical area designations (except for parcels that are shown as creeks or streams) since the City's critical areas ordinance does not prohibit development on critical areas and allows clustering to enable the property developer to achieve the same densities on the developable portion of the parcel as would be allowed on the entire parcel.

Parcels not in the categories listed above are considered available for development. Subsequently their development status is determined through a comparison of existing development to potential future development and classified as developed, vacant, or redevelopable.

Future Density Assumptions

To determine the number of potential housing units or commercial floor area that could be developed on each parcel, two assumptions are made: 1) the density of housing units to be built, and 2) a floor area ratio (FAR) to determine the commercial floor area that could be built. Table 1 below shows the equations for calculating potential housing and floor area using the density assumptions.

Residential	Commercial
Potential Housing Units = Developable Land Area ÷ Expected Square Feet per Unit	**Potential Building Floor Area = Developable Land Area x Expected Floor Area Ratio**

Table 1.

For those zones where the Land Use Code defines maximum density limits, the capacity estimates have, in past practice, assumed that those maximums would be achieved on the parcels that developed. However, examination of historical permitting data has shown that those maximums are not actually being achieved in all zones. Moreover, not all of Seattle's zones have prescribed minimum or maximum density limits, requiring an analysis to make a best-guess of what densities would be achieved.

An analysis of the actual densities that have resulted from development in each different zone from 1996-2005 has led to the creation of a set of "expected" density assumptions. These density assumptions are revised every five years as part of the City's reporting under the Buildable Lands program mandated by the Growth Management Act and are used in capacity analysis related to the Comprehensive Plan. Alternatively, maximum density assumptions, or the maximum densities a zoning category allows, can be used to examine "build-out" scenarios where appropriate.

Determination of What Land Will Redevelop

In a built city such as Seattle, where nearly every parcel already has some building or improvement on it, new buildings often come as redevelopment i.e., expansion or replacement of existing buildings. A developer's decision to demolish and replace an existing building - one that may be generating revenue for its owner - involves many considerations, such as whether the land is owned outright, how much revenue the current building brings in, how much it would cost to demolish and replace it, and how much revenue a new structure could generate. There is no way to know about these considerations for all the parcels in the city today, let alone for five or 20 years into the future.

In place of such detailed knowledge, the City uses three different measures to identify parcels likely to redevelop depending on the type of zone: 1) *residential development ratio* - the existing residential units compared to potential residential units, 2) *commercial development ratio* - existing building floor area compared to potential floor area; and 3) *improvement to land value ratio* - the value of buildings and other improvements on a parcel compared to its land value.
The assumption for assessing developability is that the value of the ratio measure is inversely proportional to the tendency to develop - that is the lower the ratio the higher the probability that the parcel will redevelop. In practice for capacity determination, developability of a parcel is determined by comparison of the appropriate ratios with a predetermined threshold value.

The *residential development ratio* is a straightforward indication of whether a parcel will redevelop. The basic assumption is that over time property owners will attempt to maximize the value of their property by maximizing the number of residential units that can be rented or sold on that property. However, if the number of units currently on-site is close to the total number of potential units that could be developed on the site, the cost of building additional units would exceed the revenue that can be generated by building new units. Therefore in residential zones, a ratio of existing units to total potential units is used to determine if a site is likely to be redeveloped at some point in the future. This measure is called the Development Ratio using Units (DR:UNITS in the model) and is used for single-family and multi-family zones.

The number of potential units on a site is based on the assumed densities. See the discussion labeled "Future Density Assumptions" below for a description of how these densities are selected.

Development Ratio:Units =
Existing Units / Potential Housing Units

The *commercial development ratio* is similar to residential except that it compares the above-ground building square footage of the existing buildings to the potential floor area. This ratio is called the Development Ratio using Square Feet (DR:SQFT) and is used for commercial, neighborhood commercial and Seattle-mixed zones.

Development Ratio:Sqft =
Existing Building Square Feet / Potential Building Square Feet

To determine the *improvement to land value ratio* (ILR), the City relies on data from the King County Assessor. Appraisers in the Assessor's office assign two monetary values to a given parcel – one for the land and one for the improvement (structures) on the site. The value of land is an indication of the demand for that land in its "highest and best" use. For vacant land, different values may be assigned to different parcels for a variety of reasons, including that those parcels are inherently more desirable because of location or physical features, or because they are zoned for higher development potential. Similarly, in the case of developed parcels, a land value that is higher than the structure value often indicates that more intense use of the land is possible. This measure is used for downtown and industrial zones.

Improvement to Land Value Ratio =
Existing Building Values / Parcel Land Value

Again, one cannot know precisely at what point a particular parcel is likely to redevelop, but an analysis of parcels that have been redeveloped in Seattle over the past ten years has provided guidance for the development of thresholds of existing development compared to potential development below which parcels are more likely to redevelop. These thresholds are outlined in the Assumptions section below. The development ratios are compared to the appropriate thresholds (depending on the zone), and a development status is determined for each parcel - developed, redevelopable, or vacant.

Residential/Commercial Split in Mixed-Use Zones

Seattle's commercial zones are primarily intended to provide locations for commercial uses, e.g., retail shops, offices and restaurants. However, the Land Use Code also allows residential uses in these zones. Analysis of permitting data has informed assumptions about the "split" between residential and commercial development in a mixed-use project in the commercial zones. These splits are represented as percentages of the type of use that, in aggregate for a zone, actually occurred. For example, in a C2-40 zone about 80% of development is commercial and 20% is residential, as opposed to an NC3/R-40 zone where development is about 80% residential.

It is important to note that the split of residential and commercial space applies across a broad area, and may not be relevant on a site-by-site basis. Any particular site or small area may be developed with residential, mixed-use or commercial uses, depending on the market. For the capacity estimates, results derived from the following three assumptions are provided to present a range of potential development in these zones: 1) all development is commercial, 2) all development is residential and 3) all development is mixed according to observed proportions expressed as the following:

Total Development in Mixed-Use Zones =
(Potential Housing Units x Percent Residential) +
(Potential Building Floor Area x Percent Commercial)

South Lake Union Development Capacity Assumptions

Development of capacity estimates for the four EIS alternatives required several assumptions:

1) Residential density estimates assume an average residential unit size of 1,000 gross square feet. This assumption is consistent with recent trends in the neighborhood.
2) One parking space per unit would be provided in residential structures and an equal amounts of parking would be below and above grade.
3) Employment density is assumed to be one employee for every 350 square feet.
4) The mix of residential and commercial development is assumed to be approximately 55% residential and 45% commercial.

Residential Densities by Height

Tower Height	45 foot podium	65 foot podium	85 foot podium
400 Feet	720 units/acre	890 units/acre	n/a
300 Feet	562 units/acre	596 units/acre	655 units/acre
240 Feet	465 units/acre	490 units/acre	535 units/acre
160 Feet	327 units/acre	353 units/acre	385 units/acre

Appendix C

Cultural Resources

3.1 CULTURAL RESOURCES

Blumen Consulting Group (BCG) retained Cultural Resource Consultants, Inc. (CRC) to evaluate potential impacts to cultural resources for the South Lake Union Height and Density EIS in accordance with the Washington State Environmental Policy Act (SEPA). The goal of this assessment was to identify any previously recorded archaeological resources within the study area, determine the potential for any as-yet unrecorded archaeological resources within the study area, and evaluate potential impacts of the proposal to archaeological resources. Assessment methods included a review of previous ethnographic and archaeological investigations in the local area; an online search of records maintained by the Washington Department of Archaeology and Historic Preservation (WA DAHP) for known sites in the immediate area; a review of relevant background literature and maps (including General Land Office (GLO), Sanborn, and Kroll maps); and the preparation of this report. This assessment utilized research design that considered previous studies, the magnitude and nature of the undertaking, the nature and extent of potential effects on historic properties, and the likely nature and location of historic properties within the study area, as well as other applicable laws, standards, and guidelines (per 36 CFR 800.4 (b)(1); WA DAHP 2010b).

3.1.1 Affected Environment

The South Lake Union neighborhood is located in the center of the City of Seattle, located immediately north of the Downtown, and adjoining the Uptown and Capitol Hill areas to the west and east. Consisting of about 340 acres, the study area is generally bounded on the east by Interstate 5, on the west by Aurora Avenue, on the south by Denny Way, and on the north by the Lake Union shoreline in the City of Seattle, King County, Washington (see **Figure 2-1**). The legal description for the study area encompasses numerous parcels located in E½ Sec. 30 and W½ Sec. 29, T. 25 N., R. 4 E., W. M. (**Figure 3.1-1**).

Four alternatives (three action alternatives and one no action alternative) are proposed as described in **Chapter 2**. Within the study area, three opportunity areas are addressed in further detail. For the purposes of this assessment, the area of potential impacts to cultural resources is considered to be the study area as described above. All proposed actions would occur within the boundaries of the study area.

Forty-three cultural resource assessments have previously been prepared within approximately one mile of the current project (**Table 3.1-1**). Many of these were conducted within the study area. Of note are recent assessments that included subsurface archaeological investigations within the boundaries of the current study area. Durio and Bard (2008:4-10–4-11) conducted archaeological testing near Broad Avenue and Mercer Street in the vicinity of a Duwamish camp or longhouse (see **Ethnohistoric Context** below) and did not recover any archaeological evidence of pre-contact or historic-period habitation. Dellert and Larson (2004) reported archaeological monitoring of excavations to remove a tunnel boring machine north of Valley Street. Deposits observed consisted of fill up to 18 feet below surface, lakebed sands, and underlying peat; no archaeological sites were identified.

As a result of these assessments, one historic-period archaeological site has been recorded within the study area (**Table 3.1-2**). Site 45KI502 is a historic-period railroad segment east of Westlake Avenue from Aloha Street north to the Fremont Bridge (Cole 2000; Nelson 2001). It was supported on a wooden trestle built in 1911 over the steeply sloped margins of Lake Union. The site was recommended not eligible for the National Register of Historic Places (NRHP). Subsequent archaeological monitoring of construction excavations in and adjacent to the site did not identify any pre-contact archaeological materials. Historic-period and/or recent refuse items (e.g., bottle glass, wood debris) were observed during monitoring but their age could not confidently be assessed at 50 years or older; therefore, they were not considered archaeological or potentially eligible for the NRHP (Shong and Miss 2004).

No pre-contact archaeological sites have been identified within the study area (see **Table 3.1-2**). The nearest recorded pre-contact archaeological site is the Baba´k^{w}ob site (45KI456) on Elliott Bay in Belltown (Lewarch 1998). The site was first identified as human skeletal elements encountered in construction excavations (Larson and Lewarch 1998). Archaeological testing and monitoring identified additional archaeological materials including shell midden, wood planks, charcoal, and a variety of historic-period personal, domestic, and commercial items (Lewarch 1998; Lewarch, et al. 2002:Table 4). Examination of stratigraphy in archaeological test units and construction trench exposures, along with artifacts dating from the 1830s to 1860s, indicated that the archaeological materials were contained within historic-period (1880s to 1912) and recent fill and landslide deposits, and dated to the historic period. Because the site did not retain depositional or locational integrity, it was recommended not eligible for the NRHP (Lewarch, et al. 2002:123).

Environmental and cultural information for the study area is presented here as context for evaluating the proposal's potential impacts to cultural resources. The study area's geological setting and past human activities have shaped the potential for the proposal to impact cultural resources.

Geological Context

Archaeological evidence suggests human occupation in the Puget Sound region began following the last glacial retreat at the end of the Pleistocene, approximately 14,000-10,000 years ago. The environmental changes produced by deglaciation, including alterations to landscapes, climate, and vegetation significantly influenced the spatial distribution of human activities, based on the availability of resources and the suitability of certain landforms for occupation. The potential distribution of archaeological resources in the vicinity of the property, and the identification of conditions that may have affected contemporaneous preservation of these resources, are informed by understanding changes to the local environment over time.

The study area is geographically situated in the Puget Lowland south of Lake Union, in a depression between Capitol Hill to the east and Queen Anne Hill to the west. Denny Hill was formerly present southwest of the Lake Union Depression (Galster and Laprade 1991). Elevation within the study area ranges from approximately 25 to 95 feet above sea level. The western portion of the Lake Union Depression, between Seattle Center and the southwestern end of the lake, was a seasonally wet meadow in the early historic era (Waterman 1922). There was a stream that flowed roughly north-south for a short distance in the vicinity of present-day Fairview Avenue, entering Lake Union near the present-day intersection of Valley and Fairview. Forsman, et al. (1997:20) speculate that this stream may have supported salmon runs. In addition to salmon, a number of freshwater fish species were available in Lake Union.

The topography and geology of the area were formed during the Late Pleistocene, following the advance of several glaciations that originated from Canada and extended between the Cascade and Olympic mountain ranges into the Puget Lowland (Kruckeberg 1991:12). The most recent glacial event in the Puget Sound, termed the Vashon Stade, is largely responsible for the region's contemporary landscape; glacial advance and retreat scoured and compacted underlying geology while meltwaters carved drainage channels into glacial outwash deposits (Downing 1983; Booth, et al. 2003). Following rising temperatures, the glacier retreated rapidly to the north and left the regional landscape ice-free and suitable for inhabitants by approximately 11,000 years ago (Kruckeberg 1991:22). Lake Union formed in a glacial basin exposed after glacial retreat.

Following glacial retreat, land surfaces that had been covered by ice uplifted. This isostatic rebound varied locally and was much more subtle in the southern Puget Lowland than in the north (Thorson 1989). Marine waters began to fill Puget Sound once the Strait of Juan de Fuca and Admiralty Inlet were no longer blocked by ice. In southern and central Puget Sound, sea levels began to rise rapidly after 8,000 years ago (Eronen, et al. 1987) and then rates of increase slowed around 5,000 years ago (Booth, et al. 2003:26). Eustatic sea levels were within one meter of present-day levels by about 1,000 years ago (Eronen, et al. 1987). Prior to construction of Lake Washington Ship Canal, the elevation of Lake Union was 21 feet (6.4 meters) above sea level (Troost and Booth 2008:29), comparable to its present-day elevation. However, the mean level of Lake Union and Lake Washington previously fluctuated by as much as seven feet over time due to changes in hydrology and tectonic events that affected the lakes' outflow near Renton. Earthquakes throughout the past 7,000 years triggered underwater slumping, landslides, ground elevation changes, and tsunami. Seiches associated with seismic activity in the twentieth century have been documented in Lake Union (Troost and Booth 2008:16-17); similar events likely affected the Lake Union shoreline in the past. A massive earthquake on the Seattle Fault 1,100 years ago caused slides and subsidence in the study area (Bucknam, et al. 1992; Jacoby, et al. 1992; Karlin and Abella 1992; Nelson, et al. 2002).

While sedimentation during glacial times was widespread and voluminous, active deposition in nonglacial periods including the present day has been more restricted, occurring in river valleys and at the base of steep slopes (Booth, et al. 2003:20-21). In the study area and environs, bedrock was eroded by the advancing and retreating late Pleistocene glaciers and was capped by glacial till. The Lake Union Depression was created by Vashon Stade ice flow and filled with a variety of sediments in the Holocene (Morgenstein and Blukis Onat 2003:23).

Surface geologic deposits mapped in the study area are composed of pre-Fraser glaciation age deposits in the vicinity of Terry Avenue between Denny Way and Harrison Street; landslide deposits north of Aloha Street between Aurora Avenue and Westlake Avenue; Vashon recessional lacustrine deposits and Holocene lake deposits north of Republican Street; Vashon till in the area bounded roughly by Republican, Aurora, Aloha, and Westlake, and in a small area near the intersection of Minor and Valley; and Vashon recessional outwash deposits in a narrow north-trending trough in the vicinity of Fairview Avenue (Troost, et al. 2005; WA DNR 2010). Large-scale landscape alterations since the 1880s have obscured and/or removed portions of these natural deposits as demonstrated by the presence of regraded land in most of the study area south of Republican Street; artificial fill over Vashon and Holocene lacustrine deposits north of Valley Street; and modified land over Vashon lacustrine and ice-contact deposits in areas east of Fairview and between Republican and Valley Streets west of Fairview (Troost, et al. 2005; WA DNR 2010). These areas have been affected by human activities including cutting, filling, grading, leveling, regrading, sluicing, construction of artificial waterways, and shoreline protection. Fill as thick as 30 feet has been logged in geotechnical borings in the area south of Lake Union (Gillis, et al. 2005:3-2; Link EIS Team 1999:7). South of the former Lake Union shoreline, fill deposits are estimated to be about five feet thick in the area between about 9th Avenue on the west and Fairview Avenue on the east (Durio and Bard 2008:Exhibit 4-1; Lewarch, et al. 1999:Figure 3). The Denny Regrade projects begun in 1907 and 1927 removed soils from the southwestern portion of the study area, south of Valley Street and west of 9th Avenue North (Forsman, et al. 1997:Figure 2). As much as the upper 60 feet of earth was removed in high-elevation areas (Corley 1969). In present-day Denny Park, the maximum elevation was 155 feet (Hall 1927); it is now approximately 95 feet above sea level. Industrial development and construction of urban residential and commercial zones following the 1907 and 1927 regrades have also disturbed former natural land surfaces.

The current local soil survey does not map soil units in the study area (USDA NRCS 2010). In general, soil formation on uplands in the Seattle area has been slow, and undisturbed surfaces typically cap a poorly- to well-developed A horizon underlain by silty weathered Vashon till parent material within a meter of ground surface (Troost and Booth 2008:28). Although sedimentary profiles specific to conditions immediately preceding Euro-American settlement and logging of this location by the 1880s are not available, the hills and valleys in the study area were likely to have been composed of soils having a relatively limited potential for soil development, with steeper slopes subject to occasional, perhaps seasonal colluvial action. Archaeological deposits in such soils would be subjected to the same geophysical forces; preservation of the depositional integrity of archaeological deposits or anthropogenic sediments would vary based upon their specific physical characteristics.

Intact native soils are generally not expected to be present within the study area due to the long record of historic-period and modern disturbances. However, fill deposits may cap native soils in formerly low-elevation portions of the study area. There may be buried wetland soils under the filled southern shore of Lake Union and formerly low-elevation areas to the south (Blukis Onat 2009:19). There may be buried wetland soils under the filled southern shore of Lake Union and filled areas to the south (Blukis Onat 2009:19). Specifically, the former stream in the vicinity of Fairview Avenue, a ravine centered near Westlake, and the former lake bed north of Republican Street could potentially contain pre-contact and early historic-period archaeological sites if intact former land surfaces are buried beneath historic-period and more recent fill.

Archaeological Context

Regional and local studies have provided an archaeological and historical synthesis of approximately the last 10,000 years of human occupation in Puget Sound (Nelson 1990). Upland terraces and ridges would have been available for occupation earlier than lower-elevation areas due to the effects of deglaciation described above; archaeological materials in the study area and similar settings could range in age from the early Holocene to the historic-period. The study is located on what were formerly a seasonally wet meadow, a ravine and stream, the northeastern flank of Denny Hill, and steeply sloped forested uplands adjacent to the Lake Union shoreline. Native American villages in this region were typically located very near or adjacent to water bodies (Suttles and Lane 1990). It is probable that the main pre-contact human activities in the study area were hunting and plant gathering based in associated seasonal camps. Historic-period Lakes Duwamish people continued to obtain resources from Lake Union and lived in the area southwest of the study area. Over the last approximately 130 years, activity in the study area has included logging, construction and demolition of residential and commercial structures, construction of manufacturing and other industrial facilities, shoreline filling and construction of artificial waterways, construction and regrading of roadways, and construction of buried water lines and other utilities. This suggests that undisturbed evidence of earlier human occupation is unlikely to be present in the study area. Archaeological materials that could potentially be found in the study area would most likely date to the historic period.

Several previous cultural resource studies and overviews provide background information applicable to the study area (e.g., Blukis Onat 2009; Courtois, et al. 1999; Larson and Lewarch 1995; Miller and Blukis Onat 2004; Nelson 1990). Characteristic of the ethnographic pattern in Puget Sound, seasonal residence and logistical mobility occurred from about 3000 BP. Organic materials, including basketry, wood and foodstuffs, are more likely to be preserved in sites of this late pre-contact period, both in submerged, anaerobic sites and in sealed storage pits. Sites dating from this period represent specialized seasonal spring and summer fishing and root-gathering campsites and winter village locations. These kinds of sites have been identified in the Puget Sound lowlands, typically located adjacent to, or near, rivers or marine transportation routes. Fish weirs and other permanent constructions are often associated with large occupation sites. Common artifact assemblages consist of a range of hunting, fishing and food processing tools, bone and shell implements and midden deposits. Similar economic and occupational trends persisted throughout the Puget Sound region until the arrival of European explorers.

Ethnohistoric Context

Ethnohistoric economies of people in the southern Puget Sound were structured upon a variable rotation of seasonally available resources. Permanent villages provided a central hub from which seasonal activities radiated. During the spring, summer and fall, temporary camps were utilized while traveling to obtain resources that included foodstuffs such as fish, shellfish, waterfowl, deer, roots and berries. Salmon was the single most important food source and was caught in weirs, traps, nets and other fashioned implements (Smith 1940). Local Indian people shared many broadly defined traditions with their inland Puget Sound neighbors, including subsistence emphasis on salmon and other fish, land game, and a wide variety of abundant vegetable foods, and household and village communities linked by family and exchange relations (Suttles and Lane 1990).

The South Lake Union Height and Density EIS study area is within the traditional territory of the Duwamish Tribe, a group of Coast Salish Southern Lushootseed speakers; historically, members of the Suquamish and Muckleshoot Tribes also utilized this vicinity (Suttles and Lane 1990; Waterman 2001). The Muckleshoot Indian Tribe is recognized as successors to the Duwamish for fishing and certain other treaty rights. The Suquamish Tribe also considers the local vicinity as a usual and accustomed place, but was denied recognition as successor of the Duwamish by District Court (Tulalip Tribes, et al. 1990). The Duwamish tribal organization does not currently have federal recognition.

The Suquamish occupied Kitsap Peninsula (Spier 1936:34), as well as Bainbridge and Whidbey Islands prior to implementation of the Point Elliot Treaty of 1855 (Ruby and Brown 1992:226). Pre-contact Suquamish settlements were often located on major waterways, and heads of bays or inlets. In the winter, the Suquamish lived at large permanent village settlements and they spent the summer hunting, fishing, and gathering at specialized, temporary camps. The Muckleshoot Tribe comprises groups who traditionally lived and used resources in the Green and White River valleys and adjacent plateaus (Suttles and Lane 1990:Figure 1, Table 1). A network of trails and waterways connected Muckleshoot villages on inland river valleys to the Puget Sound shoreline (Noel 1980:29).

Major Duwamish winter villages were formerly located on the Cedar, Duwamish, Sammamish, and Black Rivers, Lake Sammamish, Lake Washington, Lake Union, Elliott Bay, and Salmon Bay (Miller 1999; Smith 1941:207; Waterman ca. 1920, 1922), outside the current study area. Duwamish people who lived around Lake Union, Lake Washington, and Lake Sammamish were known as xa'tcoabc, "Lakes Duwamish." The Lakes Duwamish were more reliant on resources in the area's freshwater lakes, basins, and drainages, as well as wetlands and forests. Local streams and lakes provided habitat for anadromous fish. Travel by canoe and overland trails connected Lakes Duwamish groups to each other and to people throughout the Puget Sound region.

The Lakes people had several permanent and temporary settlements on all of the lakes. Ethnographic sources reviewed in this assessment (e.g., Smith 1940; U.S. Court of Claims 1927; Waterman ca. 1920, 1922, 2001) indicate that the winter village nearest to the study area was Baba´k^{w}ob in present-day Belltown, named for a prairie and ravine between Belltown and Lake Union (Forsman, et al. 1997:Figure 3; Waterman 1922:188).

At the south end of Lake Union, ethnographers Harrington (ca. 1909) and Waterman (ca. 1920, 1922, 2001) recorded two place names: Cta'q^{w}cld and TL^{3}pe'lgw1L (Miller and Onat 2004:69). The former refers to "where a trail descends to the water" at the southern end of Lake Union. From this point, a trail from the Seattle harbor descended the hill to Lake Union at the location of David Denny's sawmill (Waterman 1922:179). The latter is translated as "deep for canoes" and refers to a bluff at the foot of Lake Union on the southern shore (Waterman 2001:102-103).

According to Lane (1987:13, in Forsman, et al. 1997), there was likely a Lakes Duwamish camp or seasonal village southwest of Lake Union near the western border of the study area in the vicinity of Dexter Avenue and Mercer Street (Durio and Bard 2008:Exhibit 4-1). Thrush and Thompson (2007:225) identify the home of an indigenous man named Tsetseguis and his family at the south end of Lake Union near this location in the late 1800s; earlier Lakes Duwamish may also have made their homes in this area. The place was called scHákWsHud, translated as "the foot end of the beach," referring to its position at the end of a trail from Baba´k^{w}ob. Tsetseguis was a close acquaintance of David Denny and his family. He lived at scHákWsHud when Denny's sawmill dominated the south end of Lake Union (Newell 1977, in Thrush and Thompson 2007:225). Bass (1937, in Nelson 2001:7) also describes an Indian settlement with a longhouse for several families on Lake Union near Westlake Avenue in the nineteenth century. Dorpat (1984:60) identifies the location of David Denny's house, west of the study area in what is now Seattle Center, as having been used by Coast Salish peoples as a gathering place.

Historic Context

The first exploration and mapping of the Puget Sound is credited to Captain George Vancouver in 1792, under the auspices of the British Royal Navy. Vancouver surveyed much of the Sound, but the exploration did not extend inland and failed to recognize several waterways including the Puyallup, Nisqually and Fraser rivers (Morgan 1979:16). Decades later, in 1841, the Wilkes Expedition traveled to chart what was then called Oregon Territory. The territory was jointly occupied by the United States and Britain, particularly the British Hudson Bay Company, which established Fort Nisqually in 1834. In an attempt to increase American presence in Oregon Territory, the Wilkes Expedition produced the first detailed map of the area and promoted the region's potential for economic development (Morgan 1979). Four years after the arrival of the Wilkes party, more Americans began to settle in the Territory.

Euro-American settlement in Oregon Territory was further encouraged by the passage of the Donation Land Claims Act in 1850. In 1851, David Denny, John Low, and Lee Terry arrived at the mouth of the Duwamish River; Low and Terry soon filed land claims at Alki Point in West Seattle (Crowley 2003). Within a few years, more Euro-Americans had arrived in Seattle and filed Donation Land Claims (DLCs) between Elliott Bay and Lake Union. The earliest recorded Euro-American activity in the study area is the filing of DLCs by David Denny (DLCs 38 and 39; 323 acres in Sec. 25, T. 25 N., R. 3 E., and Sec. 30, T. 25 N., R. 4 E., W. M.) and Thomas Mercer (DLC 37; 160 acres in Sec. 30, T. 25 N., R. 4 E., W. M.) (BLM 2010; USSG 1861:535-544) (**Figure 3.1-2**). Denny's claim extended from the south end of Lake Union west to Elliott Bay between present-day Denny Way and Mercer Street. Mercer's claim was immediately to the north, including the area between Lake Union and 6th Avenue North between Highland Drive and Mercer Street (United States Surveyor General [USSG] 1863).

One GLO map (USSG 1856) shows two Euro-American residences within the study area (**Figure 3.1-3**). Thomas Mercer's residence is shown north of present-day Broad Street, in the vicinity of the block between Dexter Avenue and Aurora Avenue. Another residence is labeled "W. P. Smith" east of Fairview Avenue near Republican Street. Review of GLO notes and historical land patent data did not identify a DLC or other land claim by a W. P. Smith in the vicinity of the study area (BLM 2010; USSG 1861). Other cultural features mapped by the GLO in the study area consist of a trail west of Lake Union and a road from the south end of Lake Union to Elliott Bay (see **Figures 3.1-2 and 3.1-3**).

By the mid-1850s, British and American settlement on Puget Sound and the entire Northwest had drastically impacted local Native American groups and their traditions. In 1853, the United States organized Washington Territory and appointed Isaac I. Stevens as its governor. In 1855, the Duwamish and other Puget Sound tribes signed the Point Elliot Treaty, which forced local tribes onto reservations. The treaty called for cession of lands to the United States and the maintenance of fishing rights and annuities, as well as the concentration of Indian people living in western Washington upon reservation lands (Marino 1990). Individuals considered of the Suquamish Tribe were relocated to the Port Madison Indian Reservation, and the Muckleshoot reservation was established for people living in the White River valley and surrounding areas (Ruby and Brown 1992). The Duwamish were not assigned their own reservation, but rather were required to live on either the Port Madison Indian Reservation on the Kitsap Peninsula or the Muckleshoot Indian Reservation between Auburn and Enumclaw. Some Duwamish moved to the reservations but others remained in their homeland.

The treaty period was marked by heightened tension and violence between tribes and white settlers throughout Puget Sound. By 1855-1856, the federal government was using military force to contain Indian people dissatisfied with the poor quality of reservation lands. Many Indian groups in the Puget Sound area were relocated and interned during this period. Raids, attacks, and violent conflict occurred during this time throughout the Puget Sound region as Indian people attempted to discourage Euro-American settlement. The U.S. Marine Corps and U.S. Navy provided military support during attacks on Seattle (Phelps ca. 1856).

As Seattle expanded northward in the late 1800s, lands in the Lakes Duwamish territory were developed. The newly incorporated town of Seattle banned native urban residence in 1865, though Indians continued to live and work in the city. The Indian Homestead Act of 1875 allowed Indians to own land, provided they renounced tribal allegiance and adopted a Euro-American lifestyle (Blukis Onat, et al. 2005:25; Miller and Blukis Onat 2004:Table 1).

The study area is included in the area incorporated as the City of Seattle by act of the Territorial Legislature on December 2, 1869 (City of Seattle 2010). Denny allowed a 5-acre portion of his land claim to be used as a cemetery, Seattle City Cemetery, in the location of present-day Denny Park, in 1864. In 1884, burials were disinterred and some were moved to Lake View Cemetery on Capitol Hill and the land was repurposed for use as Seattle’s first park (Corley 1969; Crowley 1998).

Comparison of historical and present-day maps (USC&GS 1875, 1899; USGS 1897, 1983; USSG 1856) illustrates patterns of urban development and changes in the position of the lakeshore over time (Chrzastowski 1983; PSRHP 2003a, 2003b) (**Figure 3.1-4**). In 1875 the southernmost extent of Lake Union was at the present-day intersection of Republican and Terry, where there was a ferry stop (Chrzastowski 1983; USC&GS 1875). A map from 1890 (Anderson 1890) shows the southern tip of Lake Union near the present-day intersection of Harrison Street and Boren Avenue. A landing for coal barges was present on the south end of the lake near the intersection of Westlake Avenue and Valley Street in the 1870s before the Seattle & Walla Walla Railroad was built to transport coal from Newcastle and Renton to Elliott Bay (Reinartz 1993:55, in Nelson 2001:10). The south end of Lake Union was shallow to begin with, and was filled to accommodate boat mooring (Chrzastowski 1983).

The study area saw an increase in development in the 1880s. By 1882, the west side of Lake Union had been logged and the Lake Union Lumber and Manufacturing Company sawmill had been built on pilings at the south end of the lake (Reinartz 1993, in Nelson, et al. 2001:9). Denny and other investors purchased the mill in 1884 and, until 1893, operated it as the Western Mill. In 1895, the mill changed hands again and became the Brace and Hergert Mill (Sanborn Map Company 1905). Industry and commerce in the study area were largely centered on the Lake Union shoreline during this period. Sparse single-family residences were present to the south (Sanborn Map Company 1888, 1893).

By 1884, the South Lake Union neighborhood was populated enough to create demand for a streetcar line. The Lake Union Road was built by Frank Osgood to connect Elliott Bay and the south end of Lake Union. This electric street railway was extended northward to Fremont in 1890 via a wooden trestle over the marshy slopes along the west side of the lake, in the present-day location of Westlake Avenue (Dorpat 1984:64). Growth, residential development in particular, continued through the 1890s and into the early twentieth century (Sanborn Map Company 1888, 1893, 1905). By the end of the nineteenth century, the neighborhood was served by a network of water mains (Seattle Engineering Department 1899). Elements of the present-day street grid had been established (Seattle Engineering Department 1900; USGS 1897) (**Figure 3.1-5**).

Public infrastructure improvements in the early twentieth century, including regrading and paving streets, made the study area more attractive to residents and businesses. By 1906, Lake Union's southernmost point was just south of Westlake Avenue and Mercer Street (Durio and Bard 2008:Exhibit 4-1). Along the eastern and western margins of the south end of the lake, the shoreline had a naturally steep slope; filling at the toe of the slope made waterfront development possible in these areas (Weitkamp, et al. 2000). In 1909, the City of Seattle filled a portion of Lake Union with wood waste to create artificial peninsulas extending northward into the lake, providing land for new docking facilities on the south shore of Lake Union. The Northern Pacific Railroad (NPRR) built a belt line through the study area along the east side of Westlake Avenue in 1911-1912 (Cole 2000). South Lake Union was home to numerous industrial and commercial ventures including lumber mills, glass factories, an asphalt plant, and a floatplane service between the 1910s and 1950s. Multiple breweries, woodworking and furniture companies, automobile repair shops and a Ford manufacturing plant, laundries, bakeries, hardware stores, metalworkers, a NPRR freight yard, and public utility yards (e.g., Seattle Lighting Co. and Seattle Disposal Co.) were fixtures in the study area (Sanborn Map Company 1917, 1950). Residential neighborhoods dominated the area south of Mercer Street. Among the many single-family homes, duplexes, and an increasing number of apartment buildings stood shops (e.g., grocers and drugstores), churches, and Cascade Public School (Kroll Map Company 1920; King County 2010; Metsker Map Company 1936; Sanborn Map Company 1905, 1917, 1950) (**Figure 3.1-6**).

The military had a significant presence in South Lake Union in the mid- to late-twentieth century. In 1941, a Naval Reserve Center was built and designated by the federal government as a National Defense Project at the beginning of World War II (Moore, et al. 1998:10-11; Sanborn Map Company 1950). The facility remained in use for reserve training and community service activities until the 1990s.

Current land use along the Lake Union shoreline is still predominantly water-dependent, with a mix of commercial and industrial uses including marinas, commercial shipyards, and drydocks. Other businesses and a number of single and multi-family residences also border the shoreline (Weitkamp, et al. 2000). Inland from the lakefront, the South Lake Union neighborhood is characterized by urban residential and commercial development (**Figures 3.1-7 and 3.1-8**).

Potential for Discovery of Archaeological Sites in the Study Area

Forsman, et al. (1997) identified two locations within the current study area that have higher archaeological potential than other portions of the study area. The first is a ravine south of Republican Street, centered roughly between Westlake Avenue and Terry Avenue (Tobin 1987:46, in Lewarch, et al. 1999:8). This low-elevation area, identifiable using contour lines on historical maps (e.g., USC&GS 1875, 1899; USGS 1897), would have contained a seasonally wet meadow or prairie with numerous valuable plant and animal resources (Forsman, et al. 1997; Waterman 1922). Located just east of the eastern boundary of the Denny Regrade, it was filled with regrade spoils and other refuse and debris materials. The second is the pre-industrial shoreline of Lake Union. Lakes Duwamish and other Coast Salish peoples used the lakeshore and margins of Lake Union for hunting, fishing, and other resource extraction and processing activities. This part of the study area has also been heavily modified by emplacement of large volumes of fill including sawdust, regrade spoils, household refuse, and demolition debris. A third formerly low-elevation area is present in the vicinity of the Fairview Avenue Corridor (USC&GS 1899; USGS 1897; USSG 1856). In all three areas, archaeological sites could potentially be buried beneath the fill in intact native soils. Archaeological materials such as stone tools and flaking debris, shell midden deposits, faunal and botanical remains, fire-modified rock, charcoal, and postmolds, depressions, or other features could be present, reflecting a range of subsistence, domestic, and ceremonial activities. Such materials, if present, could be pre-contact or historic in age, and could potentially be eligible for the NRHP.

Historic-period archaeological sites could also be present in the study area. These could include domestic, commercial, and industrial materials such as personal ornamentation, food scraps and packaging, structural, mechanical, or manufacturing waste items. However, historic-period archaeological materials would be expected to be contained within historic and recent fill deposits and not in intact native soils. Such materials would lack aspects of integrity (e.g., association and location) and would not likely be eligible for the NRHP (NRHP 1991).

The long history of industrial and public works activities in the study area has disturbed most natural land surfaces. As a result of more than a century of urban development, undisturbed landforms are not available for inspection within the study area (see **Figures 3.1-7 and 3.1-8**). Therefore, archaeological survey was not conducted as a part of this assessment.

8th Avenue Corridor

The 8th Avenue Corridor, covering the area one-half block east and west of 8th Avenue between Republican and John Streets, is within the area cut during the Denny Regrade (Corley 1969; Forsman, et al. 1997:Figure 2; Seattle Engineering Department 1907, 1910). Up to 60 vertical feet of soils were removed in this area, just north of Denny Park (Corley 1969). Natural land surfaces that were exposed and available for human occupation from the end of the Pleistocene to 1907 are no longer extant in this area. As a result, the 8th Avenue Corridor is considered to have no potential to contain pre-contact archaeological sites or historic-period archaeological sites from before 1907. The area is considered to have a low potential to contain intact historic-period archaeological sites postdating the Denny Regrade due to impacts of subsequent urban development. Historic-period debris items are expected to be contained within deposits previously impacted by construction and earthmoving activities. Such materials would lack aspects of integrity (e.g., association and location) and would not likely be eligible for the NRHP (NRHP 1991).

Fairview Avenue Corridor

The Fairview Avenue Corridor, covering the area one-half block east and west of Fairview Avenue between Mercer Street and Denny Way, is in a formerly low-elevation area with a stream that entered Lake Union near the present-day intersection of Valley Street and Fairview Avenue (USC&GS 1899; USSG 1856). This area was mapped as containing Vashon recessional outwash deposits in a narrow north-trending trough that curves to the northwest near Valley Street at the former Lake Union shoreline (Troost, et al. 2005). This is in approximately the same location as the stream mapped by the GLO (USSG 1856) (see **Figure 3.1-2**). The stream appears to be a relict outwash channel. This environment would have supported resources attractive to humans from deglaciation to the historic era. If land surfaces exposed from the end of the Pleistocene to the pre-urban historic era are preserved beneath fill deposits, then pre-contact and early historic-period archaeological sites could be present. Pre-contact archaeological sites could include the remains of fish weirs, basketry, stone implements, and other evidence of resource procurement and processing or domestic activities. Historic-period archaeological sites buried beneath fill could include remains of logging operations or deposits related to the residence of W. P. Smith, which was east of the corridor. Historic-period debris items are expected to be contained within fill and other deposits previously impacted by construction and earthmoving activities. Such materials would lack aspects of integrity (e.g., association and location) and would not likely be eligible for the NRHP (NRHP 1991).

Valley/Mercer Blocks

The Valley/Mercer Blocks, bounded by Valley Street on the north, 9th Avenue on the west, Mercer Street on the south, and Fairview Avenue on the east, is located atop filled lakeshore. The pre-industrial Lake Union shoreline extended to approximately Republican Street near Terry Avenue (Chrzastowski 1983; Durio and Bard 2008:Exhibit 4-1; USC&GS 1875). The former shoreline and its margins would have contained a variety of plant and animal resources used by Coast Salish peoples. Archaeological sites in this part of the study area would likely be low-density, diffuse concentrations of materials lost or discarded in hunting, fishing, and other resource extraction and processing activities in the lake, such as fish weirs, basketry, stone tools, and wood or bone implements. This part of the study area now contains large volumes of fill including sawdust, regrade spoils, household refuse, and demolition debris, and has been affected by subsequent urban development. It is estimated that fill in the area containing the Valley/Mercer Blocks is 25 feet thick (Durio and Bard 2008:4-5). Historic-period debris items are expected to be contained within fill and other deposits previously impacted by construction and earthmoving activities. Such materials would lack aspects of integrity (e.g., association and location) and would not likely be eligible for the NRHP (NRHP 1991).

3.1.2 Significant Impacts

Because the study area is considered to have a low potential to contain intact archaeological deposits, no significant impacts to archaeological sites are anticipated. No pre-contact archaeological sites have been identified within the study area. One historic-period archaeological site (45KI502) has been recorded within the study area and was previously impacted by sewer line and trail construction. Further development is not anticipated to generate additional impacts to this site.

Impacts Common to All Alternatives

The potential for the South Lake Union Height and Density EIS study area to contain archaeological sites is generally considered to be low. This is due primarily to the long history of disturbance including construction and demolition of buildings, transportation developments, major earthmoving projects (i.e. Denny Regrade), and installation of buried utilities. While the area could have potentially been the location of repeated or regular pre-contact and early historic-period activities, extensive construction and landform modifications since the 1880s have most likely destroyed the integrity of any archaeological evidence of these activities that may have been present, seriously compromising their potential significance. There appears to be a low probability for intact pre-contact or historic-period archaeological deposits to be present within the study area.

Based on existing archaeological data for this region, pre-contact archaeological sites that might potentially have been present in the general vicinity prior to urbanization could have included the remains of habitation sites, lithic scatters, fish weirs, trails, or similar features, which could represent a range of domestic, subsistence, and ceremonial activities. Site significance could potentially be related to changes in site types and use of environmental resources over time (Lewarch et al. 2002:16-17). Additionally, pre-contact sites may potentially have significance as Traditional Cultural Properties to one or more tribal and/or ethnic groups (Parker and King 1990).

The vicinity of the home of Tsetseguis may have been used by Lakes Duwamish people as a habitation site repeatedly or consistently for centuries or it may have been first occupied in the nineteenth century. However, any physical evidence of this occupation is not likely to have been preserved due to its location in the Denny Regrade area and the vicinity of the present-day Broad Street and Mercer Street roadways, where road construction has disturbed soils from 6 to 30 feet or more below surface (Durio and Bard 2008:Exhibit 4-1) . The trail connecting Lake Union and Belltown (Thrush and Thompson 2007; USSG 1856) most likely passed through the southwestern portion of the study area, but any physical evidence of this route also would have been removed by urban development.

Historic uses of the study area have included logging, transportation, and domestic, industrial, and commercial activities. These activities could potentially have resulted in deposition of archaeological materials; such deposits could arguably be significant if they retained depositional integrity and could result in data that would inform research questions regarding ethnicity, domestic behavior, or other facets of historical life relevant to the social, economic, or cultural development of Seattle (Weaver 1989). Frequencies of materials found at domestic artifact scatters may provide economic data relevant to larger historical trends, and potentially may be suggestive of relative economic status and possibly ethnicity. Structures may provide data on occupational specialization, construction styles, and agricultural/subsistence practices. Pre-structural remains could suggest early settlers' domestic, social, and commercial activities (Weaver 1989). However, such activities are unlikely to leave a distinctive archaeological signature that would be recognizable following major construction excavation and building episodes within the current study area over more than a century of urban development. Physical evidence of the residences of W. P. Smith and Thomas Mercer is not expected to persist due to the effects of earthmoving and construction activities in these locations.

Alternative 1

Under Alternative 1, construction excavations that reach buried native intact terminal Pleistocene or Holocene deposits may have the potential to disturb archaeological sites. However, the contact between near-surface fill deposits and underlying natural deposits has been previously disturbed by prior construction in most of the study area. Any as-yet unknown potentially NRHP-eligible archaeological sites, if discovered in construction, would be subject to mitigation.

Alternative 2

Although the proposed changes to building heights and densities are different under Alternative 2, their potential impacts to cultural resources are the same as for Alternative 1. Construction excavations that reach buried native intact terminal Pleistocene or Holocene deposits may have the potential to disturb archaeological sites. However, the contact between near-surface fill deposits and underlying natural deposits has been previously disturbed by prior construction in most of the study area.

Alternative 3

Under Alternative 3, although the specifics of height and density changes are different, potential impacts to cultural resources are expected to be the same as for Alternatives 1 and 2. Construction excavations that reach buried native intact terminal Pleistocene or Holocene deposits may have the potential to disturb archaeological sites. However, the contact between near-surface fill deposits and underlying natural deposits has been previously disturbed by prior construction in most of the study area.

Alternative 4 (No Action)

Because no action is proposed under Alternative 4, no impacts to cultural resources would be generated. Continued development of South Lake Union within current zoning regulations is not anticipated to affect any recorded archaeological sites. As for Alternatives 1, 2, and 3, construction excavations that reach buried native intact terminal Pleistocene or Holocene deposits may have the potential to disturb archaeological sites. However, the contact between near-surface fill deposits and underlying natural deposits has been previously disturbed by prior construction in most of the study area.

3.1.3 Mitigation Measures

Should any potentially significant archaeological sites be encountered in implementation of the proposal and it is not possible to avoid them, impacts would be generated. These impacts could potentially be minimized through development and implementation of mitigation measures appropriate to the nature and extent of discovered sites. Mitigation measures could potentially include archaeological monitoring, testing, or data recovery excavations; development of interpretive signs, markers, or exhibits; and/or minimization or avoidance of further impacts through redesign.

3.1.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts to cultural resources are anticipated to be generated by the proposal. One historic-period archaeological site (45KI502) has previously been recorded in the study area. Its integrity has been affected by prior construction activities and it has been recommended not eligible for the NRHP. As a result, further development in the site area generated by the current proposal would not cause significant unavoidable adverse impacts.

Should any potentially significant archaeological sites be discovered in construction and it is not possible to avoid them, significant unavoidable adverse impacts would be generated. These impacts could potentially be minimized through development and implementation of mitigation measures appropriate to the nature and extent of discovered sites.

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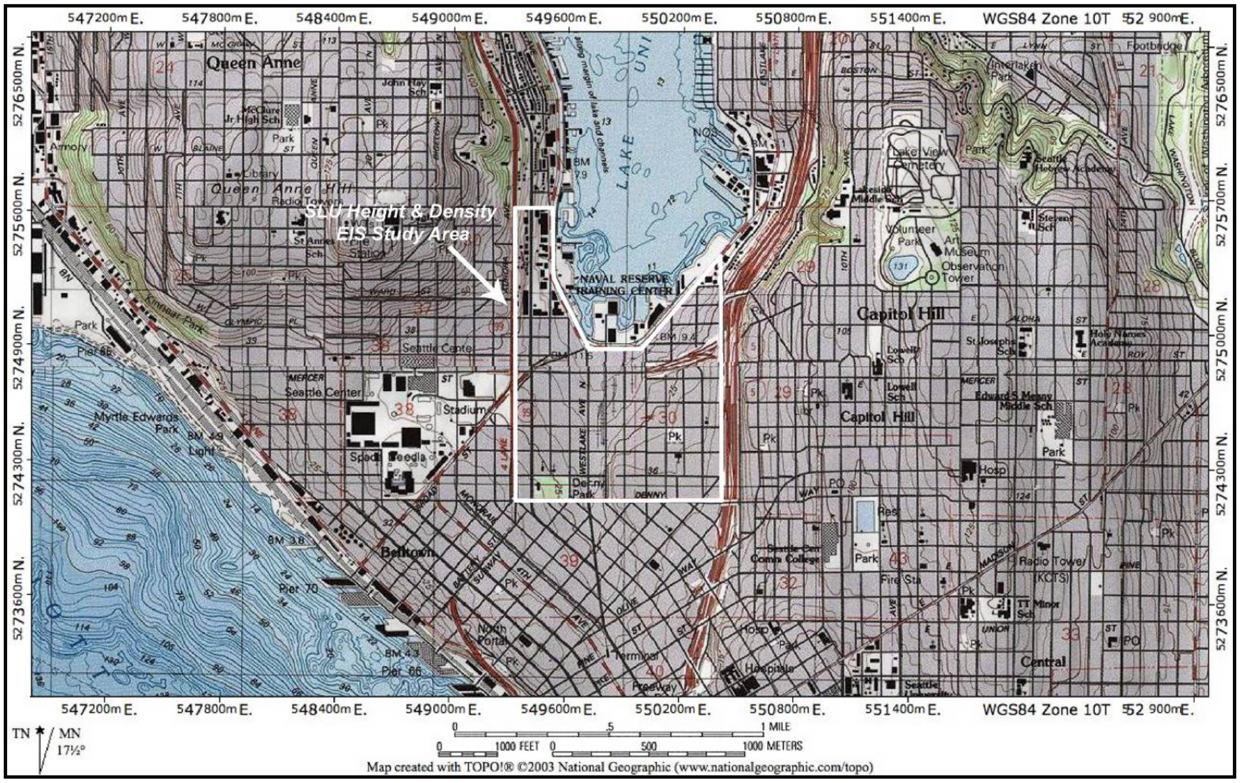


Figure 3.1-1. Portion of Seattle South, WA (USGS 1983) topographic quadrangle showing the boundaries of the study area (white outline).

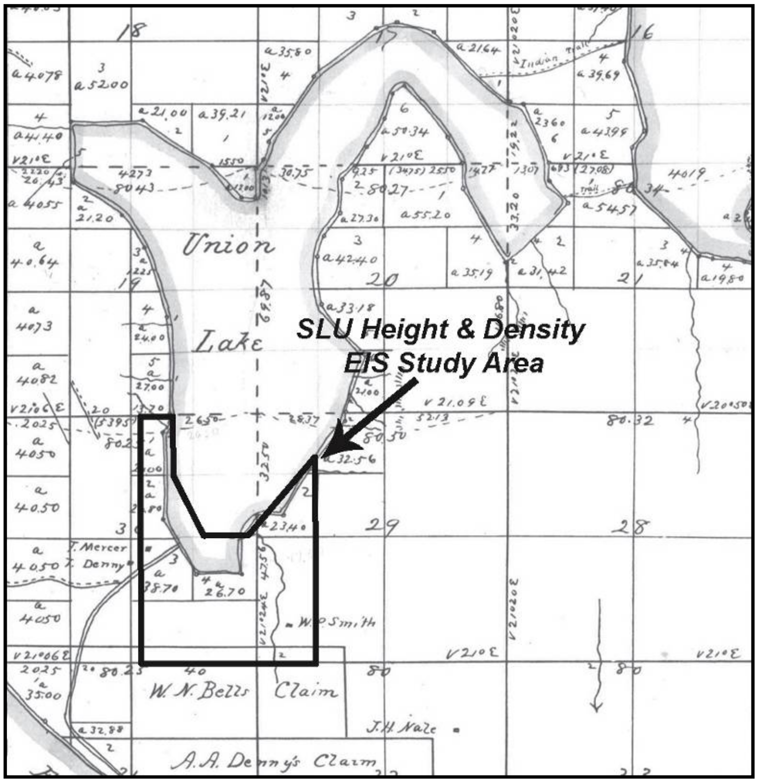


Figure 3.1-2. Portion of GLO map (USSG 1856) showing the study area. The road from the south end of Lake Union towards Elliott Bay is in the approximate alignment of present-day Broad Street. It joined an Indian trail connecting Elliott Bay and Lake Union. The residence of "D. Denny" was located just west of the study area. A small stream is shown in the eastern portion of the study area near present-day Fairview Avenue. The residence of "W. P. Smith" is mapped near the intersection of Minor and Harrison, and the residence of and "T. Mercer" is present north of Broad Street between Dexter and Aurora.

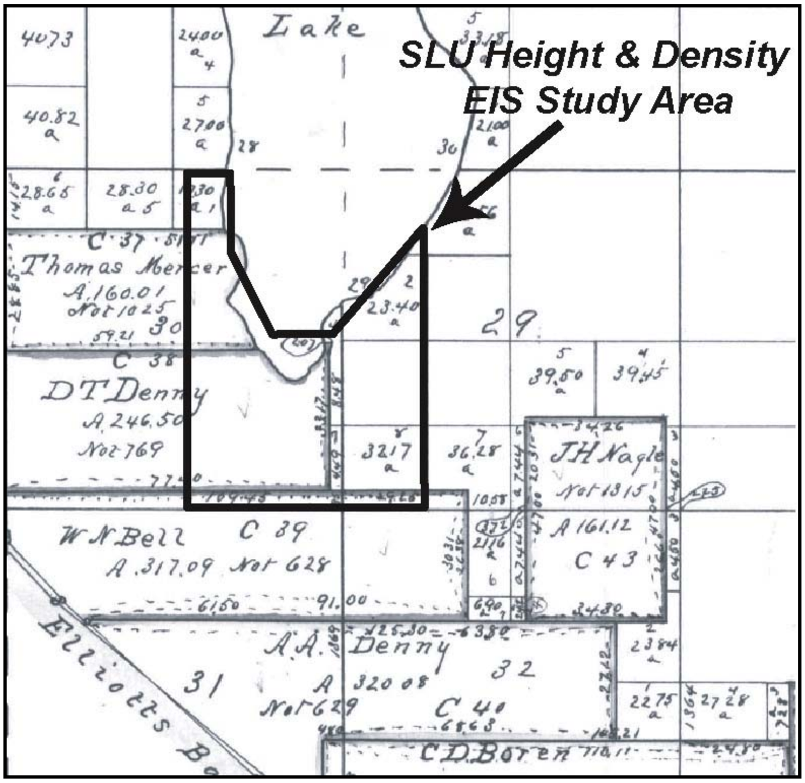


Figure 3.1-3. Portion of GLO map (USSG 1863) showing DLCs in the study area and vicinity.

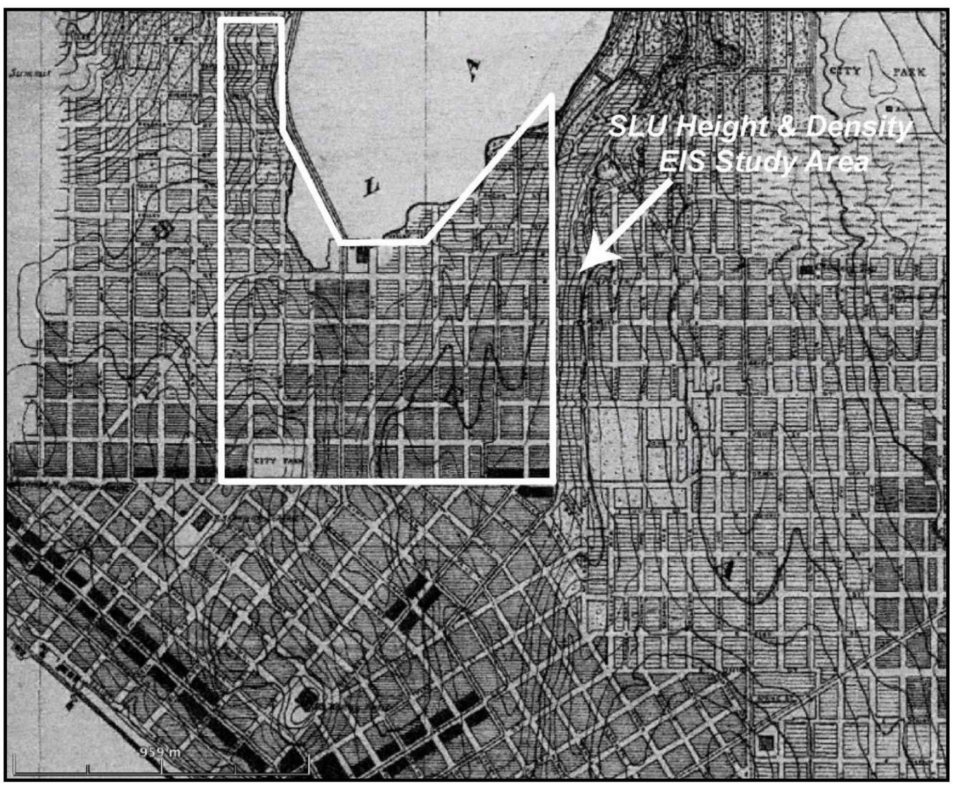


Figure 3.1-4. Portion of coast survey chart (Fox 2009; USC&GS 1899) marked with the study area.

Figure 3.1-5. Portion of historical land classification map (USGS 1897) marked with the study area.

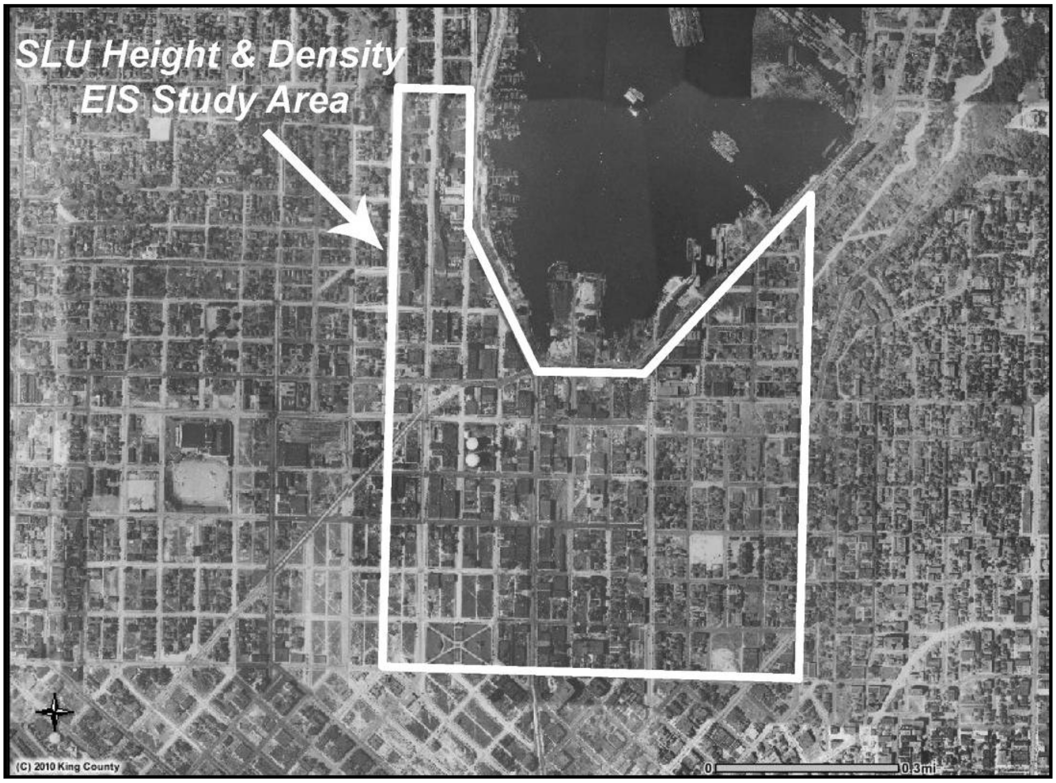


Figure 3.1-6. Aerial imagery from 1936 (King County 2010) marked with the study area. Urban development characterized the area and few lots remained vacant.

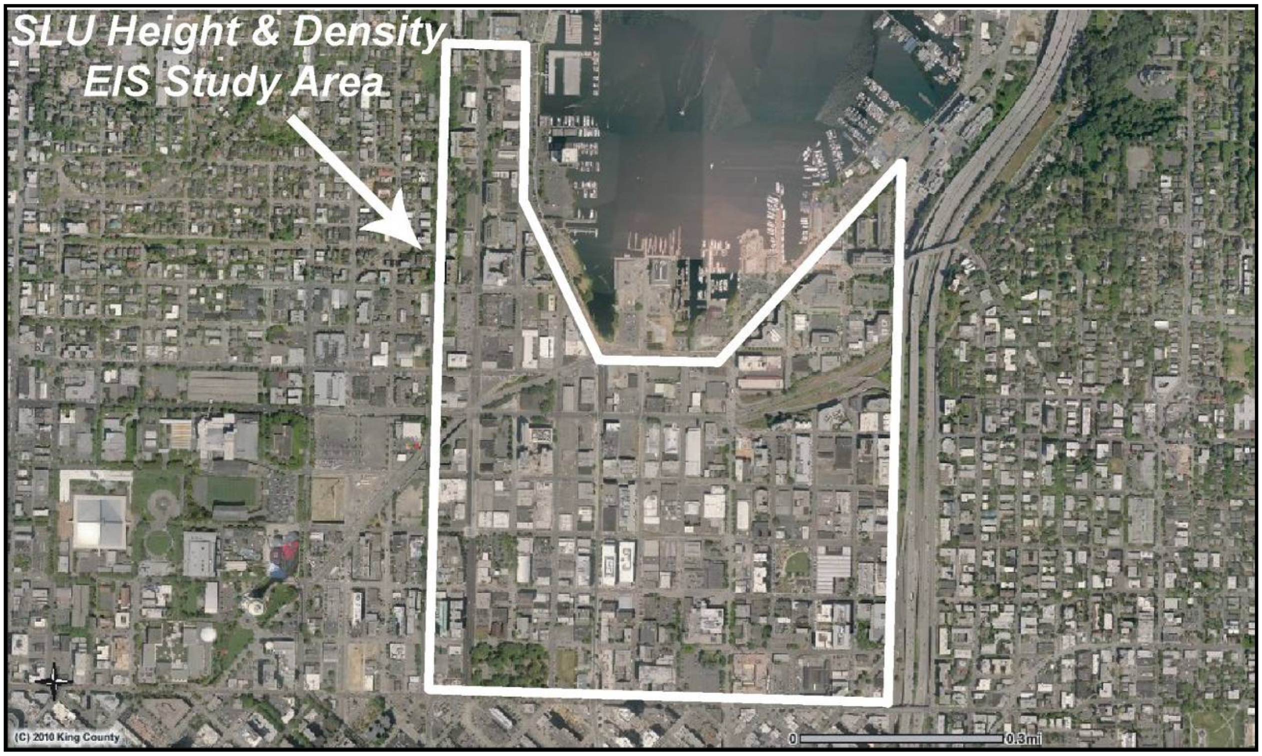


Figure 3.1-7. Aerial imagery from 2007 (King County 2010) marked with the study area.

Figure 3.1-8. Typical conditions in the South Lake Union Height and Density EIS study area. Photograph views north from intersection of 9th Avenue and Harrison Street.

Table 3.1-1. Cultural resources assessments previously conducted within an approximately 1-mile radius of the study area (WA DAHP 2010a).

Author	**Date**	**Title**	**Results and Recommendations**
Kelly	1987	Cultural Resources Survey for the U.S. Sprint Fiber Optic Cable Project Seattle, Washington to Spokane, Washington	Found four historic sites and one archaeological site in proposed cable route. Recommended additional historical research to assess potential impacts to one site. Recommended monitoring at select locations along proposed route. Did not identify any cultural resources in vicinity of current study area.
Nelson, et al.	1996	Report on the Cultural Resources Inventory Completed for the Proposed WorldCom Seattle to Salt Lake City Fiber Optic Line, Part 4, Washington	Identified six historic sites and 19 historic-period archaeological sites in proposed cable route. Recommended confining construction to previously disturbed sediments or routing cable around sites potentially eligible for NRHP to avoid effects. Recommended monitoring in vicinity of recorded sites. No cultural resources identified in vicinity of current study area.
Forsman, et al.	1997	Denny Way/Lake Union Combined Sewer Overflow Control Project Seattle, King County Cultural Resources Assessment	Identified areas of high probability for archaeological resources and assessed potential project impacts to archaeological sites. No archaeological sites were identified. Within the current study area, the Lake Union shoreline and a former ravine have higher potential to contain archaeological sites. Recommended archaeological monitoring during construction excavations in the current study area between Dexter Avenue and Fairview Avenue.
Courtois, et al.	1998	Sound Transit Central Link Light Rail Draft Environmental Impact Statement: Historic and Archaeological Technical Report	Assessed potential impacts to cultural resources for light rail route, station, and maintenance alternatives. No archaeological sites identified near current Project, but Portage Bay shorelines identified as high-sensitivity areas for archaeology. Recommended review of preferred alternative plans, when available, to identify locations for additional subsurface testing and/or monitoring.

Author	Date	Title	Results and Recommendations
Forsman, et al.	1998	Wall Street Project Cultural Resource Overview, Seattle	Provided archaeological, historical, and ethnographic overview of proposed construction location. Archaeological testing was not possible due to complete coverage by pavement. Recommended archaeological monitoring of construction due to high probability for archaeological sites to be present in project location.
Larson and Lewarch	1998	Letter to Doug Hotchkiss Re: A burial site within a construction job site for the World Trade Center complex on Alaskan Way between Bell and Lenora Streets	Described discovery of an archaeological site during construction. Recorded site (45KI456) and obtained archaeological excavation recovery permit from WA DAHP for testing to evaluate site significance. Recommended archaeological monitoring of further construction excavations in proximity to the discovery.
Moore, et al.	1998	Cultural Resources Survey and Assessment of Naval Reserve Readiness Center, Seattle	Evaluated potential significance of Naval Reserve Readiness Center (NRRC) at 860 Terry Avenue. Described history of land use in NRRC Seattle property, design and construction of buildings, and purpose and use of NRRC Seattle facility. Recommended property as eligible for the NRHP. No further investigations recommended.
Courtois, et al.	1999	Sound Transit Central Link Light Rail Final Environmental Impact Statement Final Technical Report: Historic and Prehistoric Archaeological Sites, Historic Resources, Native American Traditional Cultural Properties, Paleontological Sites	Identified potential impacts to cultural resources including historic buildings and archaeological sites. Identified high probability for archaeology on margins of Portage Bay southwest of current Project, buried beneath fill. Recommended archaeological monitoring of construction excavations.

Author	Date	Title	Results and Recommendations
Lewarch, et al.	1999	Denny/Lake Union Combined Sewer Overflow Control Project Seattle, King County Archaeological Resources Treatment and Monitoring Plans	Proposed treatment and monitoring plans to guide mitigation (i.e., archaeological evaluation and recovery) in the event that archaeological sites were encountered by the project. Included list of known NRHP-eligible archaeological sites and expected adverse effects; a proposed research design; and recommended methods of treatment and data recovery for kinds of archaeological resources expected in project area.
Liddle	1999	Letter to Hamilton Hazelhurst Regarding Results of Cultural Resource Monitoring for the World Trade Center North	Described methods and results of archaeological monitoring of construction excavations on property near a recorded site (45KI456). Identified historic-period archaeological materials (e.g., bottle glass, ceramics, metal items) in a layer of fill. Recorded the identified historic debris as archaeological site 45KI482. No further investigations recommended.
Forsman, et al.	2000	Proposed Aspen Murray Hotel/Condominium Project Archaeological and Traditional Cultural Places Overview, Seattle, King County, Washington	Provided archaeological, historical, and ethnographic overview of proposed construction location. Archaeological testing was not possible due to coverage by structures. Project area considered to have a low probability for intact pre-contact archaeological sites. Recommended archaeological monitoring of construction excavations due to moderate probability for intact historic-period archaeological sites to be present in project location.
Juell, et al.	2000	Cultural Resources Inventory of the Proposed Washington Light Lanes Project, Route 2 Backbone: Downtown Seattle to Interstate-5 (MP 164), Interstate-5 Seattle to Blaine (MP 164 to MP 276), and Blaine to the Canadian Border	Background research did not locate any previously recorded cultural resources in proposed cable route. Survey did not identify any historic or archaeological sites in vicinity of current Project. Because route avoided cultural resources and construction would occur predominantly in the interstate and previously disturbed urban areas, no further investigations recommended.

Author	Date	Title	Results and Recommendations
Dugas and Robbins	2001	Letter to Wade Metz Regarding Cultural Resource Monitoring for the Bellora Condominium Project, Seattle	Described results of archaeological monitoring of construction excavations on property near a recorded archaeological site (45KI456). Shell midden and fire-modified rock identified in exposure adjacent to Bellora project. No potentially significant cultural resources recommended. No further investigations recommended.
Nelson	2001	Cultural Resource Investigations for the West Lake Union Improvement Project, Seattle, Washington	Evaluated potential effects of project to cultural resources. Identified two ethnographic place names and historic sites (i.e. structures) on west shore of Lake Union. Conducted aboveground survey and recorded a segment of Northern Pacific railroad as historic-period archaeological site 45KI502; recommended site not eligible for NRHP. Recommended archaeological monitoring of construction excavations in the current study area (between Highland and Aloha) if native soils would be impacted.
Lewarch, et al.	2002	Archaeological Evaluation and Construction Excavation Monitoring At The World Trade Center, Baba'k^{w}ob Site (45KI456), Seattle	Described results of archaeological monitoring of construction excavations and archaeological test excavations to evaluate archaeological site (45KI456) discovered during construction. Due to compromised depositional integrity and absence of temporally diagnostic artifacts, site recommended not eligible for NRHP.
Rooke	2002	Letter report describing the procedures and results of a cultural resources survey of Cingular Wireless tower site WA-482 (Cowden Building)	Conducted cultural resources survey for proposed cell tower atop a building 1 mile east-northeast of study area. No archaeological sites identified in vicinity of study area. No further investigations recommended.
Rooke	2002	Letter Report: Procedures and results of a cultural resources survey of Cingular Wireless Project Site WA-799 (Nettleton)	Conducted cultural resources survey for proposed cell tower atop a building 0.7 miles south of study area. No archaeological sites identified in vicinity of study area. No further investigations recommended.

Author	Date	Title	Results and Recommendations
Rooke	2002	Letter Report: Procedures and results of a cultural resources survey of Cingular Wireless project site WA-795 (Gatewood)	Conducted cultural resources survey for proposed cell tower atop a building 0.6 miles southwest of study area. No archaeological sites identified in vicinity of study area. No further investigations recommended.
Rooke	2002	Letter Report: Procedures and results of a cultural resources survey of Cingular Wireless project site WA-792-06 (Broadway Associates)	Conducted cultural resources survey for proposed cell tower atop a building 0.5 miles southeast of study area. No archaeological sites identified in vicinity of study area. No further investigations recommended.
Rooke	2002	Letter to Jay Grenfell Regarding WA-794 (Securities Bldg)	Conducted cultural resources survey for proposed cell tower atop a building 0.5 miles south of study area. No archaeological sites identified in vicinity of study area. No further investigations recommended.
Billat	2004	Letter to Greg Griffith Regarding Request for Consultation and Concurrence Regarding a Proposed Collocation of a Wireless Telecommunication Service Facility to be Located on the Roof of a Building at 904 Elliott Avenue West, in Seattle	Conducted cultural resources survey for proposed installation of wireless telecommunication facility atop a building 1 mile west of study area. No archaeological sites identified in vicinity of study area. No further investigations recommended.
Dellert and Larson	2004	Letter to Joe Claire Re: Valley Street Tunnel, South Lake Union Pipelines Phase 3/4, Denny Way/Lake Union Combined Sewer Overflow Project Archaeological Resources Construction Monitoring	Described results of archaeological monitoring of construction excavations. No archaeological sites identified during monitoring. No further investigations recommended.

Author	Date	Title	Results and Recommendations
Miller and Blukis Onat	2004	Winds, Waterways, and Weirs: Ethnographic Study of the Central Link Light Rail Corridor	Reviewed historical and ethnographic reports and archival materials, and conducted interviews to provide ethnographic background and cultural landscape model for area that includes the study area. Included information about Lakes Duwamish use of Lake Union, particularly Portage Bay. Documented one TCP on the Duwamish River.
Shong and Miss	2004	Results of Cultural Resources Monitoring for the City of Seattle West Lake Union Trail Improvement Project King County, Washington	Described results of archaeological monitoring of construction excavations. Historic-period and/or recent debris items observed. No archaeological sites identified. No further investigations recommended.
Gillis, et al.	2005	SR 99 Alaskan Way Viaduct & Seawall Replacement Project, Archaeological Monitoring and Review of Geotechnical Borings from South Spokane Street to Battery Street Tunnel	Described results of archaeological monitoring of geotechnical testing. No archaeological sites identified, but eight locations with possible pre-contact archaeological materials and six locations with possible historic-period archaeological materials were observed. Recommended further monitoring if geotechnical testing anticipated to intersect possible archaeological deposits.
Gillis, et al.	2005	Archaeological Resources Monitoring and Review of Geotechnical Borings from Harrison Street to Valley Street, SR 99: Alaskan Way Viaduct & Seawall Replacement Project	Described results of archaeological monitoring of geotechnical testing. No archaeological sites identified. Location considered to have low probability for intact archaeological sites due to prior grading activities. No further investigations recommended.
Gillis, et al.	2005	South Lake Union Park Development Cultural Resources and Traditional Cultural Places Overview	Provided cultural resources overview, identified potentially significant historic sites, and updated literature review prepared for an existing EIS. Identified former lakeshore and adjacent marsh covered by fill as high-probability area for pre-contact archaeological sites. Archaeological monitoring recommended in the event that construction required excavation in native soils.

Author	Date	Title	Results and Recommendations
Lewarch, et al.	2005	Seattle Monorail Project Green Line, Seattle, King County, Washington Archaeological Resources Treatment and Monitoring Plans	Provided cultural resources overview and proposed treatment and monitoring plans to guide mitigation (i.e., archaeological evaluation and recovery) in the event that archaeological sites were encountered by the project. Included a proposed research design and recommended methods of treatment and data recovery for kinds of archaeological resources expected in project area No archaeological sites identified in the vicinity of the current study area.
Juell	2006	Archaeological Site Assessment of Sound Transit's Sounder: Everett to Seattle Commuter Rail System, King and Snohomish Counties	Conducted archaeological assessment of proposed rail improvements. No archaeological sites identified in vicinity of current study area. Archaeological testing and monitoring recommended in high-probability areas for archaeological sites. No high-probability areas identified in vicinity of study area.
NWAA	2006	Geoarchaeological Examination of Solid-Core Geoprobes: Alaskan Way Viaduct and Seawall Replacement Project	Described results of analysis of geoprobe cores. Goal of analysis was to identify and characterize fill deposits along the Seattle waterfront, and locate contact between fill material and underlying intact native soils. No archaeological sites identified.
Flathman, et al.	2007	Archaeological and Historical Resources Survey of 635 Elliott Avenue West, Seattle	Provided cultural resources overview, conducted archaeological reconnaissance, and evaluated one historic building for potential listing as a Seattle City Landmark. Building determined not eligible for SCL listing. No archaeological sites identified. Recommended archaeological monitoring of construction excavations anticipated to intersect native soils due to proximity of Elliott Bay shoreline and previously recorded archaeological sites (45KI456 and 45KI482).
Gilpin	2007	Draft: Archaeological Monitoring at the South Lake Union Streetcar Maintenance Facility, Seattle	Described the results of archaeological monitoring of construction activities on property at intersection of Harrison Street and Fairview Avenue. No archaeological sites identified. No further investigations recommended.

Author	Date	Title	Results and Recommendations
Schumacher	2007	Archaeological Monitoring for 333 Elliott Avenue W, Seattle	Described results of archaeological monitoring of construction excavations. No archaeological sites identified. No further investigations recommended.
Bundy and Walker Gray	2008	Cultural Resources Assessment, Alaskan Way Viaduct & Seawall Replacement Program, Battery Street Tunnel Fire and Safety Upgrades Project	Reviewed historical and archaeological information and monitored geotechnical testing to evaluate potential impacts to archaeological sites. No archaeological sites identified. Project expected to be contained within limits of deposits disturbed by regrading and filling. No further investigations recommended.
Durio and Bard	2008	Mercer Corridor Improvements Environmental Assessment Historic, Cultural, and Archaeological Resources Discipline Report	Provided cultural resources overview and conducted archaeological and historic resource survey for a portion of current study area, between Dexter Avenue and Fairview Avenue from Republican Street north to Valley Street. Archaeological testing was conducted within the current study area and did not identify any archaeological sites. Project considered to have low potential to affect pre-contact archaeological sites because construction not anticipated to intersect undisturbed native soils. Archaeological monitoring of geotechnical testing in fill zones recommended.
Gillespie, et al.	2008	Historical Resources Assessment for the Queen Anne Post Office at 415 1st Avenue North, Seattle	Assessed project's potential effects to historic and archaeological sites. Inventoried one historic site and recommended it not eligible for NRHP. Location considered to have low potential for archaeological sites due to past landscape alterations. No archaeological sites identified. No further investigations recommended.
Hamilton, et al.	2008	Cultural Resources Monitoring of Mass Excavation at 635 Elliott Avenue West	Described results of archaeological monitoring of construction excavations. No archaeological sites identified. No further investigations recommended.

Author	Date	Title	Results and Recommendations
Miss, et al.	2008	The Alaskan Way Viaduct & Seawall Replacement Project, Results of the Archaeological Core Collection Program: Phase 1	Examined drilled sonicores to examine subsurface stratigraphy in the project corridor, identify archaeological materials, and gain information about past land use, landscape setting, and archaeological preservation and site formation processes in the corridor. No archaeological sites identified. Continued monitoring of geotechnical testing and construction excavations recommended in all areas of the corridor except those known to contain mass deposits of historic-period or recent fill.
Witt	2008	Letter to William E. Hogg RE: Cultural Resources Review of 2500 Block of First Avenue, Seattle for the KeyBank National Real Estate Transaction and Modernization Program	Provided cultural resources overview of proposed construction site. Evaluated potential effects to archaeological and historic sites. No archaeological sites identified. No further investigations recommended.
Blukis Onat	2009	University Link Archaeological Resources Monitoring and Treatment Plan	Described archaeological monitoring methods for high-probability areas and provided protocol for actions in event of discovery of archaeological resources and human remains.
CH2M Hill	2009	Supplemental Draft EIS and Section 4(f) Evaluation, SR 520 Bridge Replacement and HOV Program, SR 520: I-5 to Medina Bridge Replacement and HOV Project Cultural Resources Discipline Report.	Identified one recorded archaeological site (45KI760), one TCP (Foster Island), and over 200 historic sites. Made NRHP eligibility recommendations and evaluated potential effects of design alternatives to archaeological sites, traditional cultural properties, and historic properties. Provided options for mitigating, minimizing, and avoiding effects.
Valentino and Rinck	2009	Assessment for the West Thomas Street Pedestrian Overpass Project, Seattle, King County, Washington	Reviewed archaeological and historical background information and monitored geotechnical testing to evaluate project's potential effects to archaeological and historic sites. No archaeological sites identified. Archaeological monitoring of select construction activities recommended.

Author	Date	Title	Results and Recommendations
Gallacci	2010	Letter to Greg Griffith RE: Wireless Proposal #SA1209 1904 3rd Avenue, Seattle (Stewart and 4th)	Assessed project's potential effects to historic sites. Inventoried one historic site and recommended it eligible for NRHP. No archaeological sites identified. No further investigations recommended.

Table 3.1-2. Archaeological sites recorded within an approximately 1-mile radius of the study area (WA DAHP 2010a).

Site Number	Site Name	Site Type	Location Relative to Study Area	Evaluation Status	Potential Impacts due to Proposal	Recommended Mitigation
45KI405	--	Historic Maritime Properties, Pre Contact and Historic Components	1 mile west-southwest	Site has not been evaluated for NRHP.	None.	N/A
45KI456	Baba'k^{w}ob Site	Historic Object(s), Pre Contact Camp; Pre Contact Shell Midden	0.6 miles south-southwest	Site recommended not eligible for NRHP.	None.	N/A
45KI482	World Trade Center North Historic Site	Historic Object(s), Pre Contact Burial	0.5 miles southwest	Site recommended not eligible for NRHP.	None.	N/A

Site Number	Site Name	Site Type	Location Relative to Study Area	Evaluation Status	Potential Impacts due to Proposal	Recommended Mitigation
45KI502	Northern Pacific Railroad Belt Line	Historic Railroad Properties	Within the study area along the east side of Westlake Avenue between Galer Street and Aloha Street (Cole 2000:4)	Site recommended not eligible for NRHP.	None. Prior construction has compromised this site. Construction in the site area under the current proposal not anticipated to generate additional impacts to this site.	None.
45KI737	Old Pine Street Stub Tunnel Site	Historic Commercial Properties, Historic Object(s), Historic Road, Historic Structures Not Specified	0.2 miles south	Site has not been evaluated for NRHP but is considered potentially eligible.	None.	N/A
45KI809	Great Northern Railroad Tunnel	Historic Railroad Properties	0.75 miles south	Determined eligible for NRHP.	None.	N/A
45KI946	--	Historic Commercial Properties, Historic Residential Structures	0.3 miles east	Site has not been evaluated for NRHP but is considered potentially eligible.	None.	N/A

Site Number	Site Name	Site Type	Location Relative to Study Area	Evaluation Status	Potential Impacts due to Proposal	Recommended Mitigation
45KI958	SDOT Maintenance Yard	Historic Commercial Properties, Historic Object(s), Historic Residential Structures, Pre Contact and Historic Components, Pre Contact Lithic Material	100 feet west	Site has not been evaluated for NRHP but is considered potentially eligible.	None.	N/A

Appendix D

Aesthetics

APPENDIX D AESTHETICS

Additional Viewshed Simulations	Figures 1-28
Shadow	Figures 29-44

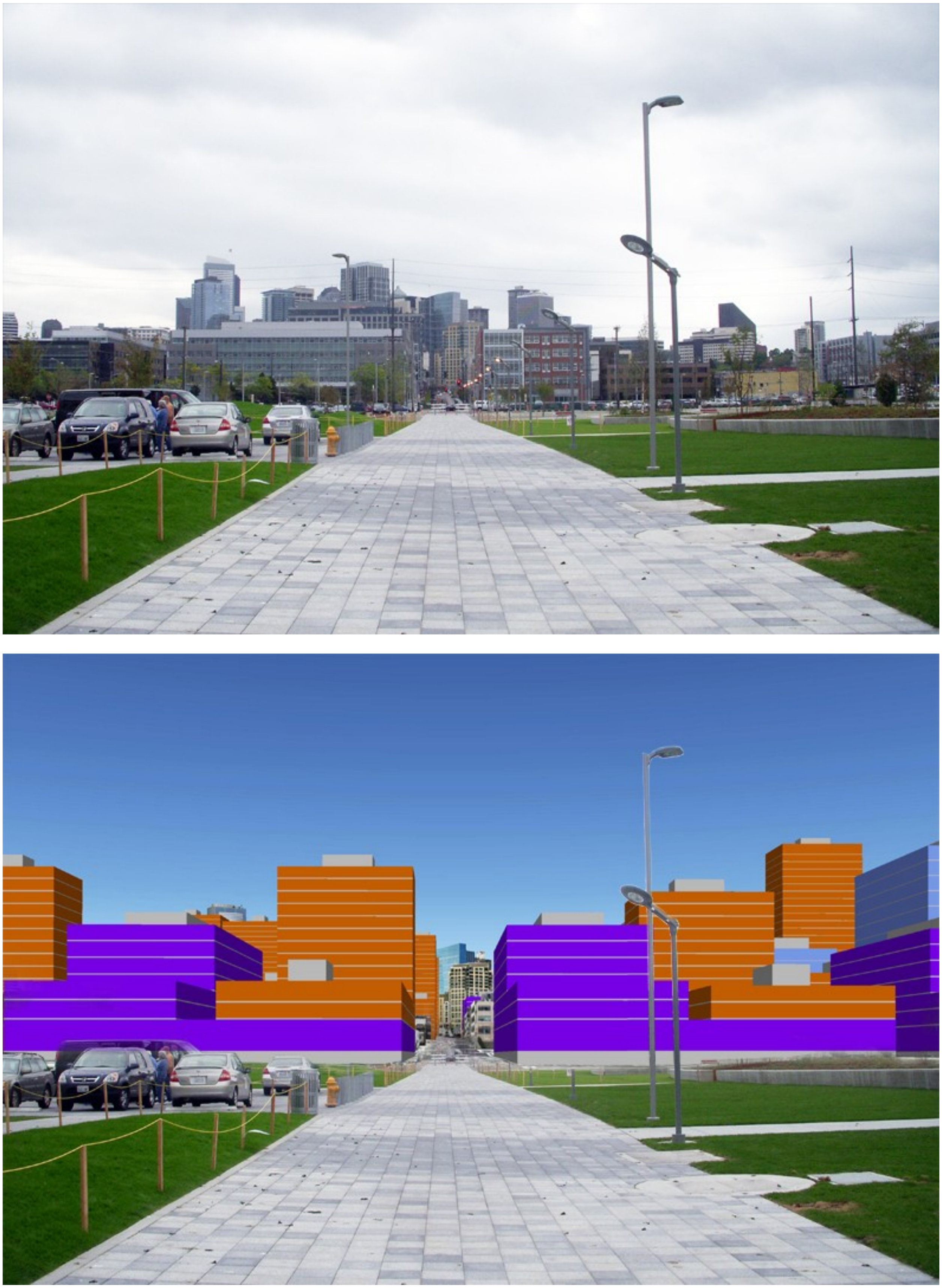
Figure 1
Waterfront: South—Alternative 1


Existing


Proposed

Source: NBBJ, 2010

Figure 2
Waterfront: South—Alternative 2



Existing

Proposed

Source: NBBJ, 2010

Figure 3
Waterfront: South—Alternative 3

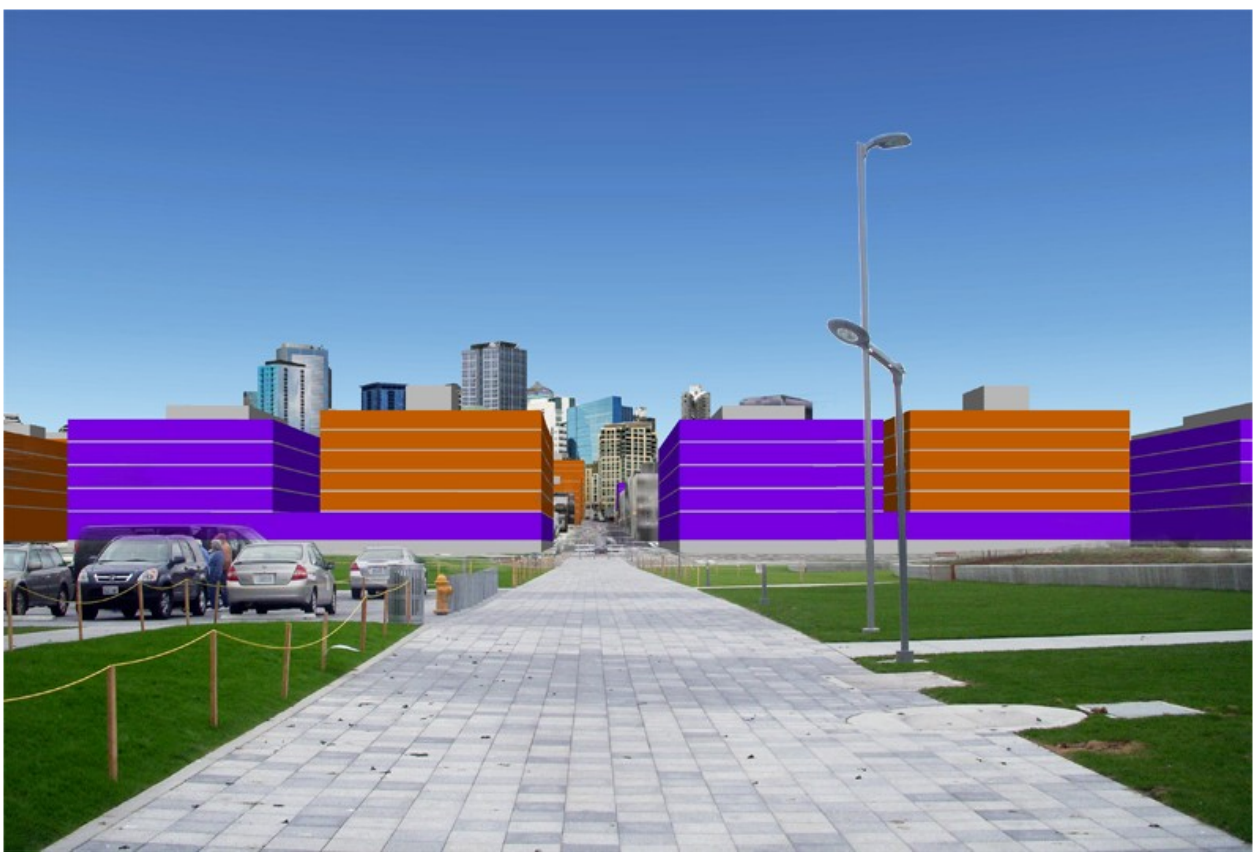
Existing

Proposed

Source: NBBJ, 2010

Figure 4
Waterfront: South—Alternative 4

Existing



Proposed

Source: NBBJ, 2010

Figure 5
Waterfront: Southeast—Alternative 1

Existing

Proposed

Source: NBBJ, 2010

Figure 6
Waterfront: Southeast—Alternative 2

Existing

Proposed

Source: NBBJ, 2010

Figure 7
Waterfront: Southeast—Alternative 3

Source: NBBJ, 2010

Figure 8
Waterfront: Southeast—Alternative 4

Existing

Proposed

Source: NBBJ, 2010

Figure 9
Playground—Alternative 1

Existing

Proposed

Source: NBBJ, 2010

Figure 10
Playground—Alternative 2

Existing

Proposed

Source: NBBJ, 2010

Figure 11
Playground—Alternative 3

Existing

Proposed

Source: NBBJ, 2010

Figure 12
Playground—Alternative 4

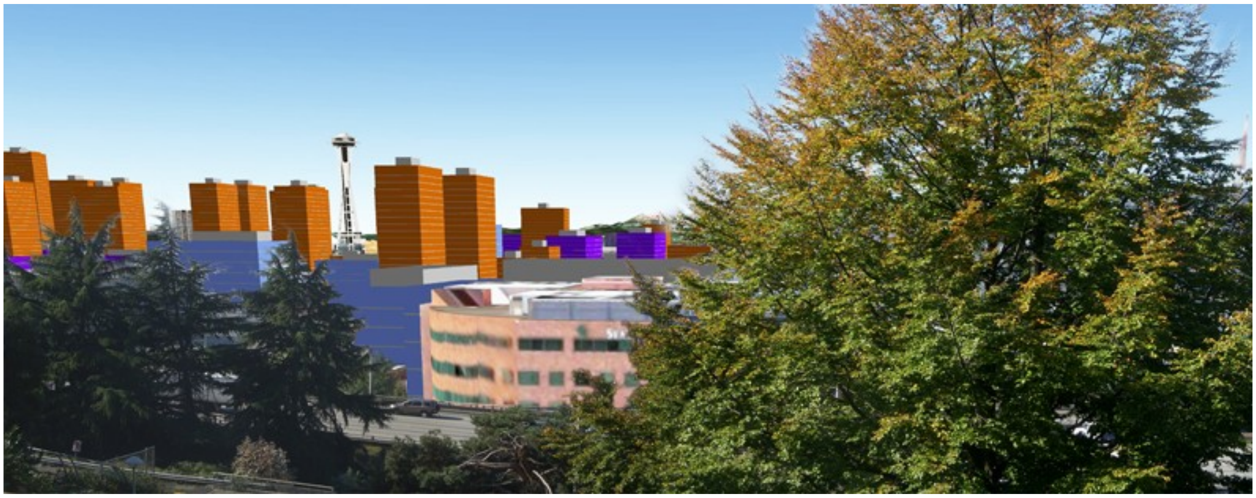
Existing

Proposed

Source: NBBJ, 2010

Figure 13
Bellevue—Alternative 1

Existing

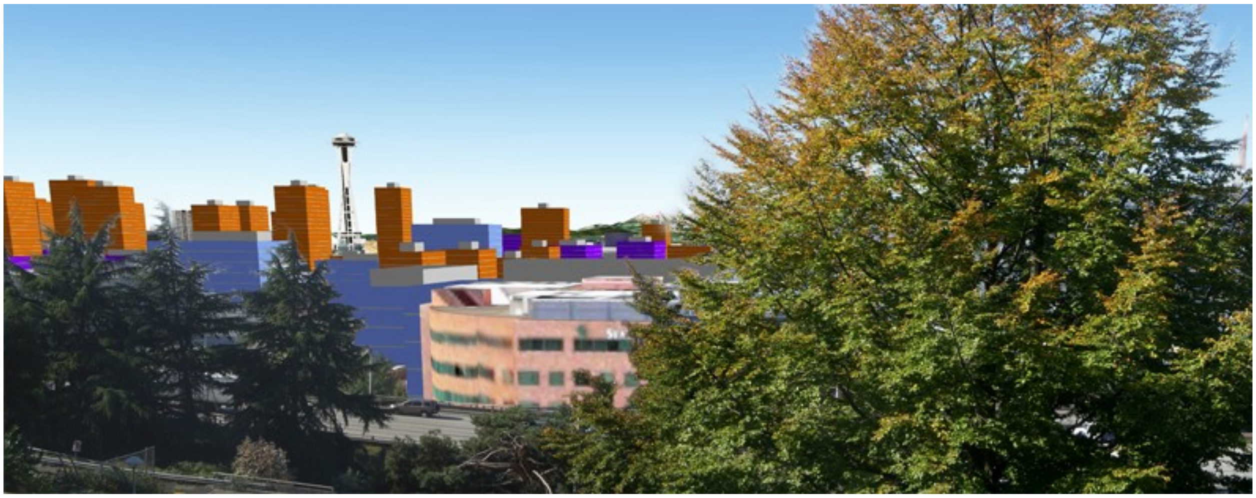


Proposed

Source: NBBJ, 2010

Figure 14
Bellevue—Alternative 2

Existing



Proposed

Source: NBBJ, 2010

Figure 15
Bellevue—Alternative 3

Existing

Proposed

Source: NBBJ, 2010

Figure 16
Bellevue—Alternative 4

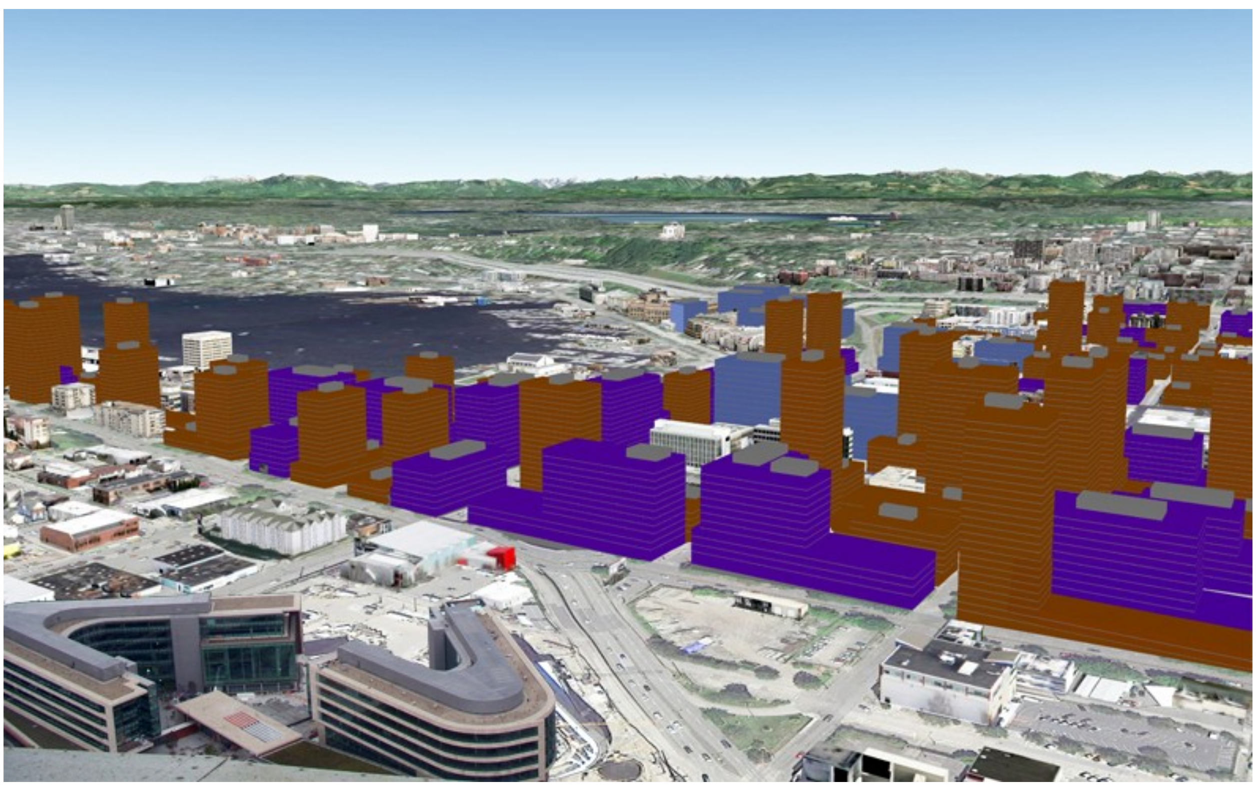
Existing

Proposed

Source: NBBJ, 2010

Figure 17
Space Needle 1—Alternative 1

Existing

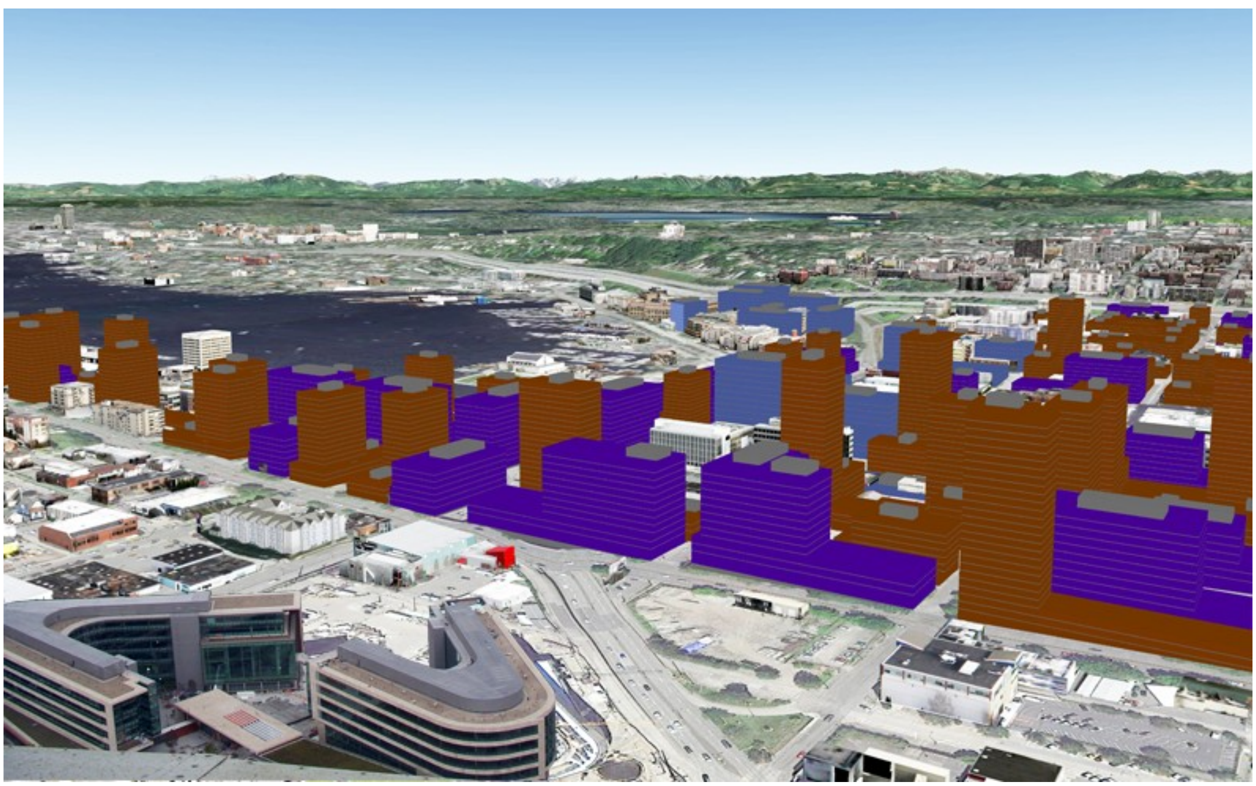


Proposed

Source: NBBJ, 2010

Figure 18
Space Needle 1—Alternative 2

Existing

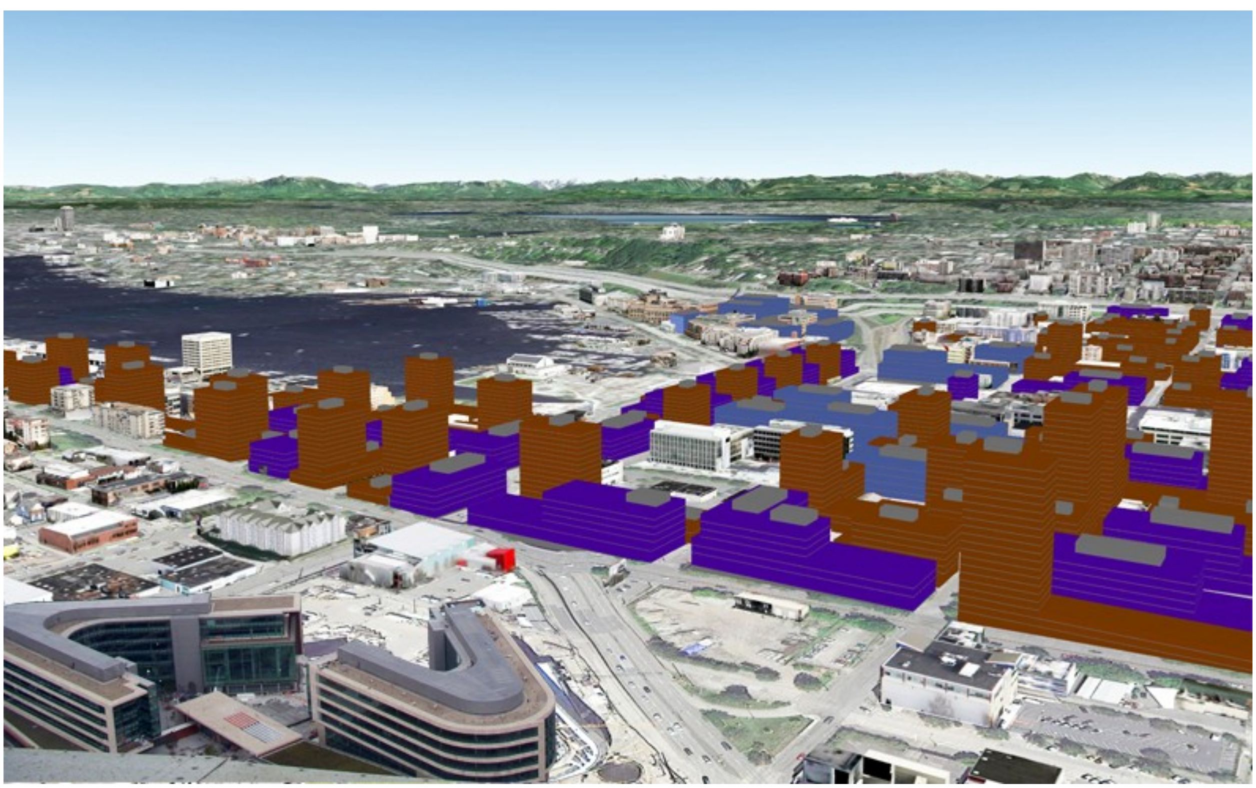


Proposed

Source: NBBJ, 2010

Figure 19
Space Needle 1—Alternative 3

Existing

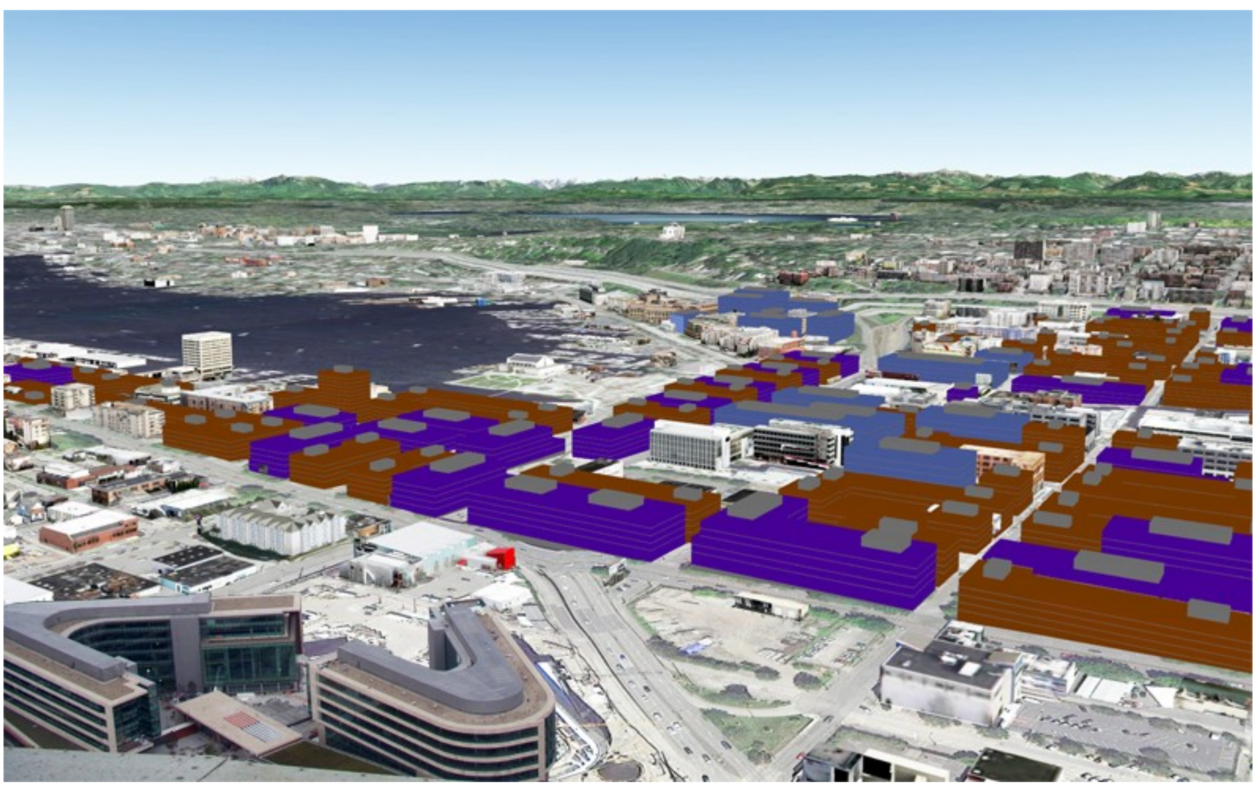


Proposed

Source: NBBJ, 2010

Figure 20
Space Needle 1—Alternative 4

Existing



Proposed

Source: NBBJ, 2010

Figure 21
Space Needle 2—Alternative 1

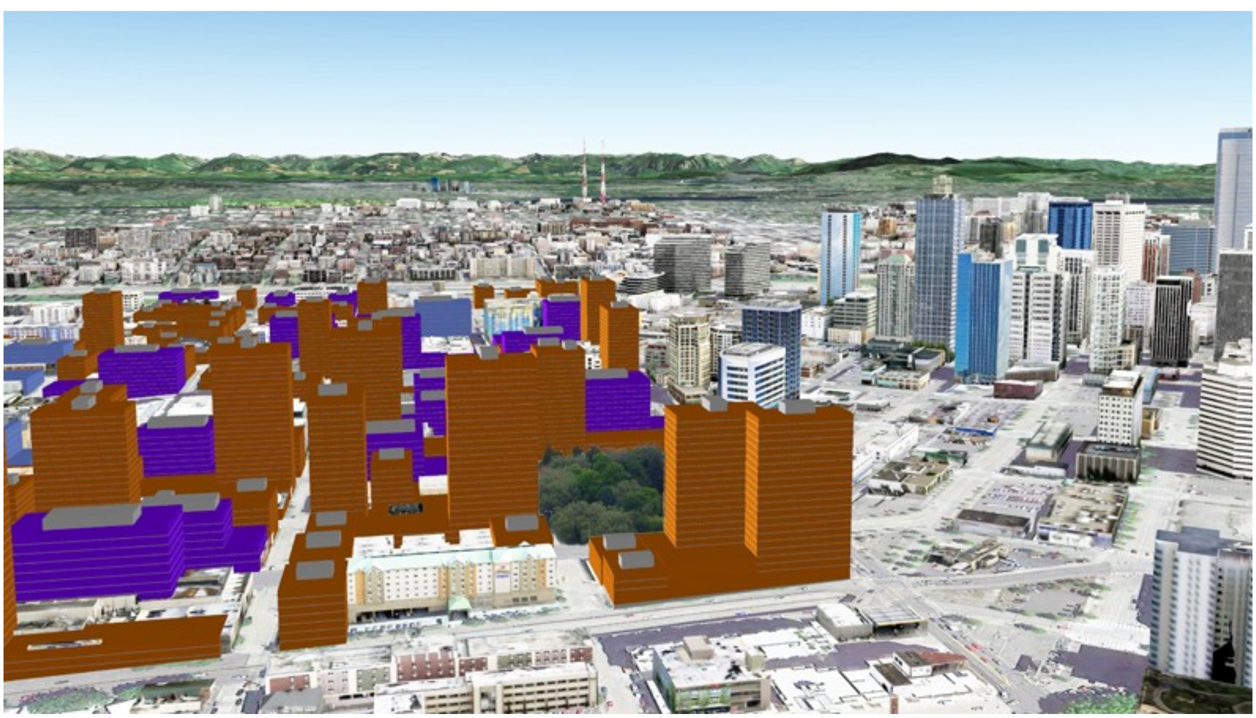
Existing

Proposed

Source: NBBJ, 2010

Figure 22
Space Needle 2—Alternative 2


Existing


Proposed

Source: NBBJ, 2010

Figure 23
Space Needle 2—Alternative 3

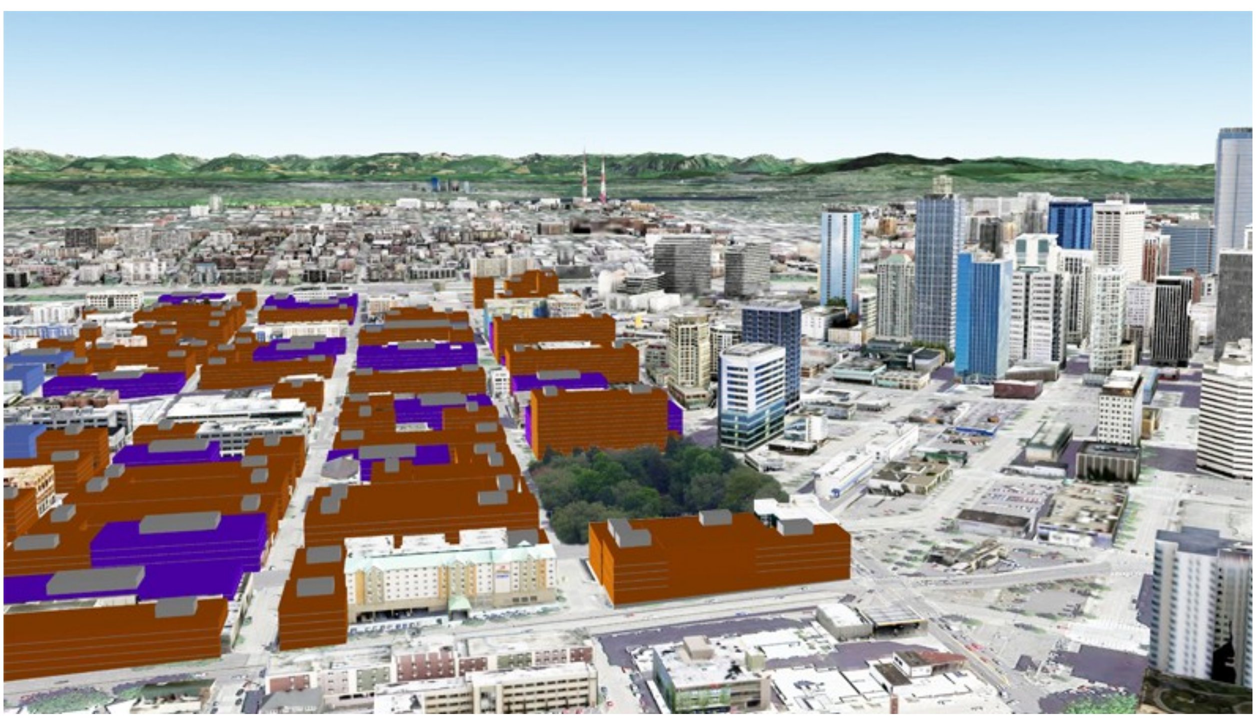
Existing

Proposed

Source: NBBJ, 2010

Figure 24
Space Needle 2—Alternative 4

Existing



Proposed

Source: NBBJ, 2010

Figure 25
Thomas—Alternative 1

Existing

Proposed

Source: NBBJ, 2010

Figure 26
Thomas—Alternative 2

Existing

Proposed

Source: NBBJ, 2010

Figure 27
Thomas—Alternative 3

Existing

Proposed

Source: NBBJ, 2010

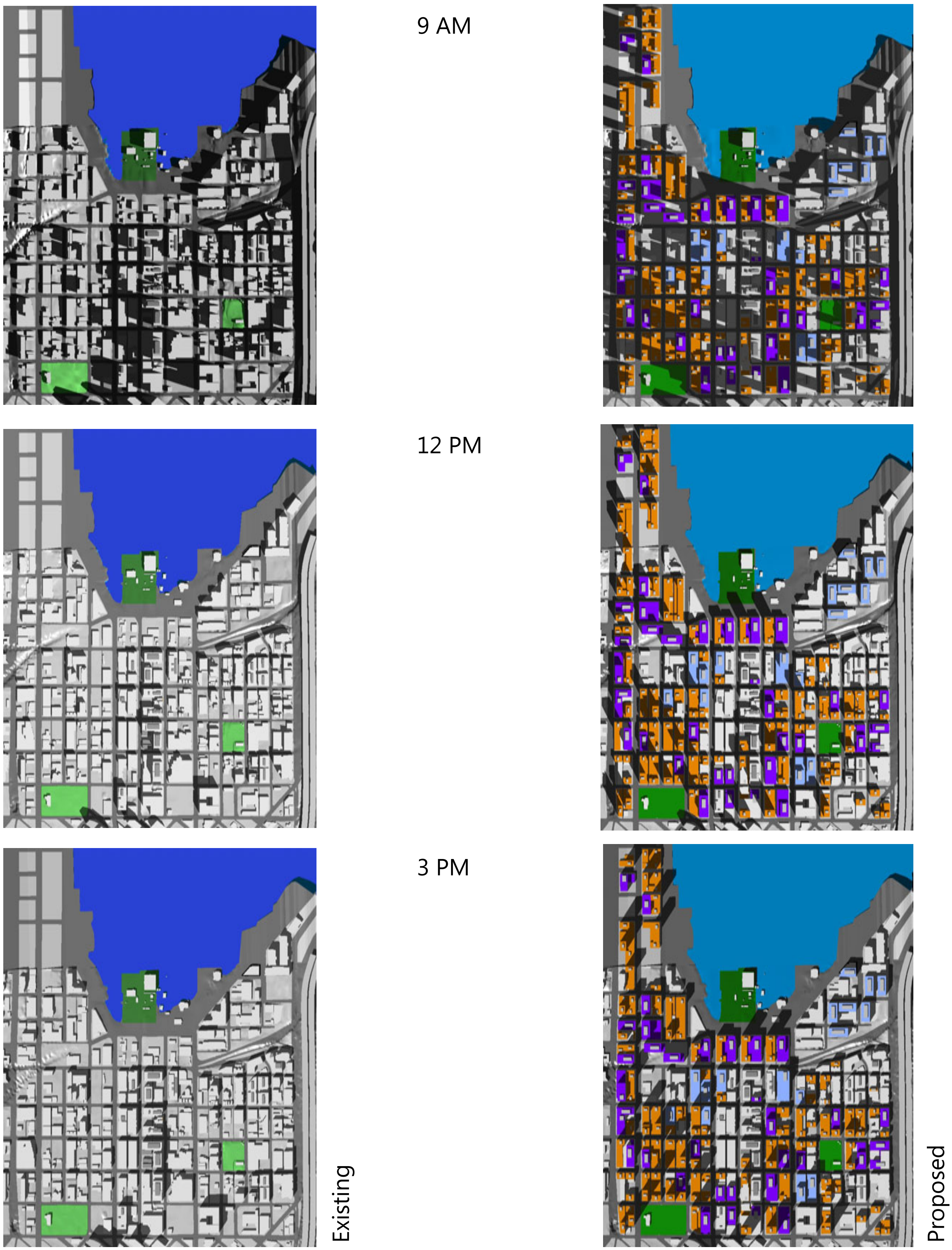
Figure 28
Thomas—Alternative 4

Existing

Proposed

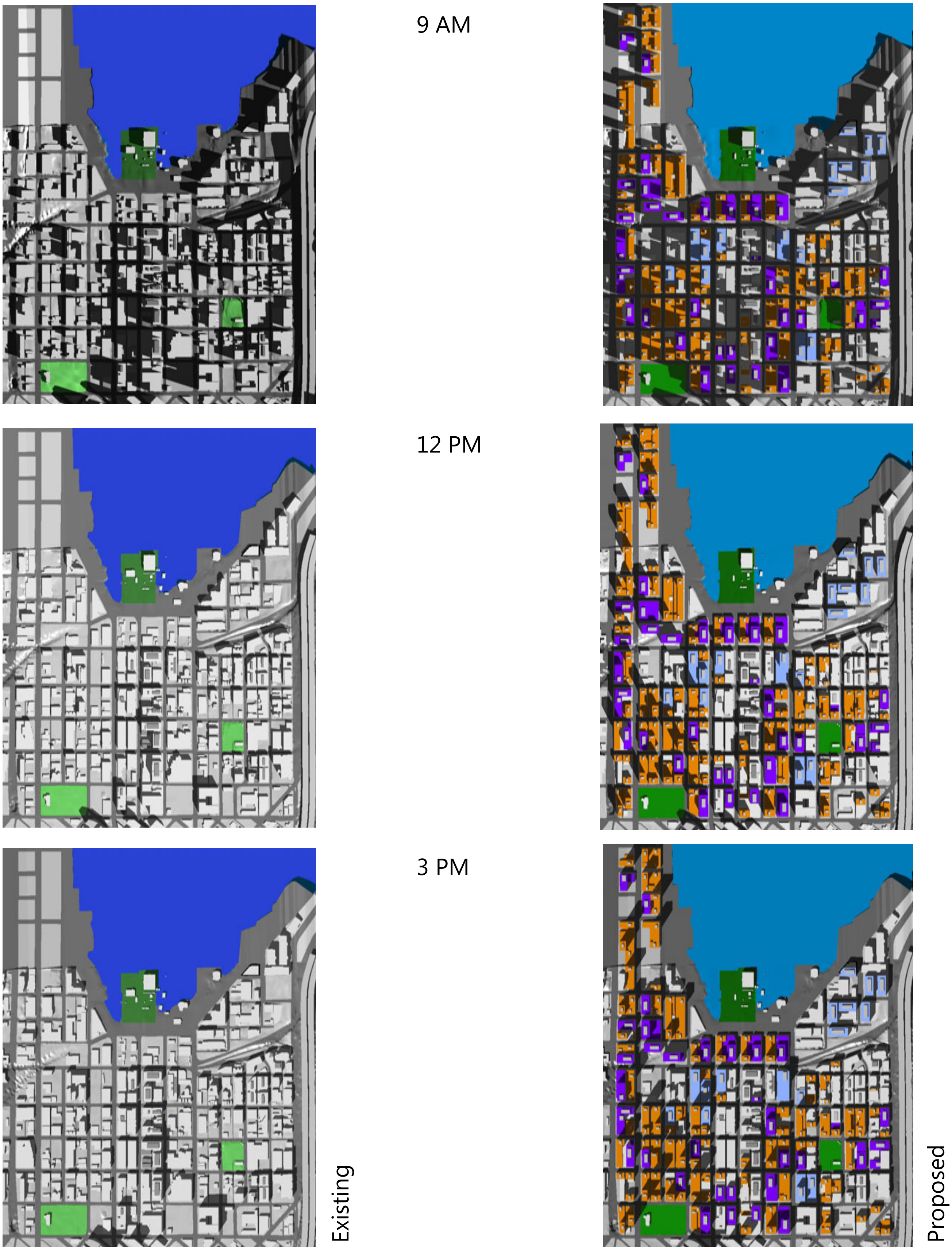
Source: NBBJ, 2010

Figure 29
March 21—Alternative 1



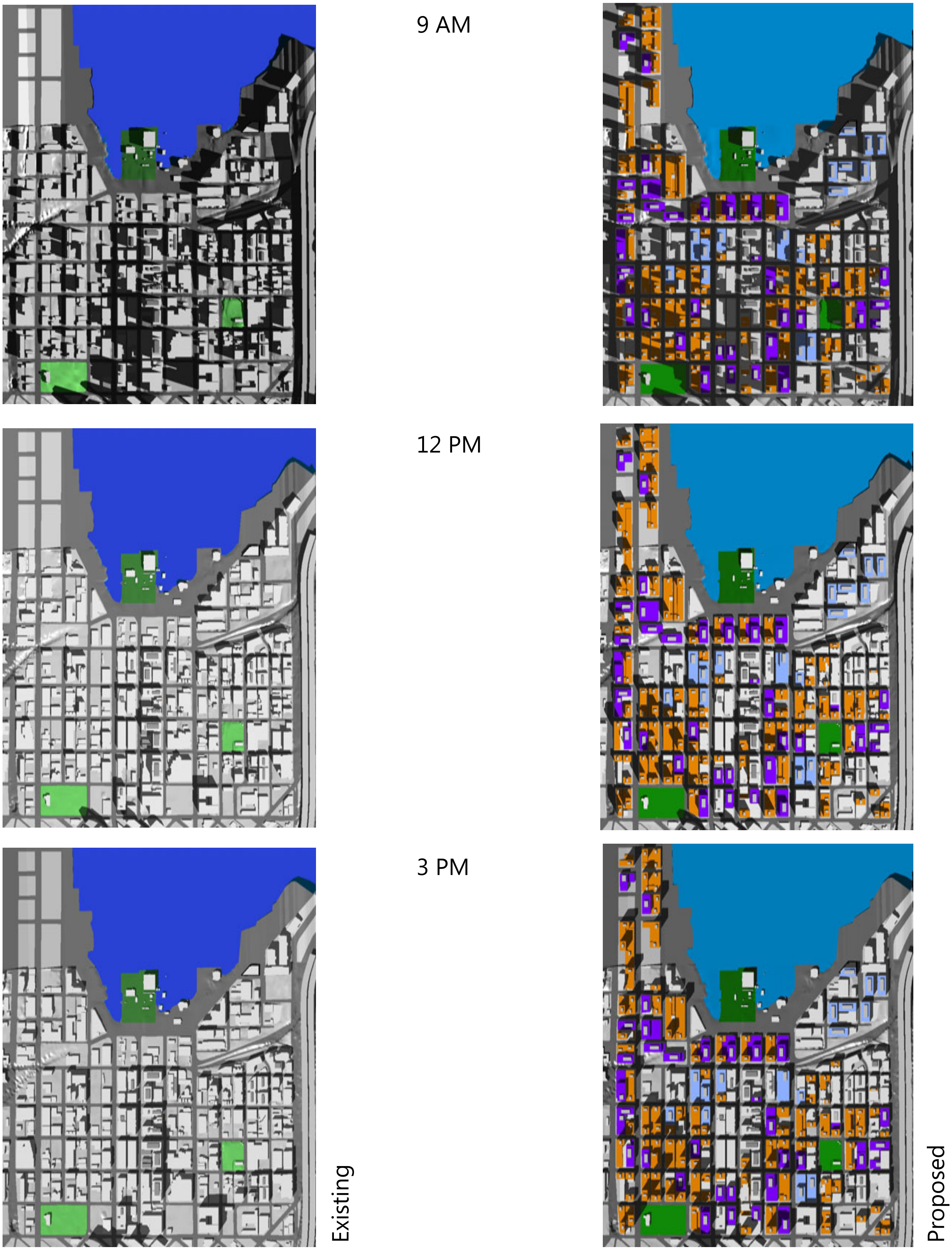
Source: NBBJ, 2010

Figure 30
March 21—Alternative 2



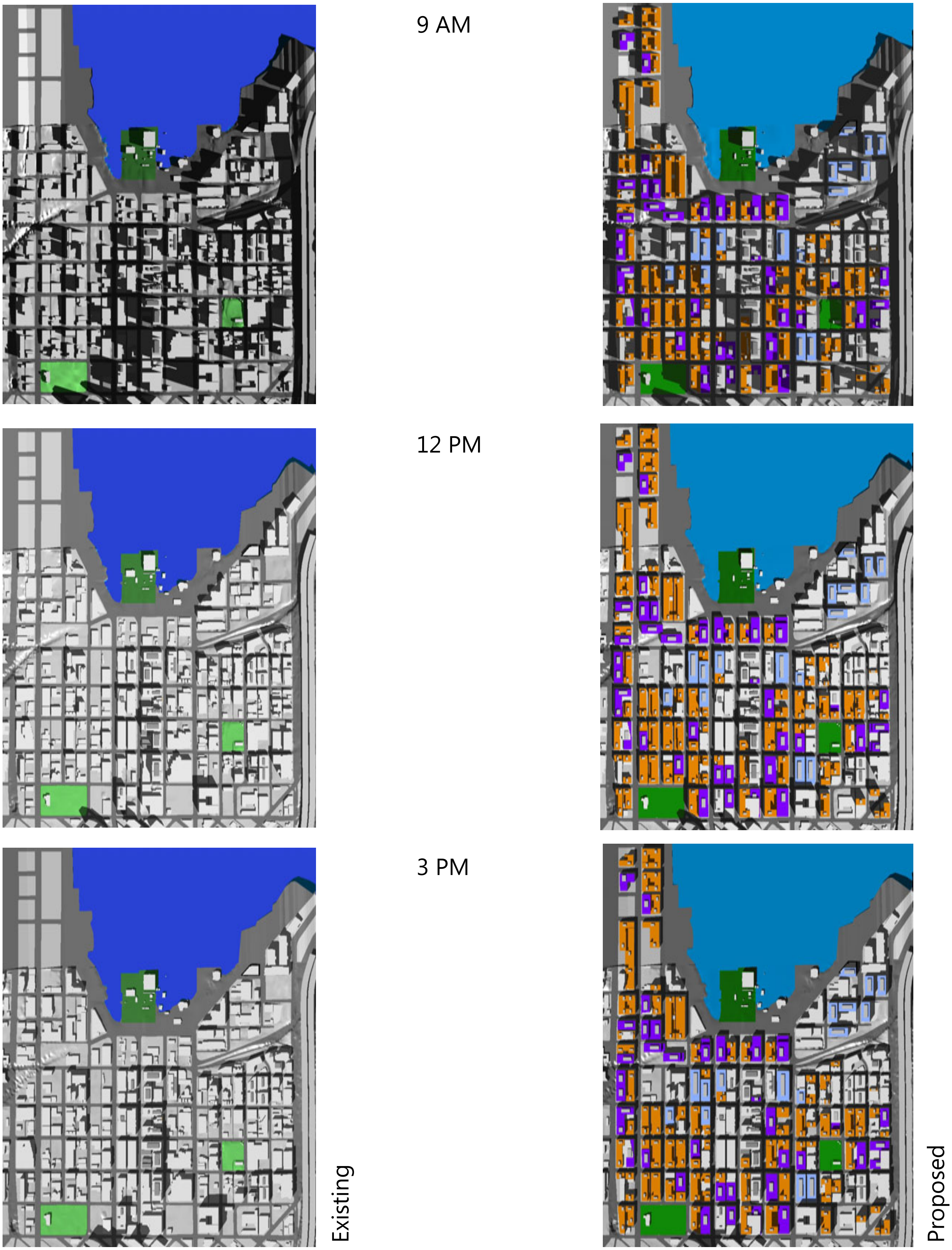
Source: NBBJ, 2010

Figure 31
March 21—Alternative 3



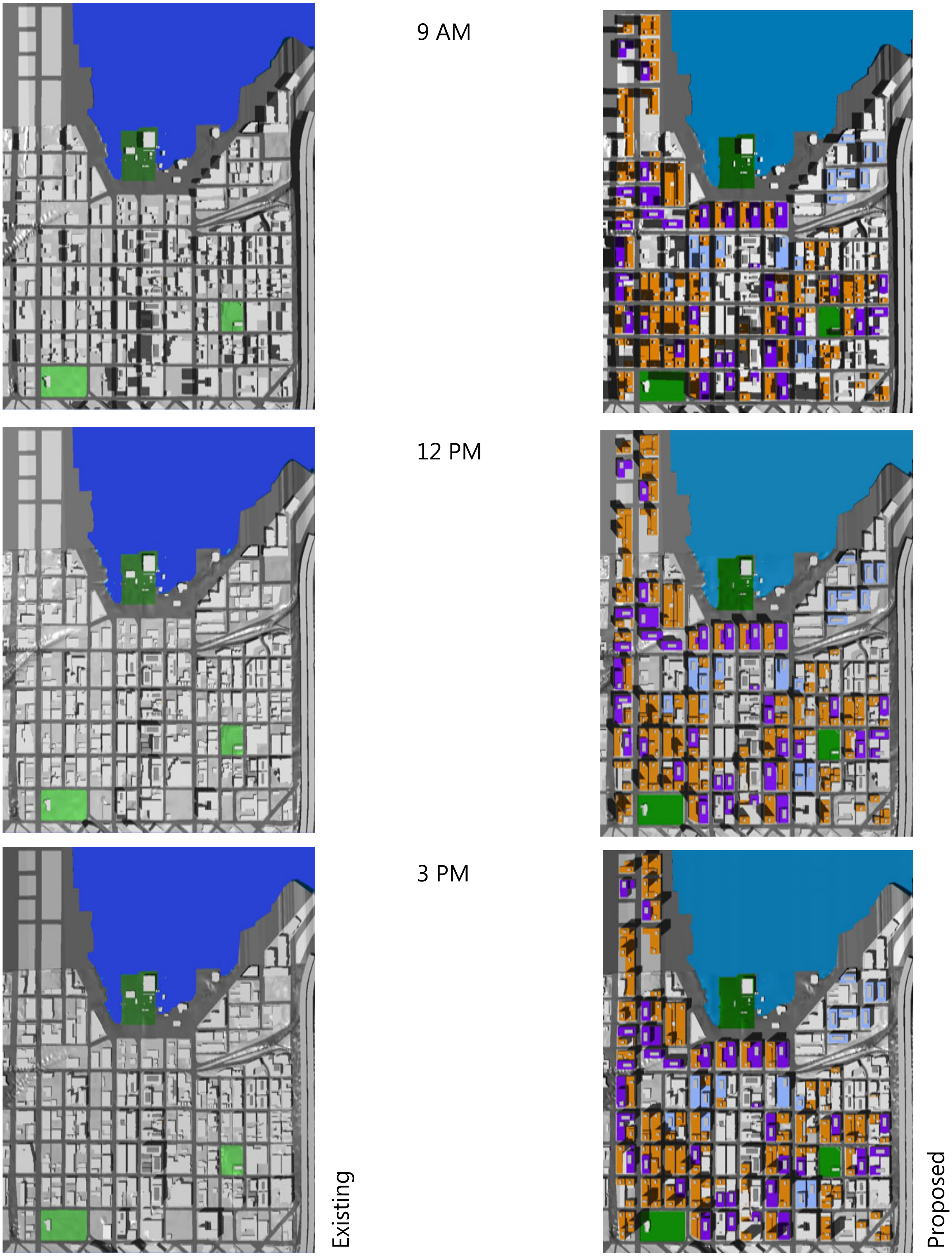
Source: NBBJ, 2010

Figure 32
March 21—Alternative 4



Source: NBBJ, 2010

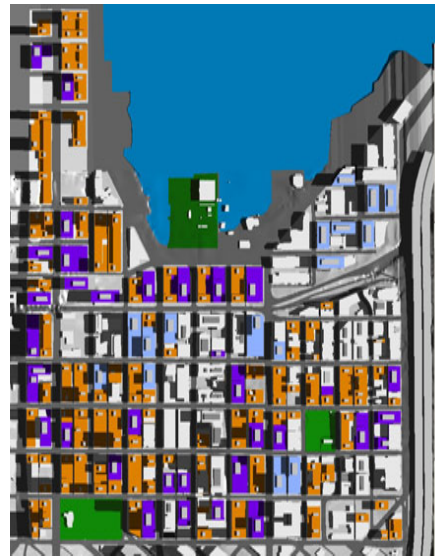
Figure 33
June 21—Alternative 1



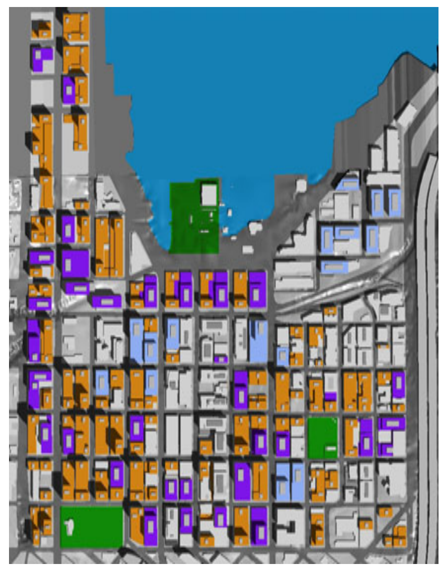
Source: NBBJ, 2010

Figure 34
June 21—Alternative 2

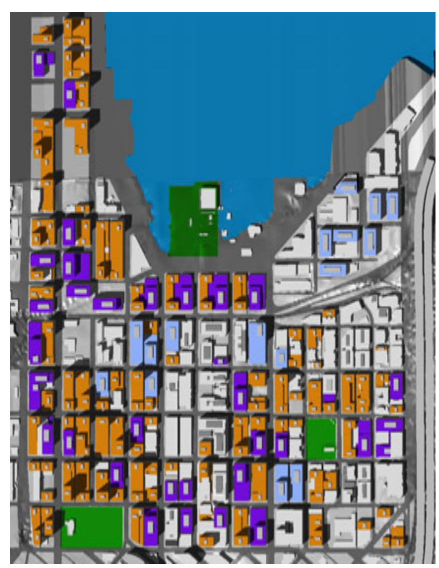
9 AM



12 PM



3 PM

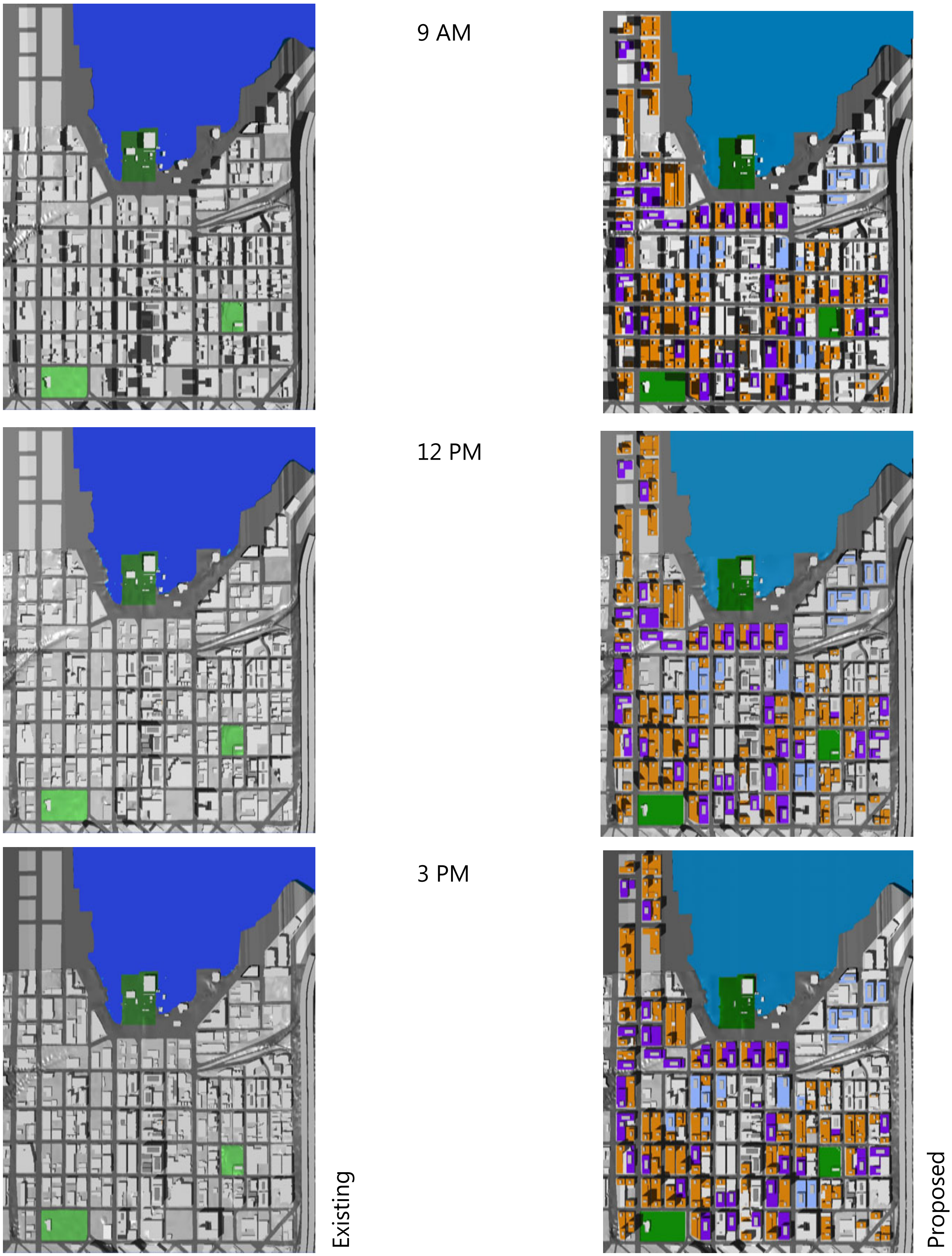


Existing

Proposed

Source: NBBJ, 2010

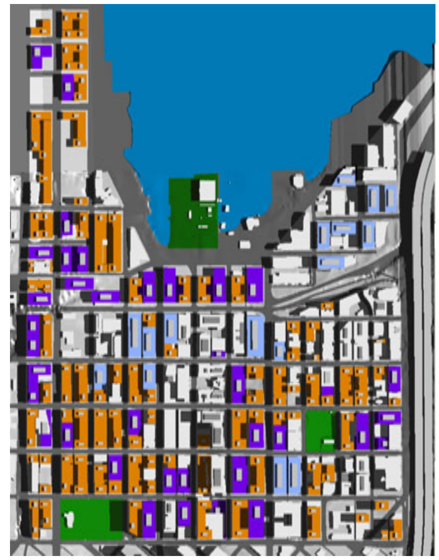
Figure 35
June 21—Alternative 3



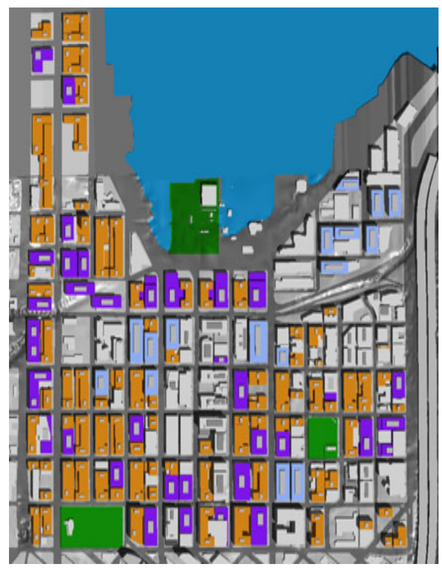
Source: NBBJ, 2010

Figure 36
June 21—Alternative 4

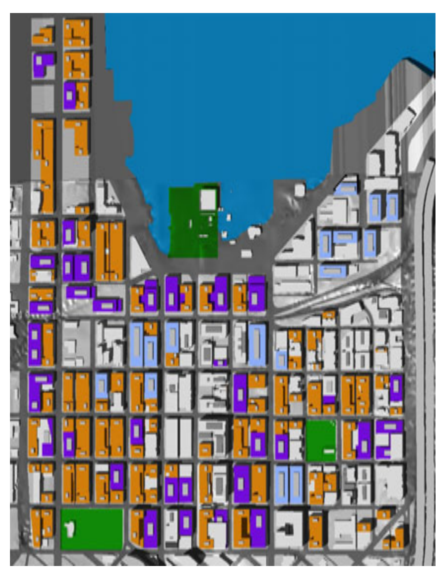
9 AM



12 PM



3 PM

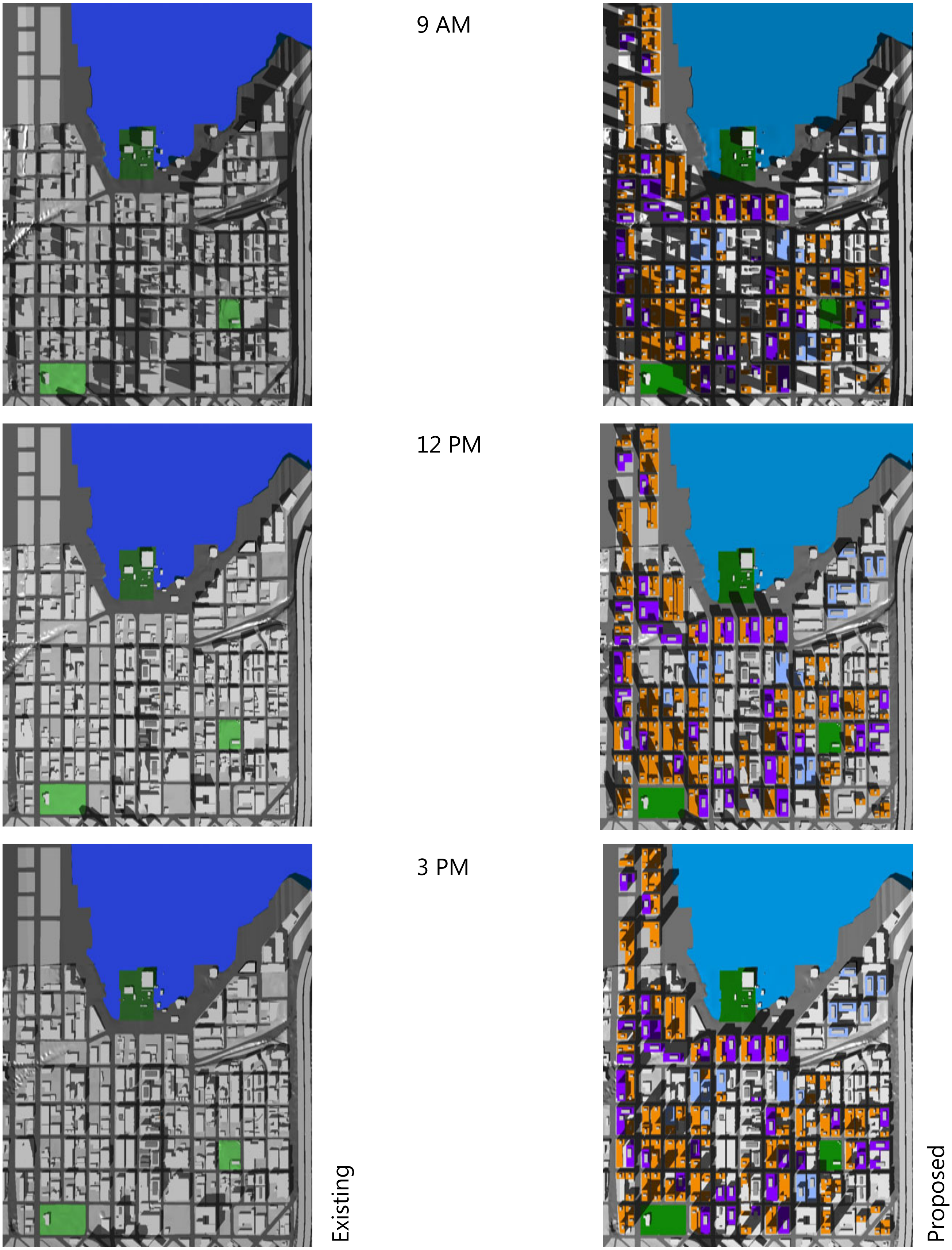


Existing

Proposed

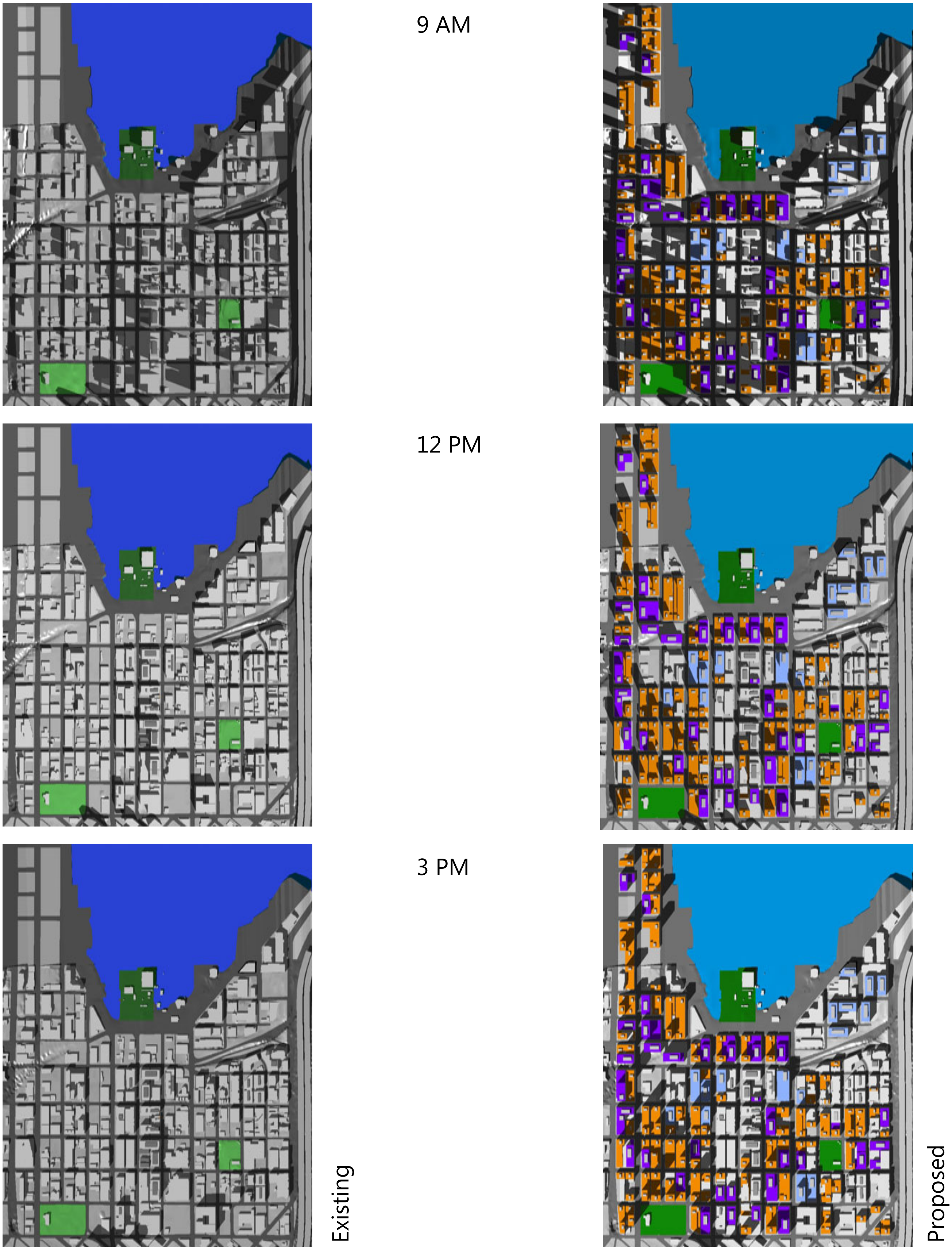
Source: NBBJ, 2010

Figure 37
September 21—Alternative 1



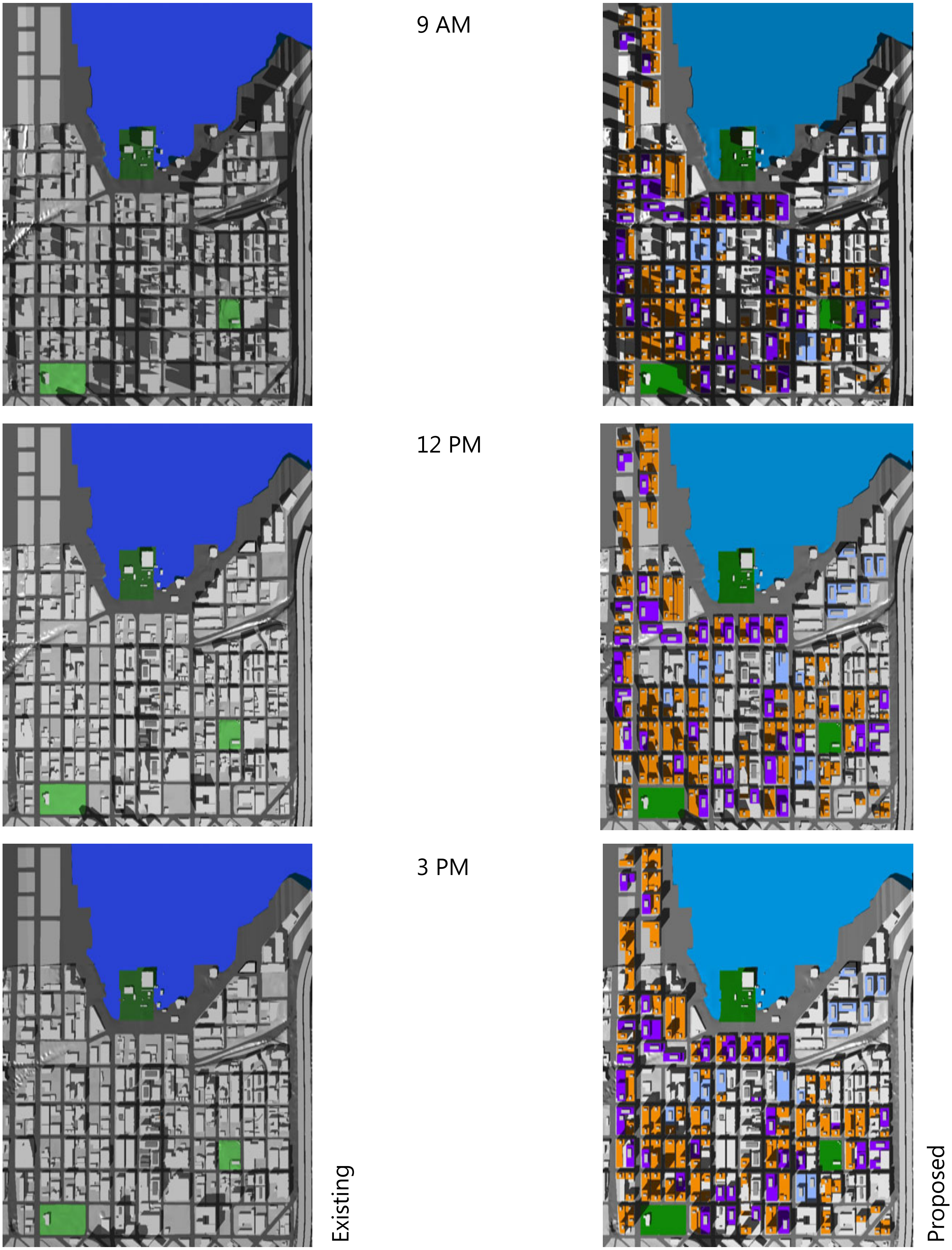
Source: NBBJ, 2010

Figure 38
September 21—Alternative 2



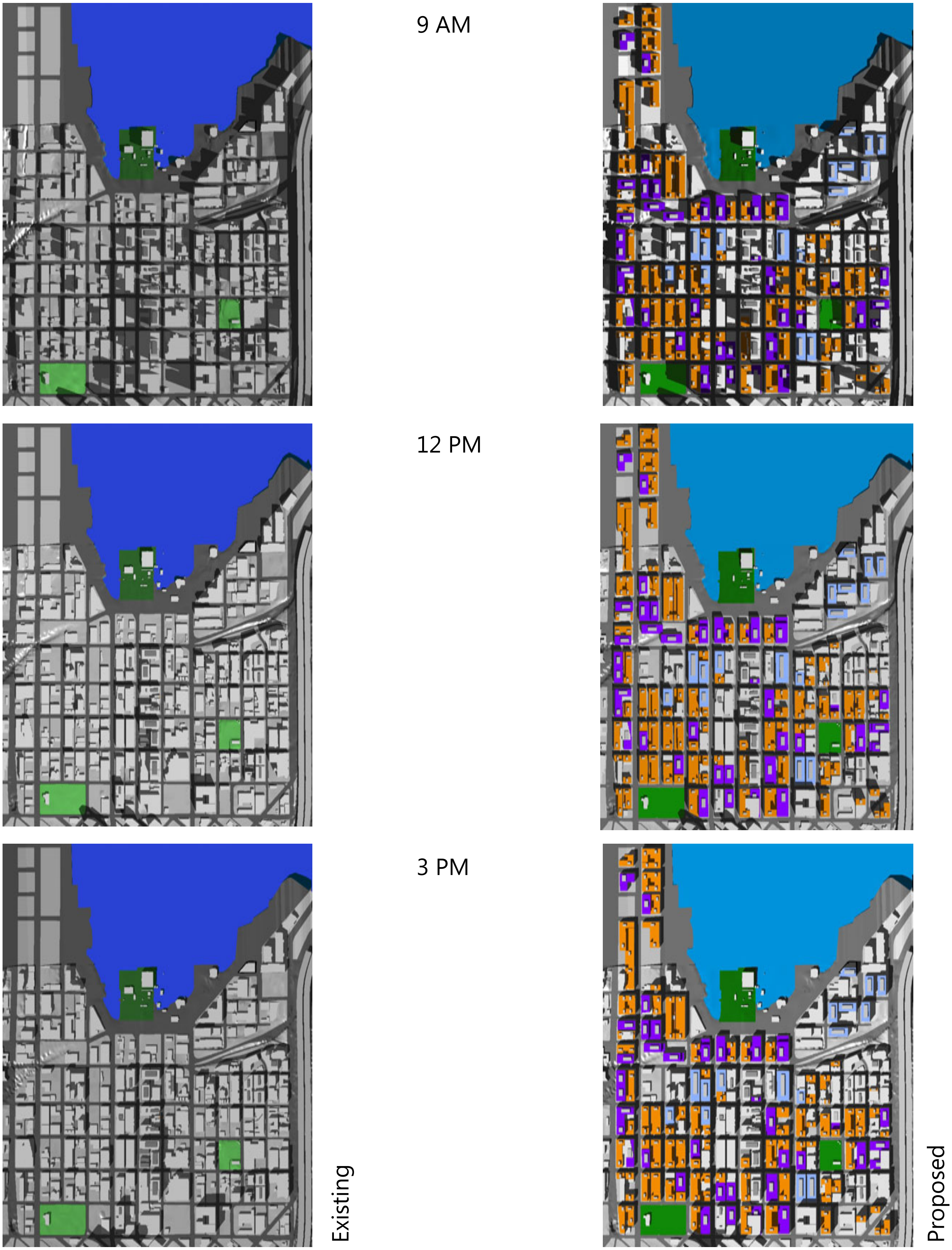
Source: NBBJ, 2010

Figure 39
September 21—Alternative 3



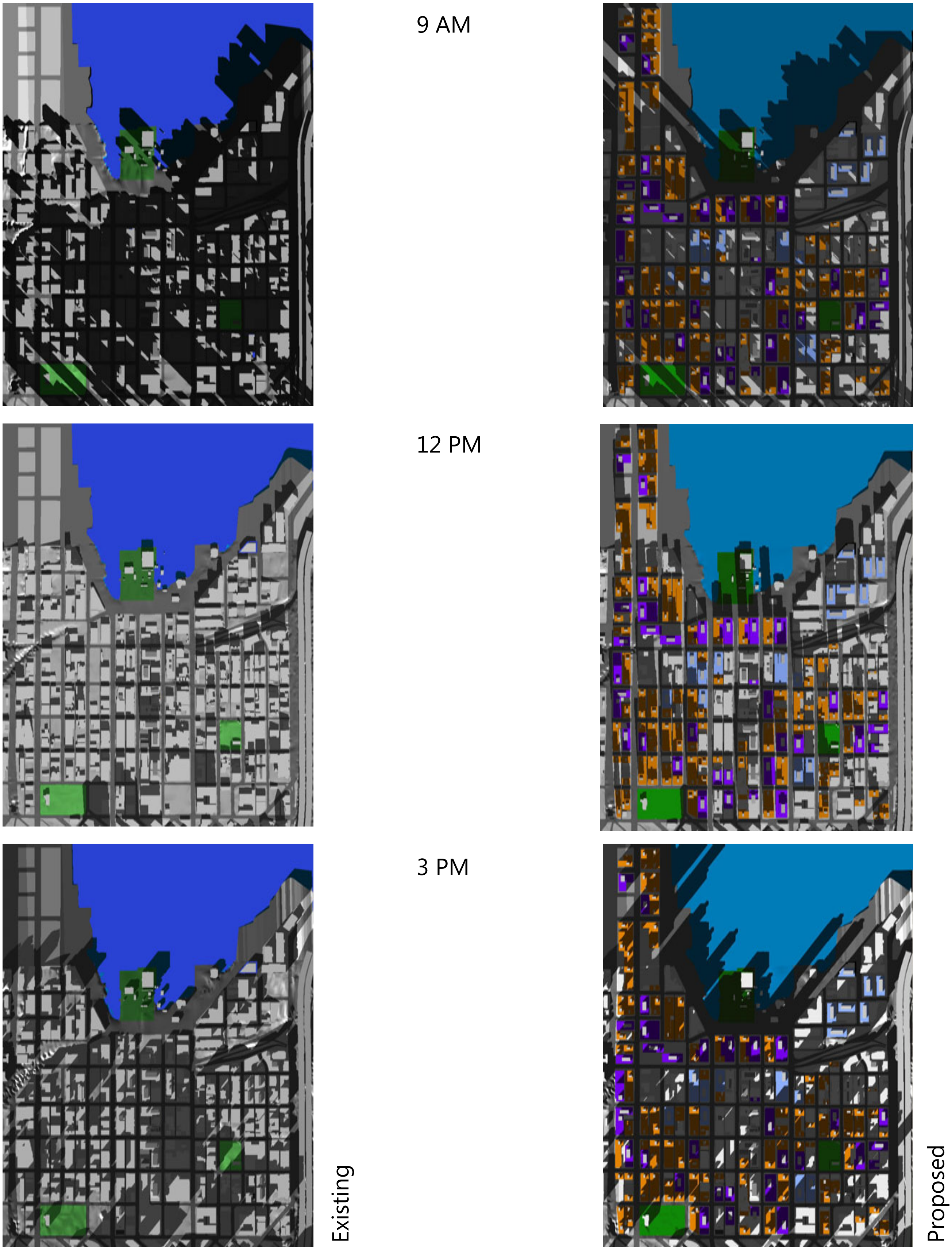
Source: NBBJ, 2010

Figure 40
September 21—Alternative 4



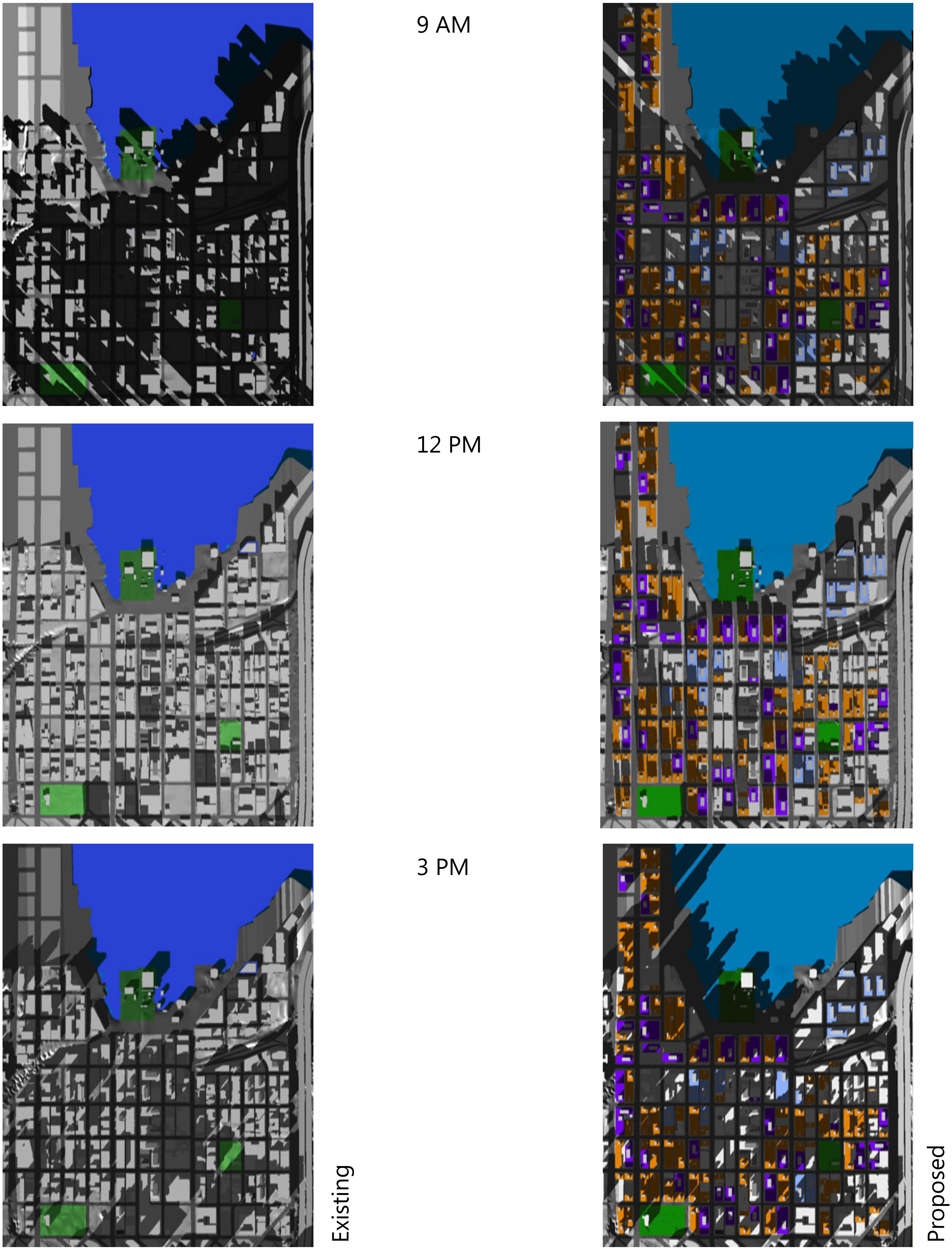
Source: NBBJ, 2010

Figure 41
December 21—Alternative 1



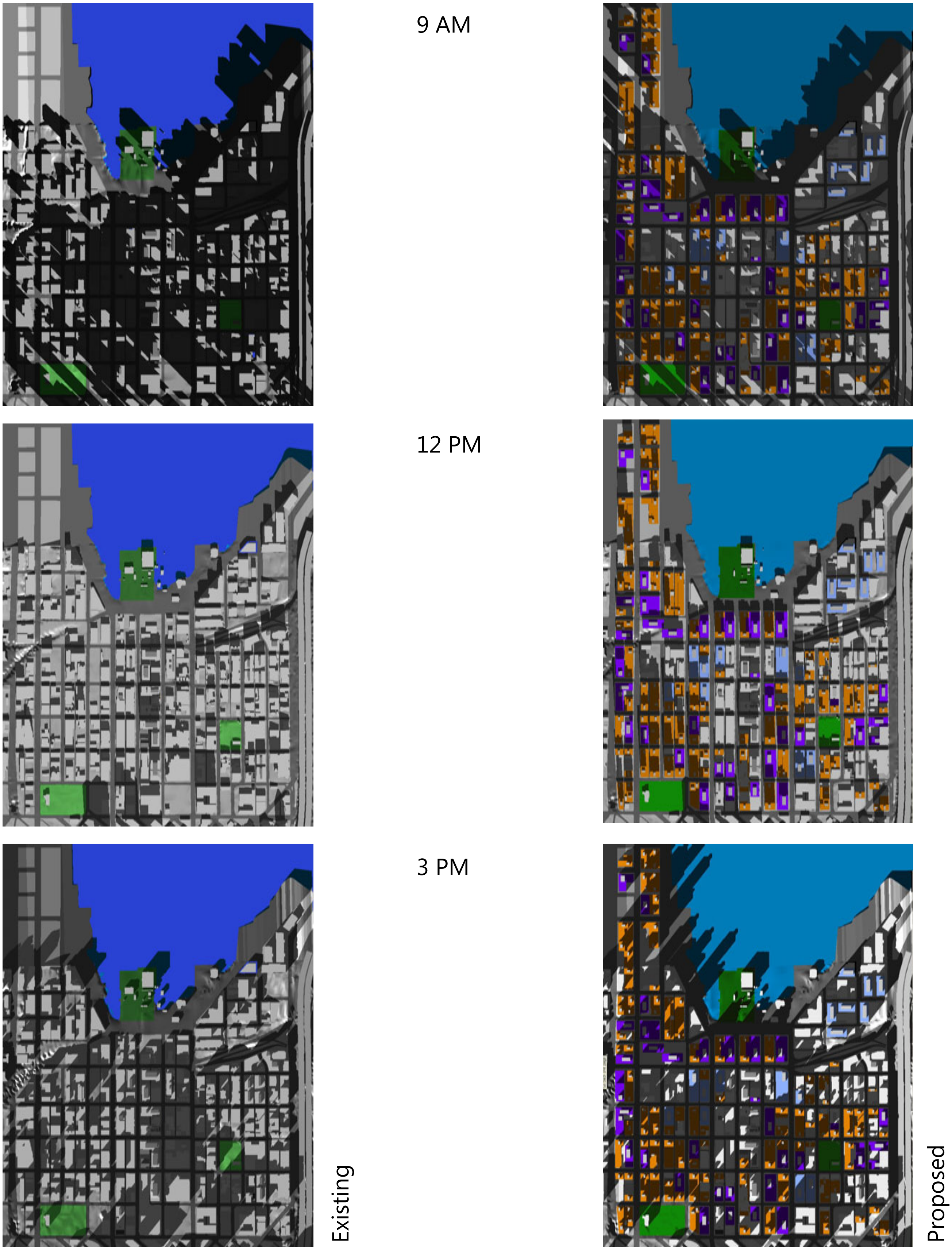
Source: NBBJ, 2010

Figure 42
December 21—Alternative 2



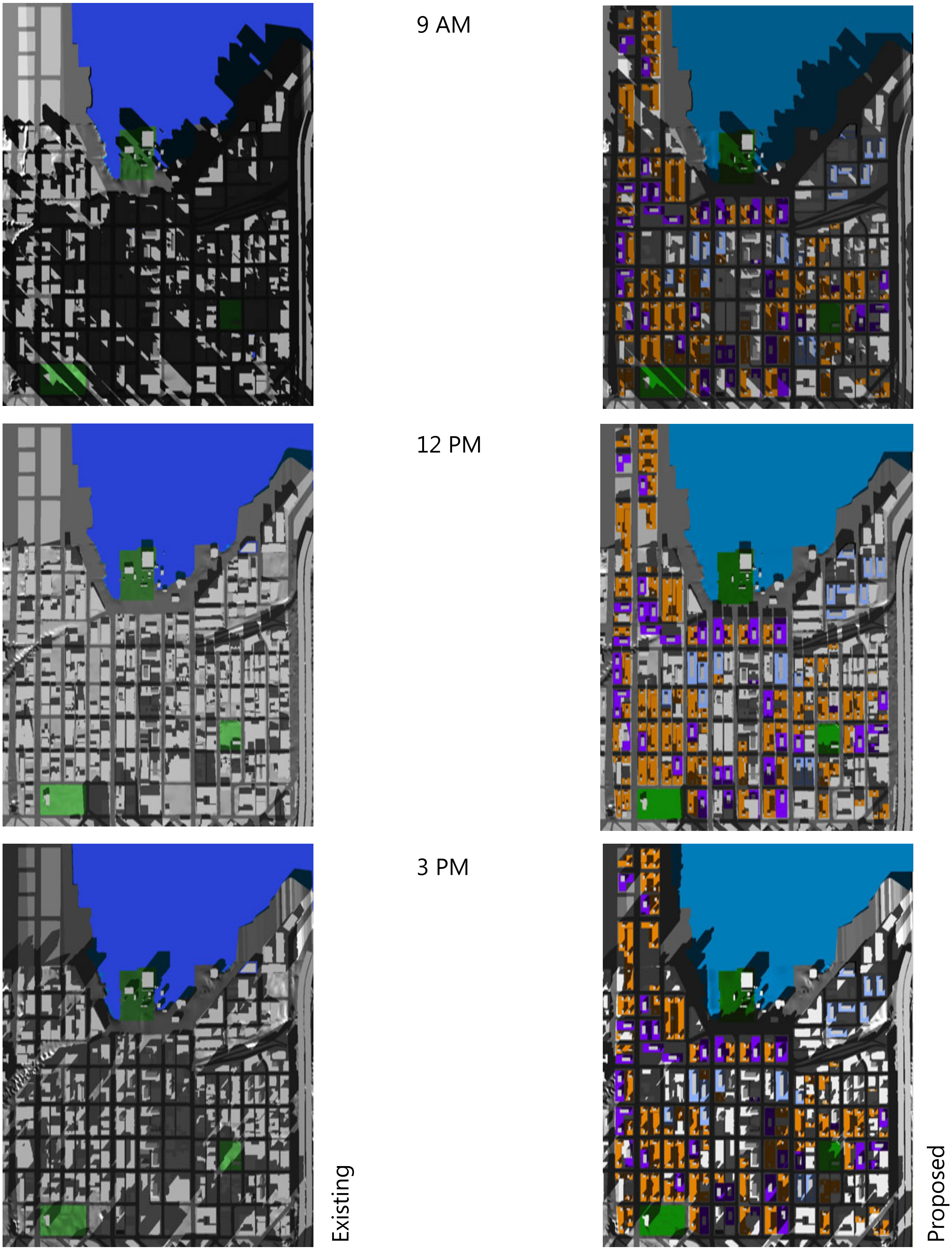
Source: NBBJ, 2010

Figure 43
December 21—Alternative 3



Source: NBBJ, 2010

Figure 44
December 21—Alternative 4



Source: NBBJ, 2010

Appendix E

Transportation

Appendix E-1: Parking

This appendix provides more information on the parking analysis completed for this document.

Existing Conditions Parking Analysis

The data used for the existing conditions parking analysis is included as Attachments 1, 2, and 3.

Future Year Parking Estimates

The future year parking estimates use the expected growth under each alternative to forecast the spaces that are required by the current City of Seattle Municipal Code (Section 23.54.015) for commercial uses. As discussed in the text, no parking is required for multifamily residential uses in commercial zones in urban centers, which applies to most of the study area; however, parking is still usually provided. It was assumed that one parking space per dwelling unit would be supplied. Since the code regarding commercial uses is complex, and varies depending on specific land use, the following assumptions were made:

- 1 space per dwelling unit for residences
- 2 spaces per 1,000 square feet (ksf)of retail space
- 1 space per 1,000 square feet (ksf) of office (non-retail) space

Future growth was provided as jobs, rather than as square footage. Therefore, the assumptions used in the MXD tool were used to convert jobs to square footage. The conversion factors are:

- 500 square feet per retail employee
- 350 square feet per office (non-retail) employee

The following table shows the household and job growth and resulting parking spaces.

Table A3.13-1
ESTIMATED ADDITIONAL PARKING SPACES IN 2031

Alternative	Households	Retail Jobs	Non-retail Jobs	Total
	Expected Growth			
No Action	9,200	2,087	13,913	25,200
Alternative 1	11,900	2,856	19,040	33,796
Alternative 2	11,900	2,856	19,040	33,796
Alternative 3	11,900	2,400	16,000	30,300
	Expected New Parking Spaces			
No Action	9,200	2,087	4,870	16,157
Alternative 1	11,900	2,856	6,664	21,420
Alternative 2	11,900	2,856	6,664	21,420
Alternative 3	11,900	2,400	5,600	19,900

Source: Fehr & Peers, 2010

Appendix E-2: Roadway Operations Analysis

This appendix provides additional information on the methods used for roadway impact assessment.

Threshold of Significance

The threshold of significance for an impact on the roadway is defined as "an increase in traffic on a study corridor that operates unacceptably (as measured by d/c ratios and LOS) under the 2031 No Action scenario that results in the d/c ratio increasing by at least .01 (increases in d/c ratios of less than .01 are less than typical daily fluctuations and are not noticeable by drivers)."

The following analysis was completed to give show that an increase of less than 0.01 would not be noticeable by drivers. A Synchro network showing the intersection of Mercer Street and Fairview Avenue N was created with turning volumes for the PM peak hour. The Highway Capacity Manual LOS report determines the average delay experienced by drivers to be 85.9 seconds.

The d/c ratio on eastbound Mercer Street increasing by 0.01 equates to an additional 32 cars (i.e. one-hundredth of the total capacity). Therefore, 32 cars were added proportionally to the eastbound movements. The same growth factor (1.24 percent) was applied to the other approaches as well. The resulting Highway Capacity Manual LOS report determines the new average delay experienced by drivers to be 89.7 seconds, an increase of 3.8 seconds. Additional delay of this length would not be noticeable to drivers, and is within typical daily fluctuations. The HCM reports are included as Attachment 4.

The Difference Method

To reduce model error, a technique known as the difference method was applied for traffic volumes. Rather than take the direct output from the 2031 model, the difference method calculates the growth between the base year and 2031 models, and adds that growth to an existing count. For example, assume a road has an existing count of 450 vehicles. If the base year model showed a volume of 400 vehicles and the future year model showed a volume of 550 vehicles, then 150 cars would be added to the existing count for a total of 600 cars.

Capacity Adjustments

The increase in capacity for one-way streets is consistent with methodology recommended by the Florida Department of Transportation FDOT). Attachment 5 from FDOT's 2009 Quality/Level of Service Handbook shows the relevant table.

Appendix E-3: Transit Analysis

This appendix summarizes the transit analysis. All future year transit information comes from the City of Seattle travel model.

Existing Conditions

The existing average headways reported in **Table 3.13-1** were calculated using current King County Metro (KCM) schedules. Average headways are the ratio of the number of minutes in the time period to the number of busses expected over the time period. Note that within each time period, the actual headway will often vary.

The existing load factors reported in **Tables 3.13-5** and **3.13-6** were provided by KCM (see Attachment 6). The peak hour for each route in each direction was chosen to reflect the highest load factor experienced over the peak period. Therefore, the time periods vary between routes as well as between directions of the same routes.

Future Year Analysis

Future year analysis was conducted the same way for both the No Action and the Action Alternatives. Future transit operations are assessed using peak hour load factors. The City of Seattle travel model uses three hour peak periods, rather than one peak hour, so assumptions were made to factor the results to represent the peak hour. These assumptions are described below.

Since load factors are based on the number of seats available on the transit route during the peak commute hour, the capacity will change under 2031 conditions as headways change. The Seattle travel model does not explicitly model PM peak period transit trips (they are modeled as the reverse of the AM trips).

Table A.13-2 displays AM peak period transit route headways from the City of Seattle travel model for the base year and 2031 conditions. Since headways can vary over the course of the peak period, weighted headways were estimated. The travel model breaks routes into multiple pieces, for example some with 15 minute headways and others with 30 minute headways. Headways are weighted based upon the ridership volume for each piece so if the 15 minute headway busses have higher ridership, the headway will be weighted more heavily toward the 15 minute headway than the 30 minute headway. An example (using Route 5 SB) is provided below to illustrate. There are 298 passengers at 20 minute headways, 1,234 passengers at 30 minute headways, and 103 passengers at 120 minute headways.

$$Weighted\ Headway = \frac{(20 * 298) + (30 * 1234) + (120 * 103)}{(298 + 1234 + 103)} = 34$$

These weighted headways are assumed to remain constant over the entire peak period for this analysis. The following table shows that all headways are expected to decrease between the base year and 2031, with the exception of the Aurora RapidRide (replacing existing Route 358) SB which will remain constant at 6 minute headways.

Table A3.13-2
NO ACTION ALTERNATIVE: SOUTH LAKE UNION AM PEAK PERIOD TRANSIT WEIGHTED HEADWAYS

Route	Termini Locations	Base Year Headway		2031 Headway	
		NB	SB	NB	SB
5	Downtown, Shoreline	33	34	26	32
8	Uptown, Rainier Valley	30	30	14	16
16	Downtown, Northgate	20	20	17	17
17	Downtown, Loyal Heights	23	21	17	15
25	Downtown, Laurelhurst	49	45	26	26
26	Green Lake, Tukwila	26	27	17	14
28	Downtown, Broadview	30	30	17	24
66	Downtown, Northgate	30	30	26	26
70	Downtown, University District	15	15	10	10
Rapid Ride	Downtown, Aurora Village Transit Center	15	6	6	6

Source: Fehr & Peers, 2010

The underlying principle used to estimate capacity is that the change in headways has an inverse relationship to the change in capacity. For example, a bus route running 35-seat busses on 30 minute headways offers 70 seats per hour. The same bus route running on 15 minute headways offers 140 seats per hour.

$$2031\ Capacity = \frac{Base\ Year\ Headway}{2031\ Headway} * Existing\ Capacity$$

To reduce model error, a technique known as the difference method was applied for transit ridership. Rather than take the direct output from the 2031 model, the difference method calculates the growth between the base year and 2031 models, and adds that growth to an existing count.

$$\begin{aligned} Forecasted\ Ridership \\ &= Existing\ Ridership + (2031\ Model\ Ridership \\ &- Base\ Year\ Model\ Ridership) \end{aligned}$$

Ridership in the City of Seattle travel model is available for the peak period only. The peak hour of transit is often assumed to contain approximately 40 percent of peak period ridership. This figure was confirmed as a reasonable average, given that KCM data indicates 44 percent of AM peak period (6-9 AM) ridership and 35 percent of PM peak period (3:15-6:30 PM) ridership occurs within the respective peak hours. Therefore, peak period ridership was multiplied by 0.4 to arrive at peak hour ridership.

$$Peak\ Hour\ Ridership = Peak\ Period\ Ridership * 0.4$$

The previous methods were used for all transit lines that appear in both the base year and future year travel models. Ridership for new routes was estimated using direct model output since the difference method correction cannot be applied to routes that do not have existing conditions ridership estimates. The same peak factor of 40 percent was used to calculate peak hour ridership. The new lines are listed below:

- Route 21: Arbor Heights to Downtown Seattle
- Route 29: Woodland Park to Downtown Seattle
- Route 56: Alki/West Seattle to South Lake Union
- Route 121: Burien to Downtown Seattle
- Route 308: Lake Forest Park to Downtown Seattle
- Route 313: Bothell to Uptown
- Route 316: Shoreline to Uptown

Capacities for the future lines were not available from KCM. Therefore, the project team made assumptions about the size of the busses that would run based upon the estimated ridership. Bus capacity does vary among the KCM fleet, but KCM plans to purchase only low-floor busses in the future. The articulated busses have 56 seats and the standard busses have 35 seats. Lines with at least 700 riders per peak period are assumed to run 56-seat busses, while lines with fewer than 700 riders per peak period are assumed to run 35-seat busses. These assumptions are based on the types of busses that serve existing routes with higher and lower ridership. Using these assumptions and future headways, capacity was estimated for the new lines, as follows.

$$Peak\ Hour\ Capacity = \frac{60\ minutes}{Weighted\ Headway} * Number\ of\ seats\ on\ bus$$

Off-Peak Headways

The UVTN calls for 15 minute frequencies 18 hours a day, every day of the week. Since the travel model only provides headway information for the AM peak hour, headways were extrapolated for other times of the day. The change in headway between the base year and 2030 was applied to existing midday headways.

Table A3.13-3
NO ACTION ALTERNATIVE: SOUTH LAKE UNION MIDDAY TRANSIT WEIGHTED HEADWAYS

Route	Termini Locations	Base Year Midday Headway		Change in Headway Between Base Year and 2031		2031 Estimated Headway	
		NB	SB	NB	SB	NB	SB
5	Downtown, Shoreline	15	15	0.80	0.96	12	14
8	Uptown, Rainier Valley	15	15	0.47	0.52	7	8
16	Downtown, Northgate	20	20	0.87	0.87	17	17
17	Downtown, Loyal Heights	30	30	0.76	0.73	23	22
25	Downtown, Laurelhurst	65	65	0.53	0.58	35	38
26	Green Lake, Tukwila	29	29	0.67	0.54	19	16
28	Downtown, Broadview	30	30	0.58	0.78	17	23
66	Downtown, Northgate	30	30	0.87	0.87	26	26
70	Downtown, University District	15	15	0.69	0.69	10	10
Rapid Ride	Downtown, Aurora Village Transit Center	9	9	0.40	1.00	4	9

Source: Fehr & Peers, 2010

This analysis indicated that Routes 16, 17, 25, 26, 28, and 66 would not meet the UVTN frequency goals due to their midday schedules. Of the remaining routes, the following indicated that they would not meet other UVTN frequency goals:

- Route 70 does not operate on Sundays.
- Route 5 currently has approximately 30 minute headways on Sundays. The expected decrease in headway (0.80 NB and 0.96 SB) would not bring the headway to 15 minutes.
- Route 8 very narrowly misses the goals. It currently has approximately 30 minute headways on Sundays. The expected

decrease in SB headway (0.52) would not bring the headway to 15 minutes.

Mitigation

Transit mitigation was considered independently of any changes in trip generation and mode share. If the transit ridership remained the same as is expected under the Action Alternatives, then one to two busses per peak hour could be added to the routes with unacceptable load factors to bring them to an acceptable level. The following table details the calculations. The size of bus assumed for each route is the same as was assumed for the original Action Alternatives analysis.

Table A3.13-4
SOUTH LAKE UNION TRANSIT MITIGATION

Route	Termini Locations	Peak Hour Ridership	Peak Hour Capacity	Unmitigated Peak Hour Factor	Minimum Required Capacity	Assumed bus size	Additional busses required	Mitigated Load Factor
21 NB	Downtown, Arbor Heights	520	386	1.35	416	56	1	1.18
21 SB	Downtown, Arbor Heights	520	386	1.35	416	56	1	1.18
28 NB	Downtown, Broadview	240	171	1.40	192	56	1	1.06
29 NB	Downtown, Woodland Park	120	80	1.49	96	35	1	1.04
29 SB	Downtown, Woodland Park	144	80	1.79	115	35	1	1.25
56 NB	South Lake Union, West Seattle	396	258	1.53	317	56	2	1.07

Source: Fehr & Peers, 2010

Appendix E-4: MXD Tool Trip Generation

This appendix contains detailed background information on the enhanced trip generation tool used for this analysis. The complete MXD report is included as Attachment 7.

Model Validation

To ensure the accuracy of the MXD model, a set of 16 independent mixed use sites that were not included in the 239 initial model development MXD sites were tested to validate the model. Among the validation sites, use of the MXD model produced superior statistical performance when comparing the model results to observed data than are found when using traditional ITE methods. Specifically, the MXD model had a significantly lower root mean squared error (RMSE) and higher pseudo-R squared than traditional ITE methods when comparing estimated to observed external vehicle trips. Estimates from the ITE *Trip Generation Handbook* had an RMSE of 40% and pseudo-R squared of 0.58 (i.e., the ITE method only explains about 58 percent of the variability in external vehicle trips), modified estimates using ITE's traditional trip internalization techniques had an RMSE of 32% and pseudo-R squared of 0.73, whereas modified estimates using the MXD model had an RMSE of only 26% and pseudo-R squared of 0.82.

Trip Generation Tables

Table A3.13-5 summarizes the daily, AM, and PM trip generation for all four alternatives. Mitigated trip generation is also shown for the three action alternatives. The following table is a more detailed version of **Tables 3.13-8** and **3.13-16**

ITE gross trips are generally based on vehicle trip generation data from suburban development projects with very little transit, pedestrian, or bicycle trip generation. In this case, gross trips were estimated using the “High Rise Condo – ITE 232,”, “Shopping Center – ITE 820,” and “General Office – ITE 710” land use types. The MXD model estimates the number of internal trips and external trips made by auto, pedestrian, bicycle, and transit by calculating the probability that a gross ITE trip will use one of these alternative modes.

When this calculation is made, the vehicle-trip is converted into a person-trip. The MXD model assumed an ITE average vehicle occupancy of 1.1 persons per vehicle. This means that one vehicle trip shifted to another mode becomes 1.1 person-trips. Therefore, the sum of the auto and non-auto trips will be greater than the ITE gross trips.

Mode share must be calculated using the same unit of trips (i.e. vehicle-trips or person-trips). Therefore, the mode share is calculated before the conversion factor is applied to internal, bicycle, pedestrian, and transit trips.

Table A3.13-5
TRIP GENERATION BY ALTERNATIVE

	Alternative	Daily			PM Peak			AM Peak		
		Auto Trips (mode share %)	Non-auto Trips (mode share %)		Auto Trips (mode share %)	Non-auto Trips (mode share %)		Auto Trips (mode share %)	Non-auto Trips (mode share %)	
			Internal, Bike & Pedestrian	Transit		Internal, Bike & Pedestrian	Transit		Internal, Bike & Pedestrian	Transit
	No Action Alternative - Current Zoning	108,946 (49.4%)	70,540 (29.1%)	52,337 (21.6%)	12,648 (51.4%)	7,279 (26.9%)	6,091 (21.7%)	11,285 (56.2%)	4,688 (21.2%)	4,991 (22.6%)
UNMITIGATED	Alternative 1 - Maximum Increases to Height and Density	136,973 (48.3%)	93,828 (30.1%)	67,509 (21.6%)	15,554 (50.5%)	9,429 (27.8%)	7,371 (21.7%)	13,262 (55.6%)	5,722 (21.8%)	5,945 (22.6%)
UNMITIGATED	Alternative 2 - Mid-Range Increases to Height and Density	136,888 (48.3%)	93,908 (30.1%)	67,509 (21.6%)	15,548 (50.4%)	9,435 (27.8%)	7,371 (21.7%)	13,257 (55.5%)	5,728 (21.8%)	5,944 (22.6%)
UNMITIGATED	Alternative 3 - Moderate Increases to Height and Density	117,326 (48.1%)	81,403 (30.3%)	57,855 (21.6%)	13,605 (50.3%)	8,334 (28.0%)	6,449 (21.7%)	12,239 (55.2%)	5,411 (22.2%)	5,501 (22.6%)
MITIGATED	Alternative 1 - Maximum Increases to Height and Density	108,027 (38.1%)	115,933 (37.2%)	77,236 (24.8%)	12,244 (39.7%)	11,835 (34.9%)	8,606 (25.4%)	10,787 (45.2%)	6,947 (26.5%)	7,443 (28.3%)
MITIGATED	Alternative 2 - Mid-Range Increases to Height and Density	107,936 (38.1%)	116,030 (37.2%)	77,235 (24.8%)	12,236 (39.7%)	11,844 (34.9%)	8,606 (25.4%)	10,782 (45.2%)	6,953 (26.5%)	7,442 (28.3%)
MITIGATED	Alternative 3 - Moderate Increases to Height and Density	92,607 (38.0%)	100,310 (37.4%)	66,139 (24.6%)	10,715 (39.6%)	10,435 (35.1%)	7,526 (25.3%)	9,951 (44.9%)	6,556 (26.9%)	6,873 (28.2%)

Appendix E-5: CAPCOA Research

This appendix contains background information on the CAPCOA research used as a basis for mitigation. The MXD trip generation tool predicts mode share based primarily on land use and demographic information. It does not take additional travel demand management measures into account. The CAPCOA research provides guidance on the mode share shift expected when various travel demand management (TDM) programs are enacted. This appendix summarizes the process used to apply both types of measures. Attachment 8 contains the parking section from the CAPCOA research report. The full report, Quantifying Greenhouse Gas Mitigation Measures, is available online.

The pedestrian and bicycle system mitigation measures were factored into the MXD model to produce the mitigated trip generation based on land use changes alone. The results are shown in the following table.

Table A3.13-6
LAND USE MITIGATION REDUCTION RATE CALCULATIONS

Alternative	Unmitigated Net Trips			Mitigated Net Trips (Increased intersection density taken into account)			MXD (Land Use) Reduction Rate		
	AM	PM	Daily	AM	PM	Daily	AM	PM	Daily
Alternative 1	13,262	15,554	136,973	12,691	14,404	127,090	4.3%	7.4%	7.2%
Alternative 2	13,257	15,548	136,888	12,684	14,395	126,984	4.3%	7.4%	7.2%
Alternative 3	12,239	13,605	117,326	11,707	12,606	108,949	4.3%	7.3%	7.1%

Source: Fehr & Peers, 2010

The CAPCOA research provides estimates on the amount of trip reduction that may take place given certain TDM measures. The 15 percent reduction in trip generation used for this analysis assumes that the maximum parking limits reduce parking supply (on a per square foot/dwelling unit basis) by 25 percent compared to the No Action alternative and that unbundled parking costs an average of $100 per month per space. See the attached CAPCOA report for details.

The land use reductions and TDM reductions should be multiplicative, rather than additive, meaning that the reduction rate to be applied to the mitigated net trips should be less than 15 percent. The following formula was used to identify the final TDM reduction percentage:

$$1 - (1 - MXD\ reduction\ rate) * (1 - TDM\ reduction\ rate) - MXD\ reduction\ rate$$

The following table shows the results. These reduction rates were applied to the unmitigated net trips above to identify the additional trips that should be subtracted from the mitigated net trips.

Table A3.13-7TDM MITIGATION REDUCTION RATE CALCULATIONS

Alternative	TDM Reduction Rate per CAPCOA Research			Additional Trip Reductions			Final Number of Trips		
	AM	PM	Daily	AM	PM	Daily	AM	PM	Daily
Alternative 1	14.4%	13.9%	13.9%	1,904	2,161	19,064	10,787	12,244	108,027
Alternative 2	14.4%	13.9%	13.9%	1,903	2,159	19,048	10,782	12,236	107,936
Alternative 3	14.3%	13.9%	13.9%	1,756	1,891	16,342	9,951	10,715	92,607

Source: Fehr & Peers, 2010

Appendix E-6: Commute Trip Reduction Surveys

This appendix contains background information on the CTR programs in place in South Lake Union.

Attachment 9 contains the table of 16 companies with SOV rates and goals. Green indicates the company met their goal, yellow indicates they reduced their but did not meet their goal, and red indicates the rate increased.

Attachment 10 contains the detailed reports used to create **Table 3.13-7**.

Appendix E-7: Comprehensive Plan Mode Share Goal Consistency

This section describes the evaluation to determine consistency with the Seattle Comprehensive Plan mode split goals. The Comprehensive Plan sets the following two goals:

- South Lake Union work trips mode split: 50% non-SOV
- South Lake Union resident trips mode split: 75% non-SOV

The trip generation analysis shown in **Table 3.13-8** and the Seattle travel model's estimate of SOV and HOV mode shares were used to determine the expected mode splits in 2031.

Under all three height and density alternatives, the project meets the first goal of at least 50 percent of South Lake Union work trips being made by non-SOV modes. However, the goal of 75 percent of all trips by South Lake Union residents being made by non-SOV modes is not met, as shown in **Table A3.13-17**. The mode shares of the three action alternative are closer to the goal than that of the No Action Alternative.

Table A3.13-17
SOUTH LAKE UNION RESIDENTS 2031 MODE SHARE

Alternative	Total Auto Mode Share (SOV & HOV)	SOV Mode Share
No Action Alternative	49.4%	27.6%
Alternative 1	48.3%	27.0%
Alternative 2	48.3%	27.0%
Alternative 3	48.1%	26.9%

Source: Fehr & Peers, 2010

Applying auto trip reduction rates correlated to the mitigation measures, the SOV mode share is reduced from approximately 27 percent to approximately 21 percent, which meets the Comprehensive Plan goal. Therefore, all three mitigated alternatives would meet the City's mode share goals while the No Action Alternative would not. Details of these calculations are provided in the remainder of this appendix.

The Seattle travel model trip tables break trips down by type including home based work (HBW), home based non-work (HBNW), and non-home based (NHB). The model also breaks trips down by mode. The HBW trips were used to determine the mode share for the goal of at least 50 percent non-SOV work trips into South Lake Union (Goal 1). All three trip types were used to determine mode share for the goal of at least 75 percent non-SOV total trips by South Lake Union residents (Goal 2). The mode shares were used to approximate SOV and HOV use, since the MXD model does not distinguish between the two.

Comprehensive Plan Goal 1

The following table shows the number of person-trips made by SOV, HOV2 (2 passengers), and HOV3+ (3 or more passengers). Since the MXD results do not distinguish SOV from HOV trips, these proportions were applied to the MXD projection of total auto share. All alternatives have less than 50 percent SOV mode share so the first goal from the Comprehensive Plan is met.

Table A3.13-8
COMPREHENSIVE PLAN MODE SHARE GOAL 1: AUTO OCCUPANCY CALCULATION

Mode	Work Trips to SLU	Percentage of Total Auto Trips
SOV	28,105	86.1%
HOV2	3,159	9.7%
HOV3+	1,368	4.2%
Total	32,632	100.0%

Source: City of Seattle travel model, 2010

Table A3.13-9
COMPREHENSIVE PLAN MODE SHARE GOAL 1: SOV CALCULATION

Mode	Total Auto Trips per MXD	SOV Trips
No Action	49.4%	42.5%
Alternative 1	48.3%	41.6%
Alternative 2	48.3%	41.6%
Alternative 3	48.1%	41.4%

Source: City of Seattle travel model, 2010

Comprehensive Plan Goal 2

A similar method to that used for Goal 1 is used here. The sum of all three trip types originating in South Lake Union is calculated. This is an approximation of the trips made by South Lake Union residents.

Table A3.13-10
COMPREHENSIVE PLAN MODE SHARE GOAL 2: AUTO OCCUPANCY CALCULATION

Mode	HBW Trips from SLU	HBNW Trips from SLU	NHB Trips from SLU	Total Trips from SLU	Percentage of Total Auto Trips
SOV	2,736	10,436	21,467	34,639	55.9%
HOV2	594	5,304	10,667	16,565	26.8%
HOV3+	340	3,086	7,284	10,710	17.3%
Total	3,670	18,826	39,418	61,914	100.0%

Source: Fehr & Peers, 2010

The breakdown of SOV and HOV types was then applied to the MXD auto mode share for both the mitigated and unmitigated alternatives. The 75 percent non-SOV goal is not met under the unmitigated alternatives, but is met under the mitigated alternatives.

Table A3.13-11
COMPREHENSIVE PLAN MODE SHARE GOAL 2: SOV CALCULATION (UNMITIGATED AND MITIGATED)

Alternative	Unmitigated		Mitigated	
	Total Auto Trips per MXD	SOV Trips	Total Auto Trips per MXD	SOV Trips
No Action	49.4%	27.6%		
Alternative 1	48.3%	27.0%	38.1%	21.3%
Alternative 2	48.3%	27.0%	38.1%	21.3%
Alternative 3	48.1%	26.9%	38.0%	21.3%

Source: Fehr & Peers, 2010

Appendix E-8: Growth Management Act Concurrency

This section describes the evaluation to determine concurrency with Growth Management Act concurrency standards.

Methodology

The Seattle Comprehensive Plan uses peak hour volume-to-capacity (v/c) ratios across designated screenlines to assess arterial LOS for GMA Concurrency assessment. The v/c ratio is defined as the ratio of measured traffic volumes to calculated roadway capacity[1]. Since busses (the primary transit mode) operate in the same roadways as general traffic, the City uses the same screenline analysis for transit. Within the traffic impact analysis area (bounded by S King Street to the south, the ship canal to the north, Elliott Avenue to the west and Broadway to the east), screenlines run along four corridors: the Ship Canal, Fairview Avenue, S Jackson Street and I-5. **Figure 3.13-24** shows the traffic impact analysis area and the screenlines it contains.

The screenline analysis was based upon methods outlined in the *Department of Planning and Development Director's Rule 5-2009* which summarizes the 2008 traffic volumes and capacities at each of the City's screenlines. From this document, the capacities of the key facilities were determined and the v/c ratio was calculated using the most recent traffic counts available from the City of Seattle.

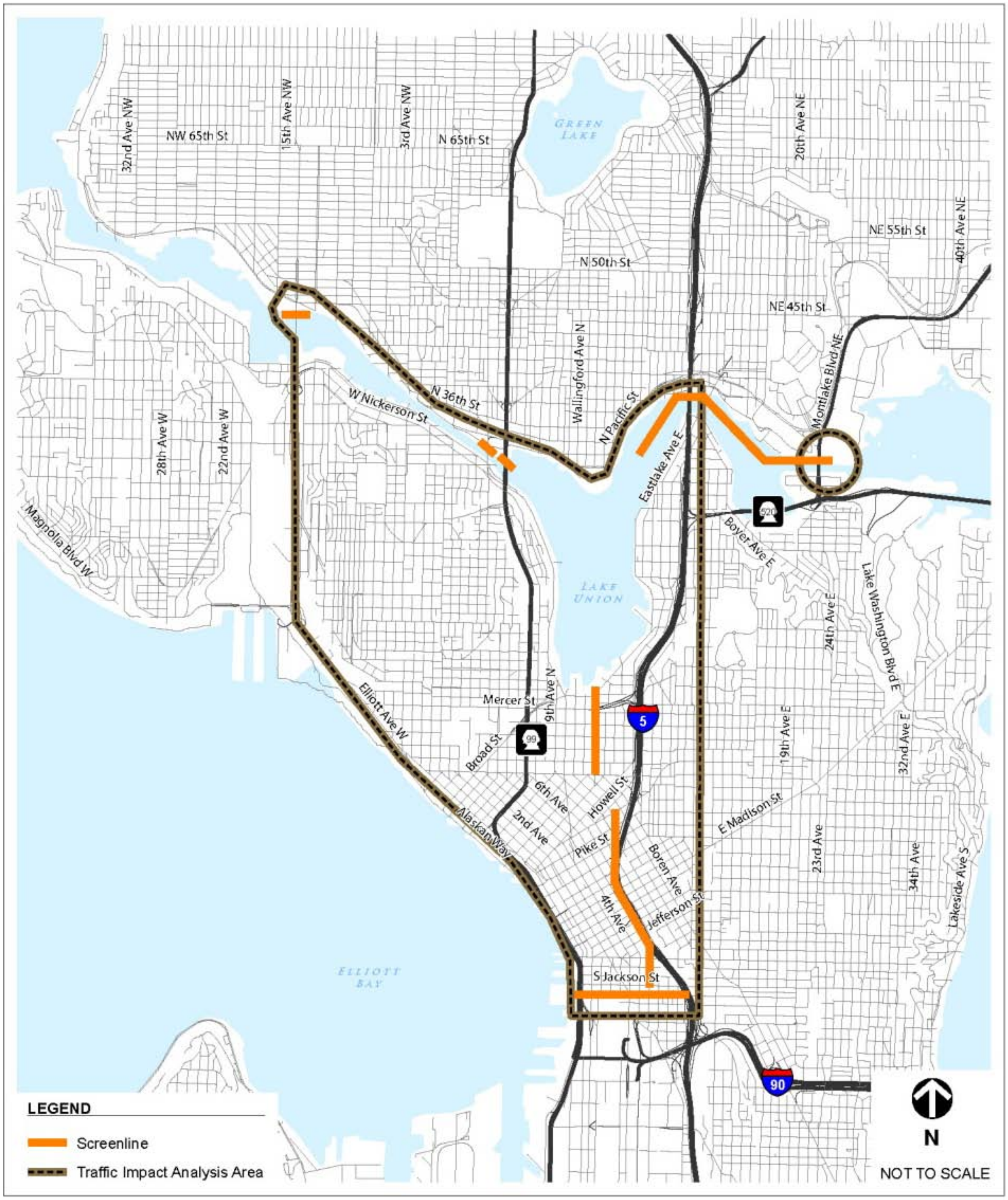
Concurrency Standard

As previously described, the Seattle Comprehensive Plan uses v/c ratios across designated screenlines to assess arterial LOS. Each screenline is assigned a maximum acceptable v/c threshold. In the event a screenline's measurement approaches this threshold, the Comprehensive Plan calls for vehicular demand reduction strategies to be pursued before increasing capacity. **Table A3.13-12** displays the screenlines and their respective v/c thresholds in detail.

[1] As noted above, v/c ratios measure vehicles that pass a given point during the peak hour and do not consider queuing. Demand/capacity ratios were not used for GMA concurrency analysis since the Comprehensive Plan specifies the use of v/c ratios.

Figure3.13-2

Traffic Impact Analysis Area Screenlines - Existing Conditions



Source: Fehr & Peers, 2011

Table A3.13-12
TRAFFIC IMPACT ANALYSIS AREA SCREENLINES

Screenline Number	Screenline Location Segment	LOS Standard (v/c ratio)
5.11	Ship Canal—Ballard Bridge	1.20
5.12	Ship Canal—Fremont Bridge	1.20
5.13	Ship Canal—Aurora Bridge	1.20
5.16	Ship Canal—University & Montlake Bridges	1.20
8	Fairview Avenue N—Denny Way to Valley Street	1.20
10.11	South of S Jackson Street—Alaskan Way to 4th Avenue S	1.00
12.12	East of CBD—S Jackson Street to E Pine Street	1.20

Source: City of Seattle Comprehensive Plan, 2005.

Existing Screenline Results

Table A3.13-13 displays the peak hour v/c ratios for the relevant screenlines. The peak hour count for each direction was used to calculate the v/c ratio. The *Department of Planning and Development Director's Rule 5-2009* document provided the capacity for each screenline. None of the screenlines currently exceed the GMA Concurrency LOS standard stated in the Comprehensive Plan.

Table A3.13-13
EXISTING SCREENLINE V/C RATIOS

Screenline Number	Screenline Location Segment	NB/EB	SB/WB
5.11	Ship Canal—Ballard Bridge	1.09	0.94
5.12	Ship Canal—Fremont Bridge	0.89	0.71
5.13	Ship Canal—Aurora Bridge	0.89	0.82
5.16	Ship Canal—University & Montlake Bridges	0.91	0.87
8	Fairview Avenue N—Denny Way to Valley Street	0.86	0.75
10.11	South of S Jackson Street—Alaskan Way to 4th Avenue S	0.35	0.41
12.12	East of CBD—S Jackson Street to E Pine Street	0.50	0.60

Source: City of Seattle count data, 2005-2010.

No Action Alternative Screenline Results

Table A3.13-14 displays the v/c ratios for the relevant screenlines. As shown, the Ballard Bridge screenline exceeds the Comprehensive Plan standard in both directions. The Fairview Avenue N screenline exceeds the threshold of significance in the westbound direction only.

Table A3.13-14
NO ACTION ALTERNATIVE: SCREENLINE V/C RATIOS

Screenline Number	Screenline Location Segment	NB/EB	SB/WB
5.11	Ship Canal—Ballard Bridge	**1.35**	**1.24**
5.12	Ship Canal—Fremont Bridge	1.11	0.96
5.13	Ship Canal—Aurora Bridge	1.08	0.98
5.16	Ship Canal—University & Montlake Bridges	1.14	1.07
8	Fairview Avenue N—Denny Way to Valley Street	1.02	**1.21**
10.11	South of S Jackson Street—Alaskan Way to 4th Avenue S	0.52	0.72
12.12	East of CBD—S Jackson Street to E Pine Street	0.45	0.64

Source: Fehr & Peers, 2010

Action Alternatives Screenline Results

Table A3.13-15 displays the v/c ratios for the screenlines within the traffic impact analysis area for all four alternatives. The 2031 travel model provided the volumes and capacities for all four future year scenarios.

As shown in the bold text, two screenlines exceed the Comprehensive Plan's v/c ratios under the three height and density rezone alternatives. These are the same two screenlines that exceeded the v/c ratio under the No Action Alternative. The screenline analysis indicates that the GMA concurrency requirements will not be met under 2031 conditions with or without the height and density rezone.

Table A3.13-15
ACTION ALTERNATIVES COMPARISON: SCREENLINE V/C RATIOS

Screenline Number	Screenline Location Segment	No Action Alternative		Alternative 1		Alternative 2		Alternative 3	
		NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
5.11	Ship Canal—Ballard Bridge	**1.35**	**1.24**	**1.37**	**1.25**	**1.38**	**1.26**	**1.36**	**1.24**
5.12	Ship Canal—Fremont Bridge	1.11	0.96	1.13	0.99	1.13	0.98	1.11	0.98
5.13	Ship Canal—Aurora Bridge	1.08	0.98	1.10	0.99	1.10	0.99	1.09	0.98
5.16	Ship Canal—University & Montlake Bridges	1.14	1.07	1.16	1.09	1.16	1.09	1.15	1.08
8	Fairview Avenue N—Denny Way to Valley Street	1.02	**1.21**	1.05	**1.22**	1.05	**1.22**	1.03	**1.21**
10.11	South of S Jackson Street—Alaskan Way to 4th Avenue S	0.52	0.72	0.52	0.73	0.52	0.73	0.52	0.72
12.12	East of CBD—S Jackson Street to E Pine Street	0.45	0.64	0.46	0.66	0.46	0.66	0.45	0.65

Source: Fehr & Peers, 2010

Mitigated Action Alternatives Screenline Results

Following the mitigation measures discussed in Chapter 3.13, the screenlines were re-evaluated. The results are shown in **Table A3.13-16**. The Ballard Bridge screenline continues to exceed the standard under all three mitigated alternatives. However, the v/c ratios under the mitigated scenarios are all less than or equal to the v/c ratios under the No Action Alternative. Therefore, the mitigated alternatives (in particular, Alternative 3) perform better than the No Action Alternative in terms of GMA concurrency.

The Fairview Avenue N screenline exceeds the Comprehensive Plan standard in the westbound direction under the No Action Alternative and Alternative 1. Alternatives 2 and 3 meet GMA concurrency requirements since they equal the maximum acceptable threshold.

Table A3.13-16
MITIGATED ACTION ALTERNATIVES COMPARISON: SCREENLINE V/C RATIOS

Screenline Number	Screenline Location Segment	No Action Alternative		Alternative 1		Alternative 2		Alternative 3	
		NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
5.11	Ship Canal—Ballard Bridge	**1.35**	**1.24**	**1.35**	**1.23**	**1.35**	**1.23**	**1.34**	**1.22**
5.12	Ship Canal—Fremont Bridge	1.11	0.96	1.10	0.96	1.10	0.95	1.08	0.94
5.13	Ship Canal—Aurora Bridge	1.08	0.98	1.07	0.97	1.07	0.97	1.06	0.97
5.16	Ship Canal—University & Montlake Bridges	1.14	1.07	1.13	1.06	1.13	1.06	1.12	1.05
8	Fairview Avenue N—Denny Way to Valley Street	1.02	**1.21**	1.02	**1.21**	1.02	1.20	1.02	1.20
10.11	South of S Jackson Street—Alaskan Way to 4th Avenue S	0.52	0.72	0.51	0.71	0.51	0.71	0.51	0.70
12.12	East of CBD—S Jackson Street to E Pine Street	0.45	0.64	0.44	0.64	0.44	0.64	0.44	0.63

Source: Fehr & Peers, 2010

Appendix F

Greenhouse Gas

South Lake Union Height and Density EIS
Existing Conditions - Original

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	Lifespan Emissions (MTCO2e)
Single-Family Home............................	0		98	672	792	0
Multi-Family Unit in Large Building	1686		33	357	766	1948501
Multi-Family Unit in Small Building	0		54	681	766	0
Mobile Home.......................................	0		41	475	709	0
Education		0.0	39	646	361	0
Food Sales		0.0	39	1,541	282	0
Food Service		0.0	39	1,994	561	0
Health Care Inpatient		0.0	39	1,938	582	0
Health Care Outpatient		0.0	39	737	571	0
Lodging		0.0	39	777	117	0
Retail (Other Than Mall)......................		1,225.0	39	577	247	1056876
Office		6,942.0	39	723	588	9367155
Public Assembly		0.0	39	733	150	0
Public Order and Safety		0.0	39	899	374	0
Religious Worship		0.0	39	339	129	0
Service		0.0	39	599	266	0
Warehouse and Storage		0.0	39	352	181	0
Other		0.0	39	1,278	257	0
Vacant		0.0	39	162	47	0

Section II: Pavement.........................

Pavement..		0.00				0

Total Project Emissions: **12372531**

South Lake Union Height and Density EIS
No Action Alternative - Original

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	Lifespan Emissions (MTCO2e)
Single-Family Home............................	0		98	672	792	**0**
Multi-Family Unit in Large Building	9686		33	357	766	**11194056**
Multi-Family Unit in Small Building	0		54	681	766	**0**
Mobile Home.......................................	0		41	475	709	**0**
Education		0.0	39	646	361	**0**
Food Sales		0.0	39	1,541	282	**0**
Food Service		0.0	39	1,994	561	**0**
Health Care Inpatient		0.0	39	1,938	582	**0**
Health Care Outpatient		0.0	39	737	571	**0**
Lodging		0.0	39	777	117	**0**
Retail (Other Than Mall)......................		2,065.0	39	577	247	**1781591**
Office		11,702.0	39	723	588	**15790038**
Public Assembly		0.0	39	733	150	**0**
Public Order and Safety		0.0	39	899	374	**0**
Religious Worship		0.0	39	339	129	**0**
Service		0.0	39	599	266	**0**
Warehouse and Storage		0.0	39	352	181	**0**
Other		0.0	39	1,278	257	**0**
Vacant		0.0	39	162	47	**0**

Section II: Pavement.........................

Pavement..		0.00				**0**

Total Project Emissions: **28765685**

South Lake Union Height and Density EIS
Alternative 1-3 - Original

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	Lifespan Emissions (MTCO2e)
Single-Family Home............................	0		98	672	792	0
Multi-Family Unit in Large Building	13586		33	357	766	15701265
Multi-Family Unit in Small Building	0		54	681	766	0
Mobile Home.......................................	0		41	475	709	0
Education		0.0	39	646	361	0
Food Sales		0.0	39	1,541	282	0
Food Service		0.0	39	1,994	561	0
Health Care Inpatient		0.0	39	1,938	582	0
Health Care Outpatient		0.0	39	737	571	0
Lodging		0.0	39	777	117	0
Retail (Other Than Mall).......................		2,375.0	39	577	247	2049045
Office		13,458.0	39	723	588	18159488
Public Assembly		0.0	39	733	150	0
Public Order and Safety		0.0	39	899	374	0
Religious Worship		0.0	39	339	129	0
Service		0.0	39	599	266	0
Warehouse and Storage		0.0	39	352	181	0
Other		0.0	39	1,278	257	0
Vacant		0.0	39	162	47	0

Section II: Pavement.........................

Pavement..		0.00				0

Total Project Emissions: **35909798**

South Lake Union Height and Density EIS
Existing Conditions - VMT

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	**Lifespan Emissions (MTCO2e)**
Single-Family Home............................	0		98	672	0	**0**
Multi-Family Unit in Large Building	1686		33	357	0	**657753**
Multi-Family Unit in Small Building	0		54	681	0	**0**
Mobile Home.......................................	0		41	475	0	**0**
Education		0.0	39	646	0	**0**
Food Sales		0.0	39	1,541	0	**0**
Food Service		0.0	39	1,994	0	**0**
Health Care Inpatient		0.0	39	1,938	0	**0**
Health Care Outpatient		0.0	39	737	0	**0**
Lodging		0.0	39	777	0	**0**
Retail (Other Than Mall)......................		1,225.0	39	577	0	**754560**
Office		6,942.0	39	723	0	**5288094**
Public Assembly		0.0	39	733	0	**0**
Public Order and Safety		0.0	39	899	0	**0**
Religious Worship		0.0	39	339	0	**0**
Service		0.0	39	599	0	**0**
Warehouse and Storage		0.0	39	352	0	**0**
Other		0.0	39	1,278	0	**0**
Vacant		0.0	39	162	0	**0**
Transportation ……............................						**8910451**

Section II: Pavement........................

Pavement...		0.00				**0**

Total Project Emissions: **15610858**

South Lake Union Height and Density EIS
No Action Alternative - VMT

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	Lifespan Emissions (MTCO2e)
Single-Family Home..............................	0		98	672	0	0
Multi-Family Unit in Large Building	9686		33	357	0	3778763
Multi-Family Unit in Small Building	0		54	681	0	0
Mobile Home..	0		41	475	0	0
Education		0.0	39	646	0	0
Food Sales		0.0	39	1,541	0	0
Food Service		0.0	39	1,994	0	0
Health Care Inpatient		0.0	39	1,938	0	0
Health Care Outpatient		0.0	39	737	0	0
Lodging		0.0	39	777	0	0
Retail (Other Than Mall).........................		2,065.0	39	577	0	1271972
Office		11,702.0	39	723	0	8914041
Public Assembly		0.0	39	733	0	0
Public Order and Safety		0.0	39	899	0	0
Religious Worship		0.0	39	339	0	0
Service		0.0	39	599	0	0
Warehouse and Storage		0.0	39	352	0	0
Other		0.0	39	1,278	0	0
Vacant		0.0	39	162	0	0
Transportation ………..............................						19709284

Section II: Pavement.............................

Pavement..		0.00				0

Total Project Emissions: 33674061

Version 1.7 12/26/07

South Lake Union Height and Density EIS
Alternative 1 - VMT

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	**Lifespan Emissions (MTCO2e)**
Single-Family Home...............................	0		98	672	0	**0**
Multi-Family Unit in Large Building	13586		33	357	0	**5300255**
Multi-Family Unit in Small Building	0		54	681	0	**0**
Mobile Home...	0		41	475	0	**0**
Education		0.0	39	646	0	**0**
Food Sales		0.0	39	1,541	0	**0**
Food Service		0.0	39	1,994	0	**0**
Health Care Inpatient		0.0	39	1,938	0	**0**
Health Care Outpatient		0.0	39	737	0	**0**
Lodging		0.0	39	777	0	**0**
Retail (Other Than Mall)..........................		2,375.0	39	577	0	**1462922**
Office		13,458.0	39	723	0	**10251681**
Public Assembly		0.0	39	733	0	**0**
Public Order and Safety		0.0	39	899	0	**0**
Religious Worship		0.0	39	339	0	**0**
Service		0.0	39	599	0	**0**
Warehouse and Storage		0.0	39	352	0	**0**
Other		0.0	39	1,278	0	**0**
Vacant		0.0	39	162	0	**0**

Transportation ………..............................						**22756080**

South Lake Union Height and Density EIS
No Action Alternative - VMT

Section II: Pavement.............................

Pavement..		0.00				**0**

Total Project Emissions: **39770938**

South Lake Union Height and Density EIS
Alternative 2 - VMT

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	**Lifespan Emissions (MTCO2e)**
Single-Family Home...............................	0		98	672	0	**0**
Multi-Family Unit in Large Building	13586		33	357	0	**5300255**
Multi-Family Unit in Small Building	0		54	681	0	**0**
Mobile Home..	0		41	475	0	**0**
Education		0.0	39	646	0	**0**
Food Sales		0.0	39	1,541	0	**0**
Food Service		0.0	39	1,994	0	**0**
Health Care Inpatient		0.0	39	1,938	0	**0**
Health Care Outpatient		0.0	39	737	0	**0**
Lodging		0.0	39	777	0	**0**
Retail (Other Than Mall)..........................		2,375.0	39	577	0	**1462922**
Office		13,458.0	39	723	0	**10251681**
Public Assembly		0.0	39	733	0	**0**
Public Order and Safety		0.0	39	899	0	**0**
Religious Worship		0.0	39	339	0	**0**
Service		0.0	39	599	0	**0**
Warehouse and Storage		0.0	39	352	0	**0**
Other		0.0	39	1,278	0	**0**
Vacant		0.0	39	162	0	**0**
Transportation ………..............................						**22740150**

Section II: Pavement.............................

Pavement..		0.00				**0**

Total Project Emissions: **39755008**

Version 1.7 12/26/07

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	Lifespan Emissions (MTCO2e)
Single-Family Home...............................	0		98	672	0	0
Multi-Family Unit in Large Building	13586		33	357	0	5300255
Multi-Family Unit in Small Building	0		54	681	0	0
Mobile Home...	0		41	475	0	0
Education		0.0	39	646	0	0
Food Sales		0.0	39	1,541	0	0
Food Service		0.0	39	1,994	0	0
Health Care Inpatient		0.0	39	1,938	0	0
Health Care Outpatient		0.0	39	737	0	0
Lodging		0.0	39	777	0	0
Retail (Other Than Mall)..........................		2,375.0	39	577	0	1462922
Office		13,458.0	39	723	0	10251681
Public Assembly		0.0	39	733	0	0
Public Order and Safety		0.0	39	899	0	0
Religious Worship		0.0	39	339	0	0
Service		0.0	39	599	0	0
Warehouse and Storage		0.0	39	352	0	0
Other		0.0	39	1,278	0	0
Vacant		0.0	39	162	0	0
Transportation ………..............................						21282472

Section II: Pavement.............................

Pavement..		0.00				0

Total Project Emissions: **38297330**

King County Department of Development and Environmental Services
SEPA GHG Emissions Worksheet
Version 1.7 12/26/07

Introduction

The Washington State Environmental Policy Act (SEPA) requires environmental review of development proposals that may have a significant adverse impact on the environment. If a proposed development is subject to SEPA, the project proponent is required to complete the SEPA Checklist. The Checklist includes questions relating to the development's air emissions. The emissions that have traditionally been considered cover smoke, dust, and industrial and automobile emissions. With our understanding of the climate change impacts of GHG emissions, King County requires the applicant to also estimate these emissions.

Emissions created by Development

GHG emissions associated with development come from multiple sources:

- The extraction, processing, transportation, construction and disposal of materials and landscape disturbance (Embodied Emissions)
- Energy demands created by the development after it is completed (Energy Emissions)
- Transportation demands created by the development after it is completed (Transportation Emissions)

GHG Emissions Worksheet

King County has developed a GHG Emissions Worksheet that can assist applicants in answering the SEPA Checklist question relating to GHG emissions.

The SEPA GHG Emissions worksheet estimates all GHG emissions that will be created over the life span of a project. This includes emissions associated with obtaining construction materials, fuel used during construction, energy consumed during a buildings operation, and transportation by building occupants.

Using the Worksheet

1. Descriptions of the different residential and commercial building types can be found on the second tabbed worksheet ("Definition of Building Types"). If a development proposal consists of multiple projects, e.g. both single family and multi-family residential structures or a commercial development that consists of more than on type of commercial activity, the appropriate information should be estimated for each type of building or activity.

2. For paving, estimate the total amount of paving (in thousands of square feet) of the project.

3. The Worksheet will calculate the amount of GHG emissions associated with the project and display the amount in the "Total Emissions" column on the worksheet. The applicant should use this information when completing the SEPA checklist.

4. The last three worksheets in the Excel file provide the background information that is used to calculate the total GHG emissions.

5. The methodology of creating the estimates is transparent; if there is reason to believe that a better estimate can be obtained by changing specific values, this can and should be done. Changes to the values should be documented with an explanation of why and the sources relied upon.

6. Print out the “Total Emissions” worksheet and attach it to the SEPA checklist. If the applicant has made changes to the calculations or the values, the documentation supporting those changes should also be attached to the SEPA checklist.

Definition of Building Types

Type (Residential) or Principal Activity (Commercial)	**Description**
Single-Family Home..................................	Unless otherwise specified, this includes both attached and detached buildings
Multi-Family Unit in Large Building	Apartments in buildings with more than 5 units
Multi-Family Unit in Small Building	Apartments in building with 2-4 units
Mobile Home...	
Education	Buildings used for academic or technical classroom instruction, such as elementary, middle, or high schools, and classroom buildings on college or university campuses. Buildings on education campuses for which the main use is not classroom are included in the category relating to their use. For example, administration buildings are part of "Office," dormitories are "Lodging," and libraries are "Public Assembly."
Food Sales	Buildings used for retail or wholesale of food.
Food Service	Buildings used for preparation and sale of food and beverages for consumption.
Health Care Inpatient	Buildings used as diagnostic and treatment facilities for inpatient care.
Health Care Outpatient	Buildings used as diagnostic and treatment facilities for outpatient care. Doctor's or dentist's office are included here if they use any type of diagnostic medical equipment (if they do not, they are categorized as an office building).
Lodging	Buildings used to offer multiple accommodations for short-term or long-term residents, including skilled nursing and other residential care buildings.
Retail (Other Than Mall)............................	Buildings used for the sale and display of goods other than food.
Office	Buildings used for general office space, professional office, or administrative offices. Doctor's or dentist's office are included here if they do not use any type of diagnostic medical equipment (if they do, they are categorized as an outpatient health care building).
Public Assembly	Buildings in which people gather for social or recreational activities, whether in private or non-private meeting halls.
Public Order and Safety	Buildings used for the preservation of law and order or public safety.
Religious Worship	Buildings in which people gather for religious activities, (such as chapels, churches, mosques, synagogues, and temples).
Service	Buildings in which some type of service is provided, other than food service or retail sales of goods
Warehouse and Storage	Buildings used to store goods, manufactured products, merchandise, raw materials, or personal belongings (such as self-storage).
Other	Buildings that are industrial or agricultural with some retail space; buildings having several different commercial activities that, together, comprise 50 percent or more of the floorspace, but whose largest single activity is agricultural, industrial/ manufacturing, or residential; and all other miscellaneous buildings that do not fit into any other category.
Vacant	Buildings in which more floorspace was vacant than was used for any single commercial activity at the time of interview. Therefore, a vacant building may have some occupied floorspace.

Sources: ....

Residential 2001 Residential Energy Consumption Survey
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

Commercial Commercial Buildings Energy Consumption Survey (CBECS),
Description of CBECS Building Types
http://www.eia.doe.gov/emeu/cbecs/pba99/bldgtypes.html

Embodied Emissions Worksheet

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# thousand sq feet/ unit or building	Life span related embodied GHG missions (MTCO2e/ unit)	Life span related embodied GHG missions (MTCO2e/ thousand square feet) - See calculations in table below
Single-Family Home.................................	2.53	98	39
Multi-Family Unit in Large Building	0.85	33	39
Multi-Family Unit in Small Building	1.39	54	39
Mobile Home..	1.06	41	39
Education	25.6	991	39
Food Sales	5.6	217	39
Food Service	5.6	217	39
Health Care Inpatient	241.4	9,346	39
Health Care Outpatient	10.4	403	39
Lodging	35.8	1,386	39
Retail (Other Than Mall)...........................	9.7	376	39
Office	14.8	573	39
Public Assembly	14.2	550	39
Public Order and Safety	15.5	600	39
Religious Worship	10.1	391	39
Service	6.5	252	39
Warehouse and Storage	16.9	654	39
Other	21.9	848	39
Vacant	14.1	546	39

Section II: Pavement..............................

All Types of Pavement.............................			50

	Columns and Beams	Intermediate Floors	Exterior Walls	Windows	Interior Walls	Roofs	Total Embodied Emissions (MTCO2e)	Total Embodied Emissions (MTCO2e/ thousand sq feet)
Average GWP (lbs CO2e/sq ft): Vancouver, Low Rise Building	5.3	7.8	19.1	51.2	5.7	21.3		
Average Materials in a 2,272-square foot single family home	0.0	2269.0	3206.0	285.0	6050.0	3103.0		
MTCO2e	0.0	8.0	27.8	6.6	15.6	30.0	88.0	38.7

Sources

All data in black text — King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

Residential floorspace per unit — 2001 Residential Energy Consumption Survey (National Average, 2001)
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

Floorspace per building — EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)
Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls

Average GWP (lbs CO2e/sq ft): Vancouver, Low Rise Building — Athena EcoCalculator
Athena Assembly Evaluation Tool v2.3- Vancouver Low Rise Building
Assembly Average GWP (kg) per square meter
http://www.athenasmi.ca/tools/ecoCalculator/index.html

Lbs per kg	2.20
Square feet per square meter	10.76

Average Materials in a 2,272-square foot single family home — Buildings Energy Data Book: 7.3 Typical/Average Household
Materials Used in the Construction of a 2,272-Square-Foot Single-Family Home, 2000
http://buildingsdatabook.eren.doe.gov/?id=view_book_table&TableID=2036&t=xls
See also: NAHB, 2004 Housing Facts, Figures and Trends, Feb. 2004, p. 7.

Average window size — Energy Information Administration/Housing Characteristics 1993
Appendix B, Quality of the Data. Pg. 5.
ftp://ftp.eia.doe.gov/pub/consumption/residential/rx93hcf.pdf

Pavement Emissions Factors
MTCO2e/thousand square feet of asphalt or concrete pavement 50 (see below)

Embodied GHG Emissions……………………Worksheet Background Information

Buildings
Embodied GHG emissions are emissions that are created through the extraction, processing, transportation, construction and disposal of building materials as well as emissions created through landscape disturbance (by both soil disturbance and changes in above ground biomass).

Estimating embodied GHG emissions is new field of analysis; the estimates are rapidly improving and becoming more inclusive of all elements of construction and development.

The estimate included in this worksheet is calculated using average values for the main construction materials that are used to create a typical family home. In 2004, the National Association of Home Builders calculated the average materials that are used in a typical 2,272 square foot single-family household. The quantity of materials used is then multiplied by the average GHG emissions associated with the life-cycle GHG emissions for each material.

This estimate is a rough and conservative estimate; the actual embodied emissions for a project are likely to be higher. For example, at this stage, due to a lack of comprehensive data, the estimate does not include important factors such as landscape disturbance or the emissions associated with the interior components of a building (such as furniture).

King County realizes that the calculations for embodied emissions in this worksheet are rough. For example, the emissions associated with building 1,000 square feet of a residential building will not be the same as 1,000 square feet of a commercial building. However, discussions with the construction community indicate that while there are significant differences between the different types of structures, this method of estimation is reasonable; it will be improved as more data become available.

Additionally, if more specific information about the project is known, King County recommends two online embodied emissions calculators that can be used to obtain a more tailored estimate for embodied emissions: www.buildcarbonneutral.org and www.athenasmi.ca/tools/ecoCalculator/.

Pavement
Four recent life cycle assessments of the environmental impacts of roads form the basis for the per unit embodied emissions of pavement. Each study is constructed in slightly different ways; however, the aggregate results of the reports represent a reasonable estimate of the GHG emissions that are created from the manufacture of paving materials, construction related emissions, and maintenance of the pavement over its expected life cycle. For specifics, see the worksheet.

Special Section: Estimating the Embodied Emissions for Pavement

Four recent life cycle assessments of the environmental impacts of roads form the basis for the per unit embodied emissions of pavement. Each study is constructed in slightly different ways; however, the aggregate results of the reports represent a reasonable estimate of the GHG emissions that are created from the manufacture of paving materials, construction related emissions, and maintenance of the pavement over its expected life cycle.

The results of the studies are presented in different units and measures; considerable effort was undertaken to be able to compare the results of the studies in a reasonable way. For more details about the below methodology, contact matt.kuharic@kingcounty.gov.

The four studies, Meil (2001), Park (2003), Stripple (2001) and Treolar (2001) produced total GHG emissions of 4-34 MTCO2e per thousand square feet of finished paving (for similar asphalt and concrete based pavements). This estimate does not including downstream maintenance and repair of the highway. The average (for all concrete and asphalt pavements in the studies, assuming each study gets one data point) is ~17 MTCO2e/thousand square feet.

Three of the studies attempted to thoroughly account for the emissions associated with long term maintenance (40 years) of the roads. Stripple (2001), Park et al. (2003) and Treolar (2001) report 17, 81, and 68 MTCO2e/thousand square feet, respectively, after accounting for maintenance of the roads.

Based on the above discussion, King County makes the conservative estimate that 50 MTCO2e/thousand square feet of pavement (over the development's life cycle) will be used as the embodied emission factor for pavement until better estimates can be obtained. This is roughly equivalent to 3,500 MTCO2e per lane mile of road (assuming the lane is 13 feet wide).

It is important to note that these studies estimate the embodied emissions for roads. Paving that does not need to stand up to the rigors of heavy use (such as parking lots or driveways) would likely use less materials and hence have lower embodied emissions.

Sources:

Meil, J. A Life Cycle Perspective on Concrete and Asphalt Roadways: Embodied Primary Energy and Global Warming Potential. 2006. Available: http://www.cement.ca/cement.nsf/eee9ec7bbd630126852566c40052107b/6ec79dc8ae03a782852572b90061b914/$FILE/ATTK0WE3/athena%20report%20Feb.%202%202007.pdf

Park, K, Hwang, Y., Seo, S., M.ASCE, and Seo, H. , "Quantitative Assessment of Environmental Impacts on Life Cycle of Highways," Journal of Construction Engineering and Management , Vol 129, January/February 2003, pp 25-31, (DOI: 10.1061/(ASCE)0733-9364(2003)129:1(25)).

Stripple, H. Life Cycle Assessment of Road. A Pilot Study for Inventory Analysis. Second Revised Edition. IVL Swedish Environmental Research Institute Ltd. 2001. Available: http://www.ivl.se/rapporter/pdf/B1210E.pdf

Treloar, G., Love, P.E.D., and Crawford, R.H. Hybrid Life-Cycle Inventory for Road Construction and Use. Journal of Construction Engineering and Management. P. 43-49. January/February 2004.

Energy Emissions Worksheet

Type (Residential) or Principal Activity (Commercial)	Energy consumption per building per year (million Btu)	Carbon Coefficient for Buildings	MTCO2e per building per year	Floorspace per Building (thousand square feet)	MTCE per thousand square feet per year	MTCO2e per thousand square feet per year	Average Building Life Span	Lifespan Energy Related MTCO2e emissions per unit	Lifespan Energy Related MTCO2e emissions per thousand square feet
Single-Family Home.............................	107.3	0.108	11.61	2.53	4.6	16.8	57.9	672	266
Multi-Family Unit in Large Building	41.0	0.108	4.44	0.85	5.2	19.2	80.5	357	422
Multi-Family Unit in Small Building	78.1	0.108	8.45	1.39	6.1	22.2	80.5	681	489
Mobile Home...	75.9	0.108	8.21	1.06	7.7	28.4	57.9	475	448
Education	2,125.0	0.124	264.2	25.6	10.3	37.8	62.5	16,526	646
Food Sales	1,110.0	0.124	138.0	5.6	24.6	90.4	62.5	8,632	1,541
Food Service	1,436.0	0.124	178.5	5.6	31.9	116.9	62.5	11,168	1,994
Health Care Inpatient	60,152.0	0.124	7,479.1	241.4	31.0	113.6	62.5	467,794	1,938
Health Care Outpatient	985.0	0.124	122.5	10.4	11.8	43.2	62.5	7,660	737
Lodging	3,578.0	0.124	444.9	35.8	12.4	45.6	62.5	27,826	777
Retail (Other Than Mall).......................	720.0	0.124	89.5	9.7	9.2	33.8	62.5	5,599	577
Office	1,376.0	0.124	171.1	14.8	11.6	42.4	62.5	10,701	723
Public Assembly	1,338.0	0.124	166.4	14.2	11.7	43.0	62.5	10,405	733
Public Order and Safety	1,791.0	0.124	222.7	15.5	14.4	52.7	62.5	13,928	899
Religious Worship	440.0	0.124	54.7	10.1	5.4	19.9	62.5	3,422	339
Service	501.0	0.124	62.3	6.5	9.6	35.1	62.5	3,896	599
Warehouse and Storage	764.0	0.124	95.0	16.9	5.6	20.6	62.5	5,942	352
Other	3,600.0	0.124	447.6	21.9	20.4	74.9	62.5	27,997	1,278
Vacant	294.0	0.124	36.6	14.1	2.6	9.5	62.5	2,286	162

Sources

All data in black text — King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

Energy consumption for residential buildings
2007 Buildings Energy Data Book: 6.1 Quad Definitions and Comparisons (National Average, 2001)
Table 6.1.4: Average Annual Carbon Dioxide Emissions for Various Functions
http://buildingsdatabook.eren.doe.gov/
Data also at: http://www.eia.doe.gov/emeu/recs/recs2001_ce/ce1-4c_housingunits2001.html

Energy consumption for commercial buildings and Floorspace per building
EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)
Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls

Note: Data in plum color is found in both of the above sources (buildings energy data book and commercial buildings energy consumption survey).

Carbon Coefficient for Buildings
Buildings Energy Data Book (National average, 2005)
Table 3.1.7. 2005 Carbon Dioxide Emission Coefficients for Buildings (MMTCE per Quadrillion Btu)
http://buildingsdatabook.eere.energy.gov/?id=view_book_table&TableID=2057
Note: Carbon coefficient in the Energy Data book is in MTCE per Quadrillion Btu.
To convert to MTCO2e per million Btu, this factor was divided by 1000 and multiplied by 44/12.

Residential floorspace per unit
2001 Residential Energy Consumption Survey (National Average, 2001)
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

average lief span of buildings,
estimated by replacement time method

	Single Family Homes	Multi-Family Units in Large and Small Buildings	All Residential Buildings	
New Housing Construction, 2001	1,273,000	329,000	1,602,000	
Existing Housing Stock, 2001	73,700,000	26,500,000	100,200,000	
Replacement time:	57.9	80.5	62.5	(national average, 2001)

Note: Single family homes calculation is used for mobile homes as a best estimate life span.
Note: At this time, KC staff could find no reliable data for the average life span of commercial buildings.
Therefore, the average life span of residential buildings is being used until a better approximation can be ascertained.

Sources:

New Housing Construction, 2001 **Quarterly Starts and Completions by Purpose and Design - US and Regions (Excel)**
http://www.census.gov/const/quarterly_starts_completions_cust.xls
See also: http://www.census.gov/const/www/newresconstindex.html

Existing Housing Stock, 2001 **Residential Energy Consumption Survey (RECS) 2001**
Tables HC1:Housing Unit Characteristics, Million U.S. Households 2001
Table HC1-4a. Housing Unit Characteristics by Type of Housing Unit, Million U.S. Households, 2001
Million U.S. Households, 2001
http://www.eia.doe.gov/emeu/recs/recs2001/hc_pdf/housunits/hc1-4a_housingunits2001.pdf

Transportation Emissions Worksheet

Type (Residential) or Principal Activity (Commercial)	# people/ unit or building	# thousand sq feet/ unit or building	# people or employees/ thousand square feet	vehicle related GHG emissions (metric tonnes CO2e per person per year)	MTCO2e/ year/ unit	MTCO2e/ year/ thousand square feet	Average Building Life Span	Life span transportation related GHG emissions (MTCO2e/ per unit)	Life span transportation related GHG emissions (MTCO2e/ thousand sq feet)
Single-Family Home..................................	2.8	2.53	1.1	4.9	13.7	5.4	57.9	792	313
Multi-Family Unit in Large Building	1.9	0.85	2.3	4.9	9.5	11.2	80.5	766	904
Multi-Family Unit in Small Building	1.9	1.39	1.4	4.9	9.5	6.8	80.5	766	550
Mobile Home..	2.5	1.06	2.3	4.9	12.2	11.5	57.9	709	668
Education	30.0	25.6	1.2	4.9	147.8	5.8	62.5	9247	361
Food Sales	5.1	5.6	0.9	4.9	25.2	4.5	62.5	1579	282
Food Service	10.2	5.6	1.8	4.9	50.2	9.0	62.5	3141	561
Health Care Inpatient	455.5	241.4	1.9	4.9	2246.4	9.3	62.5	140506	582
Health Care Outpatient	19.3	10.4	1.9	4.9	95.0	9.1	62.5	5941	571
Lodging	13.6	35.8	0.4	4.9	67.1	1.9	62.5	4194	117
Retail (Other Than Mall)............................	7.8	9.7	0.8	4.9	38.3	3.9	62.5	2394	247
Office	28.2	14.8	1.9	4.9	139.0	9.4	62.5	8696	588
Public Assembly	6.9	14.2	0.5	4.9	34.2	2.4	62.5	2137	150
Public Order and Safety	18.8	15.5	1.2	4.9	92.7	6.0	62.5	5796	374
Religious Worship	4.2	10.1	0.4	4.9	20.8	2.1	62.5	1298	129
Service	5.6	6.5	0.9	4.9	27.6	4.3	62.5	1729	266
Warehouse and Storage	9.9	16.9	0.6	4.9	49.0	2.9	62.5	3067	181
Other	18.3	21.9	0.8	4.9	90.0	4.1	62.5	5630	257
Vacant	2.1	14.1	0.2	4.9	10.5	0.7	62.5	657	47

Sources

All data in black text — King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

people/ unit — Estimating Household Size for Use in Population Estimates (WA state, 2000 average)
Washington State Office of Financial Management
Kimpel, T. and Lowe, T. Research Brief No. 47. August 2007
http://www.ofm.wa.gov/researchbriefs/brief047.pdf
Note: This analysis combines Multi Unit Structures in both large and small units into one category;
the average is used in this case although there is likely a difference

Residential floorspace per unit — 2001 Residential Energy Consumption Survey (National Average, 2001)
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

employees/thousand square feet — Commercial Buildings Energy Consumption Survey commercial energy uses and costs (National Median, 2003)
Table B2 Totals and Medians of Floorspace, Number of Workers, and Hours of Operation for Non-Mall Buildings, 2003
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set1/2003excel/b2.xls

Note: Data for # employees/thousand square feet is presented by CBECS as square feet/employee.
In this analysis employees/thousand square feet is calculated by taking the inverse of the CBECS number and multiplying by 1000.

vehicle related GHG emissions

Estimate calculated as follows (Washington state, 2006)_

56,531,930,000	2006 Annual WA State Vehicle Miles Traveled	
		Data was daily VMT. Annual VMT was 365*daily VMT.
		http://www.wsdot.wa.gov/mapsdata/tdo/annualmileage.htm
6,395,798	2006 WA state population	
		http://quickfacts.census.gov/qfd/states/53000.html
8839	vehicle miles per person per year	
0.0506	gallon gasoline/mile	
		This is the weighted national average fuel efficiency for all cars and 2 axle, 4 wheel light trucks in 2005. This includes pickup trucks, vans and SUVs. The 0.051 gallons/mile used here is the inverse of the more commonly known term “miles/per gallon” (which is 19.75 for these cars and light trucks).
		Transportation Energy Data Book. 26th Edition. 2006. Chapter 4: Light Vehicles and Characteristics. Calculations based on weighted average MPG efficiency of cars and light trucks.
		http://cta.ornl.gov/data/tedb26/Edition26_Chapter04.pdf
		Note: This report states that in 2005, 92.3% of all highway VMT were driven by the above described vehicles.
		http://cta.ornl.gov/data/tedb26/Spreadsheets/Table3_04.xls
24.3	lbs CO2e/gallon gasoline	
		The CO2 emissions estimates for gasoline and diesel include the extraction, transport, and refinement of petroleum as well as their combustion.
		Life-Cycle CO2 Emissions for Various New Vehicles. RENew Northfield.
		Available: http://renewnorthfield.org/wpcontent/uploads/2006/04/CO2%20emissions.pdf
		Note: This is a conservative estimate of emissions by fuel consumption because diesel fuel.
2205		with a emissions factor of 26.55 lbs CO2e/gallon was not estimated.
4.93	lbs/metric tonne	
	vehicle related GHG emissions (metric tonnes CO2e per person per year)	

average lief span of buildings, estimated by replacement time method	See Energy Emissions Worksheet for Calculations
Commercial floorspace per unit	EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)
	Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003
	http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls